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APRIL 2020

2020 ICT VISIONARIES

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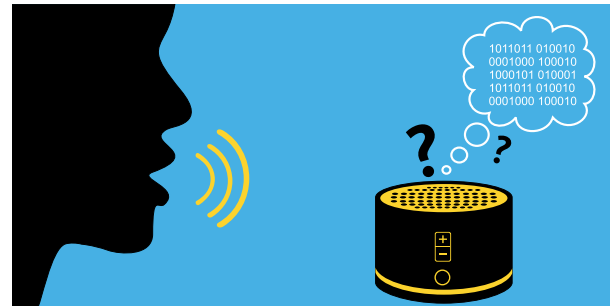
SMART HOME CONFUSION

Rather than contracting to bring a level of standardization and calm to the smart home market, the divisive array of connectivity protocols within smart home offerings will only increase in 2020.

 ABI Research expects ongoing smart home provider support for ZigBee, Z-Wave, proprietary, and Wi-Fi will extend to integrate Thread and Bluetooth across a range of competing smart home devices and applications.

No one-size-fits-all for the home this year!

Source: www.abiresearch.com

CYBER BIG BROTHER
(OR IS THAT BOARD BROTHER?)

Gartner expects that **100% of large enterprises** will be asked to report to their board of directors on cybersecurity and technology risk at least annually.

The question is: Are **YOU** helping them find the best answers to share with their boards?
(Or, will one of your competitors?)

Source: www.gartner.com

NETWORK COVERAGE

Cable · Ethernet

Access Network

FTTx · Hybrid · Legacy/Copper · RAN/NR

Network Slicing · SDN

Network Transformation

CORD · Data Centers

UHD · Voice

End User

Massive IoT · Mission Critical · IoT

Network Reliability

· xWDM · Ethernet · IMS

IP · Open Source ·

COLUMNISTS

IN EVERY ISSUE

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an article to ISE magazine in print, digital,
and online.

ICT VISIONARIES

This issue kicks-off our 2020 ICT Visionaries Program. We have compiled this thought-leadership series for the last 8 years because it's some of the most-read content on www.isemag.com. It's also some of the content you spend the most time with -- nearly 5 minutes in terms of average session duration. In this inattentive world we live in, that's nothing to sneeze at.

In this issue, our Visionaries share thoughts about how AI is impacting the telecom/ICT network and how the workforce must transition to keep up with it. They also express their concern about how we ALL must fine-tune our soft skills so we can work and play well with each other. (And that's not always as easy as it sounds, right?)

Their thoughts:

"Futurists have stated that over the next decade and beyond, more than 60% of current work activities will be impacted (directly or indirectly) by AI improvements. It is incumbent upon us as leaders to prepare our workforces for these changes."

Sheilon King, Director – Data Insights, Chief Data Office, AT&T

"CenturyLink is creating more digital tools by leveraging robotics process automation (RPA), which reduces the number of manual steps required of our Operations teams."

Anil Simlot, Vice President of Virtual Services Development and Support, CenturyLink

"The adoption of and use of AI across all areas is not in question. It will continue to explode. The more important question is: Are we going to keep blurring the lines on the ethical and moral decisions that we will ask AI to make?"

Johnny Hill, COO, Clearfield

"(AI) examples include alarm correlation and security threat management, where AI helps identify trending of network anomalies and risks. In some cases, platforms may now take immediate action to remediate problems automatically, such as applying critical security patches."

John Robbins III, Senior Manager, Network Engineering for City of Fort Collins, Fort Collins Connexion

"Soft skills are key to any start-up organization's success, as we merge new employees with old and evolve our corporate culture. So, our biggest challenge overall has been the teaching of soft skills dealing with corporate culture and interpersonal relations, (i.e., building a team)."

John Greene, Chief Executive Officer and GM, New Lisbon Telephone Company, Inc.

"Keeping up internal IT skill sets, as well as hiring individuals with those skills, is a focus and challenge. We are in a 5-to-7-year window where 50% of our staff may retire."

Curt Christensen, Customer Network Manager, Norvado

"AI can be used to improve productivity, streamline operations, and assist in customer service. Health Care systems can benefit from AI to assist with diagnostic decisions and surgical procedures. In the future, AI will empower more machines to make human-like decisions that will continue to influence customer products and technology."

LaTanya Buggs, Director of Operations, Global Network and Technology Division, Verizon

Talk about an intersection between the telecom network and the human network! Check out more of their insights on pages 12-31, and let the learning from each other continue!

Sharon

Sharon Vollman, Editorial Director

SLICE IT UP

ABI Research forecasts that network slicing stands to create approximately US$66 billion in value coming from the ever-increasing digital requirements of enterprise verticals, but in order to materialize this opportunity, CSPs and the telco supply chain will need to take enterprise requirements more seriously and promote a transparent and vendor-agnostic approach for network slicing platforms.

Network slicing revenue will eventually be on an upward trajectory, but ABI Research does not expect 2020 to be a year of any type of commercial deployment.

Source: www.abiresearch.com
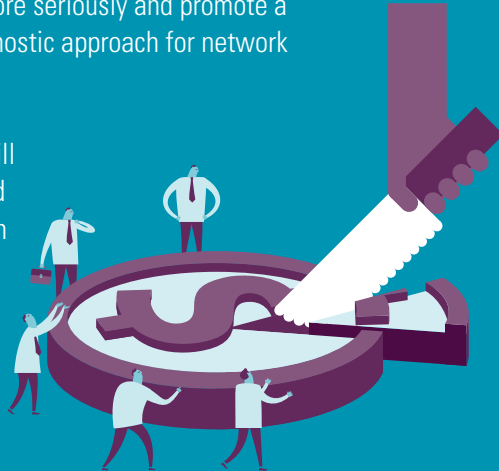
FCC FUNDING GROWS

The FCCs Rural Digital Opportunity Fund (RDOF) calls for as much as **$20.4 billion in rural broadband funding** to be made available via reverse auction in 2 phases. (Still to be voted on in late January 2020.)

Phase 1 of **approximately $16 billion** will be awarded to those providers who will target areas where broadband at speeds of least 25/3 Mbps is not available to any location. Service providers winning funding will receive their winnings over a 10-year period.

Source: www.fcc.gov

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For more information, email or visit
www.mccartyinc.com.

Don McCarty is the Copper Expert
columnist for ISE magazine, discussing
the issues around provisioning,
testing, and maintaining copper for all
services from POTs to IPTV. Don is also
President of and the Lead Trainer for
McCarty Products, a technical training
and products company training field
technicians, cable maintenance,
installation repair, and Central
Office technicians and managers.

TAKE CARE OF YOUR CUSTOMERS NOW!

New life for the old copper infrastructure

This column describes causes of service disruption. Upcoming columns will offer easy processes for identifying the location of the fault.

I have been involved in provisioning and maintaining the copper infrastructure for more than 55 years. During that time, I have had the good fortune of working with many managers and technicians who practice proactive maintenance in their quest to provide quality service over copper.

When proactively provisioned and maintained, good old copper will continue to provide service well into the future. Thousands of miles of copper circuits are providing service on a daily basis, *AND IT IS PAID FOR!*

Less than 10% of all copper cable pairs are in trouble, and the majority of those faults are terminating faults that are in pedestals and terminals.

Successful proactive teams are comprised of experienced and trained management, field technicians, and engineers. Working together, they take the time to chase down those terminating faults rather than transferring the end user's circuit to another cable pair.

Herein lies the crux: the highly skilled copper folks are retiring in droves, leaving behind many less-experienced techs together with copper-phobic management teams. These management teams want budgets focused on fiber, and they want to get rid of copper as soon as possible.

However, copper is here for a while yet.

Fiber is pricey, expensive to install, and gigabit speed sounds sexy -- but how needed is it? Many residential and small business customers don't need or want to pay for the privilege of high bandwidth. Or the high bandwidth speeds aren't being delivered as promised. I see neighborhood chat sites rampant with complaints about AT&T and Verizon fiber not delivering as promised.

Meanwhile, new technologies continue to feed the need for bandwidth over copper at a more reasonable cost -- IF it's taken care of properly.

I am not a fiber hater. I think it's great, and one day it will be pervasive, particularly with companies like Google Fiber doing much of the legwork for the highest speeds.

Take care of today's copper customers today!

Serving your copper customers now, and in the future with increasingly improved bandwidth, requires that you practice proactive maintenance, train your techs -- and retrain often, and give them the right tools.

Laser Technology's Joint-Use Audit / Pole Inventory Laser

Pole audit data collection is a continuous project that requires field crews to check-in periodically. The current ways of performing and documenting a joint-use audit can be expensive, labor intensive, and inconsistent. Pole audit crews need a solution that provides multiple high-accuracy and repeatable measurements from a single, safe location.

Laser measurement mapping is a solution that streamlines your operation and improves productivity in both the field and office, providing the right amount of detailed data needed to complete a project. Measure attachment heights, separation values, line clearances, sags, and spans, in half the time.

LTI's TruPoint 300 laser communicates directly with any smart device so you can import your field data into Mobile Excel® or any industry standard design and documentation software. Start collecting and reporting reliable data faster and more consistently!

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CRAFTMARK - Ultra Strap

Craftmark – The Snap On Marker Experts – have developed the Ultra Snap for longer term (7+ years) cable identification projects. The Ultra Snap has a crystal clear UV over-lamination that 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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www.craftmarkid.com

TOOLS

A proactive field technician should have these tools:

- a multifunction test set with both narrowband and wideband testing capabilities

- a cable locater with an earth frame for path and depth locating and pinpointing earth faults

- a clamp on ammeter

- a torque wrench

Proactive maintenance process for beginners through advanced

LONGITUDINAL BALANCE

First, disconnect the cable pair at the central office (CO) or remote. Connect the multifunction test set to run the auto test. (I prefer to use the **MANUAL TEST**; the AUTO TEST is a picture in time, and you don't see changes.)

Now, look at the longitudinal balance.

- If the longitudinal is greater than 60dB, that is a pass.

- Less than 60dB is a fail.

- A pass indicates that there are no DC volts, no ring or tip ground, or ring or tip open on the pair.

- The pair still could have series resistance fault or a split cable pair.

AC VOLTS

Look for AC Volts.

- From .2VAC to 50 VAC is expected and OK.

- More than 50VAC: this is a safety issue -- follow your company safety practices.

DC VOLTS

Look for DC Volts.

- Tip and/or ring to ground should read 0 VDC.

- Measuring DC volts tip and/or ring to ground adds resistance to your ohms/volt network, and shows an indicated voltage that is less than applied.

- Volt meters should be connected in parallel (tip to ring) not in series (tip and or ring to ground).

- Any unwanted indicated VDC tip and/or ring to ground can be located using the resistance fault locate (RFL) feature on the multifunction test set.

OHMS

Look for ohms.

- Tip to ring, tip and/or ring to ground should read greater than 20 megohms.

- Any unwanted indicated tip to ring short and or ring to ground more solid than 20 megohms can be located using the resistance fault locate (RFL) feature on the multifunction test set. *(The RFL feature will be covered in future columns.)*

OPENS

The opens function measures cable capacitance, and converts the capacitance to feet or meters, based on the capacitance of the cable pair.

Once repairs are completed, test the longitudinal balance again.

- If the pair still fails, look for a split cable pair or series resistance.

- To look for a split, apply tone to the suspect split cable pair and then look for tone on associated pairs in that 25-pair unit.

- The pair that is split with the suspect pair.

- To identify series resistance, place a grounded short on one end, and measure the resistance tip to ring and then tip and ring to ground.

  - Tip and ring to ground should measure ½ of tip to ring ohms.

  - Any difference shows series resistance on the conductor with more resistance.

Signing off

You may always reach out to me to ask questions or help clarify issues for other faithful readers. Text or call 831.818.3930, or email at dmccarty@mccartyinc.com.

PS. I love reading about new technology in any industry. Take a look at Clive Maxfield's *Cool Beans*. Here's a link to a *Cool Beans* story about dirigibles deploying drones! https://www.clivemaxfield.com/dystopian-dirigible-deploys-delivery-drones/

2020 ICT VISIONARIES

PART 1

Welcome to our 7 new ICT Visionaries for 2020 from AT&T, CenturyLink, Clearfield, Fort Collins Connexion, New Lisbon Telephone Company, Norvado, and Verizon. *ISE* asked this year's ICT Visionaries to answer 3 of these questions. Learn their network know-how in this first of our 3-part series.

TOPIC: REINVENTION

In the face of disruptive new competition, many service providers are adopting disruptive strategies of their own -- and essentially reinventing what it means to be a telecom service provider. (Source: Nokia.com)

What is your company doing in this area to reinvent itself?

TOPIC: NETWORK OPTIMIZATION

In the age of disruption, service providers need to simplify and optimize their network operations.

How are you doing that, or what are you contributing to it as a vendor partner? If your company is not there yet, what do you hope to do in the near future across your network(s) to create efficiencies and optimize operations?

TOPIC: SKILLS GAP

According to a recent research study, 60% of business leaders believe IT is leading their organizations' business transformation strategy. Yet 93% of executives say the skills gap is preventing their teams from transforming fast enough.

What gaps are you addressing across your teams? What do you suggest for those who do not have the opportunity to take advantage of formal training and educational enrichment opportunities?

TOPIC: INVESTMENT FOR THE FUTURE

What are your company's investment priorities for 2020?

TOPIC: ARTIFICIAL INTELLIGENCE

AI across the worldwide telecom market is expected to grow from $235.7 Million in 2016 to reach $2,497.8 Million by 2022, at a CAGR of 46.8% during the forecast period. The increasing adoption of AI for various applications in the telecommunication industry and utilization of AI-enabled smartphones are expected to be driving the growth of the market. (Source: www.marketsandmarkets.com)

Why is this critical, and in what areas across the network(s) do you see AI being used in the future (or already today)?

TOPIC: SD-WAN

As service providers focus on their core telecom and networking services, they'll be relying on SD-WAN more and more for intelligent path control and traffic-steering based on the application. At the same time, these providers are also selling SD-WAN to their end customers, too. IDC has predicted that the SD-WAN infrastructure market will grow to $4.5 billion by 2022. Carriers and cable giants, including AT&T, CenturyLink, Comcast, and Verizon have all mentioned SD-WAN as one of their strategic IT solutions that are leading in their business customer segments. (Source: www.idc.com)

Talk about this trend. Share what your company is doing to address SD-WAN, and the challenges that go along with embracing it.

Go to page 28 for complete biographies of our 2020 ICT Visionaries.

SHEILON KING

Director – Data Insights,
Chief Data Office

AT&T

TOPIC: REINVENTION

At AT&T we believe that innovation drives reinvention. In 2017, as streaming services disrupted our television business, (DirectTV and IPTV) we launched AT&T TV Now (formerly DirectTV Now) to provide a customer-friendly service that is cloud-based and more cost-effective. AT&T TV Now includes live HD TV and a Cloud DVR. Customers have choices to fit their individual lifestyles -- from "skinny" packages to robust international options. Later in 2020, AT&T will launch additional offerings to continue to widen the gap to all other streaming. By choosing to be a disrupter, AT&T is exerting control and redefining the definition of a telecom service provider.

TOPIC: NETWORK OPTIMIZATION

Network virtualization allows AT&T to use our internally developed Enhanced Control, Orchestration, Management & Policy (ECOMP) platform, which is now part of Open Network Automation Platform (ONAP), and software-defined networking (SDN) to virtualize and enable critical network functions. This move to SDN drives down network operational costs while enabling AT&T to quickly deploy new customer-facing offerings with greater flexibility, automation, and security. AT&T's 5G network deployment relies on the learnings so far and is more robust because of cloud computing. As we drive towards 75% network virtualization by the end of 2020, AT&T's efforts are key to being nimble, future-focused, and customer centric.

TOPIC: SKILLS GAP

Futurists have stated that over the next decade and beyond more than 60% of current work activities will be impacted (directly or indirectly) by AI improvements. It is incumbent upon us as leaders to prepare our workforces for these changes. Seven years ago, AT&T committed to aiding ALL our employees with this skills pivot. We developed partnerships with key universities to build Masters programs in Analytics, Data Science, etc. AT&T also worked with online learning institutions to develop shorter, more targeted programs (nanodegrees, certifications, and individual classes) that allow all employees to enhance their skills in diverse areas such as Digital Marketing, Machine Learning, and Web Design. In 2018, AT&T spent ~$200M to enable 16 million hours of employee training both technical and non-technical. As an industry we are all looking for employees who can analyze situations quickly and data-power the decision-making process. AT&T is leading the way to enable the next generation of employees with these capabilities as well as strengthening the skills of the current workforce.

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AT&T
Business

ANIL SIMLOT

Vice President of
Virtual Services Development
and Support

CenturyLink

TOPIC: REINVENTION

CenturyLink is transforming itself from a telecommunications provider to a technology company that delivers hybrid networking, IT agility, and security solutions. Instead of providing fragmented services, we are leveraging the latest technology to build powerful digital experiences for our customers. Our advanced products, such as SD-WAN, Business Engage, Dynamic Connections, and others, improve customers' experience by providing them the ability to grow and add services on demand. CenturyLink's Edge Compute with Cloud Connect provides a platform that enables organizations to host latency-sensitive applications while continuing to maintain their data centers or third-party clouds.

Through our investment in Black Lotus Labs, we can offer customers rapid threat defense to secure their network connections. In short, CenturyLink is continuously looking to provide solutions that solve business needs while leveraging a compelling digital experience.

TOPIC: NETWORK OPTIMIZATION

CenturyLink is constantly evaluating our networks and operations to promote further optimization, and we continue to simplify our products and services to make it easier for our customers to order and manage them. We are simplifying our network as well by moving more buildings and data centers on-net. In addition, CenturyLink is creating more digital tools by leveraging robotics process automation (RPA), which reduces the number of manual steps required of our Operations teams. Every day, we are focused on developing highly satisfying digital experiences for our customers and employees alike.

TOPIC: SD-WAN

CenturyLink was an early adopter and provider of SD-WAN services. Since we launched SD-WAN in 2017, we have diversified our portfolio while developing robust operational support capabilities. Today, we are able to sell the service globally via 3 different technical solutions.

We believe that as customers begin to leverage the "software defined" nature of the service, especially application-based traffic steering, the market will grow and we will start to see stringent requirements from them. As more mission-critical applications leverage SD-WAN, there will be a need for more concrete SLAs. Those that offer on-net facilities with proven QoE will be preferred by customers.

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JOHNNY HILL
COO

Clearfield

TOPIC: ARTIFICIAL INTELLIGENCE

The adoption of and use of AI across all areas is not in question. It will continue to explode. The more important question is *Are we going to keep blurring the lines on the ethical and moral decisions that we will ask AI to make?* General AI, multiple simple AI streams to present a set of decisions options that human judgement rules on, is where AI needs to be limited in my opinion -- Alexa, Uber, Amazon, location services, traffic shaping, etc. We are pushing so hard to reach AI's theoretical potential when we should first be working to establish an ethical framework on which AI systems are built. This topic on AI is going to get a lot of attention in the coming years by the public, industry, and world governments. I hope they will be able to come to a consensus on how it will be applied.

TOPIC: SD-WAN

As the intelligence becomes separated from the hardware in favor of SD-WAN strategies, the impact of utilizing redundant pathways for traffic shaping becomes more and more desirable. In traditional networks, this pathway waited for the other to fail. Clearfield continues to provide increasing density to its product platform without sacrificing the important elements of consolidation, distribution, access, and protection. A labor-lite approach via pre-terminated, plug-and-play products reduces the network costs of deploying increased physical connectivity. With the ability to exchange high-cost, skilled laborers for lower-skilled laborers, the speed to deploy, troubleshoot, and restore, improves.
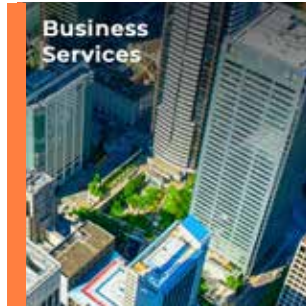
TOPIC: REINVENTION

For Clearfield, it's more a realignment and focus of our fiber management expertise we have gained over the years in deploying FTTx networks towards the obvious fiber challenges associated with 5G deployment. Meet me points, quick access, rapid deployments, and aggregation/distribution challenges remain the same in a new application environment. The strategies are not fully defined, and we are doing our part in the discovery process to deliver the most economical, speedy, and reliable fiber management platforms against current requirements in this evolving network architecture. Make no mistake -- what we are doing today will look much different 3 years from now. It's our job to anticipate and stay ahead of it.

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JOHN ROBBINS III

Senior Manager,
Network Engineering for
City of Fort Collins

Fort Collins Connexion

TOPIC: REINVENTION

Rooted in the principles of equitability, net neutrality and local investment, municipal broadband is a clear disruption in the traditional Service Provider footprint -- and Fort Collins Connexion is leading the charge in Northern Colorado. As one of more than 20 states where incumbent ISPs have managed to limit local governments from competing with private sector to provide high-speed Internet, telecommunication, and cable services, Colorado towns keep voting down the state ban SB-152 put in place in 2005. As of October 2019, more than 140 municipalities and counties have voted to reclaim local authority from the state, with Denver looking to join the pack in 2020.

With a keen eye on underserved communities, disadvantaged households, and thoughtful use of existing infrastructure,

Fort Collins Connexion is perfectly positioned to provide ubiquitous world class services to all City premises.

TOPIC: SKILLS GAP

When hiring today, we choose candidates with excellent customer service along with creative mindsets that demonstrate the ability to include automation in their work. Coding skills and systems experience, allow us to build custom solutions such as network operations dashboards. An innovative and out-of-the-box mentality is encouraged, leading to better processes and procedures, and ultimately to better service our customers.

For staff looking to build deep technical skills through non-traditional means, I recommend open-source simulation tools with well supported communities. For example, GNS3 with novice to expert level routing and switching labs, paired with any number of virtual systems, are available to anyone with little to no investment on the part of the lifelong student.

TOPIC: ARTIFICIAL INTELLIGENCE

AI technology, with its powerful learning algorithms, has long held great promise of more than just a mathematical paper exercise. Yet the adoption of AI has struggled to gain traction except in the most sophisticated networks. Today; we are seeing AI technology introduced in practical, off the shelf tools and applications, ready for even the smallest Service Providers. Examples include alarm correlation and security threat management, where AI helps identify trending of network anomalies and risks. In some cases, platforms may now take immediate action to remediate problems automatically, such as applying critical security patches.

With thoughtful implementation by tool vendors, AI technology will become even more integral in helping Service Providers address threats more efficiently, and free up technical staff to focus on innovation and customers.

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JOHN GREENE

Chief Executive Officer and GM

New Lisbon Telephone
Company, Inc.

New Lisbon Broadband and
Communications, LLC

TOPIC: REINVENTION

My company is the poster child for reinvention of a telco and I tell people that NLTC is a 119-year-old start-up company. With our small size, it was necessary that we reinvent our company, becoming more competitive and expanding our service area, and we had to do that at lightspeed. Today, we have expanded into several surrounding counties with both fiber and fixed wireless Broadband offerings -- and our customer base increased by a factor of 6.

From a technology standpoint, we are always very inventive and forward-thinking. FTTH is our go-to technology, but most of our customer base is actually on our fixed wireless network. We even deploy hybrid networks using FTTH in some communities with a licensed wireless backhaul. We are currently deploying a 200 Gbps backbone transport network to provide plenty of bandwidth headroom for future growth.

Finally, we are launching our own Over The Top (OTT) video product this year. We will eventually migrate all our traditional digital video customers to the OTT platform, eliminating the need for dedicated bandwidth, set-top boxes, and truck rolls for video installation and maintenance. Plus, it will be available to our entire wireless customer base.

TOPIC: SKILLS GAP

With our phenomenal growth over the last 5 years, filling job openings and training new employees has been one of our biggest challenges. Technology skills are always a major part of our focus, and we leverage many sources for that training, including vendors, local colleges, conferences, and training conducted by our own employees. However, soft skills are key to any start-up organization's success, as we merge new employees with old and evolve our corporate culture. So our biggest challenge overall has been the teaching of soft skills dealing with corporate culture and interpersonal relations, (i.e., building a team). Utilizing local HR training organizations, and even personality tests, has helped in this endeavor. Another "tool" has been employee-based events, from lunch meetings to family cookouts.

TOPIC: INVESTMENT FOR THE FUTURE

More of the same. We continue to grow our fiber network, always looking for good opportunities, and adding wireless sites if there is a need. Our ILEC FTTH buildout will be completed in 2020, reducing costly copper maintenance, and allowing more services to be offered. We will also continue looking for acquisitions to help us expand and grow our profitability.

Norvado

CURT CHRISTENSEN

Customer Network Manager

Norvado

TOPIC: REINVENTION

As a rural service provider of Voice/Internet/Video, we are meeting many industry challenges -- including competition from the big wireless carriers as well the national broadband companies. With the competitive pricing of High Speed Internet, we have upped our unlimited High Speed fiber packages recently as well as a path for future upgrades. Offering 1G High Speed and symmetrical High Speed Internet packages. Additionally, we are offering a residential-managed Wi-Fi product that is built into those High Speed Internet packages. We look to manage Wi-Fi as table stakes in providing the customer with the best experience possible on our network.

As an IPTV video provider with small revenue margins, we are encouraging our customers to use a streaming provider for their video content. We are creating a streaming concierge app that will help the customer choose what programming they may want. With more customers streaming, we will be able to guide them towards a larger High Speed Internet package and increase our monthly revenue. Once a telephone company, now a broadband service company.

TOPIC: SKILLS GAP

Keeping up internal IT skill sets, as well as hiring individuals with those skills, is a focus and challenge. We are in a 5-7 year window where 50% of our staff may retire. We have started intern programs with the local schools in the area. We have had a career day where interested students attended along with educational staff from those schools. We also had teachers do externship programs with us in gaining knowledge of the industry and what Norvado has to offer. Basic IT networking courses at a technical school are a great start. Norvado has done a good job sending staff to training on products we offer as well as credited IT courses like Cisco CCNA courses.

TOPIC: INVESTMENT FOR THE FUTURE

Fiber-to-the-business and fiber-to-the-home. We are currently 95% FTTH in our Norvado West locations with the goal of 2020 completion. Recently purchased Norvado East locations are at 30% FTTH with the goal of 2023 for completion. In the rural area we believe fiber is king. Our focus is also on business where we are installing fiber, and turning up business service product offerings like managed Hosted PBX, Managed network, and 1G and 10G High Speed services.

Norvado
Thrive up here

We make our small towns high tech.

On the surface all telecom companies appear equal. We all provide connectivity for your devices.

So what is the difference between one provider and another?

Simple, it's the people.

Unlike big box brands, we are solely committed to helping our local businesses and communities thrive through better products and better service. Especially service.

Though we provide the most innovative solutions available, we know it still comes down to a relationship, and how hard we work to understand local business needs and support their growth.

"I'm not limited by the technology around me. I'm enabled by it. I couldn't say that before Norvado."

BEN ILLICK, CEO
Carlson Building Supply, Ashland, WI

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LATANYA BUGGS

Director of Operations, Global Network and Technology Division

Verizon

TOPIC: REINVENTION

We said we would lead on 5G and we are. We were the first in the world to launch a commercial 5G mobile network with a commercially available 5G-enabled smartphone and currently we offer 5G mobility in over 30 cities as well as in over 20 arenas and stadiums. We were also the first to provide a commercial 5G service with Verizon 5G home, which we launched in 2018.

We were the first company in the world to launch a Mobile Edge Compute service (MEC) with AWS. In November, we announced that we're working with AWS to bring cloud computing services closer to the edge of our 5G network. We're calling it Verizon 5G Edge. (See "Verizon and AWS team up to deliver 5G edge cloud computing," https://www.verizon.com/about/news/aws-verizon-5g-edge-cloud-computing.)

The 8 currencies of 5G allows it the enabling power to drive effectiveness and efficiencies for all. Autonomous cars, smart communities, the industrial Internet of Things (IoT), and immersive education will all rely on 5G. 5G will usher in the fourth industrial revolution, paving the way for unprecedented innovations that will reshape the world.

TOPIC: INVESTMENT FOR THE FUTURE

In 2020, we will continue to support the launch and build out of Verizon's 5G Ultra-Wideband network, continuing to grow the number of 5G cities, as well as launching new 5G supported devices. Verizon was recently recognized by OpenSignal and Nielsen as having the best 4G streaming experience among all US wireless carriers, and we are committed to supporting the growth in data and video traffic on Verizon's 4G LTE network.

We also will continue deployment of significant fiber in markets nationwide as well as upgrade Verizon's Intelligent Edge Network architecture.

TOPIC: ARTIFICIAL INTELLIGENCE

AI has the potential to become breakthrough technology. It will be able to empower smart devices, and can be integrated into many facets of our everyday life like social media and digital assistants. The opportunities for AI in business are vast. AI can be used to improve productivity, streamline operations, and assist in customer service. Health Care systems can benefit from AI to assist with diagnostic decisions and surgical procedures. In the future, AI will empower more machines to make human-like decisions that will continue to influence customer products and technology.

5G✓ built right

Not all 5G is created equal. With ultra-fast speeds, ultra-low latency and massive capacity, Verizon 5G Ultra Wideband is more than 10x faster than some other 5G networks. And it's rolling out in cities across the country so people can experience the performance Ultra Wideband can deliver.

It won't just change what your phone can do. We're building it to change what cities, industries, and things we can't even imagine will do.

**There's 5G.
Then there's Verizon 5G.**

#5GBuiltRight

verizon✓

SHEILON KING

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Sheilon's team of data scientists and data engineers collaborates extensively with client partners to deliver savings and enhancements to improve the Customer Experience through data-driven solutions. Prior to her current position, Sheilon owned sales operations supporting the Consumer Mobility business, accountable for tactical execution and roll out of operational and sales processes. Sheilon grew up in Northern Virginia and attended Stanford University. She volunteers extensively in the North Texas area to support the Arts and STEM education initiatives. Sheilon recently completed a personal goal to visit all 50 states in the USA. She enjoys cooking, learning about wine, reading, and traveling.

AT&T Communications - A world leader in communications and technology, redefining how you engage with media and entertainment. AT&T Communications builds human-first technology that puts our consumer and business customers first. We deliver, and continue to invent new ways to deliver, captivating entertainment that creates emotional connections and brings us all closer.

ANIL SIMLOT

Vice President of Virtual Services
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CenturyLink

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Anil is responsible for defining technical solutions for the company's services based on Software Defined Networks (SDN), Network Function Virtualization (NFV), and Edge Compute. Anil has been at CenturyLink for 20 years. During that time, he has had responsibilities in systems development, network design, planning, technology evaluation, and product development. Prior to CenturyLink, Anil worked at Sprint and Alphatech Corporation in software development. Anil has a master's degree in Computer Science from The Johns Hopkins University, and another master's in Electrical Engineering from North Carolina State University.

CenturyLink (NYSE: CTL) is the second largest U.S. communications provider to global enterprise customers. With customers in more than 60 countries and an intense focus on the customer experience, CenturyLink strives to be the world's best networking company by solving customers' increased demands for reliable and secure connections. The company also serves as its customers' trusted partner, helping them manage increased network and IT complexity, and providing managed network and cybersecurity solutions that help protect their business.

JOHNNY HILL
COO

Clearfield

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Johnny has more than 20 years of experience in product development and engineering in the telecom industry.

Clearfield is the *Fiber to Anywhere company* – with a *Fiber to Anywhere product platform.* Rather than a pre-determined, scripted solution, Clearfield promises a product design methodology that addresses your unique requirements while providing the lowest total cost of ownership.

Offering a stream-lined, practical approach to the distribution, consolidation, management and protection of fiber, Clearfield's line of panels, frames and cabinets, optical components and full range of fiber optic assemblies and patch cords are designed for scalable deployment, craft-friendly operation and unsurpassed performance.

Clearfield's FieldShield and YOURx fiber delivery systems combine to deliver simple, fast fiber pathways and to solve the issue of slack storage through all points of the network to provide a total end-to-end solution. FieldShield pushable fiber, microduct and last mile drop technologies are saving the provider time and money with labor lite designs that reduce labor and skill at installation and at the pre-engineering stage.

JOHN ROBBINS III
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Fort Collins Connexion

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John has over 20 years of experience in architecture and design at Alcatel-Lucent and Nokia with expertise in IP/MPLS-TE, QoS, and Fiber Access Networks. John joined Fort Collins Connexion in 2018, and leads a NetOps team consisting of Design, Engineering, and a Network Operations Center. His team is actively building municipal broadband services for the community, along with maintaining the other City network infrastructure such as enterprise core, police, water, electric and transportation utilities. John holds a BS and MS in Electrical Engineering, along with several network certifications and a patent from Lucent Technologies. Outside of work, John volunteers for robotics STEM programs for youth.

Fort Collins Connexion, a municipally-owned utility, provides gigabit-speed Internet, advanced video, and phone services, to the residents and businesses of Fort Collins, Colorado.

JOHN GREENE
Chief Executive Officer and GM

New Lisbon Telephone Company, Inc.

New Lisbon Broadband and Communications, LLC

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John has more than 40 years of experience in the telecommunications industry. He began his career with AT&T as an engineer in Tennessee and held various management positions, including as a Manager at Bellcore, the post divestiture Bell Labs. John attended the US Naval Academy, graduated from North Central College with a Bachelor's Degree in General Science, and has an Information Networking Certificate from Carnegie-Mellon University. He is active in many community efforts and organizations, including serving as an Executive Board Member of the TIA. John and his wife, Maurita, have 4 grown children. In his spare time (which isn't much), John enjoys doing home projects, smallmouth fishing, and playing golf. He also enjoys a good cigar paired with a smooth bourbon.

New Lisbon Telephone Company (NLTC) is a rural service provider headquartered in New Lisbon, Indiana. Founded in 1901, it is one of the oldest telephone companies in Indiana. NLTC also has a competitive subsidiary, New Lisbon Broadband and Communications (NLBC); together they both provide services in 6 counties to more than 3,000 customers in East Central Indiana utilizing their copper, fiber, and wireless, network. NLTC provides digital voice, gigabit Internet, digital linear and Over the Top (OTT) video, and managed Ethernet for cellular backhaul and other large customers. NLTC is currently upgrading their backbone connection between their 3 primary locations of New Lisbon, Richmond, and Winchester, to 200 Gbps capacity.

CURT CHRISTENSEN
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Curt has been in the telecommunications industry over 35 years, with the last 25 years with Norvado Communications, a rural broadband company in Northwestern Wisconsin. Curt has installed and supported Norvado's legacy copper plant, PBXs, TDM, and SONET deployments of yesteryear. Curt currently manages Norvado's fiber-to-the-prem, Business Network, Hosted PBX, and 100G IP network teams. Curt attended UW-Stout and WITC in Wisconsin. He also has several certificates from industry leaders, including, Nortel, Cisco, Meta Switch, Zhone, Motorola, and Mitel, among others.

Norvado

Located in Cable and Phillips, Wisconsin, Norvado is the local, hometown telecommunications provider to over 11,000 subscribers in Bayfield, Douglas, Price, Sawyer, and Ashland, counties in Northwestern Wisconsin. In the summer of 2014, Norvado completed its Fiber-to-the-Home project, allowing for the delivery of gigabit broadband speeds to most subscribers. This made Norvado one of the limited number of companies in Wisconsin able to offer this type of speed to customers. Norvado's state-of-the-art fiber optic network allows for many beneficial offerings for all of Norvado's customers, including hosted PBX, home and business automation, as well as telephone and television offerings. Norvado prides itself on offering broadband services similar to those found in larger cities, allowing consumers the freedom to live in the beautiful North Woods, but still be connected to the rest of the world at the touch of a button.

LATANYA BUGGS

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LaTanya leads a team of 1,300 technical employees building and maintaining the wireline and wireless networks in New Jersey. With 20 years of experience in the technology sector; she has coached and developed countless leaders to achieve excellence. LaTanya has a passion for ensuring all teams consistently deliver network superiority and an exceptional customer experience. She guides her team with a focus on improving daily customer interaction, using technology to maintain a customer-centric environment. Prior to her role in New Jersey, LaTanya was an Operations manager throughout New York City, leading hundreds to successfully deliver the construction, installation and maintenance of the wireline network.

verizon

Verizon Communications Inc. (NYSE, Nasdaq: VZ) was formed on June 30, 2000, and is celebrating its 20th year as one of the world's leading providers of technology, communications, information and entertainment products and services. Headquartered in New York City and with a presence around the world, Verizon generated revenues of $131.9 billion in 2019. The company offers voice, data and video services and solutions on its award winning networks and platforms, delivering on customers' demand for mobility, reliable network connectivity, security and control.

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DATA IS POWER

By Mark Cohen

Simple Rack Changes Can Yield Powerful Rewards

The explosion of Internet of Things (IoT) devices, and growing consumer expectations of high-speed broadband data anytime, anywhere, and everywhere, put increased pressure on data networks and infrastructure. To deliver this ever-increasing deluge of data, 5G is launching to provide these services wirelessly. Higher cable speeds (can you say "10G"?) and FTTX (fiber-to-the-business/node/home) are being deployed to support this 5G evolution. One can expect more changes in the coming years, all driven by our hunger for more, and faster, data.

Architectures are also changing, as network operators push data processing closer to the edge to reduce latency and increase Last Mile bandwidth. Whether C-RAN or remotePHY, these new architectures will someday themselves be replaced as new technologies emerge.

After all, when it comes to investment in technology, decisions are always made on the bottom line. What generates more revenue and more profit? Data.

A Powerful Change

Behind the scenes, power within the network has been pressed for more capacity, while power architectures have had minimal evolution. -48Vdc is still the pre-eminent architecture for myriad reasons, including efficiency (fewer voltage conversions), low

It is THIS equipment that generates revenue, not the power panel. Clearly, data is king. Data is what the customer buys, not power. So how can we get more value for the network operator in this architecture? What are the challenges that can be mitigated by looking at the power infrastructure?

Customers need more space for traffic-carrying (i.e., revenue-generating) equipment. They need fast deployments for expansion and upgrades, and need insights into power consumption (efficiency) and pending failures (proactive mitigation).

New design approaches can reduce rack space, and streamline new installations and future retrofits. Monitoring and reporting capabilities can provide enhanced power monitoring for better energy efficiency analysis, and enable proactive response to mitigate failures before they occur. Something as simple as a fresh look at top-of-rack, tertiary DC power distribution can provide opportunities for improving facility space utilization, speed of deployment, and intelligent monitoring.

Simply Impactful

AC power (120Vac) has always been associated with a plug connection, because AC power is the ubiquitous power solution in our world. However, DC power hasn't had the benefit of a common connector, so the telecom DC world still relies on permanently fastened lugs. This is still important for technical reasons at high current connections, as it is in the AC world.

However, other than standardization (which will evolve), connectorizing the output connections on a DC panel can provide some easily obtained benefits.

Benefit #1: DENSITY

As mentioned, the standard legacy method of connecting equipment to the top-of-rack DC power distribution panel has been to use lugs. With rear-facing screws or studs, this requires the cables to come straight down (See Figure 1.), interfering with any equipment immediately below the power panel. It is typical for users to simply leave this rack unit (RU) empty.

By implementing connectors on the output power cables, cable routing can now be accomplished parallel to the floor (See Figure 2.), allowing equipment to be installed directly below the power distribution panel. Installers can then bring cables down to equipment, or route to the side of the rack
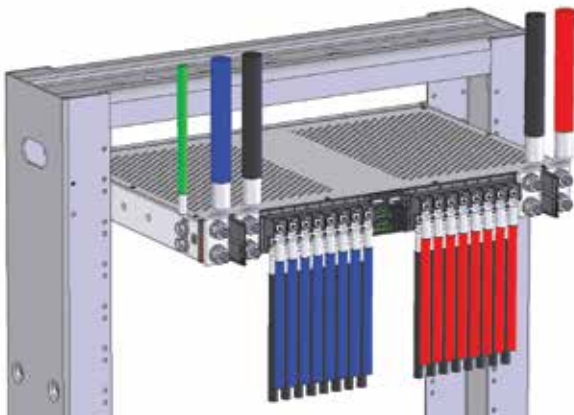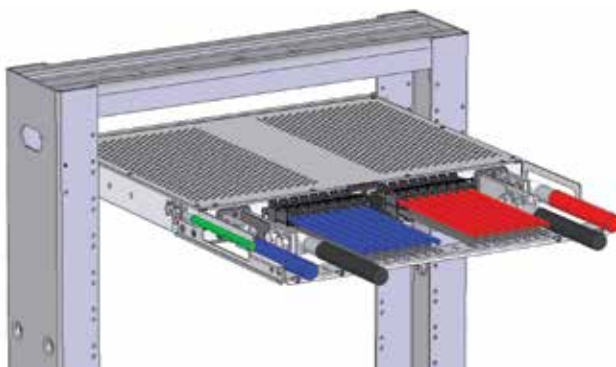

Figure 1. Traditional lug connections.

Figure 2. Connectorized output cables.

voltage safety, huge legacy infrastructure, and ease of battery backup. There's been enhancements in some areas, such as more efficient rectifiers and new battery chemistries, but the basic architecture remains.

For example, DC power tertiary distribution is widely used in telecom and cable facilities. High-current cables are routed from a main DC rectifier plant to the equipment rack, in which 1 or more power distribution panels resides at the top. This power panel then distributes power to multiple, separately protected circuits feeding individual equipment within the rack (rather than having each equipment's power routed all the way from a distant DC rectifier plant). This equipment can be servers, routers, switches, radios, or other telecom or data equipment.

or cabinet, with service loops that do not interfere with adjacent equipment.

This space-savings can extend beyond the rack to the facility, depending on scale.

Benefit #2: INSTALLATION SPEED AND SIMPLICITY

Connectors can make installations faster and simpler, when compared with lugs. A properly designed connector installs on a cable simply, with standard tools, similar to a crimped lug. That's where the similarity ends. The lug requires a screw to be removed from the panel, inserted through the lug, then re-inserted into the panel, without dropping, stripping, or breaking the screw. The same is true for stud inputs using a nut. It also requires 2 such lugs per power output.

With a connector, a single tool-free connection is made. A properly designed connector also ensures proper polarity, and in the case where a cable is installed on the wrong circuit, it is quickly moved to the correct circuit.

Where a cable is fabricated by the cable manufacturer, or assembled off-site, technicians who may not be familiar with power can easily and safely install the cable without the specialized training needed to properly terminate a cable in the field.

Customers are currently integrating DC power panels with connectorized outputs. Though some are unique to particular vendors, the industry is likely to develop common connection standards around DC power, and equipment vendors are well advised to ensure their connector solution is future-proof and not proprietary.

Sensor Integration

Just as data is king for revenue, it is also king when it comes to managing a network. While the data network is constantly monitored for performance, ensuring traffic is flowing well, the power portion of the network has typically been passive, and monitoring has been limited to whether a circuit is operational or tripped.

Advanced power management requires adding quantitative monitoring of voltage and current at the circuit level, allowing operators to understand their power consumption, and to develop proactive response. Integrating additional sensors, such as temperature sensors, extends monitoring capabilities to other relevant network metrics.

Current sensors on each output circuit of a power panel allow monitoring of energy consumption on each individual circuit. Voltage sensors on the panel allow monitoring of voltage at the top of the rack, which can be critical for long cable runs that may introduce voltage drop, resulting in lower voltage at the rack than that being reported at the main DC distribution plant.

Where additional sensors, such as temperature sensors, are integrated into the top-of-rack panel, integrators have access to additional data such as top/bottom of rack temperatures, or cold-aisle/hot-aisle temperatures, without having to install a separate environmental monitoring system.

Monitoring capabilities can be as simple as setting alarms at particular current, voltage, or environmental thresholds, or as advanced as allowing retrieval of specific quantitative measurements to track power conditions over time.

5 Areas to Track

Area #1. Alarm thresholds allow proactive responses to pending issues in a facility. Current monitoring can notify a facility operator of a pending over-current situation before the fuse or circuit breaker opens, allowing the operator to solve a pending issue before they lose power to the equipment.

Area #2. Voltage monitoring provides insights into potential issues with voltage drop that may develop as more equipment, or different higher-power equipment, is installed at a later date, over-taxing the original cabling capacity.

Area #3. Temperature monitoring can provide insights into HVAC performance at the rack level, that may not be monitored by an overall facility HVAC control system.

Area #4. Live quantitative data provides trending information for operators. This data can be useful for energy-efficiency studies, a topic gaining significant attention in recent years. Actual current consumption data is very valuable for colocation sites, where tenants may be charged for power utilization by the landlord, whether based on time-of-use (becoming more frequently used by utilities to limit overall grid load at peak times), or simply aggregated kWh energy consumption.

Area #5. Data retrieval can also reveal trends in equipment power consumption based on traffic or pending equipment issues. In an actual situation, an operator was using a server shelf with multiple independent power feeds, each feeding an individual blade server. They observed over time that the power consumed at each feed (i.e., each blade) varied considerably, while the total of the 8 feeds varied only a little. This was diagnosed as a weakness within a few of the blades, such that they would process less traffic under certain conditions, in which case some of their load would be taken by adjacent blades; the problematic blades would later recover and accept more traffic, reducing the load on adjacent blades. This manifested itself in wide swings of power consumption on a per-blade basis, unrelated to total traffic through the blade shelf as a whole. This allowed the operator to pay closer attention to the performance of this server shelf, and to develop plans to replace those blades prior to failure.

Invest in Powerful Data

When installing new top-of-rack equipment, whether due to launching greenfield facilities or expansion and upgrading of existing facilities, the incremental expense to add high-value features such as connectorized outputs (for increased equipment density, and faster deployments and upgrades) and monitoring (to add intelligence to the non-data physical network environment) can have lasting benefits that far outweigh the additional cost. ∎

Mark Cohen is Senior Product Manager, Amphenol Network Solutions. He has more than 30 years of experience in DC power systems, energy storage systems including batteries and ultracapacitors, PEM fuel cell systems, and electric, solar, and hybrid ground and air vehicles. For more information, please email getinfo@amphenol-ns.com or visit www.amphenol-ns.com.

🐦 @AmphenolNS

FEELING EDGE-Y?

How Mobile Edge Computing Will Benefit Network Providers

The pace of innovation has been invigorating, but exhausting. Now that everyone has a better idea how everything fits together and what it can do, shortcomings and limitations have become more obvious. For example, smartphones aren't the ultimate mobile device. Wireless augmented reality, the Internet of Things (IoT), wearable devices, and autonomous systems are coming.

As impressive as 4G/LTE is, it needs to be improved to keep up. The cloud can evolve and be improved with a continuing stream of specialized server instances for AI, machine learning, inference, and gaming, for example. Improving the communications links between cloud servers and users or devices is a continuing effort.

The cloud and mobile infrastructure are clearly synergistic and mutually dependent. More applications for both consumer and business run in a cloud, and more access is from mobile, Wi-Fi, and cellular wireless devices. Going forward, the success of mobile and the cloud are inescapably dependent on each other. But competition exists for a larger share of the market. As every aspect of our private and work lives evolve into a cloud-based mobile delivery model, this market is growing at an ever-increasing rate.

Closing In

Edge computing is cloud computing, moved closer to the user or device. In other words, the

cloud is closer to the "edge" of the access network. Moving it closer reduces the network connections and improves the performance in terms of latency, jitter, and bandwidth.

Sometimes edge execution is necessary such as for autonomous vehicles. In some applications, edge computing has economic and performance advantages, such as machine learning and artificial intelligence (AI). Because edge computing is a distributed system, it's complex and requires automatic operation. Despite these complexities and uncertainties, latency and network performance have always been strong and transformational enablers.

Note that low latency does not mean close proximity. To achieve the low latency required for a specific use case or application, you need to examine how to attain the optimal economic solution. A good IP network design can achieve the low latencies and optimal economic location for edge computing.

Implementation

Implementing mobile edge cloud computing within the mobile infrastructure requires the following:

• **Server resources that supply** the virtualized, on-demand resource.

• **An underpinning infrastructure that connects** the servers to the mobile user or device, to the Internet, and to the other edge resources that constitute the edge cloud.

• **An operational control system that manages and orchestrates** the allocation of resources and accounts for services delivered, and the provisioning and operation of the cloud resources.

• **Integration of this cloud infrastructure with the control system of the mobile operator systems** so cloud applications can access and source information. This information may be about the connected user or device including authenticated user identity and independently refined and validated location and perform telephony services.

Deutsche Telekom Learnings

To understand edge market potential, Deutsche Telekom (DT) invested in quantitative research over the last 3 years. This research will soon be released openly online so others can engage and create a collective understanding of the total market.

DT learned that 5 categories of new business services for service providers are enabled by investment in the mobile edge:

CATEGORY 1.

Cloud-related opportunities that emphasize the benefits of reduced network latency. Compared to wired connections, cellular connections offer more location flexibility (unwired) but with greater latency until mass-market 5G deployment. It's easier and quicker to build and operate a global

cellular edge because of the computer use within the infrastructure, and because of the existing, mature, roaming business federation among operators.

CATEGORY 2.

Mobile applications that benefit from higher bandwidth connectivity such as augmented reality experiences and games. Niantic's pioneering Pokémon GO and the anticipated Harry Potter games are 2 examples. Edge computing enables higher scaling that benefits clustered multiuser games or experiences that share context such as player location and orientation among players that are geographically located close to one another.

CATEGORY 3.

Cloud applications that are enabled by intimate use of local context such as the upcoming enhanced AR capabilities in Google Maps.

plans. The new opportunities would be explored at some future date when 5G deployment matures.

Cloud-focused application and service builders won't wait to implement early versions as OTT solutions. If mobile edge computing can be implemented before 5G, it gives mobile operators the chance to participate in these early efforts. They can learn from them and discover the required partnerships and go-to-market strategies.

The fifth category relates to using the edge as an agile development platform for the mobile operator. This topic isn't often discussed, but it should be. The traditional generational evolution cadence of the mobile industry is a competitive disadvantage against the on-demand innovation of over-the-top alternatives even if the integrated and optimized infrastructure solution has advantages.

A mobile edge cloud can be used by a mobile operator and its various business partners to evolve features and services much more rapidly than

> "This topic isn't often discussed, but it should be. The traditional generational evolution cadence of the mobile industry is a competitive disadvantage against the on-demand innovation of over-the-top alternatives even if the integrated and optimized infrastructure solution has advantages."

CATEGORY 4.

5G initiatives that overcome application connectivity issues in 4G. The 5G discussion has highlighted many potential applications that can also be implemented within an edge-enabled 4G infrastructure.

CATEGORY 5.

Agile development platforms within the cellular infrastructure that enables operators to collaborate with device vendors on differentiated offerings and to rapidly add subscriber features and functionality in response to market opportunities or challenges.

The first 4 categories are often thought of as benefits that will accrue at some point in the future, but not part of shorter-term initiatives and commercial

has been possible within large generations and to develop or augment new subscriber services, or to work with device vendors to create differentiated subscriber device offerings. An edge cloud brings a developer-friendly platform into the operator infrastructure for the first time. It enables functional integration with the cellular infrastructure and low-latency, high-bandwidth connectivity to the device that isn't possible from the conventional cloud.

Case Study: Deutsche Telekom (DT)

In 2018, Deutsche Telekom (DT) executed a 2-year internal study that evaluated the potential impact of edge computing on mobile operators. The study suggested the potential benefits were real, and it highlighted the fact that many of the potential services would be more attractive to application

and service builders if they were available in a coordinated and aggregated way from many global operators.

As a result, MobiledgeX was structured as an independent company rather than as an internal DT operation. It is capitalized to use a structure that allows it to receive additional external investment over time.

The business strategy begins with the creation of a federation of mobile operator partners by developing software that creates a developer-friendly system platform that is accessed and orchestrated from the cloud. The software is implemented as cloudlets that run on server resources near the mobile edge.

The offering is built around modern cloud architecture with virtual machines and containers. It's built to run on virtualized server environments that many network providers are adopting already as part of a virtual network functions evolution. The network appliances are replaced by software workloads running on virtualized commodity servers.

MobiledgeX provides the technical infrastructure that enables application code to be deployed in standard packaging such as a virtual machine or container. It's deployed automatically, on-demand, at an optimized location, when a mobile application using it is invoked. This lets the developer provide a declarative specification of how deployment should be done, and optimizes the location dynamically based on the current resources and loads.

Edge-ing Around

Today, DT deploys this edge computing process across Germany within the DT mobile infrastructure.

This is just one case describing how edge computing, cloud computing, and 5G, can interrelate to benefit mobile operators. It also shows how network providers can begin or accelerate their edge adaptation of 4G that can evolve naturally to 5G as it matures. ∎

MobiledgeX is an edge computing company founded by Deutsche Telekom AG and headquartered in San Francisco, California, and is building a marketplace of edge resources and services that will connect developers with the world's largest mobile networks to power the next generation of applications and devices. For more information about the 2019 Cisco and MobiledgeX white paper *Edge Computing and Global Mobile Services Infrastructure: Why wait for 5G to mature when you can start now?,* and more about Edge Computing, please visit www.cisco.com/go/edge and https://mobiledgex.com/.

NATURAL DISASTERS WREAK HAVOC ON SUPPLY CHAIN CONTINUITY

5 Best Practices to Adopt for Business Continuity

By Jim Yarbrough

With spring comes unfortunate visions of flooded homes, washed out roads, and massive power outages -- and these images remain in our minds year after year. Besides the very visible images of destruction, what is not often discussed on a national scale, despite carrying an impact potential that's greater than the physical devastation, is the damage a hurricane can do to a business's supply chain.

Natural disasters and other severe weather events remain a ceaselessly difficult-to-predict risk to business continuity in any supply chain. From the actual suppliers of a business to the transportation routes and delivery services those suppliers use, every link of the chain can be affected by natural disasters, not just hurricanes, but earthquakes, wildfires, floods, tornados, and more. (See Figure 1.)

According to CNBC, AT&T alone announced that several natural disasters cost the telecommunications company $847 million since 2016, including $626 million in 2017 alone. In light of the impact that weather events can have on supply chains, it is critical for businesses to develop detailed contingency plans to lessen the negative effects of such severe weather.

An earlier example is when Hurricane Florence slammed into the North Carolina coast on September 14, 2018, as a Category 1 hurricane. It packed winds of nearly 100 MPH and cloud bands that dumped as much as 30 inches of rain on some areas. As the storm moved up the East Coast, it caused over $38 billion in damage and resulted in flooded roads, closed ports, and major disruptions to air travel and the nation's rail system.

Figure 1. Wildfire/USFWS/Southeast

More recently, Hurricane Dorian cut a path of catastrophic destruction over parts of the Bahamas in late August and early September of 2019 before targeting the East Coast of the US. As the storm washed out roadways, destroyed major infrastructure, and even damaged an oil facility in the Bahamas, weather forecasters indicated that Florida could sustain a direct hit, resulting in massive evacuations to neighboring states. That alone caused gridlocks on major highways -- the same roads used by suppliers to deliver much-needed goods to their business clients. (See Figure 2.)

As the storm began making a turn that eventually led to a path paralleling the coast, Georgia, the Carolinas, and Virginia, began evacuations in coastal areas. Numerous ports and airports throughout the region were closed. Many businesses closed for days. Flights and trains were canceled. Deliveries were delayed by several days, and production in many factories was shut down as employees sought refuge inland, and companies prepared for the worst.

Dorian made landfall over a portion of North Carolina's Outer Banks on September 6, but the worst physical damage from the storm in the US was limited to barrier islands and some coastal areas. Still, storm preparations disrupted large swaths of the country as transportation routes were either shut down or jammed and production was slowed down or stopped entirely. The multiple shifts in the course of the storm and forecasted landfalls resulted in businesses continually recalculating a response plan and moving assets accordingly. The changing nature of the storm caused the redirecting and delay of ground and sea freight, and numerous business closures and evacuations in the prospective paths of the storm.

Furthermore, throughout the month of October 2019, California was ravaged by at least 13 wildfires, disrupting the entire state and causing widespread power outages and road closures. The devastating fires resulted in over 2 million California residents without power, and over 200,000 were forced to evacuate their homes and businesses.

Due to the breadth of the fires, major roadways closed at various intervals either due to the proximity of a fire or to accommodate evacuation routes, leading to extensive delays and detours for transporters throughout the state, including those traveling to Los Angeles International Airport (LAX).

Throughout the month, power utilities in the state engaged in widespread proactive power outages to attempt to limit the spread of the fire during times of high winds. Early estimates by experts put the economic cost of the early October blackouts in the area of 2 billion dollars. As fires continue to arguably worsen year-to-year, some experts believe that proactive power outages may become a norm in California to mitigate the strength and reach of these wildfires.

5 BEST PRACTICES

Although the damage from a natural disaster can rarely be predicted, telcos can take several steps to mitigate the impact such an event can have on them:

ACTION ITEM 1
Create a designated operation center.

Businesses with operation centers or designated emergency response teams are able to implement response plans and reallocate assets and employees accordingly, in line with real-time forecasts. These centers help businesses respond to a natural disaster by providing emergency supplies or assistance to impacted facilities. Such coordination and planning measures allows these companies to better minimize the economic impact of a severe weather event, and to rebound quickly after the event.

ACTION ITEM 2
During the supplier selection process, factor in the geography around each potentially impacted facility, and any other backup facilities you may operate.

Investigate the defensive measures your suppliers have taken (i.e., physical protection from floods), and the history of natural disasters in that area.

ACTION ITEM 3
In conducting risk assessments of business partners, you should account for not only the vulnerability and exposure of those partners to natural disasters, but also the ability to recover quickly from severe weather.

Resiliency to natural disasters, primarily the ability to repair and replace infrastructure, as well as the availability of alternative shipping lanes

Figure 2. Florida Braces for Hurricane Dorian / NOAASatellite

and facilities, are critical in any evaluation of a prospective supply chain.

You should also learn which suppliers have operations in places that are prone to natural disasters. Create a map that marks the location of your suppliers, and highlight their delivery routes. You'll also want to select alternate routes your suppliers can take in the event of mass evacuations or other issues caused by a disaster.

ACTION ITEM 4
Make a list of potential issues that can disrupt your supply chain.

This should include things such as flooding, mudslides, washed out roads, destroyed or otherwise closed bridges, massive traffic jams, power outages, impassable roads due to blizzards, damaged rail lines, airports that are shut down, etc.

ACTION ITEM 5
Prioritize your suppliers -- and your supplies -- ahead of time.

- Which suppliers are absolutely essential to keeping your business going in the short term?

- Which ones are less important, and make deliveries on a monthly basis rather than daily or weekly?

In planning for the unexpected, ensure your business has a list of the necessary number of products and materials to continue business in light of a distribution for x-amount of time. Keep this list and review it once a quarter, adjusting as needed, as part of your business continuity plan.

BEING PREPARED = RESILIENCY

A good business, regardless of the number of commas on its financial statements, should be prepared for myriad scenarios related to its supply chain. By instilling common procedures and protocols throughout the supply chain for reacting to natural disasters and other severe weather phenomena, companies can be better prepared to mitigate the disruption and damage to the supply chain.

Natural disasters will strike -- but with proper protocols in place, your business can remain resilient and minimize risk during the unexpected. ∎

Resource
AT&T, hit by higher natural disaster costs, unveils 30-year climate change model, by Emma Newburger, *CNBC,* published Wed, Mar 27 2019. https://www.cnbc.com/2019/03/27/att-hit-by-higher-natural-disaster-costs-unveils-30-year-climate-change-model.html. Retrieved 021320.

Jim Yarbrough is the Global Intelligence Program Manager at BSI. He leads BSI's team of supply chain security analysts, and assesses the potential threat of terrorism and cargo disruption to countries and businesses worldwide. These assessments are integral to the Global Risk Analysis & Data Evaluation (GRADE) tool that BSI provides to the U.S. Department of Homeland Security. For more information, visit https://www.bsigroup.com/en-US/ and https://www.bsigroup.com/.

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Challenges and Solutions for Deploying DAS and C-RAN in the Real World

UPGRADING YOUR DAS?

By Ahmed Hmimy

DISTRIBUTED ANTENNA SYSTEMS (DAS) bring cellular signals indoors to buildings, arenas, airports and other venues. As the world readies for 5G mobile technology, most operators and building owners are looking at ways to upgrade existing DAS and to deploy DAS in new venues. This presents an opportunity to upgrade to digital DAS and centralized radio access network (C-RAN). Doing so can reduce complexity, decrease the space required for DAS equipment, cut costs, allow further optimization of radio resources throughout the network, and prepare the DAS for 5G.

Traditional DAS Architecture

To understand how DAS and C-RAN can enable new services in new locations, we need to take a quick look at traditional DAS architecture. A DAS consists of a headend, remote units feeding antennas, and potentially intermediate transport nodes between the headend and remote units. The big difference between a traditional DAS and a next-generation DAS is in the headend and streamlining C-RAN deployments.

DAS deployments have traditionally been challenging because a headend requires the main distribution equipment for the DAS along with an operator's RF signal source baseband unit plus the remote radio head. Because the remote radio head (RRH) puts out a far stronger signal than the DAS distribution headend can handle, the setup requires racks of frequency attenuators between the RRH and the headend. In addition, the setup requires monitoring equipment, a battery backup, and related power equipment to power the signal sources. (See Figure 1.)

And that's not all. Because virtually all building owners want to support services to users of multiple mobile operators, each DAS requires RRHs

Figure 1. Traditional DAS Headend

and related equipment from each mobile operator. This equipment is very expensive, especially the RRH and related gear, and it takes up a lot of space. Venue owners have frequently been challenged to provide enough space for a DAS headend. In many cases, these headends have required construction of new spaces with attendant power and air conditioning equipment.

Moreover, each DAS headend must have its own signal source, so there must be an RRH in each headend location. In a university, corporate or hospital campus, for example, each building would have its own headend with RRH equipment.

C-RAN Architecture

C-RAN and DAS are related to each other because DAS deployments have historically been challenging in terms of cost, space, and the need to have all the signal sources from the different operators located in the equipment room of the building.

Initial C-RAN architecture moved the RF signal sources (RRHs and BBUs) from the DAS headend into a central office for centralized RAN, which is also known as *base station hotels (BSH).* This move significantly reduces the need for space, power, and air conditioning, at the building.

However, this approach only shifts the equipment outside the building to another location, and doesn't address actual cost reduction.

To fully leverage C-RAN architecture, the DAS

should be digital, transmitting digital rather than analog signals to the remote units. This is because a digital DAS can interface directly with the mobile operator's BBU through Common Public Radio Interface (CPRI) rather than requiring a radio. With the CPRI interface, the operator and building owner can eliminate the need for a remote radio head to feed the DAS headend, and can instead run fiber directly from the headend to the mobile operator's BBU located either in a central office or in the cloud.

Moving to such digital C-RAN architecture allows buildings to eliminate radio equipment on-site and enables operators to use BBUs located at near-by macro sites/central offices to feed the DAS.

In addition to eliminating space for radios, building owners can reduce the space needed for a headend by up to 90%. (See Figure 2.)

Benefits of C-RAN and Digital DAS

Digital DAS enables operators to deploy a centralized headend that serves multiple buildings, or even to tap capacity from the operator's existing C-RAN hubs. The digital DAS routes baseband capacity to a distribution point within the served building or campus and allocates baseband capacity where it is needed while reducing the amount of on-site headend equipment and the amount of fiber needed for signal transport. In typical deployments, the space savings are up to 90%

and 92% at operators BBU/BTS locations and head-end at the building, respectively. Additionally, a fiber saving of up to 89% is achievable. (See Figure 3.)

All-digital architecture enables capabilities that analog DAS simply cannot. Capacity re-allocation, soft re-sectorization, system setup, and diagnostics, are all software functions in a digital DAS, capable of being changed with a few clicks of a mouse.

Capacity reallocation allows users to move DAS capacity from one antenna or set of

antennas to another. This makes it easy to support heavy-use areas like lobbies, meeting rooms, or cafeterias, without having to over-provision antennas in any given area.

Digital DAS also transports Gigabit Ethernet backhaul to each remote antenna, which can be used for separate Wi-Fi networks, IP security systems, or to support a small cell overlay needed for future network expansion.

Resource-sharing is another benefit. When the operator has to dedicate a radio resource to a
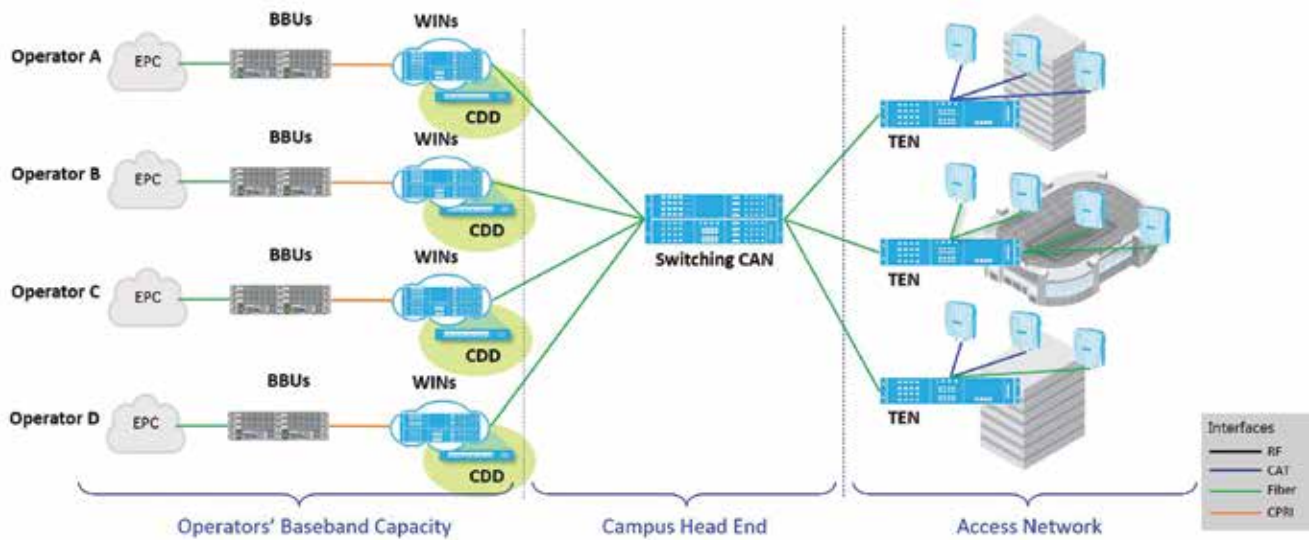
Figure 2. C-RAN Architecture
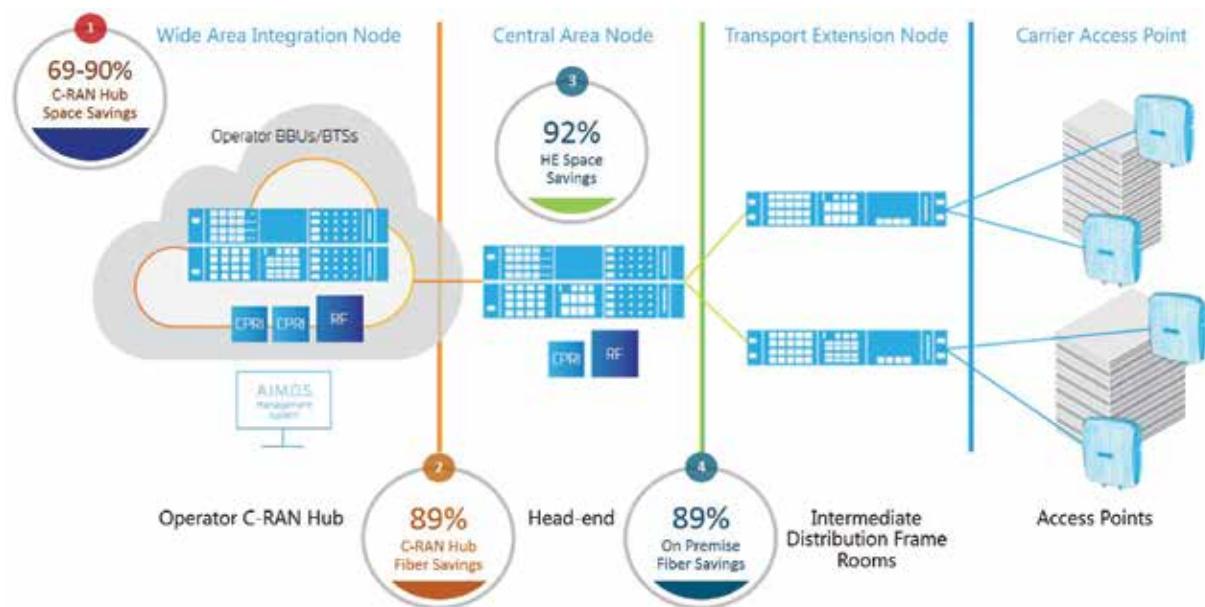
Figure 3. Digital DAS Space and Fiber Savings

venue or building, it removes the advantage of re-source-sharing. A C-RAN allows operators to share baseband resources among multiple buildings.

5G readiness is another benefit. 5G architecture leverages C-RAN architecture, so by deploying a digital DAS with a direct fiber interface to the mobile operator BBU, the DAS is 5G-ready. Moreover, 5G will require many more DAS deployments than we have now because it will use higher frequencies that attenuate more quickly. Today's 4G signals can sometimes penetrate buildings, but 5G frequencies will be much more limited in their ability to do so, necessitating indoor solutions. Digital DAS and C-RAN address this need.

Finally, by reducing the space and cost requirements for DAS, digital DAS and C-RAN make it possible to deploy DAS in far more locations than were previously tenable. A great many enterprises and small venues have historically shied away from DAS due to the cost, and now these can also deliver strong and consistent cellular service to their employees and visitors.

5G services are coming quickly, and mobile operators and building owners know they'll need DAS in many buildings in order to distribute strong 5G signals. By moving to digital DAS and C-RAN architecture, it's possible to deploy more DAS in more locations in a timely, space-efficient, and cost-effective manner. ■

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He is responsible for strategic direction of CommScope's in-building wireless solutions, and works closely with mobile network operators, neutral hosts, and enterprises, to define communication solutions that meet the business and technical needs of all stakeholders. He has more than 20 years of experience in system engineering, operation, research and development, and product management. Ahmed holds an BSEE from Alexandria University School of Engineering, and MSEE and PhD from Southern Methodist University (SMU). For more information, please visit https://www.commscope.com/.

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THE KNOW HOW NETWORK BY MICHELLE LABROSSE

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By Sonnhalter
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By Kent J. Wessinger, PhD
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In-Depth Analysis of 2020's Best & Worst Metro Areas for STEM Professionals
By Adam McCann
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