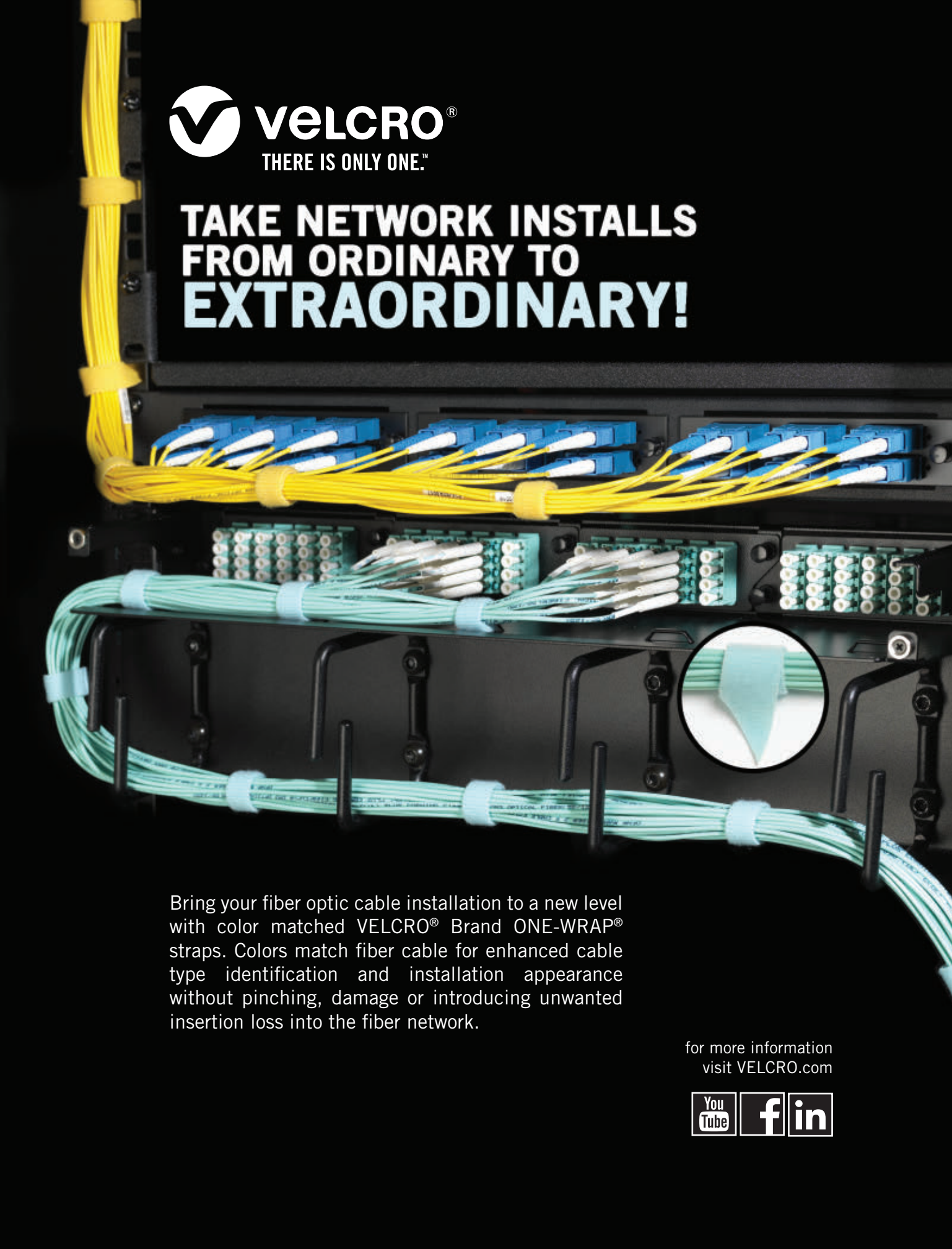
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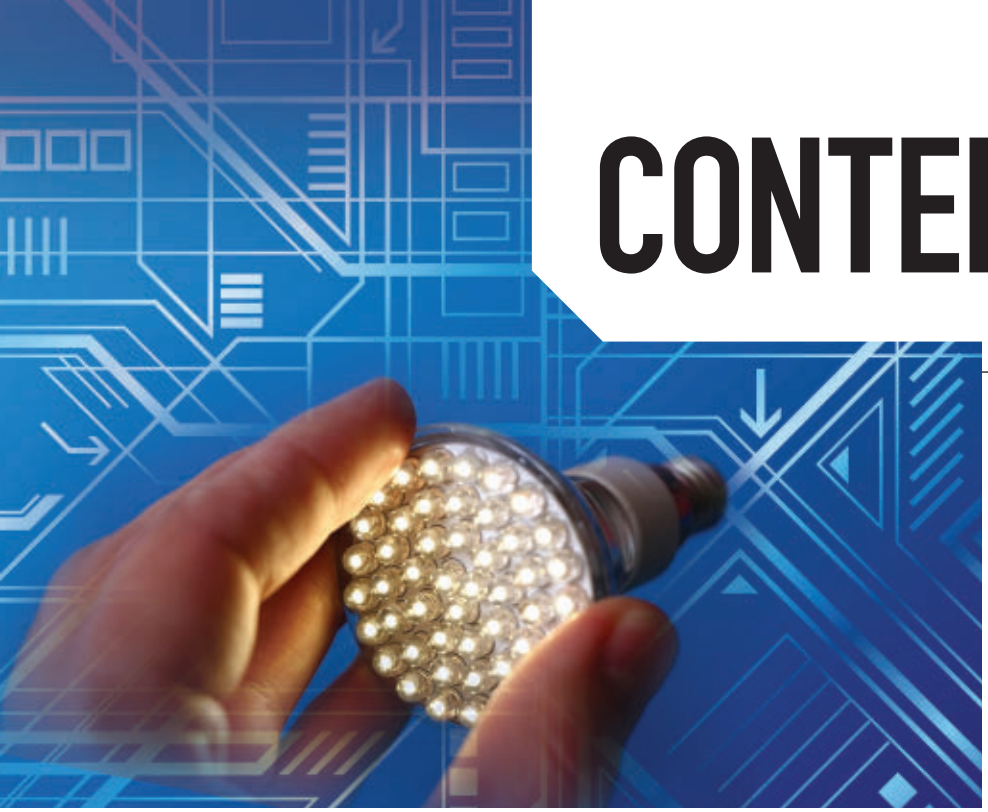

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Why indoor cell coverage is a lot like Festivus

PATRICK McLAUGHLIN
patrick@pennwell.com

While reviewing the article in this issue authored by Karl Griffith ("Improving wireless coverage in smaller buildings," page 9), the state of in-building cellular coverage kept reminding me of Festivus, the holiday that Seinfeld made famous.

If you're not familiar, Festivus is a fictional observance held in late December as something of a protest against the commercialization of Christmas. As such, it was referred to as "A Festivus for the rest of us." The sitcom Seinfeld's popularity put Festivus on the cultural map, where it remains for many.

I couldn't shake the parallels between Festivus and in-building cellular wireless connectivity. If you haven't read Griffith's article, please do, then return to this page and decide if you, too, notice similarities. Here's what I see.

Airing of grievances. Frank Costanza told his guests, "I got a lot of problems with you people. Now, you're gonna hear about them." In many commercial office buildings, you don't have to go too far or listen too long before hearing someone complain about the lack of a wireless-carrier signal. Or see someone run to a window or door so they don't drop their call. And I, as a mobile-phone user, "got a lot of problems" with this reality.

The Festivus pole. The undecorated pole stands solemnly in a corner, in keeping with the holiday's no-frills theme. As Griffith points out, a primary component in a cell phone signal booster system is an outdoor omnidirectional antenna. Google "Festivus pole," then Google "outdoor omnidirectional antenna." Look at the images that come up. You tell me.

Feats of strength. The feats of strength ceremony ends when the head of the host household is pinned by a guest. Installing a consumer signal booster system requires not so much strength, but certainly well-pinned-down and skilled installation capability. Plus, "A handheld RF signal ***strength*** meter is used to measure ... PCS/cellular frequency signal *strength*." Coincidence?

For the rest of us. Like Christmas, active DAS networks get a lot of publicity (including, full disclosure, in this magazine). But as Griffith points out, these systems often do not easily scale downward to meet the needs of the many smaller commercial office buildings in the U.S. The signal-booster systems he describes are, literally, for the rest of us who office in smaller spaces.

So what do you think? Is it me, or are the parallels really there?

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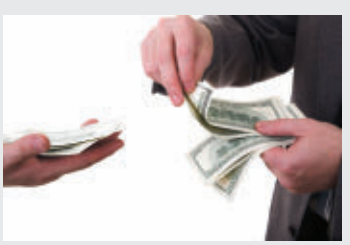

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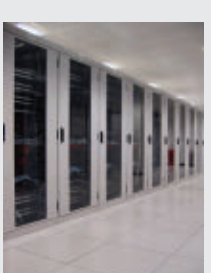

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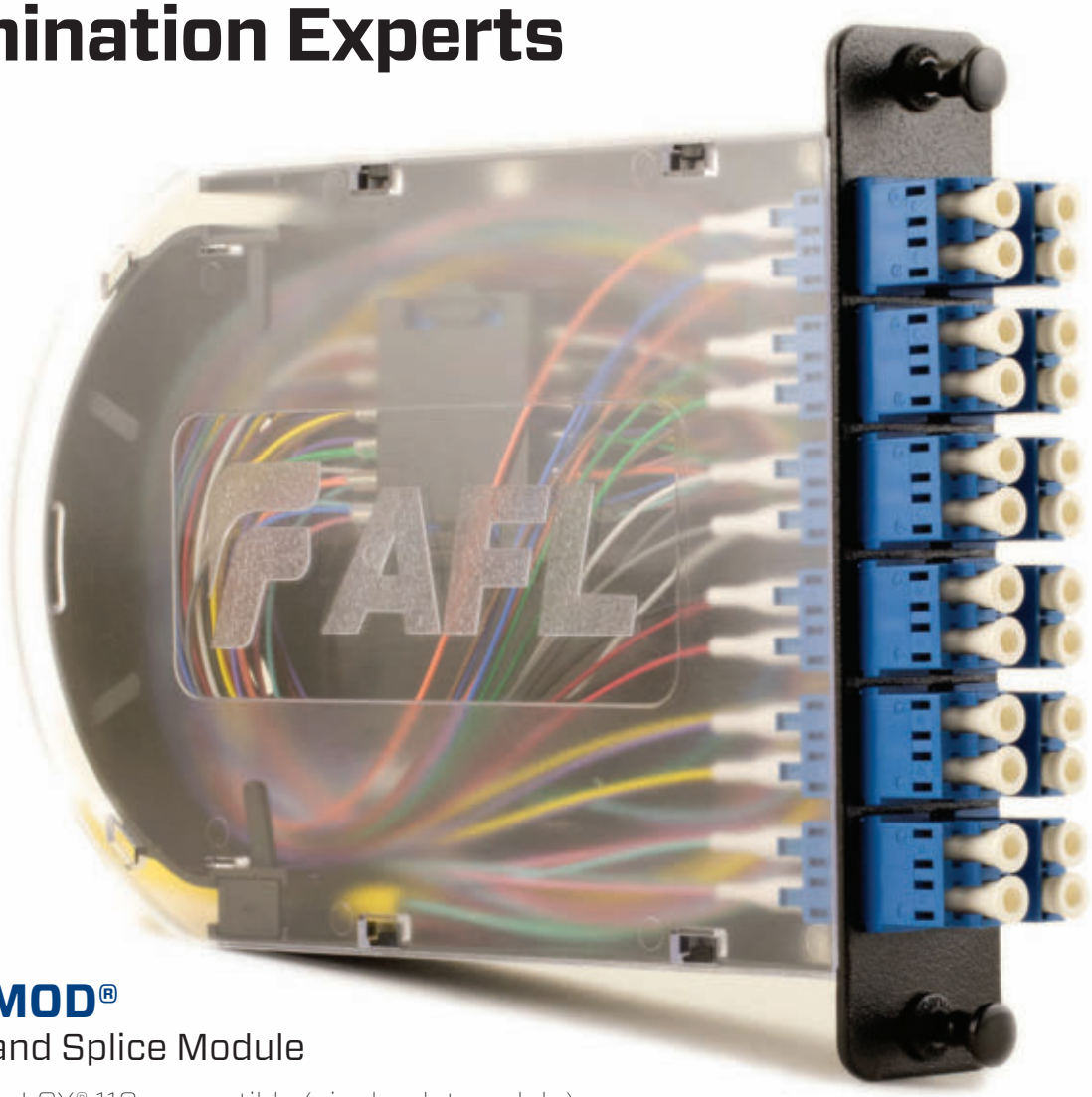

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What's the right cabling infrastructure for enterprise wireless networking?

High-performance cabling is required to provide sufficient backhaul for wireless applications.

BY MASOOD SHARIFF, COMMSCOPE

Wireless networking technology in the enterprise requires cabling, and there are several solutions offered by wireless networking vendors. Which one makes the most sense? In this article we'll look at the pros and cons of coaxial cabling, optical cabling, and Category 6 or Category 6A cabling for wireless networking.

Which wireless?

In many cases, the choice of cabling will be dictated by the type of wireless system being deployed. Enterprise WiFi systems typically use balanced twisted-pair cabling such as Category 6 or Category 6A, while distributed antenna systems (DAS) for mobile phone coverage can use coaxial cabling, Category 6/6A, or fiber. Small cells are another option for mobile phone coverage in smaller (less than 50,000 square feet) enterprise buildings, and these connect with Category 5e or fiber.

While it seems beneficial to integrate these disparate wireless solutions on one network with a common cabling infrastructure like Category 6/6A or fiber, or even on the same network as the one used for data in the enterprise, such integration is complicated for many reasons, some of which are discussed below.

Disparate antenna placements—WiFi, DAS, and small cell networks may have different placement maps for access points. For example, a typical WiFi system might have access points laid out in a grid with cells 18 meters wide, while a high-power DAS might have antennas located in cells that can be up to 200 or more meters wide. Even low-power DAS antennas may have much larger coverage areas than wireless access points (WAPs), though in the 5-GHz band, the difference is not that significant. Readers should refer to TIA TSB-162-A for more details, and look for TIA TSB-5018, which has been approved for publication.

Different protocols—Legacy WiFi uses CSMA/CA protocol, while DAS uses digitized RF, and small cells use IP/Ethernet packet data. Running multiple protocols over the same cabling infrastructure is complicated but possible.

Low-power digital DAS and small cell technology use structured cabling. Currently, high-power digital DAS uses coaxial cabling. On the network switch level, there are several factors influencing the choice of cabling. First, it depends on the technology used. Some small cell systems use the same Ethernet switch as IT. So running on the same IT Ethernet LAN is possible using VLAN protocol. However, since the operator owns the cellular frequency band, operator agreement is required especially for maintenance purposes. Other technologies such as digital DAS and remote radio head (RRH) do not use Ethernet switches even though the equipment has Ethernet ports. So running over the same IT Ethernet LAN is not possible except where a bypass card is provided.

Requirements for enterprise cabling

Wireless or not, network managers consider several factors when selecting cabling systems within an enterprise, including suitability for the application, cost, familiarity, and longevity.

Application suitability—Naturally, the cabling system should support the wireless application. As wireless LANs move to 802.11ac (with a top data rate of 6.9 gigabits per second) and DAS platforms move to carrying 4G, and eventually 5G, traffic at up to 10 Gbits/sec and possibly more, network managers will need cabling that can handle these higher data rates. For twisted pair, the industry is rapidly converging on Category 6A cabling as the most suitable media to support wireless access points.

Cost—Twisted-pair (copper) cabling systems are lower cost than equivalent fiber systems when the associated active equipment and installation costs are also included in the cost comparison. The cost of the fiber cabling or twisted-pair cabling alone is comparable but installation labor rates are higher for fiber systems. Overall, there is a significant cost premium for fiber solutions over copper solutions.

Familiarity—Enterprise IT managers are very familiar with using twisted-pair cabling systems and the introduction of coaxial cabling systems to support wireless systems complicates design, support and maintenance processes.

Longevity—Generally speaking, IT managers should put in the best cabling systems on day one. Cabling infrastructure has multi-generational utility; they can support today's applications as well as the next one or two generations forward. Using Category 6A and fiber allows IT managers to provision for the future needs of wireless applications and migrate upwards without ripping and replacing cabling infrastructure.

Cabling systems compared

Since fiber and Category 6/6A are the two cabling types that meet all enterprise buying criteria, we will focus on these and compare their capabilities.

Category 6 cabling provides performance of up to 250 MHz over distances of up to 100 meters. For the 100-meter maximum channel distance specified in standards, Category 6 cabling can support Ethernet speeds up to 1 Gbit/sec. Although it can also support the emerging 2.5-Gbit/sec and 5-Gbit/sec Ethernet speeds, because it lacks alien-crosstalk specification, some use cases may not be supported or may be distance-limited.

Category 6A cabling delivers performance of up to 500 MHz over distances of up to 100 meters. For the 100-meter maximum channel distance specified in standards, Category 6A cabling is the media of choice in new installations to support Ethernet speeds higher than 1 Gbit/sec, including full support of 2.5 Gbits/sec, 5 Gbits/sec and 10 Gbits/sec.

Both Category 6 and Category 6A use standard RJ-45 connectors and support Power over Ethernet (PoE), which delivers 13 or 25 (PoE Plus) watts of power over 100 meters. Many WAPs can be powered this way, eliminating the necessity of providing a local power source at each WAP location. Some small cells also use PoE. When supporting PoE, Category 6A is often preferred due to the lower temperature rise in cable bundles.

Multimode fiber is typically used for the backbone cabling in wireless network deployments in enterprises, as it supports run lengths of up to 550 meters. Newer deployments often use laser-optimized 50/125-micron multimode fiber (OM3 or OM4). Fibers that meet this designation provide sufficient bandwidth to support 10-Gigabit Ethernet up to 300 meters for OM3 and up to 400 meters for OM4. When using multimode fiber to the WAP, power for the WAP, small cell or distributed antenna unit must be provided separately. ◆

Masood Shariff *is a senior principal engineer in the systems engineering group of CommScope (www.commscope.com). He represents CommScope in the ISO WG3 committee, as well as several TIA TR-42 subcommittees. He served as chair of TR-42.7 for many years. Currently he serves as chair of the committee revising TSB-162, covering cabling guidelines for wireless access points; and as chair of the committee that developed the TIA-5016 Physical Network Security standard.*

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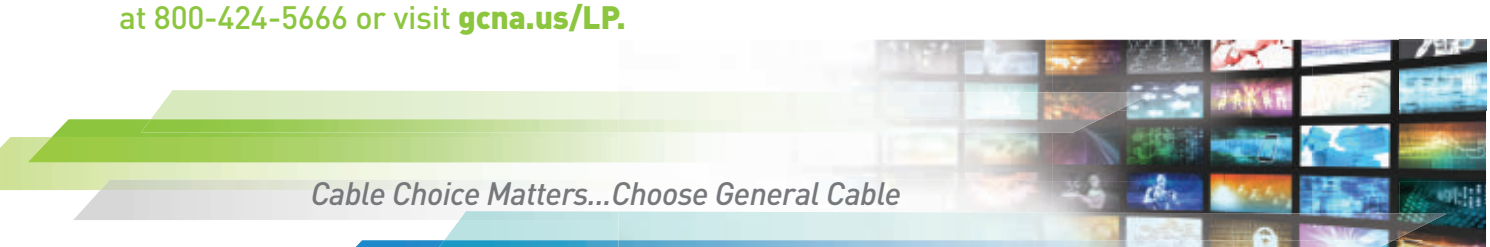

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Improving wireless coverage in smaller buildings

Consumer signal boosters are an approved and appropriate option for commercial use.

BY KARL GRIFFITH

Many times budget constraints prevent us from solving our client's cellular reception problems. The installed cost of an active distributed antenna system (DAS) coupled with the lack of carrier funding is usually the issue. Active DAS solutions are better suited to serve large buildings and venues with large user counts. They are ideal for taking the load off of a cellular service provider's macro network. A problem exists because active DAS solutions do not easily scale downward to satisfy the needs of smaller buildings, smaller spaces, and smaller user counts. Fortunately, there is a Federal Communications Commission (FCC) approved, passive DAS solution known as consumer signal booster that may fit the need of many smaller enterprises. The consumer signal booster is less expensive than an active DAS and consumer signal boosters also come in commercial versions that can be specified, designed, and installed by cabling contractors and integrators.

SureCall's Force5 cell phone signal booster system, pictured here, is an example of a kit that includes a 5-band signal booster unit designed for use with all major wireless providers. The kit also includes an outdoor omnidirectional antenna, an indoor antenna, and preconnectorized 50-ohm cables.

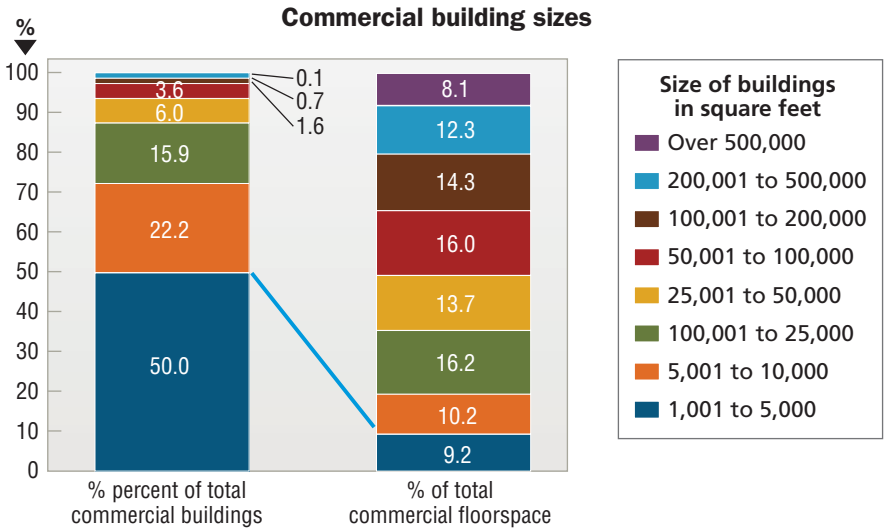
By definition a signal booster amplifies the wireless signal that is received from a donor antenna and distributes the amplified signal via coaxial cable to indoor antennas serving weak signal areas in a building. Other terms for these devices are repeaters, amplifiers, or passive DAS. Their use is limited to Cellular (Part 22), Broadband PCS (Part 24), AWS-1, 700-MHz Lower A-E Blocks, 700-MHz Upper C Block (Part 27) and Specialized Mobile Radio (Part 90).

This is different from an active DAS, which has centralized base station permitting (network aware) direct connections from multiple carriers each with their own input port. The input signals are combined, processed, and distributed typically with optical fiber to strategically placed powered remote units connected to the indoor antennas. The remote units eliminate cable attenuation regardless of the distance from the base station. These systems have extensive end-to-end monitoring and remote management. Design and installation is restricted to the wireless service provider's licensees and their qualified installers.

Following are a few examples where smaller, scalable DAS solutions are needed.

- Smaller buildings constructed with materials such as steel, concrete, and low-energy glass hampering cellular reception
- Buildings in which cellular service is inadequate in part of the building, but not the entire building
- Leased space in a building and the building owner will not invest in a DAS solution for the tenants
- Large campuses with low signal strength in a few buildings but not all buildings
- Buildings in underserved rural areas

The need for robust cellular connectivity is more than a convenience. Dropped



Source: U.S. Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey

This chart from the U.S. Energy Administration shows that as of 2012, 88 percent of commercial buildings are 25,000 square feet or smaller. Many of these structures can benefit from obtaining cellular-service coverage through consumer signal boosters.

calls, reduced data rates and loss of service are all problems that must be addressed. Quality wireless service is a necessity. Forty-six percent of U.S. cellphone users state they "couldn't live without" their cell phone according to the Pew Research 2014 American Trends Panel survey. Every day, decisions are being made to move and relocate to satisfy the wireless connectivity needs of building owners, employees, tenants, and customers. Small and medium businesses have the same operational business needs as large enterprises.

The U.S. commercial building inventory is mostly smaller buildings. The U.S. Energy Administration 2012 Commercial Building Energy Consumption Survey indicates 88 percent of commercial buildings are 25,000 square feet or smaller. These buildings represent more than 35 percent of the total commercial floor space. Also noteworthy, commercial buildings constructed between 2000 and 2012 average 19,000 square feet. Obviously, there is a large service area/market requiring improved cellular coverage in this building category.

With the above understanding, as well as ensuring wireless networks are not adversely affected by signal boosters, the FCC developed the "Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters (WT Docket No. 10-4, Document No. FCC 13-21)." This "Report and Order" dated February 20, 2013 is the new federal regulatory requirement providing the technical, operational, and registration rules for low power signal boosters. All signal boosters sold and marketed after May 1, 2014 must comply. The "Report and Order" was developed with consensus of the major wireless service providers (carriers), industry associations, and manufacturers. Some of the participants in the process included the Association for Information Communications Technology Professionals (ACUTA), The Wireless Association (CTIA), The HetNet Forum (formerly The DAS Forum), The Wireless Infrastructure Association (CTIA), and The Telecommunications Industry Association (TIA).

Consumer signal boosters come in various designs to perform specific functions. These are: 1) mobile/vehicle, 2) home/personal workspace, 3) small and medium businesses (SMB), 4) commercial, 5) machine to machine (M2M).

Commercial use

Confusion may exist because of the FCC's use of the term "consumer" in the document. Some may equate the word "consumer" with "residential." This is not the case. The FCC rules do not have specific prohibitions restricting commercial use of consumer signal boosters to a specific building type. In fact, the document (Section 1, Paragraph 4) clearly states the FCC will conduct outreach to educate small business on the consumer signal booster regulatory framework. Manufacturers of consumer signal boosters have kitted solutions specifically designed for commercial use. The basic kits include a five-band signal booster unit designed for use with all major wireless service providers. The kits also include an outdoor (donor) omnidirectional antenna, an indoor antenna, and preconnectorized 50-ohm cables. Directional yagi donor antenna systems are also available.

Additional antennas, cables, and coupling components may be added to the consumer signal booster. These system-expansion accessories are also part of the manufacturer's pre-engineered solution approved by the FCC. Unauthorized accessories are prohibited as they may alter the gain at the antenna and may increase the potential for interference. Technical resources are available from the manufacturers to assist with system expansion so adequate signal can be provided to underserved areas in a building. Iain Gillott, founder

and president of iGR, a market research consultancy focused on the wireless and mobile industry, puts it this way: "Signal boosters are a valid and beneficial part of the het-net [heterogeneous network]. They provide a solution to a specific problem—how to cost-effectively extend coverage to outlying areas of a building."

Consumer signal boosters designed for commercial use are ideal for cabling contractors. The installation can become extremely complex very quickly for end users. The commercial solution requires mounting an outdoor donor antenna on the roof or side of the building. A handheld RF signal strength meter is used to measure 4G LTE and 2G-3G PCS/cellular frequency signal strength. Data from the meter helps the contractor determine the best location and direction of the donor antenna.

The outdoor donor antenna cabling must be routed to the indoor signal booster location. Each indoor antenna requires a cable pathway, which may pass through risers, ceilings and plenum spaces. Power is also required near the signal booster. Clearly these installations require the services of structured cabling infrastructure professionals with commercial building experience. Manufacturers of commercial consumer signal boosters welcome trained and credentialed contractors to specify and install commercial consumer signal booster systems. As incentive, they are offering installer programs and training. Iain Gillott also states, "Enterprises have many options to providing wireless coverage in a building, including WiFi. Signal boosters have several benefits, especially that they can be installed without specific RF expertise and without the assistance of a mobile operator."

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FCC compliance requirements

These solutions are pre-engineered and are designed to operate "out of the box" without "fine tuning" or adjustments. They must comply with the FCC Network Protection Standard (NPS). The standard outlines the built-in technical safeguards to protect against network and adjacent channel interference,

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oscillation and cell site signal overload. Specifically, the standard requires the consumer signal boosters comply with the technical parameters of the spectrum band they operate in, self-monitor and automatically shut down if not in compliance with the standard. They are also required to automatically detect and correct oscillations that may occur in the uplink and downlink, and shut down when the signal booster is not needed. They must have interference avoidance features and the compliance features cannot be easily defeated. Consumer signal boosters must also be certified to ensure they meet the rules outlined in the FCC Report and Order. A list of all FCC-approved devices (so far) was published February 8, 2016 and is available on the FCC website.

All consumer signal boosters must be registered with the wireless service providers. This registration is also a "condition of authorization" or consent to operate the signal booster. Practically, this rule provides the wireless providers the ability to locate, notify the owner, and shut down a signal booster if it interferes with their network. Registration is an online process. Each wireless service provider has a website and procedure to facilitate the registration and offer consent to operate.

The consumer signal booster manufacturers must provide specific labeling indicating the installed device is a consumer device. The labeling must appear on the device, the packaging, the owner's manual, installation instructions and marketing materials. Label language as specified by the FCC follows.

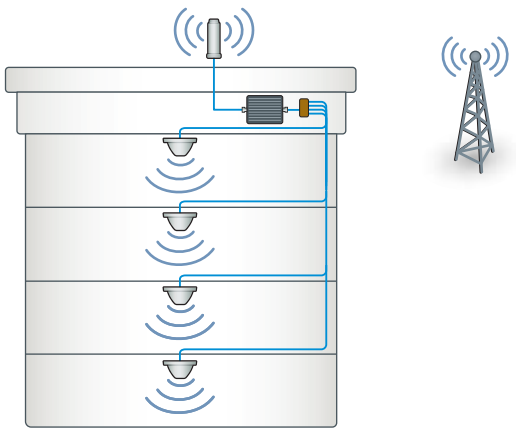
This is a CONSUMER device. BEFORE USE, you MUST REGISTER THE DEVICE with your wireless provider and have your provider's consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their network. If you are unsure, contact your provider.

You MUST operate this device with approved antennas and cables as specified by the manufacturer. Antennas MUST be installed at least 20 cm (8 inches) from any person.

You MUST cease operating this device immediately if requested by the FCC or a licensed wireless service provider.

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this device.

Consumer signal booster system deployment



This schematic, provided by SureCall, shows how a passive DAS, such as a consumer signal booster solution, serves a small to medium sized commercial building. Despite the word "consumer" in its name, a consumer signal booster solution is appropriate for use in several types of commercial environments.

The FCC Report and Order also provides information and guidance for industrial signal boosters. The category industrial signal booster represents all signal boosters other than consumer signal boosters. Industrial signal boosters are also passive DAS solutions. They are very similar to the consumer signal booster, except they have higher gain and output power and are more designed to serve larger buildings and venues with large user counts. Similar to active DAS solutions, their installation is restricted to the wireless licensees and their qualified installers. They may only be installed with "explicit" wireless licensee consent and close wireless service provider (carrier) coordination. These systems are widely deployed today.

Additional and more-detailed information is available from the following resources.

- FCC Report and Order (106 pages): fcc.gov/document/use-and-design-signal-boosters-report-and-order
- The FCC Signal Booster website: fcc.gov/wireless-telecommunications/signal-boosters/general/consumer-signal-boosters
- The list of approved Signal Boosters: https://apps.fcc.gov/edocs_public/attachmatch/DA-16-137A1_Rcd.pdf
- The FCC Electronic Comment Filing System, ECFS 3.0. Here you can find all the docketed proceedings including notices and comments for wireless signal boosters. fcc.gov/ecfs/search/filings?proceedings_name=10-4 ◆

Karl Griffith *serves manufacturers, distributors, installers, and consumers in the communication connectivity supply chain through his company Karl Griffith Consulting, LLC. He retired in April 2016 after 39 years with Graybar Electric Company. He served his last 25 years at Graybar in corporate marketing as a product specialist, market manager, and director of emerging technology. He also served two terms on BICSI's board of directors and holds the Registered Communications Distribution Designer (RCDD) credential. Griffith welcomes inquiries and comments at karl@karlgriffith.com.*

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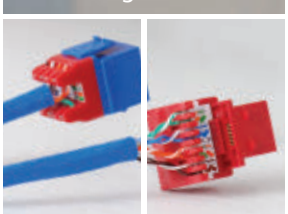

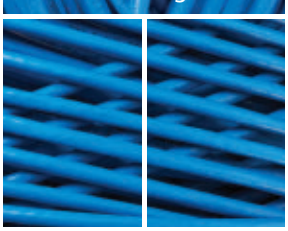

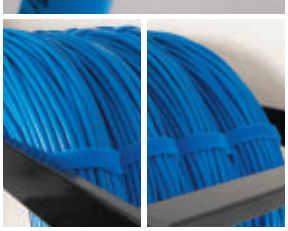

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Five key considerations for implementing railway passenger WiFi networks

The complex design process requires consideration of network reliability, data rate, load balancing, security and other characteristics.

BY ZED SHEN, MOXA

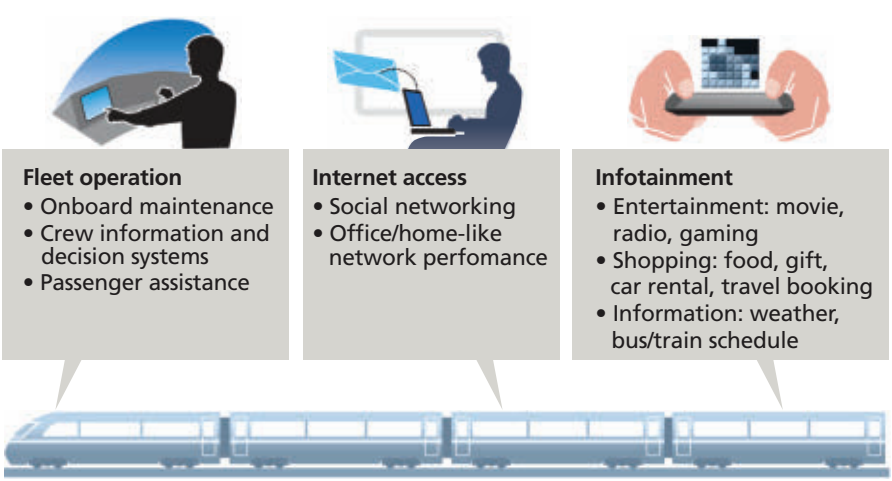
In recent years, the use of mobile devices for information and communication has changed passengers' expectations about railway travel. As well as expecting a comfortable journey, passengers are increasingly demanding Internet access and the ability to work on board, to make efficient use of their travel time.

According to a railway industry survey, 65 percent of the respondents plan to provide WiFi connectivity to passengers by the end of 2016 and 60 percent expect to provide content over WiFi within five years.

Beyond simple Internet access, railway operators have also begun to recognize that they can leverage on-board WiFi networks to support a variety of operational and passenger infotainment applications. A digitally connected fleet enables real-time system status reporting and better information flow. These services make operations more efficient, reducing costs, improving service quality, and raising customer satisfaction.

Connecting hundreds of passengers to the Internet at the same time is a daunting task, far harder than operating a simple home or office WiFi network. This article discusses the challenges of on-board WiFi networks and the top five considerations for selecting products to serve a high-density WiFi environment.

Applications of on-board WiFi



A digitally connected railway fleet enables real-time system status reporting and better information flow. These services make operations more efficient, reducing costs, improving service quality, and raising customer satisfaction.

Challenges of a high-density on-board WiFi network

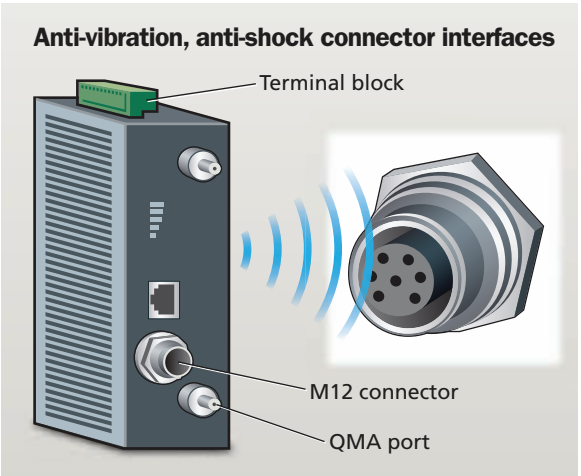
The huge growth in use of smartphones and WiFi-enabled mobile devices is the catalyst for the increased usage and ubiquity of WiFi connectivity in public places. In response to the explosive growth in data volume, service providers are offloading traffic from their cellular networks to WiFi networks. Additionally, the changes in user behavior and data network landscape have created a huge challenge for railway operators: to provide enough bandwidth for each passenger in a high-density environment. A traditional enterprise WiFi deployment—just aiming to provide coverage—is no longer enough. In a high-density WiFi infrastructure, operators must look for a solution that

combines coverage, bandwidth capacity, and reliability. These characteristics ensure a seamless user experience.

Here are the top five factors to consider when choosing a WiFi solution for high-density deployment in industrial applications—beyond supporting the same standard features as general-purpose access points.

Reliability. An access point (AP) plays a central role in connecting passengers to the on-board WiFi network. However, although many enterprise solutions are available, few meet the requirements of rolling stock operations. Access points suitable for use on trains must include the following characteristics.

- ***Wide operating temperature***—On-board APs could be exposed to extreme hot or cold. The EN50155 standard specifies the operating temperature criteria for different classes of devices. The EN50155 Tx Class defines the widest operating temperature range of -40 to +70 degrees Celsius. To ensure on-board network reliability, APs should be tested to conform to the classification level required for rolling stock applications.
- ***Anti-vibration/Anti-shock connector design***—In an on-board WiFi network, APs usually need to be physically connected to various devices. Many of these devices use a variety of interfaces, such as serial ports, LAN ports, and digital input/output channels. However, shock and vibration are a fact of life in moving trains. APs with an M12 connector for digital communication and QMA antenna ports will ensure reliable cable connections, able to withstand the tough conditions.
- ***Versatile power input***—Power voltage on trains does not always stay constant. There can be sudden changes in voltage simply from the starting or stopping of the train. These voltage dips and surges can damage electronic components and render an AP inoperable. To ensure reliable network connectivity on trains, choose a WiFi solution with at least a 30-percent voltage tolerance range.



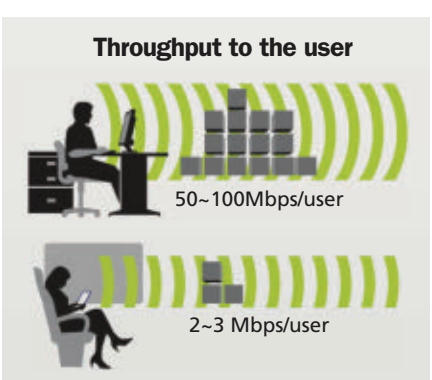
An access point with an M12 connector for digital communication and QMA antenna ports will help ensure reliable cable connections that are able to withstand tough conditions.

High Throughput. It is difficult to predict how much bandwidth each passenger needs to enjoy seamless network connectivity while traveling. Estimates are usually based on studies of application usage and user behavior. In an average home or office, 50 or 100 Mbits/sec is adequate to enable Internet access for multiple devices simultaneously. However, with passengers having more than one device, and considering other factors constraining AP throughput, a recent study concludes that passengers are often left with 2 to 3 Mbits/sec of bandwidth for applications.

In addition, the type of WiFi technologies (a/b/g/n/ac) and applications used can affect the total network capacity. For example, an AP operating in 802.11n mode supports varying speeds but throughput degradation is unavoidable if the network is to support devices in legacy modes.

By taking into account the multiple factors, such as the complexities of the technologies and user behavior, railway operators can design a WiFi network with high throughput to ensure a positive user experience.

High Density Connectivity. If a conventional wireless network is deployed in a high-density user environment, it is not hard to predict the result: poor user experience. This is especially true at live events and on trains where hundreds of users are trying to access the WiFi network at the same time. To provide a good user experience, one study recommends deploying one AP for every 60 users. For example, a train carriage that carries 100 passengers will require at least two APs, each serving 50 passengers. If not enough APs are deployed, some passengers may experience poor connection quality.



In an average home or office, 50 or 100 Mbits/sec is sufficient to enable access for multiple devices. However, when railway passengers have more than one device, passengers often are left with 2 to 3 Mbits/sec of bandwidth for applications.

TABLE 1. EN50155 classifications and operating temperature ranges

Standard	Operating temperature range
EN50155 T1 Class	-25 to +55 degrees Celsius
EN50155 T2 Class	-40 to +55 degrees Celsius
EN50155 T3 Class	-25 to +70 degrees Celsius
EN50155 Tx Class	-40 to +70 degrees Celsius

TALBE 2. Bandwidth required by common applications

Application	Bandwidth
Netflix HD quality	5 Mbits/sec
Netflix DVD quality	3 Mbits/sec
FaceTime	500 Kbits/sec to 1 Mbit/sec
YouTube	500 Kbits/sec to 1 Mbit/sec
Web browsing	1.5 Mbits/sec
Skype (HD)	1 Mbit/sec
Google Hangouts	5 Mbits/sec
Google Play	320 Kbits/sec
Facebook video calls	500 Kbits/sec

Bandwidth-intensive applications such as YouTube reduce the number of users an AP can service. Therefore, in addition to a good AP/user ratio, knowing which applications need to be supported and their bandwidth requirements allows better AP placement and improves bandwidth utilization. Table 2 shows bandwidth required by common applications.

While challenging, finding out how application bandwidth requirements affect capacity is an important step toward designing a high-performance, high-density WiFi network.

Client Load Balancing. When too many client devices try to connect to an AP, the bandwidth available for each client device decreases, eventually resulting in poor connectivity and user experience. With client load balancing, railway operators can limit the number of client devices that can connect to an AP. When this limit is reached, the AP can refuse any new connection requests, forcing client devices to connect to other APs, thereby sharing the available radio channels evenly among client devices in the area. Additionally, client load balancing allows APs to prevent client devices from connecting to a congested channel, encouraging an even

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distribution of available bandwidth for all client devices.

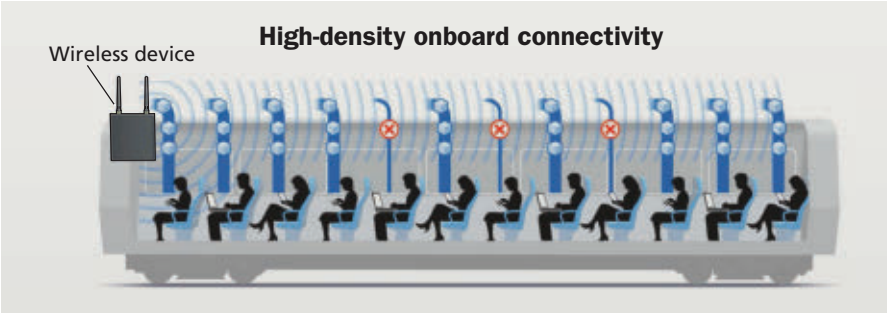
Although APs cannot force client devices to connect to a specific channel under the IEEE 802.11 specification used by WiFi, there are mechanisms to ensure uniform client associations on all channels on the WiFi network.

Because a client device always connects to the AP with the strongest channel, an inconsistent load condition can still occur in a high-density environment with uniform client distribution. For example, if a large number of client devices happened to be active in a single train carriage, they could connect to only one AP, causing slow connections or even no connection for some passengers and leaving other APs with light loads.

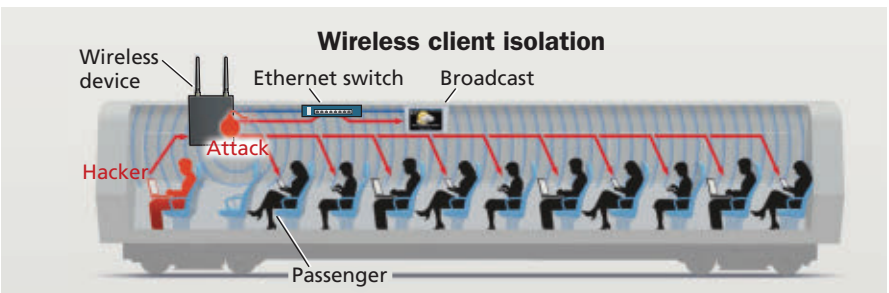
To provide maximum bandwidth for all client devices and enable the even distribution of client devices in a high-density environment, an AP should support effective automatic client load balancing that takes into account the following factors: optimum number of client devices on a channel; signal strength; and favoring 5-GHz channels over 2.4-GHz channels.

Wireless Client Isolation. Railway operators must implement client isolation in a public WiFi network to prevent client devices from communicating with one another; they can only access the Internet. This serves two purposes; it increases network security and limits broadcast traffic.

Every device that connects to on-board APs belongs to the same network, including on-board systems such as broadcast or other control systems. However, unlike a home network where one can freely access resources on different devices, passengers and train operators do not need to access each other's devices. In fact, they do not want to share resources or information with others, especially with any hackers lurking on a public wireless network.



When too many client devices try to connect to an AP, the bandwidth available for each client device decreases, eventually resulting in poor connectivity and user experience, as illustrated here. With client load balancing, railway operators can limit the number of client devices that can connect to an AP.



Unlike in a home network, passengers and train operators do not need, and in most cases do not want, the ability for users to access each other's devices, particularly with the potential for hacking to take place. Wireless client isolation prevents direct communication between or among wireless devices on the same network.

Wireless client isolation prevents wireless clients from directly communicating with other wireless devices on the same network. This provides an added layer of protection against passengers gaining access to other devices for malicious purposes.

Although broadcast traffic is essential in network discovery and content delivery, it is mostly redundant on a public WiFi network. By using client isolation to limit broadcast traffic between wireless devices, passengers can use the bandwidth that would otherwise be used for broadcast traffic, enhancing overall network performance.

The rise of smartphones and other mobile devices has driven the demand for ubiquitous Internet access, including access for train passengers. An intelligent WiFi solution for a high-density environment allows railway operators to provide both cost-effective operational applications and passenger infotainment applications that can generate additional revenue streams.

The design of a high-density WiFi network is a complex process. By considering a number of important factors—network reliability, data rate, mixed mode client ratios, load balancing, and network security—railway operators can choose an effective WiFi solution that meets the requirements of rolling stock applications. ◆

Zed Shen *is a product manager with Moxa (www.moxa.com).*

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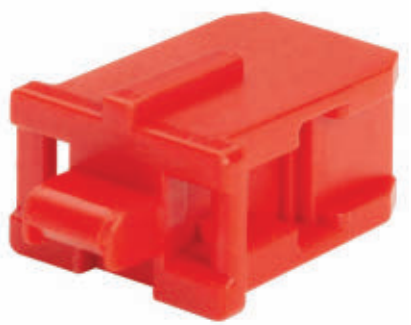
Emerging stakeholders create new considerations for structured cabling design

Meeting the needs of facility management, IT, AV and security teams with a single, robust cabling infrastructure

BY JEFF DRENOVSKY, Environmental Systems Design Inc.



Shown here is an example of an outlet block-out device for an SC fiber-optic interface. Photo courtesy of Panduit.

Traditionally information and communications technology (ICT) systems engineers have designed structured cabling and technology systems with only one of their client's departments in mind—the information technology (IT) group. Now, with lighting, mechanical systems, cellular enhancement and audio visual equipment coming to rely upon the structured cabling system for connectivity, another department—facilities management—has emerged as an important stakeholder in this aspect of building construction.

Similarly, as buildings have become more and more intelligent, it's not just phones and computers that have a technical-wiring component, but security and maintenance measures have become technology-driven too. For example, many companies have building automated systems (BAS) for heating, cooling and/or ventilation, or feature intelligent lighting control. Facilities management, not IT, maintain and manage these systems.

With multiple voices at the table, designers are challenged to fully understand each party's needs and develop a unified structured cabling design solution that meets the demands of multiple clients within the client.

Three ways to separate cabling infrastructure

In order to succeed at this lofty goal of meeting the total, combined and separate objectives of the IT, facilities group and more, the first step is to understand the three concepts of systems separation that govern cabling and wiring: physical, visual, and pathway separation.

Physical separation—Corporate security policies for change control management may require moving facilities-managed systems to separate rooms from the networking equipment. This allows easier access by technicians or electricians when maintaining facilities-related equipment. Within the IT-managed spaces, there may be additional concerns. Many businesses today have governmental and/or corporate policies and regulations that require a physical separation of their cabling and networking infrastructure. For example, private firms working for security-sensitive government agencies may have to create a physical separation of cable terminations and network equipment that house sensitive information from their operational network. Businesses that process financial transactions often require the computing devices running or storing those financial transactions to be separated from the company's general computer equipment in order to conform with internal PCI compliance audits. HIPAA compliance requirements also demand very specific levels of data security related to patient health information, which may drive care organizations to consider separating physical infrastructure to prevent unauthorized access.

Cabling designers will need to sit down with each of the corporate stakeholders to determine the level of physical

Case in point: Top 10 banking firm

One large, international banking firm has a number of different internal departments, each with their own cabling requirements—facilities management, network management or IT, audio-visual and a physical security team. Typically, each department would hire their own contractors to work on department-specific projects, but this could mean as many as four different contractors working in the same space, which also houses secure client information. The banking firm was concerned that a lighting contractor, for example, could access servers with personal data or accidentally disconnect critical cabling.

Working with Environmental Systems Design Inc., the banking firm agreed to separate the cabling into two rooms: Room A for secure client banking data and Room B for the bank's day-to-day operations cabling. Room A is officially called the telecommunications room, or TR, and has all the network management necessary to house their clients' banking and data server equipment. Room B is the facilities technology room, or FTR, with security panels for access control, network wiring for security cameras, sound masking systems, equipment for AV and cable TV and electrical distribution equipment, including the UPS system.

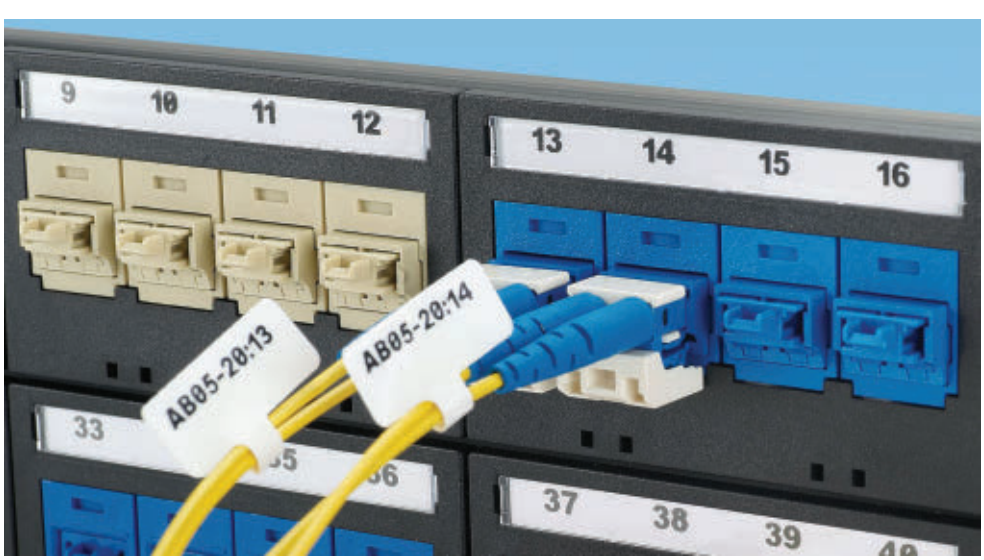
Because Room B houses the cabling for most of the bank's internal departments, ESD used various color schemes to differentiate between the systems. Now, when someone enters Room B, a quick look determines which cabling belongs to which department.

Ultimately, the physical and visual separation of systems has helped all departments and their contractors identify the right cabling, while containing and minimizing the risk to personal client data.

-J.D.

separation required. The ultimate design could include two totally separate adjacent rooms in which the cabling infrastructure is completely divided based on function. Or, the company may require two separately caged areas within a single room. If a client chooses to co-mingle the equipment, the ICT design engineer must be aware of products that can increase security at the rack level, including locking covers for patch panels/switches, port-blocking devices, special card access for server cabinets, etc. At the work area, design elements such as security plugs, locking covers or the use of keyed jacks can be used to prohibit unauthorized connections to secured networks.

Visual separation—Whether a physical separation is required or not, a visual separation may be necessary as well. Using the same type, but different color wires can create a visual separation of systems within a shared pathway or space. Visual identification of the systems in a congested ceiling environment or within a crowded telecommunications room may be important to designate cable function and can be helpful in determining which wires service which systems. For example, blue cables and jacks may represent normal network connections and orange or yellow cable and jacks may be used for security devices, violet cable and jacks may represent audio visual infrastructure, etc. A hospital may have separate vendors for network infrastructure, nurse call systems, security, audio visual systems, low voltage lighting, mechanical systems, etc., all working in the same dark ceiling spaces. Having a visual separation plan for maintenance allows individual contractors working on cabling infrastructure to easily identify one from the other as to prevent inadvertent damage to any system.



Shown here is an RJ45 plug lock-in device. Photo courtesy of Panduit.

Pathway separation—For

businesses that service different clients, industries and/or types of businesses subject to varying regulations, separating the cable pathways may be necessary. For example, one business with a government client is required to separate the cabling that houses classified government information from the cabling that houses the company's day-to-day operations by 18 inches when installed. This separation has to be maintained for the length of the entire cable route—from point A to point Z. This can be a challenge depending on the physical layout of the building, but when disclosed during the pre-design phase, it's possible to segregate cabling routes, wherever they are housed.

Less severe pathway separation may be achieved with options such as separate conduits for different systems, pathway dividers within a shared basket tray, or with the use of colored J-hook supports. The ICT design engineer must marry the proper separation solution to the requirements of the multiple stakeholders.

Best practices for optimizing cable installation

In addition to the separation of cabling according to building function and program requirements, there are a few best practices that can be applied to most cabling installations, regardless of industry or separation type. These include the following.

Institute internal corporate processes. During the cabling pre-design phase, it's important to create internal corporate processes that determine room/building area program function and personnel authorization. This will include which employees or vendors are allowed to access areas/rooms on a day-to-day basis and for prescheduled maintenance. Maintenance, especially where equipment downtime applies, should be scheduled as early as two to six weeks in advance, in order to ensure the seamless rerouting of equipment function, when necessary, and to alert staff of potential downtime.

Establish a change control process. Even when organizations have instituted internal processes and lead time for maintenance, there's still the possibility of an inadvertent shutdown. Establishing a change control process can help reduce the amount of risk for each space, equipment and cabling route. This includes documenting risk management and notifying teams managing the systems.

Use signage to differentiate. Another way to create a distinction between cabling system functions is to use signage. Sounds obvious, but many organizations don't take advantage of this simple way to differentiate. A sign for each room could specify what's inside, or signage within a room might designate various equipment cabinets. It can also offer required separation and more.

Developing and installing a comprehensive structured cabling system for diverse applications—one that will meet the needs of the facilities management group and the IT team while meeting compliance requirements—requires utmost collaboration between the ICT systems design engineers and all departments on the ground. From the pre-design phase to installation, ICT systems engineers and contractors must fully understand the needs of each of the organization's teams. When this happens, the project can achieve structured cabling design success. ◆

Jeff Drenovsky *is a senior associate with Environmental Systems Design, Inc. (www.esdglobal.com).*

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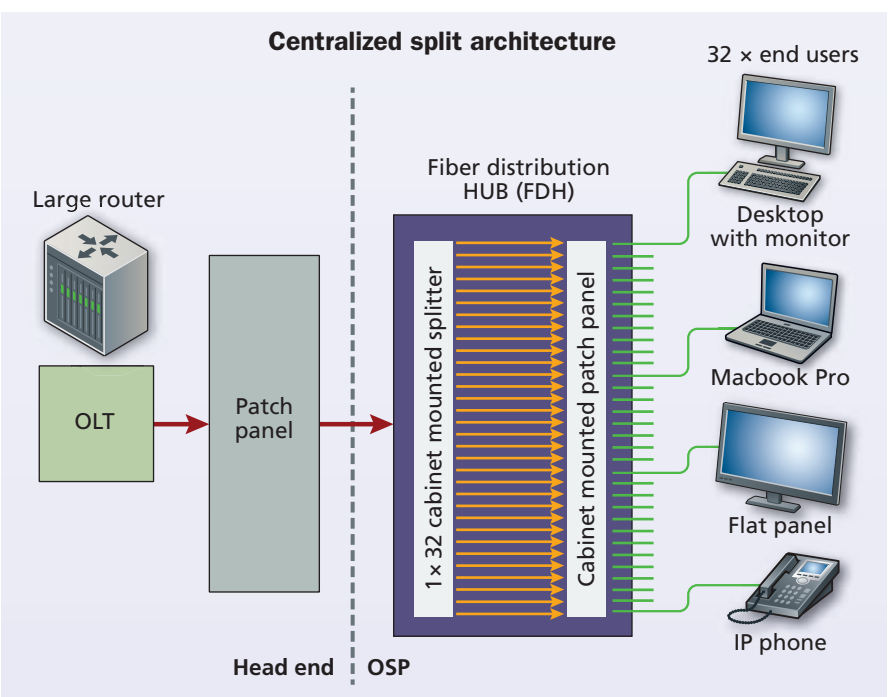
Flexibility, scalability emerging as key requirements for FTTH rollouts

A fiber-to-the-home's circumstances will dictate the network architecture best suited for it.

BY TOM WARREN, CLEARFIELD

Virtually every type of communications company is rolling out fiber-to-the-home (FTTH) services. Not only are traditional service providers and cable operators pushing their projects and services forward with determination, but so too are Internet Service Providers (ISPs), Wireless Internet Service Providers (WISPs) and municipalities.

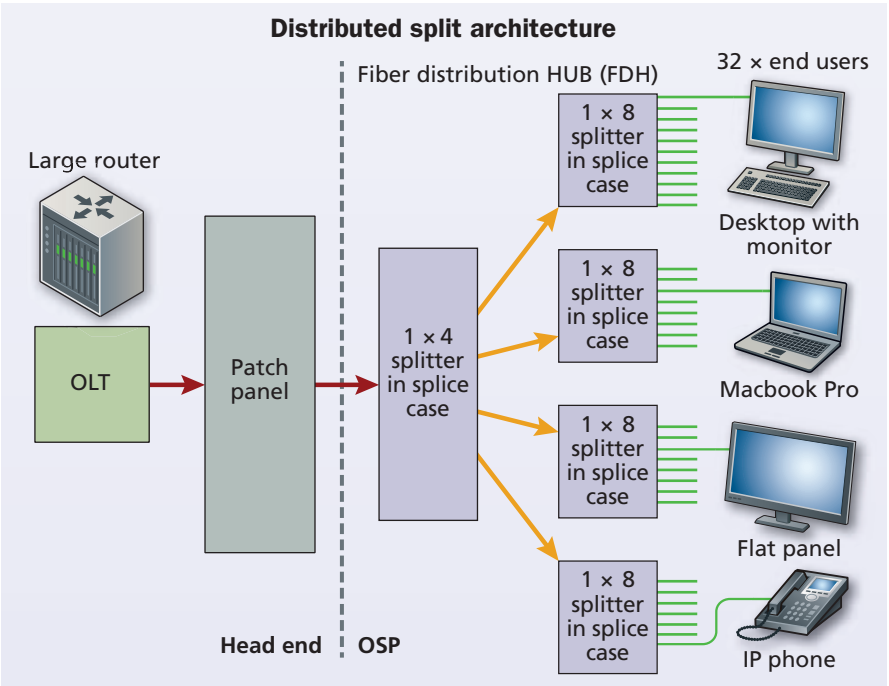


In a Centralized Split Architecture, the fiber distribution hub (FDH)—also called a PON splitter cabinet—is centrally located in a neighborhood. Within the FDH, each feeder fiber's optical signal is split according to the desired split ratio. In this architecture the FDH is the central location where splitters for a specific area are housed.

In the United States, FTTH deployments grew 13 percent (nearly 3 million homes passed) in 2015, bringing the cumulative total of FTTH homes passed in the U.S. to 26 million, according to the FTTH Council Americas. Furthermore, 2015's FTTH deployment marked the second-largest expansion since fiber-optic networking was introduced, the council reports. Of homes passed, 12.3 million homes are connected with FTTH—reaching nearly a 50 percent penetration rate.

But because activity is high, so too is the demand for experienced engineers and technicians required to design and install these fiber networks. Simple laws of supply and demand mean that high-quality outside plant (OSP) construction firms are able to charge a premium for their services. The demand for trained fiber splicers is also rising quickly. Trained splicers, who have honed their experience over the years splicing high-count loose-tube buffer cables or ribbon cables, are now being asked to splice lower-count fiber close to the home.

If providers can reduce the amount of time and money spent both designing and deploying networks, it makes sense to do so. The race is on to capture subscribers, and providers are looking for ways to reduce the time and money it takes to roll out FTTH networks.



In a Distributed Split Architecture, splitters are placed deeper into the network in a cascade or tree-type design to achieve the desired split ratio. Virtually any split combination can be achieved by using multiple splitters.

That means they need to start looking at new approaches—and perhaps a few old ones—that allow highly skilled technicians to focus on the high-count fibers required in the core of the network, but call on less-skilled labor and true plug-and-play solutions for connecting homes to the FTTH network.

Overcoming technology challenges

As mentioned above, unless a FTTH rollout is a greenfield one into a new neighborhood, it's likely that the design and architecture for each rollout—and perhaps even each phase of a rollout—will have some unique characteristics. Two architectures have emerged that allow service providers to have the ultimate flexibility in their FTTH rollouts, and the choices depend on the specific requirements of their network build, as well as expected subscriber take rate (and growth projections). The architectures include the following.

Centralized Split Architecture. In this architecture, service providers deploy a fiber distribution hub (FDH), also called a PON splitter cabinet, in a central location in a neighborhood. A few PON feeder fibers are deployed from the central office/headend to the FDH cabinet, where each feeder fiber's optical signal is split according to the desired split ratio in the cabinet. Larger count distribution fibers are spliced in or near the cabinet, providing one or sometimes two distribution fibers for each home in a neighborhood.

The FDH cabinet becomes the one central location in the network where the splitters for that area are housed. A Centralized Split Architecture is often used to optimize cash flow during the network build—when the expected subscriber take rate is unknown, as the architecture's higher splitter output port efficiency allows providers to minimize the purchase of splitters initially in the network, then add them as the take rate increases. Centralized split also reduces points of failure in the network, simplifying network troubleshooting and fault location that directly translate into labor savings.

Distributed Split Architecture. This architecture is an older approach that can be used when subscriber take rates are expected to be high, for example, in a municipality build where the town or city already has an existing—and successful—relationship with the customer base. In this architecture, splitters are placed deeper into the network in a cascade or tree-type design to achieve the desired split ratio. Virtually any split combination can be achieved by using multiple splitters, for example a 1:4 splitter can feed four 1:8 splitters. Because the splitters ae not centralized, the need for a FDH cabinet is reduced or removed. The Distributed Split Architecture uses as few splices as possible, reducing reliance on highly skilled technicians.

The key component in this type of network is a terminal with an optical splitter inside. These terminals are fed with a single fiber and the optical power is split into the desired split ratio. The input is located in the central port of the terminal and the outputs are found on the outer ring of connectors. The only splice is at the very beginning, typically located in a splice case.

The disadvantage of this design is it can increase network complexity, oftentimes without the benefit of reducing fiber count. Locating faults can be more difficult because of the wide array of splitters, and network reliability might be impacted by an increase in optical components.

Providers need to weigh each of these architectures thoroughly to understand which will meet the overall requirements of their build, including capex costs, labor costs, geography and expected take rates.

Plug-and-play technology

Regardless of which architecture is selected, there's an emerging trend that is simplifying fiber rollouts significantly: plug-and-play technology. While this term means different things throughout the industry, what it means here is the use of preterminated terminals and low-loss connectors in the field instead of fusion or mechanical splices, reducing the need for highly skilled labor and speeding up the installation processes.

In a traditional PON build, one or two splices are performed for every customer drop—a costly practice. By providing a preterminated terminal with low-loss connectors in them, a lower-level technician can be sent to inspect, clean and install one end of a double-ended patch cord into the terminal, and then push or pull a connector toward the home. Advances in pushable fiber and microduct have solved previous slack storage problems. The cable signature for these new fibers is so small that 50 feet of slack in a small flower pot or pedestal is easy to accommodate.

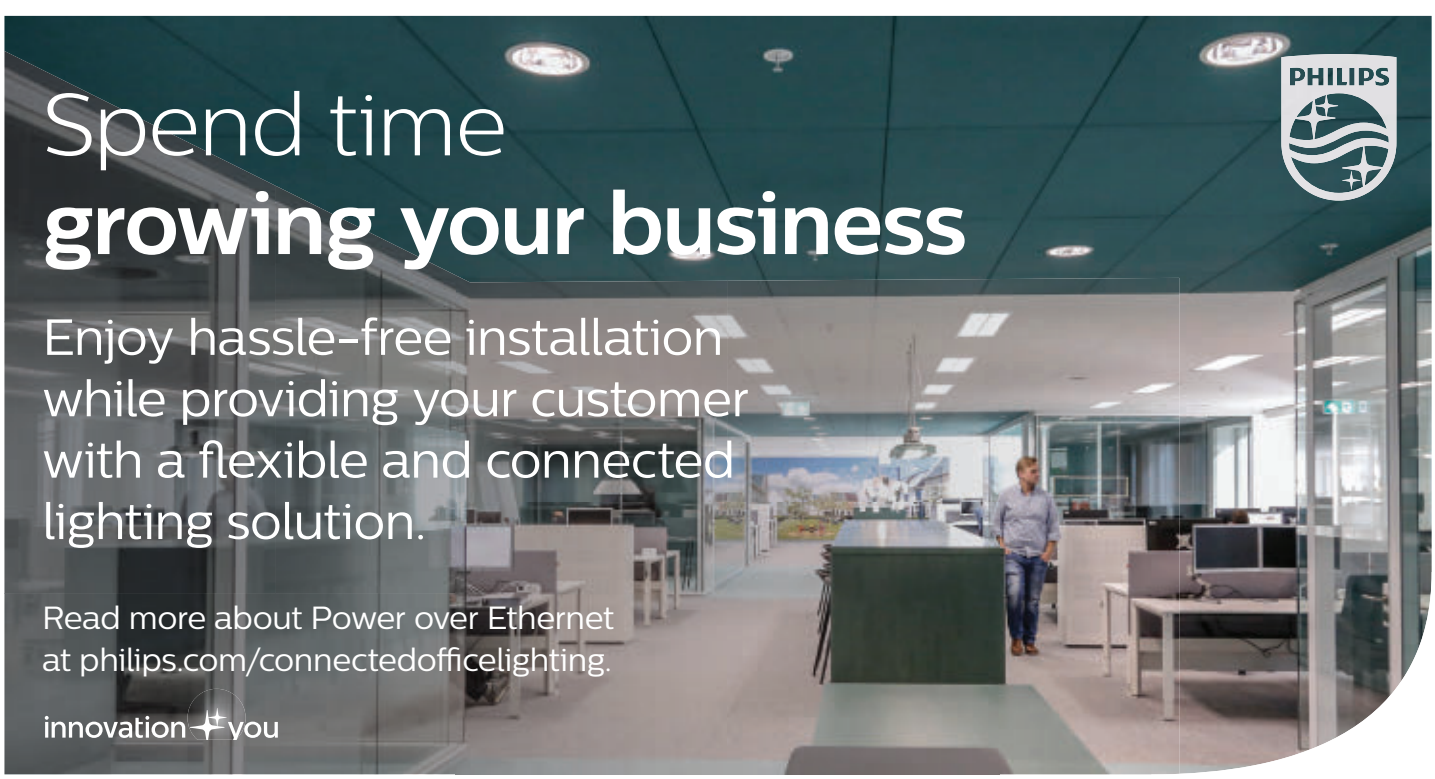
Plug-and-play technology also helps speed up the installation process. Microduct can be installed with a variety of methods, depending on the environmental conditions: microtrenching, directional boring or vibratory plowing. Once the duct is in place, it is simple to pull or push a terminated cable into the duct.

Putting it all together

One of the biggest concerns for most projects is total cost of ownership, or the combination of both capital expenditures and operational expenditures needed to see a project through to completion. While in some deployments, a Centralized Split Architecture may be the best fit, other scenarios call for a Distributed Split Architecture. In both scenarios, having a plug-and-play fiber solution reduces the need for a highly trained fiber splicer at each customer turn up, simplifying design and installation, and reducing the project's overall cost.

Because every fiber deployment has unique circumstances, what providers need the most is the flexibility to choose solutions that match the job at hand with an eye on turning up subscribers and capturing revenue as quickly as possible. ◆

Tom Warren *is an application engineer with Clearfield (www.clearfieldconnection.com).*



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Low-voltage lighting an intriguing element of Cisco's Digital Ceiling platform

The Digital Ceiling ecosystem includes several vendors that provide the enabling physical-layer infrastructure.

BY PATRICK MCLAUGHLIN

Market-intelligence firm BSRIA recently reported that its latest study of the structured cabling marketplace shows that the industry's hot topic is convergence and the impact of digitization. "With the launch of its Digital Ceiling, Cisco has, with its many partners, boosted the level of interest in convergence," BSRIA noted. "And cabling suppliers and channel players are expecting to see an increase in demand for cabling, and in particular, for higher-specification cabling."

Cisco launched Digital Ceiling at its Cisco Live event in Berlin, Germany in February.

BSRIA additionally reported that most of the large converged intelligent buildings are new-build or major refurbishments in verticals like retail/shopping centers, high-end offices, universities, hospitals, airports, sports stadiums, government buildings and hotels. Lone Hansen, manager for BSRIA's IT cable group, commented, "The growth in WAPS [wireless access points] and DBS [distributed building services] is coming from a small base. The main factor that could boost the market is the performance of solutions for the retrofit market."

Separately, ZK Research principal Zeus Kerravala authored a paper in August titled "A Digital Ceiling is Now a Business Imperative." Housed on Cisco's Digital Ceiling website, Kerravala's paper states, "The evolution to LED lighting creates an opportunity for organizations to bring all of their parallel networks together. New LED lighting systems are now connected to and powered from the corporate data network. The network-powered lighting system can be the centralized hub for a digital ceiling that brings together lighting, building automation and other technologies such as sensors. In fact, the digital ceiling is the easiest, fastest path to a true smart and connected building. The evolution to a digital ceiling will not only make buildings smarter and lower-cost, but can also significantly change the way companies interact with customers and workers."

> "Digital technology can be used to energize the workforce, which will lead to more productive, engaged employees," says ZK Research.

Building an ecosystem

Indeed, low-voltage lighting, and particularly lighting that receives power via twisted-pair cabling, has drawn focus to the Digital Ceiling technology platform. Cabling vendors Legrand, Siemon, and Superior Essex are among the partner organizations in the Digital Ceiling ecosystem.

When Siemon announced in March that it had joined the partner community, the company stated, "Unequivocally aligned with Siemon's ConvergeIT cabling solutions for intelligent buildings, which create a unified infrastructure for converging low-voltage building systems, Cisco's Digital Ceiling aims to transform buildings to be not only smart, but also connected, highly secure and easy to manage.

"A key part of the Digital Ceiling includes systems and devices that are powered by network switches using Power over Ethernet, including PoE-powered LED lights with sensors that can help lower energy costs by up to

85 percent. Siemon's ConvergeIT cabling solutions include advanced copper shielded cables and connectivity that provide superior support of PoE-enabled systems."

Siemon also stated it would work with Smartworld to implement a Digital Ceiling deployment in the Middle East. Smartworld is an Etisalat and Dubai South joint venture company based in Dubai. Bob Allan, global business development manager for intelligent buildings and strategic alliances at Siemon, commented, "Siemon has long been an expert in and advocate for integrated systems over a single unified cabling solution that combines power and control to building devices and lighting to cut cost, save energy and improve overall building control, management and security. From innovative patented crowned jack contact geometry used in our jacks to eliminate the effects of spark gap erosion caused by unmating under PoE load, to shielded cables that are qualified for mechanical reliability and superior heat dissipation in PoE applications, as well as a wide range of components specifically designed to connect lights, sensors and other digital ceiling endpoints, Siemon is well-positioned to help customers like Smartworld quickly and confidently deploy a Cisco Digital Ceiling smart, connected architecture to capitalize on the IoT revolution."

Lighting capabilities

Allan teamed up with Cisco solutions architect and technical marketing engineering Luis Suau, as well as Philips Lighting U.S. vice president of enterprise sales for commercial/industrial, Keith Moreman, to deliver a web seminar on Digital Ceiling on June 2. *Cabling Installation & Maintenance* hosted that seminar and it is available for on-demand viewing until December 2. Within

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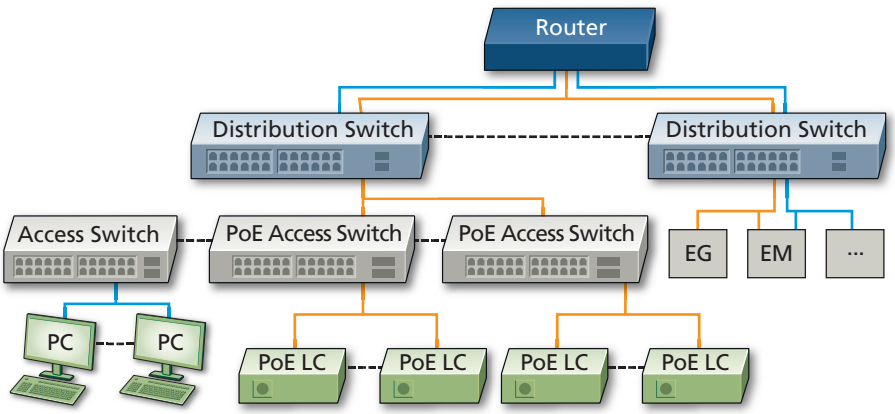
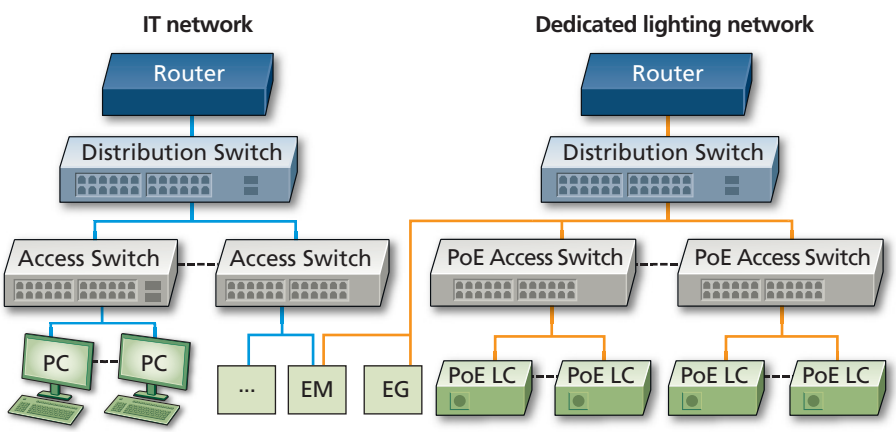
Shared network - Re-use IT infrastructure



Dedicated Network - Prepared by the IT department



Presented by Philips Lighting U.S., these illustrations describe two scenarios for LED lighting systems. The first depicts logically separated networks, in which many components are physically shared. The colors indicate to which virtual LAN a specific connection belongs. Trunk connections between the distribution switch and router support multiple VLANs. The second depicts physically separated networks, in which all network components are dedicated lighting or IT infrastructure. Lighting management software (EM) is connected to both networks using two network interfaces. Lighting management software and gateway server (EG) may be connected to an access switch or distribution layer switch.

it, Cisco's Suau provided an overview of the platform, including the explanation that LEDs are semiconductors that run on direct-current (DC) power. "With the network being able to provide DC power, there's a synergy between LED lighting and networks in buildings," he noted. Furthermore, he explained, if a light has a proverbial "big pipe" of data communication capability—in the form of a high-performance twisted-pair cable—connected to the fixture, that light also can contain sensors to gather data about not just the light, but also about the environment around it. The existence of data-gathering sensors within lights can begin the evolution of data becoming information, information becoming knowledge, and knowledge becoming intelligence—within a building.

During his presentation, Philips's Moreman stated, "These systems are collecting copious amounts of data. The sensors are constantly gathering information." Speaking about Philips products in particular, he explained that the system incorporates visible light communication (VLC), which "enables personal control over individual luminaires, groups of luminaires, entire offices, et cetera."

Among the building-efficiency gains that can be made based on the data/information/knowledge/intelligence are floor-space optimization based on occupancy patterns, and workspace (desk versus meeting-room) decisions.

Moreman also discussed the physical setup of PoE-enabled lighting systems, describing two scenarios. "It can ride on the existing IT infrastructure," he said, diagramming the path from router to distribution switches. "Off those switches, we run into specific PoE lighting switches, then off to the individual luminaires," he said. "The switches do not have to be dedicated to lighting exclusively; they also can be used for other applications."

The other scenario includes a separate network for lighting. "This is the same effective concept, but is a standalone network" entirely devoted to lighting, he said.

Launch Fishers

Legrand and Superior Essex have jointly publicized their participation in a Digital Ceiling deployment at Launch Fishers, a 52,000-square-foot building in Fishers, IN. The facility is designed to serve the unique needs of entrepreneurs working to start and build high-potential enterprises in health, information, life sciences, biotech, consumer products, agri-tech and other technologies.

"To create the kind of environment conducive to entrepreneurial spirt, and to foster innovative teamwork and creative thinking, the Launch Fishers facility created an open office with a collaborative feel to the workspaces," the companies said. "However, the need for new high-tech amenities such as occupancy sensors, advanced LED lighting and high-speed data communications infrastructure was evident."

Launch Fishers chief executive officer John Wechsler stated, "It was imperative for us to offer our tenants a work environment that not only offered a high level of efficiency in terms of building systems management, but also promoted the productivity and positive, innovative thinking we associate with our entrepreneurs. We saw lighting as one major area in which we could significantly improve these aspects of the work space and add significant value to our tenant experience."

Platformatics, an Indiana company that specializes in providing intelligent PoE lighting solutions, was enlisted. That company's president, Matt Laherty, recalled, "The Launch Fishers facility was a great opportunity for us to showcase the variety of benefits that our PoE lighting solutions can offer to both facilities managers and tenants. For Launch Fishers, we were able to devise a PoE lighting solution that would help them increase their operational efficiency by giving them more control of their lighting network, as well as improve the overall quality of light throughout the work space."

Superior Essex supplied 10,000 feet of its PowerWise Cat 5e+ cable, and Legrand supplied HDJ series angled patch panels, Category 5e jacks, and two-port surface mount boxes. "Together, this team provided a Digital Ceiling with PoE LED lighting for Launch Fishers, paving the way for a sophisticated converged power, light and data network," Legrand and Superior Essex said.

In the ZK paper, Kerravala details several benefits of implementing Digital Ceiling technology. Among them is improved worker productivity. He explains, "In an office building, network-powered lighting within the Digital Ceiling can help create a new employee experience and improve productivity because the high color-rendering index allows companies to closely approximate natural light. This improves moods, productivity and health, and it gives workers more energy. Network-enabled lights can be programmed to suit individual needs or task requirements using a laptop, a mobile device or even a tablet mounted to the wall."

The document cites the Launch Fishers project as well as the project at RBC WaterPark Place III in Toronto as examples of successful Digital Ceiling deployments. (In our July issue we published the article "Enabling IoT capabilities through a single converged IP network," which detailed the RBC WaterPark Place III project.)

In the conclusion of his paper, Kerravala notes, "In the digital era, the ability to create new experiences that delight customers will be one of the factors that determine marketplace leaders. Also, digital technology can be used to energize the workforce, which will lead to more productive, engaged employees. A Digital Ceiling deployment enables both. Consequently, ZK Research believes that a digital ceiling is now a business imperative and should be at or near the top of every business and IT leader's priority list." ◆

Patrick McLaughlin *is our chief editor.*

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Hyperscale data centers make commitments to renewable energy

The likes of Google and Microsoft acknowledge there is still room to improve, and pledge to do so.

BY PATRICK MCLAUGHLIN

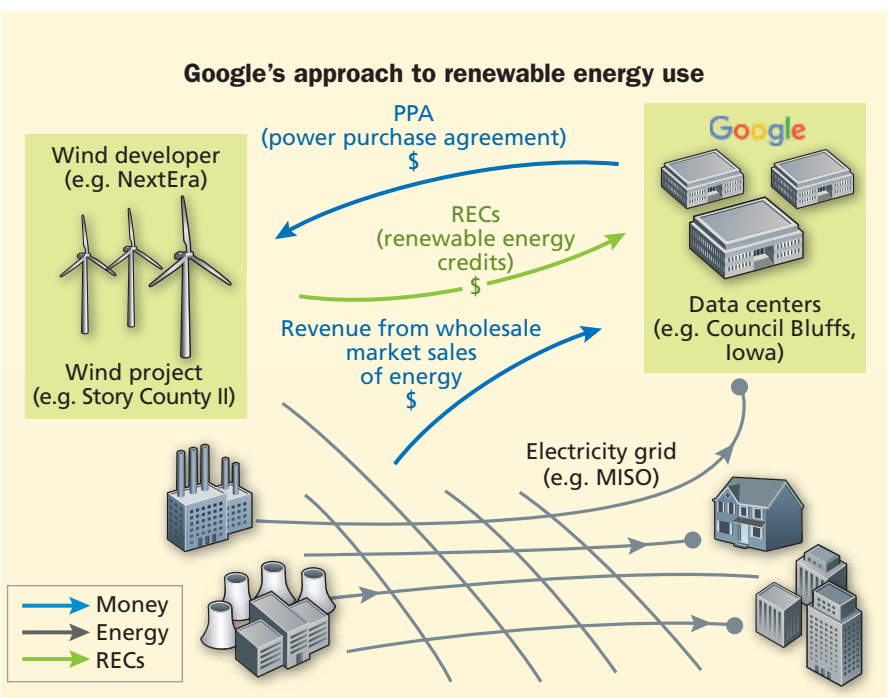
An often-cited nine-year-old report from the United States Environmental Protection Agency (EPA) estimated that data centers accounted for approximately 1.5 percent of the country's total electricity consumption. The EPA's "Report to Congress on Server and Data Center Efficiency," published in August 2007, was written in response to the U.S. Congress's Public Law 109-431, which requested such a report. The EPA said the 133-page document "assesses current trends in energy use and energy costs of data centers and servers in the U.S. and outlines existing and emerging opportunities for improved energy efficiency."

Based on data gathered through 2006, the report states, "The energy used by the nation's servers and data centers is significant. It is estimated that this sector consumed about 61 billion kilowatt-hours (kWh) in 2006 (1.5 percent of total U.S. electricity consumption) for a total electricity cost of about $4.5 billion. This estimated level of electricity consumption is more than the electricity consumed by approximately 5.8 million average U.S. households (or about five percent of the total U.S. housing stock)."

The report detailed practices that could be taken to avoid a continued escalation of electricity consumption by data centers. In a practical sense, the report also served to kick off the EPA's EnergyStar program for data center facilities and, later, for data center equipment. From a public relations standpoint, the report cast data centers as energy hogs. In doing so, it branded the largest data centers—frequently referred to as hyperscale data centers—as hyperconsumers of electricity.

Electricity sources

In the nine years since that report was issued, significant strides have been



Google purchases clean energy via Power Purchase Agreements, which the company explains create new clean energy now and help the renewable energy industry grow in the long-term.

made to improve energy efficiency among data centers of all types and sizes. The practices, techniques and technologies that enable this efficiency have been well-documented and continue to be. Also in the years since the publication of that EPA report, attention has begun to focus not just on how much electricity data centers use, but also facilities' total carbon footprint. Among the characteristics of a data center's carbon footprint are the sources of the electricity it uses, i.e. coal-fired power plants versus renewable sources. Several owners of some of the world's largest hyperscale data centers—including Microsoft, Google and Facebook—have embarked on awareness campaigns to emphasize their increasing use of renewable energy sources and their shrinking carbon footprints.

On May 19, 2016, Microsoft's president and chief legal officer Brad Smith authored a post on the company's blog titled "Greener data centers for a brighter future: Microsoft's commitment to renewable energy." He began the lengthy post by stating, "As the world increasingly races to a future based on cloud computing, a host of new and important public issues are emerging. One of these issues involves the energy and sustainability practices of the data centers that power the cloud. Over the past year we've spent considerable time focusing on our work in this area at Microsoft.

"When it comes to sustainability, we've made important progress as a company since the start of this decade, but even more important work lies ahead … We need to keep working on a sustained basis to build and operate greener data centers that will serve the world well. For Microsoft, this means moving beyond data centers that are already 100-percent carbon neutral to also having those data centers rely on a larger percentage of wind, solar and hydropower electricity over time. Today roughly 44 percent of the electricity used by our data centers comes from these sources. Our goal is to pass the 50-percent milestone by the end of 2018, top 60 percent early in the next decade, and then to keep improving from there."

Power purchase agreements "create new clean energy now as well as help the renewable energy industry grow in the long term," according to Google. The company says that "additionality" is a fundamental principle of its approach.

Smith detailed some of what the company has done already to achieve carbon-neutrality, which it accomplished in 2012. "We've achieved this progress by driving efficiencies, charging our business units a fee on carbon, and investing in sustainable energy projects and technologies," he said. "When we're not able to eliminate our energy use or directly power our operations with green energy, we purchase renewable energy certificates to reduce carbon emissions. When we include the use of these certificates, 100 percent of our consumption has been powered by renewable energy since 2014."

Google's approach

Another hyperscale data center owner, Google, similarly addressed its use of renewable energy and contractual agreements that help it drive down its carbon footprint. On its website the company explains, "Across Google, we're currently using renewable energy to power over 35 percent of our operations. We're committed to using renewable energy like wind and solar as much as possible. So why don't we build clean energy sources right on our data centers? Unfortunately, the places with the best renewable power potential are generally not the same places where a data center can most efficiently and reliably serve its users. While our data centers operate 24/7, most renewable energy sources don't—yet. So we need to plug into the electricity grid, and the grid isn't currently very green. That's why we're working to green the electricity supply as a whole—not just for us, but for everyone.

"We've purchased renewable energy from wind farms, adding new clean power near our data centers and the communities around us," Google continues. "We found an opportunity in power purchase agreements (PPAs)—long-term contracts (typically 20 years) to buy clean energy from a particular producer."

Google explains that a PPA works as follows: "1) We purchase energy from a renewable project developer. 2) We then sell that energy right back into the grid at a wholesale price. 3) We apply the renewable energy certificates [RECs] to the non-renewable 'brown' energy used at our data centers."

The company says it purchases clean energy via PPAs "because they create new clean energy now as well as help the renewable energy industry grow in the long-term."

In a document titled "Google's PPAs: What, How and Why," which was initially published in 2011 and most recently revised in 2013, the company says it has "pledged to reduce its carbon footprint to zero. Zero is an aggressive goal, not easily achieved by any one measure, so we pursue a multi-pronged approach to get there. Efficiency is one prong of the approach and carbon offsets is another. But a very important third prong of the approach is the purchase and use of carbon-free renewable electricity to power our data centers."

A fundamental principle of Google's approach to PPAs is what it calls "additionality." "Fundamentally, a renewable energy purchase is additional if it has an effect in the real world, be it direct or indirect. A direct effect would be causing a new renewable project to be built. An indirect effect would be increasing demand for renewable energy such that market pressures are able to encourage new investment." A second principle, the company says, is that its project "should go beyond basic additionality and directly address problems that limit the growth of the renewable industry."

In a section of the document headlined "Meeting our principles," Google acknowledges, "Additionality is a tricky concept. Perhaps it is easiest to give an example of what's not additional." It sets the scenario of a power company with a functioning wind farm that was built years ago and provides power to the grid. The power company has no plans to build more wind farms. "One day, they learn that Google is looking to purchase renewable electricity. The power company figures it could sell Google the output of their wind farm; for their existing customers they would just make up the difference by buying some other source of energy, perhaps from the coal plant down the street.

"In our view, this is not additional. We'd be handing money over for green electricity, but in the grand scheme of things, nothing would change. The carbon output of the whole system would be the same and no new renewable generation would be built."

Under a different scenario—one in which a wind farm does not yet exist—Google's desire to purchase renewable electricity would spur the development of a new wind project by a company that wants to build one but needs a reliable customer to help make the project financially feasible. "Let's change the scenario one more time," Google follows-up. "Perhaps a company does own an operating wind project, and is known to be a serial developer of renewable energy projects. They use the cash flow from one project to finance the next, or to convince Wall Street that they have bankable income. As in the previous case, we would consider the power from this wind farm as additional since we have confidence that the proceeds will be used to finance additional renewable power."

On the topic of RECs—renewable energy credits—Google tackles its nuances as well. "We are often asked: If RECs are a tradable commodity, why not just buy RECs from a renewable project and not mess with the energy? The answer in this case is that buying a few years' worth of RECs from a renewable project does not provide the stable and sizable cash stream that a renewable project developer needs to get financing to build new green power projects. In PPA, Google is agreeing to buy all the power from a project for many years. Google has, in effect, totally accepted the power price risk that the project owner would otherwise face—instead of taking the risk of selling into the power market on a short-term basis, Google is providing the seller with a guaranteed revenue stream for 20 years. This is something the developer can literally take to the bank. If we were to buy only the RECs, this would represent a fraction of the value of a typical power project, and would still leave the renewable developer to face the market risks of future energy prices, making it much harder for them to obtain financing for projects."

Facebook in Ireland

Facebook—another often-cited owner/operator of hyperscale data centers—recently announced some renewable-energy initiatives associated with its under-construction facility in Clonee, County Meath, Ireland. In January, Facebook's vice president of infrastructure Tom Furlong said the Clonee data center "will be packed full of cutting-edge technology, making it one of the most advanced, efficient and sustainable data centers in the world. All the racks, servers and other components have been designed and built from scratch as part of the Open Compute Project … Our data center in Clonee will be powered by 100-percent renewable energy, thanks to Ireland's robust wind resources. This will help us reach our goal of powering 50 percent of our infrastructure with clean and renewable energy by the end of 2018."

In April, Brookfield Renewable Partners announced a long-term supply agreement with Facebook in Ireland. Brookfield said it "will supply 100 percent renewable wind energy to Facebook's second European data center under construction in Clonee, County Meath, Ireland and to Facebook's international headquarters in Dublin.

"The supply contract, which will be for a period of at least 10 years, will see Brookfield Renewable supply electricity approximately equal to the long-term average annual generation of approximately 150 MW of wind capacity. Brookfield has an additional greenfield wind development portfolio of over 200 MW across Ireland with 75 staff based in Cork."

In his blog post from May, Microsoft's Smith comments bluntly, "There is no room for complacency. The largest tech companies today may each consume as much electrical power as a small American state. There may come a point in just a few decades when we each may consume as much power as a mid-sized nation. This creates an obvious responsibility that we need to take seriously." ◆

Patrick McLaughlin *is our chief editor.*

TIM WIDDERSHOVEN is global marketing manager for Ideal Networks (www.idealnetworks.net).

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BY TIM WIDDERSHOVEN, Ideal Networks

Granite Telecommunications is a communications service provider to multi-location business and government entities in the United States and Canada. The company provides solutions for voice, data, internet, wireless, video and secure-network options to a number of globally well-known retail clients and many Fortune 500 companies.

Challenge faced

In order to demonstrate proof of performance, all moves/adds/changes work undertaken by Granite requires test reports in PDF format. With cabling installer and technician teams working all over the U.S. and Canada, it is important that installers have access to the correct technology and equipment to enable transfer of the test data from the jobsite.

"Faults can occur from post-installation damage or changes," says Dan Puffer, project management supervisor for Granite. "Referring to test reports at the time of installation is essential to prove work was completed correctly and helps to steer troubleshooting in the right direction."

To prove performance at the end of a job, customers receive a network traffic performance test report to the IEEE 802.3ab standard for the installation. However, in the past this information could sometimes be delayed while waiting for the test reports to be sent to the central office by the field technicians. On average, test reports would take three days to arrive, delaying work tickets from being closed out and preventing the job from being invoiced.

To complicate matters further, the installers and technicians were using various equipment from a total of eight different tester manufacturers. Therefore, to create the customer reports, the software for each type of tester had to be installed on a PC so that every set of results could be read and formatted, and a final report could then be compiled.

Solution presented

To eradicate the issue of inconsistent test result files and formats, over the past 12 months Granite has provided all 17 of their MAC and installation work technicians with the SignalTEK NT, a fiber and copper network transmission tester from Ideal Networks. This ensures that the PDF test reports provided at the end of each job are consistently formatted, thereby allowing customers to receive their promised verification reports sooner.

"We realized that consistency of data was key to improving our process, and this was best achieved by investing in the right equipment for the job," says Puffer.

To ensure that technicians have the ability to quickly share PDF test reports from the jobsite, SignalTEK NT supports

Over the course of a year, communications service provider Granite Telecommunications provided all its moves/adds/changes and installation technicians with the SignalTEK NT tester (shown). The technicians use the Ideal AnyWARE app along with the tester to ensure efficient test reporting.

the free Ideal AnyWARE app. Once tests have been performed using SignalTEK NT, users simply activate the app and transfer the test data to their mobile device. To make this hassle-free and time-efficient, there is no need to connect to a local WiFi network, as Ideal testers such as the SignalTEK NT act as a WiFi hotspot.

Once transferred, test reports can then be sent on via email or file-sharing apps in a few clicks. This means that installers and technicians can share test data with colleagues based off-site without delay, improving collaboration, troubleshooting capabilities and job-completion times while removing the need to transport testers.

Granite Telecommunications project management supervisor Dan Puffer explained how his cabling installer and technician crews' use of SignalTEK NT and Ideal AnyWARE have improved Granite's business in the areas of affordability, operating costs, time saving, ease-of-use, and customer satisfaction.

Affordability—"We originally thought we would need to buy expensive certifiers for the work we were undertaking. However, we realized that the SignalTEK NT was more than sufficient for creating reports to demonstrate good Ethernet connectivity, which was what we needed to show customers. It was also far more affordable, meaning we have been able to invest in more equipment and can have one on every truck."

Reduced costs—"In the past, sometimes test results could be lost or overwritten as technicians moved on to other jobs before they had a chance to send in the data. This resulted in occasions when we had to retest, which incurred unnecessary costs. Being able to use the Ideal AnyWARE app to send the reports straight away has significantly reduced the need for re-testing and has also meant that our technicians are available to get on with other paying work."

Time saving—"Previously, technicians would have to conducts the tests, then download the results to a laptop or PC at a later time before emailing them to the office for collation into the customer report. The Ideal AnyWARE app has completely transformed the way we work at no additional cost. It almost feels like we receive the test data in real time—which in turn means we get our deliverables back to the client much more quickly.

"Using the built-in WiFi hotspot of the SignalTEK NT with the Ideal AnyWARE app, PDF test reports can be sent back to the office on the same day the job is completed, a time savings of three days per job. Due to quick receipt of the required PDF test reports and the lack of retesting, work tickets can be closed out more quickly."

User-friendliness—"The equipment was really easy to get started with and that saved us a lot of time. Although we are planning to have more in-depth training soon to ensure we are using the technology to its fullest, a two-hour internal training session was enough for our technicians to be able to familiarize themselves with the tester and get up and running straight away."

Client satisfaction—"Customer reports are an agreed deliverable for each job, so the ability to get this information to them several days more quickly than before is a real benefit. Customers can not only see the evidence that work has been finished to the standards agreed upon, but can also be assured that the job has been completed in a suitable timeframe. The improved reporting process has removed the inconvenience and delay of retesting, both of which could cause client dissatisfaction in the past." ◆

PRODUCT FOCUS

POWER DISTRIBUTION UNITS

Intelligent rack transfer switch

Raritan's PX3TS Transfer Switch series distributes power in cabinets with single power supply devices. It prevents downtime in those devices with patent-pending technology that eliminates points of failure. It also offers one of the fastest load transfer times of products in this class, the company says.

Built on the same platform as the PX3 series of intelligent rack PDUs, the PX3TS is capable of metering at the inlet, outlet, and branch circuit level. It offers outlet-level switching for remote power cycling, plus support for environmental sensors that capture temperature, humidity, airflow, and more, according to Raritan, which adds that these features enable better power, capacity and energy management from afar. The transfer switch series is available in a range of voltages, plus types and form factors. It offers time-saving options for setup and configuration, as well as an open API that makes it easier to integrate with third-party solutions, and manage from a single pane of glass, the company concludes.

Raritan, a brand of Legrand, *www.raritan.com*

Three-phase rack ATS

Tripp Lite's 3-Phase Rack ATS enables redundant power for network devices with non-redundant power supply configurations by combining the speed of solid-state switching with the efficiency of electromechanical relay switching. For high-density, clustered server environments, this solution delivers high reliability, high efficiency and substantial cost savings, while opening the door to new server design possibilities, Tripp Lite continued.

Its high-capacity hybrid design combines solid-state switching with the holding power of electromechanical relays to create reliable and efficient ATS solutions up to 17.3 kW. Its switching time of less than 7 ms provides reliable transfer from primary to secondary power sources. It also provides rapid coordination of A/B power sources that are not phase-synchronized, in addition to transferring loads between synchronized sources.

Tripp Lite, *www.tripplite.com*

Intelligent PDUs

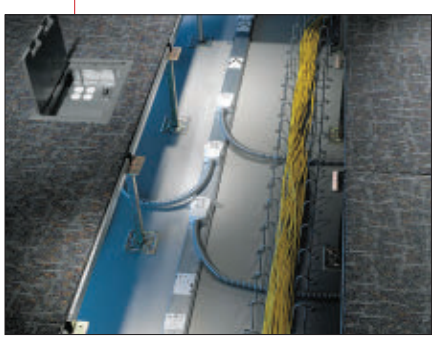
Siemon's WheelHouse Advanced Data Center Solutions includes a full line of intelligent PDUs in metered, monitored, smart, switched and managed styles for troubleshooting, control and monitoring of power usage, capacity and environmental conditions. Available in single-phase and either Delta or Wye three-phase power, the PDUs feature a variety of input currents and voltages with either NEMA or IEC plug styles. Multiple NEMA and IEC output options distribute reliable 120V, 208V or 230V to rack-mounted IT equipment, ranging from 1.8kW to 22kW.

All Siemon PDUs come in both horizontal and vertical styles. Horizontal PDUs mount easily in any standard EIA 19-inch rack, while vertical PDUs are ideal for mounting within a cabinet's zero-U space. One such environment is the shared zero-U space between bayed Siemon VersaPod cabinets that allows PDU outlets to be shared by equipment across two cabinets for savings and efficiency, the company notes.

Siemon, *www.siemon.com/wheelhouse*

Snake Bus

Snake Bus is a modular power distribution system that offers "the most flexibility in power distribution for workstations, call centers, trading floors and data centers," Snake Tray says. Snake Bus's characteristics include a 50 Amp/208 Volt, 3-phase system that delivers up to 27.5 kilowatts of power; a modular track system that installs more quickly than traditional hard-wiring methods; and the ability to be moved and reused easily for changes and retrofits.



Additionally, Snake Tray says that Snake Bus is energy-efficient, with copper bus bar technology. The system also incorporates an IP-addressable current monitoring system. Its slim profile fits in a space less than 2.5 inches. The system, made in the United States, addresses California State Title 24 requirements and other state equivalents for a green energy delivery system, Snake Tray concludes.

Snake Tray, *www.snaketray.com*

Smart PDU

The RPM1581HVN is an 8-port IP-addressable PDU that allows administrators and technicians to remotely control the power to connected servers, network equipment, and security devices, eliminating the need for wasteful service calls to reboot locked-up devices. The Remote Power Manager (RPM) can be managed from any smart device, including a PC, laptop, tablet or smart phone. Communications are handled through a built-in webserver. Access is limited by a user name and password. Other security features include HTTPS support, SSL encryption, IP and MAC filtering, RADIUS, SYSLOG and others.

The RPM1581HVN is also able to automatically detect if a device is locked up and send an email or SNMP trap notification. Each receptacle is independently addressable, and each port can also be assigned to a group. In addition to the 8-port version, 2-, 16- and 24-port versions are available.

Minuteman, *www.minuteman.com/rpm*

1970 Series X-Treme Box

Southwire's X-Treme Box unit provides worksite power distribution that Southwire says is "economical, rugged, and safe." The box's new roll-cage designs are constructed with a tubular steel frame for added durability and are vertically stackable for easy transports. The box features weatherproof receptacles and circuit breaker cover, is made of heavy-gauge carbon steel, and includes a corrosion-resistant powder coat finish, the company adds.

The X-Treme Box incorporates a 50A CA-style main inlet and outlet, and a NEMA 30A locking receptacle with overload protection along with six 20A receptacles, one 30A receptacle and a plug-and-play design with standard jobsite power connections away from surface moisture. The receptacles are overcurrent-protected, and include a dedicated GFCI module for each 20A outlet.

Southwire, *www.southwire.com*

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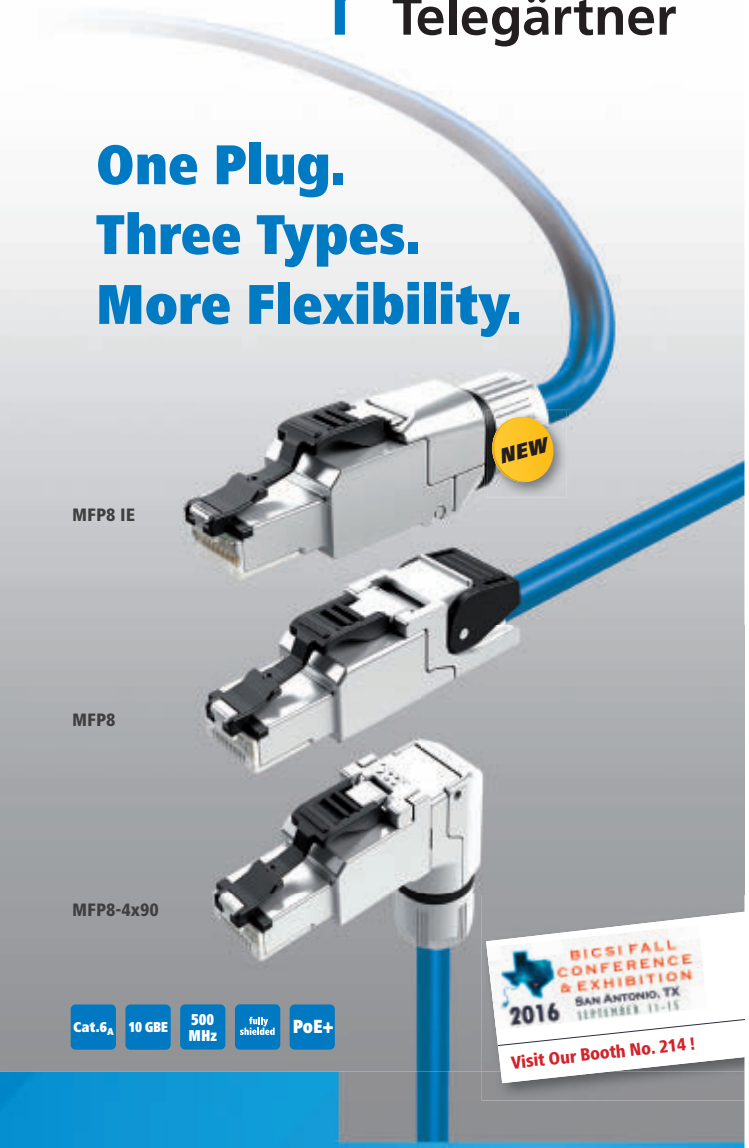

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For further information, videos and technical data refer to:

www.telegaertner.com/mfp8

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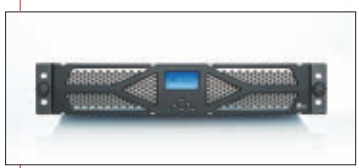
PRODUCT FOCUS

eConnect PDUs

Chatsworth Products Inc.'s (CPI) eConnect power distribution units (PDUs) now include cost-saving capabilities such as Secure Array IP Consolidation, Click Secure Locking Outlets and high-outlet-density models. Secure Array IP Consolidation enables users to link up to 32 PDUs under a single IP address using standard Ethernet cables. Click Secure Technology is available on all eConnect PDUs with IEC outlets. The patent-pending technology features locking outlets that securely fasten equipment to the PDU without proprietary power cords. Featuring densities of up to 60 outlets on monitored models and 48 outlets on switched models, CPI's eConnect high-outlet-density PDUs maintain the desired low-profile design.

Chatsworth Products Inc., *www.chatsworth.com*

UPS protects IT equipment, supplements AC grid



Methode uses lithium-ion battery technology to deliver a UPS with unprecedented energy density and battery life, while providing a much smaller footprint within the data cabinet. The Active Energy AC6000 is designed to both protect IT equipment from power outages and supplement the AC grid during peak energy consumption. The patent-pending peak shaving technology provides the ability to supplement grid power at the rack level to prevent power overdraw. Methode says the technology transforms the UPS into a working asset to assist in reducing power costs or adding vital additional capacity when power is maxed out.

Methode Data Solutions Group,
www.methode.com/data

EDITOR'S PICKS

News, products and trends for the communications systems industry

- LINKWARE LIVE MEETS LABELS
- NEW CATEGORY 8 PLUG
- COMTRAN'S WOMEN IN WIRE

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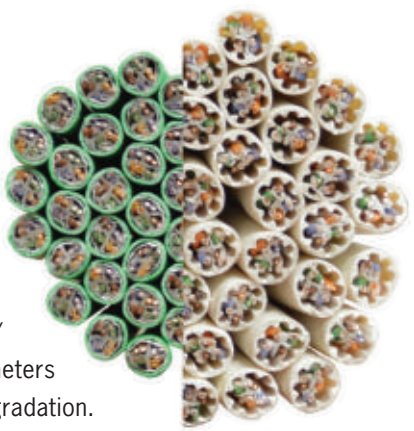
BROADCAST & AV CABLING

Belden's 10GXS Cat 6A cable awarded 'Most Innovative AV Installation Accessory' at InfoComm 2016

Belden announced that its 10GXS Category 6A cable received the "Most Innovative AV Installation Accessory" award, presented by *Systems Contractor News (SCN)* at InfoComm 2016 (June 4-10) in Las Vegas. The awards program showcased innovative commercial AV products.

Belden says its 10GXS Category 6A smaller-diameter cables reduce space and weight up to 25 percent without sacrificing performance or quality. "Exceeding industry standards, 10GXS cables offer 75 percent less noise coupling than other Category 6A cables," notes a product press release from the company. With the company's Equiblock barrier providing uniform heat-flow dissipation, the 10GXS cable can support 100 watts of PoH/PoE+ up to 100 meters without signal degradation. Its smaller size and bend radius accommodate tight spaces and smaller conduits. Easy-to-remove barrier tape accelerates installation.

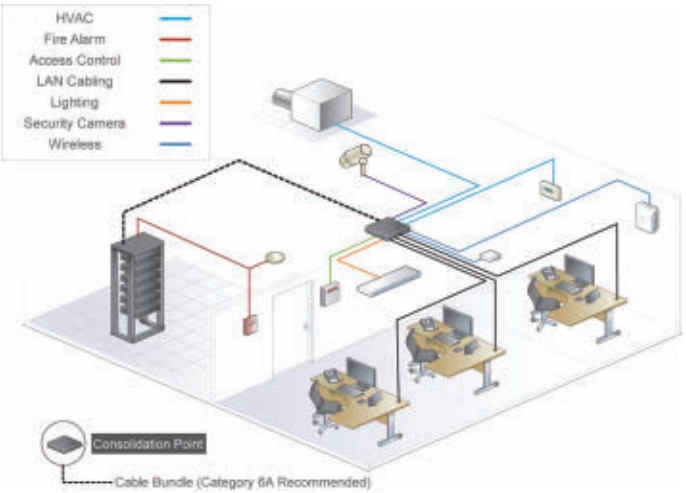


The company adds, "Belden 10GXS addresses HDBaseT's biggest challenge—alien crosstalk—by offering a patented EquiSpline that controls the balance of the cable by providing a compartment for each pair. These compartments ensure consistent cable geometry, which enables higher performance in terms of noise rejection and insertion loss. This provides excellent alien crosstalk isolation in an environment where cables are tightly bundled. The pairs are very well balanced, and the system is not affected by ground loops that can cause interference and transmission errors in shielded systems. It optimizes electrical performance with up to 10 dB of alien crosstalk headroom and offers superior crosstalk isolation and EMI suppression."

In addition to its non-bonded 10GXS cable, Belden notes that it now also offers the 10GXS in bonded-pair construction. Belden says its bonded-pair cables "feature a patented design that bonds the individual conductors along their longitudinal axis to guarantee extremely uniform spacing within each twisted pair—a key factor in maintaining consistent electrical performance." ♦

INTELLIGENT BUILDINGS

CommScope showcases data center infrastructure, intelligent buildings at Cisco Live 2016



CommScope demonstrated its latest data center infrastructure and intelligent building solutions at Cisco Live 2016, held July 10-14 in Las Vegas.

In its booth at the Mandalay Bay Convention Center, CommScope experts showcased network solutions for connecting users to meet future bandwidth requirements, connecting and powering network devices, and managing the physical infrastructure more efficiently. The company's cabling experts also hosted demonstrations of multi-gigabit NBase-T signaling on Ethernet cabling, a technique for boosting transmission speeds in a cost-effective, minimally disruptive manner.

Additionally, CommScope's intelligent building experts were also present in the event's Digital Ceiling Pavilion to demonstrate the company's Universal Connectivity Grid (UCG) solutions, including its Systimax GigaSpeed X10D Category 6A cabling and imVision Automated Infrastructure Management (AIM) platform. The UCG is CommScope's common connectivity platform designed to deliver high bandwidth and remote powering capabilities in support of intelligent building applications, accelerating the convergence of connected lighting sensors, gateways, building controls and analytics over a Power over Ethernet (PoE) infrastructure to unleash the power of IoT in buildings.

"Data centers are changing quickly with many organizations choosing co-location facilities and the cloud for analyzing and processing data with on-demand access. Buildings are evolving rapidly because of technology advances in connecting people and machines in the Internet of Things and new capabilities for space utilization and energy efficiency," said Dr. Ispran Kandasamy, global leader, Enterprise Building Solutions, CommScope. "With our wide range of fiber and copper solutions for wired and wireless networks, CommScope is ready to help IT departments build connected and efficient data centers and buildings." ♦

OUTSIDE PLANT

NEC breaks spectral efficiency record over single optical fiber, close to Shannon limit

NEC Corporation in June announced that it has demonstrated a transmission capacity of 34.9 terabits per second (Tbit/s) on a single optical fiber, over a distance greater than 6,300 km. This achievement breaks the spectral efficiency record for transoceanic transmission*, achieving 8.3 bit/s/Hz using the C-band spectrum. This is a 16.9 percent improvement on the previous record, contends the company.

"These results come very close to the Shannon limit, the fundamental spectral efficiency limit of optical communications," said an NEC press release. "Maximizing spectral efficiency is one of the primary goals in the design of submarine cable networks, enabling the highest possible capacity per fiber pair, while reducing the terminal equipment cost, space and energy consumption. This demonstration of NEC's technologies comes within 0.5 decibels (dB) of the theoretical maximum value."

"We are proud to have come so close to Shannon's cornerstone of communication theory," said Toru Kawauchi, general manager of the submarine network division at NEC Corporation. "NEC's research and development teams will continue to explore the limits of even greater subsea capacity, flexibility, and cost-effectiveness."

The research results were recently presented at the post-deadline session of the Optical Fiber Communication Conference and Exhibition (OFC) 2016 in Anaheim, California.

**According to research by NEC. The previous world record was 7.1 bit/s/Hz.* ♦

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WORKFORCE TALENT

Workshop focuses on hiring military veterans in cable and telecommunications industry

On July 13, the Cable and Telecommunications Human Resources Association (CTHRA) and the National Cable and Telecommunications Association (NCTA) sponsored a workshop titled Heroes Work Here, which educated industry employers on hiring and retaining United States military veterans. Mission Media and the Disney Institute hosted the event. The CTHRA said the workshop drew 150 attendees from across the cable and media industry.

The program focused on how to target, recruit, engage, develop and retain military veterans in the industry, the CTHRA added. "Targeted for human resources professionals and others responsible for and passionate about veteran hiring, attendees had the opportunity to learn from and network with national thought leaders from industry employers, government agencies and veteran support organizations," the association said.

Retired U.S. Army Brigadier General and current vice president of military and veterans affairs for Comcast, Carol Eggert, moderated a panel titled "Transitioning from Military to Civilian Careers in Cable and Media." Keynote speakers were Jeffrey Horne, chief executive officer of IVET and a retired U.S. Army Brigadier General; as well as Wes Moore, a U.S. Army combat veteran, author, and host of "Beyond Belief," which airs on the Oprah Winfrey Network.

Pictured left to right are Wes Moore, author and host of "Beyond Belief," keynoter; Yamil Cedeno, network operations center technician, Charter Communications; Jon Dorsey, associate producer, Discovery Communications Emerging Networks; Carol Eggert, vice president of military and veterans affairs, Comcast; Michael B. Smith, solutions specialist, Cox Communications.

Mission Media was founded in fall 2015 by the cable and entertainment industry. It is described as a systematic, industry-level approach to the hiring and retention of veterans. The program was developed by the industry's 22-member Veterans Advisory Council under the honorary chairmanship of NCTA president and chief executive officer Michael Powell. Mission Media is managed by the CTHRA.

DATA CENTER POWER & COOLING

Wastewater treatment plant used to cool Apple's Oregon data centers

As recently noted by local news media outlet *The Oregonian / Oregon Live*, "Apple, known for its polished smartphones and antiseptic stores, is getting into the wastewater business" when it comes to cooling its data centers in the state.

"The company confirmed...that it has agreed to pay for a treatment facility to re-use water for evaporative cooling in its Prineville data centers," wrote The Oregonian's Mike Rogoway in a June report. "By recycling water for Apple instead of taking it straight from the tap, the city says its new facility will save nearly 5 million gallons a year."

The report adds, "The recycled water will come from the city's regular sewage treatment system, water that would otherwise have been less rigorously treated before being used at the city's golf course or flow to pasture lands or into the Crooked River. The city says it has other water rights that provide adequate supplies for those other purposes. Apple is already Prineville's top water user, gulping down 27 million gallons of water in the last year, according to city estimates."

The company has a massive, 338,000-square-foot data center on the bluff above town, adds the reporting, which includes some modular facilities; it is also seen building a second, large-scale building. "[Apple] owns 200 more acres nearby with capacity for considerable expansion," adds Rogoway. "Prineville said Apple's ongoing construction inflated last year's water consumption, but neither the city nor the company would provide forecasts of how much water the data centers themselves use."

DESIGN AND INSTALLATION

Pinacl opens office in London's Canary Wharf

Pinacl, a U.K.-based provider of network infrastructure, services and wireless technologies, recently opened an office in the heart of London's Canary Wharf financial district. "This move is in conjunction with our continued investment, which enables us to respond to the growing needs of our customers and work closely with vendors. Additionally, it accelerates our desire to pursue prospects in line with our strategic growth plan," the company said.

The new space is in the 1 Canada Square building, which Pinacl characterized as "an iconic part of the London skyline.

Liam Wynne, the company's global account director, commented, "Our international clients often procure centrally out of London, hence with Pinacl now being part of Canary Wharf, it allows us to be more effective in responding to the needs of our customer base. It also affords us the opportunity to expand our core solutions into the city, with the new office location reinforcing our commitment to strategic growth. This is a very exciting time for Pinacl and I am very pleased to be involved in spearheading this development and growth of our services into the marketplace."

Pinacl's board of directors and several of the company's clients and vendors were present for the office's official opening on August 8.

Rob Bardwell, the company's managing director, added, "Pinacl are in an exciting growth period post the management buyout successfully accomplished a year ago. Now focusing on growth markets by delivering ICT solutions in a way that allows our customers to enjoy new opportunities within their businesses and not be restricted by its delivery. This presence in London puts us at the heart of one of our key customer markets."

According to its website, Pinacl offers managed services, managed wireless, and managed network infrastructure incorporating LAN, WAN and public and private WiFi.

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CABLE LABELING

Brother's LabelLink streamlines cable labeling using Fluke Networks' LinkWare Live

Brother Mobile Solutions recently announced it has formed a relationship with Fluke Networks, through which Brother has licensed the LinkWare Live API to create LabelLink, a mobile app and back-end solution "designed to dramatically streamline the network and cable labeling process," Brother Mobile Solutions said.

"Built on Fluke Networks' LinkWare Live platform, the new solution leverages the latest developments in cabling certification testing technology and advanced mobile printing capabilities to deliver unprecedented speed, efficiency and accuracy to the cable ID and labeling process—a discipline which continues to grow in scope, complexity and urgency as data centers evolve," Brother added. "Electrical construction and engineering contractors can now meet multiple project needs for cable ID by inputting data only once."

Here's how Brother Mobile Solutions describes the process of using the LabelLink solution.

In the office, the system designer uses CAD to plan the network infrastructure, and then uploads cable ID and component identifiers to LinkWare Live, Fluke Networks Cabling Certification tester and report management application.

Contractor downloads and installs free LabelLink app.

On the jobsite, the contractor or technician downloads the identifiers from LinkWare Live through a smartphone into a Brother P-Touch EDGE PT-E550W industrial labeling tool, which is used to create and print high-quality, standards-compliant laminated labels.

On the jobsite, the contractor also downloads the same identifiers into the Fluke Networks Versiv Cabling Certification System, performs the tests, and uploads testing results for each identifier using LinkWare Live.

In essence, the LabelLink solution allows the cable identifiers and test results for each project to be stored in one place and to be retrieved and used as many times as needed, contends the company. "Keeping track of cable identifiers across multiple databases for testers and printers wastes time and cuts into our profitability," commented CJ Santeford, operations manager of PowerCom, a Bothell, WA-based installer of communications infrastructure. "Brother's LabelLink app combined with LinkWare Live gives us the ability to use a single database for managing this important task."

According to David Crist, president of Brother Mobile Solutions, "This solution was created by two great brands combining their technologies to make network wire, cable and component testing and labeling faster and easier than ever before. It's a real game-changer, especially for contractors engaged in standards-based labeling of large and complex datacom installations. Our Brother Mobile team is thrilled and excited to work with Fluke Networks to introduce the LabelLink application to the world."

Eric Conley, vice president and general manager of Fluke Networks, added, "LinkWare Live bridges the gap between the project manager's office where the data for testing cables and printing labels originates, and the jobsite where Fluke Networks testers and Brother labeling tools are used by the installation crew. For network designers, integrators and contractors, the combination of Versiv, LinkWare Live, and the LabelLink app automates multiple workflow processes and will help eliminate a major pain point in jobsite productivity. More importantly, it ensures labeling accuracy across the entire project."

"Brother created an app for our EDGE label printer that interacts seamlessly with the cloud ID data file, so installation workers can instantly access the relevant cable identifier and create and print labels without the need for additional data entry," said Duane Yamashita, senior product manager for Brother's P-Touch EDGE industrial labeling brand. "This not only ensures accuracy and consistency of the network labeling scheme as designed and built, but also provides the

foundation for an effective cable management program going forward."

The Brother P-Touch EDGE PT-E550W features wireless connectivity for transferring data and printing directly from mobile devices. It can print labels up to 24mm wide, including heat-shrink tube, and Brother says it is ideal for labeling large, complex IT network projects.

Fluke Networks added that this agreement between itself and Brother Mobile Solutions "highlights extended benefits of the LinkWare Live platform for cable installers." The company said the agreement "makes the network and cable labeling process more efficient by allowing technicians to print cable and ID labels on the jobsite using data generated during the design and installation stages. The Brother LabelLink app enables cable installers to achieve greater efficiencies, improved accuracy and profitability by entering data a single time for reuse in the labeling phase of the cable installation process."

Conley added, "The relationship with Brother is a model for this type of technology integration partners Fluke Networks is working to identify. There are other companies who have applications and services that make sense to integrate with Fluke Networks' technology that will ultimately benefit our customers' business and the jobs they do.

"Today's cable installation projects are larger and more complex, and demands facing network designers and installers are more rigorous than they were only a few years ago. When we initially conceived of LinkWare Live in 2014, we realized that it would establish a powerful and flexible infrastructure for our customers and provide Fluke Networks a way to efficiently update our tools and capabilities. Now we have a greater understanding about how other vendors can leverage the platform to improve the capabilities of their tools as well." ♦

DATA CENTER

Take a virtual tour of CyrusOne's 172,000 sq. ft. Austin III data center

Following the recent completion of its Austin III data center, CyrusOne is giving internet audiences a glimpse into the design of the facility through the company's latest virtual tour video. The video is now available online at CyrusOne's website and YouTube channel.

Centrally located, the colocation provider's Austin III data center is housed in the Met Center, Austin's premier mixed-use business park. The facility encompasses 172,000 square feet and features stringent physical security, redundant utility power feeds, and exceptional connectivity solutions, says CyrusOne. It also features advanced cooling infrastructure and, at full build, will offer 120,000 colocation square feet and up to 18 megawatts of power. As part of CyrusOne's National Internet Exchange (IX) platform, Austin III can also provide interconnection to other CyrusOne data centers in Texas and multiple other markets across the country.

"Designed and built with the latest features and amenities, the Austin III data center provides enterprise-class service and capabilities to meet the rapidly growing demand of our customers in the Austin market," said Scott Brueggeman, chief marketing officer, CyrusOne. "The new Austin III virtual tour highlights the facility's design, systems, amenities, and security features, which make the CyrusOne Austin campus ideal for production and disaster recovery server environments for national, international, and local companies."

View the virtual tour at: http://www.cyrusone.com/data-center-location/texas/austin-texas-met-center-iii/ ♦

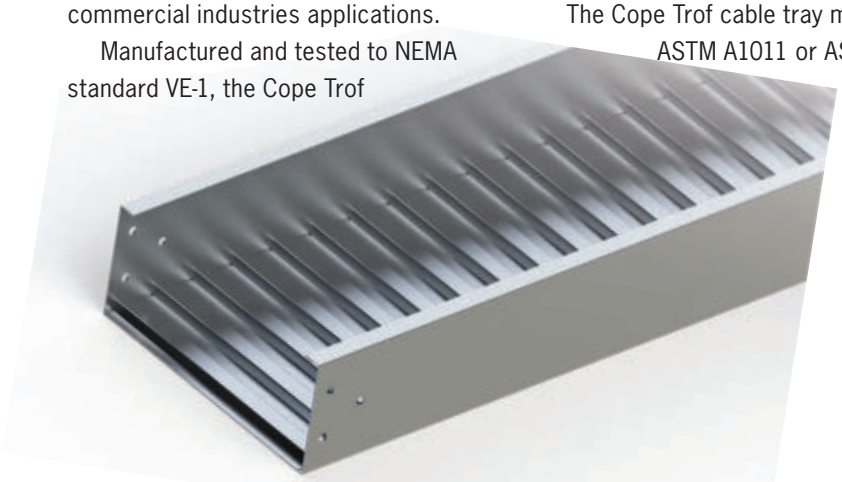
CABLE MANAGEMENT

Prefab metal cable tray features ventilated or solid bottoms

Cope, a specialist in cable management solutions, now offers the Cope Trof cable tray system, a pre-fabricated metal structure featuring ventilated or solid bottoms welded to side rails. Designed for most size cables, the Cope Trof cable tray is available in hot-dip galvanized steel, pre-galvanized steel, stainless steel, and aluminum versions. The range of materials is intended for customization to all environments. Cope says the Trof cable tray is ideal for use in the power, automotive, transportation, service entranceway, data, heavy industrial, commercial industries applications.

Manufactured and tested to NEMA standard VE-1, the Cope Trof cable tray features corrugations that provide great lateral rigidity to the bottom of the tray, transmitting the load to the side rails. Offering continuous support of one inch ribs every two inches, with or without ventilation, the tray's design virtually eliminates cable sag and uneven cable point loading, claims the company. The bottom design offers safety and security from unauthorized access. The tray system's ventilation allows for free passage of air through the openings, resulting in a 68 percent open area to facilitate proper heat dissipation.

The Cope Trof cable tray meets ASTM A1011 or ASTM A1008 standards for hot-dip galvanized steel products; ASTM A-653-G90 for pre-galvanized steel products; AA-6063-T6 and AA-6063-H34 for aluminum side rails and bedplates, respectively; and ASTM A-240 type 304 for stainless steel products. A comprehensive range of fittings makes the system customizable to accommodate varying configurations. Users can achieve design flexibility with numerous sizes of horizontal and vertical elbows, adjustable elbows, cross pieces, tees, reducers and branches. Cope's customer service experts can help customers select the right fittings for specific applications. ♦



DATA CENTER POWER & COOLING

Siemon launches comprehensive data center aisle containment line

Siemon recently announced an expansion of its line of WheelHouse Advanced Data Center Solutions to include comprehensive aisle containment systems with both cold aisle containment (CAC) and hot aisle containment (HAC) options. The company contends that the new product options can significantly improve efficiency and cost-effectively expand capacity for today's data centers.

"By either containing and isolating the cold air supply (CAC), or by guiding hot exhaust to overhead return air spaces (HAC), Siemon's Aisle Containment Solutions prevent the mixing of hot and cold air in the data center," said a company press release. "This allows for higher temperature return air to improve the efficiency of existing cooling systems and reduce energy costs, while preventing over-provisioning of computer room air conditioning (CRAC) units. Alternatively, these solutions cost-effectively expand the capacity of the data center to cool higher heat densities, maximizing both cabinet and data center floor space without the need for supplemental cooling."

Designed with robust seals for optimal thermal isolation, Siemon's new Aisle Containment Solutions product line consists of CAC roof panels, HAC

SECURITY

Nest 're-invents' outdoor security cameras

Nest Labs, Inc. recently announced sweeping changes to its security camera portfolio with the introduction of its Nest Cam outdoor security camera, as well as additional features to its Nest Aware service, and a new way to interact with the entire range of Nest products through the Nest mobile app. A synopsis of the new offerings, according to the company, is as follows.

Nest Cam Outdoor: With a brand new, completely weatherproof industrial design created for permanent outdoor use, Nest Cam Outdoor extends security outside the home. Customers can keep an eye on their homes 24/7 with full high-definition (1080p) video quality anytime, anywhere and in any weather. Customers also get all the features of Nest Cam Indoor, including activity alerts and Talk and Listen.

Person alerts: Subscribers to the Nest Aware service will receive person alerts, allowing Nest Cam to distinguish between a person and another activity and let you know when someone comes into view. Person alerts are the first of a new generation of intelligent alerts from Nest that leverage Google's expertise in machine learning and algorithms to deliver deeper insights to customers about what's happening at home. Nest Aware features including person alerts are available on all Nest Cam and Dropcam cameras.

New Nest app: The redesigned Nest app delivers new software features and makes existing Nest products better, including earlier versions of Nest Cam. With the introduction of Spaces, the Nest app delivers a brand new user interface that groups Nest products by room, across multiple platforms, making it easier to access and control Nest products.

"Nest is completely reimagining the camera experience with new hardware, a redesigned app, and more intelligent alerts. And because Nest is constantly improving its products, current Nest Cam Indoor and Dropcam customers will also benefit from these new features," comments Maxime Veron, director of hardware product marketing for Nest. "Nest Cam provides customers with peace of mind and the ability to stay connected to the things they care most about. Now, Nest Cam Outdoor brings thoughtful security outside of customers' homes, helping them secure their property and giving them more ways to watch over their families, even when they're miles away."

Nest Cam Outdoor is available now for pre-order in the U.S. and Canada at nest.com, bestbuy.com, and bestbuy.ca with a suggested retail price of $199, same as Nest Cam Indoor.

It will be on shelves this fall.

Multi-packs will be available later this year. ♦

vertical standing and end panels, single and double manual and self-closing doors, and end panels that have been designed for quick and easy on-site attachment to rows of Siemon VersaPOD, V800 and V600 data center cabinets. The containment systems are also compatible with Siemon's SidePOD and Baffle solutions that support side-to-side ventilated active equipment. A range of accessories are also available to complement the system, including filler panels to fill spaces where cabinets are not present, wall mount brackets for installation against a wall for a single cabinet row, angled support brackets to provide lateral support to vertical panels when attaching to the ceiling is not feasible, and riser brackets to increase clearance within the contained aisle when using shorter (42U) cabinets.

"Hotter return air temperatures facilitate heat exchange within cooling systems, improving power usage effectiveness (PUE) and reducing energy costs through lower fan speeds, higher chilled water temperatures and greater economizer hours while sufficiently cooling data center equipment to maximize performance and life expectancy," adds Stuart Gray, product manager at Siemon. "For both new and retrofit situations, aisle containment systems are an economical way to prevent costly oversupply of cold air while enabling growth in data center environments — whether using cold aisle containment for a raised floor environment with no overhead return air space or hot aisle containment to maintain an overall cooler working environment outside of the contained area." ♦

CONNECTIVITY

New Category 8 plug has integral circuit board technology

Optical Cable Corporation (OCC) announced that it is introducing a new Category 8 RJ45 plug with integral circuit board technology that provides advanced control of crosstalk, return loss and other impediments, "ensuring consistent performance at higher frequencies up to 2000 MHz."

The company continued, "Category 8 Ethernet cable will play a major role in meeting today's burgeoning needs for high-speed communications, whether in the data center, voice, video or other high-bandwidth applications that run on copper cable for distances up to 30 meters."

Derrick Stikeleather, OCC's copper connectivity manager and a member of the TIA TR-42.7 Engineering Subcommittee, commented, "Essentially, the new plug contains technology that provides advanced control of plug performance. In a conventional category style plug, the plug wires must be arranged in specific positions, leading to variations in performance. But when a circuit board is used, it basically eliminates the possibility of plug wire variations. It also means that electrical properties transition from a cable to a terminal in a more controlled fashion."

He added that the new, proprietary technology uses a higher-performance type of circuit board material than what is contained in a standard connector. "Without this, achieving quality data transmission rates of 40 Gbits/sec would not be possible."

This new plug was recently granted a patent, OCC announced, for circuit board layout and the advanced materials used in its construction. The company says the Category 8 plug is ideal for direct-attach, high-speed links and data center server connections.

In 2014, OCC announced the commercial availability of a field-terminable plug that met the then-current draft of Category 8 specifications.

About the newly patented plug, Stikeleather said it provides consistent and reliable terminations that are guaranteed to meet or exceed Category 8 standard specifications when paired with compliant Category 8 cable. The new RJ45 plug is fully backward-compatible with existing RJ45 infrastructure used by a majority of Ethernet connection ports, including Category 6A, Category 6 and Category 5e. It is field-installable. OCC adds that the new plug also is compatible with its family of ruggedized RJ45 connectors, a family of receptacles, plugs, and back shells that enabled users to extend their Ethernet platforms into harsh industrial and military operating environments. ♦

INTERNET OF THINGS

Report: 84 percent of IoT data comes from data center equipment

The vast majority of IoT data derives from data centers, claims a new analyst report.

Even though they may not be familiar with the term "Internet of Things" (IoT), 65 percent of organizations are collecting data from equipment, devices, or other connected endpoints. And they're using that data for business purposes, according to an IoT study conducted by 451 Research.

The study finds that the vast majority of IoT data derives from data centers. The research indicates that more than half of IoT data (51 percent) is coming through data center IT equipment, followed by camera/surveillance equipment (34 percent), data center facilities equipment (33 percent), and smartphones (29 percent).

The types of data being collected are broken down into three categories: machine sensing (data gathered from machines), biological sensing (data gathered from humans and animals), and environmental sensing (data gathered from the environment). The majority of the data today is gathered from machines for business use (71.5 percent), while data gathered from humans and animals (8.5 percent) and the environment (20 percent) represents a smaller, but growing portion of the overall data.

The type of industries predominantly using IoT platforms today are evenly split between manufacturing organizations collecting data from factory equipment and healthcare organizations from medical devices, adds the study. "Not surprisingly, 46 percent of the study's respondents showed concern with IoT security, and nearly a third of respondents said that lack of internal skill sets was their biggest issue," added the analyst. "These are followed by lack of IT capacity and lack of perceived ROI/benefits." ♦

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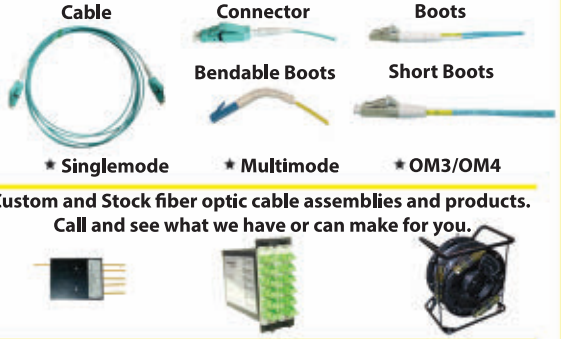

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WORKFORCE TALENT

Comtran Cable credits women in key roles for ongoing success

Comtran Cable recently publicized the fact that women in sales, marketing, engineering and materials roles represent 42 percent of the company's non-manufacturing staff. "This is well above average for wholesale and manufacturing industries," the company pointed out. "According to the U.S. Bureau of Labor Statistics, in 2015 women comprised about 14 percent of engineering, 26 percent of sales, and 44 percent of purchasing in similar occupations. The good news is that these numbers are significantly higher than 20 years ago."

The company added that executives did not specifically set out to hire women, but are seeing the positive impact of the hiring decisions they have made. "In every case we hired the most qualified person," said Joe Barry, general manager. "As luck would have it, we ended up with our own dream team of talented women … and the company is doing better than ever."

"Being the only woman at the table can have its challenges, but times are changing," Comtran Cable stated. "More and more, women are considered equals."

In a statement, Comtran detailed the professional backgrounds as well as current responsibilities and achievements of several women in its employ.

Paulette Blagburn spends her workdays at the R&D bench, solving cable design problems and creating new products. Karen Credit manages purchasing, planning and inventory control. Kathy Beaudoin leads the sales team in landing new accounts and closing deals in a highly competitive market. "These three are part of a group of women playing key roles at Comtran," the company said. "Their presence in the largely male-dominated cable world is part of a 'dream team' credited with Comtran's ongoing growth and success."

Their career paths are as varied as their current jobs, the company added. Some are just beginning their careers; others are 20-year veterans of wire and cable. "I was entrepreneurial from the time I could count change and work my grandparents' vegetable stand," recalled Danielle Braley, Comtran's Midwest regional sales manager. "I started at Draka working for the VP of engineering 20 years ago, and rose up through the ranks. I was fortunate to have some amazing mentors along the way."

Paulette Blagburn, product design engineer, has been at Comtran for one year. She works primarily on new and existing fire-resistive and rail-transit specialty cable products. She acknowledges that when she was in high school, girls were not encouraged to pursue STEM (Science, Technology, Engineering, Mathematics) careers the way they are today. Blagburn was drawn to electronics when she started installing and terminating networks for the City of Woonsocket, RI. She said she has not encountered discrimination in her career, and also credits male mentors for contributing to her success. On the topic of job satisfaction at Comtran, Blagburn commented, "My products contribute to saving lives. How awesome is that?"

Tracy Pajala, inside sales account manager, shared her perspective on how to thrive when colleagues primarily are men: "Being a woman, you tend to get more attention focused on you in a male-dominated industry. The challenge is keeping that attention positive and professional. Having a good sense of humor and not being easily offended helps immensely."

Other women on Comtran's team include Kristen Davenport, inside sales account manager and Brianna Cote, marketing coordinator. Davenport's clients benefit from her degrees in economics and marketing, which help her position and market Comtran products to meet current economics of the cable industry. Cote joined Comtran 3.5 years ago after earning her marketing degree. As a millennial, she is fluent in social media and digital marketing, which have helped Comtran gain industry exposure and qualified leads.

Pictured on this page are the women in Comtran's "Dream Team" (left to right): Donna Fitzgerald, Danielle Braley, Tracey Pajala, Kristen Davenport, Kathy Beaudoin, Karen Credit, Brianna Cote, Paulette Blagburn. ♦

TESTING

Android app controls Greenlee's DataScout Ethernet tester

Greenlee Communications now offers an Android application that enables remote control of the company's DataScout multi-service network analyzer. "This new Bluetooth interface and app option enables the device to be remote controlled up to 100 feet away using any Android tablet or mobile device equipped with Bluetooth," said a company press release. "The DataScout can also be locally controlled via the built-in ruggedized LCD touch screen in addition to WAN remote control via a web browser."

The DataScout tester integrates eight independent test options including dual-port 1G and 10G Ethernet, T3/E3, T1/E1, DS0, PRI-ISDN, 2W/4W Signaling-TIMA, DATACOM and DDS.

"Service providers and utilities are integrating mobile devices into their workflow and seeking test equipment leveraging these devices," said Ken Fridley, product manager for the Greenlee Communications branded products. "The DataScout mobile application enables technicians to work independently of their test equipment, yet still retain touch-screen command and control when working at the device."

Fridley added, "Technicians traditionally expect to have a touch-screen display embedded in their test device but also enjoy freedom of movement provided by mobile device control. By integrating Bluetooth technology into the DataScout 10G, technicians now have the best of all worlds. Our Bluetooth and LAN remote management options enable both onsite and remote technicians to perform testing virtually anywhere Bluetooth or network connections are available. This enhances safety by allowing techs to step out of noisy or cramped work locations as well. As former technicians and managers ourselves, the engineering team and I enjoy getting into the field with customers to design quality test solutions with the right combination of features required to get services provisioned quickly and confidently. The DataScout multi-service network analyzer is built by technicians, for technicians." ♦

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INFRASTRUCTURE INSIGHTS

WLAN market: Commoditization, cannibalization, K-12

Market research and analyst firm IHS Technology recently released information from its first-quarter 2016 WLAN Equipment and WiFi Phone market tracker service. "Wireless LAN equipment sales totaled $1.2 billion worldwide," for the quarter ended March 31, the researcher said, "declining 14 percent sequentially due to seasonal demand factors, but continuing on an overall growth trajectory. On a year-over-year basis, revenue is up 5 percent, slightly ahead of 2015's 4-percent growth rate."

Among the other highlights in IHS Technology's analysis, it commented, "Now that the FCC's new E-Rate program is up and running, WLAN sales to K-12 customers are recovering, and along with it the North American market."

Otherwise, the analyst's view of the market includes commoditization, low-cost purchasing, and 802.11ac Wave 2 cannibalizing Wave 1. "Among the good news is further acceleration in access point shipment growth, which stands at 20 percent year-over-year in Q1 2016, with a total of 4.7 million access points shipped," the company said. "On the other hand, average selling prices haven't materially increased despite good adoption of 802.11ac and Wave 2 products—the latter standing at 3 percent of all units shipped in Q1 2016. Demand for WLAN is strong, but monetizing that demand has been a challenge for the last two years as organizations chose lower-cost approaches."

Nonetheless, IHS says it maintains a bright outlook for the wireless LAN market overall, "as infrastructure investments over the long term shift to WLAN equipment to support the rapid rise of wireless devices, both personal and Internet of Things, as well as mobility requirements."

The researcher pointed specifically to the following data points from Q1.

- Independent access point shipments continue to post small growth, rising 7 percent year-over-year in the quarter, thanks to demand for low-cost solutions, particularly in Asia-Pacific.
- Commoditization is keeping a lid on independent access point revenue, which declined 8 percent in 2015 and was flat in Q1 2016 from the year-ago quarter.
- More than 70 percent of all access point revenue comes from 802.11ac products, and Wave 2 products broke through the 5-percent mark in Q1; Wave 2 products have started to cannibalize Wave 1 802.11ac gear.
- The three biggest year-over-year gainers in the wireless LAN market in Q1 2016, in alphabetical order, were Aerohive, Ruckus and Ubiquiti.

Overall Cisco took nearly half—46 percent—of all global wireless LAN equipment spending in the first quarter of 2016. HPE followed with 16 percent, then Ruckus with 7 percent, Ubiquiti with 4 and Aerohive with 2. Other providers, combined, accounted for 23 percent of spending. ◆

United States wireless LAN market recovers, propped up by E-Rate.

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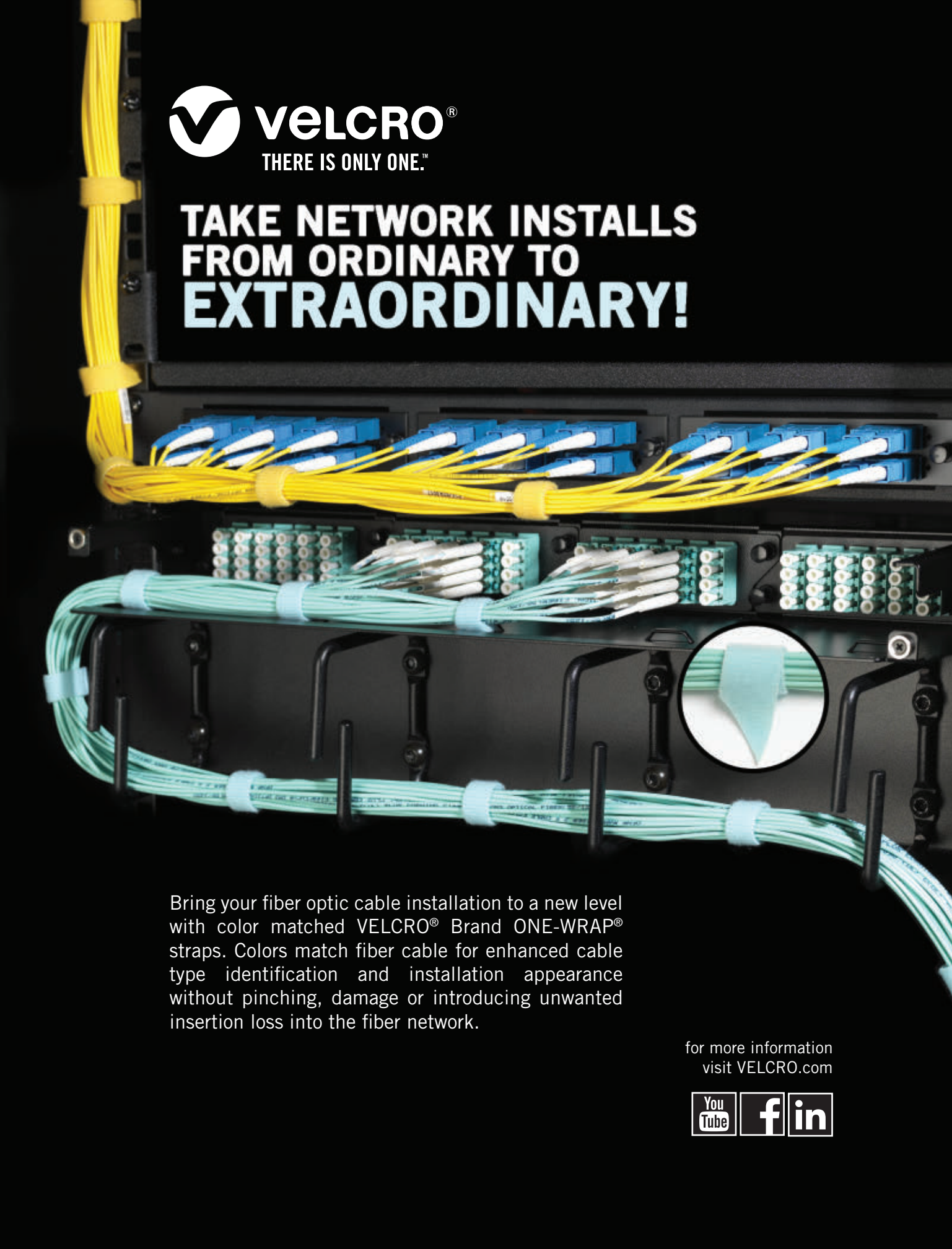
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