

BEYOND THE HYPE

5G

- **Impact on Carrier Networks**
- **Strategies for Success**
- **Implications for Industry Competition**
- **How to Maximize Investments**
- **More . . .**



Connect the Dots to 5G

Get From Here to There One Step at a Time

Getting your network ready for 5G can seem like an impossible task, full of insurmountable obstacles. But it doesn't have to be.

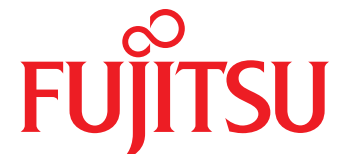
Fujitsu helps you understand your network's needs and see the way forward, one step at a time, from the big picture to the tiny details. We offer a comprehensive portfolio of hardware, software and services, as well as our extensive experience transforming multivendor networks.

Find out how our innovative solutions can shape your network:

- Network migration
- Network modernization
- 5G RAN evolution
- Open networks

Talk to your Walker representative about connecting the dots to 5G.

shaping tomorrow with you



Fujitsu Network Communications • 2801 Telecom Parkway, Richardson, TX 75082 • us.fujitsu.com/telecom

© Copyright 2019 Fujitsu Network Communications, Inc. FUJITSU (and design)® and "shaping tomorrow with you" are trademarks of Fujitsu Limited in the United States and other countries. All Rights Reserved.

IN THIS ISSUE . . .

FEATURE ARTICLES

- 4 5G - Driving the Right Conversations
By Alan Fitzpatrick, Open Broadband, LLC
- 10 NFV, Edge Cloud and 5G
By Prayson Pate, ADVA Optical Networking
- 13 The Road to 5G is Paved with Fiber
By Lisa R. Youngers, Fiber Broadband Association
- 16 5G: Opportunity, Threat or Hype?
Sean Buckley, Broadband Communities
- 20 Fact: No Competition, No 5G
By Chip Pickering, INCOMPAS
- 23 5G Is Coming . . . But Where?
By Shirley Bloomfield, NTCA
- 26 Making Way for 5G
By Derrill Holly, NRECA
- 34 Will Utilities Run to 5G?
By Bob Lockhart, UTC
- 39 Leaders - Need It To Be A Big Year?
By Brenda Abdilla, Management Momentum

RESOURCE ARTICLES

- 6 5 Key Ingredients for a Successful 5G Roll-out
By Daniele Loffreda, Ciena
- 9 Fast Forward to the Future With 5G Networks
By Morgan Kurk, CommScope
- 15 5G Network Building - Not A Skinny Task
By Dr. Olufemi Adeyemi, Fujitsu
- 19 Coming Soon: 5G Networks
By Juniper Networks
- 27 One Touch Make Ready
By Deborah L. O'Mara
- 29 Connectivity for the 5G RAN
By Dr. Michael Ritter, ADVA Optical Networking
- 30 The Impact of 5G
By John Dulin, Corning
- 33 Fulfilling the Promise of 5G
By David Inglett, Ixia
- 37 5G and Next Generation Broadband: A Symbiotic Relationship
By Michael Sumitra, ADTRAN

WALKER NEWS

- 7 Fiber Solutions for FTTx Deployment
- 41 Celebrating Sales & Marketing Excellence
- 42 In the Spotlight
- 46 Upcoming Events

Letters to the editor may be sent to SWEditor@walkerfirst.com

*Skinny Wire is a bi-annual publication of Walker and Associates, Inc.
"Equal Opportunity/Affirmative Action Employer m/f/d/v"*

Editor's Letter

I recall that nearly as quickly as LTE emerged the industry was already abuzz about 5G. Its promises are finally materializing, and the marketing blitz to consumers is well underway. During the final quarter of 2018, ads promoting 5G networks were prolific among mobile service providers. Whether 5G services are available nationwide, however, is certainly debatable.

What the general public doesn't know about 5G from those ads, is that it holds the key to what many are now preaching as the fourth industrial revolution. Its potential impact, per some experts, stands to rival earlier revolutions brought on by steam power, electricity and even the computer itself. With such dramatic impact, it is only right to conclude that 5G is about more than better streaming of the latest cat videos, or improved voice quality on mobile devices. And if the impact is truly that significant, it stands to reason that the impact of 5G on the ICT industry, carrier networks specifically, is even more dramatic.

Contributors to this issue remind us of what is at stake. It's about managing more data - LOTS more data. As the IoT industry finally matures in coming years, it is projected that the number of connected devices worldwide will surpass 75 billion by 2025. The impact on backhaul, fronthaul - what some are now referring to as "anyhaul" - is significant. As you would expect, the repeated message from our contributors is the importance of infrastructure. Fiber networks are critical for 5G success.

Another theme emerged while reviewing content and conducting research for this issue, which is the importance of innovation through competition and partnership. As areas in the US wrestle with getting access to Internet service that barely meets the federal definition of broadband (minimum of 25 Mbps download and 3 Mbps upload - *really?*), others enjoy access to download speeds in excess of 200Mbps. That's a huge disparity with plenty of potential for the ICT industry to fill. It is easy to imagine that legislation is having a tough time keeping up with technology in ways that allow for competition to truly flourish. As utilities, electric cooperatives, rural service providers, municipalities and others can attest, their communities are ripe for competitive broadband services.

Networks ready for 5G have distinct qualities, As Dr. Adeyemi notes in his article on page 15, "network technologies like virtualized RAN, network slicing and smart x-haul transport will be critical." The flexibility of these technologies, as well as their reliability in improved latency, is critical with emergence of automated vehicles, remote surgery, and AI advances. You simply can't afford a "buffering" message when your self-driving car needs to change lanes, or when your surgeon is in the middle of a procedure. Network synchronization takes on an entirely new priority when considering 5G applications.

And, with the advent of 5G, perhaps virtualization is finally coming into its own. It is easy to imagine that network upgrades can no longer be dependent on truck rolls and physical equipment installs. 5G's flexibility and agility are simply too nimble to rely on traditional modes of network modernization. As Prayson Pate notes in his article on page 10, "Concepts like virtualization and network slicing are baked into the 5G architecture."

Our hope is that you will read and share this issue as you consider strategies for making your network 5G ready. How are you prepared to manage the additional data? What do you need to know about network automation? Is your network prepared to counter security attacks? Is your fiber network 5G ready? Ready or not, 5G is here!

Randy Turner

Editor, Skinny Wire
Director, Marketing Communications
Walker and Associates
336-731-5246
randy.turner@walkerfirst.com
SWEditor@walkerfirst.com



Opinions expressed by contributors and commentators do not necessarily reflect the views of Walker and Associates, Inc.

5G - Driving the Right Conversations

By Alan Fitzpatrick
CEO
Open Broadband, LLC

I personally find the hype of 5th Generation cellular service a bit annoying. The 5G term is a marketing one that can mean just about anything you want (see AT&T's announcement at the end of 2018 as an example). The speeds and wireless spectrum being used in the planned 5G rollouts are already in use today in advanced fixed-wireless implementation. Despite these annoyances, I still value the hype about 5G. Why? Because it is driving the right conversations.

Faster Speeds

When Google Fiber entered the Kansas City market it was a game-changer. They made "gigabit" part of the conversation and they established a definition for high-speed internet. Arguably there were other providers already doing this (hello Wilson NC and Salisbury NC), but having the Google brand behind gigabit forced a competitive reaction from the other ISPs. Not only did AT&T and Spectrum step up with their own gigabit offerings, smaller ISPs in the Carolinas like North State Communications, Comporium, and my company Open Broadband offer it as well. Consumers won.

It wasn't that long ago when carriers were arguing about the FCC's 25 Mbps by 3 Mbps definition of broadband, and trying to get away with calling 10 Mbps service "broadband". With the speeds of the 5th Generation cellular networks, this low benchmark becomes as absurd as someone saying DSL is fast internet. This is a positive change to the conversation; faster internet is needed and expectations need to be raised.

Urban vs Rural Access

Much has been written about the gap between our urban and rural areas when it comes to having high-speed access. This gap is magnified when the urban areas get even faster speeds with 5G while rural areas continue to struggle for better internet service. 5G requires dense network deployment and ready access to fiber. This is not as likely to be found in rural areas. Left to profit-maximizing strategies, the large cell companies will go to the rural areas last, if at all.



The threat of being left behind on the digital highway already is a topic of conversation in many of the rural counties I've visited in the Carolinas. Amazingly enough, one can live 15 minutes outside of Chapel Hill, home of one of the nation's foremost universities, and only have access to 3 Mb DSL. Even if you are a Duke fan you'd realize that's just not right (besides, the same issue exists in north Durham County).

Counties and towns are taking action. We see RFPs and RFIs from areas across North Carolina where residents are not going to accept being left behind. The state of North Carolina is doing something about it by placing \$10M in a grant program for broadband in underserved areas. The problem of high-speed internet access is well recognized by our political leaders, and 5G will increase the level of conversation and positive action.

The Power of Wireless

We see a change in which technology is hyped every couple of years. We've seen mobility, data centers, cloud computing,

fiber to the building, and now 5G each take their turn as the end-all, be-all for advancement. My personal take is all of these technologies are valuable and useful in the right situation. Having a hammer doesn't mean every problem requires a nail. It just might need a Phillips tip screw, or a flat head screw, or glue. Everything isn't fiber - wireless has its place.

The conversation about 5G points out the advancement of wireless technology. If you strip away the marketing terminology and look at the radio frequencies, one can see that the 60 - 80 GHz frequencies deliver gigabit speeds today. Companies like Siklu and IgniteNet offer fixed-wireless systems delivering gigabit speeds using the same 60mm wave spectrum touted by 5G. These are in production today and used by Wireless ISPs across the county. We offer symmetrical gigabit wireless at Open Broadband. It has limits on distance and line-of-sight, but being able to show wireless operating with better performance than cable is pretty impressive. 5G is advancing the



“It wasn’t that long ago when carriers were arguing about the FCC’s 25 Mbps by 3 Mbps definition of broadband, and trying to get away with calling 10 Mbps service ‘broadband’.”

conversation that wireless can be an ideal high-speed internet solution in the right situation.

Town and County Partnerships

The FCC seems to be doing everything possible to help large cellular companies advance their 5G networks. This includes things like setting maximum fees a town can charge for pole attachments, and simplifying deployment processes so the cell companies can do as they please. Will this help speed up 5G deployment in

urban areas? You bet. Is it the right thing for the town? The answer depends on who you ask.

One positive development is that the infrastructure deployment of 5G is advancing the conversation on how ISPs and government entities work together. One way is through the regulatory process and lobbyists influencing the FCC to see things their way and mandate things from a top-down approach. Another way is for ISP and towns/counties to work together in public-private partnerships, determining the needs of the community, and how the ISP can help solve the high-speed internet access problem. Positive conversations between ISPs and towns/counties can yield positive results for all parties.

Setting a Winning Expectation

Slow internet is just not acceptable to anyone. We need a competitive spirit among the ISPs to increase speeds

across the board. It’s been fun to read the competitive banter about AT&T’s “5G” announcement at the end of 2018, and the other carriers jockeying for position for their network rollouts. I personally liked seeing AT&T’s announcement. For me it’s not whether it is “real” or not, it’s the fact that every major tech publication was talking about faster internet. Faster internet access means entrepreneurs and innovators will be freed up to develop the next generation of applications. When the conversation shifts to high-speed internet being the expectation, we all win.

5G adds a new element to the conversation – once you have ultra high-speed internet, what do you do with it? What are the benefits? All the promised capabilities of telehealth, online education, and Ag Tech are in our grasp. IoT information can be collected in real-time, processed in a Blockchain ledger, and accessed from anywhere. Artificial Intelligence processes information to give us exactly what we want, when we want it. It’s the benefits from technology that are key, not marketing hype or terminology. The conversation is going in the right direction, let’s take advantage of it.



About the Author:

Alan Fitzpatrick is the CEO of Open Broadband, an ISP providing broadband internet service to underserved communities. Prior to Open Broadband, Alan had 20-years management experience in the Telecommunications and Software industries, including COO of DC74 Data Centers, COO of VoIP Services at ACN Inc., Sr. VP of Engineering for US LEC Corp, and founder and CEO of two software companies.

Alan is a promoter of a gigabit internet infrastructure in North Carolina, and co-founded Charlotte Hearts Gigabit, widely credited with attracting Google Fiber to Charlotte. He later joined as a co-founder of NC Hearts Gigabit. Alan is also an Adjunct Professor and enjoys teaching entrepreneurship and technology courses for Central Michigan University and Johnson and Wales University.

Alan has an MBA from Vanderbilt University and a B.S. in Industrial Engineering from Purdue University.

Five Key Ingredients for a Successful 5G Roll-out

By Daniele Loffreda
Senior Advisor, Market Development,
State/Local Government and Education (SLED)
Ciena

We've seen a lot of hype over the past few years about how 5G will replace all previous generations of wireless technology. The reality is that 5G will likely coexist alongside 4G, and probably even 3G and 2G in some locations.

Ask any user about how their smart phone connects to the network. They will likely only talk about the cellular or wireless technology. In fact, 5G Radio Access Network (RAN) only makes up a small portion of the total path data must travel to provide connectivity.

If 5G RAN is to achieve its promised speeds and capacity performance leaps, the rest of the network—the wireline network—must also adjust proportionately to accommodate these changes. In an interview for a Forbes article, AT&T CEO Randall Stephenson put it quite eloquently:

"The more wireless we become, the more fixed-line dependent we become. Meaning, as data requirements on these mobile networks grow, you have to get a denser and denser and denser cell site grid. Denser, denser, denser means more cell sites. All of those cell sites connected by fiber and Ethernet. Basically, all you're doing is building this big massive fixed-line network with wireless antennas hanging on the end of it."

Most migrations will likely entail installing 5G New Radios (NRs) in sites already housing 2G, 3G, and 4G radios and antennas. This means the wireline network needs to support multiple generations of wireless technologies. To accomplish this, operators should focus on five key ingredients to their wireline network upgrades:

01 FRONTHAUL – This connects multiple Remote Radio Heads (RRHs) to Centralized Baseband Units (BBUs), where the baseband processing takes place.

BBU processing signals are traditionally located at the base of macro cell towers, connected to the radio heads at the

top by copper cables. Fiber should replace copper connections because fiber is lighter and more power-efficient, secure, and resilient to the elements.

Fiber also supports far longer distances and much higher transmission rates. This enables operators to centralize multiple geographically separated baseband units from diverse towers into a single physical location.

Centralization unlocks multiple benefits for service providers:

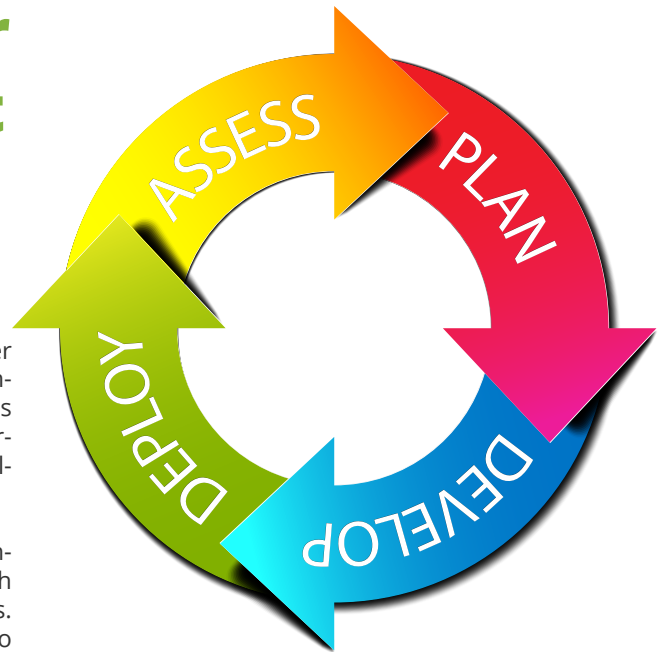
- Intelligent traffic coordination between multiple remote radios
- A single secure site to manage
- Access to web-scale benefits from centralizing the processing functions

02 SCALABILITY – 5G promises to make available to the end-user a massive amount of bandwidth. On the RAN side, a 20MHz 5G MIMO antenna array can generate upwards of 64 Gb/s of data, an exponential increase in fronthaul traffic. This data flood will need to be aggregated and placed on wireline networks.

For backhaul, a 5G specifications model can assume that 75 percent of users/sites will get 500 Mb/s, 20 percent at 1 Gb/s, and 5 percent at 10 Gb/s. This creates an order of magnitude increase in backhaul traffic to be aggregated and delivered to the wireline network.

The fronthaul and backhaul bandwidth increases will be passed along to the metro, regional, and long-haul networks all the way back to the data centers. The requisite ingredient for this is fiber, and lots of it.

03 DENSIFICATION – Today's 4G macro cells are in big towers that typically serve a 20-30 km radius. The faster 5G speeds, which traverse the higher parts of the wireless fre-



quency spectrum, require smaller cells that are closer to the end-users. These should include 'user-deployed' indoor cells—known as femto, micro, and pico cells—as well as operator-deployed small cells.

The capacity of these small cells is such that each will require a fiber-based connection. There'll be some radio-based backhaul in cases where the network operator cannot get right of way or it is simply impractical. But fiber is always the preferred option due to its inherent security, capacity, and ability to scale.

04 VIRTUALIZATION – Virtualization allows operators to move from custom networking appliances to virtual applications run over x86 server clusters. These clusters can be moved around the mobile network, depending on the type of application required.

For example, enhanced mobile broadband could have a cloud-evolved packet core at a metro hub site, cloud RAN at an aggregation site, and numerous sites with IP/optical back to the access point, which then feeds into the data center.

For ultra reliability and low latency, however, network operators could move network functions closer to the radios. A shorter path to process the data over less network equipment produces lower latency and higher reliability. This combination opens a whole new range of possible use cases.

05 NETWORK SLICING – Many of the use cases for 5G will use the network in very different ways.

“If 5G RAN is to achieve its promised speeds and capacity performance leaps, the rest of the network—the wireline network—must also adjust proportionately to accommodate these changes.”

For example:

- Streaming very high-definition video over mobile broadband
- Telemedicine applications connecting to a mobile network using WiFi
- IoT devices with low capacity and periodic access

Each application will require distinct and guaranteed Service Level Agreements (SLAs), and each will need to be orchestrated from end to end. Providing different network attributes to different applications requires network operators to perform what’s known as network slicing. There are different approaches to network slicing on the wireline infrastructure.

- Hard slicing – A specific network instance (such as wavelength, Optical Transport Network [OTN], or FlexE channel) is dedicated to a specific application or customer. For example, a network operator may dedicate an OTN channel to a fire department, so it can be guaranteed the same performance, availability,

and reliability it has from a private cellular network.

- Soft slicing – This uses technologies such as segment routing, Ethernet VPN, and IP VPNs, combined with stat muxing technologies to share resources. Some resource contention is expected with this approach, but it is ideal for less-demanding applications and would be less expensive than hard slicing.
- Flex slicing – This combines hard and soft slicing by sharing dedicated resources among users, including hard-sliced network segments, provided SLA guarantees are maintained.

The migration to 5G will be a multi-year journey fraught with challenges and opportunities. Legacy static, atomistic networks will give way to an adaptive network that leverages automation and analytics while being built upon a highly programmable infrastructure.

¹ “AT&T’s Big Call: Randall Stephenson on the iPhone, His Wireless Ambitions And The Next Big Thing, Forbes, Jan 2, 2013



Daniele Loffreda is Senior Industry Advisor, State/Local Government, Education and Healthcare market development. In this role he leads Ciena’s initiatives to apply hardware, software and services technologies to help these sectors ensure that their networks have the capacity to support their digital transformation, optimize their cloud strategies, consolidate infrastructure and improve data security.

Daniele has more than 20 years of experience helping the public sector leverage Information, Communications and Technology solutions provide greater value to their constituents, improve their operations and generate higher returns on public funds.

Fiber Solutions for FTTx Deployment

By Randy Turner
Director, Marketing Communications
Walker and Associates

To better support new fiber cable stocking initiatives, Walker and Associates maintains a fiber cable yard at its Winston-Salem, NC Distribution Center. This resource, dedicated to stocking large fiber reels, enables Walker to support customer fiber cable demands. In addition to stocking the cable, Walker’s investment in equipment to cut cable to customer specified orders provides expanded opportunities to meet the growing demand for fiber cable.

Walker currently stocks bulk cable from manufacturers such as CommScope and Corning, in addition to the fiber equipment necessary for FTTx projects, central office redesigns and more. Walker provides a single source for customer needs, offering products as well as a range of services. Through their engineering staff, Walker assists customers with network design. Their expansive range of logistics services provides customers with worry-free supply chain management. Additional services

include managed services such as monitoring, remote support, Network Operations Center (NOC) services, Security Operations Center (SOC) services, and more.

Fiber cutting, re-spooling and maintaining and inventory of bulk fiber cable has positioned Walker to support customer needs in even greater capacities. Walker is uniquely poised to provide not only fiber cable, but also the associated equipment and services that matter to anyone involved in designing, building and maintaining networks.

As operators upgrade and modernize their networks to keep pace with growing demands from new technologies such as 5G, partnerships with trusted professionals is essential. Now in its 49th year, Walker remains the partner of choice for network professionals. When more than distribution matters, contact Walker and Associates.

FIBER ACCESS
IS CRITICAL TO

5G

The 5G evolution is well underway, with enormous implications for the broadband industry and society as a whole. 5G promises a wide range of new services, from its support of Internet of Things to enhanced broadband and mission critical applications. In this new world of 5G densification, the macrocell environment will increase by 100x or more, millions of microcells will be required, and fiber will be key to enabling it all.

adtran.com/5G

ADTRAN[®]

Fast Forward to the Future with 5G Networks

By Morgan Kurk
Executive Vice President/Chief Operating Officer
CommScope



With a lot of fanfare, excitement and speculation, 5G is slowly making the transition from general idea to network implementation. Network operators are already scheduling 5G network trials and test beds to sort out how the 5G vision will be realized. 5G networks promise to support new services, more video, and cloud connectivity. There are three main case uses driving the 5G revolution:

- 1. Enhanced mobile broadband.** With the promise of 10 Gbps connectivity and latency of less than five milliseconds, it's no surprise the ongoing surge in demand for mobile connectivity will accelerate dramatically. The industry estimates this increased speed will result in a 10- to 100-fold increase in the number of 5G-connected devices over the number of 4G devices.
- 2. The Internet of Things (IoT).** Thanks to 5G's virtualized, radio technology-agnostic core, published predictions estimate as many as 20 billion IoT connections by 2020—connections that will drive smart buildings and smart cities. CommScope anticipates 5G will offer 1,000 times the bandwidth of 4G, and up to five times the density, making room for all those "things" on the network.
- 3. High-reliability,** low-latency networks. Beyond just doing what 4G does better and faster, 5G speeds open new doors to allow driverless cars to coordinate over the network, enable augmented reality and virtual reality, and expand the horizons of remote surgery and other applications that can fulfill their promise only on a network with such ultra-low latency times as 5G's five-millisecond threshold.

With these case uses in mind as the template for a real-world 5G rollout, it makes sense to also consider what can be done to make these applications possible. For operators, that plan boils down to three key strategies.

The first of these is densification, or the practice of increasing capacity in a given area through more antennas, small cell sites or other measures. Upgrading to MIMO and sector-splitting technologies also falls under this strategy. The second is virtualization, shifting the work of physical equipment to virtualized environments operating in centralized data centers. This strategy's inherent efficiency can reduce costs by as much as 70 percent. The third strategy is optimization of existing assets and processes, including—but not limited to—repurposing earlier-generation wireless and TV spectrum and moving computing resources closer to the edge. Throughout the converged network, efficiency will be a critical design requirement for all aspects of 5G.

Getting ready for 5G is as important as knowing how it will be used. CommScope has made an extensive study of the pre-5G and coming 5G landscape, and we are excited to share what we know. To participate in a 5G workshop, learn more about CommScope's solutions, request a quote or begin a new partnership, visit commscope.com or contact us anytime. Powered by experience and focused on progress, CommScope can't wait to help you unlock the power and potential of 5G networks.

Learn more at www.commscope.com/5g or click here is viewing PDF version.

“Throughout the converged network, efficiency will be a critical design requirement for all aspects of 5G.”

NFV, Edge Cloud and 5G

By Prayson Pate
CTO, Ensemble Division
ADVA Optical Networking

5G is a constant in the tech news, and now operators are touting the technology in their wireless networks. But 5G is not just a new radio technology. 5G brings an entirely new way of building networks and providing ubiquitous high-speed applications. That means change ahead for service providers.

For end users, the biggest impact of 5G will be wider availability of high-speed access, including fixed wireless access. In addition, new applications like augmented reality (AR), virtual reality (VR), location-based services and internet of things (IoT) will drive demand for 5G. But will they drive revenue for service providers – and more importantly, profits? Paying for innovation

Successful 5G rollouts will require many more access points than 4G, and each will require higher speed connections back into the network. In particular, bandwidth for video is growing quickly. Ericsson reports that mobile video traffic is forecast to grow by around 50% annually through 2023, accounting for 75% of all mobile data traffic. That's a lot of cat videos. In addition, Cisco reports that mobile business internet traffic is projected to increase at a compound annual growth rate of 41% through 2021. All that data will require a lot of new equipment and fiber, and it all has to be paid for.

At the same time, end users have come to expect continuing reductions in what they pay for services. The clash between cost and revenue has already gotten to the point that CIMI Corporation said 2017 was the first year when the cost-per-bit surpassed revenue-per-bit for many operators.

Supporting these 5G applications profitably means reducing costs, increasing flexibility and sharing resources. Service providers must leave behind today's closed, static and single-purpose wireless infrastructure. Network functions virtualization (NFV) and edge cloud are essential tools for building the network for 5G.

NFV: Bringing the power of the cloud to telcos

Service providers created NFV because they saw the power and benefits of cloud technologies, and wanted to apply them

“Ericsson reports that mobile video traffic is forecast to grow by around 50% annually through 2023, accounting for 75% of all mobile data traffic. That's a lot of cat videos.”

to the telco network. Specifically, with cloudification they wanted:

- Open, multivendor implementations of network functions such as routers and firewalls
- Replacement of closed single-vendor appliances with low-cost standard servers
- The ability to share resources and scale applications as needed
- New commercial models such as usage-based and success-based payments
- The ability to move quickly to deliver new services and respond to customer requirements using new development methods like agile and DevOps
- A framework for giving end users dynamic control over their services

With NFV, service providers can reach those goals. They can replace stacks of network appliances with a single server hosting software functions delivered from the cloud, as shown in the illustration below.

And, because with NFV they are using cloud-centric technologies, they can go even further and offer their customers services like micro-clouds and office-in-a-box solutions using the same infrastructure.

Why NFV for 5G?

5G is being designed from the ground up to use the latest technologies – and not just on the wireless side. Concepts like virtualization and network slicing are baked into the 5G architecture.

With virtualization, networking functions like evolved packet core (EPC), IP multimedia subsystem (IMS), and virtual radio access networks (vRAN) are being built as portable, scalable software packages. Network slicing means being able to allow applications such as emergency networks to have a dedicated portion of share infrastructure.

Where does edge cloud come in?

Both virtualization and network slicing



have a clear need for an NFV base. On the other hand, IoT, AR and VR drive the need for a distributed and shared edge cloud infrastructure. So how do we bring these together?

My view is that edge cloud and NFV are two sides of the same coin. NFV is about using generic compute infrastructure to provide networking services, while edge cloud is about using the same resources to meet the needs of new services like IoT, AR, and VR. But what are those needs?

- Low latency for proper functioning of applications like AR and VR
- Local processing to reduce the amount of data that must be back-hauled to the central cloud
- Location-based services require local processing to maximize the precision and value of services
- Efficient IoT implementations require local gateways for buffering chatty protocols and mediating intermittent connections

With edge cloud deployments, service providers can meet these requirements and position themselves to maximize the return on their network investments.

Recommendations: It's all about the cloud ... and partners

5G will require significant investments in new towers, micro-cells and fiber – but that's just the start. Successful and profitable implementations of 5G will require an innovative approach to network infrastructure. That means applying the lessons of the cloud to the telco: using standard compute servers throughout the network, layering on NFV for services, and treating the infrastructure as an edge extension of today's cloud. In addition, security must be designed in at all layers, not added on. Finally, telcos will need to flatten their silos and work cross-functionally to get all the benefits of cloudification.

For most operators, that means ramping up the cloud skills of their teams. It also means establishing relationships with pure-play cloud providers to enable delivery of bundled cloud and connect services. Many telcos will also need to partner with forward-looking suppliers as well as working with sophisticated distributors such as Walker and Associates, who can provide valuable integration and fulfillment services optimized for cloud-centric operators.

By taking those steps, service providers can maximize the flexibility, revenues and profitability of their 5G rollouts.



Prayson Pate is ADVA Optical Networking's chief technology officer for the Ensemble division and is an evangelist for network functions virtualization (NFV). He speaks at industry events and writes posts

and articles to inform, educate and entertain, mostly about NFV with plenty of innovation for good measure. These include The Real CTOs of NFV series.

Prayson received a master's degree in electrical and computer engineering from North Carolina State University and a bachelor's degree in electrical engineering from Duke University. Prayson has contributed to standards bodies such as the MEF and IETF. He is a named inventor on nine patents.

3G/4G/5G Generational Standards

3GPP

The group responsible for developing international cellular standards. Short for 3rd Generation Partnership Project, this group has worked to harmonize 3G, 4G, and 5G specifications for the past two decades.

3G

Third-generation cellular communications technologies, which were used in most mobile phones sold from 2007 through 2011-2012, unifying most (but not all) countries' phones under a global standard.

4G LTE

Fourth-generation cellular communications technologies, used in most phones sold from 2011-2012 through 2018. The 4G "Long-Term Evolution" (LTE) standard noticeably boosted data speeds over 3G, and became significantly faster over time.

5G / 5G NR

Fifth-generation cellular communications, the late 2018/early 2019 follow-up to 4G. The 5G standard uses "New Radio" (NR) as a suffix, distinguishing this generation from 4G LTE.

5G TF

A pre-standard version of 5G developed by Verizon so that it could debut an early next-generation network. In October 2018, Verizon launched this version of 5G in four U.S. cities, but has said it will replace 5G TF devices with standards-compliant 5G NR hardware in late 2018 and early 2019.

Release 15

Also known as 3GPP's Release 15, this refers to the initially finalized version of the global 5G standard. 3GPP continues to hold meetings to advance its standards; there were seven separate 4G releases that evolved LTE to "LTE-Advanced Pro" before the launch of 5G.



CORNING

Concerned about 5G Densification?

We've Got Connections.

Corning products and solutions will enable 5G networks that offer:



Ultra-reliability and low latency



Enhanced mobile broadband



Massive IoT



The Road to 5G is Paved With Fiber

By Lisa R. Youngers
President and CEO
Fiber Broadband Association

5G is the next generation of mobile networks that is expected to provide gigabit speeds, sub one-millisecond latency, and the capacity to connect an astonishing 2.5 million devices per square mile. It will enable the connected devices of the future at exceptional scales, but will also place enormous demands on fixed-wireline networks. Making 5G a reality will require not only access to spectrum that enables high throughput service, but also connections to dense, high capacity fiber networks.

5G will use much higher radio frequencies than today's cellular networks do. While these higher frequencies carry larger amounts of data, they also have very short ranges. For 5G to work well, many additional small radios or "cells" must be installed close together—as close as 200 feet apart. To provide multi-gigabit service to many users and applications, these small cells will need to be connected to hundreds of thousands—perhaps millions—of miles of new fiber optic cable. In fact, providing full 5G service to just the top 25 metropolitan areas in the United States will require an estimated 1.4 million miles of fiber cable, according to research by the Fiber Broadband Association. Likewise, Deloitte Consulting recently reported that the United States will require an estimated \$130 billion to \$150 billion in fiber investment over the next five to seven years to adequately support future network technologies such as 5G.

It is also important to note that 5G will not replace fiber connections to buildings. Even with very large investments in fronthaul and backhaul network capacity and small cells, bandwidth demand will continue to outstrip supply, as it has done in the past. Home network connections, which may need to support multiple 4K and 8K video streams, hundreds of in-home internet-connected things, and multiple AR and VR users, will require much higher bandwidths than can be delivered by 5G under current development standards.

While 5G will not replace fiber to the home, it is the future of wireless technology. Its enormous potential is matched only by the scale of the demands 5G will place on fixed-wireline networks. 5G will depend on densification: a significant number of small cells must be installed close together and be connected by miles of new fiber optic cabling. Fiber infrastructure, with its ability to offer nearly limitless bandwidth between fixed locations, will be the key to unlocking 5G's potential. Policymakers can help put the required fiber infrastructure in place by making it easier for fiber providers to get much-needed public and private rights of way—poles, ducts, and conduits—and to access commercial and residential buildings. Ultimately, the road to 5G is paved with fiber; if we want to start transitioning towards 5G, we have to be able to lay down the fiber necessary to get there.

The Fiber Broadband Association estimates that 1,390,816 MILES OF FIBER CABLE would be required to provide full 5G service to just the TOP 25 metropolitan land areas in the United States, assuming all of those 5G cells were served by fiber connections.

The most demanding 5G applications will require fiber to each small cell, but the exact fiber cable requirements for each deployment will differ based on local geography and expected demand.

While 5G WILL TRANSFORM MOBILE CONNECTIVITY, it is not an easy replacement for wired connections to homes and businesses because common building materials substantially block high-frequency 5G signals.

Using 5G technologies to reach building interiors can be achieved using antennas on the outside of the building and a wire to carry the signal inside the building, incurring additional costs and energy usage. Direct fiber connections will always be superior, except where fiber installation is not feasible.

Download the full FBA whitepaper "The Road To 5G Is Paved With Fiber" at <https://www.fiberbroadband.org/p/do/sd/topic=121&sid=2356>



Connectivity for the 5G RAN

Staying ahead of change at the edge

www.advaoptical.com



5G Network Building – Not a Skinny Task

By Dr. Olufemi Adeyemi
Chief Solutions Architect, Wireless
Fujitsu Networks Communications, Inc.

5G will revolutionize economies and societies through hyper-connectivity, enabling innovations in the automotive, manufacturing, energy, utilities and healthcare sectors, among others. However, designing and deploying a 5G network presents a variety of complex issues for service providers to address. In addition to having to 'overlay' 5G onto a 4G network, service providers must ensure the network can support many different use cases, each with different technical requirements, under one larger network.

The main 5G use cases are Massive Machine Type Communications (mMTC); Enhanced Mobile Broadband (eMBB) and Ultra-Reliable and Low Latency Communications (URLLC). mMTC involves automated wireless connectivity to tens of billions of machine type terminals, each requiring long battery life but without low latency needs. eMBB enables applications requiring high data rates and moderate latency across a wide coverage area. URLLC includes applications like autonomous driving, characterized by low data rates, low latencies and very high mobility.

The new 5G networks will need greater scalability, reliability and performance — from the first mile through the last, and to the edge — in order to meet the varying speed, latency and density requirements of these diverse and demanding use cases. Consequently, network technologies like virtualized RAN, network slicing and smart x-haul transport will be critical.

Evolution to Virtualized RAN, Network Slicing and Smart x-Haul Transport

Next-generation networks will require denser RAN architectures with distributed intelligence, virtualization, networking slicing and smart x-haul transport. This higher densification means more advanced topologies will be deployed in the access part of the transport network, such as mesh or ring configurations, as well as evolved fronthaul and backhaul interfaces. In addition to connecting physical radio sites, tomorrow's mobile networks need to support virtual network overlays in order to enable network slicing and connect subscribers to cloud-based applications.

Unlike any other technologies in radio access network history, 5G deployment success will be measured by how well the industry embraces network virtualization, network slicing and x-haul transport.

Network virtualization will enable service providers to dynamically support a range of use cases with varying demands using SDN control and orchestration. Moreover, by running the baseband units (BBUs) as virtualized network functions (VNFs) on open hardware platforms and interfaces, service providers can be free of vendor constraints and lock-in, helping to keep both OpEx and Capex costs in check. Therefore, a key benefit of this new ecosystem is the opportunity to disaggregate the entire RAN network end-to-end.

Network Slicing, which allows multiple logical networks to run on top of

a shared physical network infrastructure, will potentially be most relevant in 5G. In addition to connecting physical radio sites, tomorrow's mobile networks must support virtual network overlays in order to enable network slicing of the access, transport and core functionality. Imagine a scenario where a single mobile operator network is able to support public safety emergency services, IoT massive connectivity, industry machine-to-machine communications, autonomous driverless vehicles and mission critical use cases. This is only possible when these applications are running as dedicated end-to-end virtual slices of a larger network but each meeting their own unique latency, bandwidth, throughput and security requirements.

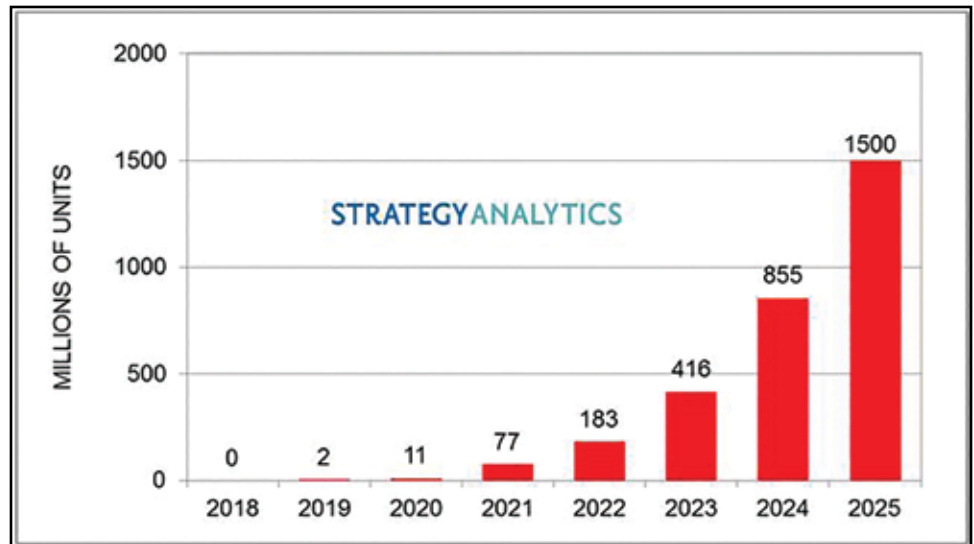
Finally, smart x-haul (programmable fronthaul, midhaul and backhaul architectures) will be key to delivering faster end-to-end network services, while simplifying the mobile operator's network for future expansion. In this way, the 5G network can adaptively handle multiple open radio interfaces, network latencies and virtual infrastructures to support a plethora of devices and applications, delivering the full 5G experience.

Smart, disaggregated transport solutions will also allow service providers to quickly realize returns on their 5G investments with use cases they can monetize immediately, and fuel growth well into the future. Contact Fujitsu to discuss how we can help you deliver on the promise of 5G.

5G: Opportunity, Threat or Hype?

Each of the major wireless companies has its own take on 5G.

By Sean Buckley
Associate Editor
Broadband Communities



Promising theoretical speeds of up to 1 Gbps, wireless operators will move forward with 5G deployments using millimeter-wave and other spectrum bands in 2019.

Wireless operators will garner the majority of 5G revenues from business customers, followed by consumers, online apps and government agencies. Wireless industry association GSMA forecasts that 4G connections will continue to be viable through 2025.

Still, the potential for 5G remains great. A recent Strategy Analytics study forecast global 5G smartphone shipments to grow from 2 million units in 2019 to 1.5 billion in 2025.

Unsurprisingly, no two of the top operators are looking at 5G the same way. Having laid a mobile 5G play foundation, AT&T plans to reach at least 19 cities in early 2019. It built its 5G network foundation with 5G Evolution (which is not, strictly speaking, 5G) and Long-Term Evolution-Licensed Assisted Access (LTE-LAA).

"It is a mobile-centric offering, and I'm a huge believer in mobility. Will there be fixed-line substitute applications here? Absolutely," Randall Stephenson, CEO and chairman of AT&T, said during the UBS 46th Annual Global Media & Communication Conference. "I do think the path Verizon is pursuing [with fixed mobile] is going to be a really good service. That's not our priority."

Meanwhile, Verizon advocates a mobile

and in-home broadband approach as a wireless competitor to cable outside its wireline markets.

Verizon deployed 5G in four markets using its 5G Technical Forum (5GTF) proprietary technology, with plans to expand deployments in 2019. It plans to migrate to a full commercial launch on the emerging 5G New Radio (NR) standard technology. New 5G Home customers will pay \$70 a month, and existing customers will pay \$50 a month.

Ronan Dunne, EVP of Verizon and president of Verizon Wireless, told investors during the Citi 2019 Global TMT West Conference that its 4G buildout method enables an easier 5G path.

"The way we look at network strategies, we look at spectrum, we look at densification and we look at features," Dunne said. "What that's allowed us to do is build ahead over the last few years in a way that allows us an easier and faster migration to 5G. The first part of [the] initial commercial launch of our 5G residential."

Sprint will start its mobile 5G rollout later this year, initially targeting nine major cities. The service will run over its 2.5 GHz spectrum and use massive MIMO antenna technology.

AT&T's 5GE Controversy

For all 5G's promise, AT&T's claims that they already offer the service caused a stir in the wireless industry. AT&T faced criticism after it implemented a soft-

ware update on its Android phones that changed the 4G logo to a 5GE logo, claiming its service is now "5G."

Following the emergence of a #fake5G Twitter hashtag, T-Mobile and Verizon also called out AT&T on what they believed to be a deceptive marketing effort.

In a tweet, Neville Ray, CTO of T-Mobile, mocked AT&T with a video on how to upgrade an iPhone to "9G" by placing a sticky note on it.

Likewise, Verizon's CTO Kyle Malady, while not mentioning AT&T specifically, cautioned that players should not confuse consumers about 5G.

"The potential for 5G is awesome, but the potential to over-hype and under-deliver on the 5G promise is a temptation that the wireless industry must resist," Malady said in a prepared statement. "If network providers, equipment manufacturers, handset makers, app developers and others in the wireless ecosystem engage in behavior designed to purposefully confuse consumers, public officials and the investment community about what 5G really is, we risk alienating the very people we want most to join in developing and harnessing this exciting new technology."

Malady added that Verizon "will not call our 4G network a 5G network if customers don't experience a performance or capability upgrade that only 5G can deliver."

Continued on page 17

FCC's 28GHz mmWave 5G Auction Ends, Raising Millions But Leaving Questions

By Jeremy Horwitz

Though the Federal Communications Commission officially closed its doors more than a month ago, due to the U.S. government shutdown, the agency kept enough staff around for a critical 5G development: Auction 101, the sale of 28GHz millimeter wave (mmWave) spectrum licenses covering the United States. After 38 days and 176 rounds of bidding, Auction 101 sold the licenses for just over \$700 million — a decent but not amazing sum for the U.S. Treasury.

Auction 101 was important because mmWave is a crucial technology underlying 5G networks, but until now, very few companies could legally use that spectrum for communications purposes. In one fell swoop, the auction made an entire country's worth of high-bandwidth spectrum available to national, regional, and smaller companies, enabling 5G networks to be built by anyone with enough cash to win licenses.

In a nutshell, mmWave promises super-fast data speeds and unprecedented responsiveness, also known as ultra-low latency, which are set to enable everything from wireless home broadband service to untethered VR/AR headsets, remote surgery, and fully autonomous vehicles. Verizon and AT&T anticipated mmWave's importance years ago, each acquiring obscure companies that held FCC mmWave licenses long before the latest auction. Others had to wait for the auction to stake a claim to spectrum.

While mmWave isn't the only way to

send 5G data, it's the fastest and most responsive. That's the key reason Verizon says its "true 5G" network is focused on mmWave hardware, and it largely explains why AT&T's latest marketing now refers to mmWave as "5G+." As a fallback, carriers with few or no mmWave licenses plan to offer slower and less responsive 5G service over lower radio frequencies, a decision that has recently led to marketing battles (see: AT&T and T-Mobile) over the meanings of "5G" and "5G Evolution."

Buying mmWave spectrum before the auction required an expensive leap of faith. Engineers would somehow need to shrink mmWave hardware from satellite dish-sized enclosures down to pocketable devices. A consortium of companies rallied and got the 5G standard approved early, but the mmWave miniaturization process took so much time and effort that regulators around the world weren't all ready to license millimeter wave spectrum to cellular carriers.

Now virtually any U.S. company can buy a mmWave license. Several of the over 3,000 town/city-sized licenses reportedly sold for as little as \$200, with fewer than 200 licenses raising between \$1 million and \$12.5 million. But a bare bones statement from the FCC has left more questions than answers as to what actually happened. Did any of the major cellular providers purchase additional 28GHz spectrum for 5G? How about cable companies? Any other competitors of possible significance?

As of now, the identities of the winning bidders aren't known to the public, and they won't be revealed until the FCC concludes a second millimeter wave auction, Auction 102, focused on nearby 24GHz spectrum licenses. The start date for Auction 102 hasn't been announced yet — and may well wind up impeded by the shutdown — but it could itself take another month or more to wrap up.

It's fair to say that what happens with 24GHz and 28GHz mmWave spectrum will determine the evolution of 5G services in the United States, as well as the world. The United States is now in an awkward situation in which two carriers have launched early, spotty 5G networks using chunks of millimeter wave spectrum. And multiple carriers have announced vague plans to expand their 5G footprints using mixes of mmWave and non-mmWave hardware. Whether any carrier has a super-fast nationwide network powered by tons of mmWave "small cells," or a slower, less responsive network based on older radio technology, depends substantially on the outcome of these auctions.

Auction 101 had the potential to be an international 5G milestone, and history may wind up recording it as such. Unfortunately, we'll have to wait a while to see who won the auction, what happens with Auction 102, and how widespread any carrier can get with mmWave hardware.

Continued from page 16

To be fair, Verizon also came under fire for releasing its in-home 5G service via its 5GTF technology, a move it said allows it to test out the service before the NR standard is ready.

Threat to Wireline?

Will providers that don't have wireless networks see 5G as a threat to their wireline broadband market? Traditional wireline and cable operators will likely leverage 5G for backup circuits for business customers and continue to provide fiber-based backhaul services.

"5G will have an impact on some portion of the consumer business, but again, fiber is very competitive relative to 5G, and therefore our focus is on fiber even for consumers," Neel Dev, CFO of CenturyLink, said during the UBS 46th Annual Global Media & Communication Conference. For the enterprise business, we think it will be net positive, so as some of our wholesale customers roll out 5G networks, hopefully we'll benefit

from that. 5G also has a mechanism for access."

However, Dexter Goei, CEO of Altice USA, which is building out a dual FTTH and DOCSIS 3.1 network, dismisses 5G as a near-term threat.

"By and large, if you look at the material and timetables associated with 5G, it seems like this is something that's far off. I think this is something that will be a slow burn, but we'll be watching," Goei also said during the UBS event. "Outside of the time and capital outlay, the business plan from our standpoint looks shaky when they start launching a product in any breadth."



Sean Buckley is the associate editor of *Broadband Communities*. He can be reached at sean@bbcmag.com.

FORT WORTH

UTC TELECOM & TECHNOLOGY

At the Crossroads of Utility Education & Training

Where our future begins!

JOIN US JUNE 17-21, 2019

The 2019 UTC Telecom & Technology Conference features engaging speakers delivering technical and strategic presentations that will tackle the leading-edge issues of electric, gas and water utility industry. Sessions will focus on key telecom areas of security, policy, IT/OT convergence, analytics and much more. Join us in Fort Worth, Texas for the industry-leading conference for communications infrastructure for utilities!



HOST UTILITY

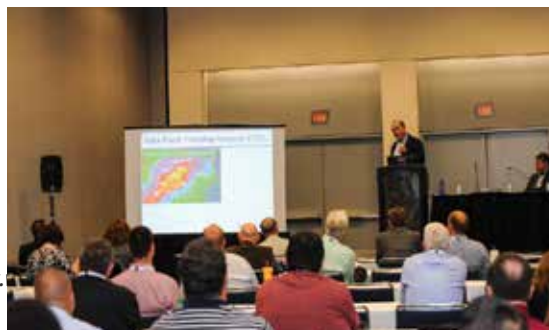
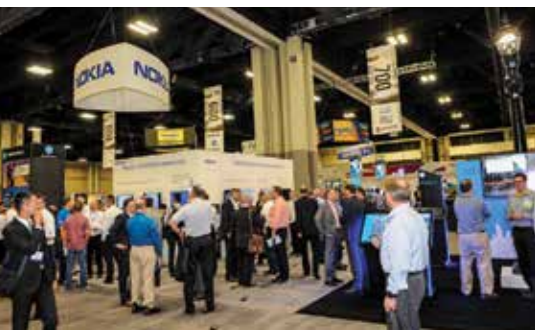


Co-host Utilities for 2019:

AEP Texas
Center Point Energy
Cleco
Lower Colorado River Authority

PREMIER SPONSOR

NOKIA





By Juniper Networks

As 4G mobile networks continue to evolve, industry leaders from around the world are defining the standards for 5G, the fifth generation of mobile technology. While 4G is primarily about speed and enablement of an all-IP network infrastructure, 5G aims to create an array of new business opportunities for mobile operators while delivering a highly personalized user experience for customers. With commercial trials beginning as early as 2018 and large commercial rollouts expected in 2020, 5G will bring the very high performance and scale needed to incorporate the billions of users within the mobile community. It will also give service providers the ability to create a new generation of personalized services while supporting machine-to-machine communications (M2M) and the Internet of Things (IoT).

The demands that will be placed on the network five years from now are difficult to imagine today. By most estimates, the number of IoT-connected devices will stretch into the tens of billions. Smart phones, as we know them, will give way to a world of smart, connected devices such as wearables, vehicles, drones, and myriad sensors, all communicating in new ways, in a wide arc of advanced business and consumer applications.

For the 5G architecture to achieve its goals as it connects these varied devices, it will need to model intensified new levels of flexibility, agility, and automation. The architecture will rely heavily on Network Functions Virtualization (NFV) and software-defined network

(SDN) infrastructure for the elasticity to scale and deploy network functions on demand, supporting a wide variety of new-world mobile applications.

Analytics will derive prescriptive actions to help mobile operators create customized services that adapt to different device types. The rise of hybrid devices—those that are used for both personal and enterprise applications—will call for heightened threat intelligence to adjust security policies dynamically, at both the network and device levels.

If you're a mobile operator, you can start preparing today for 5G. As your company's innovators begin stretching their imaginations to visualize unique and inventive new services for end users, there's no time like the present to begin forming a 5G network roadmap.

One of the most valuable tools available today towards a 5G migration is the ability to virtualize network functions with the help of NFV technology. NFV can let you preview some of the flexibility and agility that 5G promises, using virtualization to help you deploy and deliver new network functions, services, and capacity on demand.

Ready to start planning?

Here are two steps you can take today to begin your path toward 5G.

- Understand Juniper's NFV and cloud platform for new service creation.
- Understand Juniper's 5G vision

Key 5G Speed Concepts

Bandwidth

Put simply, the quantity of data sent or received in a second, as commonly measured in Mbps or Gbps.

Mbps

Megabits per second, the nearly universal measure of wireless network speed until now. While 4G networks today deliver under 30Mbps average download speeds — with peaks of 150Mbps in some areas — 5G networks are expected to start at 300Mbps, with typical speeds in the 600 to 800Mbps range.

Gbps

Gigabits per second, or 1,000 megabits per second. Early 5G networks are promising peak speeds between 1 and 6Gbps, which is to say roughly 10 times the best speeds of current 4G networks, though the actual line is blurrier than that.

Mb versus MB

Note that a lower-case "b" refers to bits, while an upper-case "B" refers to bytes. There are eight bits in a byte. For marketing reasons, data speeds these days are generally measured in "bits," even though file sizes are measured in bytes, which confusingly means that a 10MB file will take 8 seconds to transfer at a data rate of 10Mb per second.

Latency

A network's responsiveness to user requests, as measured in milliseconds (ms). 4G networks typically have 20-70ms of latency, roughly one-half or one-third the latency of 3G networks. 5G networks hope to achieve human-imperceptible single-digit latency (in the sub-10ms to sub-1ms range), with the specific latency rate depending on the connected device application.

Millisecond

One thousandth of a second. Abbreviated "ms."

FACT: No Competition, No 5G

By Chip Pickering
CEO
INCOMPAS

The excitement for 5G is building. CES booths in Las Vegas are buzzing about it, the cars of the future are roaring about it at the Auto Show in Detroit, and doctors working in rural hospitals are clamoring for connectivity solutions that bring life saving technology to America's small towns.

Because of the applications 5G enables, from education and medicine to cyber security and national defense, it's easy to see why many leaders in Washington D.C. have called winning the race to 5G a national priority.

At INCOMPAS, we have long been staunch advocates for policies that advance the deployment of 5G. It's far more than just changing the icon on the top of your smart phone. Building a true 5G network requires substantially more densely deployed fiber networks across the county, including residential and remote areas not just the financial districts.

Here are two critical things policy makers in DC need to know about the build-out of 5G networks:

First, competition equals fiber builds that are needed for 5G deployment

For decades, the largest telecommunications companies have tried to sell policy makers on bad competition-killing ideas based on the myth that only the big companies, with deep pockets, can be counted on to build. That's not true.

This summer, INCOMPAS released a game-changing economic study that showed, in reality, smaller local broadband providers—many of which are 200 times smaller than companies like AT&T—are deploying more fiber and providing faster broadband speeds in the areas they operate—including small rural towns and residential areas—than the incumbent telephone giants.

This competitive investment pressures big phone and cable ISPs to deploy new networks and offer better services.



“ . . . we need small, fiber providers to continue making the necessary investments that will support 5G networks.”



This map shows Sonic's fiber deployment in the same area – Sunset District. Sonic's UNE-evolved fiber deployment is ideal for a 5G future: a new fiber grid reaching virtually every potential 5G cell site.

What does competitive investment look like? Take a look at the map above from SONIC, based in northern California, where you can see the density of deployment in a residential area that you might expect to see in a downtown financial hub

In addition to the faster speeds and lower prices, new competitive networks builders are changing their communities for the better. Fiber builders like Gorge Networks, Mammoth Networks,

Socket Telecom and IdeaTek Telecom are bringing gigabit speeds to farmers, small businesses and residential communities in rural areas of Oregon, Wyoming, Missouri, and Kansas.

So the real question is: why aren't the big, deep-pocketed ISPs investing? Well, it's been widely reported that several of these companies are carrying historic, record amounts of debt. Merger mania and the expensive hunger to buy con-

tent companies comes with a steep cost. Policy makers are starting to take note that these companies, after receiving millions in tax reform relief and government subsidies responded with plans to lay off workers. It's evident that we need small, fiber providers to continue making the necessary investments that will support 5G networks. How do we ensure that these providers can continue to build?

Second, we need pro-competition policies to get more choice and better networks, including 5G

Since the landmark bipartisan Telecommunications Act of 1996, it is competition that drives more investment and innovation that has helped transform our economy into a digital economy. Enabling new innovators to enter the market and invest in new ideas, new technology, and new networks has driven our industry's growth and will be the catalyst to a 5G future.

Now is not the time to cut off competitors building the fiber networks that will connect 5G to consumers. That's why we need policy makers to maintain and

strengthen existing competition policies and reject any attempts to cut off competition.

And there are very real threats to competitive fiber builders. In fact, the big telephone company trade group, USTelecom, has a petition pending at the FCC that would cut off the bridge to broadband that smaller competitive builders use to reach customers and build out gigabit networks. This includes cutting off rural Americans who rely on smaller companies who have literally taken lines abandoned by the big guys, and updated them with electronics to provide the only, yes the only, access to broadband these communities have.

The FCC record reveals strenuous opposition to USTelecom's competition killer – including from 23 competitive providers, 10 consumer groups, 4 state public utility commissions, 2 cable providers, the US Small Business Administration, and Members of Congress.

Rejecting the competition cut off and saving the bridge to broadband should be the top priority for an FCC serious about

building the 5G future, faster.

This FCC has taken pro-competition and pro-deployment steps over the past year. In particular, recent adoption of one-touch make-ready ("OTMR") to speed the deployment of fiber on poles and its small cell deployment agenda—are critical to the deployment agenda and the race to 5G networks.

5G is the technological leap our nation, and the world, desperately needs. It has the potential to open up new jobs, more powerful applications and unleash a new generation of tech driven dreams. The men and women climbing towers and putting shovels in the ground have a critical job to play in our future, and policy makers can help make sure they have the ability to compete.



Chip Pickering is the CEO of INCOMPAS, and a former Member of Congress from Mississippi

The Ambition of 5G

A variety of goals for 5G are often expressed as representing the Fourth Industrial Revolution. The following stages of 5G deployment, it is projected, will enable 5G networks and their connected devices for fully remote management with immediate responsiveness. Proponents and advocates of 5G anticipate not only faster service, but entirely new levels of responsiveness that will unleash new potential in connected devices designed to impact entire industries such as transportation, medical, manufacturing and more.

eMBB

At first, 5G will most commonly be used for "enhanced mobile broadband," specifically higher data bandwidth with improved but not peak latency (faster responsiveness) compared with 4G. 5G bandwidth will eventually get up to 20Gbps, with a guaranteed minimum of 100Mbps, and 5G networks will support 10,000 times the traffic of 4G networks.

mMTC

5G is also designed to support Massive Machine Type Communications, a way to bring billions of tiny connected devices and sensors online. The 5G standard supports an insane density of up to 200,000 sensors in a 1 million square kilometer area, with long range, low data rate radio signaling that can deliver 10-year battery life.

URLLC

Pushing 5G for purposes beyond 4G, the Ultra Reliable Low Latency Communications specification is designed for specific 5G use cases such as full car automation, factory automation, and remote-controlled surgery where reliability and responsiveness are mandatory. A 5G network will respond to URLLC requests by delivering data so quickly and reliably that responsiveness will be imperceptibly fast — 5ms end-to-end latency — and transmission errors will be lower than 1 packet loss in 100,000 packets. But bandwidth will be limited to under 10Mbps.



Accelerating the Connected Future

FIBER CONNECT

June 3-5, 2019

June 2: Fiber Starter Kit Workshop

Gaylord Palms Resort
& Convention Center

Orlando, Florida

North America's Premier Fiber Event

Join industry leaders, fiber broadband network operators, and cutting-edge vendors and equipment providers for three days of new products, new ideas, and new connections.

The Fiber Connect is your best opportunity to:

- Explore the latest tools to initiate new deployments and monetize your networks
- Learn new strategies for successfully advancing through the stages of all-fiber deployment
- Discover ways to grow and enhance your networks at the lowest cost

www.fiberconnect.org

Exhibits and sponsorship opportunities are available
Contact us at +1 (312) 673-5635 or ksveen@fiberbroadband.org

5G Is Coming ... But Where?

By Shirley Bloomfield
CEO
NTCA

Like many of my peers in the communications industry, I read a great deal of trade press. Mostly it consists of skimming through various publications to see what and where the buzz is on any given day. On many a given day lately, the focus has been on 5G and how it will transform our society and bring new connectivity at speeds far faster than previous generations of wireless technology, enabling everything from telemedicine to entertainment for millions of Americans.

Many of the reports offer broad words of praise for a technology that has yet to have any global industry standards. Verizon upped the ante by announcing the launch of 5G-based home broadband in parts of four cities—Houston, Indianapolis, Los Angeles and Sacramento—making it the first national ISP to offer what is known as next-gen wireless services in the United States. More recently, the cable industry announced ambitions for 10G through a ramp up to 10 gigabits-per-second speeds, setting off a flurry of giddy gossip about who will vanquish whom in the race to rule the wireless world.

This is usually the point at which I pause, take a deep breath and ask myself, “but where?”

To the extent that our industry's fascination with 5G influences federal policies, it's very important that we take a step back and recognize the technology pieces that will need to be in place for all Americans, most especially those living in rural areas, to be part of this evolution. At the top of the list of considerations is the very important but often overlooked fact that fiber-fed broadband is the foundation of 5G. We have a mantra at NTCA that “wireless needs wires” and regularly repeat it with hopes that others will join us in getting excited about connecting these dots.

I have been gratified to see more of my communications industry colleagues join me in voicing support for building strong wireless and wired networks (even as I take pride that NTCA is leading the chorus). One of my favorite moments of 2018 was participating in a House Energy and Commerce Committee hearing about broadband solutions to close the digital divide, when one of my fel-

low witnesses representing the wireless industry testified that small cells are not a rural solution. If only it was as easy as installing “little white boxes” on every pole and ranch in rural America!

More voices certainly help, but there is no better advocate for connecting the unconnected in rural and remote communities than the small broadband

and sufficient have allowed rural providers to get back to the business of investing in infrastructure and delivering even higher-quality services in rural America. I have no doubt those efforts will bear fruit for the proliferation of 5G wireless networks in the future.

To put it quite simply, a wireless network is only as good as the wired infrastruc-



providers working every day to do just that. Even in the face of persistent challenges, independent broadband providers continue to lead the charge in driving deployment of higher internet speeds and greater adoption of broadband services in rural communities. A recent survey of NTCA members found that they continue to take substantial steps to replace aging copper networks with fiber connectivity where possible. In turn, broadband speeds made available by NTCA members have increased, with more than 70% of survey respondents' customers now having access to 25 Mbps or higher speeds.

Throughout the 16 years NTCA has conducted this survey, the No. 1 cited barrier to broadband availability has been the cost to deploy networks. It's no surprise, considering the average population density is seven subscribers per square mile versus many hundreds in urban areas. Providing broadband in rural America is exceptionally expensive. And connecting remote communities to next-generation technologies would not be financially feasible without public-private partnerships and programs like the FCC's Universal Service Fund. Recent reforms to that program to make it more predictable

ture that lies beneath it. More users and devices on a wireless network eventually lead to more wired infrastructure upgrades to accommodate increased traffic and consumer demands. No doubts about it, there is a symbiotic relationship between wired and wireless networks, and I hope policymakers continue to keep this physics lesson in mind as they craft policies for broadband deployment.



Shirley Bloomfield is chief executive officer of NTCA—The Rural Broadband Association, the premier association representing nearly 850 independent, community-based telecommunications companies that are leading innovation in rural and small-town

America. With more than 30 years of experience representing the country's smallest independent telecom operators, Bloomfield is an expert on the role of federal communications policies in sustaining the vitality of rural and remote communities and the benefits rural broadband networks bring to the national economy. Bloomfield is also active in leadership efforts to seek synergies and align strategic partnerships among rural telecom companies, their larger counterparts, other rural utilities and federal agencies.

A nighttime cityscape featuring a prominent skyscraper with a pointed top, illuminated against a dark sky. In the foreground, a multi-level highway interchange is visible, with light trails from traffic. The scene is overlaid with large, semi-transparent blue and teal geometric shapes.

COMMSCOPE®

The Path to 5G

Unlocking the potential of your network's 5G future begins with a winning densification strategy – and CommScope has you covered.

Densification isn't a single solution or practice. It's a new way of thinking about how wireless and wireline networks converge in the 5G age to deliver more performance and efficiency.



Antennas

- More antennas, more ports and more small cell sites: 5G density requires a new antenna approach.

Indoor/Outdoor

- Most connections occur indoors. In-building wireless gives your 5G network an onramp to the outside.

Fiber Infrastructure

- Faster and more flexible than ever, fiber connects the denser networks of our 5G future.

Spectrum Management

- Like LTE, 5G bands can be better leveraged with smart spectrum management to increase performance.

Deployment Economics

- More sites in more kinds of locations – keep deployment costs under control, wherever they take place.



MAKING WAY FOR 5G

Next-generation wireless communication could present some weighty challenges for co-op infrastructure

By Derrill Holly
Senior Writer/Editor
RE Magazine & NRECA News
Reprinted with permission from
RE Magazine

5G is coming.

The much-anticipated fifth generation of wireless communication promises to deliver on a host of futuristic technologies, including self-driving cars, real-time virtual reality, and “smart” cities and towns.

“The advent of 5G is groundbreaking and will likely have a huge impact on the way we communicate with each other and with our modern devices,” says Michael Leitman, an NRECA strategic analyst.

Lietman notes that the 5G network will require new national infrastructure that will take several years to install. The network will radically improve the bandwidth, capacity, and reliability of wireless mobile and will likely supplement rather than replace today’s 4G technology.

But for all its promise, the deployment of 5G may present challenges for electric co-ops and other utilities.

The platform relies on a dense network of small, connected antennae to deliver fast speeds with low latency (responsive-

ness). A single 5G antenna, which will cover about 250 meters, weighs only a few grams. But some parts of the system are designed for so-called block-matrix mounting, where hundreds of the devices are packed in arrays. These come with additional equipment, including control units, backup batteries, and other devices housed in refrigerator-sized metal or composite boxes.

The success of 5G rests in part on evenly distributed coverage in any given area. In electric cooperative territories, distribution poles will likely bear a significant portion of this burden.

“Outside of urban areas, the poles owned by electric cooperatives and other utilities are the most common existing structures with the necessary height for attaching the equipment,” Leitman says. And there is concern in the industry that the additional weight could affect pole performance and maintenance.

“Any foreign attachment that departs from the design and construction of the original overhead line could introduce significant engineering, safety, and reli-

ability issues,” says Robert Harris, senior principal engineer in NRECA’s Business and Technology Strategies group. “Co-ops and other utility providers are concerned about the added weight on the poles, and how that will affect their stability and integrity during wind and ice storms, or prolonged rain events.”

The race to 5G

Wooden poles have been iconic symbols of electric cooperatives since they were raised to support power lines for rural communities 80 years ago.

Most co-op poles are 40 feet long and set 6 feet deep. The top 4 to 12 feet are typically used for high-voltage electric equipment, including lines and transformers. Telecom attachments must be installed at or below a prescribed safety buffer.

The Wireless Industry Association has its sights set on a zone 6 to 8 feet above ground for the heaviest 5G equipment. That’s high enough for security and offers the economic benefits of pole attachments, which are traditionally charged lower rates than ground-mounted equipment on public rights-of-way.

“Each cooperative is unique and faces specific challenges and costs. Pole-attachment rates should reflect the actual cost of providing attachment service.”

“Some of that equipment could be near energized lines, so training, safety, and potential service reliability issues need to be considered,” Harris says.

The race to 5G could have a major impact on the oversight of pole attachments and cooperatives’ local control, says Tammy Embry, an NRECA senior legislative adviser. As the wireless industry pushes for uniform national attachment rules and lower rates, co-ops could be faced with new federal regulations that impinge on decades-long right-of-way relationships with private landowners and state and local jurisdictions.

NRECA and its member cooperatives are supporting a resolution opposing regulatory authority over pole attachments by the Federal Communications Commission (FCC).

“Congress long ago recognized the con-

sumer-focused nature and democratic local control inherent in the cooperative business model and exempted electric cooperatives from federal pole attachment regulation,” Embrey says.

Nineteen states have enacted legislation to streamline pole attachment policies and reduce rates for small cell and 5G deployment.

“Legislators in all of those states have had the foresight to make sure these rules do not apply to electric cooperatives,” says Brian O’Hara, NRECA’s senior director of regulatory issues, adding that several states have excluded electric utilities more broadly from new pole attachment regulations, citing their critical infrastructure status.

Compensation and compromise

Full compensation for pole-attachment costs cannot be guaranteed with a uni-

form regulatory policy, O’Hara says, and artificially low rates could burden co-op members with undue costs, effectively subsidizing large, for-profit telecommunications companies.

“In some cases, the addition of foreign attachments may necessitate installation of taller or stronger poles, relocation of poles, or additional poles, increasing costs to the electric cooperative members,” he says. “Each cooperative is unique and faces specific challenges and costs. Pole-attachment rates should reflect the actual cost of providing attachment service.”

NRECA has joined several entities representing utility, telecommunication, and communication technology interests in calling for cross-industry compromises on spectrum issues related to 5G technology and its deployment. A letter outlining their position was submitted to the FCC on May 9 and includes measures that will help ensure options of some local involvement in how the technology is deployed and administered.

5G technology is expected to take root at first in densely populated areas before extending into nearby suburbs. It could be several years before it arrives in rural communities distant from major metropolitan areas, and it may never be extended to isolated locations.

One Touch Make Ready

By Deborah L. O’Mara Published In August 2018

Passed on Aug. 2, the Federal Communications Commission’s (FCC) One-Touch Make-Ready (OTMR) Ruling, “Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment WT Docket No. 17-79,” is intended to promote greater internet service provider (ISP) freedoms and access in broadband communications, lessen installation restrictions and level the playing field. But with the ruling comes additional questions about the process itself, worker qualifications and what the ultimate results will be.

According to the FCC’s Report and Order issued on August 3, the ruling is designed to “promote broadband deployment by speeding the process and reducing the costs of attaching new facilities to utility poles. Now, more than ever, access to this vital infrastructure must be swift, predictable, safe and affordable, so broadband providers can continue to enter new markets and deploy facilities that support high-speed broadband. Pole access also is essential to the race for 5G because mobile and fixed wireless providers are increasingly deploying innovative small cells on poles and these wireless services depend on wireline backhaul,” the FCC writes. The new attachments that are excluded are those that are more complicated or above the communications space of a pole, where safety and reliability risk can be greater, it adds.

Make-ready is designed to easily accommodate additional facilities on the pole, specifically the modification or replacement of a utility pole or the lines or equipment. With OTMR, the new attacher performs all make-ready work.

“OTMR speeds and reduces the cost of broadband deployment by allowing the party with the strongest incentive—the new attacher—to prepare the pole quickly by performing all of the work, rather than spreading it across multiple parties,” states to the FCC’s Report and Order. It also cites industry estimates that OTMR alone could result in approximately \$8.3 million incremental premises passed with fiber and \$12.6 billion in incremental fiber capital expenditures.

Prior to the ruling, a new carrier that wanted to deploy their service on public utility poles first had to wait for the provider that was already using the location to move their equipment, leading to delays. The new ruling could also mean smaller firms may be able to deploy fiber and cellular equipment with a lower cost of entry and fewer labor delays. Utilities like Comcast publicly opposed OTMR, while Google Fiber, the Fiber Broadband Association, American Cable Association and others were strong proponents.

NTCA
2019

TECHNOLOGY+BUSINESS CONFERENCE

APRIL 23-25; CHICAGO, IL

WHERE
BUSINESS +
TECHNOLOGY
MEET

DISCOVER IMPROVE NETWORK

Your company exists at the intersection of technology and business, working to keep pace with constant streams of change from all directions. The NTCA Technology + Business Conference is your connection to the industry's leading technologists and business executives with the latest developments in rural broadband deployment and how rural carriers can maximize new revenue opportunities.

DISCOVER MORE

www.NTCA.org/techconf

B2B

B2C

CO

NTCA

THE RURAL
BROADBAND
ASSOCIATION®



4G

5G

Connectivity for the 5G RAN *Staying Ahead of Change at the Edge*

By Dr. Michael Ritter
VP Technical Marketing & Analyst Relations
ADVA Optical Networking

5G is finally becoming a reality after years of hype about gigabit speeds. During 2018, we got an initial taste of 5G as AT&T completed a live test on a 5G network and Verizon launched a home broadband service using the next-generation wireless technology. T-Mobile has started to build out 5G in 30 cities and we will see more launches of actual 5G wireless networks during 2019.

Regardless of the wireless technology employed, fiber will be the supporting infrastructure for 5G networks. The promise of 5G enabling an interconnected world with highest capacity, lowest latency, maximum scalability and open design paradigm, however, needs more than the evolution of the radio access network. The underlying fiber-based connectivity at the edge of the network also plays a critical role.

Capacity

With 5G, we are migrating cell site connectivity from a backhaul-centric to a fronthaul- and midhaul-centric architecture. This is not without challenges. Building on the eCPRI protocol for enabling C-RAN and massive MIMO results in significantly higher data rates when interconnecting cell sites. Coming from traditional backhaul with gigabit speeds, we are now arriving at 25, 100 and even 1000s of gigabits of capacity to serve multiple sectors, spectrum bands and operators. Low-cost WDM technology such as pas-

“Regardless of the wireless technology employed, fiber will be the supporting infrastructure for 5G networks.”

sive WDM and G.metro deployed at the network edge has turned out to be crucial for this cost-sensitive application.

Latency

Lower latency is one of the big gains on offer from 5G and critical for many use cases on the horizon, including machine-to-machine communication and real-time applications. The 5G RAN can bring significantly reduced latencies to the users, but that needs to be supported by the underlying connectivity network, especially at the network edge. Reducing latency on the transport network has several components. Topology optimiza-

tion, low-latency forwarding and collapsing the layers of the transport network at the edge are all needed in an environment where every fraction of a millisecond counts.

Synchronization

Precise synchronization of radio base stations and remote radio heads is critical to exploit the most value from the 5G radio spectrum and enable location-based services at a new scale. Aligning clocks with accuracy of hundreds of nanoseconds and maximum reliability in a highly distributed environment needs a new approach. That’s why synchronization distribution is moving to the edge of the network, demanding more compact and highly integrated devices deployable in any environment.

Intelligence

Finally, the edge network needs to become more intelligent. 5G is designed following the concept of openness to enable multi-service, multi-class-of-service and multi-operator RAN sharing. This network slicing flexibility needs to be reflected in a programmable fashion by any network interconnecting radio access network resources. An SDN-controlled network edge is therefore critical.

5G is shifting the tectonic plates at the network edge and ADVA can help you to exploit the most from it with its hardware and software solutions.

The Impact of 5G

Changing the Telecommunications Landscape

By John Dulin
VP, Market Development
Corning

The digital transformation is driving demand for more applications, more services, and as a result, more bandwidth. As this trend progresses, in-building networks are increasingly becoming strained. One of the most significant emerging trends that will stress networks is 5G.

5G represents the fifth-generation of cellular wireless. What's notable is 5G will connect people and things through greater speed, lower latency, and massive simultaneous connectivity. These network advancements will enable and inspire a new wave of computing and technological innovation that will

change the way we live and work – which some refer to as the Fourth Industrial Revolution.

Since the 1980s, wireless services providers have rolled out a new generation of cellular wireless approximately every 10 years. 5G is based on specifications defined by the international standards body 3GPP (3rd Generation Partnership Project) in its Release 15 document. According to 3GPP, 5G performance targets include high data rate, reduced latency, energy saving, cost reduction, higher system capacity, and massive device connectivity.

5G, which is now starting to be introduced in controlled test markets worldwide, exhibits traits which characterize it to be both evolutionary and revolutionary. Specifically, while the increase in higher data rates may be considered evolutionary, its other aforementioned capabilities are expected to revolutionize virtually every industry and economy, and the way we live our lives. For instance:

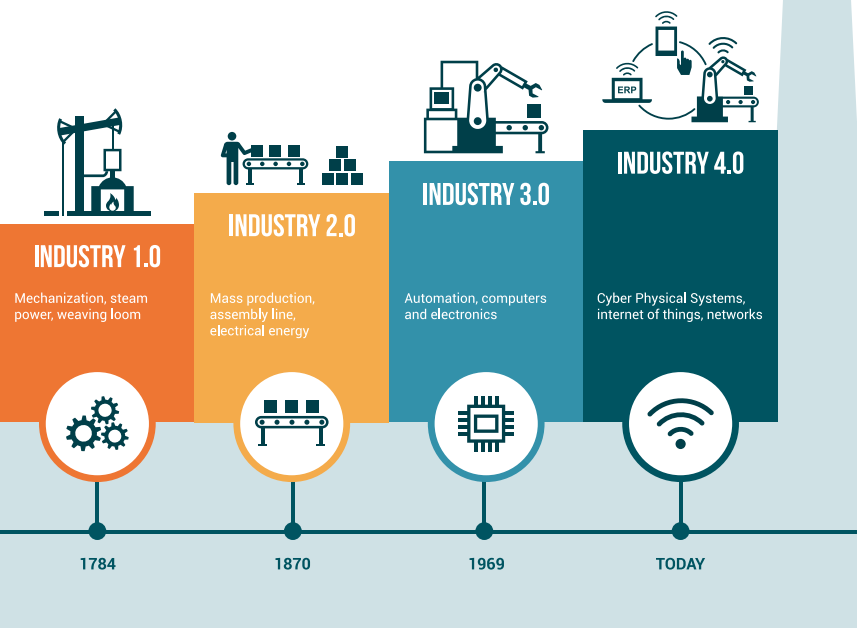
- 5G-enabled Internet of Things (IoT) sensors throughout smart buildings, cities, communities, and campuses will provide more efficient services to citizens, increase collaboration among different economic sectors, and encourage innovative business models in both private and public sectors.
- In healthcare, 5G will enable virtual medicine to substantially increase the effectiveness of preventative care, as well as robotic surgery.
- Autonomous vehicles, enabled by the low-latency 5G network, will help make transportation safer, parking easier, and improve traffic flow and congestion.

The challenge, however, is each of the above applications depends heavily on real-time data and edge computing. Additionally, the 5G network requires a significantly higher density of radios both indoors and outdoors. The density of radios and the fiber optic backhaul infrastructure are as critical as the spectrum itself for 5G. So even if the spectrum is available, 5G won't become a reality if the network isn't properly designed.

5G is likely the tipping point for in-build-

INDUSTRIAL REVOLUTION

TRANSFORMING INDUSTRIES AND INNOVATION



“These network advancements will enable and inspire a new wave of computing and technological innovation that will change the way we live and work – which some refer to as the Fourth Industrial Revolution.”

ing networks already strained by the “dilemma of more.” The digital transformation, which comprises myriad technologies, services, and applications inside the building, represents an undeniable shift that has a snowball effect upon the network. And, lest we forget about in-building cellular connectivity – often described as the Fourth Utility – 5G will likely “break” many legacy distributed antenna system (DAS) and small cell networks unable to support the density of radios and bandwidth requirements. Ironically, the critical aspect in network planning that gets overlooked most is the network itself.

To meet the demands to enable smart building outcomes and prepare for 5G, it is necessary to proactively deploy “smart infrastructure” capable of adapting to and supporting the rapidly-evolving connected world. Infrastructure is the “plumbing” for connectivity and needs to serve two functions: first, it needs to

provide transport for bandwidth; and secondly, it should deliver power to the active devices at the edge of the network. Like plumbing, infrastructure should last the lifetime of the building.

Fiber is the ideal smart infrastructure media because it provides virtually unlimited capacity. An elegant way to provide power is through a composite cable infrastructure, which marries fiber and copper conductors into a single infrastructure to deliver both bandwidth and Power over Ethernet (PoE).

A network plumbed with fiber and power as deep as possible to the edge provides low long-term total cost of ownership. Fiber not only provides virtually unlimited capacity, but it is also the ideal media to converge multiple applications and services such as voice, data, and video on the same infrastructure to deliver compelling ROI.

5G will most certainly be an evolution of today’s networks, but the impact will likely be even more significant. Beyond being evolutionary, 5G is potentially revolutionary. The possibilities are virtually unlimited, and a smart, fiber-deep infrastructure will be paramount to making the digital transformation vision.



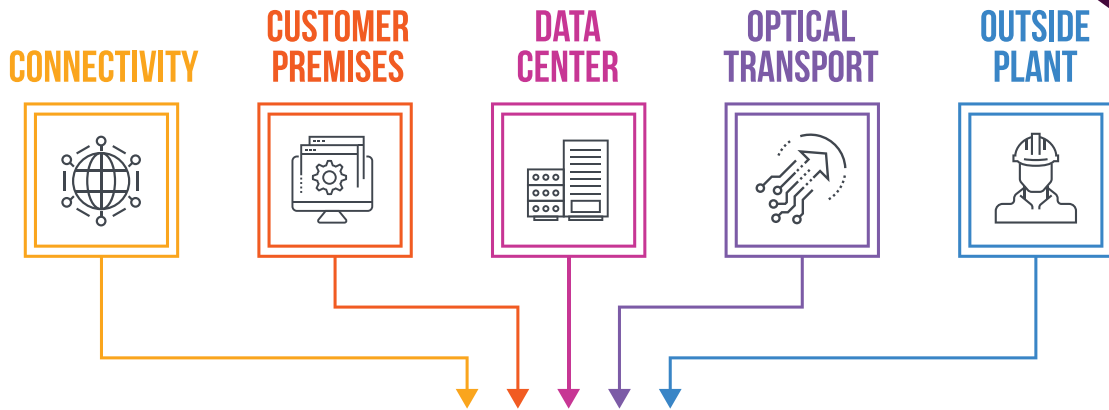
YOU THINK 5G IS FAST? WE CAN KEEP UP!

GLCC’s indoor and outdoor enclosures,
combined with our passionate team of experts,
can support the world’s fastest network—no problem.

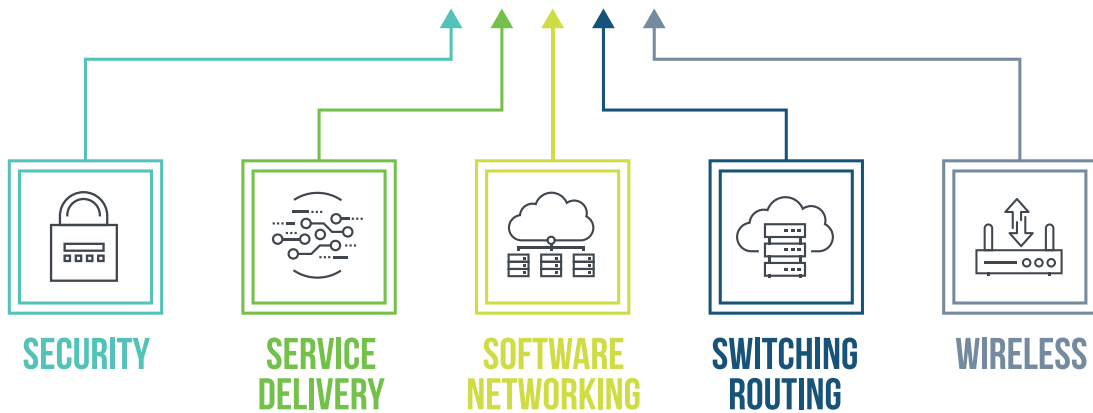
GreatCabinets.com

GREAT LAKES
CASE & CABINET 
Put it all on us.

Delivering end-to-end solutions for **BROADBAND DEPLOYMENT**



CUSTOMER ASSET MANAGEMENT PROGRAM (CAMP)
INSTALLATION SERVICES | ENGINEERING SERVICES | INTEGRATION SERVICES
NETWORK ARCHITECTURE AND DESIGN
MANAGED SERVICES | NETWORK DEPLOYMENT KITS



For nearly 50 years, Walker and Associates has built and maintained a reputation for excellence, resulting in high levels of customer commitment and confidence. Through extensive partnerships with industry-leading manufacturers, a strong commitment to value, and high standards of customer service, Walker delivers **MORE THAN DISTRIBUTION.**



Fulfilling the Promise of 5G: Two Can't-Miss Strategies for Securing an Early Lead

By David Inglett
Strategic Channel Development, Service Provider Markets
Ixia

5G is happening now and happening everywhere. A 2018 survey by Keysight Technologies found more than 50 percent of respondents were already adopting 5G technologies, with pioneers looking to secure an early market lead.

Expectations for fifth-generation or 5G wireless are high led by faster mobility and large-scale support for the Internet of Things (IoT) and Connected Everything. Not to mention greater automation and programmability, and reduced OPEX cost.

Yet questions abound. Will the subscriber experience live up to the hype? Which will be the “killer apps”? When will providers achieve payback on investments? And at the heart of all these: How will 5G interact with and overlay 4G/LTE networks as the two coexist for years to come?

The answer to these questions is: There's only one way to find out—test.

Ixia, a Keysight Business, offers the world's only solution for validating wireless core and RAN networks with industry-leading scale and performance. Ixia's new XAir3 5G test platform and XAir2 4G/LTE solution enable complete assessment of evolving networks, including

sub-6Ghz and mmWave radio solutions pivotal to 5G.

The XAir3 chassis and Ixia's IxLoad-Wireless test application provide emulation of user equipment (UE) based on 5G New Radio (NR) specifications. Operators can run capacity tests, detail cell throughput, measure voice/video quality, and model real-world scenarios.

5G's legacy and biggest challenge will be supporting billions of connected devices from smartphones to toasters to parking meters and self-driving cars. This feat will entail massive virtualization of the network infrastructure that requires additional, very targeted testing of virtual network functions (VNFs) also enabled by Ixia. The portfolio also includes solutions for testing Ethernet networks up to 400Gbps (including functional and performance tests for data, voice, video) and network security.

But validating performance throughout design and development is only the beginning. Once networks and services go live, operators must maintain complete visibility to promote world-class security and operational efficiencies. For example, being able to troubleshoot performance issues remotely without dispatching technicians. To this end, Ixia also provides a full suite of network visibility solutions including taps used to access traffic and intelligent network packet brokers (NPBs) used to provide exactly the right data to exactly the right security and monitoring tools.

So, who will be the early winners? Companies that adopt two pivotal strategies—test and visibility—through each stage of the 5G lifecycle. Learn more about 5G test and network visibility for a decided advantage at <https://ixiacom.com>.

5G for Dummies

5G is a revolution, an evolution, and a reality. Naturally, when a technology like 5G is evolving, carriers and mobile operators face design spin ups to conform to the 3GPP standards. There is a need to properly understand the potential of 5G in the Internet of Things (IoT) and telecommunications, connected vehicles, and augmented and virtual reality (AR/VR) domains. Being first and best in 5G depends on how prepared you are.

5G For Dummies, Ixia Special Edition, consists of eight short chapters that explore:

- How next gen networks are blazing the 5G trail to higher speeds and scale with low latency
- Why the IoT, connected vehicles, and AR/VR requires 5G connectivity
- Where virtualization in mobile networks can help address the need for scale and elasticity
- What 5G New Radio (5G NR) is and how it will help create a 5G future

5G for Dummies also provides a peek into the 5G networks of the future, various use-case scenarios, and the technologies that will be leveraged in the unlicensed spectrum.

Download your complimentary ebook, 5G for Dummies, at <https://www.ixiacom.com/resources/5g-dummies>.



Will Utilities Run to 5G?

By Bob Lockhart
Vice President of Cybersecurity, Technology, and Research
UTC

5G dominates discussions about telecommunications nowadays, and rightly so. More officially known as the International Telecommunication Union (ITU) International Mobile Telecommunication standard for 2020 – that’s IMT-2020 for short – proponents of 5G claim that it will provide mobile telecommunications performance that could barely have been imagined a decade ago. Consumer and societal benefits abound. 5G will enable use cases that are difficult to impossible today, such as self-driving cars, ever smarter homes, and machine-to-machine communication – the Internet of Things.

But what about utilities? Does 5G have a play in the utility world? Before answering that question, let us briefly dive below the surface hype and explore what 5G is.

5G’s Flashy Numbers

5G discussions revolve around some impressive buzzwords: high-speed, low-latency, mobile, ubiquitous, and connection density. Without a doubt, 5G will offer mobile telecommunications capabilities unlike any technology that has come before it. Some of 5G’s flashier numbers:

- Peak downlink rate: 20 Gbit/s per mobile station
- Peak uplink rate: 10 Gbit/s per mobile station
- Downlink user experienced data rate: 100 Mbit/s.
- Uplink user experienced data rate: 50 Mbit/s.
- One-way latency:
 - 4 ms for “Enhanced mobile broadband” (eMBB) networks
 - 1 ms for “Ultra-reliable and low

latency” (URLLC) networks

- Minimum connection density per base station: 1,000,000 devices per km²
- Mobility interruption time (for switching base stations): 0 ms, up to speeds of 500 km/h
- Minimum aggregated bandwidth: 100 MHz; 1 GHz for bands above 6 GHz

These numbers indicate that 5G, at least in its URLLC configuration, can support low-latency use cases such as protective relays for electric utilities.

Some Concerns for Utilities

Carrier telecommunication networks and utility telecommunication networks are different animals that happen to use the same technology. This will remain so in 5G. Telecommunications carriers make a return on their telecommunications operations, so they rightly create networks that operate at high enough speeds to satisfy consumer and enterprise expectations reliably. By contrast, utilities make a return on generation and delivery of their commodities, such as electricity, water, gas, or heat. A utility telecommunications network must enable effective and timely management of the systems that control generation and delivery of its commodities. Consumer-friendly features are less important than nonstop availability, even during a major natural disaster such as the hurricanes of 2017 and 2018. Carriers’ telecommunications networks are profit centers, while utilities’ telecommunications networks are cost centers. For a utility, rock-solid telecommunications are a cost of doing business.

Telecommunications carriers are offering 5G deployments during 2019 and into 2020. The 2018 Winter Olympics in Japan claimed to have had its opening and closing ceremonies choreographed with 5G. While the performance characteristics of 5G have been published by the ITU, technical specifications are not scheduled for completion until mid-2020. The IMT-2020 web page includes the statement: “In 2018-2020 the evaluation by independent external evaluation groups and definition of the new radio interfaces to be included in IMT-2020 will take place.” The final meeting on IMT-2020 specifications is tentatively scheduled for October 7, 2020.

This situation begs the question: how can 5G truly be deployed before the evaluation of 5G radios is complete? The short answer is, it cannot. 5G deployments undertaken now risk obsolescence as of the release of 5G specifications in 2020, possibly resulting in lock-in to a single equipment vendor or telecommunication carrier. Finalized specifications in late 2020 point to availability of a truly mobile 5G in the middle of the coming decade. Added to that, utilities tend to be late adopters of most technologies because of their non-negotiable reliability requirements, and because existing capital assets often have very long service lives.

The large number of small cell base stations envisioned for 5G will present a challenge to anyone that deploys 5G. For carriers, managing those small cells is a core competency. Utilities are certainly capable of managing such a complex environment, but they may balk at taking on the added complexity and staffing dic-

“For a utility, rock-solid telecommunications are a cost of doing business.”

tated by 5G, unless they are unavoidable. Utilities will also be wary of acquiring the necessary spectrum for 5G telecommunications, as they are currently facing challenges that may disrupt their existing wireless telecommunications in several frequency ranges.

Where will utilities use 5G?

Utilities are unlikely to replace existing telecommunications networks that are fit for purpose and not at risk of near-term obsolescence. That is, if something is working, it is unlikely to be replaced by 5G simply because 5G is a newer or better technology. Potential stranded assets – writing off telecommunications assets with remaining book value – coupled with 5G project costs and capital expense, could challenge any utility financially. Still, a technology lifecycle event may consider 5G as a replacement for an existing network with soon-to-be obsolete telecommunications technology.

Utilities like fiber. UTC’s Utility Network Baseline, published late in 2017, showed that our member utilities’ networks nearly always had fiber and wireless transmission capabilities, in general with a higher percentage of each network being fiber than wireless. The same survey demonstrated that nearly all of the copper wire being decommissioned in the next 3-5 years will be replaced with fiber. UTC’s members tend to choose Optical Ground Wire (OPGW) for new construction, and they are more likely to specify

All Dielectric Self-Supporting cable (ADSS) for retrofit of fiber to existing construction, because ADSS does not require de-energization of a circuit for installation, and it can be installed lower on most structures.

UTC has observed that nearly all our member utilities have outlier use cases that cannot be met with fiber: a desert substation on the other side of the mountain from a large city; dense urban environments where deploying more fiber is expensive or impossible; environmental restrictions or endangered species in the direct path of planned fiber deployment. Unfortunately, 5G is less likely to be deployed in remote or rural areas, as telecommunications operators may be unable to cost-justify roll-outs of 5G in remote areas.

Summary: Large-scale adoption of 5G by utilities is a ways off

Utilities are unlikely to decommission perfectly good telecommunications installations to get on the 5G bandwagon. Telecommunications networks that are in place now and at little risk of near- or mid-term obsolescence will likely remain in place and be upgraded as wireline technologies such as dense wave division multiplexing (DWDM) continue to increase fiber’s apparent throughput. Utilities will first seek to use already deployed telecommunications capabilities – wired or wireless – for addressing new use cases or network growth.

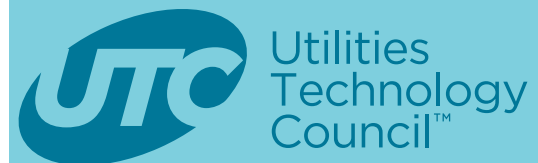
Beyond the financial and project challenges of a 5G rollout, utilities are fast-tracking expensive grid updates to cope with the explosion of renewable energy inputs into their grids – especially residential photovoltaic generation. A decision to deploy 5G may divert staff and resources away from a utility’s ability to keep pace with the growth of renewables generation.

To be sure, there are likely to be outlier use cases where 5G is a viable option that will be considered. Utilities are sophisticated at balancing near-term capital expense with long-term return on that capital. Where 5G makes the most sense, utilities will use it.

UTC does not foresee widescale adoption of 5G by its member utilities within the next 5-10 years. But we do see smaller use cases where 5G will make perfect sense, and we expect utilities to adopt 5G where they perceive that it offers the most benefit.



Bob Lockhart is the Utilities Technology Council's Vice President of Cybersecurity, Technology, and Research. In that role he manages the association's programs of work for IT/OT convergence and technology initiatives, plus all of UTC's market research activities. Mr. Lockhart has eight years' experience in control systems cybersecurity, with over 25 years' total experience in information security. He was previously Navigant's Research Director for transmission, distribution, smart metering, demand response, home energy, software, telecommunications, data analytics, and cybersecurity. Before becoming a market researcher, Mr. Lockhart had a 31-year career in IT outsourcing with EDS. He has held a current CISSP certification since 2002.



ABOUT UTC

The Utilities Technology Council (UTC) is a global trade association dedicated to serving critical infrastructure providers. Through advocacy, education and collaboration, UTC creates a favorable business, regulatory and technological environment for companies that own, manage or provide critical telecommunications systems in support of their core business.

THE FUTURE OF 5G IS HERE.

Enable the 5G Revolution.

NETWORKS | IT OPERATIONS



ixia
A Keysight Business

www.ixiacom.com/5G

5G and Next-Generation Broadband: A Symbiotic Relationship

By Michael Sumitra
Strategic Solutions Marketing Manager
ADTRAN

An Intelligently Connected World

The fifth generation of wireless technology, commonly known as 5G, represents the next evolution of mobile broadband technology. Unlike other wireless evolutions that brought incremental improvements in wireless performance, 5G is revolutionary and will produce a major paradigm shift in communications. Its implications for the broadband industry and society as a whole remain a subject of considerable discussion, but its impacts are clearly expected to be enormous.

From connecting billions of devices to providing enhanced broadband for mission critical applications like autonomous vehicles and medical applications, 5G will be fundamental to the smart connected world of the future. Ultimately however, we need to remember that 5G operations require the support of a deep fiber broadband network. A robust fiber optic backbone provides the underpinnings for the low latency and seamless connectivity that will be the hallmarks of 5G. Fiber and 5G are forming a symbiotic relationship, where each drives the other's business case. Therefore, we can expect the implementation of 5G to drive unprecedented investment in fiber networks.

The Wonder of 5G

The transformational nature of 5G stems from its capacity as a technology offering both high performance and flexibility to support multiple service requirements. 5G promises network connectivity up to 100 times faster than today's current mobile networks, with latency of less than 1 millisecond. This extremely low latency will power real-time innovations, including smart city technologies, augmented and virtual reality applications, and widespread use of autonomous vehicles. Additionally, 5G will be able to support massive scale and highly efficient spectrum use, enabling machine-to-machine communications and fueling innovation of new smart applications in healthcare, agriculture, and many other industries.

5G Densification and Next-Gen Fiber Broadband

The growth of 5G will drive massive demand for fiber-enabled bandwidth. The combination of shorter range wireless transmission and gigabit required applications on mobile devices will impose substantial changes to traditional network topologies. While earlier generations of wireless communications could be supported by a relatively low number of cell towers, 5G wireless architecture will vastly increase the number of macrocell sites needed. In turn, each of these sites will need microcells capable of multi-gigabit, highly-reliable fronthaul, backhaul or cross haul connectivity rooted in a fiber network. Only through this densification of wireless and wired infrastructure can we achieve the performance levels necessary to seamlessly deliver bandwidth-intensive mobile applications like ultra HD mobile video or augmented reality. Dense, highly-scalable, fixed broadband access deployments will therefore be key to realizing the ambitions of 5G.

Addressing the range of x-haul applications needed to connect an array of 5G cell sites will require an access network with very high capacity and low latency. Passive Optical Networks (PON) are ideally suited for these demands as they are the most broadly deployed fiber access infrastructure in the world, offering the advantage of both cost-effectiveness and scale compared to traditional point-to-point cellular backhaul technologies. Next-generation 10 Gigabit PON standards are widely expected to provide the optimal foundation over which 5G will thrive, by being deployed as deeply as possible into the access network and providing needed network bandwidth to every new cell site. In certain cases, where economics or right-of-way issues prove prohibitive, fixed wireless options and gigabit-capable copper and coaxial networks may be leveraged to feed new 5G installations. However, 5G will be underwritten by fiber.

Fiber Fuels a Wealth of Options

As service providers lay the fiber necessary to support 5G, they will also be creating multiple paths to monetization.

Given the demand for high-bandwidth connectivity in homes and businesses is growing exponentially, new fiber builds designed around a 5G microcell use case should be equally utilized for Fiber-to-the-Home (FTTH) consumer use or Fiber-to-the-Premises (FTTP) enterprise applications. The same holds true for existing FTTH providers whose networks ought to be leveraged for 5G applications amid a growing fiber densification model. This mutually-beneficial relationship between 5G and fiber is a major reason why existing networks look so attractive for additional investment by operators. 5G changes the game, and the broadband industry clearly is at the beginning of a massive move to dramatically increase fiber connectivity.

SD-Access and 5G

Lastly, with SDN and NFV technology developments permeating most industry initiatives today, the 5G mobile network is no different. We can expect significant impacts across the core access network in the form of software-defined access (SD-Access). SD-Access represents an architectural shift from previous broadband and carrier Ethernet networks that have historically relied on closed, monolithic systems being managed by vendor-specific systems. Emerging practices in network management will enable mobile and fixed operators to vastly lower their cost to build, operate, innovate and maintain their network. For 5G specifically, SD-Access will create a more open, programmable and scalable broadband access architecture, one that will play a leading role in building the converged x-haul networks to support high-bandwidth connectivity.

SD-Access-based 10G PON networks offer service providers the performance and programmability to deploy converged residential, business and x-haul services while offering unprecedented advantages in economics and capacity—all of which supports further investment in the rollout of 5G. And as 5G is our future, 10G PON is the infrastructure technology best suited to deliver low latency, multi-gigabit services that will advance human progress through innovation.

THE 2019

INCOMPAS SHOW

NOVEMBER 4-6 | LOUISVILLE | KENTUCKY



THE STAKES ARE HIGH...

Gain the advantage and be a front runner in the communications market at The 2019 INCOMPAS Show

- Meet with top decision makers to generate new business deals
- Network and build valuable connections
- Stay at the forefront of the latest industry news and trends

Learn more at
SHOW.INCOMPAS.ORG



Leaders - Need It To Be A Big Year?

3 Essential tips to coach your team to success

By Brenda Abdilla
CEO
Management Momentum

One of my clients was recently promoted to Executive Vice President of her company. She credits her current success to the time and attention the CEO of the company invested in her very early in her career. She remarked that she has no idea how he found the time, as she struggles now to find time for her one-to-ones with her own team. "He just saw something in me for some reason and took time out to help me practice being good," she said. "He was so patient - much more patient than he usually is - and he let me take chances and make mistakes so that I could learn. I feel very grateful that he did that for me and it really set the bar for how I should be leading and coaching my own team."

Taking time to teach and coach your team seems like a luxury most leaders cannot afford, but research supports the time investment as expressed by Monique Valcour, Professor, EDHEC Business School, France: "Regular communication around development - having coaching conversations - is essential. In fact, according to recent research, the single most important managerial competency that separates highly effective managers from average ones is coaching."

Essential Tip #1 – Discern between coaching and other tools.

Tools commonly confused with coaching:

- **Advising/Directing** – Sometimes a situation requires straight-up advice, and coaching would be a waste of time and energy for everyone involved. If there is a logical right way—and wrong way—to do something, then simply be direct.
- **Discipline** – If you are observing behaviors that are unacceptable, then coaching is not the way to go. Where coaching is about asking good questions and allowing the recipient to come to their own conclusions, discipline is about a required behavioral change with clear consequences for non-compliance.
- **Mentoring** – Coaching, in our context here, is targeted to your direct reports or their direct reports and there is an expectation that the recipient of the coaching will be held accountable to the agreements made with their supervisor in the

coaching engagement, which is very different than a mentoring relationship.

Essential Tip #2-Improve your questions and your listening skills.

After spending hundreds of hours in coaching school I can share with you the inside secret to coaching: the secret is asking great questions. It's all about the questions! Now, of course, there is an art and a science to letting your question land in a timely way, and the tone of your voice and the intention behind your question are key as well - but those are all things you can work on over time. For now, the most important aspect of your coaching skill as a leader is asking a good question - instead of just talking - and becoming an excellent listener to the answers to your questions.

Keys to asking great questions:

- Ask questions that elicit dialog.
Hint: many questions are not really questions—they are invitations to elaborate. This takes practice.
- Listen for a good entry point for coaching. As your direct report is talking, train your brain to look for thinking patterns, such as stressful aspects of the work or project, or what is going well.
- Avoid leading questions and accountability questions. A leading question is when you already know the answer and you are trying to get the person to answer correctly. Example: Do you really think Judy belongs in your department? A better question to create dialogue is: Talk to me about your thinking on Judy as a fit for your department. An accountability question is inquiring about status such as: Where are you with the Greenburg data analysis? You can do better than that.

Don't give advice if you can help it. This is the most difficult aspect of coaching for leaders because of time constraints and general conditioning. The bottom line here is that if the person comes up with the idea or to-do list themselves, they are much more likely to do it. While you may feel a sense of accomplishment by telling them what to do, they are less likely to do it.

Essential Tip #3 – Dive right in and start today.

In most cases, you don't have to ask permission or set-up a formal coaching relationship with your direct report (see mentoring above) to get started. Let's say one of your key directors appears to be struggling with keeping his timelines on a big project that is highly visible in the organization. You suspect that his team is floundering, and you are hearing from your peers that he might be overwhelmed. In the last one-to-one you asked him if he needed help, and he insisted he was fine (typical response to a status question). To switch over to coaching, you could send him a meeting request and ask him to bring certain documents. When he arrives, ask him to set his phone to DND while you do the same and simply dive into a working session.

Ask your good questions and inform him you are here to help. Get him to talk. Working side by side with him and asking good questions while being patient with the process is coaching. That's it. It is not more complicated than that. If you have to switch gears and give some advice—tell him you are going to give advice, but otherwise remain in "coaching mode."

Why coaching works so well

If there is a magic to coaching I think it is this: Letting people talk out loud, uninterrupted, helps them organize their thinking in a way that nothing else does. In many cases we already have answers, process improvement ideas and wisdom relating to our leadership dilemmas, stalled projects, or prioritization issues, but they are trapped within our stressed-out brains.



Brenda Abdilla is a PCC level Executive & Leadership Coach. Her diverse client list ranges from the US Department of Justice, Medtronic, Cisco, the Women's Bar Association, Comcast to IHS Markit. Brenda also serves as the Professional Chair of a Women Presidents' Organization group in Denver. She is the author of three books, her most recent is *What's Your Lane: Career Clarity for Moms who Want to Work a Little, a Lot or Not at All*. Visit her site to take free assessments on your next Career Change, Working Style or Time Management issues. <https://managementmomentum.net/assessments/#freeassessments>

LET WALKER HELP YOU REDISCOVER YOUR NETWORK

with a Complimentary Fortinet
Cyber Threat Assessment

Fortinet Cyber Threat Assessment Program

Validate your network's security, performance and usage by enlisting guidance from Walker's Fortinet certified experts. Using a FortiGate Next Gen Firewall, we will monitor key indicators within your network evaluating security threats, user productivity, and network utilization. This non-intrusive assessment can be set-up and monitoring your network in less than 60 minutes using a passive span port. At the end of the evaluation, Walker will present a Cyber Threat Assessment Report highlighting the following:

Security and Threat Prevention

Learn more about what application vulnerabilities are attacking your network, which malware/botnets were detected and even pinpoint "at risk" devices within your network.

User Productivity

Discover how peer to peer, social media, instant messaging and other application subcategories are being utilized within your network.

Network Utilization and Performance

Find out more about your throughput, session and bandwidth requirements during peak hours.

Learn more about your network by registering today for a complimentary assessment, or forward this opportunity on to your Security Team members, CISO or CIO.

For quotes and more information on Fortinet products and solutions, contact your Walker sales associate at 1-800-WALKER1 or visit walkerfirst.com.

SCAN QR CODE TO REGISTER FOR COMPLIMENTARY ASSESSMENT



Celebrating Sales & Marketing Excellence

Walker's 2018 Sales and Marketing Performance Recognized by Manufacturer Community

By Randy Turner
Director, Marketing Communications
Walker and Associates

2018 marked another year of growth and new business opportunities between Walker and its manufacturer partners. Members of some of the industry's most elite manufacturer community gathered in Clearwater Beach, FL during the Walker and Associates Commercial Sales & Marketing Kick-off Meeting January 20-25 to recognize Walker's commercial sales and marketing leaders. As usual, presenters included highly recognized industry brands, underscoring the wealth of manufacturer relationships Walker offers its customers. Their recurring theme was an appreciation for the hard work, commitment, and determination demonstrated by Walker and its sales and marketing teams, who are recognized as trusted advisors, bringing systems solutions to a shared customer base.

The awards event was sponsored collectively by ADTRAN, ADVA Optical Networking, Ciena, CommScope, Corning, Fujitsu, Juniper Networks, and SmartRG.

Walker presented its annual Hank Ford Award to Kara Swanson, Corning Optical

Communications' Channel Manager for Walker. The Hank Ford Memorial Award is presented each year to recognize an individual who rises to the highest level of performance in support of product and event marketing, as well as their focus on best of breed channel marketing strategies. Kara has supported Walker since 2008, driving a growth rate of over 700% during her tenure. Her vital role in creating successful outcomes was noted earlier in her career when she received the same award in 2016, Kara's reputation for excellence, innovation, and leadership, clearly resonates with her industry peers, and her work alongside Walker's sales and marketing associates has been exceptional. Kara is moving on to new opportunities at Corning, and will be missed in her current role with Walker. Congratulations, Kara, on your achievements, and best wishes for great success in your new endeavors!

In addition to individual awards, Walker was recognized by ADTRAN as their Top Service Provider Distributor in 2018 marking the company's 16th consecu-

tive year achieving this status. The partnership between ADTRAN and Walker spans more than two decades, representing solid commitments to carriers throughout the US market. Walker's status as ADTRAN's largest global service provider distributor provides customers enormous value, including selection, availability, pricing, service and customer support.

ADVA Optical Networking recognized Walker as their ongoing Top Distributor in North American Markets. Walker's long-standing partnership with ADVA continues to accelerate, particularly with new industry innovations in virtualization and synchronization solutions. Their ongoing support and commitment to research and development accent their solid status as one of Walker's premier partners.

In addition to awards presented by manufacturer partners, Walker recognized associates in sales and marketing for their performance during 2018. The President's Citation Award was presented to OEM Development Managers who reached 100% of their annual plan, and sales associates were recognized for their leadership in sales and profit goals attainment. These awards included Inside Salesperson of the Year, Field Salesperson of the Year, and recognition of salespeople achieving 100% of their 2018 sales plan.

The evening included comments from Chrystie Walker-Brown, company CEO, and Mark Walker, company President. They expressed appreciation for strong partnerships with manufacturers, commitment by associates, and acknowledgement of a strong team of collaboration and innovation between Walker and its healthy list of manufacturer partners. A challenge was issued to rise to challenges and opportunities ahead in 2019 as the company moves toward its 50th anniversary in 2020.

Below - Hank Ford Award Presentation, pictured left to right: Trey Hall, Steve Mitchell, Kara Swanson, Mark Walker.



In the Spotlight

By Randy Turner
Director, Marketing Communications
Walker and Associates



STAN FEDYNYSHYN joins Walker and Associates as Regional Account Manager in the northeast. Stan has been in the telecom industry for 35 years and has held several positions while advancing his career. Previously he held a Product Line Management and National Account Executive position at Champion ONE. Prior to Champion ONE he was an Account Manager with Adtran for almost 13 years with increasing responsibilities supporting a large service provider. Stan started his career with Telco Systems which extended for 20 years in several positions from Field Systems Engineering, Product Support, Lab Manager, Sales Engineering to sales as Director of Major Accounts.

Stan can be reached by email at stan.fedynyshyn@walkerfirst.com or by phone at 336-731-5434.



JOHN PETER joins Walker and Associates as a Regional Account Manager responsible for sales account development in Minnesota, Iowa and Wisconsin.

For over 22 years, John has provided industry-leading solutions to service providers, utilities and enterprises in the Upper Midwest. He held various positions, spending 10 years with Solunet, advancing from Sr. Account Manager to Sr. Solutions Consultant, providing integrated solutions from Juniper, Cisco, Brocade, Adtran and ADVA. As a Sr. Director of Sales for Fujitsu and RAD, John consulted with customers to design and deploy systems for critical infrastructure applications to meet the demanding requirements of the utility, public safety, state/local government and transportation market sectors.

John can be reached by email at john.petery@walkerfirst.com or by phone at 336-731-5426.



DAVID DOBRY joins Walker and Associates as Federal Account Manager for Navy/USMC Southeast. Dave has directly supported Space and Naval Warfare Systems Command, Atlantic (SPAWAR LANT) for over 21 years, including Navy and Marine Corps Tactical Mobile (TacMobile) systems, Air Traffic Control, and FBI SOA systems. A 12-year Navy Veteran, Dave brings a wealth of experience as the former VP of Operations for L-3 Communications in Charleston, SC, responsible for a 300+ employee operation generating over \$35M in yearly revenue. He also successfully established local offices for Imagine One Technology & Management, LTD, and Spry Methods, Inc. Both continue to be successful small businesses supporting SPAWAR.

Dave served as a Director of the Charleston Defense Contractor's Association (CDCA) for 7 years, and founded the highly successful CDCA Small Business and Industry Outreach Initiative (SBIOI), which is soon holding its 50th Quarterly Symposium, recognized as the official forum for SPAWAR industry engagement. The CDCA SBIOI has introduced over 500 new small businesses to the Charleston/SPAWAR market.

Dave also served from year one as the Co-Chair and production lead of the CDCA Government/Industry Partnership Summit for 10 years, now the largest Defense Summit on the east coast.

Dave can be reached at dave.dobry@walkerfirst.com, or by phone at 843-818-9976

MEGHAN ROBESON-POOLE joins Walker and Associates as an Inside Sales Executive for the Midwest. Meghan has been with Walker and Associates for almost two years. She started her career with Walker as a Customer Service Representative supporting our Inside Sales Team and quickly moved into the Sales Executive position. Prior to Walker, Meghan was an Operations Manager for 16 years at

a map publishing company located in North Carolina.

Meghan can be reached by email at Meghan.Robeson-Poole@WalkerFirst.com or by phone at 336-731-5329



TOM STRANGI has joined Walker and Associates as Director of Sales, East Region, managing Regional Account Managers who cover all commercial accounts in the eastern US. Prior to joining Walker, Tom worked in the telecommunications industry since 1980, with more than 20 years at ALLTEL, 2 years at Telco Systems, and most recently, 16 years at ADTRAN. Serving in several VP positions at ALLTEL and Telco Systems, and Sr. Director of Sales at ADTRAN, he is an accomplished sales leader with extensive experience developing and leading high performing teams to uncover business needs and identify solutions for broadband networking challenges faced in today's competitive market. Tom graduated from Texas at Arlington with a BBA in Accounting, and currently resides in Johns Creek, GA.

Connect with Tom by email at tom.strangi@walkerfirst.com, or by phone at 336.731.5437.



CINDY SHOAF has been promoted to the position of Customer Service Representative (SCR) Supervisor at Walker. In her new role she manages a team of CSR agents who support sales with back office responsibilities that directly impact customer satisfaction. Cindy previously worked as a CSR at Walker, and her familiarity with the responsibilities of CSRs and the importance of their work, provides her a solid background in her new leadership role. She manages her department at Walker's corporate headquarters location in Welcome, NC.

Cindy can be contacted by email at cindy.shoaf@walkerfirst.com, or by phone at 336.731.5265,



Jerry Jones was presented with the Juniper Networks Ingenious Champion of the Year award for the Americas theater, at Juniper Americas Tech Fest in Phoenix, AZ, Jerry was the sole recipient of this award from among nearly 400 Ingenious Champions in the theater.

Per Michael D. Messina, Systems Engineering Director, Americas Partners, Juniper Networks, "Jerry embodies the collaborative spirit and technical expertise of an Ingenious Champion. His Juniper advocacy and pre-sales opportunity support have led to significant business growth with Walker's and Juniper's joint customers, leading to strong increases in mindshare in the Tier2/Tier 3 Service Provider space and quadrupling Walker's Juniper security business in the span of 2 years. His forward-looking mindset has proven invaluable in driving opportunities around CSO and SD-WAN. Jerry's technical acumen and trusted advisor status with customers have made him a household name across the field sales teams in the US."

Jerry Jones has been a Field Sales Engineer with Walker and Associates since 2011, supporting customers as they scope network security upgrades. Congratulations Jerry!



Jerry Jones, pictured left, with Mike Messina, Partner Systems Engineering Director with Juniper Networks during Walker's Annual Commercial Sales & Marketing Kick-off Meeting in January.



— REGISTER NOW —

AUSTIN

APRIL 8 – 11, 2019

Renaissance Hotel – Austin, Texas



FIBER: PUTTING YOUR GIGS TO WORK

As the leading conference on broadband technologies for communities, the **Broadband Communities Summit** attracts broadband system operators, network builders and deployers of all kinds. Many of the country's major property owners and real estate developers attend the Summit each year, along with independent telcos and cable companies, municipal and state officials, community leaders and economic development professionals.

SPECIAL DISCOUNTED RATE

Exclusively for
SkinnyWire Readers

\$485

Use VIP Code: **SkinnyWire485**

(Save \$465 off regular Summit price of \$950)

Offer expires March 29, 2019

Offer good for new registrations only.

TO SPONSOR OR EXHIBIT:

email: irene@bbcmag.com | phone: 505-867-3299

 twitter.com/bbcmag








www.bbcmag.com

877-588-1649



ADVERTISER INDEX

Thanks to our advertisers. Contact SWEditor@walkerfirst.com for information on advertising opportunities in upcoming issues.

ADVERTISER	PAGE #	URL
	8	http://www.adtran.com/
	18	https://www.advaoptical.com/en
	Back Cover	https://www.ciena.com/
COMMSCOPE®	Center Spread	https://www.commscope.com/
CORNING	12	https://www.corning.com/worldwide/en/products/communication-networks/products.html
	Inside Front Cover	http://www.fujitsu.com/us/products/network/
	31	https://www.werackyourworld.com
	36	https://ixiacom.com
	Inside Back Cover	https://www.juniper.net/us/en/

CONNECT

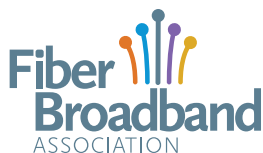


As an active member of multiple state, regional and national industry associations, Walker and Associates is strategically engaged with organizations supporting telecommunications markets. We demonstrate our commitment through event sponsorships, contributing educational content and advertising, and exhibiting at conferences and expos.

Look for us at the events listed here, and refer to the Upcoming Events section of our website, <http://walkerfirst.com>, for additional details.

We look forward to seeing you at these events!

Proud Member of:



FEBRUARY 2019	
* AFCEA West	San Diego, CA
* UTC Region 8/9/10	Reno, NV
* UTC Region 7	Houston, TX
GTA Vendor Showcase	Macon, GA
* FISPA Live	Nashville, TN
Telecom Training & Safety Conference	Bismarck, ND
MARCH 2019	
NTA Technology Day	Grand Isle, NE
* UTC Region 3	Columbia, SC
* ITA Showcase NW	Portland, OR
NRECA TechAdvantage	Orlando, FL
* Big Sky Tech Fest	Harve, MT
MTA Annual Convention	Minneapolis, MN
AFCEA Belvoir Industry Days	National Harbor, MD
TechNet Ft. Bragg	Ft. Bragg, NC
* UTC Region 6	Overland Park, KS
* ICA Annual Meeting and Expo	Des Moines, IA
APRIL 2019	
SCTBA Annual Convention	Charleston, SC
TANE Spring Symposium	South Portland, ME
* TCEI Expo	Belton, TX
* CalCom Showcase and Tech Expo	Sacramento, CA
Broadband Communities Summit	Austin, TX
* FNA Conference Summit	Jekyll Island, GA
OTA Annual Convention	Columbus, OH
IBTA Spring Meeting	Noblesville, IN
OTA Outside Plant Seminar	Newport, OR
MAY 2019	
NDTA TOC Conference and Showcase	Fargo, ND
* AFCEA TechNet Cyber	Baltimore, MD
ATA Annual Meeting	Valdez, AK
WSTA Annual Convention	Lake Geneva, WI
NTA Spring Conference	Lincoln, NE
KTA Annual Meeting	Lexington, KY
JUNE 2019	
OTA / ATA Summer Conference	St. Louis, MO
* Fiber Connect	Orlando, FL
IBTA Annual Convention	French Lick, IN
OTA/WITA Joint Annual Meeting	Gleneden Beach, OR
INDATEL	Indianapolis, IN
NYSTA Annual Conference	Clayton, NY
ITA Annual Convention	Osage Beach, MO
* UTC Telecom and Technology	Fort Worth, TX
Tri State Telecom Conference (NC, SC, VA)	Wrightsville Beach, NC

* - Indicates Walker and Associates is an event sponsor

Multiple levels of encryption.

Integrated broadband and wireless connectivity.

Scale across multi-tenanted environments.

NOT ALL SD-WAN SOLUTIONS ARE CREATED EQUAL.

WAN requirements are changing as traffic increases and enterprises seize the benefits of the cloud. SD-WAN is in demand as a more flexible, intelligent, and cost-effective way to route traffic. This burgeoning market presents new revenue opportunities that you can't overlook.

Learn how to start up new services with Juniper's SD-WAN now.

juniper.net

JUNIPER
NETWORKS®

Engineering
Simplicity



THE ADAPTIVE NETWORK™

The future of networking is here

Industry-leading networking solutions and open software principles to redefine how you do business, enabling you to:

- **Power massive bandwidth and service agility** with Waveserver® Ai 's next-gen programmable 400G
- **Adapt to changing network demands** by leveraging intelligent automation and open APIs
- **Gain real-time visibility into network performance and improve scalability** with Liquid Spectrum™



Walker and Associates, Inc.

PO Box 1029

7129 Old Hwy 52

Welcome, NC 27374