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OPTICAL LAN MARKET'S upward trajectory

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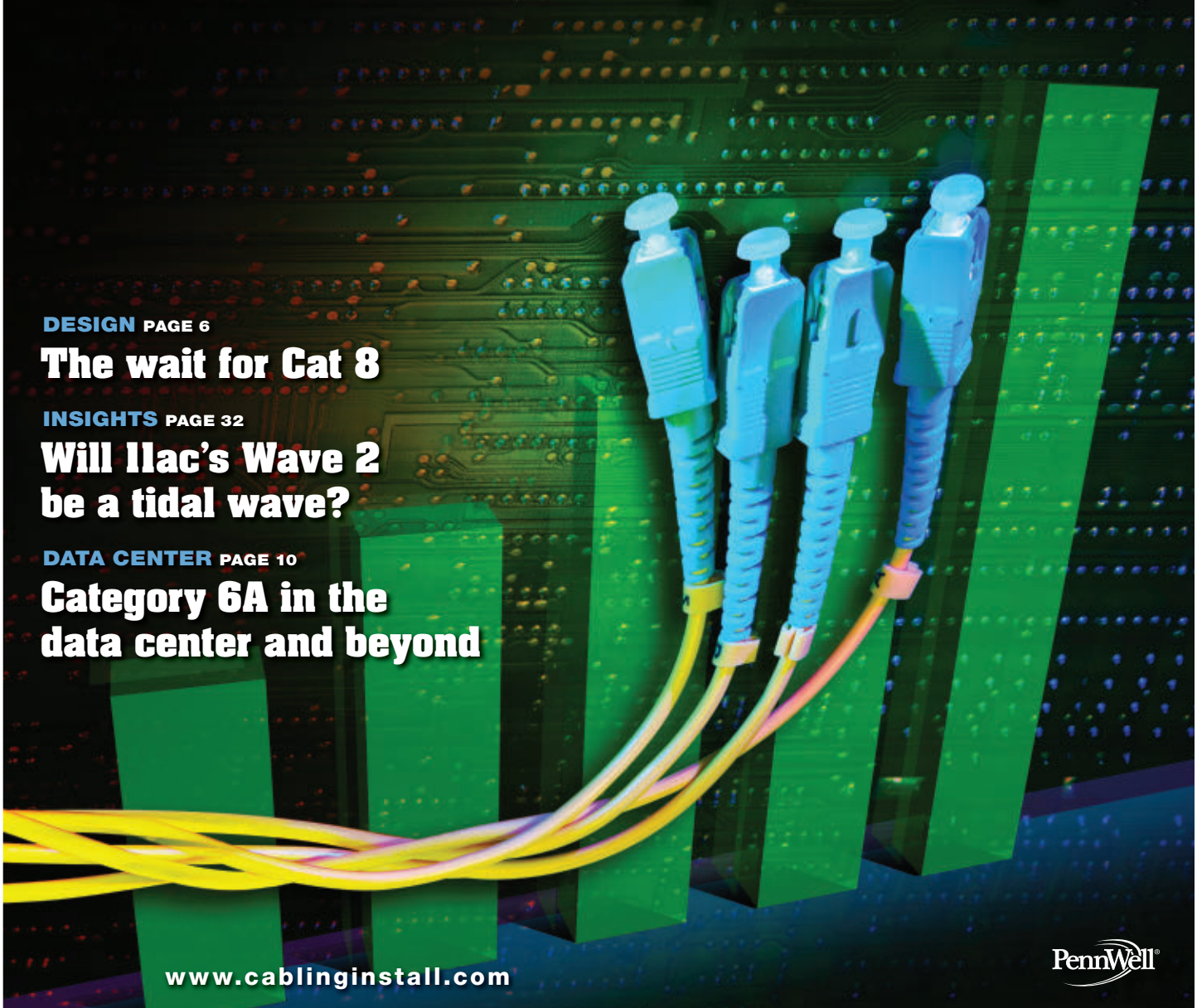

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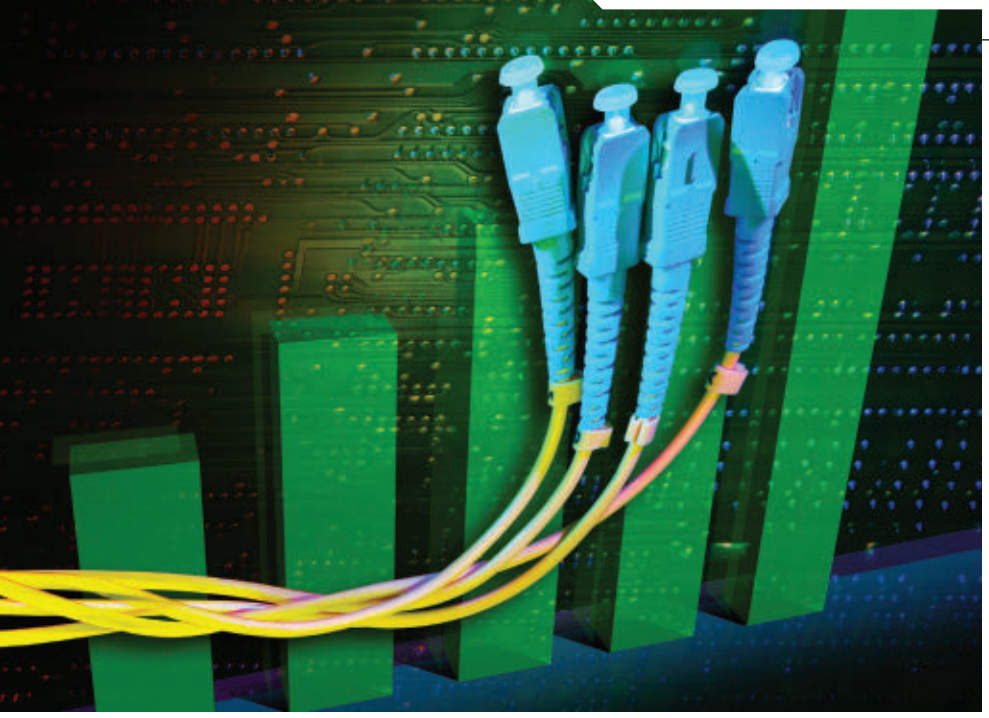

ABOUT THE COVER
Analysis of the passive optical LAN market forecasts a compound annual growth rate in excess of 20 percent globally through the year 2024.
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FEATURES

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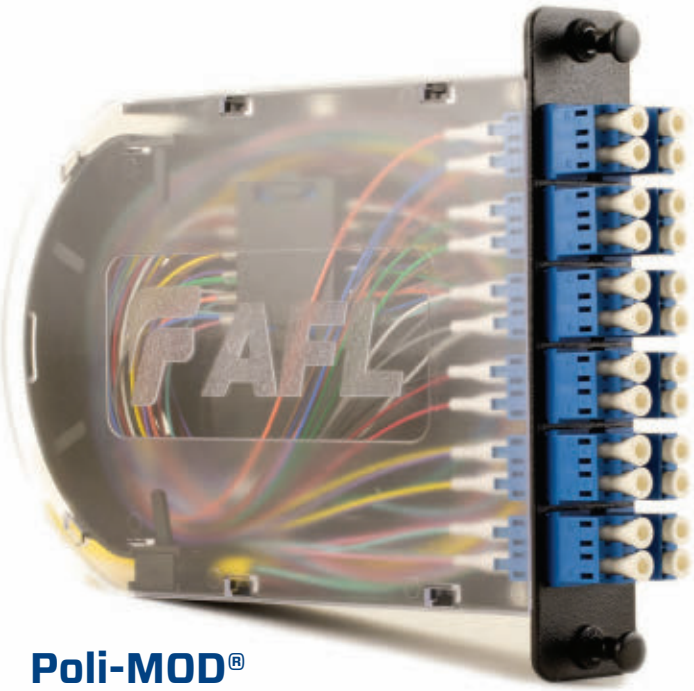

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Convergence of a different kind

PATRICK McLAUGHLIN
patrick@pennwell.com

The contents of this month's issue are representative of just how much is going on in the structured cabling industry in early 2017. In one article (page 18) we report on the bullish outlook one analyst has for the passive optical LAN market around the globe. Another article (page 10) explains that Category 6A cabling is going mainstream in many enterprises today. Still another (page 6) reports on what's new, and what's to come, with Category 8.

Meanwhile, wireless connectivity in places like stadiums, arenas and convention halls is enabled only when a robust-enough fiber and/or copper infrastructure is supporting it, as we also detail (page 14). And speaking of wireless, it looks like deployment rates of 802.11ac Wave 2 access points are growing steadily. Our Infrastructure Insights column (page 32) reports on how big a chunk of the global wireless LAN market Wave 2 occupies. Like other on-premises wireless technologies, 802.11ac Wave 2 relies on a capable wired backhaul. Over the past couple years we have reported on the technological and standards efforts that resulted in the publication of the IEEE's 2.5G and 5GBASE-T specifications, which are intrinsically tied to Wave 2's throughput capacity.

For good measure, throw in a discussion about low-smoke halogen-free (LSHF) cables (page 4) and we have ourselves a veritable stew of topics that face the professionals who specify, purchase, install, or own structured cabling systems for any number of applications.

This collection of different-yet-related topics strikes me as convergence of a different kind. We talk regularly about technologies converging and the need for a rock-solid layer-one physical infrastructure to support a number of IP-based converged building systems. But even among that layer-one infrastructure, technical, market and even political forces are converging to make product and system choices as important as they ever have been.

We recently polled your peers in the cabling trade and found that among the most troublesome aspects of getting projects completed are: A) obtaining all the products needed for a project from a single source, and B) having sufficient time to plan and execute the job. That tells me many projects could be described as both a balancing act and a race against time. Now there's some convergence that will test the mettle of any project manager. We're grateful you've turned to us as a source of information while navigating such tricky waters. Please let us know how we're doing and what else we can do to make your job a little easier.

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ROBERT BELLASSAI, RCDD is senior staff engineer with Underwriters Laboratories (www.ul.com). Questions about the topics and programs discussed here can be sent to: Robert.W.Bellassai@ul.com.

UL to industry: Time to clarify some misconceptions

Shedding light on claims—most of them self-certified—about low-smoke halogen-free cables and the materials used in them.

BY ROBERT BELLASSAI, UNDERWRITERS LABORATORIES

There is a lot of confusion in the industry regarding claims, mostly self-certified, of low-smoke halogen-free cables and the materials used in these cables.

Product claims about low-smoke halogen-free (LSHF)—also known by the industry as low-smoke zero-halogen (LSZH)—have been with us for some time now. Of note, these claims are frequently self-certified and tests used may not be standards-based. More importantly, there are some misconceptions about what some tests actually cover, which this article aims to clear up.

LSHF products originated in Europe and the U.S. in the 1970s. In the 1980s they were used in applications such as the London Underground, U.K. Navy and North Sea offshore oil drilling platforms. LSHF cables were installed in confined spaces where the toxicity and corrosivity of the smoke generated in a fire would be particularly problematic. The adoption of LSHF cable products has been slow in the U.S., but that has changed due to some high-profile fires. A key example is the January 12, 2015 L'Enfant Plaza incident in Washington D.C., during which a fire caused by an electrical malfunction filled a tunnel with smoke, killing one person and injuring others.

LSHF cable products have traditionally been found in the power and control categories, but now have branched out to categories including data/telecom cables, fiber-optic cables and appliance wire and cable. They also are being used in more locations than the traditional confined spaces (tunnels, subways, ships, submarines and mines), and are now also found in hospitals and data centers. UL will be proposing the optional HF and LSHF Marking for the 2020 edition of the *National Electrical Code*.

Asia and South America are also adopting LSFH wire and cable, which has been the EU approach to cable standards. In a global economy manufacturers now have access to a standards-based LSFH cable designation, and cable designers can produce one design that can be sold and applied around the world.

To better understand LSHF, we need to consider what a halogen is in terms of the Periodic Table of Elements. The five halogen elements found in Column 17 are fluorine, chlorine, bromine, astatine and iodine. The three primary elements found in insulation, filler and jacket materials/components are chlorine, bromine and fluorine.

Four predominant wire and cable industry standards—IEC 60754-1, IEC 60754-2, IEC 61249-2 Non-halogenated series, and MIL DTL-24643C Part 3.3 (NEMA WC57)—continue to be the source of some of the confusion regarding the halogen content of cable and materials. In particular, there is still an incorrect association, primarily with IEC 60754-1, "Test on Gases Evolved During Combustion of Materials from Cables—Part 1: Determination of the Halogen Acid Gas Content," and IEC 60754-2, "Test on Gases Evolved During Combustion of Materials from Cables—Part 2: Determination of Acidity (by pH measurement) and Conductivity."

These standards do not test for or reference chlorine, bromine or fluorine

content levels; they are methods to test the halogen acid content—via titration method in the case of IEC 60754-1 and pH and conductivity for IEC 60754-2—established from the combustion of the tested material. Also, for IEC 60754-2, the minimum pH value of 4.3 and maximum conductivity of 10 µS/mm are described as "recommended performance requirements" as shown in Annex A of the standard. This recommendation implies that these requirements are "suggestive" as opposed to "normative" requirements.

The IEC recently developed the LSHF 62821-1, -2, and -3 standard series, "Electric Cables – Halogen-Free, Low-Smoke, Thermoplastic-Insulated and Sheathed Cables of Rated Voltage Up to and Including 450/750 V." This series is one of the first to provide component material hydrogen free (HF), complete cable smoke requirements and applicable LSHF cable surface marking.

As a result of the publication of this standard, UL launched two new certification programs: a Material Recognition service and an optional Cable Surface Mark program.

The Material Recognition service uses test methods from IEC 60754-1/-2 and IEC 62821-1/-2 as described under Subject Outline UL 2885, "Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Material and Assessment of Halogens," dated 2015-02-12. This service is geared to support suppliers of insulation and jacket compounds, and cable components such as filler, tapes, wraps and the like. It can be summarized as follows.

IEC 60754-1. Under the UL 2885 standard, combustible materials are evaluated for the amount of Hydrogen Chloride (HCl) and then classified to a Performance Level Category (PLC). The PLC chart as shown in Table 8.1 of UL 2885 was developed by UL and is not found in IEC 60754-1. Combustible materials (insulation, jacket, fillers, tapes, etc.) evaluated under this service/standard(s) would not make claims or assertions to the halogen content of the material(s) and are not appropriate for use in validating cable products or their material components as non-halogen (ed.), zero halogen, halogen-free, low halogen or LSZH.

IEC 60754-2. Combustible materials for this standard under UL 2885 are evaluated for pH and conductivity. Combustible materials (insulation, jacket, fillers, tapes, etc.) evaluated under this service/standard(s) and are not appropriate for use in validating cable products or their material components as non-halogen (ed.), zero halogen, halogen-free, low halogen or LSZH.

IEC 62821-2/-2. Under the UL 2885 standard, combustible materials are evaluated for halogen content. Materials evaluated under this standard will allow for the "HF" Material Recognition designation for any combustible compound/component in a finished cable. Suppliers of insulation and jacket compounds and cable components may choose to obtain a Material Recognition for any one or more of the above standards.

For wire and cable manufacturers, UL established a "-HF" and "-LSHF" Cable Surface Mark designation in accordance to IEC 62821-3 (e.g. Type CMR-LSHF or OFNR-LSHF, TC-LSHF, RHHW-HF, CM-HF, SJO-HF, etc.). We announced this program in an Announcement Bulletin, "Halogen Free (HF) and Low Smoke Halogen Free (LSHF) Service Offerings for Wire and Cable," dated 2015-02-20.

Under the "-HF" and "-LSHF" cable program, all combustible materials (insulation, jacket, fillers, tapes, wraps, shields, etc.) must first be recognized under UL's Material Recognition Program as per UL 2885 (described above) or tested individually by the cable manufacturer. The cable manufacturer would be authorized to use these HF Recognized materials in order to apply the "-HF' and "-LSHF" optional Cable Surface Mark.

Under the optional Cable Surface Mark program, no reference is permitted, within the UL print legend surface print, regarding non-halogen, non-halogenated, zero halogen, low halogen or LSZH or reference material provided by the cable manufacturer at these designations are not covered in the IEC 62821-3 standard.

Currently, UL has certified seven wire and cable companies to mark certain cable constructions as "HF" and "LSHF" and 10 suppliers of HF compound material to the wire and cable industry. ◆

Legal fallout remains from fatal tunnel fire

The fatal fire at the Washington, D.C. Metro's L'Enfant Plaza, which is referenced in this article and occurred on January 12, 2015, spurred a legal battle that is unresolved more than two years after it occurred.

On January 10, 2017, *The Washington Post's* Martine Powers reported on the litigation. Dozens of passengers, as well as the family of the late Carol Glover who perished in the fire, filed a civil suit against Washington Metro. In response, Metro sought a dismissal of the case but also filed a counterclaim that cites a "chaotic and ineffective response," on the part of emergency responders, Powers reported. **—Ed.**

The high-data-rate wait for Category 8

TIA Category 8 standards are done, testers are ready for use. We just need Category 8 cabling systems and 25/40G gear to plug them into.

BY PATRICK MCLAUGHLIN

If the high-data-rate applications 25 and 40GBASE-T can be compared to high-performance automobiles, and the cabling systems upon which they'll run can be compared to highways, then the current state of the technological market is that the plans for those highways have been approved. There are no actual highways built yet, but that's not holding up the process, because there also are no high-performance automobiles ready to race up and down them. Such is the status of Category 8 cabling systems and 25/40GBASE-T Ethernet systems.

The "plans have been approved" analogy refers to the respective standards for these technologies. In June the Telecommunications Industry Association (TIA) approved the Category 8 specs, ANSI/TIA-568-C.2-1. Very shortly thereafter the Institute of Electrical and Electronics Engineers (IEEE) approved the 25/40GBase-T specifications, officially titled 802.3bq Standard for Ethernet Amendment: Physical Layer and Management Parameters for 25 Gb/s and 40 Gb/s Operation, Types 25GBASE-T and 40GBASE-T. The development of each standard was a multiple-year process.

The WireXpert 4500 from Softing IT Networks, which has been available for a number of years, recently obtained approval from Stewart Connector to certify copper cabling products including Category 8.2.

In August Masood Shariff, an engineer senior principal with CommScope, authored a post on the company's blog titled "Intense development leads to Category 8 twisted-pair standard." In that post he explained, "Category 8 cabling quadruples the specified bandwidth of balanced twisted-pair cabling from 500 MHz to 2000 MHz. This quadrupling of cabling bandwidth is utilized by the 40GBASE-T application to quadruple the previous maximum BASE-T data rate of 10 GB to a new maximum of 40 GB. The higher data rate was achieved while preserving backward compatibility, standardized RJ45 interfaces and cabling that is very similar to previous categories in size and installation practices. These higher data rates are supported over a maximum reach of 30 meters of cabling with two connections sufficient to serve a row of 20 cabinets or racks in equipment rooms or data centers."

Shariff continued, "Category 8 enables high-speed applications to use mid-span and end-span

switch placements with structured cabling between the switches and servers. This allows for better port utilization and more flexible changes to both equipment and servers since the cabling is independent of the network equipment, supporting multiple types and generations of equipment."

When the IEEE 802.3bq specifications were under development, Siemon, in its Standards Informant blog, characterized the upcoming 25G application as "one to watch" in a post titled "25GBASE-T to optimize migration to 40GBASE-T." In that post the company asked and answered, "Is there a sweet spot for data centers transitioning from 10GBASE-T to higher speeds? Based on recent market surveys and technical feasibility analysis, the answer is definitely yes. Trends for cloud servers and the latest forecast on server port needs … lead to the conclusion that 25GBASE-T is a critical and heretofore lacking point on the migration roadmap to 40GBASE-T. In addition, multiple feasibility presentations have clearly demonstrated that 25GBASE-T can allow users to leverage capital investment and research-and-development in 10GBASE-T and 40GBASE-T technology to optimize deployment costs as server and switch data speeds incrementally increase."

A set of standard specifications from the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC), also intended to define twisted-pair infrastructure supporting 25 and 40-Gbit/sec transmission, is in the late stages of development. Again from its Standards Informant blog, Siemon explains that ISO/IEC 11801-1 Generic Cabling for Customer Premises – Part 1: General Requirements is under development and will replace the organization's 11801 Edition 2.2 standard. The company says, "Significant changes from the previous edition include: Class I and Class II channel and link requirements have been added; Category 8.1 and 8.2 connecting hardware and cord requirements have been added." Class I and Class II are specified up to 2000 MHz.

Product availability

With the TIA Category 8 standard published and the ISO/IEC specifications for Category 8.1/8.2 and Class I/Class II nearly complete, the industry is in a state of waiting for widespread availability of Category products and systems. Some, but not many, have hit the market.

Optical Cable Corporation (OCC) announced a Category 8 RJ45 plug with integral circuit board technology that the

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company says provides advanced control of crosstalk, return loss and other impediments, thereby ensuring consistent performance at frequencies up to 2000 MHz.

"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," OCC said when it made the announcement in July 2016.

OCC's copper connectivity manager Derrick Stikeleather commented at that time, "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," Stikeleather added.

In mid-2016 Nexans introduced the LANmark-8 end-to-end twisted-pair cabling system, which the company says is fully compliant with the ISO/IEC's draft Class I/Class II cabling standards. "The new generation of twisted-pair cabling is designed to support growing data needs by enabling cost savings for BASE-T protocols compared to fiber or twinax solutions," Nexans said. "LANmark-8 is built around the GG45 connector interface, one of the standardized connectors intended to be used in the permanently installed cabling infrastructure. GG45 supports 2 GHz and offers plenty of additional headroom above the applications requirements. It is fully compliant with the Class I/Class II cabling standards and compatible with the RJ45 interface. As it runs in two modes—one for 10G today (RJ45) and a new high-speed mode for 25G/40G—future switch upgrades can be accommodated very easily by simply exchanging patch cords."

The LANmark-8 system includes connectors, cables, patch panels, GG45 patch cords, and GG45-to-RJ45 patch cords. Nexans notes that the GG45-to-RJ45 patch cords are in development and "will arrive with first 40GBASE-T switches."

The absence of 40GBASE-T (and for that matter, 25GBASE-T) network equipment appears to be a bit of a logjam vis-à-vis cabling-system availability. In gathering information for this article, the author reached out to manufacturers that supply twisted-pair cabling systems to the North American market to gain insight into the current or upcoming availability of Category 8 products and systems. One manufacturer anonymously stated that their release date for Category 8 products was not yet determined, based largely on the pending availability of 25/40GBASE-T networking equipment.

Testers emerge

So the high-performance automobiles (25/40GBASE-T) haven't yet rolled off the assembly line, and there are scant few roads (Category 8 products) upon which they could drive. But if you wanted to conduct a "road test" of sorts, you could do that—because several testers with Category 8 capability are available.

In October the TIA authorized publication of the ANSI/TIA-1152-A standard, which covers field testing of installed Category 8 cabling systems. In development since late 2013, the standard specifies Level 2G testing accuracy.

The WireXpert 4500 from Softing and the Certifier 40G from Viavi Solutions—each with a 2-GHz frequency range—have been available for years. In January, Softing announced that the WireXpert 4500 received approval from Stewart Connector for certification testing of all copper LAN cabling products including Category 8.2. "The Stewart Connector approval is associated with the Softing IT Networks WireXpert 4500 product, which uses ARJ45 connectors for testing up to 2 GHz," Softing said.

When announcing the approval from Stewart Connector, Softing also noted that BKS Kabel-Service AG approved the WireXpert 4500 for testing its MMCPro System up to Class II. BKS offers the NewLine 2000 cable, which the company describes as a Category 8.2 cable.

Tobias Heilmaier, product manager for Softing IT Networks, said, "We have been working hard on getting our products to this level of conformity and we are pleased to have made it first in the market through extensive R&D investment. This has been the first step for us and we look forward to completing the round of certifications available in order to continue being a strong player in this specific field."

At last month's BICSI Winter Conference and Exhibition, Fluke Networks introduced the DSX-8000 CableAnalyzer, which is independently certified and endorsed to meet all the requirements for the Category 8 field testing standard. "The DSX-8000 is the latest addition to the Versiv cable certification family, continuing the Fluke Networks tradition of designing products to help data communications installers more quickly, accurately and profitably achieve system acceptance for copper and fiber jobs," the company said when making the introduction.

"The Fluke Networks DSX-8000 CableAnalyzer has been confirmed by Intertek to meet the ANSI/TIA-1152-A level 2G requirements for measurement accuracy," said Antoine Pelletier, project engineer for ICT cabling products

testing with Intertek. "The availability of testers that meet this standard is an essential milestone in the evolution of Cat 8 and means customers can ensure their installations are standards-compliant."

"With the launch of a field tester, designers and installers now have the tools they need to deploy Cat 8 in support of 25- and 40-Gigabit Ethernet networks," Fluke Networks said. It added that with the introduction of the 8000, the DSX tester series has achieved the following technological accomplishments.

- Permanent link and channel adapters with a full 2-GHz range, allowing field certification of TIA Category 5 through 8 and ISO/IEC Class C through F_A and I/II (Class II adapters will be available in summer 2017)
- The ability to test screen continuity along the path of the cabling as required for Level 2G testers
- The ability to test the optional resistance unbalance measurements that are critical for guaranteeing operation of advanced Power over Ethernet systems

Eric Conley, vice president and general manager of Fluke Networks, commented, "While Versiv owners report a fast payback on their investment, contractors expect their testers to last for years. By purchasing the DSX-8000, they can ensure they will be ready when their customers deploy Cat 8 technology."

Panduit has endorsed the DSX-8000 CableAnalyzer and verified that it meets all Category 8 requirements. Marc Naese, vice president of Panduit's data center business unit, said, "Category 8 will offer promise of smooth migration to higher bandwidths in the data center, with ease of deployment and significant cost saving. To realize these benefits, customers will need to ensure their installation meets all Cat 8 specifications. Panduit Labs have evaluated and endorse the Fluke networks DSX-8000 for certification of our installations."

The close association of cabling component or system manufacturers with Category 8 tester providers—Panduit with Fluke Networks and Stewart Connector with Softing—indicates these cabling manufacturers are well down the road (pun intended) of product development with their Category 8 products or systems. It strongly suggests that the wait for Category 8 will not be much longer.

We will continue to follow technological developments and keep you informed of Category 8 as well as 25/40GBASE-T introductions as we learn of them. ◆

Patrick McLaughlin *is our chief editor.*

Category 6A cabling expands its reach

In the data center as well as the enterprise, Category 6A can be the right choice. Here's a look at the considerations to make when specifying the cabling type.

BY DUSTIN GUTTADAURO, L-com Global Connectivity

When the first generation of Category 6A cable was introduced it was about 50 percent larger than its predecessors. Today, Category 6A cable is about 15 percent larger than predecessors, making it easier to use in higher-density environments like this data center.

Although other technologies often take center stage in the Ethernet "ecosystem," the cable types and connectors required to implement Ethernet's increasing speeds are every bit as important—and often confusing. When viewed over the long term, those with deep pockets might consider an enterprise-wide investment in either singlemode or multimode fiber as the obvious choice. But fiber is not a panacea and as this article will illustrate many organizations, or at least large portions of them, can be served quite well by Category 6A twisted-pair copper cables.

Category 6A Ethernet cables have been available since before 2008 when the ANSI/TIA-568-B.2-10 Category 6A standard was released. However, their adoption began slowly as nearly 9 years ago, most organizations had no need for them as data rates were well below those of today, which are typically at least 1 Gbit/sec and rapidly increasing. Data centers were the primary areas where Category 6A Ethernet cables were initially used, so it's not surprising that this remains their largest application.

Category 6A cables have evolved considerably since their introduction, when they were 50 percent larger than their predecessors. Today's small-diameter Category 6A cables are about 15 percent larger, which minimizes considerations of added size and weight as well as how many cables can be placed into a cable tray or conduit. They also have much better alien crosstalk performance and noise immunity.

These more-advanced Category 6A cables and their small-diameter variants are being adopted by greater numbers of organizations that recognize the need to update their current Ethernet connectivity solutions to support applications that frequently transfer very large files to and from the data center. As a result, Category 6A cabling is being deployed in many more areas of the enterprise and even for backhaul of cellular and WiFi traffic, an application that will grow in importance as the fifth generation of cellular networks with data rates above 1 Gbit/sec are rolled out early in the next decade.

10GBASE-T is soon likely to be the choice for most organizations, driven by data center backbone speeds moving to 25, 40 and eventually 100 Gbits/sec. As data rates increase so too will the number of organizations switching to optical fiber, at least in those areas where its vast bandwidth and immunity to EMI (electromagnetic interference) and RFI (radio frequency interference) make it extremely appealing. In the meantime, copper solutions will continue to improve so it's likely that both technologies will coexist for many years to come.

One of the greatest reasons for this is that copper-based systems cost less, are much more familiar to installers, and use the simple RJ45 interface that is almost universally used in all generations of Ethernet. They also support Power over Ethernet (PoE) at increasing power levels, currently up to 100 W, thanks to design techniques that dissipate heat around the circumference of the cable to eliminate areas of high temperatures (hot spots).

Getting started

The first step in making an upgrade from existing Category 5e (or earlier) cabling is evaluating the needs of where it will be implemented. For example, most organizations have what could be called "standard," "enhanced," and "performance-centric" centers that rely on Ethernet connectivity. Standard-class operations, which usually encompass most departments in an organization, have minimal speed requirements: 1 Gbit/sec is more than adequate.

The enhanced category includes areas in which data must be transferred to and from the data center very quickly, and file sizes are often enormous. These can include engineering, a creative team whose work includes both high-resolution graphics and video, and basically anywhere high speed is essential to productivity. In these cases, data rates of 1 Gbit/sec should be acceptable, but up to 10 Gbits/sec might be preferable. At the high end is the data center itself, which requires the highest possible throughout and 10 Gbits/sec is essential.

Standard-class operations today typically use Category 5e or Category 6 cables, which in terms of throughput are fine for now and in the future. The enhanced class of operations requires Category 6A cable as it satisfies speed requirements and is a newer, more-advanced standard.

The data center represents the area in which there are multiple cabling possibilities. In contrast with other corporate groups in which users are typically widely distributed, data centers are designed specifically to support data processing, storage, and distribution, with subfloors and overhead areas. When compared with the space constrictions and other issues central to upgrading to newer cabling standards in other areas they are a comparative walk in the park.

Intra-data center cabling also requires shorter cable runs, so the distance limitation on Category 6A of 100 meters (including 10 meters of patch cords) while supporting 10-Gbit/sec data rates is not an issue. In addition, as the data center is the "mother ship," which all things data pass through, and requires comparatively less cable, it is economically well suited for the use of fiber and its essentially unlimited bandwidth. The overall cost of using fiber today is determined not by the cost of the cable itself (which continues to decline) but by the hardware associated with it, such as transceivers and switches that remain expensive. If the goal is to become "futureproof," the additional cost of fiber can be amortized over years of Ethernet enhancements with relatively low upgrade cost.

Having delineated the three major categories in an organization, their needs and thus cabling requirements, the next issue is how to implement Ethernet upgrades within them. In new buildings this is far less difficult as they are typically designed and constructed with future requirements in mind. However, for existing structures that currently use Category 6 or earlier cables, other things must be considered—foremost of which is space, or the lack of it.

To meet the more stringent needs of Category 6A such as 10-Gbit/sec data rates (10GBASE-T), an operating frequency of 500 MHz, and a maximum theoretical distance of 100 meters, significant changes to cable design were required. They include the need to more-effectively address noise and alien crosstalk (noise between cables in a bundle), grounding, bend radius, the demands of PoE, and overall construction. The result is that these cables are larger than their predecessors, and while cable manufacturers have minimized the increase in size, this can still present challenges, especially in existing structures.

Upgrading to Category 6A from Category 6 or earlier Ethernet cables places demands on the space limitations imposed by conduit, cable trays, and all areas of a building through which cables pass. The result may be the inability to use the same number of cables as the

existing solutions. Solving this problem typically requires additional cable routing hardware, which can be expensive and why it's extremely important to understand where Category 6A cables are a necessity.

Recognizing the issues surrounding the increased size of Category 6A cables, some manufacturers, including L-com, have created cables using 28-AWG copper wire, which is thinner than the traditional 23- and 24-AWG wire used in Category 6 and other Ethernet cables and results in cables whose outside diameter is reduced by half. They are shielded to fend off EMI and crosstalk, support PoE at reduced power levels, maintain 10-Gbit/sec performance, have a tighter bend radius than standard Category 6 cables, and are more flexible, making them easier to work with.

Shielding and other considerations

Any type of shielding provides some level of isolation from signals emitted by the host system, but the fact that a cable is stated as being shielded is no guarantee that it will be effective. This is because its shielding performance depends on factors including how well it is constructed, the materials from which it is made, grounding, and the effectiveness of the Faraday cage created by the shielding.

EMI and RFI are increasing concerns as Ethernet cables are often co-located with systems that produce RF energy either as a primary function or incidentally as a byproduct of the frequencies at which they operate. The problem has also long been associated with the proximity of Ethernet cables to electrical cables, as they can include 50- or 60-Hz currents and noise spikes from the electrical cable to the Ethernet cable.

The solution is the same as always but more important with Category 6A: Keep cables as far as possible from power cables as well as the sources of line-frequency interference such as fluorescent lights, some medical equipment, motors, air conditioners, and other sources of low-frequency energy.

There are other considerations when installing Category 6A cables, and one often missed is achievable distance. Although the standard specifies maximum cable length of 100 meters, it includes the distance covered by patch cables. This means that the total specified cable length must include not just the horizontal run but the patch cables on each end as well.

Another factor to consider is that electrical conduit and termination boxes aren't well-suited for use with Category 6A cables because their allowable bend radius is less than the cables can reliably achieve. Attempting to circumvent this rule will result in performance degradation as well as possibly failure caused by kinking and stress.

The environments thus far described are typical of enterprise environments. However, factories, oil and natural gas refineries, and other industrial applications represent a significant portion of Ethernet cable installations. In these scenarios, repeated flexing, vibration, shock, crushing, temperature cycling, electrostatic discharge and intense magnetic fields, and exposure to salt and corrosive chemicals are commonplace. Cable manufacturers offer jacketing material to meet these needs that is often made from polyurethane or FR-TPE (flame-retardant thermoplastic elastomer) that is extremely resistant to abrasion, chemicals, sunlight, and water. Other jacketing is also available from those manufacturers offering customization.

About quality

The quality of cables and connectors is, or should be, important to anyone who buys them, as reliability, performance, and many other factors vary among manufacturers. Consequently, it is important to choose manufacturers with an established long-term record of accomplishment and stand behind their products and specifications.

It is also common these days to find counterfeit products in the marketplace. Detecting counterfeit cables requires the buyer to thoroughly examine them to determine whether they have the stated-diameter wire, that their twist ratios are consistent, and their sheathing is well constructed (or even present), among other things. For example, it should never be taken for granted that if the cable is promoted and labeled as using 24-AWG wire that this is what's inside. Close inspection can reveal that the cable actually uses 26-AWG wire and may be copper-clad aluminum (CCA) rather than copper. CCA reduces performance and reliability.

Connector quality and its interface to the cable should also not be assumed. For example, cheap or counterfeit connectors may have a flash layer of gold on their contacts rather than 30 or 50 µm gold plating. The flash gold layer will rapidly wear off in test and measurement and other applications in which cables are repeatedly connected and disconnected.

Industry pundits have for many years projected the death of copper-based Ethernet cabling only to repeatedly be proven wrong, as Category 6A cables amply demonstrate. There is no question that optical fiber has immense benefits in some situations where copper-based solutions cannot compete, and this is not likely to change soon. That said, most Ethernet applications are well served by copper-based solutions, and this is not likely to change soon either. ◆

Dustin Guttadauro *is a product manager with L-com Global Connectivity (www.l-com.com).*

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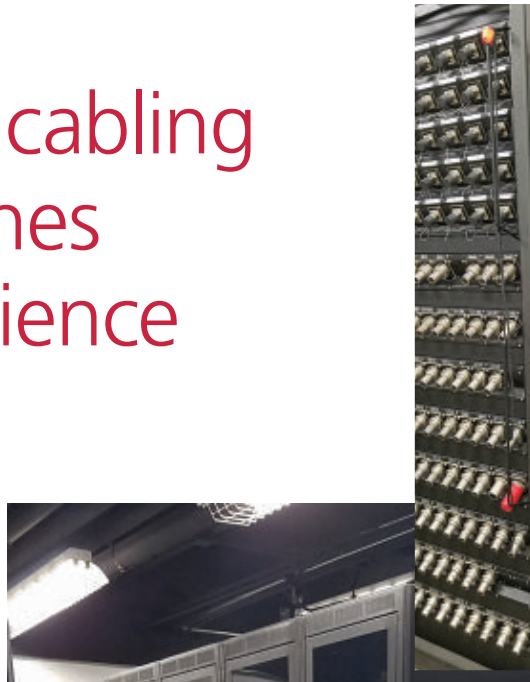
In places of assembly, cabling infrastructure determines user and viewer experience



Wireless connectivity dominates the discussion in stadiums, arenas and other venues, but on-premises communication is also critical.

BY PATRICK MCLAUGHLIN

When tens of thousands of people gather on a single premises to watch a sporting event, communications infrastructure gets put to the test. Not the "plug-in-and-press-autotest" kind, but the real-world live kind, during which the stadium's or arena's communications infrastructure will provide a user experience that is satisfactory or unsatisfactory. Often this user experience is measured by an attendee's ability to receive and use a wireless signal. That's likely the biggest single part of the picture, but there is more to it. And as professionals in the cabling industry understand, the wired infrastructure is the enabling technology that makes these communications systems run.

Several cabling vendors have publicized their roles in providing infrastructure for arenas, stadiums and similar venues. This article will discuss some of those projects and provide other information on communications-infrastructure systems in these environments.

High speeds and high capacity

CommScope supplied infrastructure for upgrades at the Daytona International Speedway in Daytona, FL and Bank of America Stadium in Charlotte, NC, as well as for the new home of the NBA's Sacramento Kings—the Golden 1 Center.

The Daytona Rising project, begun in 2013 and completed in January 2016, included the building of networks that "would both enhance the fans' experience and improve track operations," CommScope explained. The cabling infrastructure installed supports more than 1500 HD video displays, digital signage and synchronized messaging, WiFi, enhanced audio, security cameras, fire and safety services, as well as HVAC and lighting controls.

Craig Neeb, International Speedway Corporation's executive vice president and chief development and digital officer, commented, "The solutions that we're enabling will keep fans connected throughout the stadium and allow them to experience the event at a higher level, and with greater ease, than ever before. The technology will also help our operations team provide a safe, comfortable environment for our fans to enjoy the race.

The construction project included the installation of 250 miles of CommScope's Systimax Category 6 cable, 100 miles of its TeraSpeed

Since its inception in 1999, American Airlines Arena in Miami, FL has used cabling technology from Canare to support its broadcasts. Canare products enabled the conversion from standard definition to high definition in 2009.

singlemode fiber-optic cable, and more than 12,500 terminations. CommScope technical manager Vince Sumrall explained, "The cabling at Daytona was old and outdated, installed piecemeal over a period of many years. Daytona Rising provided an opportunity to start over with a clean slate."

Neeb added, "Early on, the key challenge for the design of the technology platform for Daytona Rising was looking beyond where we are today. We're talking about an infrastructure plant that has to last 20 years beyond the opening, and we want to make sure that what we implement will be able to support things that we don't know exist today or tomorrow … Daytona International Speedway will provide fans and partners alike access to some of the most advanced technology platforms available today."

At Bank of America Stadium, home of the NFL's Carolina Panthers, CommScope was part of an upgrade to the wireless network. The system now in place at BofA Stadium is the ION-U distributed antenna system (DAS), which CommScope explains enables "fans to upload photos and videos, text and make calls, and enjoy other mobile applications despite the high concentration of wireless users during football games and other events. The Panthers were able to deploy the DAS in less than 90 days from start to finish, and three wireless operators are now on-air throughout the stadium."

The stadium also upgraded its local area network in the form of a passive optical LAN (POL), also using CommScope layer-one infrastructure, in areas including suites. Elsewhere in the stadium, the LAN employs a structured cabling architecture. CommScope noted, "This integrated infrastructure enables applications such as high-bandwidth data, voice, VoIP and WiFi services, high-definition TV and hospitality services for the suites, and broadband video."

Golden 1 Center, the new home of the NBA's Sacramento Kings, opened September 30. Boasting LEED Platinum designation, the venue seats 17,500 people and includes 630,000 square feet of retail and restaurant space. It also is the site of the first installation of CommScope's LazrSpeed 550 OM5 wideband multimode fiber cable, which supports both wired and wireless communications.

Shortly before the arena's opening, Sacramento Kings chief technology officer Ryan Montoya said, "Golden 1 center will be the smartest and most connected venue in the world, providing a seamless and intuitive experience for our fans and attendees. We believe connectivity is critical to the venue experience of the future."

CommScope also supplied other cabling technologies—singlemode and Category 6A cable along with iPatch panels.

Wireless considerations

Montoya's comment about connectivity's criticality rings true across sports venues, and the recently renovated Texas A&M University Kyle Field is another example. With a capacity of more than 100,000, the renovated facility opened for the university's 2015 football season. University chancellor John Sharp observed, "When renovating Kyle Field, we wanted to create one of the most cutting-edge college stadiums with the best technology for a very robust game-day experience."

The university installed the Corning ONE Wireless Platform into the facility. Corning's vice president for wireless networks, Mike O'Day, commented, "In order to bring fans from the living room and into the stadium, you need to have the best fan experience possible. By using the ONE Wireless Platform, an all-optical network, fans can share their experience at Kyle Field by uploading imagery, downloading live-video streams, or accessing the internet and social media as much as they want over the cellular or WiFi networks in the stadium."

The ONE platform supports more than 1000 cellular antennas and 1500 wireless access points, enabling visitors to connect, whether it is through their mobile providers or through WiFi. That hybrid or heterogeneous network is common among large places of assembly.

Oberon Inc. provides enclosures for wireless devices, particularly including access points. It offers one product in particular—the Model 1013-Cover—that it says meets the demands placed on access points in venues such as stadiums. When introducing the Model 1013-Cover in 2015, Oberon explained, "Large spaces such as auditoriums, conference rooms, and stadiums often require network engineers to abandon ceiling installations and develop a wireless infrastructure around walls and pillars. Security, precise positioning of equipment, and aesthetics become a challenge in such settings. The Model 1013-Cover is an articulating access point and antenna mount for most manufacturers' access point and directive (or patch) antennas. The mount can be swiveled on two axes to provide the desired down-tilt and azimuth coverage of the directive antenna."

Oberon also offers its 3000 series enclosures for stadium applications. The 3010 is a stadium underseat enclosure for wireless access points. It is "large enough for most enterprise access points, yet compact enough to fit under the seat without impeding foot space," the company explains. The 3015 underseat access point/antenna enclosure is "designed to protect both wireless access point with attached dipole antennas and external antenna(s) when mounted under seats," Oberon notes. And the 3020 is an enclosure for an access point or antenna that mounts to a handrail.

Broadcast quality

American Airlines Arena, home to the NBA's Miami Heat, opened as the world held its breath about "Y2K" on December 31, 1999. Over its 17-year existence, the facility has undertaken several upgrades of its communications systems, including the cabling infrastructure. One constant throughout has been equipment from Canare, a manufacturer of audio and video cabling products and systems. The infrastructure supplied by Canare enables the broadcast of game and event action from the arena.

David Vickery, director of arena broadcasting services for The HEAT Group within American Airlines Arena, provided detail on the facility's use of Canare products over the years, and the importance of that infrastructure. "Broadcast cabling is the least-thought-of but the most critical for a successful television production or live TV broadcast," Vickery said. "Proactive maintenance on the cable infrastructure lends itself to early warning signs for potential failure. This can also enable an organization to lessen the amount spent on large repairs along with predictive maintenance that identifies an issue before it becomes a problem, and minimizes service downtime."

The arena's broadcast services department has been using Canare BNC RG-59 and RG-6 connectors since the broadcast facility's original installation in 1999. "Upon the conversion from standard definition to high definition in 2009, Canare was selected as the better product and best adaptable to the integration into existing junction boxes television [JBT] throughout the facility and the broadcast truck dock," Vickery said.

The original installation, he elaborated, had triaxial and coaxial cable for connectivity in the building back to the broadcast dock input/output panels. "With the 2009 HD upgrade, a percentage of the triax remained for legacy standard def, and some hybrid forms of HD that continue to use this method of connectivity. New SMPTE [Society of Motion Picture and Television Engineers] fiber and singlemode ST fiber lines were installed to accommodate the newest forms of HD camera systems. In addition to the broadcasters' needs, the in-arena broadcast control room also installed HD SMPTE fiber cameras and have their own dedicated pathway from the JBT boxes back to the broadcast center control room. In the upgrade to HD, SMPTE connectivity would be a new concern of maintenance for fiber connectivity. Having a connection device with simple modular features lends itself to quick diagnostics and repair."

Vickery added that his planning

continued

including consideration of panel configurations and connection population, to ensure the upgraded infrastructure would fit into existing rack systems both at the broadcast center and at the broadcast truck dock. He added that among the particularly useful characteristics of Canare's offerings are their variety of panel mounting options and the ease-of-repair thanks to the SMPTE connection's modularity.

There's more to life than sports

Large groups gather in places other than sporting venues, of course. And connectivity is just as much an issue in these other facilities. One recent example of a communications-system upgrade in a place of assembly other than a sporting venue took place at the Las Vegas Convention Center (LVCC). Cox Communications recently announced that it packed "the power of fourteen cell towers inside a single convention facility" at 3.2-million-square-foot LVCC.

The $18-million DAS project took three years to plan and ten months to build, according to Cox. "The job was so large that four separate installation contractors split up the work, tackling different areas of the campus simultaneously," the company noted. "In addition, various specialized construction trades from HVAC to electrical to fire suppression to custom fabricated steelwork were used to support the massive equipment and antenna infrastructure."

Derrick R. Hill, vice president of Cox Business and Hospitality Network in Las Vegas, commented, "With the support of our partners at InSite Wireless Group, we've constructed a neutral host DAS infrastructure that will provide reliable, high-speed cellular connectivity within the Las Vegas Convention Center. As a result, cell providers will be able to give their customers improved coverage and this will enhance the overall convention center experience for attendees and guests."

Cox also stated that in addition to the center's existing WiFi network, the capacity of the new cellular DAS "is immense. With an ability to deliver service to more than 100,000 guests simultaneously, visitors to the LVCC can expect faster download speeds on their smartphones than typically provided on most corporate networks." It said four U.S. wireless carriers have signed agreements to launch service.

Cox said that Corning provided the DAS core equipment; it also offered up the following numbers for the project.

- 48,000 feet of half-inch coaxial cables
- 20,000 feet of 144-strand singlemode fiber-optic cable
- 25,000 feet of 24-strand singlemode fiber-optic cable
- 1,700 feet of dual 864-strand fiber trunks
- 295 MIMO antenna locations
- 41 equipment racks in the DAS headend
- 1,412 coaxial jumpers at remotes and antennas

The DAS project capped off three years of upgrades throughout LVCC, which included increasing the number of 802.11ac access points from 166 to 2,100, the installation of a new fiber-optic backbone infrastructure, and the addition of redundant 10-Gigabit fiber connections.

Venues that host large assemblies of people, as well as those that host televised events, rely heavily on communications systems to provide attendees and viewers with a seamless experience. Those communications systems, in turn, depend on sound physical-layer infrastructure. ◆

Patrick McLaughlin *is our chief editor.*

Bullish outlook for passive optical LAN market

Researcher predicts a more-than-20-percent CAGR over a 10-year period.

BY PATRICK MCLAUGHLIN

The future is bright for the passive optical LAN (POL) market, at least according to one research organization that recently published a study on the technology. Published in August 2016, the study "Passive Optical LAN Market Global Industry Analysis, Size, Share, Growth Trends and Forecast 2016-2024" by Transparency Market Research examines the market's technology all the way to the chip. According to Transparency, the market's revenue totaled $14.1 billion in 2015 and will reach $103.4 billion by 2024, yielding a 22.9 compound annual growth rate (CAGR).

"By component, the wavelength division multiplexers/de-multiplexers segment accounted for 12 percent of the global POL market revenue in 2015," the organization said, "emerging as the leading contributor. This segment is expected to grow at a CAGR of 22.3 percent over the forecast period. Optical amplifiers, on the other hand, are poised to register the highest CAGR of 24.0 percent during the same period."

Transparency says that Huawei Technologies Co. Ltd, along with ZTE Corporation and Alcatel-Lucent S.A. lead the market. "These three companies accounted for a combined share of over 75 percent in the overall POL market in 2015, indicating the high degree of consolidation … Most of these companies are focusing on business expansion to increase their consumer base and new product development and technological enhancement to deliver value enhancements to customers."

Africa and Asia are likely to witness a sudden surge in the demand for bandwith, rising at a CAGR of more than 38 percent. North America is expected to grow at a CAGR of 20 percent.

Growing need for bandwidth presents a significant opportunity for the POL market's players, the researcher said. "IT professionals have declared that the demand for higher bandwidth is presently large and is likely to grow in the near future, owing to the increasing number of subscribers using a greater number of connected devices and data-dense services. Africa and Asia are likely to witness a sudden surge in the demand for bandwidth, rising at a CAGR of more than 38 percent."

In 2015, the Asia-Pacific region led the POL market geographically, accounting for more than 36 percent of the $14.1-billion total. Transparency Market Research noted, "The growing demand for passive optical networks in the region, especially in China, is one of the primary forces driving this POL market. A surge in data traffic and the use of electronic gadgets by a large number of customers further drives the APAC market.

Governments of major countries across the region are planning to invest in the deployment of fiber-optic networks to improve the network infrastructure in their respective countries. This is anticipated to boost the Asia-Pacific market for POL during the forecast period."

North America is also a key market, the firm said. "Technological advancements and an increasing demand for more-advanced security are some factors that can be expected to boost the growth of passive optical LAN in North America," Transparency stated. "Furthermore, the rising demand for energy conservation and simplified network operations is anticipated to bolster the growth of the POL market in this region. The POL market in North America is expected to grow at a CAGR of 20 percent over the forecast period."

Shortly after Nokia launched its POL technology portfolio in April, Ana Pesovic—who heads the company's fixed networks fiber marketing

activities—discussed the merits of POL in a blog post titled "What to Use When Your Ethernet LAN Maxes Out." In the post she explained, "Ethernet LANs are reaching their capacity limitations and many enterprises are considering how their LANs will cope 5, 10, 15, 20 years from now. Many are also looking to their IT managers to deliver cost savings from the LANs and services."

Citing a seven-page report by Gartner, Pesovic then described POL's reach advantages over a tradition structured cabling system (30 kilometers versus 90 meters), as well as the fact that a POL's singlemode cabling infrastructure is equipped for whatever upgrade the user will undertake.

"An area where Gartner advises caution is in calculating capex and opex savings," she noted. "POL requires less active equipment than Ethernet and cabling is easier to install, which translates into real estate, power and other savings. POL uses statistical multiplexing to share bandwidth between users in a dynamic way and optimize the network performance.

"This concept needs to be understood when designing a POL, but the bottom line is that there is a tradeoff between cost and bandwidth per endpoint. A large number of ports at the optical splitter will reduce cost, but may not provide sufficient bandwidth performance. Enterprises need to carefully consider their bandwidth objectives now and in the future when designing the LAN."

She concluded by acknowledging Ethernet's familiarity and POL's relative unfamiliarity among networking professionals.

"There is a large pool of talent with Ethernet LAN experience as well as an abundance of equipment providers," Pesovic noted. "For most IT managers and support staff, POL installation and operation must be learned and there are few experienced POL providers to guide them. In telecoms networks, fiber is a no-brainer in greenfield deployments. It's the only futureproof solution. The same argument can apply to a greenfield LAN deployment for exactly the same reasons."

We will continue to follow technological and market developments with passive optical LANs, and keep you updated in this magazine and on our website, cablinginstall.com. ◆

Patrick McLaughlin *is our chief editor.*

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TRANSCEIVERS

Optical transceivers from Berk-Tek

Berk-Tek's optical transceivers give network managers full control over their Layer 1 performance, allowing them "to fully own the link," as the company says. "Traditionally, transceivers have been sourced from switch manufacturers, but the performance of the transceiver has more to do with the cable (and vice versa), than the switch," contends a company statement. "Therefore, it makes both financial and operational sense to specify the cabling and transceivers together in order to ensure maximum network performance." Berk-Tek's transceiver product line consists of 1G/10G/40G/100G Ethernet transceivers and 8G/16G Fibre Channel transceivers. Singlemode and multimode versions are available in various form factors.

To help customers understand the most economical method to connect their devices, Berk-Tek has also developed an easy-to-use online calculator. By inputting their data rate, distance between devices, and number of connections, users can obtain an immediate recommendation of which fiber type and transceiver type will support their application at the lowest cost.

Berk-Tek, *berktektransceivers.com*

Legrand expands transceiver line

To meet market demand, Legrand recently expanded its transceiver and direct attach cable offering to operate in a wider range of equipment from popular manufacturers such as Arista, Brocade, Cisco, Finisar, HP, Juniper, and others. In addition, the company notes that its transceiver line "is competitively priced, TAA-compliant and guaranteed to meet or exceed OEM specifications." Legrand says its transceiver offering encompasses "thousands of solutions, including quick-turn custom drop ships, making it one of the broadest in the industry." Each transceiver is tested in-application and bears a lifetime warranty, adds the company.

Legrand, *www.legrand.us*

EXFO's iOptics test application

Available on EXFO's FTBx-88200NGE and FTB-890/890NGE test platforms, iOptics is an intelligent pluggable optics test application for field and lab environments, geared to efficiently evaluate the proper operation of transceivers using minimal user configuration. According to a product press release, "iOptics offers a complete, powerful and easy-to-use tool for CFP and QSFP qualification, and can validate the full range of low- to high-rate transceivers including SFP, SFP+, XFP, CFP, CFP2, CFP4, QSFP+ and QSFP28. iOptics offers a faster, streamlined and automated test sequence, aimed at quickly and simply validating any type of 10M to 100G interface. It is the ideal solution for multirate field commissioning with a simple one-button pass/fail." The application further offers automated stress testing for lab qualification, and is ideally suited for data center and data center interconnect (DCI) testing, adds the company. "iOptics provides a smart, automated and simple way to test the proper function of transceivers," concludes EXFO. "It provides a pass/fail verdict based on predefined or autonomously discovered thresholds. The test allows any fault to be quickly pinpointed to a specific area of the optical device under test."

EXFO, *exfo.com*

EDITOR'S PICKS

News, products and trends for the communications systems industry

- PLENUM AV SPEAKERS
- TIER I AND TIER II TEST GUIDANCE
- OPEN SOURCE RACK HARDWARE

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WIRELESS

Light fidelity (LiFi) technology transmits data through light, turns lamps into wireless Internet access points

Professor Harald Haas, CSO of pureLiFi and Professor of Mobile Communications at the University of Edinburgh, received the International Solid State Lighting Alliance (ISA) Award for Outstanding Achievement in Beijing, China this past November. The award, presented at the 13th International Forum on Solid State Lighting, relates to Professor Haas's contribution to diversify the applications of solid state lighting (SSL) technology. According to the forum, "LiFi, which stands for 'light fidelity', is a technology that can transmit data through light and turn the lamps in every office, home, car or streetlight into wireless Internet access points. It offers higher speeds than traditional wireless technology, greater security and the potential to deliver unprecedented bandwidth and data density." 2014 Nobel Prize for Physics winner and previous winner of the Outstanding Achievement, Professor Shuji Nakamura, presented Professor Haas with the award.

Professor Haas was recognized as the "father of LiFi" after introducing the technology to the world at a TED Global talk in 2011, where he demonstrated light fidelity for the first time and coined the term LiFi. The company he founded in 2012, pureLiFi, is at the forefront of the commercialization of LiFi technology, and in 2016 launched the world's first LiFi dongle–"LiFi-X"–and integrated LiFi luminaire. A statement from the ISA jury presenting the award noted that "[Professor Haas] not only pioneered the novel concept of communication by lighting devices, but also publicized the technology earning him the recognition as the 'father of LiFi'. The technique based upon SSL devices is penetrating the market of indoor ICT and certainly will have a great future in the era of Internet of Things. This is a considerable contribution to diversify the applications of SSL technology and open up new markets. His scientific-technical achievement certainly deserves to be awarded."

Haas established the world's first LiFi center in 2013, when the LiFi Research & Development Center opened at the University of Edinburgh. The center now leads cutting-edge R&D, including pioneering work into the use of solar panels as receivers, in a move which Haas says could help tackle Internet access problems in the developing world–the so-called "digital divide." Professor Haas said about the significance of receiving the commendation, "It has been such a great honor to receive this prestigious award, which I would like to devote to everyone who supported me on this 14-year journey. LiFi is like an undiscovered beach full of pebble stones–under each stone there is something new and exciting to discover, and what is really thrilling is that these discoveries can change our lives and create massive commercial opportunities." ◆

SUPPLY CHAIN

Anixter opening new flagship facility in Houston, TX

On October 7, 2016 Anixter International Inc. announced that it would be opening a customized Houston, TX flagship facility in Jersey Village, located near the city's Beltway 8 and 290 interchange areas.

Scheduled to open in early 2017, the new 200,000 sq. ft. Anixter location will enable the company to stock a comprehensive product portfolio spanning across electrical, data and security solutions, and will showcase its full range of value-added services. In addition to the warehouse facility, a team of on-site sales and technical experts will be available to help customers with product, technology and solution questions covering electrical, electronic, data, enterprise and security applications.

The new location is also being designed to include a "Solutions Briefing Center", where customers can receive hands-on product evaluation and training and engage with technical specialists for product and solution selection.

Chris Blakeslee, Anixter's North American SVP–Electrical and Electronic Solutions (EES), commented, "Our new location in Houston will allow us to fully execute our value proposition for customers in the Houston market. Our range of products, covering every aspect of electrical, data, and security installations is the broadest in the industry, and will result in a true one-stop shopping experience. It also represents our continued enthusiasm and commitment to our suppliers and customers."

"To collocate with our EES salespeople will create an environment that makes it easier to provide our customers with broader value and more relevant business solutions," added Dirk Naylor, North American SVP–Network and Security Solutions, Anixter. "Hosting all of the resources for customer support in one location will make Anixter a more effective business partner in the Houston marketplace, and will allow our customers to better leverage our supply chain solutions and technical expertise," added Naylor.

Anixter, which acquired the Houston-area locations of HD Supply–Power Solutions Division in October 2015, has also announced the appointment of a new senior business leader for the Houston market. Greg Roth, formerly regional vice president for Anixter's EES business in central Florida, brings 25 years of electrical wholesale distribution experience. Roth will immediately assume the role of vice president of sales for the distributor's Houston-area Electrical and Electronic Solutions' business. ◆

AWARDS AND HONORS

Panduit named best 'Data Center Cabling Solution' by NetworkWorld Asia's Reader's Choice awards

Panduit Corp. was recently honored to receive the Reader's Choice Product Excellence Award from NetworkWorld Asia magazine and Networksasia.net for the company's "Data Center Cabling Solutions." The award was announced last October 29th in Singapore.

NetworkWorld's Reader's Choice Award is in its 12th year, and is based on votes received through NetworkWorld Asia magazine, as well as the Networks Asia, Security Asia, Storage Asia and Asia Cloud Forum websites. Award criteria included: reputation of vendor in the marketplace; features and unique selling proposition (USP) of the solution; widespread acceptance of technology and/or brand; users' feedback on the solution/deployment; as well as platform durability, scalability and quality of service, as contributing factors.

"For over 60 years, Panduit has been recognized as a leading brand for our high quality, innovative and reliable infrastructure solutions which solve our customers' real world challenges," commented Thomas Poh, Panduit's director of marketing for the APAC region (pictured, right). "This award is an endorsement from our customers of the kind of experience they have come to expect from Panduit. We are honored and will continue to work hard to maintain this trust." ◆

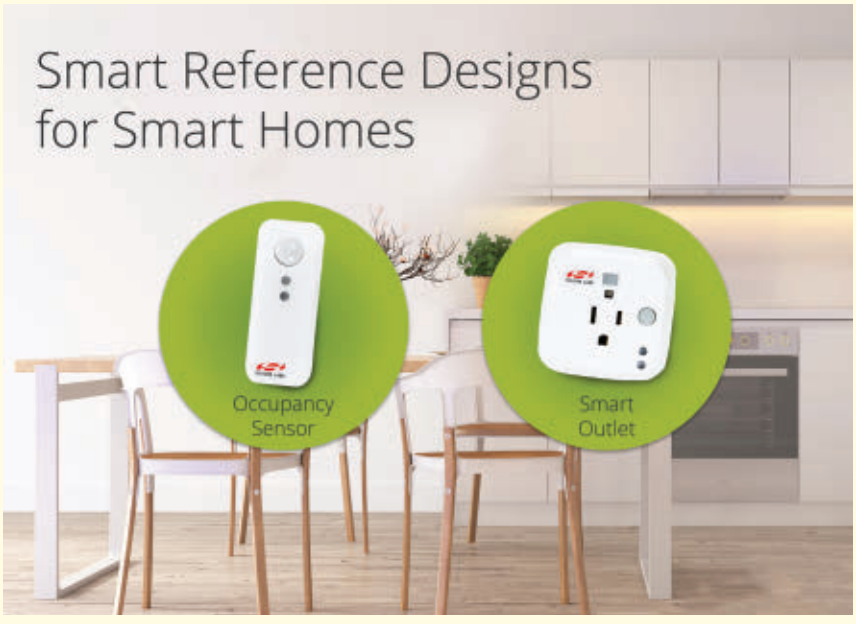
INTERNET OF THINGS

ZigBee-based occupancy sensor, smart outlet reference designs foretell IoT-connected smart homes

Silicon Labs has released wireless occupancy sensor and smart outlet reference designs for the home automation market, outlining IoT (Internet of Things) connected device solutions projected to help make homes safer, as well as more convenient and energy efficient.

The FCC and UL precertified reference designs include all of the hardware, firmware and software tools required to create feature-rich, future-proofed connected home products based on Silicon Labs' robust ZigBee "Golden Unit" Home Automation (HA 1.2) software stack and multiprotocol Wireless Gecko system-on-chip (SoC) portfolio. Silicon Labs says the occupancy sensor and smart outlet reference designs will help home automation device makers and developers accelerate time-to-market and reduce system cost and complexity via best-in-class ZigBee mesh networking technology. By leveraging the turnkey reference designs, developers can quickly advance from design concept to final product with precertified wireless technology, open-source hardware design files and industry-standard software stacks, while also taking advantage of proven test setups and manufacturing methods.

"Successful home and building automation products must be standards-based, cost-effective, easy to deploy by end users, and designed to work in real-world environments and solve specific problems with minimal design complexity," said Daniel Cooley, senior vice president and general manager of Silicon Labs' IoT



products. "We're helping connected home developers achieve these market-critical objectives with precertified reference designs based on our breakthrough multiprotocol wireless and sensing technologies."

The occupancy sensor reference design is a compact, precertified ZigBee HA 1.2 solution featuring a wirelessly connected passive infrared sensor along with ambient light and temperature/relative humidity sensors from Silicon Labs.

Occupancy sensors are key components for residential and commercial security systems, as well as other home/building automation systems that use occupancy detection to automate tasks such as turning lights off and on. The occupancy sensor's small, battery-powered design (the size of two AAA batteries) is so energy efficient it can operate for up to five years before battery replacement. The sensor's detection range extends up to 12 meters (nearly 40 feet) with a 90-degree viewing window.

The smart outlet reference design is a complete, precertified solution for a wirelessly controlled outlet plug that can be used to power and control a wide range of home and building automation products. Powered by an AC main-voltage line, the smart outlet communicates wirelessly to ZigBee mesh networks. The smart outlet design includes the following key features: built-in diagnostics and metering with a user-friendly web interface for wireless control and current/voltage monitoring, easily accessible from mobile devices; a wide AC voltage range (110-240 V) for global use along with a 15 A load current; integrated high-accuracy sensors for measuring ambient light and temperature/humidity; and compact design footprint of 6.5 cm x 6.5 cm x 4.0 cm. ◆

SUPPLY CHAIN

Graybar appoints new Seattle district VP

Graybar, a North American distributor of electrical, communications and data networking products and a provider of related supply chain management and logistics services, has appointed Stephen Cray as its district vice president in Seattle, effective January 1, 2017.

Cray will replace Kirk Snure, who retired as district vice president after more than 31 years with the distributor. Graybar's Seattle district is one of 13 operating districts for the employee-owned company, serving customers throughout Washington, Oregon, Idaho, Montana, Alaska and Hawaii. In total, the district includes 12 locations and more than 430 employees. Cray has 30 years of experience in the electrical industry and has been with Graybar for more than a decade. He currently serves as director, electrical sales in the company's Southern California region, a position he has held since 2008.

"We thank Kirk Snure for his leadership, dedication and service to Graybar and wish him all the best in retirement," said David Maxwell, Graybar's regional vice president. "We also congratulate Steve Cray on his appointment to Seattle district vice president. He brings extensive experience to this assignment and we are confident in his ability to lead our business in this region. I look forward to working with him as he takes on this new role." ◆

DATA CENTER CONSTRUCTION

Massive Ashburn, VA data center campus on 76.5 acre site to accommodate 6 buildings

RagingWire Data Centers, a U.S. data center provider, and its parent company NTT Communications (NTT Com), the ICT solutions and international communications business within the publicly traded NTT Group, announced that the company is investing $160 million to build the new Ashburn VA3 Data Center in the heart of the famed "Data Center Alley" in Ashburn, Virginia, widely cited as the top data center market in the world.

The Ashburn VA3 Data Center represents phase one of RagingWire's massive Ashburn Data Center Campus development, which can accommodate six buildings on the 76.5-acre site. The VA3 Data Center with 245,000 square feet of space and 16 megawatts of power is scheduled to be available by the end of 2017. RagingWire and NTT Communications made the announcement of the new facility at the 2016 Gartner Data Center, Infrastructure, and Operations Management Conference, held in Las Vegas last December 5-8. Last year was RagingWire's fifth as a sponsor of the Gartner conference.

According to a press release, "The VA3 Data Center will realize new levels of availability, flexibility and global reach. The facility features a new flexible electrical design that builds on RagingWire's patented and award-winning 2N+2TM power delivery architecture to offer wholesale customers that purchase an entire vault the option of dedicated electrical solutions including N+1 and 2N. Vaults will be available in increments of two to four megawatts, and there will be space and power available for multi-rack cages that can grow over time. The campus will have three diverse fiber entrances, reliable and cost-effective utility power from Dominion Virginia Power, a high-security gated entrance and anti-climb perimeter fence, and world-class customer amenities including lounges, breakrooms, a game room, a gym, locker rooms and showers, conference rooms, and office space. VA3 will also offer extensive, carrier-neutral network connectivity services to other data centers and cloud providers."

"The Ashburn VA3 Data Center raises the bar for data center colocation in the largest data center market in the world," said George Macricostas, chairman, CEO and founder of RagingWire Data Centers. "VA3 offers mission-critical performance, flexible configurations for hyperscale cloud and enterprise deployments, exceptional customer amenities, and global integration with NTT Com's growing portfolio of over 140 data centers around the world."

The VA3 Data Center joins RagingWire's VA1 and VA2 data centers, which also are in Ashburn. The company notes that the combination of VA1, VA2 and VA3 creates a data center footprint of more than a half million square feet of space and 44.4 megawatts of power, and includes on-site security officers and multi-layered security systems, highly efficient cooling and carrier-neutral telecommunications, and direct connectivity to top cloud providers and other data centers in Data Center Alley. On a wider scale, VA3 will grow RagingWire's existing 1.2-million-square-foot U.S. data center platform, which includes CA1, CA2, and CA3 in Northern California and TX1 in Dallas, TX, as well as NTT Com's global data center services platform operated under the Nexcenter brand. ◆

AV NETWORKS

Two-way ceiling speaker approved for plenum spaces

Extron Electronics recently introduced the SoundField XD model SF 26CT, a 6.5-inch two-way ceiling speaker that features an 8-inch-deep composite backcan for use in plenum-rated ceiling environments. The driver complement includes a 6.5-inch woofer coupled with a 0.75-inch ferrofluid-cooled dome tweeter.

"With the AV industry's first UL 2043-listed composite speaker enclosure, the SF 26CT meets stringent UL requirements for smoke and heat release in plenum air spaces," Extron said when introducing the speaker in January. "A magnetically attached grille with a thin-edged bezel gives the SF 26CT a refined appearance on the ceiling. The SF 26CT offers both direct 8-ohm and 70/100-volt operation with a behind-the-grille, six position power selector switch. With 70/100 volt taps at 8, 16, 32 and 64 watts, the SF 26CT can be used in applications where a high-power distributed speaker system is needed."

Casey Hall, vice president of sales and marketing for Extron, commented, "The SF 26CT represents a new level of quality and innovation in speaker design. With excellent performance and features that simplify installation, the SF 26CT is ideal for use in applications that require both vocal clarity and musical accuracy."

Extron says that SoundField XD speakers are designed with integrators in mind; they are constructed using a two-piece modular design with a separable backcan and baffle, which the company says simplifies installation in both single-trade and division-of-labor installations. "These speakers include a cable/conduit access plate that can be oriented as side mount, for low-clearance ceilings, or as top mount for blind-mounting into drywall ceilings," Extron added. "Opti-Torque indicator rings provide a visual indication when the locking arm screws have been sufficiently tightened, preventing damage to the speaker caused by over-torqueing." The speakers are sold in pairs. ◆

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SECURITY

Patented RF technology monitors wireless signals in the home for 'camera-less' security

At the 2017 Consumer Electronics Show (CES) in Las Vegas, Cognitive Systems Corp., an RF technology specialist, announced the launch of Aura, an intelligent home security system that uses the company's patented spectrum analytics technology to detect and monitor motion. The patented technology is used to monitor the disruption of wireless signals caused by movement in the home, without the use of cameras.

The simple, two-piece Aura system provides full coverage for the average home, even in rooms where people are typically unwilling to place cameras. Household members are notified on their smartphones of unauthorized motion that occurs anywhere in the residence. The Aura system can also recognize the presence of known household members, show motion patterns in the home, provide a timeline of activity, deliver tailored notifications to homeowners' smartphones, and interact with other smart home systems.

"When we realized that our technology could understand motion by seeing how the patterns in wireless signals change in a home, we knew that we had something special," said Taj Manku, cofounder of Cognitive Systems. "By using radio frequencies to detect motion, we provide a more dependable solution to consumers by eliminating most of the false detections that occur with traditional sensors. We thought about how people want to interact with their security system and provide convenient features like auto-arm and disarm. We're excited to be launching Aura at CES, and looking forward to shipping by the end of February 2017."

Aura is powered by a custom chipset from Cognitive Systems that monitors and analyzes wireless signal patterns that occur when movement takes place within a home, and alerts the user if unauthorized motion is detected. The company says its Aura system is more accurate than other motion detectors, because the system is not dependent on light and it understands the difference between human and non-human movement (e.g. a fan, shadows, drapes blowing, etc.). Aura will be launching with IFTTT integration so it can connect with other smart home systems as desired.

The Aura system is set-up and managed via a free app available in the Apple App Store and on Google Play. The app allows homeowners to see three different views of motion for Live, 12 Hour and Weekly. Consumers can also use the app to see who is currently at home, a timeline of household activity, arm or disarm the system and more. ◆

STANDARDS

IEEE publishes 802.1Qbz bridged networks amendment

IEEE and the IEEE Standards Association (IEEE-SA) recently announced the availability of the IEEE 802.1Qbz Standard for Local and Metropolitan Area Networks—Bridges and Bridged Networks Amendment: Enhancements to Bridging of IEEE 802.11 Media. The new standard specifies protocols, procedures, and managed objects for IEEE 802.11 media to provide internal connections within bridged networks, as well as access to bridged networks.

According to the IEEE-SA, "A number of new products, including home entertainment systems and industrial control equipment, are enabled with both IEEE 802.11 wireless station capability and wired IEEE 802.3 Ethernet capability. IEEE 802.1Qbz meets a growing demand to incorporate IEEE 802.11 media at the same level as other media supported by bridges, both as a medium internal to the network and as a medium offering access to the network."

IEEE 802.1Qbz is available for purchase at the IEEE Standards Store.

"IEEE 802.1Qbz demonstrates our commitment to stay abreast of industry needs and respond quickly to ensure technology standards continue to meet evolving networking challenges," said Norm Finn, editor of IEEE 802.1Qbz. "Enabling IEEE 802.11 on par with other media within bridged networks offers greater and more flexible options for overcoming connectivity issues and ensuring the highest degree of reliability for devices operating on a network." ◆

OPTICAL FIBER

Corning receives Technology and Engineering Emmy Award

At the 68th Annual Technology and Engineering Emmy Awards, held in conjunction with the Consumer Electronics Show in Las Vegas, NV, Corning Incorporated received an award for its 1970 invention of low-loss optical fiber. "The award honors breakthrough innovations that materially affected television engineering," Corning said in an announcement after receiving the award. Corning received the award in the category of Pioneering Invention and Deployment of Fiber Optic Cable.

Corning's executive vice president Clark Kinlin stated, "The ability to view high-quality video at any time of the day, from almost any place on a variety of connected and mobile devices, is commonplace today. But it would not be possible without the broad deployment of optical fiber. It's impossible to imagine the television industry today without the virtually limitless bandwidth capability of optical fiber. It was born in Corning labs in 1970, and our scientists haven't stopped improving it since."

The company recalled that scientists Drs. Robert Maurer, Donald Keck and Peter Schultz developed the first low-loss optical fiber capable of maintaining the strength of laser light signals over significant distances. This breakthrough, Corning added, helped solve the problem network carriers faced at the time in handling the growing volume of information with the transmission limitations of copper lines.

Kinlin concluded, "As we envisioned in our 'A Day Made of Glass' videos, our portfolio of glass products both redefine the simplest of today's activities and make new things possible. We're grateful to be recognized by The National Academy of Television Arts and Sciences and, just as we've always done, we remain committed to bringing glass-related innovations to the continuously evolving communications and entertainment industries." ◆

TESTING

Ideal Networks offers guidance on Tier-1 and Tier-2 fiber-optic testing

To help cable installers and maintenance technicians select the correct fiber-optic testing equipment for their deployments, Ideal Networks recently published a free technical white paper that offers guidance on the different tiers for certifying fiber-optic cabling.

"Unlike copper cabling, there are two tiers available when certifying fiber-optic cabling, and these dictate which type of tests must be performed, and therefore which testers should be used," notes Dan Payerle, business unit manager for Ideal Networks. "To remove confusion around which type of test should be used — and whether performing Tier-2 certification also meets the requirements of Tier-1 certification — the new white paper clarifies the different requirements in detail, as well as looking at the advantages of different testers and how they work."

Briefly, as explained by the company, Tier-1 certification is a measurement of the total insertion loss (or attenuation) of cabling from one end of the link to the other, and either uses an optical power meter and optical light source (PM/LS) or an optical loss test set (OLTS) for testing.

Tier-2 certification provides loss information about each component of the link and uses an OTDR (optical time domain reflectometer) to perform certification, providing a useful graphical representation of each connection, splice and cable segment in the link, and their performance.

When certification is required, the guide recommends that "it is good practice to perform a Tier-1 test, and optionally conduct a Tier-2 test. Although an OTDR can show the total link loss like an OLTS does, Tier-2 certification cannot replace Tier-1 certification, as there is a subtle distinction between the total link loss reported by the two devices."

The white paper further advises, "An OLTS, such as the Ideal Networks OC I Tier-1 fiber cable certifier, measures the true optical loss of the link, which makes it the most accurate way to determine end-to-end loss of a link and a requirement for Tier-1 certification. However, an OTDR, like the OTDR II from Ideal Networks, characterizes the link under test and can offer additional advantages, such as advanced troubleshooting for faster repairs."

"Ultimately the required testing is an agreement between the cabling contractor and their customer," concludes Ideal's Payerle. "However, in order to provide customer satisfaction, it is essential that fiber-optic installers understand the different tiers and therefore which certification reports will provide the necessary assurance." ◆

FIBER CLEANING

Alternative to trigger-operated fiber endface cleaning tools

MicroCare Corporation introduced the Sticklers brand Cassette CleanClicker at the BICSI Winter Conference and Exhibition, which took place January 23-26. "The cassette cleaner is designed to be an economical alternative to more-expensive, trigger-operated cassette cleaners," the company said. The Cassette CleanClicker uses a high-performance microwoven fabric for the cleaning ribbon, which has high absorbency for removing endface contamination, the company explained. "The woven material provides excellent dust-trap capabilities," MicroCare added about its new fiber endface cleaning tool.

It can be used either as a dry wipe or as part of a wet/dry cleaning process, MicroCare noted. It cleans all female MPO connectors of any fiber count, as well as standard single and duplex fiber connector assemblies. "This makes it ideal for field installations, test labs, OEM equipment and cable assembly production, field installers and installation kits," the company added.

MicroCare describes the Cassette CleanClicker endface cleaning tool as disposable in a translucent housing. The device is unique in that it features manual, user control of the cleaning ribbon. "This enables the operator to perform multiple cleanings on the same piece of ribbon, which reduces cleaning costs," the company said. "The translucent plastic housing also makes it easy for the operator to visually judge the quantity of cleaning ribbon remaining in the cassette, avoiding unpleasant surprises out in the field."

It also features a shutterless cleaning window. MicroCare declared, "Traditional, more-expensive cassette cleaners use a shutter mechanism in an ineffective attempt to protect the cleaning ribbon. These tools also require a complex, spring-loaded trigger mechanism to advance the cleaning ribbon and open the shutter to expose the cleaning ribbon. These features also make those tools more expensive so companies refill them, which adds even more costs and logistical worries. All of this over-engineered complexity is not necessary since it does not protect the cleaning ribbon from moisture or dust. The new Sticklers Cassette CleanClicker tool avoids all these problems and costs without sacrificing performance." ◆

DATA CENTER MARKET

Analyst: 145 cloud and colo companies account for 40 percent of global data center space

The top 145 cloud and colocation companies are now estimated to account for 40 percent of global data center space, measured in square footage, according to a new study by IHS Markit. "This is a remarkable figure given that Amazon's AWS—the largest provider of Infrastructure-as-a-Service—set up its first data center just 10 years ago, in 2006," the analyst organization said. "It was at this same time that Equinix—the top colocation provider—first purchased a data center campus in Ashburn, VA, a region that over half of the internet's traffic now travels through," the company added. "Cloud and colocation [colo] companies are growing and building data centers fast, and it's changing the data center market in significant ways."

In its analysis, IHS further noted that the domination of the data center market by so few companies "means there are a decreasing number of companies accounting for an increasing percentage of spend on data center infrastructure." That reality comes with the following two significant consequences, the analyst explained.

- It creates volatility in the market for data center infrastructure suppliers. When just a few large companies account for such a great share of the market, builds and purchasing of equipment will ebb and flow more than what is historically typical.

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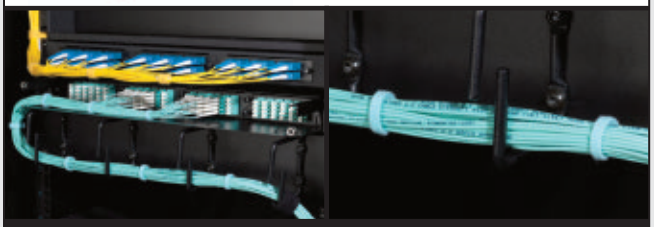

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OPEN COMPUTE PROJECT

Pentair, Radisys collaborate on open source rack hardware systems for carrier data centers

Last November, Pentair with its Schroff brand, and Radisys Corporation announced their joint development of open source rack-level hardware systems specifically designed to meet the next-generation requirements of the telecom industry. According to the companies, "the resulting open source hardware design leverages Open Compute Project (OCP) principles, with optimizations for telco central offices and service provider-oriented data centers."

The joint design innovations are being contributed to OCP as the CG-OpenRack-19 specification.

A press release from the companies adds, "Communications service providers are transitioning their networks from traditional central offices to virtualized data centers in order to meet demand for real-time service delivery while saving capital and operating expense. This migration from purpose-built systems to software-based applications running on commercially available infrastructure is driving a broader ecosystem that is increasingly using open source software and open hardware solutions. The Radisys and Pentair collaboration has resulted in Radisys's DCEngine product offering, which integrates Schroff's ServCite open rack-scale hardware solution, enabling service providers with the infrastructure to deliver an agile software-driven approach to deploying new services quickly."

"Radisys's strategy is to enable the telecom industry to deploy software-centric networks that leverage open source hardware and software and we look to work with partners that share our vision," said Brian Bronson, president and CEO, Radisys. "Pentair shares our commitment to agile hardware development and our teams worked closely together to provide Radisys's customers with our new open rack-scale infrastructure systems rapidly. With our strategic collaboration with Pentair for our open hardware design, combined with our open software integration experience and professional service capabilities, we believe that Radisys is uniquely positioned to offer open rack-scale platform solutions for next-generation telecom data centers."

"There is a robust open source ecosystem developing that will drive the future of next-gen networks, and Schroff is embracing this new model," added Daniel Stirpe, vice president and general manager, Schroff. "Radisys is an agile and flexible partner, and our collaboration together highlights what a model partner relationship should look like with the resulting delivery of a new open source rack-level solution that meets the specific needs of communications service providers. We're pleased to collaborate with Radisys to contribute this innovative technology to the open source community." ◆

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- It means that these cloud and colo companies have an increasing ability to negotiate for lower prices. One lost sale to a major cloud or colo provider could make or break a data center infrastructure supplier's revenue target for the year. Cloud and colo players know this and use it to their advantage when seeking best pricing.

Going forward, IHS forecasts that it expects cloud and colo companies to account for an even greater share of data center investments. Liz Cruz, associate director in the analyst organization's cloud and data center research practice, commented, "I would not be surprised if, in just a few short years, we see cloud and colocation companies approaching the 60-percent mark in terms of ownership of data center square footage worldwide. The pace at which they are building, and at which regular enterprise users are outsourcing their own data center operations to those cloud and colo companies, is phenomenal, and there are no major roadblocks ahead. Sure, some enterprises may still choose to keep a few mission-critical applications in-house, but a growing adoption and acceptance of the cloud is leading to a hybrid approach to data center operation that allows for an increasing number of applications to be managed by cloud providers, which themselves are moving into colocations, causing the need for more colocation facilities to be built as well." ◆

DISTRIBUTED ANTENNA SYSTEMS

In-building wireless specialist Zinwave appoints former Ericsson, Corning DAS expert as CTO

Zinwave, a provider of wideband distributed network solutions for in-building wireless systems, announced that it has named Slavko Djukic its chief technology officer (CTO). Djukic, an expert in DAS and small-cell systems, will lead the development and refinement of technologies to improve the cellular and wireless experience for Zinwave's enterprise customers. "Zinwave already possesses a unique, highly differentiated technology platform that makes it the ideal solution for in-building wireless coverage for enterprise customers," commented Djukic. "I look forward to driving our wideband DAS development into new territory as enterprises, building owners and mobile operators around the world look to expand in-building wireless services."

Djukic comes to Zinwave with 18 years' experience in indoor wireless technology development. He most recently served as Ericsson's head of strategy and solutions for small cells, DAS, and WiFi. Prior to Ericsson, Djukic served in a global technical role for Corning, where he was responsible for expanding the company's global indoor building solutions, acted as the primary technical interface for indoor wireless experts around the world, and acted as the technical lead in Corning's acquisition of Mobile Access. Djukic also held a leadership role with Powerwave, where he built and led the technical indoor and outdoor DAS solutions organizations for North, Central and South America. He received his B.S. in Electrical Engineering from the University of Alabama and his M.S. in Electrical Engineering from the University of Colorado.

"Zinwave is wholly committed to delivering a superior wireless experience to our enterprise and public venue customers, and that means we must always stay several steps ahead of our competitors," said Scott Willis, president and CEO at Zinwave. "Slavko is a visionary leader who combines deep technical knowledge with a broad understanding of the challenges and opportunities that lie ahead. We expect him to hit the ground running and to make a rapid and dramatic difference for Zinwave and our customers." ◆

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INFRASTRUCTURE INSIGHTS

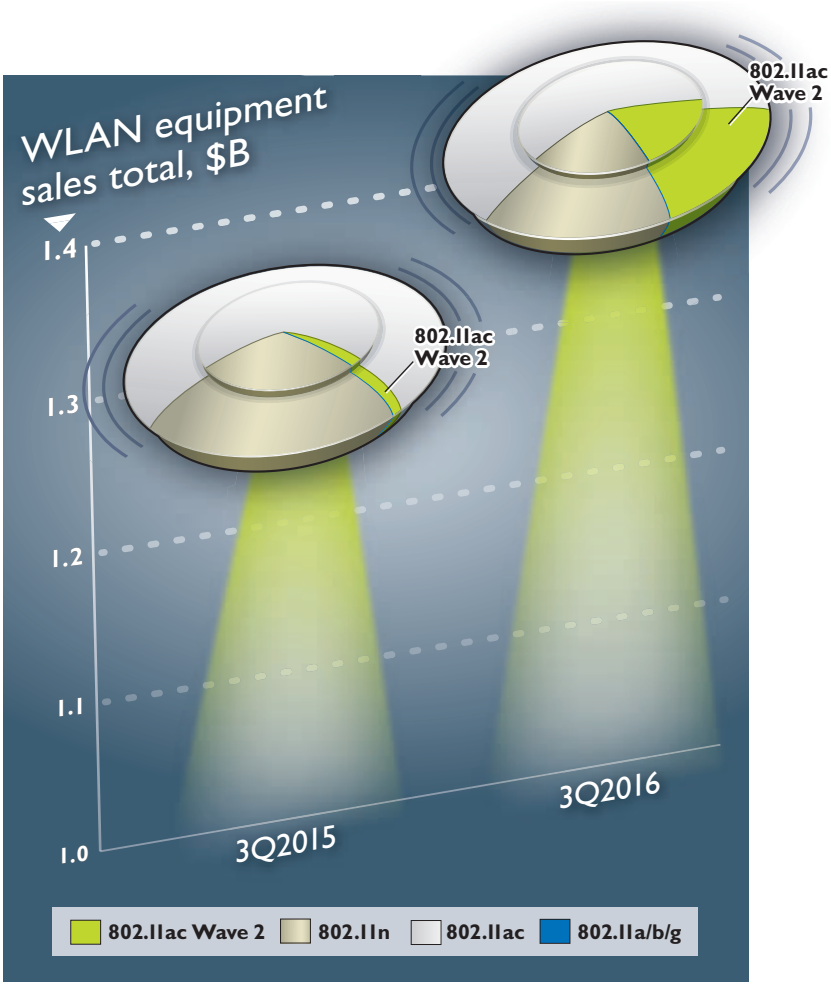
More than half a million 802.11ac Wave 2 access points shipped in Q3

In a recent quarterly tracking report covering wireless LAN (WLAN) equipment and WiFi phones, IHS Markit reported that WLAN equipment sales totaled $1.4 billion globally in the third quarter of 2016. That is a 6-percent sequential growth over the second quarter, due to a seasonal pickup in demand. It also represents an 8-percent year-over-year increase from the third quarter of 2015. From a volume standpoint, IHS Markit reported that access point shipments were up 21 percent year-over-year.

"A total of 6 million access points shipped in Q3 2016, including more than 500,000 802.11ac Wave 2 units," the analyst firm said. "Wave 2 accounted for 10 percent of all units in Q3, nearly double Q2's rate."

IHS Markit continued, "Despite strong adoption of 802.11ac and Wave 2 products, average selling prices have not increased and are in fact down more than 10 percent year-over-year. Demand for WLAN is strong, but monetizing that demand has been a challenge for the last two years as organizations chose lower-cost approaches."

The graph on this page reflects that dynamic. As the firm explained, Wave 2 access points accounted for 10 percent of units shipped in Q3; but as the graph shows, the "Wave 2" slice of the pie for Q3 2016 represents approximately 20 percent of revenue.



The analyst firm asserted that despite the popularity of lower-cost access points, "The outlook for the WLAN market remains bright, as infrastructure investments over the long term will shift to WLAN equipment to support the rapid rise of wireless devices, both personal and for the Internet of Things, and also requirements for mobility."

IHS Markit also reported the following about the global WLAN market.

- Asia-Pacific, the fastest-growing region for WLAN in 2015, continued to lead in 2016. Fiscal stimulus in China helped drive demand.
- In North America, the commencement of the FCC's new E-Rate program helped to steady the market, but growth there remains relatively small.
- For Europe-Middle East-Africa (EMEA), Brexit is likely to cause lower growth in 2017, but a resurgence in 2018 will continue through 2020.
- Revenue leaders in Q3 were, in order: Cisco, HPE (Aruba), Brocade (Ruckus).
- Huawei and Ubiquiti led in year-over-year growth. IHS Markit characterized Huawei as a "major WLAN player, tripling revenue year-over-year" thanks to steady demand in China and its expansion into Europe.
- Portfolio updates propelled Ubiquiti to 53-percent YoY growth. ◆

In Q2 2015 Ruckus Wireless unveiled the ZoneFlex R710, an 802.11ac Wave 2 access point. The following quarter, Wave 2 access points accounted for a small sliver of wireless LAN revenues. A year later, in Q3 2016, the technology accounted for approximately 20 percent of revenues.

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