

The cover of ISE magazine features a portrait of Jonathan Spalter, President and CEO of USTelecom-The Broadband Association. He is a middle-aged man with short brown hair, smiling, wearing a grey turtleneck and a green plaid blazer. The background is a blurred outdoor setting with trees and a building. The magazine title 'ISE' is in large white letters on a blue background in the top left corner. Below it, 'ICT SOLUTIONS & EDUCATION' and 'DECEMBER 2020' are also in white on the blue background. The main title 'Executive Insights: JONATHAN SPALTER' is overlaid on the portrait, with 'JONATHAN SPALTER' in large red letters. Below that, his title is in white. In the bottom right, 'ALSO INSIDE' is in red, followed by a list of featured articles in white. The bottom of the cover has a blue bar with 'VOLUME 38, ISSUE 12' and 'www.isemag.com' in white.

ISE

ICT SOLUTIONS
& EDUCATION

DECEMBER 2020

Executive Insights:

JONATHAN SPALTER

President and CEO, USTelecom-
The Broadband Association

ALSO INSIDE

Best of 2020 Executive
Insights Interviews

Farmers Put the Byte Into
Food Production

The Year Fiber Became an
Essential Service

Connecting the Underserved
and the Unserved



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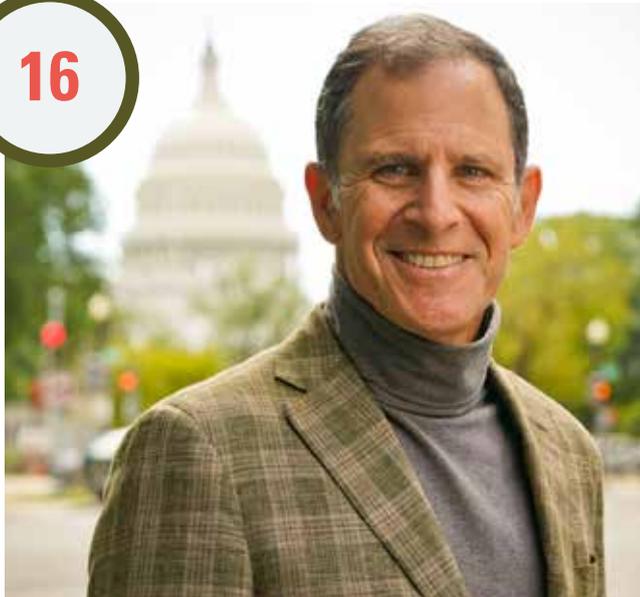


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DISCLAIMER: The views expressed in ISE magazine are those of the authors; they do not reflect the views of ISE magazine, the publisher, or its employees.

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Only available at www.isemag.com

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By Brad Russell

Learn how COVID-19 impacted telecom's landline lifelines in 2020.

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Follow Sharon on Twitter and LinkedIn for further conversation and insights.

Visit www.isemag.com/contribute for more information on submitting an article to ISE magazine in print, digital, and online.

LISTENING TO THE QUIET

I like quiet.

I like it so much, that many mornings I get up before dawn to simply listen to the quiet. Sounds silly to some. But, I crave those moments in our not-so-quiet world.

As a passionate observer of the Information and Communications Technology (ICT) industry, it seems disloyal to admit this. Our entire industry is designed to overstimulate the world with a tsunami of information that comes to us in the form of push notifications, sounds, and vibrations, that alert us to something we might be missing -- so that we don't suffer from FOMO, the Fear of Missing Out.

What we're missing is the quiet.

While we may know that noise has a detrimental effect on blood pressure and impacts our sleep, we ignore how silence can help relieve stress. It's also said that just 2 hours of silence a day can help the brain prompt cell development in the hippocampus region of the brain. That part of our wickedly complex brain is related to memory, emotion, and learning. (Just call me Dr. Quiet. LOL.)

So, why not give yourself a gift this season? Try waking up extra early and stalk the quiet for a moment or two.

“All profound things and emotions of things are preceded and attended by silence.”

– Herman Melville

Turn off all distractions. (Yes -- that means your mobile device.) Focus on capturing the elusive quiet -- even if you have to use a sneaky weapon called noise cancelling headphones.

Embrace the quiet. Snuggle it like a child holds a favorite comfort object.

Then, wait. You may start to feel a bit of peace blanketing your brain. It could make you want more. In fact, learning to listen to the quiet could be the greatest gift you give yourself this season. (It could also be a gift that keeps giving to those you love as well.)

I'm not saying I know anything at all. But, I can have a simple wish for this holiday season. May we all purposely carve out a bit of time to discover how comforting it can be to find our quiet.

And may that quiet help us find a few moments of peace.

Sharon

Sharon Vollman, Editorial Director

Source: https://www.iahe.com/docs/articles/Science_Says_Silence_Is_Much_More_Important_To_Our_Brains_Than_We_Think.pdf



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Fun telecom facts help keep the giving spirit alive. Be sure to put a bow on them and share with your colleagues.

(P.S. Don't be a Grinch)

Open Says Me!

Open RAN Radio Units to Soar to More Than US\$47 Billion by 2026

The Open Radio Access Network (Open RAN) market is rapidly expanding, and is expected to exceed the traditional RAN market for the first time around 2027-2028. ABI Research expects the total CapEx spent on Open RAN radio units (RUs) for public outdoor networks, including both macro and small cells, will reach US\$40.7 billion in 2026. Cumulative unit shipments will reach 9.9 million during the same year. Meanwhile, the total revenue of Open RAN radios for indoor enterprise networks will reach as much as US\$6.7 billion in 2026, with cumulative unit shipments expected to reach 29.4 million.

Source: <https://www.abiresearch.com/>

The Race for In-Vehicle Payments

A study from Juniper Research has found that the value of in-vehicle payments, where a payment is made via embedded vehicle systems, will reach \$86 billion in 2025, up from just \$543 million in 2020.

In-vehicle payments automate and simplify several existing payment processes via the vehicle's onboard systems, providing increased convenience for drivers. This dramatic growth will be driven by increased partnerships, which are improving the availability of services, particularly in the fuel and smart parking segments.

Fuel and electric vehicle charging payments will be the leading area for in-vehicle payments adoption, accounting for 77% of payments by value in 2025. This will be largely due to the high number of anticipated future partnerships.

Source: <https://www.juniperresearch.com/home>

You Didn't Know You Were Automated?

The "Automation's Rise and the Telecom Engineer" report quantifies telco spending on labor costs, focusing on the telecom and IT network engineering workforce in particular.

The funds spent on building and upgrading telecommunications network operator (telco) networks, represented by capital expenditures (CapEx), get a lot of industry attention. This research says telco labor costs are 23% of operating expenditures (OpEx); half is spent on the network and IT staff.

Global telco CapEx was \$297 billion (B) in 2019. Telco labor costs amounted to \$292 billion in the same year, or 23.1% of OpEx excluding depreciation & amortization (OpEx ex-D&A). Half of this figure is for technical staff: about 30% for line, radio, and equipment, installation and repair; and 20% for computer/IT/software development-related occupations.

Source: <https://www.researchandmarkets.com/>, and for the report: https://www.researchandmarkets.com/reports/5136103/automations-rise-and-the-telecom-engineer?utm_source=Ci&utm_medium=PressRelease&utm_code=s-b8cwd&utm_campaign=1426779+-+2020+Study+on+the+Rise+of+Automation+and+the+Telecom+Engineer+-+Automation+Tools+Rising+in+Importance+with+Cost+Pressures+and+COVID-19&utm_exec=joca220prd



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LIMITED ACCESS INSTALL PROCEDURES FOR FTTH / DSL / BONDED DSL

I was recently contacted by the GM of a small independent Telco asking me about good procedures for installation in general and also in this time of COVID-19 pandemic concerns. This is not a problem I've had to deal with during my active working career so I reached out to my friend, Randy Lis, the GM of Piedmont Rural Telephone Cooperative (PRTC) in Laurens, South Carolina, and asked about his processes. I have tremendous respect for Randy and PRTC. They are proactive and organized in creating and implementing best practices.

Randy referred me to his Outside Plant Supervisor, Mike Foster, who had put together a process for **limited access** install procedures for FTTH / DSL / Bonded DSL. The procedures are used in the event of limited access to the inside of a customer's home or business.

PRTC makes every attempt possible to install service for their customers while taking every necessary precaution to ensure the safety of their employees and customers.

FTTH Install

1. Begin by verifying information displayed on the service order is accurate (Name and Address). In some cases you may have the customer information e-mailed to you; please verify with customer all information is correct.
2. With all information correct, proceed to unbox equipment (Gigacenter, Gigapoint) and make any equipment connections possible before turning equipment over to customer.
3. Take note of any necessary equipment ID information needed to activate equipment before turning equipment over to customer.
4. Run temporary fiber jumper from Primex enclosure to house. The jumper will need to be ran through a window or door in most instances. (FTTH jumpers are ruggedized and should withstand this type of install under most circumstances.)
5. After jumper is ran you may pass equipment on to customer. (Equipment may be left at door or on porch area for customer to pick up.)
6. While keeping a safe distance (minimum 6 feet) you may explain how to complete any inside connections required. (This may also be done by phone if necessary.)
7. After customer has equipment connected inside home, call IT to have equipment provisioned.
8. IT can change password for customer if requested, and answer customer questions regarding connecting customer-owned equipment.
9. When install is complete you may check off assigned work using your work app and e-mail Dispatch "Install complete w/FTTH jumper ran temporary." Please include the service order number.



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sheds harmful UV rays for years as well as providing abrasion resistance. These markers have been tested side by side with competitor products in accelerated weatherometer testing equipment. After the equivalent of 4 years outdoors, the competitor sample was completely faded while the Ultra Snap retained its brilliant color. See our website for test results. Available in your choice of wording, logo and colors.

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Mark Horn, Senior Account Executive,
773.754.3247



DSL Install (Single Pair)

1. Begin by verifying information displayed on the service order is accurate (Name and Address). In some cases you may have the customer information e-mailed to you; please verify with customer all information is correct.
2. With all information correct proceed to unbox equipment (DSL Modem / PWR Supply / Modem Antenna(s)) and make any equipment connections possible before turning equipment over to customer.
3. Take note of any necessary equipment ID information needed to activate equipment before turning equipment over to customer.
4. In some cases, the customer may have existing wiring that will work for DSL install. In the event a customer has existing wiring that will work, PRTC will provide in-line filters for customer to install. (We will provide 1 dual filter and as many single filters as necessary to complete install.)
5. If there is no existing wiring or the existing wiring will not work, a jack may be wired up on a temporary CAT5 wire and passed through a door or window.
6. After the necessary wiring has been completed (Existing wire or Temp wire), you may pass the DSL equipment to customer. (Equipment may be left at door or on porch area for customer to pick up.)
7. While keeping a safe distance (minimum 6 feet) you may explain how to complete any inside connections required. (This may also be done by phone if necessary)
8. After customer has equipment connected inside home and modem is in sync, customer will be required to connect any customer-owned equipment.
9. In the event a customer is having trouble connecting customer-owned equipment, you may assist customer over the phone or have IT call customer and assist them.
10. When install is complete, you may check off assigned work using your work app and e-mail Dispatch "Install complete w/FTTH jumper ran temporary." Please include the service order number.

DSL Install (Bonded)

1. Follow all procedures used for standard single pair install with 1 exception. A temp jack and wire will most often be required due to the need for 2 pairs to be wire correctly at the NID and inside the jack.
2. In the event a customer has had a Bonded DSL service in the past and an existing jack may be used, the customer may connect DSL modem to the existing jack to restore service.
3. After customer has equipment connected inside home and modem is in sync, customer will be required to connect any customer-owned equipment.
4. In the event a customer is having trouble connecting customer-owned equipment, you may assist customer over the phone or have IT call customer and assist them.
5. When install is complete you may check off assigned work using your work app and e-mail Dispatch "Install complete w/FTTH jumper ran temporary." Please include the service order number.

Extra Safety Thoughts

- Please remember that when close contact with your customer is necessary, respect the 6-foot social distancing recommendation and mask up.
- I know masking isn't required everywhere, and this is not a political comment; as a 77-year-old recovering from a recent bout of cancer, I'm thankful to everyone who is helping me stay healthy.
- Also, do frequent hand cleaning with soap and water when you can or use hand sanitizer.
- Also, if you don't feel good for any reason, talk with your supervisor to decide if you are safe to go to work.

We all wish this was behind us but we can learn something about being healthier. If we practice safe procedures, it's very possible we can decrease cold and flu viruses. ■

Signing off

Perhaps you have technical processes you would like to share. I'd love to hear -- all of you are important members of a community to help each other learn and grow. Please reach out to me: dmccarty@mccartyinc.com, or text or call me at 831.818.3930.



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TELUS TELLS US THEIR CHURN REDUCTION SECRET

It's GIS

Merriam-Webster defines geospatial as an adjective: *consisting of, derived from, or relating to data directly linked to specific geographical locations.*

The telecom industry has used site-specific data for decades. So how does this technology solve problems better than traditional data set analysis?

Because when it comes to basics, troubleshooting network issues boils down to *What?* and *Where?*

Why is the circuit not working? What is the problem? These can be easy answers or difficult ones. Often, an answer could be as simple as *that 23 Ohm ground on the Tip might be causing a problem.* The hard part is determining where it is.

Other times *Where?* is easy and *What?* is difficult. *I know the 911 system is not provisioned properly, but which one of the 448 settings is wrong?*

Example: 2018 Outage in Rural Iowa

1. Cell Tower is down
2. On-site -- no light in -- light out
3. OTDR measures 2KFT to open
4. The CO is 5KFT away, so the *What* is a cut fiber
5. CO -- Light in -- Light out
6. OTDR measures 3KFT to open from CO
7. Visual inspection shows 2 road bores at every block for a mile along the cable path
8. All circuits on the southern route are down
9. 2:00 AM -- No network engineers available
10. Where do we dig to find the cut fiber?

Geospatial data can answer a question without holding a footage wheel out of a car window or a SWAG based on the odometer. With GIS, 2 OTDR measurements can be correlated to show the location on a map, and a street view illustrates the approximate location. This can be done by the technician on-site with no remote support required.

Example: Hurricane Isaias Analysis

The tactical restoral of a single outage using geospatial data is enough to get excited about. But, what about catastrophic outages over large geographic areas? Consider the next few images that share screen shots from Hurricane Isaias, a destructive hurricane that caused extensive damage across the Caribbean and East Coast of the US in August 2020. (See Figures 1, 2, 3, and 4.)

GIS allows Network Engineers and Architects to evaluate the outages and perform triage without needing a technician to test in the field. Equally, a field technician dispatched on a single subscriber outage can perform the same analysis alone without ever leaving the truck or even calling the NOC. For either user group, the analysis can be done with a few clicks and in less than 5 minutes.

Sure, field techs have been able to complete the analysis above for some time using traditional systems, but the process might take a couple of hours and require 4 different departments coordinating the resolution.



Figure 3. The green squares depict working circuits and the black squares show non-working circuits in the area.

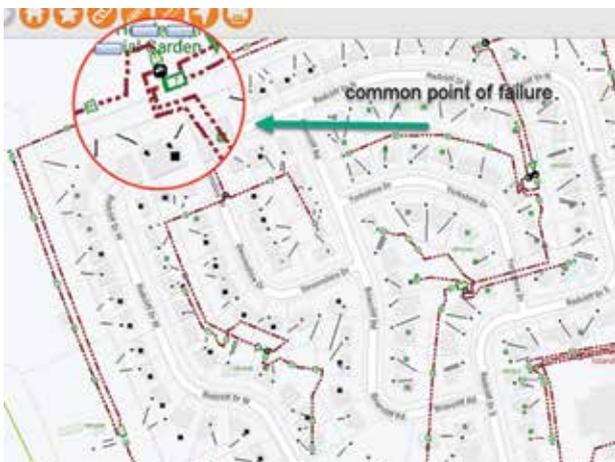


Figure 4. The red circle illustrates the common point of failure for the subscribers involved.

facilitates cross-functional communications and speeds up the restoral process.

Not only did the call volume drop, but duration decreased as well. Calls that used to take 15 minutes now take 1 minute. The decrease in call volume and duration has freed NOC personnel to take on new roles. Remote support for the new in-home security product line is being handled by the same group without adding staff.

May: Can you share some recent GIS applications?

Vishram: TELUS was able to be proactive during the COVID-19 pandemic planning. We were able to locate all the hospitals in our territory and the wireless network elements that serve them. We were then able to automate surveillance on those network elements. Before the permanent cell sites were overloaded, we were ready to provide additional temporary bandwidth using portable cell sites.

May: What was the hardest part of the journey so far?

Vishram: The initial application was a bit challenging. This journey began with a project to replace the software used by the Network Engineers. The old system had to be replaced. Not only was the system old, it was segmented into 800 different regions with no centralized data repository. Receiving buy-in from this group of 1,400 users for a completely new system was difficult. Still, this step was crucial to the success of the overall project because the engineering drawings are now available to 7,000 people.

Adding the twisted copper data sets was difficult, and data accuracy was an issue. However, the field technicians wanted the same data access for copper as they had for fiber optic, so we provided it for them.

May: What was your biggest surprise?

Vishram: How quickly the system has grown. We now have 30 different applications using 354 different data sets. At TELUS, we are constantly finding new ways to utilize this system.

May: What excites you the most going forward?

Vishram: Migrating the application to the cloud. Having everything in one system fundamentally changes the scalability and performance of the system overall. ■

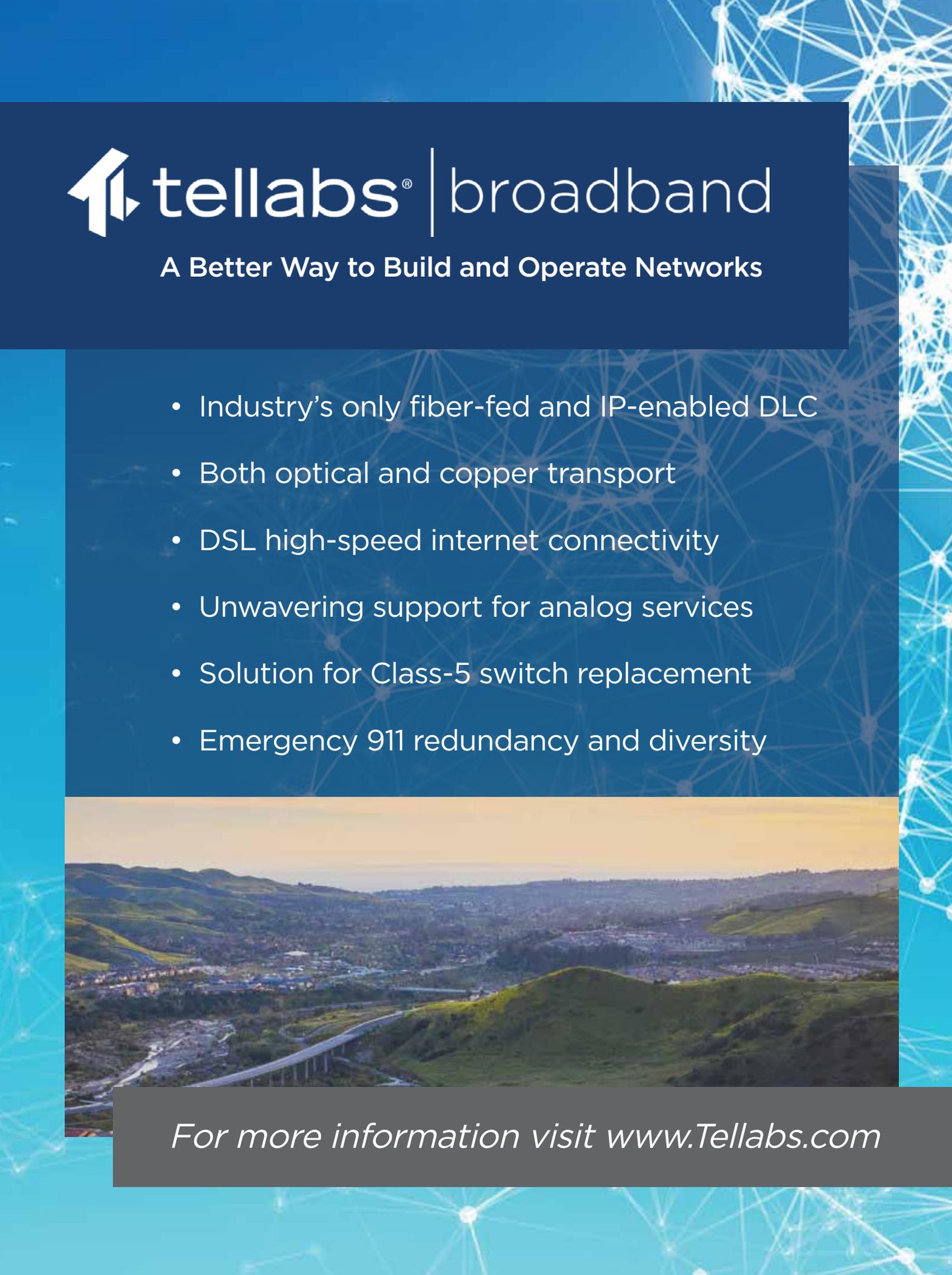


Faisal Vishram is Senior Technology Architect, CTO Office, at TELUS.

Vishram joined TELUS in 2012 and has been the technical lead on several key strategic initiatives. He is passionate about

technology and enjoys simplifying complex problems to deliver results. Faisal has focused on delivering end-to-end solutions that streamline business processes, enabling positive customer experiences. He has also worked in the airline, hospitality, and energy industries. Follow Vishram on LinkedIn:

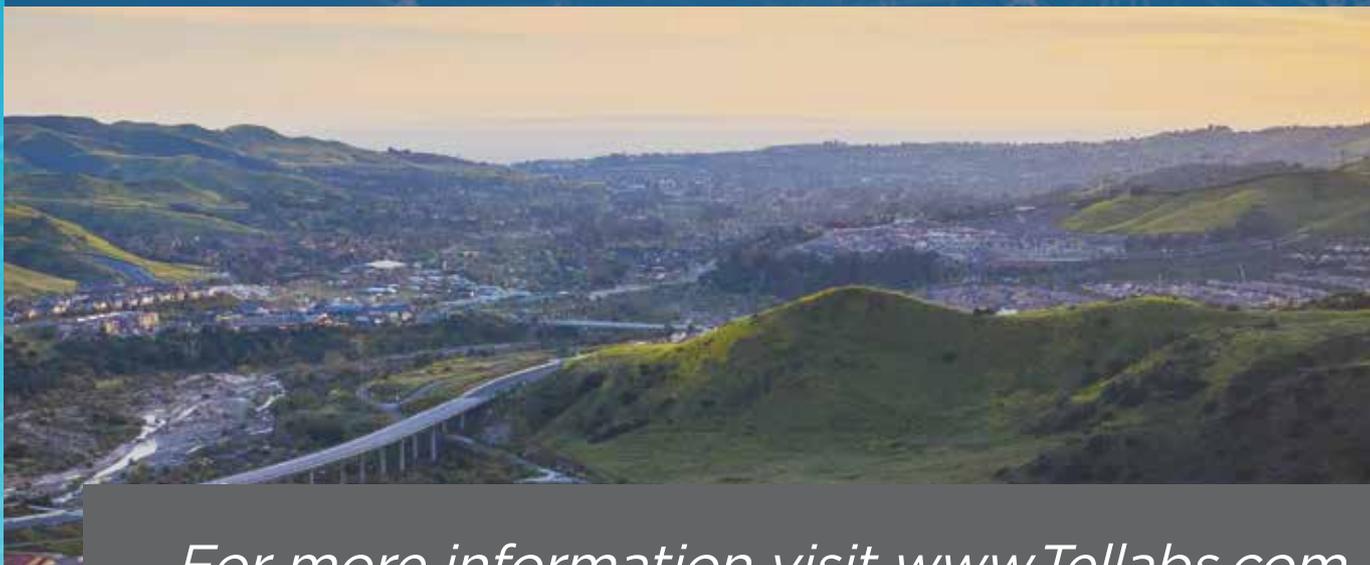
<https://ca.linkedin.com/in/faisal-vishram-p-eng-8b4b7b41>.

The background of the slide features a network diagram with white nodes and connecting lines on a blue gradient background. The diagram is most prominent in the top right and bottom right corners, extending across the entire page.

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Executive Insights:**JONATHAN SPALTER**

President and CEO, **USTelecom-**
The Broadband Association



By Sharon Vollman, *ISE*

ISE: Jonathan, give us some background about USTelecom - The Broadband Association.

Spalter: USTelecom - The Broadband Association is the place where *all* conversations -- and effective advocacy -- about the future of connectivity takes place. USTelecom's members include broadband and technology innovators working together to connect our families, communities, and enterprises, to the future. Our diverse membership ranges from local Main Street companies and heartland cooperatives to large global technology leaders -- all of whom have stepped-up and stood tall during this COVID-19 pandemic emergency to ensure continued access to communications services for all citizens regardless of where they live and work. By bringing together all of the diverse parts of our communications ecosystem, we deliver a singular and united voice to policymakers, and ensure that all our members can invest and innovate in the networks of the future -- and all the opportunities that come with it.



our shared sense of community if this hit in an era when we had no high-speed connectivity.

Biggest challenges:

First, ensure our critical broadband workers are safe and healthy and have access to essential personal protective equipment. Some functions can be handled only in person, so we worked with the federal government to designate broadband employees as essential critical workers, and we pushed leaders in Washington to make good on providing PPE.

Second, continue to drive progress so that nobody is left behind during this moment while accelerating our ongoing work to finish the job of connecting the entire country. We are investing \$70-80 billion annually to connect new communities, upgrade infrastructure, and innovate our networks, but private investment alone can't finish the connectivity job. My message to Washington: #InvestInBroadband, and pass smart bipartisan policies that cut through the red tape, eliminate bureaucratic roadblocks to deployment, and allow providers and their technology partners to compete, invest, innovate, and thrive, on a level playing field in our dynamic marketplace.

TOPIC: FIBER AND 5G

ISE: Post COVID-19, the 5G infrastructure market is estimated to grow from \$12.6 billion in 2020 and projected to reach \$44.9 billion by 2025 -- a CAGR of 28.97%. The projection for 2025 is estimated to be down by 22.79% compared to pre-COVID-19 estimation. (Source: <https://www.businesswire.com/news/home/20200424005429/en/COVID-19s-Impact-5G-Infrastructure-Market-Communication-Infrastructure>) **While 5G is being slowed by COVID-19, what are your members doing to adopt innovative deployment approaches for FTTx and next-gen wireless networks?**

Spalter: 5G is not being slowed by the COVID-19 pandemic. In reality, this next-generation technology has already arrived in numerous American cities, and will ramp up this year and beyond. What will carry 5G traffic? America's wired communications networks. That's what is so exciting. 5G will not only enable transformative new services -- the Internet of Things, connected cars, telehealth, and precision agriculture -- it will create economic productivity and jobs.

Here's how I think about it. The future of wireless is inextricably linked to our ability to deploy fiber infrastructure across the country. 5G is only wireless for the Last Mile, and I tell policymakers all the time: if you want to bring the power of 5G to hard-to-reach communities -- beyond just our big cities -- help us extend wired networks deeper into areas where we need to scale our communications infrastructure and lay lots (and lots) of fiber.

TOPIC: PAIN POINTS

ISE: What are your members' biggest challenges right now? What is USTelecom doing to help them?

Spalter: As the world confronts this unprecedented global health and economic challenge, we know that broadband has never been more indispensable. Our economy and our neighbors have been hit hard, but you can only imagine the body blow to productivity and



“Our diverse membership ranges from local Main Street companies and heartland cooperatives to large global technology leaders -- all of whom have stepped-up and stood tall during this COVID-19 pandemic emergency to ensure continued access to communications services for all citizens regardless of where they live and work.”

TOPIC: PUBLIC AND PRIVATE INVESTMENTS

ISE: You recently said: “I encourage Congress to continue to look for ways to both ensure that customers can afford the broadband they need and keep providers on sound financial footing as they continue to do everything possible to keep our nation connected.” **Share 3 of the most viable solutions to make that happen.**

Spalter: Our goal must be 100% connectivity for all Americans. Full stop. We’ve pursued this public policy goal for some time, but incremental approaches with limited budgets, combined with rapid redefinitions of how we use and integrate broadband into our lives, has left too many Americans still without the access they need. That’s unacceptable.

The economic, social, and human, challenges of this are well documented, and connecting the last 1% to 2% of Americans is going to be costly. Different entities and even Congress, have identified various funding targets for ubiquitous fiber broadband, some of which exceed \$100 billion. This is a significant amount of money, but if that is what it takes to get the job done, I say then let’s get it done.

We can’t stop there.

I speak regularly to many members of Congress, and here’s my message: adopt a legislative framework that capitalizes on the work, preparation, and expertise, of the government agencies it has already charged with meeting our nation’s broadband needs. The best programs are the ones that were implemented deliberately, well thought-

out with both government and industry input, and that can provide nearly immediate results. Congress should provide substantial additional funding to the FCC so that it can allocate to programs such as the Rural Digital Opportunity Fund (RDOF) as well as the Alternative Connect America Cost Model (ACAM) at levels that will achieve 100% fiber broadband connectivity nationwide.

TOPIC: COST-CUTTING

ISE: As more businesses enable remote work and consumers switch to unlimited plans, telcos have an opportunity: if they can support remote work while giving consumers a positive experience throughout the crisis, their brand perception will be improved. Still, telcos face financial uncertainty caused by the COVID-19 pandemic. So, they must plan accordingly. In the long term, challenges will include cost-cutting, as commodity services will likely become cheaper. **What does this mean for your members’ teams?**

Spalter: The value of broadband has never been clearer. As the global economy shut down, USTelecom members worked tirelessly, and often in harm’s way, to keep America’s Internet open and our communities connected. Our members not only joined the FCC’s Keep Americans Connected Pledge, but they consider their commitment to connectivity a core value and worked with customers facing economic uncertainty. But it’s not always easy, and it does come at a cost. Many of our members are local and regional Main Street enterprises and cooperatives, and feeling the financial strain, too.

We're glad to be delivering more broadband to more families and enterprises than ever before.

Here's why broadband will not be a commodity -- there is more competition and innovation than ever before with providers constantly evolving and delivering a variety of new services and network technologies with new applications and new options. Innovative and dynamic businesses can't be commodified.

TOPIC: SUPPLY CHAIN

ISE: What issues do your members face related to supply chain? Are there some suggestions you have for the vendor community to help remedy these challenges?

Spalter: Supply chain security, diversity, and availability, matters. A lot.

During the COVID-19 pandemic, we've seen the global supply chain come under stress, especially network components. Complex issues of international commerce, diplomacy, and national security, also impact our supply chain outlook. USTelecom has become an essential place where supply chain solutions can be forged. We chair the Communications Sector Coordinating Council at the Department of Homeland Security (DHS). And we co-chair the Information and Communications Technology (ICT) Supply Chain Risk Management Task Force at DHS, a first of its kind public-private partnership to identify and manage risk to the global ICT supply chain.

One of the things we've been advocating for is consistency across the government. It becomes a problem when Congress uses one definition of suspect equipment and the FCC uses another.

USTelecom is creating a platform that encourages stability -- and certainty -- for future network investment so we need the federal government to be on the same page.

TOPIC: CULTURAL TRANSFORMATION

ISE: Explain why cultural transformation is as important as technical transformation to ensure that Communications Service Providers thrive in the future.

Spalter: We are a community of innovators. That doesn't just mean excellence in technology, but fundamentally it means our members are in the business of creating opportunity, connecting communities everywhere, and bringing humanity together. We have an obligation to work as an industry to build a more inclusive country, and to ensure that we have the best-trained and most inclusive workforce possible -- including our own. This includes the frontline, in the executive suite, and in the boardroom. Our members understand this, and they are making commitments to championing new voices and new perspectives across all facets of their operations. The way we innovate in our workplace is key to how we innovate for our customers.



(top) Spalter with U.S. Senator Ed Markey (D) of Massachusetts.

(below) Spalter with House Majority Whip James Clyburn (D) of South Carolina.



TOPIC: PRIORITIES

ISE: What are 2 of USTelecom's top priorities for the next 18 months?

Spalter: There are 3 top priorities, and they are interrelated.



Spalter, USTelecom Board of Directors with U.S. Congressman Marc Veasey (D) of Texas.

First, ensuring investment by working with government to extend broadband.

Second, boosting digital trust by fighting illegal robocalls, shoring-up the cooperation needed to keep our networks secure, maintaining our open Internet, and passing a strong national privacy framework that treats all parts of the digital ecosystem the same.

Finally, tearing down the barriers to deployment that we know exist. This means we have to continue the hard but necessary work of dragging many of the tired old analog and thumb-on-the-scales rules still on the books that hamper broadband access for consumers and weigh-down competition in our nation, along with the backwards-looking hyper-regulatory mindsets that champion them, fully and finally into our pro-consumer, fiber-broadband-fueled dynamic modern digital era -- even if they are kicking and screaming.

This is not a partisan project. The ones and zeroes comprising our Internet and traversing our networks are neither red nor blue. If we are to fully put the Digital Divide in our rear-view mirror, Congress and the executive branch must examine some of the outdated and legacy regulations that don't get headlines but play a major role in slowing broadband builds. The fact of the matter is slow government approvals and rights-of-way and permitting disputes hold back broadband construction and deployment.

I can't tell you how many of our network innovators -- and their customers -- bump into red tape and rules that make these essential infrastructure projects slower, more expensive, or nearly impossible to get off the ground. If Washington wants to help consumers, especially those in corners of the country that need 21st Century connectivity, streamlining regulations and creating a level-playing field for all competitors are great places to start.

TOPIC: OVERLOOKED ISSUES

ISE: What should all of us in the Information and Communication Technology (ICT) industry be talking about that we are not? Or, what current topic is the most important that needs additional and different attention?

Spalter: A shared vision and common effort to advance the security, resiliency, and interdependence, of the technologies that comprise our networks that includes the good (IoT) to the bad (botnets), and everything in between. We need a conversation about how to work together if we ever have a very bad day in cyberspace. I am proud the Council to Secure the Digital Economy (CSDE) we founded, which includes several of the world's largest and most innovative ICT enterprises, has become a central venue for this practical, solutions-driven collaboration. But this is not just an ICT project. Increasingly, ALL sectors understand their reliance on the underlying network technologies that impact their businesses. This includes transportation, finance, energy, healthcare, and beyond. They too must join us in this work and as our partners. And we welcome them.

TOPIC: THE FUTURE

ISE: What emerging or disruptive technology excites you the most for the ICT industry? Why?

Spalter: The short answer: who knows? Which is what makes this work so exciting. The future is increasingly driven by cloud, virtualization, open standards, and the

promise that permissive innovation will always be a better formula -- and we're going to continue to make investments in the core infrastructure that will get us to 5G, 6G, and beyond.

Our networks are evolving to accommodate permissive innovation over government controls and mandates. We should not put our efforts into backing a single horse or turning our networks over to the government (a supremely bad idea). Rather, we should be supporting a diverse field of vendors to minimize economic and national security risks, and encourage next-generation technologies like Open RAN. Innovation is going to be key here. Moving to software-based and virtualized networks will help reduce dominance by one country or a single provider.

TOPIC: RISK

ISE: What's the biggest professional risk you've taken?

Spalter: Does having a supporting actor role in a Hong Kong Kung Fu movie count?

TOPIC: GUIDANCE

ISE: What professional and leadership guidance would you offer a younger Jonathan Spalter as he was forging his career path?

Spalter: I think the business leader and Chief Diversity Officer Maria Castañón Moats said it best: *Cultivate a network of trusted mentors and colleagues. Other people can give us the best insight into ourselves -- and our own limitations. We must have the courage to ask for help and to request feedback to expand our vision of what's possible.*



"The future is increasingly driven by cloud, virtualization, open standards, and the promise that permissive innovation will always be a better formula -- and we're going to continue to make investments in the core infrastructure that will get us to 5G, 6G, and beyond."

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TOPIC: YOUR ROLE

ISE: What would you recommend to someone who wants to achieve a high-level position in his/her career?

Spalter: Strive constantly to make new mistakes.

Remember the old axiom: *It is amazing what you can accomplish if you do not care who gets the credit.*

And always recognize that every team member, no matter their role or station in your organization, matters. ■

Jonathan Spalter is President and CEO of USTelecom - The Broadband Association. USTelecom is the national trade association representing technology providers, innovators, suppliers, and manufacturers, committed to connecting the world through the power of broadband. Visit USTelecom at <https://www.ustelecom.org/>.

 @Jspalter
 @USTelecom

BEST OF 2020 EXECUTIVE INSIGHTS INTERVIEWS

Some Stellar Quotes
to Inspire and Educate

By ISE



Kristin Karp, President
and CEO, Hotwire
Communications

TOPIC: SMART CITY COLLABORATION

Now and in the coming years, telecommunication providers need to strongly advocate for the integration of Smart City solutions and the proliferation of fiber optics networks, which will be essential and necessary for the successful widespread adoption of 5G.

This integration will need to be the result of a relationship between telecommunication providers and the communities they serve, one which takes the unique needs of those communities and their residents into account in order to tailor-make an initiative that suits those needs. A one-size-fits-all approach won't be appropriate, as every com-

munity is different, but each plan will have to be built upon the 2-way understanding that a robust fiber network is critical in allowing for the benefits of Smart City technologies to be achieved.

TOPIC: INSPIRATIONAL QUOTE

"All our dreams can come true, if we have the courage to pursue them."

– Walt Disney

Excerpted from the June 2020 issue.

For more information, visit hotwirecommunications.com.

 @gethotwire



Michael Burke, CEO
Matanuska Telephone
Association

TOPIC: 5G ROADMAP

One fact that often gets overlooked on the 5G deployment discussion is the need for robust fiber backhaul to support the data transport that will occur. 5G involves deploying thousands of towers spaced closely together, which means there has to be a lot of fiber connecting each of the towers. MTA's fiber projects will be necessary to provide any kind of 5G in our area, and we hope to have a strong network that can support any 5G deployments in the near future.

TOPIC: FAILURE

You have to embrace failure, since not everything that is attempted will succeed. If you have no failures, then it suggests you are not trying to push for anything new, and a business that is stuck in the past will ultimately become irrelevant. Thomas Edison took 1,000 tries to invent the light bulb, but didn't regard each action as a failure, but rather part of the learning process to get something accomplished.

Excerpted from the February 2020 issue.

For more information, visit <https://www.mtasolutions.com>.

Bob Udell, President and CEO, Consolidated Communications

TOPIC: ARTIFICIAL INTELLIGENCE

We have embraced AI as a tool to help us be more efficient, while at the same time making it easier for our customers to do business with us. We currently look at AI as a decision-support tool. We use it to make sure that our customers' calls are routed appropriately to address their needs.

Also, we're implementing AI and process automation to handle some of the routine types of activities in our frontline, like seasonal line suspensions and restorals. Automation of processes allows us to spend more time developing custom solutions for our customers.

AI is beginning to play a role in network deployment. Looking into the future, I can see a time where AI does even more of the network engineering for our industry, especially on choosing site locations for fiber hubs and wireless antennas.



TOPIC: MENTORING

I'm fortunate to be in a position where I currently mentor a few young professionals on an ongoing basis. The advice I give them is simple: Make this world a better place than you found it. That's my guiding principle. While simple to state, it can apply to everything.

One should follow their passion and use the energy they get from doing so to motivate those around them to achieve great things. Along the way, listen and learn from the best. Treat others as you like to be treated.

Build a network of trusted advisors. Especially in areas in which you feel weak or unskilled.

When it comes to tough conversations, have them. Do it with respect but with an appropriate tone. The worst feeling is knowing you should have had a conversation and didn't. Most people respect when they are held accountable, and they benefit from constructive feedback.

Excerpted from the May 2020 issue.

For more information, visit www.consolidated.com.

 @CCI4Biz



Shirley Bloomfield, CEO, NTCA–The Rural Broadband Association

TOPIC: WOMEN IN TELECOM

I find that women who work on the financial aspects of business have a very good gut for leading on critical business decisions.

At NTCA we launched our Women in Telecom network to allow women leaders to share, support,



As Eleanor Roosevelt famously said:
It is better to light a candle than curse the darkness. We all have a role to play in putting out a helping hand to that next generation of leaders. I certainly owe that much to my 2 amazing daughters!



– Shirley Bloomfield on women in telecom.

and compare, career and management advice with one another. I have a similar group of women I work with at GlobalWin, a group I helped organize in D.C. with other female leaders in various tech industries, and we share those same opportunities from a national perspective.

TOPIC: OVERLOOKED ISSUES

Dispel the myth that rural America is disconnected. Yes, we need to connect rural America more than ever, but a significant portion of rural America is already connected, thanks to community-based providers. As community-based entities, their focus is always on serving the area where they themselves live, work, and play, as well as the economics will allow.

What you see is not simply a rural/urban divide, but a divide between rural areas themselves



Johan Gustawsson, Network Engineering & Architecture, Telia Carrier

TOPIC: CAPACITY FORECASTING

The recent dialogue seems to revolve around how networks cope in a fully operational state. This is not typically what they are built for in the first place, thus making for an equally poor metric now for us to utilize.

What is more useful is understanding whether the network can cope during outages, with the most common one being able to handle any single failure. We model and measure this for every hour of the day in 3 different models:

- **The Retrospective Model** provides a historical view of “Traffic at Risk” considering any ongoing failures at the time of the auto-discovered snapshot.
- **The Reference Model** examines the network in a fully operational state and is used to do “what if” scenarios with regards to topology or metric changes, the addition of new devices, and simulating impacts of planned maintenances and other events.
- **The Forward-Looking Model** is essentially a copy of the reference model, but it includes all committed augmentations to take that into account when adding new capacity to the network (i.e., combining the 2nd model with known upcoming projects).

Utilizing these 3 methodologies, we can immediately identify where new hotspots have emerged should we have failures -- measured in the form of “Traffic at Risk” per time period, device, network role, SRG, and/or region. This informs us where we need to build ahead of time, thereby preventing slow speeds or even the dreaded downtime that we all despise as end users.

Excerpted from the August 2020 issue.

For more information, visit www.teliacarrier.com.

-- between those who have lightning-fast broadband speeds in their community of 3,000, and those who perhaps are served (or not served) by some of the larger companies out there who, quite frankly, have shareholder pressure to put their resources into more lucrative markets with larger returns on the investments.

We know where the problem is. Now we just need to incentivize companies, like NTCA

members, to be part of the solution by edging out even further to bring service in collaborative ways to these underserved areas outside of their existing current markets.

Excerpted from the March 2020 issue.

For more information, visit <https://www.ntca.org/>.

 @sbloomfield15

Jens Laipenieks,
CEO/General Manager
ASTAC (Arctic Slope Telephone
Association Cooperative, Inc.)

TOPIC: CHALLENGES

To understand the challenges ASTAC faces, you must first understand the landscape of the North Slope. Our serving area is immense, over 90,000 square miles, with a population of ~9,500. That is about 10 sq. miles per person. Imagine the land-mass of Minnesota, with one dirt road to access a tiny part of it, the rest unreachable by road. The only access to most of the ASTAC communities is by small plane or once-per-year barge service.

The real question is how to deliver affordable high-speed services to our customers. The majority of the North Slope population is not wealthy, with an average income of \$47,000-\$58,000. The largest businesses are native corporations and the different divisions of the North Slope Borough government.



Everything in the Arctic costs more. Gas, \$5.50/gallon; milk, \$10/gallon; travel from Anchorage to the North Slope, \$750; intervillage airfare, \$400. ASTAC's cost of operation is greater than anywhere else in the US.

Our field techs work 3-weeks-on/3-weeks-off shifts, 21 ten-hour days with OT built in. ASTAC also provides transportation from Anchorage and room and board. All these factors drive up our cost

“

This is a sensitive question for me. About 70% of the population of the North Slope are Alaska Native. Maintaining the strength and respect of the Inupiat culture is critical for ASTAC. Technology and cultural values do not have to be at odds.

– Jens Laipenieks on cultural transformation.

of service, which are compounded by the very high cost of monopolistic Middle Mile transport (discussed earlier). These are the greatest challenges to delivering truly transformational and affordable broadband speeds to our membership.

TOPIC: CULTURAL TRANSFORMATION

Providers like ASTAC have a responsibility to promote and encourage the benefits of broadband, and I'm not talking about just gaming and better streaming service. We are making investments and developing partnerships to enable new opportunities for the Inupiat culture to grow and remain strong.

ASTAC believes in inspiring science and technology leaders of tomorrow. Our support of the NSBSD's FIRST Lego League (FLL) has helped expand the robotics program from middle school to also include K-4 and high school students. FLL's objective is to make children and youngsters enthusiastic about science and technology; equip them with the idea of team spirit, and to encourage them to solve complex tasks in a creative way.

Excerpted from the September 2020 issue.

For more information, visit www.astac.net.

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VISIONARIES

ROUNDTABLE HIGHLIGHTS

Network Executives Gathered Virtually to Share Pain Points and Passions

By Sharon Vollman, *ISE* magazine

Like the rest of us, our 2020 ICT Visionaries have adapted to working in a hybrid environment. Most are combining a Work-from-Home (WFH) model with working from the office. All of them have learned much about leadership, walking their talk and learning what really matters in this COVID-19 era.

Fittingly, our annual ICT Visionaries roundtable event was intended to be a videoconference gathering. But, we ran into the typical challenges you've likely hit before. Platforms didn't "talk" to each other; participants' firewalls prevented them from easily joining us. We sent instant messages and texted each other while we tried to problem-solve platform glitches. After trying a few work-arounds, we ditched the videoconference notion and joined a good ol' IP audio conference. Still, the latency gremlin got in the way of our verbal spontaneity. (There's nothing like the audio black hole when you say something you hope is clever, only to hear silence and a late awkward laugh.)

None of that was surprising. By now, we all know how technology can help and hijack our best efforts to communicate.

What was happily surprising was the patience and light-heartedness I saw amongst our ICT Visionaries after many minutes of waiting and problem-solving. They were easy-going despite having to-do lists pinging them in the background. They were collaborative and honest with each other even though they represented competitors. And when we had to sign off because of time constraints, many were open to virtually gathering again.

THAT is what I adore about our industry. Nuff said.

Check out a few nuggets they agreed to share in print. After you read their insights, think about what you, or someone you know, could add to this discussion. Then, consider nominating someone extraordinarily good at what they do for the ICT Visionaries 2021 program. *Email me: svollman@isemag.com.*

ICT Visionaries Attending ISE's 2020 Virtual Roundtable Discussion

- Johnny Hill, COO, Clearfield. Johnny kindly sent his written responses so we could share them here. Brian Schrand, VP of Application and Field Engineering, joined us during the roundtable discussion.
- John Greene, CEO and GM, New Lisbon Telephone Company, Inc., and New Lisbon Broadband and Communications, LLC
- John Robbins III, Senior Manager, Network Engineering for City of Fort Collins, Fort Collins Connexion
- Curt Christensen, Customer Network Manager, Norvado



JOHNNY HILL

COO

Clearfield

TOPIC: VENDOR AND CONTRACTOR PARTNER WISHES

What do you think vendor/contracting partners need to understand that they don't?

It's no secret that when a service provider finds the right combination of vendor and contractor it takes something very drastic to get them to deviate from not using either party. Now more than ever, service providers are being pressured to build their

networks faster and more cost effectively.

There are considerations that providers weigh when constructing a network. First, there is speed of deployment. With bandwidth consumption going up exponentially, there is a need to build out quickly. Second, there is network reliability. Vendors will collaborate with service providers to develop products that will allow them to do both functions: build quickly and reliably. In most cases, those products come with some amount of plug-and-play. This can be an issue with contractors who traditionally hard splice network elements.

Contractors need to be included in the conversation when developing network solutions.

Last, there is the mean time to repair. Customers have grown very dependent on their high-speed connection so, when service is affected, they expect it to be restored as quickly as possible. Rapid restoration can be achieved by the ability to simply plug in a replacement for the faulty network element. No matter what network architecture is chosen, all parties need to communicate with one another to ensure that all network demands are being addressed. Providers place a high value on having solid relationships, knowing they can trust both their vendor and contractor.

TOPIC: INDUSTRY CHALLENGES

Which ONE of the opportunities noted below do you believe is the most important for our industry to advance in 2021, and why?

- 5G Mass-Market Rollouts
- Edge Computing
- Network Transformation

- Public Private Partnerships
- Telecom Cultural Transformation
- Wireless/Wireline Integration
- Other?

I believe wireless/wireline integration is the most important. Mobility and speed are the 2 elements that subscribers are demanding.

Across the globe, the number of mobile devices accessing the web continues to increase. Today, that number is roughly 90%. This statistic would suggest that a wireless network is the best answer for delivering high-speed services.

Clearly, a fiber-rich network is required to backhaul wireless traffic. As network speeds continue to grow, fiber is the best option for future-proofing a network. Unlike wireless technologies, single mode fiber has stayed consistent since its development, and hasn't yet reached its physical capacities. Many networks are still utilizing fiber cables that were installed in the 1980s. So, the question is: If you're building a dense fiber network for wireless backhaul, why not plan for the future, provision for FTTx, and pay today's labor rate instead of tomorrows?



JOHN GREENE

CEO and GM

New Lisbon Telephone Company, Inc.

New Lisbon Broadband and Communications, LLC

TOPIC: YOUR TAKE

Share one problem/challenge you are passionate about solving for the ICT Industry.

The number one issue, in my opinion, is the Digital Divide across Rural America. As a small provider in rural Indiana, I see the positive effects of providing reliable and affordable Broadband to our customers. But I also see the large numbers of customers that cannot obtain this essential service, due to a lack of network facilities in those areas.

The issue is, and always will be: how to fund these expensive network build-outs, and to choose the right technology that will provide what is needed today and allow for upgrades and expansion in the future. From fiber to fixed wireless to satellites, everyone has a plan that they think will work.

Many different technology advocates are pressing both the States and Federal government agencies to support their technology with funding. Unfortunately, there is not enough money to go around, so these technologies, while they should be complementary, are in competition for the scarce assets.

Fiber optics technology has been, and will always be (IMO), the penultimate technology for high-speed Broadband connections.

- **However, the costs to build fiber networks is high**, and is not always economically feasible.
- **Fixed wireless and satellites seem to be a lower-cost solution**, but they may not be easily upgradable to meet the needs of Broadband users in the future.
- **Disbursement of the necessary governmental funding still lacks accuracy in many rural areas of the country** due to inaccurate self-reporting and poor technology assumptions, meaning many areas that are shown to be adequately served and not eligible for government funding are actually underserved or even unserved.
- **Finally, politics are playing a bigger role in determining the haves and have nots for Broadband**, something that should not happen.

While I don't agree that Broadband access is a right, it is certainly an essential service, and determining who gets funding should not be based on

what party is currently in power at the state and Federal level.

I am passionate about Rural Broadband, and my company will continue to do what we can with limited resources to build out to as many rural residents as we can. But until we solve (or at least streamline) the funding issues associated with Rural network build-outs, the US will continue to struggle in getting ubiquitous Internet to all its citizens.



JOHN ROBBINS III

Senior Manager,
Network Engineering for
City of Fort Collins
Fort Collins Connexion

TOPIC: DIGITAL DIVIDE URGENCY

Share your thoughts about this pressing issue.

As a municipal provider, equitability and inclusion is second nature to Fort Collins Connexion. Providing high-speed Internet to the unserved and underserved population while offering a digital equity option to low-income residents has been part of our plans from launch.

On a larger scale, the reality is that many State and Local municipalities are not prepared to deal

with the overhead that comes from operating and maintaining a fiber backbone.

Another common challenge for disadvantaged populations is accessible fiber due to geographic footprint. For example, many mobile home parks in Northern Colorado reside just outside of City boundaries, and therefore are out of reach to City broadband.

The COVID-19 pandemic has compounded the problem for these communities, and has exposed the fact that millions of kids across our nation have little or no access to Internet for on-line school.

Public Private partnerships and Intergovernment Agreements (IGAs) between State and Local officials may help solve some of the accessibility challenges. But to truly bridge the Digital Divide, *all service providers*, public and private alike, need to go *all in* with effective plans to address this crisis.

TOPIC: AUTOMATION

Many providers are focusing on cost reductions. They aim to drive savings through software-based technologies, automation, AI/AR, and other solutions.

What are some successful strategies you've seen executed in these areas? What are we NOT doing that we should be doing to effectively reduce costs?

Small and large providers alike have adopted virtualized, cloud-based management into their production networks. As cloud-based IP traffic explodes, putting pressure on edge networks, so too does the need for better integration of software-defined-networking technology (SDN) into ready-to-use network solutions.

SDN and AI bring the promise of service delivery automation and user-friendly provisioning that provides control over an entire life cycle, from service creation to configuration, administration, and maintenance.

And while these technologies may lower OpEx and provide tools normally out of reach to providers, equipment vendors have been slow to provide off-the-shelf solutions that leverage network virtualization in a practical way. Most small- to mid-sized ISPs do not have the experience with network service abstraction tools, such as use of NETCONF protocol and YANG modeling language, and are reliant upon vendors to build SDN and AI into

their offerings. Doing so has clear advantages for the equipment vendor in staying competitive and potentially lowering their own development cost, while at the same time providing operators better automation tools for network orchestration and end-user provisioning.



CURT CHRISTENSEN

Customer Network Manager

Norvado

TOPIC: BEST OF

Share the “best of” network solution/technology/tactic you or your team embraced during this very interesting year. If there isn’t one, what solution/technology do you wish existed in 2020?

Best of 2020, was there really any? For Norvado, it was expediting turn-up of our managed residential Wi-Fi. This was a multi department effort to enable managed Wi-Fi so we could assist customers remotely and limit truck rolls to lessen COVID-19 exposure for our customers and technicians.

We also implemented additional remote support tools which allows us to send a link to the customer’s device that opens as an App, and we have live video access to what the customer was pointing

their device at, as well as do a network scan on the customer network equipment remotely.

We have a very successful Hosted PBX (HPBX) offering, and we put in effort how to support training customers remotely better. All our HPBX turn-up training used to be on site but now we are able to do much of this remotely. Updating our company’s website knowledge base support with How-To video guides was a key for supporting all types of customers better efficiently.

TOPIC: VENDOR AND CONTRACTOR PARTNER WISHES

What do you think vendor/contracting partners need to understand that they don’t?

We have used contractor/consultants in many of our departments over the years. Contractors need to understand that we are a customer and that their employees are an extension of our company. Contractors are in demand throughout the industry, and it is hard for them to find skilled technicians for engineering, installs, and fiber splicing. Many of their staff are not seasoned and experienced, so there is a lot of training that we call the “Norvado Way” when they work our jobs. We demand a lot of our install contractors doing fiber conversions. We expect testing of existing Cat5 infrastructure, and customer training. It is not just get the customer converted and on to the next. We also use those contractors for Service Order and Trouble Ticket overflow support. Contractors need to follow the same procedures and process that our own technicians do. From using our billing Apps to update Service Orders and Troubles with information and pictures, to training and upselling services to customers and providing an excellent customer experience. We have moved on from individuals if they could not produce the work we are expecting. ■

Consider nominating someone extraordinarily good at what they do for the ICT Visionaries 2021 program.

Email: svollman@isemag.com.

ADVERTORIAL

The *HT Element X Alloy*TM Advantage

GS Yuasa Energy Solutions

Reliability of communication and data networks has become critical as more and more people use wireless devices to access the internet, route their vehicles thru traffic congestion, find a restaurant, or just surf the ‘net.

As more equipment is being deployed in telecom networks, the capital outlay for replacement batteries is one of the largest reoccurring costs, driving the need for longer life solutions. This network growth situation exacerbates the need for technological improvement in batteries which resist, and even thrive, in high heat environments.

GS Yuasa Energy Solutions (GYES) answers the need for a long life, high temperature battery through our proprietary *HT Element X Alloy*. Research by the scientists at GS Yuasa Corporation in Japan found trace amounts of a common element, Element X, had a negative impact on key lead acid battery performance criteria. They also found this Element X was in the alloys and pure lead solutions used by all battery manufacturers.

	<i>HT Element X Alloy</i>	Pure Lead Alloy	Pure Lead
PPB Impurity Level Control			
Low Float Current			
Low Corrosion Rate			
No Thermal Runaway			
Low Water Loss			

HT Element X Alloy
 The researchers at GS Yuasa found controlling the amount of Element X, down to the parts per billion level, had a major positive, impact on the performance of our batteries, increasing life in high temperature applications by minimizing positive grid corrosion, reducing float current and dry-out and eliminating thermal runaway.

Using their research finding, GS Yuasa developed the proprietary *HT Element X Alloy*. Eliminating Element X results in a longer life more consistent product.

GYES’ proprietary *HT Element X Alloy* has been proven to deliver best in class performance in the harshest environments and in multiple studies in the southeastern US and the desert southwest.

The improved performance provides the lowest cost of ownership due to longer battery life, longer replacement intervals and fewer outages. The reduction in downtime will improve customer satisfaction and customer retention due to poor network performance.

GYES stocks product in our US warehouses for expeditious shipment.

Contact your local representative, visit our website: www.GSYuasa-ES.com, or call 1.800.472.2879.





FARMERS PUT THE BYTE INTO FOOD PRODUCTION

Farmer-to-Everything
Connections for the Future

Agriculture-applied facial recognition software perceives patterns and shapes on each animals' face and hide, giving them a digital identity that farmer's use to protect herd health.

By Paul Pishal

The USDA estimates that if US agriculture realizes the full potential of digital technologies, then the industry would add \$47-65 billion annually in additional gross income to the US economy.

As high-tech city concepts gain momentum, like Bleutech Park Las Vegas (<https://www.bleutech-park.com/>), they become a beacon of our transforming world, a shining example of sustainable, smart living. But urban areas aren't the only fertile grounds for data-driven initiatives.

Like US tech giants and entrepreneurs, farmers are futurists by nature: they plan for the next growing season, predict frost and storms, and forecast market sell targets. As part of their long-game, farmers deploy digital technologies such as sensors, machine learning and visioning, and artificial intelligence (AI), in their fields and facilities. These technologies help umpire animal behavior, crop yields, soil conditions, market pricing, and other unknowns, to optimize how farmers plan, produce, and bring food to market. A sustainable, high-yield approach to agriculture is critical because, by 2050, the global population will reach 9.8 billion, and food demand will increase by 50%.

Interest in tech-savvy farming is on the rise, but the rural Digital Divide is slowing agriculture modernization. As home-grown leaders, rural electric cooperatives (co-ops) may be the linchpin of closing the Digital Divide and building the networks to realize Agriculture 2.0 and our global food supply goals.

Farmer-to-Everything Connections

The Internet of Things (IoT) has made its way to America's farms. From cropland and dairy barns to storage facilities, farmer-to-everything digital connections are putting the byte into food operations.

Digital apps, devices, and use cases, are evolving continually. Facial recognition software, for example, has evolved beyond its original use as a security tool. This evolution means that farmers will never look at cows the same way -- literally. In the agricultural application, facial recognition

software perceives patterns and shapes on each animals' face and hide, giving them a digital identity. Cameras and AI track and monitor cow movement. This helps farmers understand individual feeding and watering habits, find lost cows, and discern illness or unusual behavior. As another device twist, Bluetooth-enabled health wearables -- imagine a Bovine FitBit -- monitor livestock health and reduce production costs, slashing medication per animal by 15%.

In the air, drones hover above specialty and row crops. With US predicted market growth from \$1.2 billion by 2019 to \$4.8 billion by 2024, drones with thermal and spectral cameras produce low-altitude, high-resolution imagery that depicts farmland conditions beyond the naked eye. Farmers use drone data to spot pests, weeds, and irrigation issues, as well as to estimate crop yield, monitor livestock locations at night, and detect soil nutrient deficiencies. When paired with computer vision and machine learning, hyperspectral imaging can recognize food characteristics. What if tough steak and underripe fruit were a thing of the past? IoT technologies help farmers identify and cull low-quality products before they hit the grocery store.

The United States Department of Agriculture (USDA) estimates that if US agriculture realizes the full potential of digital technologies, then the industry would add \$47-65 billion annually in additional gross income to the US economy. For the farmer, these technologies help balance their day-to-day issues such as worker shortages and the new complexities of climate change, which emphasize resource conservation. Connected technologies provide data-vision and fine-scale understanding of operations, which helps farmers identify precise, sustainable cultivation and management methods for their specific location, conditions, and production goals.

Incubator Farming

The future of farming is taking shape on a 40-acre plot near Fargo, North Dakota. The Grand Farm Initiative, spearheaded by Emerging Prairie, is a non-profit, collaborative test site that could give farming a techno-shot in the arm. With more than 200 experiments conducted in 2020, Grand Farm is a venue for experimentation and education centered on high-tech farming, such as autonomous farm vehicles and crop science.

Grand Farm's incubator approach is not unlike other high-tech accelerators. It fosters collaboration and partnerships among farmers, businesses, higher education, and technology leaders, including Microsoft and North Dakota State University. These partnerships accelerate innovation that will kick-start technology growth and sustain farming into the future. Just as important, incubators help farmers climb the digital learning curve, which leads to faster technology adoption.

Technology testing grounds, like Grand Farm, help close the global food gap by developing sustainable production approaches that increase yield while conserving resources and reducing the need for pesticides and other chemicals. The USDA estimates that high-tech agriculture could reduce food insecurity by 7.5% in developing countries, cut fuel use by 40%, reduce water use by 20-50%, and slash chemical application by 80%.

Collaboration gets innovation flowing, but telecommunications -- which enable sensors, IoT data, apps and digital technologies -- transform ideas into field-deployed solutions. Wired and wireless networks are the gateways to the future of farming, and are essential to meet the world's food and sustainability goals. But, the rural Digital Divide could cause agricultural innovation to lag.

The Rural Digital Divide

About 22% of rural communities do not have access to high-speed broadband, while many with service are plagued by inconsistent or slow connections. Broadband, enabled by fiber, is quickly becoming the chief indicator of which businesses stay competitive. It also makes farms more valuable and attracts younger digital natives to farming, which could slow generational decline and increase active farms.

It may be difficult to fathom dead zones in the US considering that fiber networks grew 17% in 2019

and now pass over 49 million homes. But, with a mix of urban and rural areas, most states contain digital haves and have-nots. Urban areas are wired, while fiber broadband in rural areas is unevenly applied.

By many accounts, fiber is the gold standard to enable broadband and support data-hungry apps and connected technologies that are pivotal to evolve agricultural innovation. While farmers use other broadband technologies -- such as present-day satellite, mobile, dial-up, and Digital Subscriber Line (DSL) -- these services have high-latency and/or low-bandwidth and are affected by weather, line-of-sight obstructions, and distance to towers or antennae.

Fiber sends large amounts of data securely over long distances with high reliability. With nearly unlimited data capacity, it supports a range of apps and technologies, and scales alongside future needs and capabilities, like 5G use cases. Once fiber is in place, the network can reach exponentially higher speeds with simple radio equipment additions.

What's delaying fiber broadband in rural areas? Rural areas have low-density populations that are spread across expansive geographies. These conditions require significantly more miles of fiber to connect communities than urban or suburban settings where homes and businesses are tightly packed.

With fewer resident subscriptions to pay for service, the return on investment (ROI) period lengthens -- or worse, cannot be realized. Often, these scenarios are non-starters for Internet service providers, but rural electric cooperatives (co-ops) are more flexible, making them ideal leaders for telecommunications deployment.

Rural Electric Cooperatives Lead

Rural electric co-ops have already deployed thousands of miles of fiber in rural districts -- enough to account for 30% of rural fiber service. Co-ops may be the linchpin of closing the Digital Divide because they can deploy fiber successfully despite the challenging business model.

With agriculture innovation picking up speed, now is the right time for communities to assess fiber broadband infrastructure options and to develop a plan for deployment. Black & Veatch's eBook, *Rural Broadband – 8 Steps to Ensure Fiber Deployment Success*, offers 8 steps, summarized here, to help deploy the critical communications networks.

8 Steps to Ensure Fiber Deployment Success (Summarized)

Step 1. Review Cost Assumptions and Business Plan

After the feasibility study, continue the positive momentum by adding definition and surety to the business model and assumptions.

Step 2. Map Existing Fiber Assets

This step is invaluable to the formal design process, and impacts the project financials.

Step 3. Resolve Outstanding Program Hurdles

Tackle tough issues head-on and address long lead-time items early, such as “make ready” pole arrangements, railroad crossings, or billing system integration.

Step 4. Evaluate Ownership Models

Look at pluses and minuses to all options. Many communities find that a public-private partnership is a good balance of all the costs and benefits.

Step 5. Conduct Comprehensive Design and Engineering

Detailed engineering in preparation for construction is essential, and could be contracted directly or performed by a private partner.

Step 6. Consistent Internal Communications

A clear understanding of objectives and expectations is a characteristic of successful fiber projects.

Step 7. Effective External Communications

Strategic and consistent communications with the community amplifies the service provider marketing efforts and increases subscriptions.

Step 8. Conduct Mapping and Deployment Tracking

Use real-time mapping and tracking tools to manage construction. Scrubbed construction data doubles as public information data to support external communications.



As the world’s food demand ticks higher, disruptive technology in agriculture takes on global importance. In the US, closing the rural Digital Divide will spark the full potential of broadband-enabled farming. With a digital

foundation, farmers can evolve beyond the industrial age to use connected technologies and data analytics to plan, produce, and sell crops and livestock, more efficiently and sustainably. ■

Resources and Notes are available at the end of this story at www.isemag.com



Paul Pishal is a Business Development Director in the Telecom Division of

Black & Veatch. Paul leads business development, strategic partnerships, including Public-Private Partnerships, and client engagements for the expanding markets of fiber and wireless networks for municipal and private broadband. Paul brings more than two decades of experience managing business development, product marketing and corporate strategy for technology companies in the telecommunications, electronics and business consulting industries. For more information, please email PishalP@bv.com or visit www.bv.com/connectedcommunities.

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The Year Fiber Became an Essential Service

4 Reasons to Deploy FTTP Now



Burying fiber in Kentucky.

By Andy Heins, Mark Mrla, and Sean Middleton

There's no argument that high quality, low-latency broadband is an essential service. Fortunately, this heightened awareness for high-quality broadband coincides with an accelerated growth in broadband funding available through such mechanisms as the Rural Digital Opportunity Fund (RDOF) auction, as well as other state and federal funding sources. This creates growth opportunities for telecom providers of all sizes and types. It creates unique opportunities to obtain funding for the expansion of broadband capabilities to the communities that need them the most: unserved and underserved markets.

While fiber networks provide the highest quality and lowest latency service for end users' needs, they also can be expensive to install, and the ROI can take time. That's why many providers, including fixed wireless operators, hesitate to expand and upgrade their networks with fiber-to-the-premises (FTTP).

4 Reasons

This article shares 4 reasons why communications service providers of all sizes and types should seize the day and improve the capacity and effectiveness of their networks by deploying FTTP.

Reason #1. COVID-19 Impact

Growth in wireline video and broadband connections have increased demand for higher broadband speeds and capacity. Most providers are successfully meeting this demand for the time being. But, 82% of employers are now saying their remote employees may not be required to come back to the office, according to a Gartner, Inc. survey completed in June 2020 (<http://www.gartner.com>). Respondents shared that they intend to allow remote working some of the time for the long-term. This, in addition to remote educational requirements, calls for increases in fiber deployments to the premises.

This future reality contrasts with a recent forecast saying there may be a decrease in global spending on broadband access equipment and CPE. According to Dell'Oro Group, spending in this area is expected to fall 7% this year before increasing 5% next year (<http://www.delloro.com>).

The research firm projects the 5-year rate for broadband access equipment and CPE spending may decline .9%. Given those declines, the report cautioned that network operators may not be quick to spend in this environment. Instead, they will likely wait to see when there is long-term increase in subscriber growth.

This illustrates the challenge between what is needed and what investments providers may be willing to make in the near future. While broadband access equipment and CPE spending is important, fiber is far more critical. Short-term hesitation about fiber investment is not a productive strategy when it comes to meeting the needs of the underserved.

Reason #2. Competitive Threats

Aggressive competitors have access to the same funding programs inciting providers to invest in network upgrades. These funds may allow them to serve nearby communities or even overbuild existing FWO territory with FTTP. To prevent losing territory or risk losing future opportunities to expand their networks, providers should proactively go after those funding incentives. Network



Ben Humphrey, VP and Chairman of the Board, on the job in Slayton, Minn.

operators that delay decision-making may find themselves too late to the table to make up for lost opportunities.

New competitors are also entering the scene. These include low-earth orbit (LEO) satellite technologies such as Starlink by SpaceX. LEOs are expected to start delivering broadband to the continental US by late 2020, with widespread availability taking hold by 2023. The services provided by Starlink and others represent a strong competitive threat to network operators by improving bandwidth capabilities at potentially reduced price points. The challenge that satellite broadband poses to conventional fixed wireless broadband is significant and should not be taken lightly.

Reason #3. 5G Upgrades

5G requires fiber.

The Broadband Forum, (<https://www.broadband-forum.org/>), describes this symbiotic relationship in its recent whitepaper, *5G Network Architecture Overview*. It describes how 5G networks require intelligent, automated coordination between mobile core networks and the radio access network (RAN), as well as from the underlying transport network to meet 5G demands.

"5G is driving mobile operators to take a holistic approach to transport network planning," said Robin Mersh, CEO of Broadband Forum, in a prepared statement. "The technology also brings a



Mark Mrla, Director, Strategy Operations, Finley, presenting at the Great Lakes Connect conference.

significant increase in capacity, requires an estimated doubling of radio sites deployed, and the need for a new architecture with new RAN and Core interfaces. These new architectures and new interfaces each have specific requirements that must be met not only by the mobile equipment, but by the underlying transport network.” This translates into more fiber needed for 5G’s success.

Reason #4. Network Upgrades and Expansion

Many legacy networks require costly maintenance and upgrades to make good on their SLAs, the FCC’s *Keep Americans Connected Pledge*, and the *COVID-19 Telehealth Program*.

Funding that’s currently available provides the opportunity to subsidize broadband expansion in new areas with fiber. Oftentimes, there are additional communities and territories located near the unserved communities toward which funding is targeted. In addition to leveraging broadband funding to expand and build fiber to unserved communities, network operators can lay the groundwork for additional expansion later to nearby established or growing pockets of density that can make fiber a very attractive option.

In order to properly address the extensive capital requirements of a network build-out, a firm’s cost control structure must be implemented.

- Budget controls for projects of this magnitude

must include an itemized per-unit methodology so controllers can compare and contrast competitive alternatives.

- This prescription also allows for a scalable base which can be modified to encompass scope adjustments.
- Controls should also include significant check and balance procedures to ensure that ultimate budgetary goals are met.
- A detailed feedback reference loop can additionally ensure that only critical items make it into the final design while prioritizing capital outlay which creates the greatest expansion for a given investment.
- This methodology can also help with prioritizing critical service location inclusion versus density considerations.

Proactive Partnerships

Network providers are not wondering IF adding more fiber to their networks is the correct choice. But they can’t help but question *When, How, and How Much?*

Frequently, implementation decisions are made based on short-term cost projections that can result in sub-optimal deployments. All fiber designs are not created equal, and cutting corners to limit the amount of fiber needed upfront may be an expensive mistake in the long run. The short-term cost benefits associated with choosing a distributed split architecture, for example, could result in a design that limits future network growth and service potential.

A simple maxim to keep in mind when designing FTTP architecture is: *No one has ever complained that they have too much fiber capacity in their network.*

5 Questions

That’s why it’s critical to choose a partner that is well-equipped to meet your FTTX construction and engineering needs. Here are 5 questions you should ask potential partners as you move forward in your fiber partnership due-diligence:

Question #1: Do their solutions provide best-fit technologies to solve the problems at hand?

Every customer, network and business case is unique. Some firms have a one-size-fits-all methodology that may not fit with the type of solution you need. Make sure they listen and work with you to find the best solution on all fronts: business, financial, and technical.

Question #2: Do they use sub-contractors for work completion?

A firm that has staff and expertise in many technical areas means little or no subcontracting for completion of work.

Firms that depend heavily on subcontractors often have more issues managing their schedules, reliability, and quality of work, which often increases overall project costs.

Find out if they have a vested interest in promoting a certain vendor or product. If so, are you receiving an objective perspective to ensure that you are making the right choices for your business, customers, and community?

Question #3: Do they offer future-ready, end-to-end solutions taking you from the beginning to the end of a project and into the future?

Firms that focus on creating partnerships are relationship-based and tend to be with you for the long haul. As you are making your decision, consider what a long-term relationship would mean for your project's success vs. what bottom dollar bidders have to offer. You can cut costs on the front end, but ultimately a solution that will be compatible with future technologies will save you in the long run. A consultant that will be with you from beginning to end and into the future has a long-term, vested interest.

Question #4: Do they have project management leadership along with certified PMP's on staff with extensive industry knowledge?

- Good project management has a positive effect on all aspects of a project, including schedules, costs, quality, communications, and managing any risks you may face.
- Make sure their staff is large enough to handle a wide variety of workloads at any time, and they have a range of knowledge and experience in



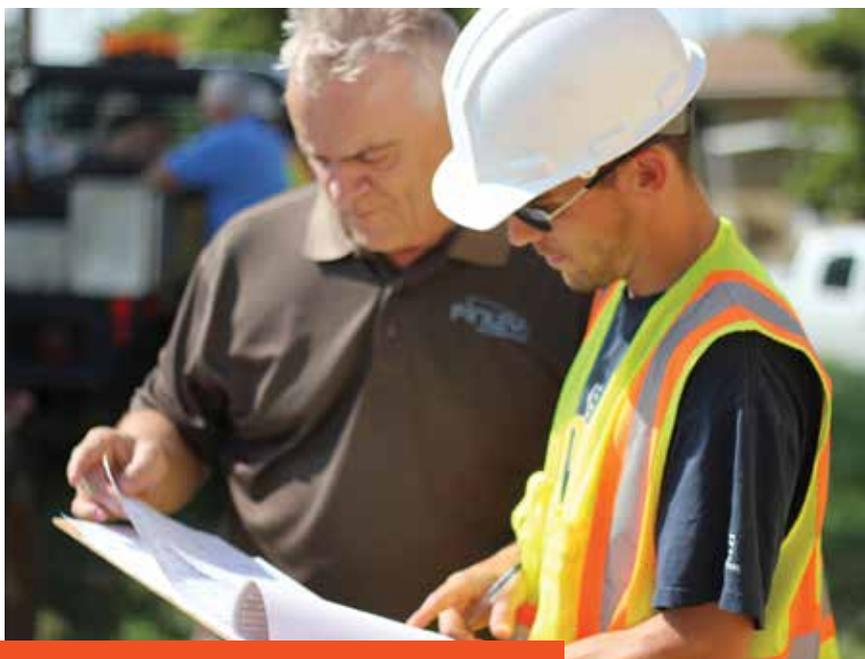
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Finley workers on the job in Bismarck, North Dakota.

broadband planning, engineering, operations, and deployment.

- If you are looking for loans and grants to fund your project, make sure they have a proven track-record with the funding process. Do they develop and manage grants on your behalf? More experience can equal more funding awards.

Question #5: Many consulting firms are similar, and have an extensive history. Ask how they are unique and what makes that uniqueness of value.

- Is the company forward-thinking?
- Are they at the forefront of the industry and viewed as thought leaders, constantly looking at new technologies and innovative ways to deliver broadband?
- How much are they considering the future and impacts on smart grids, IoT for homes and businesses, smart cities/towns, security, and many other considerations?

The thought leaders of today are the companies of tomorrow. ■

Resources and Notes

<https://www.broadband-forum.org/2020-07-07-broadband-forum-motivates-5g-transport-network-architecture-and-requirements-in-new-whitepaper>

<https://www.businesswire.com/news/home/20200707005472/en>

<https://www.delloro.com/news/broadband-access-equipment-spending-to-drop-7-in-2020/>
<https://finley.finleyusa.com/acton/rif/10105/s-010e-2008/-/I-0166:124/I-0166/showPrepared-Message?sid=TV2:ipWip2165>

<https://www.gartner.com/en/newsroom/press-releases/2020-07-14-gartner-survey-reveals-82-percent-of-company-leaders-plan-to-allow-employees-to-work-remotely-some-of-the-time>

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Visit www.isemag.com to watch the **Finley Engineering video: An inside perspective on successful broadband ventures.**

<https://www.isemag.com/2020/10/do-rural-broadband-partnerships-work/>



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Open Source Networks

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Professional Development

Safety

Trends/Research



CONNECTING THE UNDERSERVED AND THE UNSERVED

By Mike Kavanagh

A 5-Step Broadband Strategy

Broadband connectivity is essential now more than ever to battle our nation's Digital Divide problem.

- Some studies have calculated that 83 million people in the USA lack access to high-speed Internet services -- many of whom live in rural areas.
- Other statistics indicate that during the current COVID-19 pandemic, 30 million underserved Americans are not able to access telehealth and online learning resources that are desperately needed.
- Scenes of Americans parked outside fast food restaurants, trying to get Internet connectivity are all too common.

- In one instance, a parent drove her son from their family farm to the nearest hill so that he could participate in Zoom classroom meetings.

Existing Multi-Service Access Platforms (MSAPs) have significant embedded bases that can play a critical role in closing these broadband service gaps in metropolitan, suburban, exurban



and rural areas. These MSAP systems already connect millions of homes and businesses across the USA. Consequently, many Service Providers can upgrade and expand existing MSAP systems to deliver 100M/20M, 50M/5M, and 25M/3M, Internet connectivity. These existing MSAPs are an ideal platform for both large and small network operators participating in Connect America Fund and Rural Digital Opportunity Fund (RDOF) broadband stimulus programs.

5 Steps to Take

Here are the 5 steps a broadband service provider can take to better serve the underserved and unserved in an economical, timely and efficient manner.

1. Identify which MSAP systems can reach the underserved and unserved customers.
2. Upgrade and expand these existing, and already operationalized MSAP systems with xDSL.
3. Expand bandwidth capacity of MSAP systems and shelves using gigabit Ethernet.
4. Aggregate gigabit Ethernet ports to 10 gigabit Ethernet and wave division multiplexing transport.
5. Hire qualified professional services to assist to supplement your internal resources.

Detail About Each of the 5 Steps

Step 1: Identify Existing MSAPs

It all starts with identifying which MSAP systems can reach the underserved and unserved customers within the network operator's territory.

- These MSAP systems are typically located in small or large Central Offices (CO), and Remote Terminals (RT) in either enclosures, cabinets, or huts.
- A number are also located on customer premises locations.

- They may also have a mix of fiber and copper-based technologies.

Telecom service providers for many years have counted on these MSAP systems to collapse, converge, and connect, their access networks in a cost-effective manner that leverages existing approved equipment and infrastructure. These MSAP systems often support a wide variety of technologies, including, but not limited to, Ethernet, xDSL, TDM, and ATM.

Step 2: Upgrade Targeted MSAPs

Once located and analyzed, these targeted MSAP systems that are already operationalized within the network operator's business, can be upgraded and expanded. This helps deliver a broadband expansion solution in the fastest time to market and in the most economical means possible.

These MSAPs can be used for high-speed Internet over copper for both residential and business customers, especially in exurban and rural areas where fiber distribution facilities are rarely available. This provides network operators with the ability to leverage the existing copper plant to maximizing connectivity options for DSL, while strategically growing the new fiber deployments.

With these options available, additional broadband xDSL service cards can be added to support higher speeds through bonding, and more customers through the addition of high-speed subscriber ports.

This combination of higher speeds and additional customer capacity helps stem the erosion of the customer base and, more importantly, results in additional revenue for the network operator.

Step 3: Expand MSAP Bandwidth Capacity

Often these MSAP systems offer a variety of shelf transport options. Their capacities and technologies can be flexible to fit the network operator's applications. For example, these MSAP systems may have OC3 or OC12 transport across the outside plant from CO to the RT. If that is the case, service providers can enhance the



and rural areas. This aggregation capability provides for higher bandwidth capacity, while minimizing fiber requirements. It even provides for “re-use” of the same fiber at multiple RT sites in a single feeder route.

Complementing the fiber utilization benefits, there is also the option to use a Wave Division Multiplexing (WDM) system for economic relief of broadband exhaustion. This is accomplished by

performance of those MSAP chassis and maximize their transport capacity by installing gigabit Ethernet uplink cards into the same shelf as the xDSL service cards.

With gigabit Ethernet connectivity to the shelf, bandwidth capacity is enhanced and xDSL speeds can be increased to homes and businesses served by the MSAP system.

Step 4: Aggregate MSAP Backhaul

A service provider also has the option to aggregate multiple gigabit Ethernet ports by installing a 10 Gigabit Ethernet plug-in card. This allows for the aggregation of broadband traffic transport from multiple 1 gigabit cards (i.e., shelves), enabling the highest possible DSL speeds over the MSAP system.

Having a 10 gigabit Ethernet option helps enhance the MSAP shelf capacity, saves on service providers’ capital expenditures by aggregating individual gigabit Ethernet ports, and maximizes revenue from DSL, Ethernet, and other business services.

Another valuable benefit of gigabit aggregation is the optimization of OSP fiber utilization. Quite often, spare fiber is a scarce resource, especially in exurban

the addition of a passive optical multiplexing solution that provides multiple wavelengths from the CO to the RT. With this CWDM solution in place, alternate wavelengths on existing fiber cable can now support additional 10 gigabit backhaul transport to resolve bandwidth exhaust, while avoiding the need for additional fiber facilities.

Step 5: Supplement Internal Resources

Broadband service providers should also consider tapping into outside professional services to assist with these broadband upgrade projects. By supplementing with professional services, a network operator can plan, build, and operate, these expansion projects in a more economical manner.

- For example, network consultation services used for planning and design can help accelerate the development of network expansion and enable quick turn-up of these services.
- Deployment services can also be leveraged to quickly deploy and test equipment with minimal impact to existing operations.
- Once the broadband network is operational,

then outside professional services can be added for resident engineering help, software upgrade assistance, and customer scripting, to automate tedious, yet critical tasks.

By supplementing internal resources, this allows internal staff to stay focused on core business.

There has been great progress from the Federal Communications Commission (FCC) over the past couple of years steadily advancing the Connect America Fund (CAF) and Rural Digital Opportunity Fund (RDOF) programs that promise faster broadband speeds to help close the Digital Divide in many rural areas.

Tellabs stands ready to help with economic options utilizing telecom providers' existing Tellabs® 1000 MSAP embedded bases for these broadband expansion projects in underserved and the unserved areas. This iconic MSAP can provide flexi-

ble deployment, broad offerings, and the highest capacity services at the lowest first time and total ownership costs. ■



Mike Kavanagh is VP - Telco Sales, Tellabs. He has 30 years of experience in both telecommunication equipment manufacturer and service provider positions.

His extensive service provider network experience includes outside plant planning and engineering, network planning, loop electronics, new technology introduction, and IP network transformation. Mike holds a Bachelor of Science in Industrial Engineering (Summa Cum Laude) from Mississippi State University. For more information, please email ask@tellabs.com or visit <https://www.tellabs.com/>.

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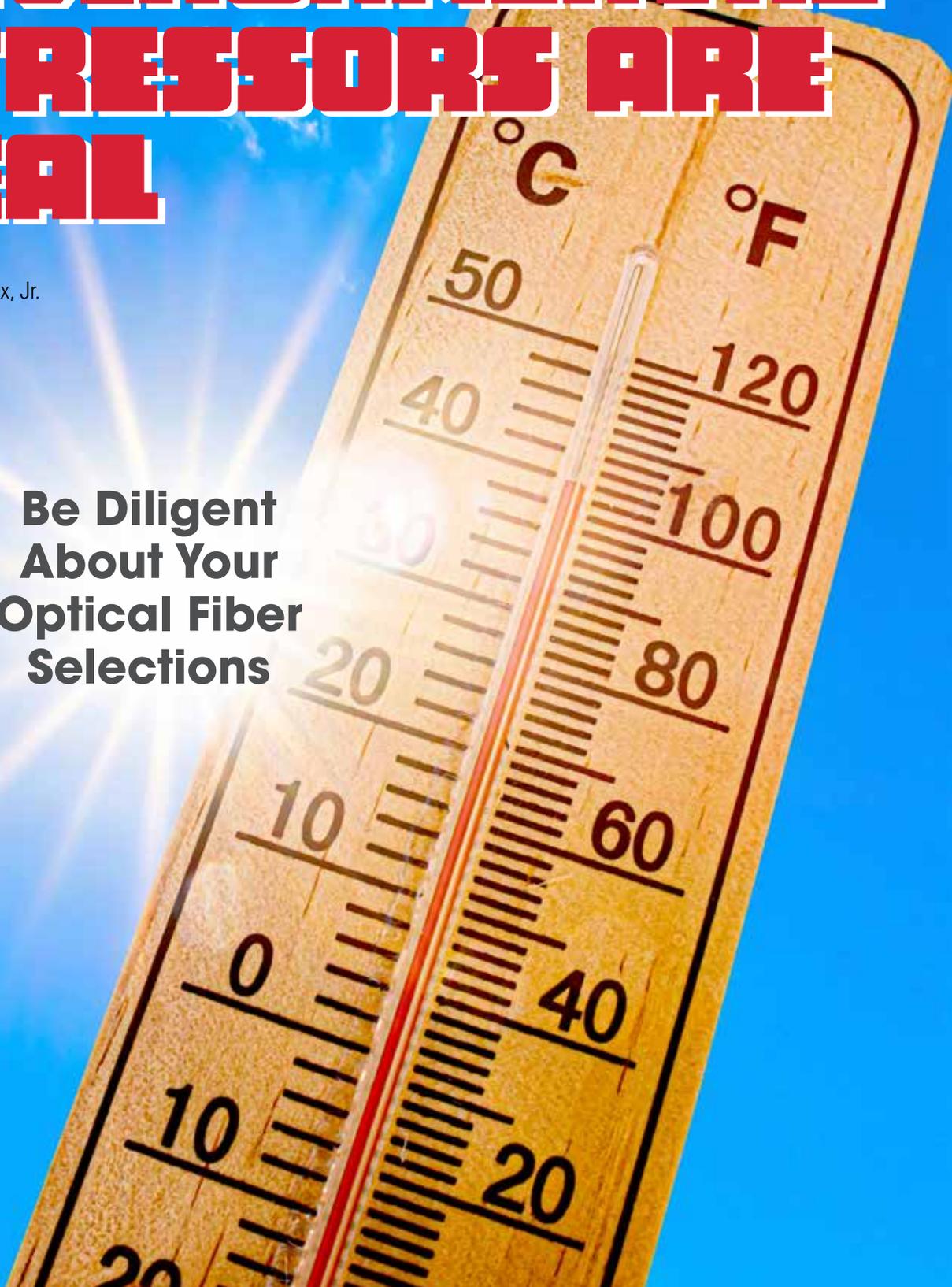
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The advertisement features a character named Dan, a man with a beard and a white hard hat, wearing a white t-shirt and blue pants. He is shown in various scenarios: holding a clipboard, standing next to a cooling unit being hit by a hammer, standing next to a cooling unit being set on fire, and standing next to a cooling unit being hit by a fire hose. The background is blue with white text and images. A QR code is provided for more information.

ENVIRONMENTAL STRESSORS ARE REAL

By Paul Neveux, Jr.

**Be Diligent
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Optical Fiber
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There are cables designed for every environment. One might argue there are *too many options* and that deciding between designs is not simple. Choosing a cable not only requires fiber type and count, but also confirming that the cable will last for the expected lifetime of the application.

Cables need to resist mechanical and environmental stresses both during the installation and where the cable is finally placed. Since installation is a significant portion of the overall cost of a cabling system, selecting the right cable mitigates expensive replacement costs.

CONSULT INDUSTRY STANDARDS

From the beginning of a project, specifying the correct industry cable standard is critical to ensure that the cable performance meets the demand of the application. Standards address the majority of use cases, but in certain environments additional requirements for performance and safety may be necessary. In most situations, it's important to also share the details of your application with the cable manufacturer so they understand the final installed application.

There is a **hierarchy in standards** depending on what you are specifying. Each tier describes what is necessary for the successful implementation of that network layer. For example, if you are installing a passive optical network in a campus environment, the applicable standards would be, in order, as follows:

1. **IEEE 802.3ah, 802.3av (EPON) or ITU G.984, G.987, G.989 (GPON)** specify the networking protocol and channel performance. These specifications are constantly evolving to address higher transmission speeds, so this list is not all-inclusive.
2. **ANSI/TIA-758** extracts the physical media requirements of IEEE and ITU and translates

them into cable and connectivity requirements. TIA documents typically reference the appropriate ICEA specifications to attain the necessary physical requirements for the cabling system.

3. **ICEA S-87-640-2016 (OSP), ICEA S-104-696-2019 (Indoor/Outdoor), and other ICEA documents** specify the physical, mechanical, and environmental, requirements the cables must pass using ANSI/TIA-455 (FOTP) test methods.
4. **BICSI-G1-DL-17** completes the list with recommended general practices for OSP construction and installation.

It is important to familiarize yourself with the last 2 tiers since they impact the cable characteristics, where it can be installed, and the best installation practices.

PROTECTING THE OPTICAL FIBERS

Optical fiber cables are designed to protect the inner fibers from external stresses. Excessive external mechanical stresses can increase optical attenuation, and reduce the usable life span of the fibers.

Cables can experience tensile forces during and after installation. Strength elements such as aramid or fiberglass-reinforced polymer (FRP) yarns and rigid steel or glass-reinforced plastic (GRP) components give the cable the necessary properties to mitigate these stresses. Longitudinal compressive forces due to low temperatures can be counteracted only by rigid strength elements.

To alleviate stress on the optical fibers within the outer sheath of the cable, fiber subunits are often laid in a helical fashion, like a telephone handset cord. (See Figure 1.) This allows the cable to expand and contract during installation in varying weather conditions without damaging the fibers. To facilitate mid-entry to a cable, most manufacturers reverse direction of the helix approximately every 6 feet.

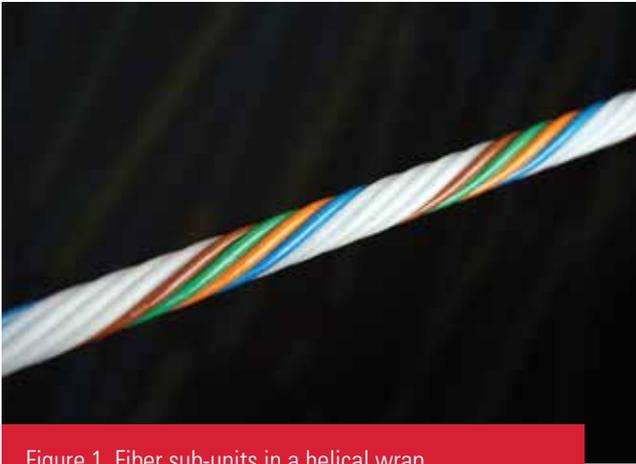


Figure 1. Fiber sub-units in a helical wrap.



Figure 2. Armored cable with corrugated steel tape.

Polyethylene, whether medium- or high-density, offers great moisture resistance and very low temperature brittleness, typically to around -100°C , and is the material of choice for OSP cable jackets. To survive long-term exposure to UV radiation in sunlight, carbon black is added to the compound. Other chemical UV stabilizers are typically added, but carbon black is ideal since it prevents UV induced oxidation. Yellow- or orange-jacketed cables do not have the longevity of a cable that uses carbon black.

Aside from necessary tensile and bend radius properties, cables must be able to withstand compression, especially if the cable is direct buried. For best practices when direct burying a cable, the cable should be armored using continuous corrugated steel tape (CCST) to prevent point compression due to rocks. (See Figure 2.) Aluminum interlock armored cables are not recommended for direct buried installations.

For rodent protection, CCST is regarded as the best option. Although there are non-metallic options available, including nylon jackets, glass yarns, and chemical repellents, metallic armor remains the most reliable.

In applications with a high water table or where flooding is likely, the choice of water-blocking solution is critical. Since brackish and seawater have high ionic strengths, only gel-filled cables are suitable. In freshwater applications, it is possible to specify dry-block or super-absorbent-powder (SAP) type cable.

INDOOR / OUTDOOR CABLES

A standard OSP jacketed cable is permitted only 50 feet into a structure, unless it is in a conduit. Having an indoor/outdoor (I/O) cable alleviates the need for a transition point between OSP and inside plant (ISP) cables. The I/O cable must have the necessary fire safety ratings, typically riser (OFNR) or plenum (OFNP). While millions of feet of both riser and plenum versions have been installed without incidence, there have been issues.

For riser cables, the PVC compound used for the jacket material is highly plasticized to make it flexible and easier to install. Fungus present in soil will consume any plasticizer at the surface, leading to more plasticizer migration. The net effect of this is that the jacket becomes brittle and can cause attenuation at temperatures above the cable's rated low temperature limit.

For plenum cables, the situation is different. Plenum cables are required to pass NFPA 262, which has both peak and average smoke requirements. For the cable to pass NFPA 262, smoke suppressants are added to the PVC. Unfortunately, if a cable is submerged in water for extended periods, the water can migrate through the jacket material, taking the smoke suppressant with it. Despite the presence of dry water-block, the moisture may eventually migrate to the end of the cable at the splice enclosure and evaporate, leaving behind smoke suppressant. Enough suppressant can accumulate to cause attenuation of the fibers in the enclosure. There is an alternative jacketing material that doesn't have this issue: PVDF.

PVDF (a chloro-fluoropolymer) is a material that has been used for years as an architectural coating, helping to preserve the exterior of commercial buildings. It is resistant to chemicals, heat, moisture, and UV light, allowing end users to procure cables in any color without concern for sunlight UV degradation. While more expensive than PVC, overall it is still less expensive than replacing a plenum PVC cable.

UNFORESEEN ENCOUNTERS

Even with the best planned routes, unforeseen obstacles can delay or even prevent cables from being installed. Those who have installed in urban areas are familiar with finding other utilities or services that are not where the maps indicated. In rural or wide open areas, rock outcroppings, underground springs, streams, or swamps, can be encountered.

Even steam, which you might think would be the purview of urban or campus locations, has been seen in the wild. In 1991, Williams Communications was installing standard OSP cable in decommissioned pipelines just north of Bakersfield in an area where steam was being injected under high pressure to help recover shale oil. The cable in that pipeline began showing high attenuation and after reaching the underground cement splice vault, it was discovered that escaping steam had melted the cable. Only the steel central strength element and the optical fibers remained. The original cable had to be replaced with a temperature- and steam-resistant Steampath cable.

FINAL THOUGHTS

There are other environmental and mechanical stresses that were not discussed in this article, but by using the standards and working with the cable manufacturer, the best choice of cable can be made.

Keep in mind a few questions when starting a project:

- What is the expected temperature range?
- Will the cable be exposed to sunlight?
- For aerial cables, what are the wind and/or ice loading conditions that will affect span length?
- For direct buried cables, what are the mechanical forces due to soil type?
- For all buried cables, what is the impact of water table levels or the propensity to flooding?
- For cables transitioning from the outside plant into the premises, what fire safety requirements need to be considered?

Asking the right questions beforehand can ensure a smooth installation and save on expensive replacement costs. ■



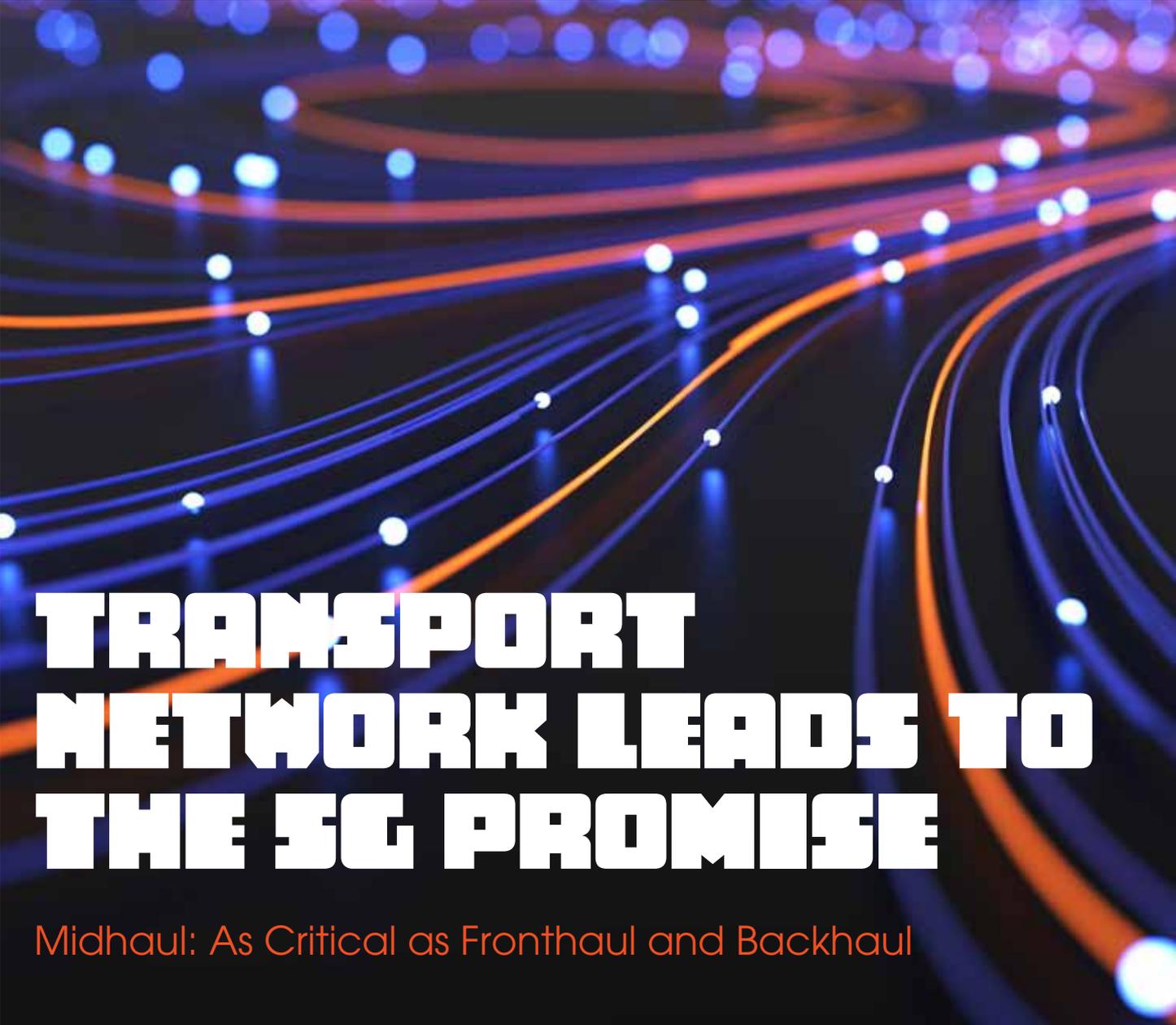
Paul Neveux, Jr., Ph.D., is an industry consultant and contractor for Light Brigade. His optical fiber career, with more than 34 years of experience, started at Sumitomo Electric, followed by Lucent Technologies / Bell Labs (now OFS), and Superior Essex. He has extensive design and manufacturing experience in OSP and premises optical fiber cables and premises copper twisted-pair LAN cables. He has 10 patents, has written numerous articles, and given many presentations at industry conferences, including BICSI and IWCS. For more information, please email training@lightbrigade.com or visit <https://www.lightbrigade.com>.

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TRANSPORT NETWORK LEADS TO THE 5G PROMISE

Midhaul: As Critical as Fronthaul and Backhaul

By Kashif Hussain

5G technology is touted as a platform that enhances our connected world. To deliver on this promise, 5G demands the network supporting it to be as flexible as the services running on it.

High-Level 5G Use Cases

The following high-level 5G use cases are well understood and documented by the wireless industry.

Enhanced Mobile Broadband (eMBB) -- providing greater data-bandwidth services with peak data rates of 10 Gbps and beyond. This data rate enables new use cases such as augmented reality / virtual reality or ultra-high density (UltraHD) applications.

Ultra-Reliable Low Latency Communications (URLLC) -- providing ultra-reliable capabilities with availabilities in the range of 99.9999%, and extremely low latency features in millisecond range. Vehicle-to-vehicle communication over 5G networks is one prominent use case for this category.

Massive Machine Type Communication (mMTC) -- supporting extremely large numbers of

Midhaul Challenges/ Opportunities

Today the most widely used technology is based on the common public radio interface (CPRI) protocol. This includes a link in the RAN infrastructure called *fronthaul*, in contrast to the *backhaul* that connects the BBUs with the core mobile network.

Centralization enables resource pooling which optimizes resource utilization. Furthermore, the architecture provides some key functions for advanced LTE technology. The ability to coordinate multiple radios from one location is a key enabler for implementing features such as coordinated multipoint (CoMP), which helps increase user bandwidth by aggregating traffic sourced from multiple cells at the user terminal. All of these advantages come with a massive disadvantage for emerging 5G services: inefficient bandwidth.

CPRI's stringent delay requirement is well-suited for centralization. However, it creates challenges in terms of bandwidth and node flexibility. CPRI provides a dedicated transport protocol specifically designed to transport radio waveforms between the RRU and BBU. CPRI frames expand with increased radio channel bandwidth and the number of antenna elements. However, CPRI is not very efficient in statistical multiplexing, and cannot scale to the demands of 5G, especially for massive MIMO and larger bandwidth increments. The required bandwidth and antennas in a 5G scenario would push the CPRI bandwidth requirements above 100 Gbps. (See Figure 2.)

These bandwidth allocations would be extremely expensive for larger 5G network rollouts. Therefore, it is important to develop an alternative solution that includes an analysis of the key functional elements between a BBU and an RRU. In this examination, CPRI is the key disadvantage of bandwidth inefficiency: it also has a very limited delay budget. In practice, this means that the distance between BBUs and RRUs will be very limited.

The distance between the radio unit and the baseband is determined by the delay budget and the type of transport technology deployed in the fronthaul. Dark fiber is the simplest one allowing for maximum distance. Transport equipment that contains some processing elements reduces the delay budget, sometimes substantially, as with Optical Transport Networking (OTN). As it is often the case, operators must look at the individual use case, and conduct a trade-off analysis to determine the best



Figure 1. Importance of key capabilities in different usage scenarios. (Source: ITU IMT Vision)

devices in the range of hundreds of thousands per square kilometer. Essential for this application class are battery lives up to 10 years.

The big challenge is how to support these use cases on the same network. (See Figure 1.) Much of the trade buzz to date has been centered on 5G-NR (new radio), virtualized core, and mm-Wave spectrum. Receiving far less attention, but equally important as the new radio interface, is the evolution of the transport network connecting 5G nodes that enable the key 5G use cases -- simultaneously.

ture. Ultimately, neglecting to test can negatively affect the customer experience, cause end-user churn, and hurt the topline.

Service level agreements (SLAs) for midhaul networks are very similar to backhaul, which means testing requirements are similar:

- A. Bandwidth Measurement / Committed Information Rate
- B. Delay and Jitter
- C. Packet or Frame Loss
- D. RFC 2544 and Y.1564 Test

SLAs for fronthaul networks grow more stringent as higher capacity and ultra-low latency and reliability services are deployed. We will see the network evolve from dark fiber to a wider WDM expansion, which means WDM testing is needed. Some service providers are in the process of deploying NG-PON already as a future investment.

We anticipate more frequent use of Time Sensitive Networking (TSN) for real-time communication with hard, non-negotiable time boundaries for end-to-end transmission latencies, where devices in the network need to have a common time reference and therefore, need to synchronize their clocks. This means in addition to the tests listed earlier, timing and synchronization tests are also required.

Conclusion

As service providers continue the quest to offer new 5G services that require different levels of quality, they are bound to evolve from a CPRI-based fronthaul approach to a more packet-based split architecture. This architecture can meet their needs because it offers greater flexibility, but it also requires a different testing approach. Validating latency,

timing and sync, and network availability at a scale, calls for test solutions that are efficient and simple.

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Kashif Hussain is the Director of Wireless Solutions at VIAVI Solutions. He has more than 20 years of wireless industry experience. His expertise in RF, DAS, HetNets, and LTE, comes from developing, managing, supporting, marketing, and consulting, on major mobile communications projects. Hussain's industry experience also includes various senior roles at MobileNet, Tektronix Communications, Ericsson and Nortel. Kashif has also authored patents for wireless products. For more information, please visit <https://www.viavisolutions.com/en-us/5g-testing>.

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**YOUR
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LISTENING?**

Performance Data Analysis

By Alan DiCicco

Millions of Americans are currently working and learning from home.

Before working outside of the office was the norm, only around 7% of US workers had the option to regularly work from home. In this new day and age, what is the “norm”? According to a CNBC report from earlier this year, while 55% of Americans will want to work in an office environment at some point at the same or limited capacity, once the economy reopens, 24% say they’d like to work either entirely or more from home compared to how they worked before. That’s a large jump from pre-COVID-19 days.

With over 53% of Americans considering the Internet as “essential” during the pandemic, it’s imperative that providers ensure that reliable Internet access is available at all times. How can providers guarantee workers and students reliable Internet service at home? The answer can be found in the network performance data.

There are 3 congestion points that are likely to hinder the subscriber’s experience of peak Internet performance:

1. Home Wi-Fi network
2. Outside access network leading to the home
3. Provider’s aggregation network

Application Visibility

In the home, the Wi-Fi network is increasingly the source of data congestion, subscriber frustration, and service provider blame. A poor Wi-Fi network can ruin a brilliantly fast broadband network in the eyes of the subscriber.

During our time of work and study from home we’re using more of our home Internet bandwidth on applications and activities we would have previously conducted at businesses and schools. Video meeting company Zoom now has over

265,000 customers with more than 10 employees each, a number that’s grown 354% since the COVID-19 pandemic began earlier this year. That’s a lot of video meetings that would have been in person at the office or in a school’s classroom.

“In the home, the Wi-Fi network is increasingly the source of data congestion, subscriber frustration, and service provider blame. A poor Wi-Fi network can ruin a brilliantly fast broadband network in the eyes of the subscriber.”

Gaming has also seen a rise since we began quarantining at home. According to a WeForum study, gaming traffic during peak hours increased 75%. Tools to watch gaming also saw an increase in users. Twitch, YouTube Gaming, and Facebook Gaming are all experiencing growth, with an approximate 20% increase in usage hours reported across services.

And clearly more people are streaming and bingeing at all hours of the day. The new average is about 8 hours per day -- more than double the number of hours before the pandemic. That means bandwidth capacity on home Wi-Fi networks is strained.

While all these activities take bandwidth, applications are not the same in how they use data. Binging a Netflix series will require up to 16 Mbps

in the Era of Working and Learning Online

of near continuous download capacity while high bursts of upload speed will be necessary when collaborating live on a creative student film project or choir practice.

Network performance data within the home Wi-Fi network can help service providers understand how their subscriber's upload and download

but small changes can be made that result in big improvements. For example, a subscriber on a large 2.5G GPON network may be capacity-constrained not by their individual use of the PON bandwidth, but by the aggregate demands of all 64 subscribers on the PON. In this case, the service provider may be able to quickly split the PON into two 32:1 PONs

“Video meeting company Zoom now has over 265,000 customers with more than 10 employees each, a number that's grown 354% since the pandemic began earlier this year.”

speeds are utilized and changing over time. As we continue to work and learn from home, we're participating in activities that depend as much on upload speeds as download, including taking part in virtual meetings and participating in real-time interactive collaboration.

In an ideal world, an Internet provider should review Wi-Fi performance data and analyze what's being used and at what hours. With a focus on the application data traversing the home network, a provider could give Zoom meetings, for instance, highest priority, therefore ensuring that Wi-Fi bandwidth is used to support a video conference work meeting or online classroom rather than shared equally with a streaming 4K Netflix binge.

It is critical for providers to expand *beyond I deliver Wi-Fi coverage across the entire home* and begin looking at the application data necessary to ensure a high subscriber quality of experience (QoE).

Looking Deeper Into Access Network

Congestion caused by the outside access network's physical limits can likewise result in a poor Internet access experience for the subscriber. No matter how a home is connected to the service provider local office or headend -- be it over fiber, HFC, DSL, or fixed wireless -- performance data can show if the network can handle the aggregate capacity of all the subscribers.

It's not as simple to upgrade the outside access network as it is to fine-tune a home Wi-Fi network,

or overlay the GPON network with an XGS-PON network to shift power users to the new higher capacity network.

A VDSL service may be capacity-limited because the copper loop is too long, requiring the service provider to deploy fiber deeper into the network, shortening the copper connection to the home.

Similarly, a fixed wireless network connection may be improved by shorting the distance between base station and the home, or by adding additional wireless spectrum.

Each of these access network remedies are not new, and many have been in progress for years as service providers look to increase capacity to keep up with the incremental year-over-year increase in bandwidth use. The COVID-19 pandemic has put additional strain on the access network, particularly in the upstream direction where DSL, HFC, and wireless networks, are inherently limited. A thorough review of access network performance data shows where and how to address the new outside network bottlenecks.

Starting and Ending at the Top

Most service provider networks can be viewed as a hierarchical distribution and aggregation network -- a bit of a pyramid shape as myriad numbers of homes connect to access networks, access networks into aggregation networks, and aggregation networks into regional and core networks.

Continuous monitoring and analysis of network performance data at all levels of the aggregation

and content delivery network can identify congestion points that have a wide scope of subscriber impact. Service providers around the globe have been upgrading their aggregation switch, router, and transport capacity, to satisfy the COVID-19-pandemic-fueled hunger for bandwidth.

With insight into network performance data, a provider can understand why the network is performing the way it is, and can ensure that QoE-impacting congestion is limited and quickly removed.

In the era of COVID-19, we are spending more time online with essential work, education, e-commerce, and, yes, even entertainment activities. Not only is congestion more prone to happen but the impact is more damaging.

The analysis of network performance data can help solve old problems, and create new opportunities for subscribers and service providers. It's time to take a closer look at what the data has to tell us. ■

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By Danny Shields

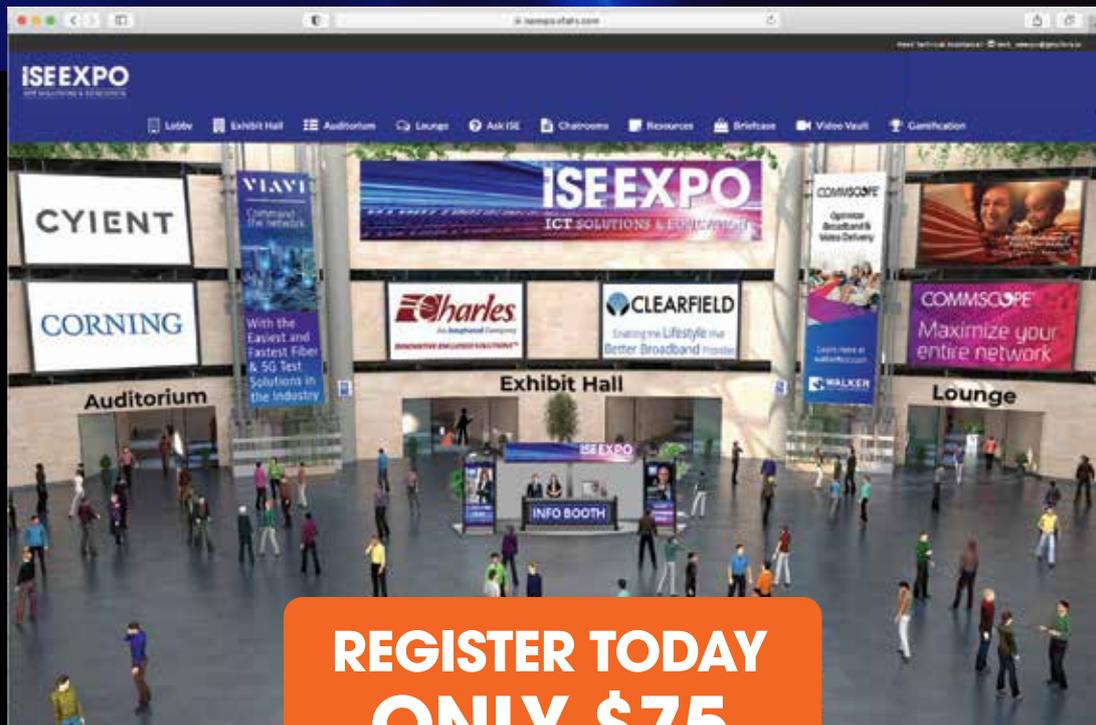
The white paper, *In the Event of a Workplace Fatality -- Reacting in the Wake of Catastrophe*, was recently published by a global supplier of online supply chain risk management. The 11-page document offers practical advice on several issues.

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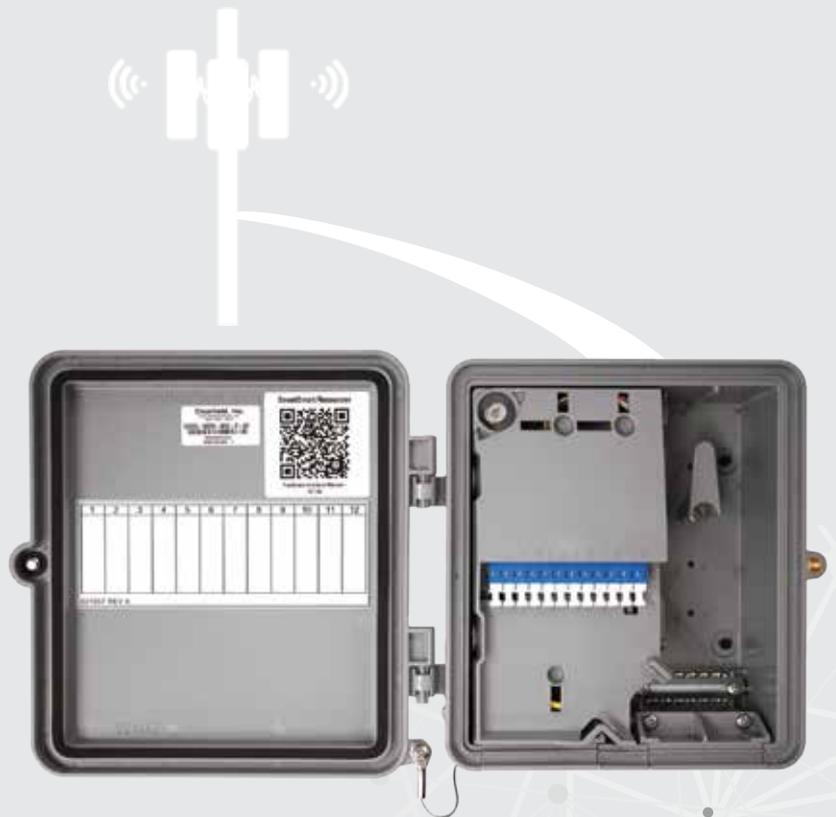
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