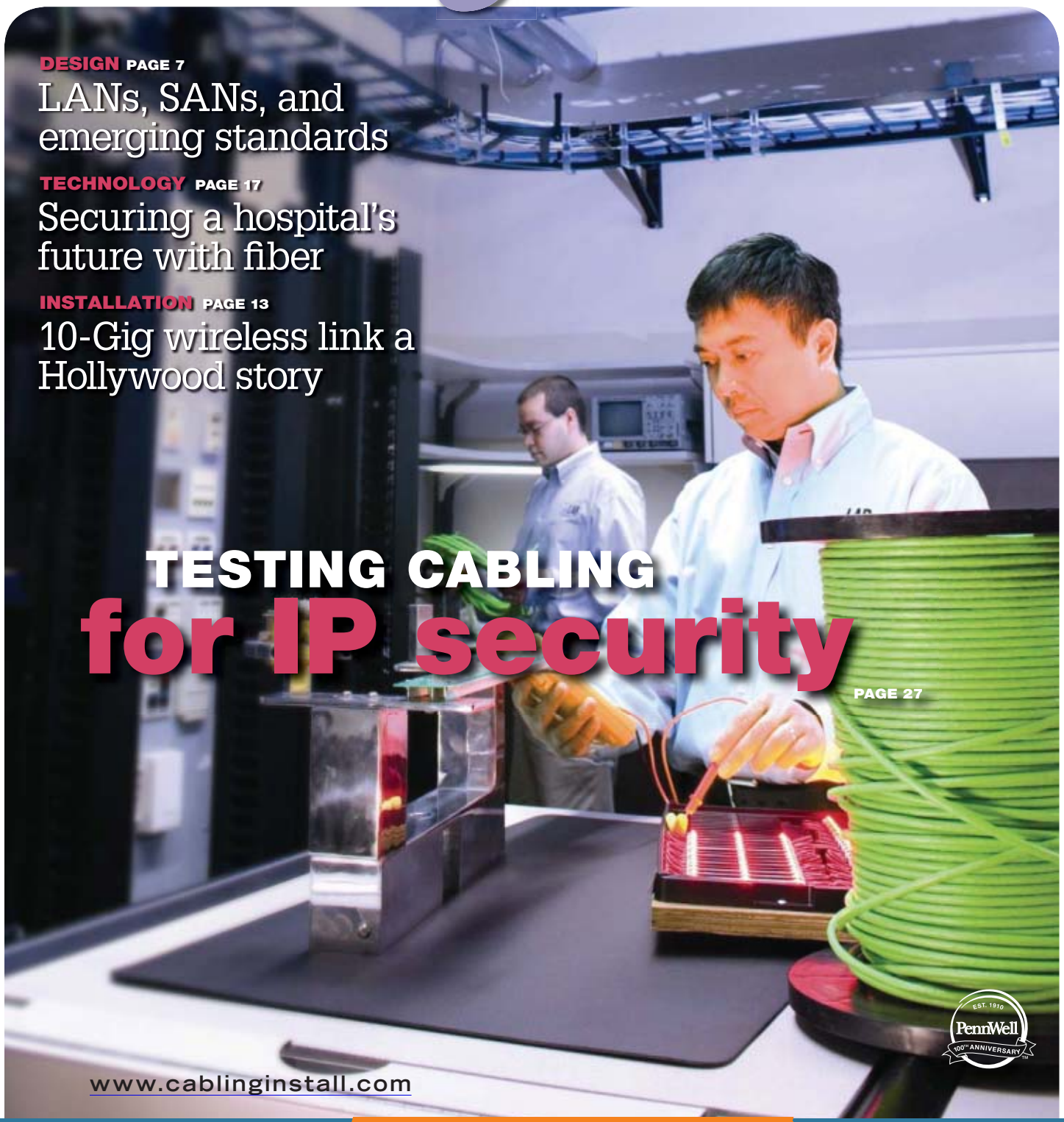
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LANs, SANs, and emerging standards

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Securing a hospital's future with fiber

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10-Gig wireless link a Hollywood story

TESTING CABLING for IP security

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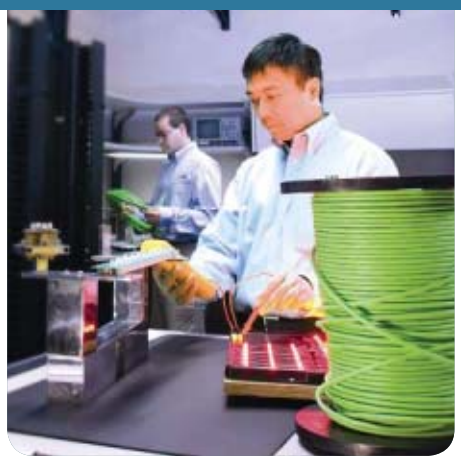


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Anixter's Andy Jimenez tests a cabling system's ability to support IP-based security applications inside his company's Infrastructure Solutions Lab.

TO LEARN MORE, SEE ARTICLE ON PAGE 27.

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New look, same commitment



Yes, this is Cabling Installation & Maintenance magazine that arrived in your mailbox—whether that mailbox is a physical or virtual one. The look of our magazine has changed with this month's issue, but much of the information we're providing in the newly reformatted version remains the same. We're still going to provide you, on a monthly basis, articles that deal with the specification, design, installation, and management of structured cabling systems in many types of environments for the transmission of several forms of information.

One element that has changed is that we've combined what used to be our New Products and Industry Spotlight sections into a new format we're calling Editor's Picks. Found on page 31 of this month's issue, Editor's Picks will include some of the latest product introductions as well as industry news, with a little bit of my opinion thrown in.

Part of the reason for the new look is that over the past few years more and more of you have asked to receive the magazine in your e-mail inbox. To those of you who receive it that way each month, we hope you find the new format easier to read on your computer screen. We welcome comments from everyone—those who receive the magazine digitally as well as those who receive the printed version—about our new design. We are not necessarily done changing our look, and your comments certainly can influence any additional changes we make.

Living just north of Massachusetts and getting all the network-television affiliates from Boston, I heard more about the Scott Brown/Martha Coakley Senate race than I did about the most recent Senate race in my own state. Perhaps Brown's most famous quote of the campaign came during a debate. I'm paraphrasing here but he said something like, "It's not Ted Kennedy's seat. It's the people's seat." He now has a little bit of time to prove to the voters in his home state that it's not Scott Brown's seat; it's their seat.

Likewise this magazine is responsible to you, the individuals who choose to receive and read it in the interest of professional education and development. The extent to which this magazine keeps you up-to-date in your profession and helps you in your day-to-day duties, is the extent to which the editorial staff is doing our collective job satisfactorily. Please, let us know how we're doing.

PATRICK McLAUGHLIN
Chief Editor
patrick@pennwell.com

on cablinginstall.com



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Rugged fiber-optic cable fit for harsh outdoor environments

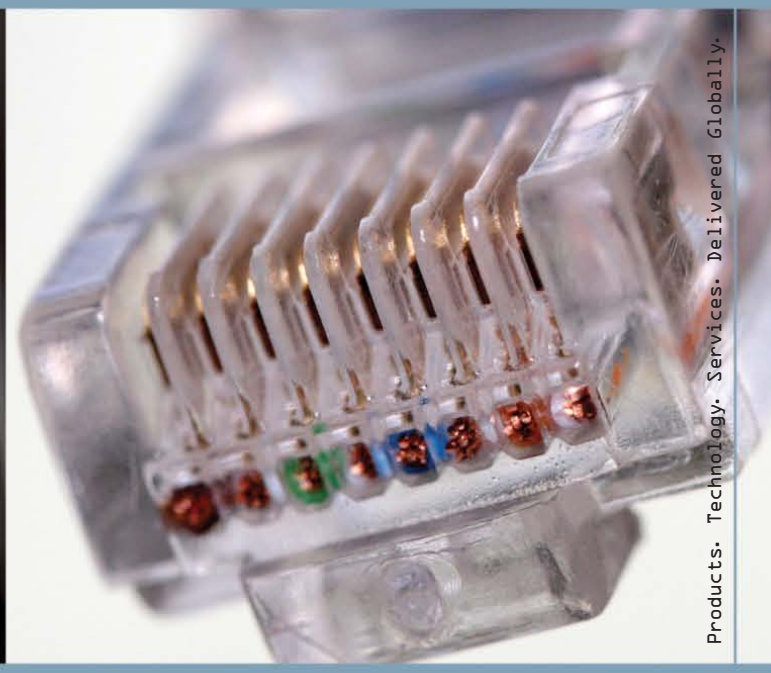
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DESIGN

The impact of emerging standards on LAN and SAN infrastructures

Creating and deploying a unified fabric in the data center requires consideration of today's and tomorrow's cabling systems.

BY KEVIN KOMIEGA

Storage area networks (SANs) came to the forefront in the late 1990s as a preferred way to connect servers to external, shared storage devices. This evolution from direct-attached, local server storage to networked storage created two divergent data center networks: SANs for storage and local area networks (LANs) for application traffic.

There was a clear need for two separate networks as Ethernet protocols were, at that time, not up to the task of transporting storage traffic due to performance and latency risks and a penchant for dropping data packets.

A little more than a decade later, times and technologies are changing. Ethernet speeds are quickly surpassing those of Fibre Channel and lossless performance is paving the way for 10-, 40-, and 100-Gbit Ethernet to potentially displace Fibre Channel as the foundation for SAN networking in the data center, begging the question: What will the LAN and SAN infrastructure look like in the future?

The costs and complexity associated with operating separate network infrastructures for LANs and SANs are numerous, especially on the storage side of the data center. Fibre Channel SANs require host bus adapters (HBAs) for server connectivity, not to mention storage administrators with a completely different skill set than their network administrator counterparts.

In terms of cabling, Fibre Channel SANs employ optical fiber, coaxial copper, or twisted-pair copper cabling with speeds of 1, 2, 4, and 8 Gbits/sec.

The advent of 10-, 40-, and 100-Gbit Ethernet could eventually eliminate the need for separate LANs and SANs, network teams and cabling infrastructures by creating a single network fabric for LAN and SAN traffic.

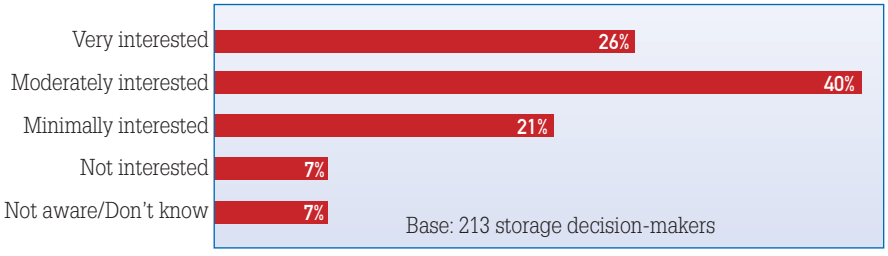
Interest in a unified fabric

According to a recently released research study conducted by information technology (IT) research firm Forrester Consulting and commissioned by Dell Inc., customer interest in using 10-Gbit Ethernet as the physical network or common network protocol for storage and application network traffic – known in the industry as the unified fabric – is on the rise.

The study, which was based on a survey of 213 storage professionals in the United States, United Kingdom,

Interest levels in unified fabric

"How interested are you in unified fabric or network convergence between LAN and SAN?"



Source: "The future of Unified Fabric", a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

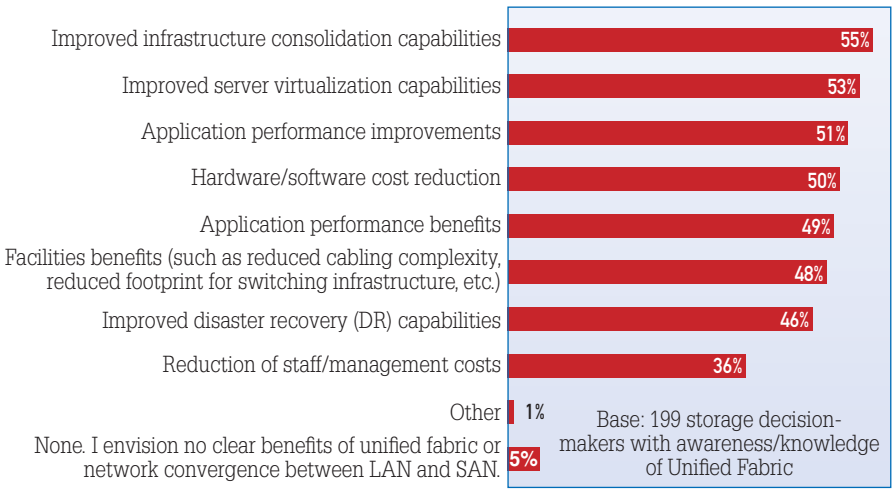
In a study conducted by Forrester Consulting for Dell last fall, 66% of storage networking decision-makers said they are either very interested or moderately interested in a unified fabric/network convergence between LAN and SAN.

China, and the Netherlands, revealed that interest in SAN/LAN convergence is high. Sixty-six percent of respondents overall said that they are very interested or moderately interested in the concept of unified fabric or SAN/LAN convergence.

In terms of storage, it remains to be seen which protocol will win-out as the de facto transport mechanism for storage traffic. The Internet Small Computer Systems Interface (iSCSI) has an entrenched installed base with Fibre Channel over Ethernet (FCoE) coming on strong as customers seek ways to connect existing Fibre Channel storage devices to the network. Regardless, the consensus is that high-speed Ethernet will serve as the underlying transport mechanism.

Predicted benefits of unified fabric

"Regardless of your current interest, what do you see as potential benefits of unified fabric or network convergence between LAN and SAN?" (select all that apply)



Source: "The future of Unified Fabric", a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

A reduction in cabling complexity was characterized as a facilities benefit in the Forrester study. That complexity reduction, alongside other facilities benefits such as a reduced footprint, was an appealing benefit to just about half the storage-networking professionals who are familiar with the unified-fabric concept.

Cabling for the next generation

Most experts believe the separation of LANs and SANs will remain for the next several years. David Kozischek, data center market manager for Corning Cable Systems (www.corning.com/cablesystems), predicts that 40-Gbit/sec uplinks will be used to edge switches to support 10-Gbit/sec downlinks into servers within the next two years while 40-Gbit/sec servers will make their way into the network over the course of the next five years.

However, he maintains that Fibre Channel will continue to dominate in the storage realm for the majority of this decade.

"Based on history, we know that any technology that substitutes for another will take time to replace the existing one. I think both technologies will coexist in the data center for some time," states Kozischek. "But I would start thinking now about the cabling that will be supporting [40- and 100-Gbit] networks in the future."

Several data center trends are driving the need for 40- and 100-Gbit Ethernet, including server virtualization, cloud computing, and network convergence. While the aforementioned technologies can reduce the number of servers and storage devices that reside in the data center, they all increase the load on the network.

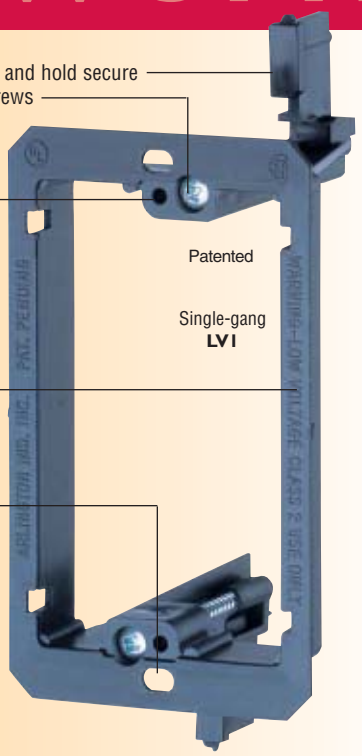
Kozischek says the increased need for more storage and faster response times will drive the need to increase network bandwidth and that avoiding bandwidth bottlenecks to storage access is of paramount concern. Couple those storage demands with the ever-increasing speeds of server processors and the proliferation of virtual servers and I/O demands are poised to skyrocket.

User should make several considerations when it comes to future cabling designs for LANs and SANs. According to Kozischek, optical loss and how well cables perform when bent and routed will be the keys to a design that can migrate from 10- to 40- and 100-Gbit Ethernet.

Other considerations for network designers include the following.

- **Media options:** OM3 or OM4 (multimode), or OS2 (singlemode).
- **Distance:** Are the links in the data center 100 to 125m, or longer?
- **Network architectures:** How will the cabling and hardware architectures migrate to 40- and 100-Gbit speeds? Can I run different types of logical network architectures (point-to-point, mesh, and ring) over the physical architecture

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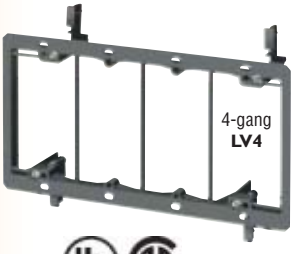
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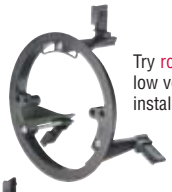
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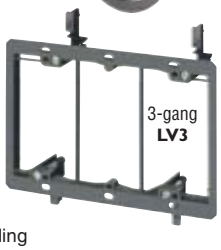
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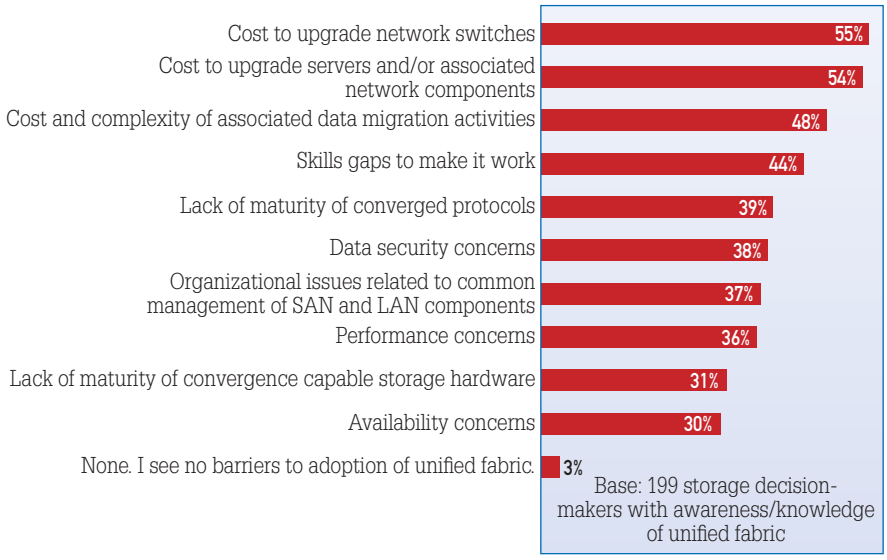
Kozischek believes OM3 and OM4 fiber will be the dominant choices in the data center due to lower electronics costs versus singlemode options. He says the use of parallel optic transmission will affect the types of cables needed in the data center, making polarity a "big issue."

Distance and link-loss budgets will also become more important as data centers move to higher speeds.

"Link budgets and distance will be a function of how many crossconnects are in each link," Kozischek says. "It will become more important to adhere

Potential barriers to adoption of unified fabric

"What barriers do you see for unified fabric or network convergence between LAN and SAN? (select all that apply)



Source: "The future of Unified Fabric", a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Cost concerns dominate the list of potential barriers to the adoption of a unified fabric.



to data center cabling standards like TIA-942 to ensure that architectures can migrate seamlessly from 10- to 40- and 100-Gbit Ethernet."

More convergence of electronics can lead to less connectivity in the data center, but it also leads to lower oversubscription ratios on the optical ports, which can increase fiber count, according to Kozischek.

Today 10-Gbit Ethernet technologies are shipping, with ratification of the 40- and 100-Gbit standards tentatively slated for June 2010.

"The only snag that could potentially occur ... would have to do with selecting connectors."

Milestones to reach

David Percival, a senior systems engineer with ADC, says all of the passive infrastructure vendors have had product available for quite some time. There is, however, one potential hurdle to the adoption of 40- and 100-Gbit Ethernet.

"The cabling infrastructure has been ready in advance of the electronics for a couple of years, but that's typically how things work. It happened that way for Cat 6 and 6A. Looking toward the future, the only snag that could potentially occur in terms of trying to prepare for 40- and 100-Gbit would have to do with selecting your connectors for fiber, particularly for multimode fiber," states Percival.

In their current form, MTP multi-fiber connectors, which provide multiple connectors on the faceplate to reduce overall system footprint, are an area of concern, according to Percival.

"The MTP connectors are the only [component] where there could be some technological improvements. They are currently at a place where they could potentially support these data rates, but you can always improve a native connector," he says. "The connector is the weakest link."

Kevin Komiega is a contributing editor for *Cabling Installation & Maintenance* and senior editor of InfoStor magazine, which covers storage networking.

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Free space optics technology evolves to higher speeds, broad deployment

FSO's value proposition remains steady and worthwhile for many users.

BY PATRICK MCLAUGHLIN

Deployed primarily as a high-speed connection for enterprise users who are unable to run cable from one point to another, free-space optics (FSO) technology has matured over the past decade. A handful of equipment providers did not survive the 2001 dot-com crash, but those that remain provide systems with data-rate increases and price stabilization.

Peter Schoon is president of System Support Solutions (www.systemsupportsolutions.com), an integrator of FSO and other wireless-connectivity systems including radio-frequency (RF)-based products. System Support Solutions has been installing FSO and RF systems for approximately 10 years and says it has made more than 400 link deployments in that time.

We interviewed Schoon about the recent history, current state, and potential future direction of the FSO marketplace. A broad look at FSO technology, including quotes and specifications from some providers of FSO systems, can be found on our Web site, www.cablinginstall.com. For now, here are relevant excerpts from our interview with System Support Solutions' Peter Schoon.

CI&M: Is the basic value proposition for FSO the same as it has been for some time—an affordable high-speed option when running cable from point to point is either not possible or not economical?

Schoon: It is. FSO is one of many tools in a bag. Users look at their options and sometimes find that even a single trenched fiber is cost-prohibitive. The telco might say it's going to take six months [to get the connection made] and it will cost $20k per month. The user tries to find another option.

FSO fits best when the bandwidth requirement is high, 100-Megabit minimum, and distances are shorter. FSO systems definitely max out at 2 kilometers. Links between 1 and 2 kilometers probably make up about 10% of what we install now, and hops up to 500 meters make up about 70% of our installations. Once the link



Post-production company The Post Group in Hollywood, CA installed a rooftop-to-rooftop 10-Gbit/sec free-space optics system (top) with a 1-Gbit/sec radio-frequency backup (bottom).

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distance gets to 500 meters, it can make sense to pay more money and go with an RF link.

CI&M: Fog has historically been the enemy of FSO. Is that still the case?

Schoon: Yes, it's fog. Snow, ice, and rain are not so much an issue. Fog is. I try to explain it simply to potential customers: If you can see from one point to the other, your FSO link will work. Some links may be a little farther than the eye can see, but the point is if the physical conditions allow line-of-sight vision, you'll have a working FSO link. If not, like in the case of fog, you won't.

CI&M: How have current economic conditions affected the industry?

Schoon: The recession has actually been good for the industry. Manufacturers have right-sized and they are all doing well financially. Integrators specializing in point-to-point are lean, mean, and profitable.

CI&M: The FSO market's dynamics have evolved over the 10 years you have been installing these systems, haven't they?

Schoon: One thing that applies to a lot of industries, including this one, is that we lost some companies that burned through cash. Those that made it through have streamlined and economized. Product improvements are customer-driven. A lot of the smoke-and-mirrors are gone, which is nice. Ten years ago some in the industry were incorrectly setting expectations. That's half the battle in any business: don't overpromise, but make sure you overdeliver.

CI&M: What are some of the more recent customer-driven product improvements?



FSO systems, like this one at The Post Group, most often reside in unglamorous positions atop roofs. Nevertheless, they provide critical connectivity.

Schoon: One is a Web-based management interface. Customers really do want that. Lightpointe has added it to some of their equipment and MRV Communications has it across the board.

Power over Ethernet is also very popular, especially for 100-Megabit links. Typically a 100-Mbit link is installed in a lower-cost environment. And using PoE over a Category 5 cable can save three or four, sometimes up to six thousand dollars on an install.

Another feature is adding an RF feature as a backup to lasers. It gives a dual-path hybrid link at little [additional] cost. This type of feature had been bundled and sold as part of a more-expensive package. But in the enterprise industry what's important are low cost and simplicity. With this backup feature, the link is 100% available. If you put this in, you have 100% redundancy and the telco doesn't.

CI&M: How can systems without this integrated-backup feature achieve redundancy?

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Schoon: Use lasers [FSO] for shorter distance or RF for longer distance. Putting redundancy in is inexpensive. We have a lot of hybrid [FSO as the primary and RF as the backup] sites running, and I've never had someone call and say the performance has failed or is slow because they're on the RF setup. The RF backup is a 20-Mbit link. When it activates it is for minutes, not days. Users don't notice [the difference in transmission speed].

The real target market over the next five years will be 500-meter links, Gig speed, 10k list.

CI&M: FSO and RF remain competitive technologies to some extent, depending on distance and uptime requirements, as well as cost. Is there a sweet spot for FSO?

Schoon: There are a lot of cost-competition issues. Bridgewave sells a lot of their SLE100 products with 802.3at PoE. That's a hot item from the leader in the RF industry and provides true 100-Meg transmission. The list price is $9,995. I tell the FSO providers their real target market over the next five years is going to be 500-meter links, Gigabit speed at a 10K list. There are some FSO systems at that price point that do Gig speeds. They offer 10 times the throughput of Bridgewave's SLE100 for the same price, but with a little bit lower availability.

CI&M: What about super high speeds like 10-Gigabit? Is there any demand for that?

Schoon: The biggest news in the industry is probably MRV's 10-Gig product. 10-Gig is getting requested now. When MRV first started work on that product two years ago, I didn't get many requests for that speed. But now I do. The big home for FSO continues to be a company that has a 10-Gig environment and is expanding across a campus.

The Post Group [a post-production company in Hollywood, CA] installed a 10-Gig link and backed it up with 1 Gig of RF. It added between $16,000 and $17,000 to the project cost, but to have dual paths on a rooftop … their telco option was very expensive.

MRV's 10-Gig design uses an erbium-doped fiber amplifier, which solves amplifying issues.

CI&M: After 10 years installing FSO systems do you find them durable?

Schoon: Some of our early links are still running flawlessly. The second install I ever did is nearby [in Minnesota]. I call him every year and he says everything's good; his only question is when I'm going to take him to lunch. We offer three-year on-site support and maintenance, and we don't think twice about renewing those agreements. With some customers we are on our third agreements, which will take them to nine years of coverage.

Patrick McLaughlin is chief editor of Cabling Installation & Maintenance.

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TECHNOLOGY

Securing the future of fiber
in a health-care facility

A new fiber backbone enhanced a hospital's information-technology infrastructure to support applications including surveillance.

BY JENNIFER CLINE AND MEMBERS OF THE CORNING CABLE SYSTEMS STAFF

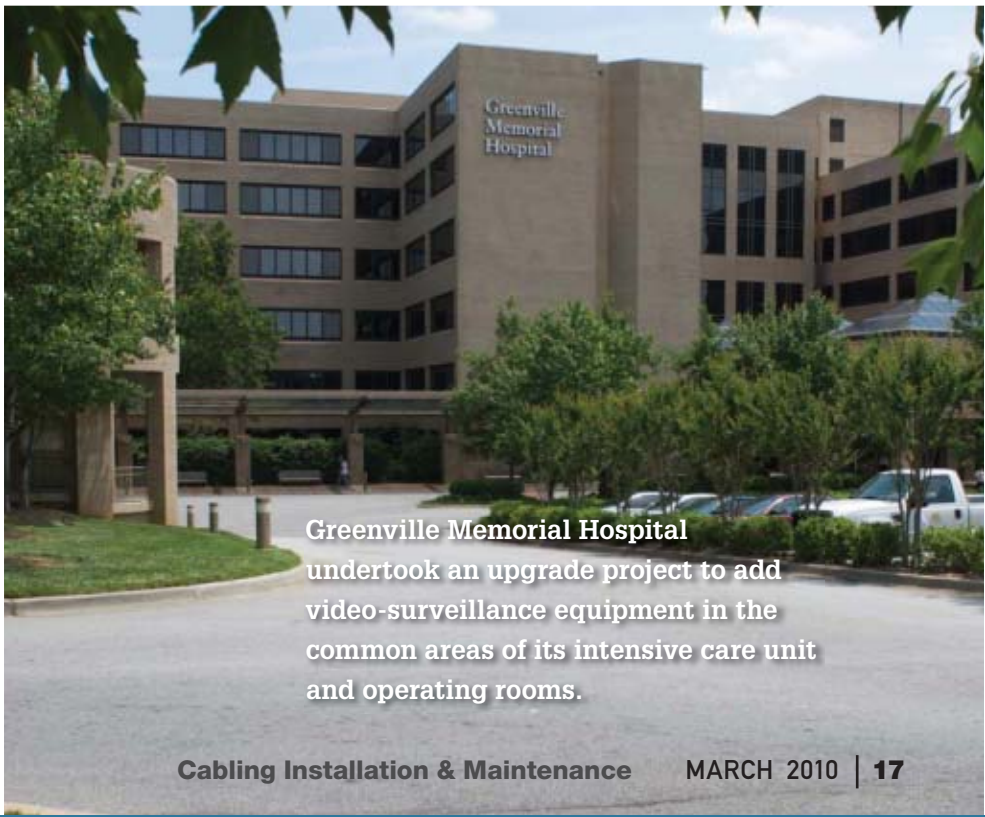
Health-care services organizations are facing unprecedented information-technology (IT) infrastructure challenges. Local area networks (LANs) are rapidly converging voice, video, and data, and are upgrading to support imaging and archiving communications systems. There is a growing need to move patient and clinical information tools from paper forms to end-to-end electronic formats. Security, Voice over Internet Protocol (VoIP), and building automation applications are driving the demand for more secure, robust, and easy-to-install fiber backbones.

Greenville Hospital System University Medical Center (GHS) is a leading integrated health-care provider and academic health organization with five campuses, providing integrated health care to communities across upstate South Carolina. GHS has a total of 1,052 beds and its facilities include a tertiary referral and education center, multiple community hospitals, an acute-care hospital, nursing home, outpatient facilities, and wellness centers.

GHS has made extensive use of fiber-communications technologies to ensure its IT infrastructure meets current and future applications requirements. In July 2009 GHS was listed among *Hospital and Health Networks'* "2009 100 Most Wired Hospitals and Health Systems," and has been honored with this recognition for five years. GHS has worked closely with Corning Cable Systems on a number of projects implementing cutting-edge fiber-optic solutions. A recent project to support the expansion of security systems gave GHS and Corning the opportunity to use a new dielectric-armored optical cable for its in-building backbone.

Investing in healthier infrastructure

GHS is making extensive investments in optical connectivity for in-building and intrabuilding enterprise networks based on bandwidth demands and distance requirements that make optical



Greenville Memorial Hospital undertook an upgrade project to add video-surveillance equipment in the common areas of its intensive care unit and operating rooms.

fiber the future-ready media choice.

"We use fiber exclusively in our intrabuilding and interbuilding pathways," said Russell Lowery, RCDD/OSP, senior network engineer, telecommunications for GHS. "We don't do any backbone cabling on copper except our legacy telephones, and we have begun to transition to Voice over IP for that as well." Lowery said the primary reasons for the use of fiber throughout GHS's system are bandwidth and distance, driven by increasing imaging, data movement, and data storage applications demands.



"Having armored cable for the backbone offers GHS exponentially higher levels of network protection than just an innerduct or regular-routed cable in the ceiling." –*Russell Lowery, RCDD/OSP; senior network engineer, telecommunications, GHS.*

"Nobody carries a paper chart anymore," he said. "And in certain parts of the hospital, people have a tablet PC, and these systems need to connect and communicate with each other as quickly as possible. Given those conditions, we want to install telecommunications cabling to provide the highest bandwidth opportunity possible so that we know the network isn't going to slow things down."

Lowery said that GHS is committed to being a leading-edge adopter and user of information technology. Working with Corning Cable Systems, he added, provides an opportunity to use the latest fiber technologies to

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ensure GHS is equipped to get past what is needed today and ready to handle what is needed tomorrow. That is why GHS became the first enterprise to install a new type of Corning Cable Systems dielectric-armored riser cable to provide the backbone for an upgraded security system at the Greenville Memorial Medical Center.

ICU and OR security upgrade

The security-upgrade project at Greenville Memorial Hospital, GHS's main hospital facility, added new video surveillance system cameras in the hospital's intensive care unit (ICU) and operating room (OR) common areas. The purpose was to improve security coverage in these critical areas, such as public hallways, nurses' stations, and drug-distribution sites.

Previously, only five to six cameras provided security coverage for these areas, with each camera individually connected via coaxial cable to the security center five floors below the ICU level. The security upgrade included replacing the older cameras with 20 new units in both the ICU and the OR areas. Because there was no backbone installed previously, Lowery said the increased coverage called for a networked approach to provide a more-efficient installation, rather than running thousands of feet of coaxial cable for each endpoint to the security center.

"With the current electronics we're using, rather than running six strands of coax, one for every camera, I can connect six cameras to one fiber, which is a lot more efficient," he said.

To provide the fiber backbone connecting the video endpoints with the security center, it was determined that two, 24-strand dielectric-armored cable runs would be required. These backbones link new equipment rooms installed on the ICU and OR floors (where the individual camera feeds are combined) with the security mainframe room.

Armored cable provided the best solution for this application due to the constant pace of change to the physical infrastructure of the Greenville Memorial Hospital and the critical safety factor associated with the security application. "This is a very



big hospital, and there are all kinds of changes going on," Lowery said. "So having armored cable for the backbone, with all the other things that go on in these ceilings, offers GHS exponentially higher levels of network protection than just an innerduct or regular-routed cable in the ceiling."

Non-metallic armored cable

For the two backbone cables, GHS chose to use a new cable offering: Corning Cable Systems' MIC DX Armored Riser Cable, which is an all-dielectric armored fiber-optic cable design that eliminates the labor and costs associated with accessing and grounding a typical metallic armored cable.

Designed for use in riser, plenum, and general-purpose environments for intrabuilding backbone and horizontal installations, the MIC DX Armored cable also offers four times the crush protection when compared to unarmored cables, a smaller outside diameter, and improved tensile strength. Lowery said these features, particularly including crush resistance and installation ease, made it the best choice for the video surveillance system's fiber backbone.

"One of the challenges we've had in the past when installing armored cable is ensuring that it is properly grounded," he said. "We want to make sure that once the cable is in place, no one gets hurt. So having an armored product with a non-metallic coating really sounded like a good idea."

Another of the cable's key benefits, from an installation perspective, is reduced weight and smaller diameter than other armored cables. These characteristics make MIC DX easier to fit into tight overhead horizontal spaces and other areas where the cable had to run from the IC and ORs to the security center.

"Our security headend is seven floors below the top floor, so any time we can reduce the weight and outside diameter of the backbone cable, yet protect it, there is a really big benefit for us," Lowery said.

With a flame-retardant outer jacket and individually jacketed TBII Buffered Fibers, MIC DX Armored Cables are particularly useful for heavy traffic or more challenging exposure conditions and applications requiring extra-rugged cables. Offered in 50-µm and 62.5-µm multimode, singlemode, and hybrid version, MIC DX Armored Cables feature no metallic parts. This makes them faster, easier, and safer to install.

Designing and installing the backbones went relatively smoothly, according to Lowery. In early 2009, two cable runs were specified to be installed from the security operations center of Greenville Memorial Hospital to the OR two floors above and to the ICU four floors above the security operations center.

The fiber backbone had to be installed and ready for use by May 2009 when the new security cameras would be switched over. And when GHS chose to go with the MIC DX Armored Cable, Corning was able to supply the cable runs within the installation timeframe.

According to Lowery, installation went relatively smoothly and the cables were installed during one off-hour shift. Because Greenville Memorial Hospital was the very first Corning Cable Systems customer to install MIC DX Armored Cables, Corning provided on-site technical support from the company's Hickory, NC plant to ensure that installation of the new product proceeded smoothly—support that Lowery said is typical of the customer service and technical resources Corning has always provided for GHS.

He also said he appreciates the fact that MIC DX Armored Cable is easier and safer to install when compared to metal-armored cables. "The technicians who do the installation work are pretty valuable to us, based on their skills and their knowledge of the facilities," he said. "Anything we can do to protect these guys as they're putting it in is something that we value."

The integration of the new video security cameras for the ICU and ORs proceeded smoothly on May 1, 2009, Lowery said, and the new backbones have been functioning flawlessly since then. He said the armored cable's performance, bandwidth capacity, and non-metallic features make it his preferred choice for future armored-cable applications throughout the GHS system.

"We're completely satisfied with the ways the MIC DX Armored Cable is working, and expect to begin specifying it for other armored cable applications for GHS," he said.

JENNIFER CLINE is a sales engineer with Corning Cable Systems (www.corning.com/cablesystems).

Other contributions to this article were made by members of the Corning Cable Systems staff as well as Russell Lowery/RCDD/OSP of the Greenwood Hospital System University Medical Center.



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DATA CENTER

Putting a number on data center energy efficiency

Established by The Green Grid, Power Usage Effectiveness is a calculable measurement used by many.

BY PATRICK MCLAUGHLIN

In November we reported on some steps the United States Environmental Protection Agency (EPA; www.epa.gov) is taking to encourage energy-efficient data center operations. (See "Adopting best practices for efficient energy use," November 2009, p. 21.) Since the time that issue was published, the EPA has reconsidered the primary means by which it will measure energy efficiency for its upcoming EnergyStar program for data center facilities.

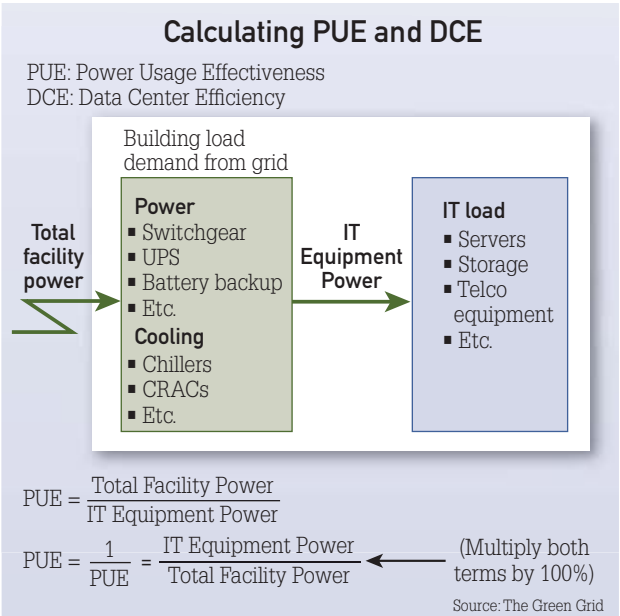
The agency originally planned to establish and use a measurement it called Energy Usage Effectiveness, or EUE, rather than the Power Usage Effectiveness, or PUE, metric established by The Green Grid (www.thegreengrid.org). In a conference call last September, the EPA explained that it opted to develop EUE to quantify overall energy consumption, including natural gas, diesel, and other fuels, rather than simply power consumption. In addition, the EUE calculations would be made based on source energy rather than site energy, in keeping with its other EnergyStar programs.

In a follow-up conference call in November 2009, the EPA said it would in fact use PUE as the metric for the data center EnergyStar program. The agency made this decision based largely on feedback it received after announcing the EUE metric. Representatives of the EPA stated that this feedback included the pointing out that PUE does allow for the calculation of total energy use, not just electricity use.

Calculating PUE

PUE is a simple formula to measure complex consumption. That simple formula is total facility power divided by information technology (IT) equipment power. When The Green Grid proposed the use of PUE in early 2007, it also proposed the use of its reciprocal—IT equipment power divided by total facility power, which the organization dubbed Datacenter Efficiency (DCE). The next year, The Green Grid revised the DCE measurement to DCiE, for Datacenter Infrastructure Efficiency. Its calculation is 1 divided by PUE, or IT equipment power divided by total facility power x 100%.

By virtue of the calculation, the



Power Usage Effectiveness and its reciprocal, Data Center Efficiency, compare the total power consumed by a data center facility with the amount of power its IT equipment consumes.

closer a PUE gets to one, the more efficient the data center's IT equipment is. The EPA collected energy-consumption data from 121 data centers in its initial information gathering for the EnergyStar program and reported those facilities' PUE ratings ranged from 1.25 to 3.75, with an average rating of 1.91. More than 30 of the participating data centers had PUEs between 1.51 and 1.75; more than 20 rated between 1.76 and 2.0; and between 15 and 20 facilities had a PUE between 2.01 and 2.25.

1 of 121 data centers achieved a 1.25 rating.

In the 2008 Green Grid white paper that presented the DCiE metric, authors Andy Rawson, John Pfleuger, and Tahir Cader explained, "Ideally, a PUE value approaching 1.0 would indicate 100% efficiency (i.e. all power used by IT equipment only). Currently there are no comprehensive data sets which show the true spread of the PUE for data centers."

Getting close to 1

Of the 121 data centers analyzed by the EPA, only one achieved a 1.25 rating. According to Rob Mann, director of engineering with HP's rack and power infrastructure group, another government agency is zoning in on low PUE. In January the Department of Energy (DOE; www.energy.gov) announced $47 million in grants to organizations for the specific purpose of supporting the development of technology to increase energy efficiency in IT and telecom facilities.

HP received a $7.4 million grant from the DOE to develop a modular data center with integrated power, air conditioning, and distributed-energy systems that promises to reduce energy requirements. Mann commented that a requirement of the grant is that the technology developed results in a PUE that does not exceed 1.25. "The closer you get to 1, the more efficient you are," he said. "To do that, you've got to put [the IT equipment] in a controlled environment."

Yahoo! got nearly 10 million of those DOE grant dollars to passively cool a data center it is currently building in Lockport, NY. When the DOE announced the $9.9 million grant to Yahoo!, it described the undertaking as follows. "The integrated building design, including the building's shape and orientation and the alignment of the servers within the building, allows the data center to use outside ambient air for cooling 99 percent of the year. The relatively low initial cost to build, compatibility with current server and network models, and efficient use of power and water are all key features that make this data center a highly compatible and replicable design innovation for the data center industry."

The EPA addressed the use of air-side economizers in its November conference call. To put into context the EPA's position on the use of economizers, the agency was responding to suggestions that a facility applying for the EnergyStar rating should be rewarded with additional point(s) for using economizers. The EPA's explanation in response was facilities that properly use economizers will in fact achieve lower energy use and therefore a lower rating. The agency emphasized the word "properly" in addressing that issue.

Refining the metric

In its 2008 white paper, The Green Grid recognized some challenges in calculating PUE and DCiE, including the integration of cooling elements into some of the latest IT equipment. "These technologies blur the lines between what has traditionally been a clear delineation between facility equipment and IT equipment," the paper said.

More recently the group published a white paper entitled "Use and public reporting guidelines for The Green Grid's infrastructure metrics (PUE/DCiE)." That paper addresses the manner in which organizations publicly state their PUE and DCiE ratings.

Last year The Green Grid unveiled a proposed Data Center Productivity (DCeP) metric. The simple formula for its calculation is DCeP equals useful work divided by total energy consumed. For those who will try to calculate the metric using real numbers, it will be significantly more complex. Recently the organization posted a presentation on its Web site updating the work it has put into that effort; that work is ongoing.

Originally put forth just a few years ago, the Power Usage Effectiveness rating has taken hold as a popular metric by which data centers count their energy efficiency. The Green Grid continues to refine the metric and its use.

Patrick McLaughlin is chief editor of *Cabling Installation & Maintenance*.

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SEURITY



Program gauges systems' ability to handle IP security applications

Anixter's ipAssured program aims to match cabling infrastructure with applications' anticipated lifespans.

BY PATRICK MCLAUGHLIN

Unveiled to customers last fall, Anixter's (www.anixter.com) ipAssured program aims to help users of Internet Protocol (IP)-based security applications match their cabling infrastructures to the anticipated lifespans of the applications they require to secure and support their businesses.

Andy Jimenez, Anixter's vice president of technology for enterprise solutions, described three trends that prompted the development of Anixter ipAssured. "First is Moore's Law," he said. "Transistor density doubles every 18 months while prices drop." With respect to security and surveillance systems in particular, he said, Moore's Law has paved the way for analytics, storage capacity, and other bandwidth-consuming technologies. "Second is that network capacity has increased dramatically," and alongside that fact is the third trend, "Cabling bandwidth increases have been just as dramatic."

Cabling technology has kept pace with the increased demand of new applications, Jimenez added. He commented, "Think of network cabling as a utility. Bandwidth and headroom are like the capacity of a pipeline."

Many user organizations are now looking to their structured cabling systems as the utility or pipeline through which security applications will travel. Whether or not those systems have the capacity to support these applications is what gave rise to this new program.

Steeped in the history of the Anixter Levels program, Anixter ipAssured establishes three classes into which cabling systems are grouped according to the performance they achieved during testing conducted in the company's Infrastructure Solutions Lab.

- IP-Class 1+ systems support security applications with a lifecycle between 1 and 5 years. Cabling systems in this class have 155 MHz of usable bandwidth, can support Gigabit Ethernet, and exceed the performance specifications of Category 5e.
- IP-Class 5+ systems support applications with lifespans between 5 and 10 years. These cabling systems are characterized by 250 MHz of usable bandwidth, can support Gigabit Ethernet, and exceed the performance specifications of Category 6.
- IP-Class 10+ systems support applications that are anticipated to have lifecycles longer than 10 years. The systems are characterized by 500 MHz of usable bandwidth, can support 10-Gigabit Ethernet, and exceed the performance specifications of Category 6A.

Cabling systems meeting the requirements of a particular class will be able to support commonly used video-surveillance, access-control, and storage-and-recording equipment. Additionally, Anixter recommends that certain other infrastructure products and systems be used so each class of cabling can perform optimally. (See Table on page 28.)

As it did when it introduced the Levels program more than two decades ago, Anixter put the cable and connectivity products involved in this newest program through the rigors of significant testing. In a technical brief posted on its Web site the company described that testing.

Thorough lab testing

"Anixter assessed the ability of twisted-pair cabling systems to support error-free transmission at less than ideal conditions," the brief said. "The tests examined the ability of these cabling systems to support the higher levels of power delivery needed with recent Power over Ethernet advancements.

Anixter uncovered some potential limitations in cabling channels running security-oriented applications."

Starting at the industry-standard 68 deg. Fahrenheit baseline, Anixter ratcheted up the external ambient temperature in its test lab incrementally, 5 degrees at a time. The company reported that when the ambient temperature reached 113 degrees, a minimally compliant Category 5e system exhibited intermittent link status and could not support 100% error-free transmission on an IP camera.

Overall, test results showed higher grades of cabling perform better at increased temperatures. Anixter's technical brief cautions that even though failure was shown to happen at 113 degrees, errors may start to occur earlier than that failure point.

Anixter's Jimenez reported that while a minimally compliant Category 5e system began losing data frames at 113 degrees, systems that meet IP-Class1+ support error-free transmission up to 188 degrees; IP-Class5+ systems are error-free up to 248 degrees; and IP-Class10+ systems are error-free up to 263 degrees.

	IP-Class 1+	IP-Class 5+	IP-Class 10+
Video surveillance	Analog cameras with encoders	IP standard-definition H.264 cameras	Multi-megapixel cameras capable of edge analytics
Access control	Existing panels	IP controllers with video integration	IP controllers with BAS integration
Storage and recording	External DVR storage	External RAID expandable storage	Edge recording with audio updates to centralized storage
Physical infrastructure products (Anixter says it recommends these products to help the IP-Class infrastructure perform optimally)	H.264 DVR	NVR with external analytics engine	NVR with internal analytics capability
	OM2 fiber	OM3 fiber	OM4 fiber
	Passive cooling	Enhanced passive cooling	Precision cooling
	4-post racks	IP lockable cabinets	IP monitored and controlled cabinets
	3-phase monitored power	3-phase monitored power	3-phase monitored power
	13-watt Power over Ethernet	25-watt Power over Ethernet Plus	(future) 70-watt Power over Ethernet technology
		Upgradable intelligent infrastructure management	Intelligent infrastructure management

PoE implications

One of the touted benefits of IP devices such as cameras and access-control systems is they can be Power over Ethernet-enabled, saving end-user organizations the cost of running separate power cables to these devices. For some time, questions have been raised about the possible cabling-system performance degradation that may result from running direct-current power over the cables' twisted pairs. Anixter took on that issue in its laboratory tests when developing the ipAssured program.

Lab technicians created two test bundles, each with 37 cables in a 36-around-1 setup. One bundle included exclusively Category 5e cables; the other included exclusively Category 6 cables. Jimenez explained, "The FCC [Federal Communications Commission] allows 750 milliamps on a conductor. We put 750 milliamps through each conductor pair for 24 hours." Technicians then measured the conductors' temperature rise in the center cable of each bundle. While Anixter did not release specific loss-measurement numbers, Jimenez explained, "The result was a 25% increase in signal loss with Category 5e versus Category 6 cable." He added that the Category 6 cable's gauge size—23 AWG rather than 24—helped mitigate the effects of increased power on the conductors.

Jimenez said five conclusions can be drawn from the testing conducted in Anixter's Infrastructure Solutions Lab.

1. Industry standards assume cabling systems operate at room temperature.
2. Category 5e fails at 113 deg. Fahrenheit.
3. A 1-degree rise in ambient temperature equals a 0.6% increase in insertion loss.
4. Power over Ethernet and Power over Ethernet Plus internal temperatures are additive to loss created by ambient-temperature increases.
5. Bundling cables adds stress to them.

Five cabling systems are part of the Anixter ipAssured program: ADC's TrueNet; Belden's IBDN; Berk-Tek/Ortronics' NetClear; CommScope's Systimax; and Panduit's TX systems.

Patrick McLaughlin is chief editor of Cabling Installation & Maintenance.

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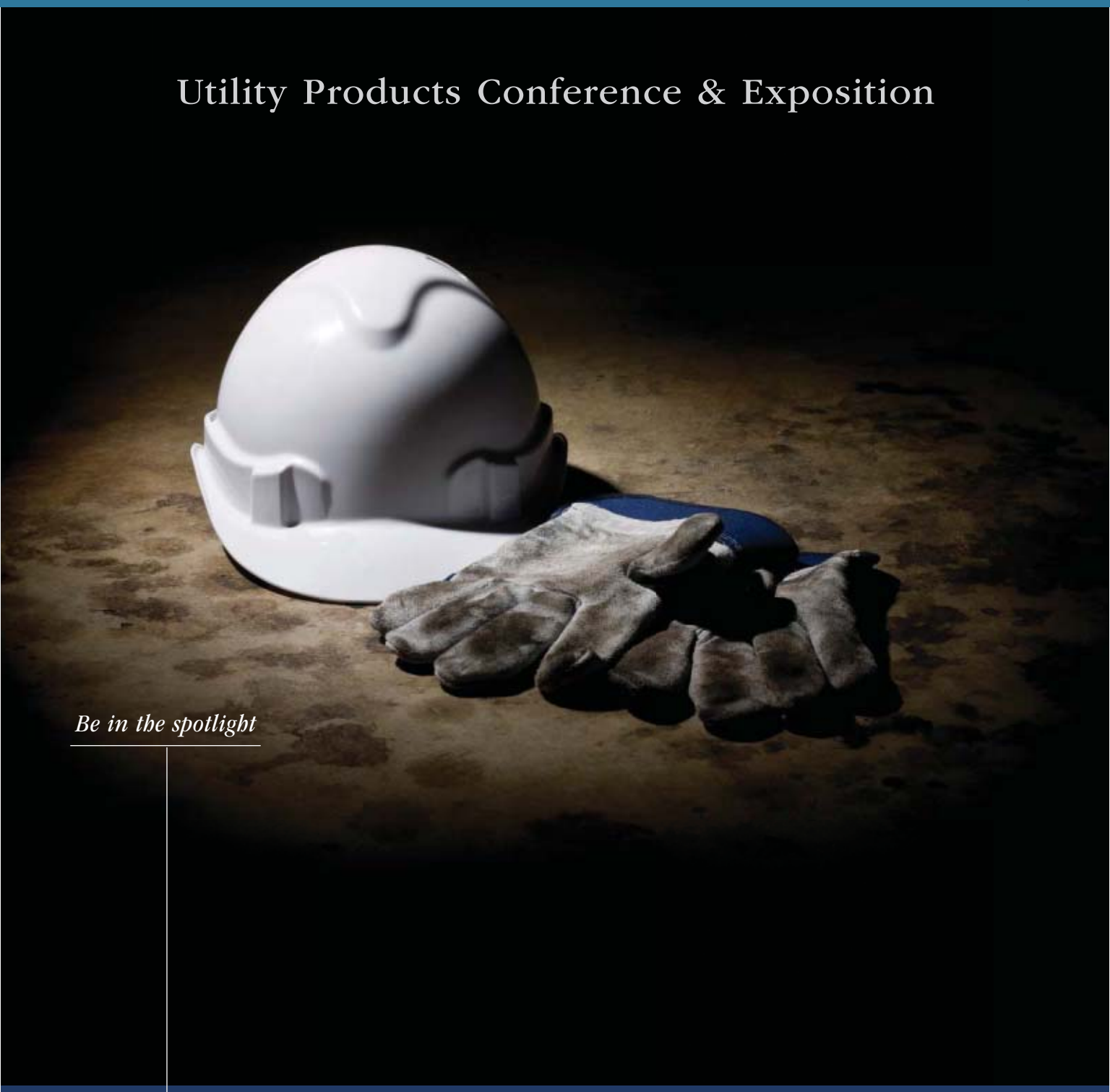
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EDITOR'S PICKS

COMPILED BY PATRICK McLAUGHLIN

Thanks for taking an interest in our premier "Editor's Picks" section of Cabling Installation & Maintenance. As part of our magazine redesign, we decided to combine what used to be our New Products section and what we called Industry Spotlight—a news and analysis section. From here forward, these pages will be filled with a selection of newly introduced products, other news, and my opinions on what's happening in the industry.

Self-terminating Category 6A FTP jacks

Legrand/Ortronics (www.ortronics.com) recently introduced a self-terminating Category 6A foiled twisted-pair (FTP) workstation jack. The product is a rear-loading, rugged cast-encased jack featuring a tool-less termination process that the company says dramatically reduces termination times. The jack's wire-lacing feature includes a wiring diagram, maintains pair geometry, and limits pair untwisting. By closing the jack housing, the technician fully seats the lacing cap onto the jack insulation-displacement contacts, terminating all four pairs simultaneously. Die-cast metal construction creates an integral shield that provides 360-degree coverage, Legrand/Ortronics says. A supplied cable clamp provides a shield/ground wire connections.






Cisco offers 10GBase-T

Here's what I think is the biggest news to affect our industry in a long time. In early February Cisco Systems (www.cisco.com) announced it was coming out with 10GBase-T switches. Their first products will be in the Catalyst family, and later this year they'll roll out 10GBase-T Nexus switches.

Until now, Arista Networks (www.aristanetworks.com) and Extreme Networks (www.extremenetworks.com) were the only providers of 10GBase-T switching equipment. I believe that once these Cisco products come to market within a couple months, the adoption rate of 10GBase-T will increase significantly. Evidently, at least one other person sees it that way as well. George Zimmerman, chief technology officer of Solarflare Communications (www.solarflare.com), commented, "Cisco's entry validates the compelling operational economics and simplicity of running 10 gigabits over the existing infrastructure, and avoiding forklift upgrades to 10G by allowing triple-speed 100/1000/10G PHYs to connect to existing endpoints at a lower speed when only one end has been upgraded."

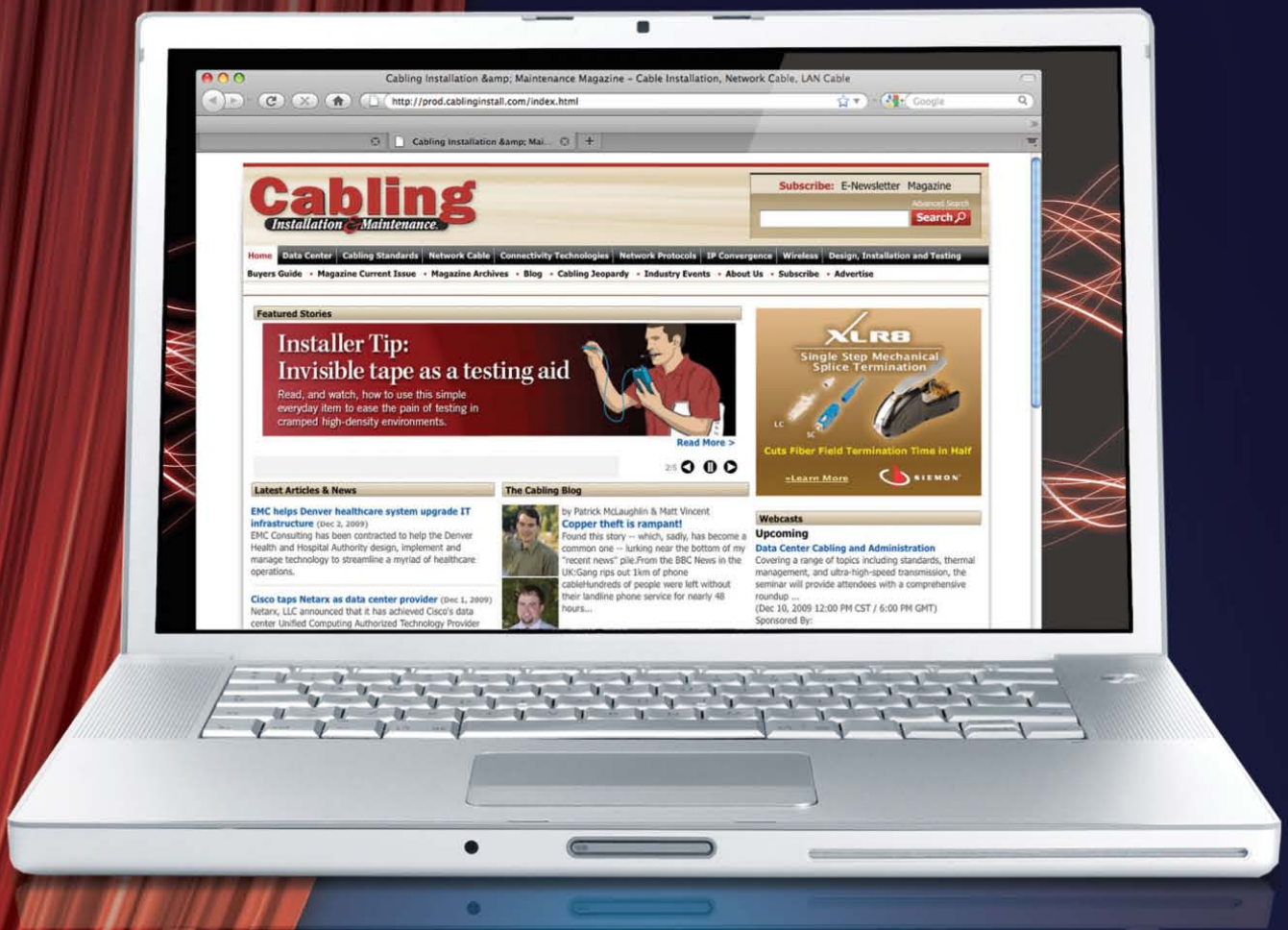
He later stated, "This is obviously a big inflection point for 10GBase-T deployments. Movement by Cisco, the giant of the Ethernet industry, indicates widespread adoption. Expect to see many announcements and products with 10GBase-T this year."

Within a day of the Cisco announcement, PHY developer Aquantia (www.aquantia.com) announced it entered full volume production of its 10GBase-T PHY solution. Last year Aquantia secured $44 million in a round of private funding. "We are seeing the momentum quicken for 10GBase-T," the company's president and chief executive officer Faraj Aalaei said. He added that the $44 million in funding "underscores that the commitment to this mainstream, standardized and cost-effective solution is growing in both switching and server architectures. Aquantia's recent move to full volume production is in direct response to the strong uptick in market demand."

Intel (www.intel.com) joined Cisco in making the announcement and explaining that both cost and power-consumption have come down, which is good news for 10GBase-T. Along with executives from Cisco and Intel was Panduit's (www.panduit.com) vice president of technology, Jack Tison, who discussed Category 6A cabling and its ability to support 10GBase-T.

Not everybody is on the 10GBase-T bandwagon. David Richards, RCDD/NTS/OSP, owner of DR Consulting commented, "I don't think we're in an, 'If you build it, they will come,' world these days. Customers are growing savvy to emerging technologies, are tracking their IT dollars more closely, and are asking questions like, 'Do I

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really need this?'"

I wonder how many users do in fact believe they need connectivity speeds as high as 10 Gbits/sec, but have been waiting precisely for this—a copper version of the technology from Cisco Systems.

TIA-942 data center standard being revised

In the second half of 2009, members of the Telecommunications Industry Association's (www.tiaonline.org) TR-42.1 Commercial Building Cabling Subcommittee began working on a revision of the TIA-942 Telecommunications Infrastructure Standard for Data Centers. TIA was published in 2005 and, according to ANSI guidelines, the standard must be revised, affirmed, or rescinded in five years.

At its August 6, 2009 meeting TR-42.1 unanimously approved the creation of a project to revise the standard. The revision ultimately will be published as TIA-942-A. Minutes from TR-42.1's final meeting of 2009, which took place November 5, indicate the TIA-942-A standard will include a number of changes and additions, several of which will focus on energy efficiency.

TR-42.1 met most recently on February 4 but during that meeting was unable to complete ballot comments. March 3 was the next scheduled meeting date for the group, so by the time you read this, more work on the 942-A standard will have been carried out.

One report from the February meeting indicates that the group has agreed to include an additional layer of distribution for larger data centers. The proposal called for an intermediate distribution area (IDA) to reside between the main distribution area (MDA) and the horizontal distribution area (HDA). The IDA would house an intermediate crossconnect (IC). Other proposals are being discussed as well; there is no set timetable for the completion of the TIA-942-A standard.

Worthy recipient

Playing no small part in the revision



EDITOR'S PICKS

of TIA-942 will be Jonathan Jew, who also was one of the main architects of the original standard. Jew was honored in January with the Harry J. Pfister Award for Excellence in the Telecommunications Industry. Given annually by BICSI (www.bicsi.org), the Pfister is essentially a "lifetime achievement" award. Here's what BICSI had to say about Jonathan Jew when it bestowed the award on him. "Jew has devoted countless hours of volunteer time, effort, and expertise that have resulted in immeasurable benefits to BICSI members and ITS professionals globally. He has been a subject matter expert contributor to numerous BICSI manuals and has acted as co-chair, vice-chair, editor, and a project lead on many standards and working groups."

From a professional standpoint I can echo BICSI's praise of, and appreciation for, Jonathan Jew and his selfless efforts. This magazine has benefited from articles he has either written or been quoted in on such topics as TIA-942, the TIA/EIA-606 series of labeling and administration standards, and other data center issues such as humidity and electrostatic discharge.

From a personal standpoint, I can't overstate my appreciation for how willing he has been to contribute his time and expertise to these articles and other information products.

Jonathan Jew is one of many individuals who travel the country and the world constructing standards that govern the design, installation, and maintenance practices for structured cabling systems. One thing that separates him from many of his standards-making colleagues is that he is not employed by a manufacturer that sells products in the cabling market. He is principal of J&M Consultants (www.j-and-m.com), a data center design firm based in San Francisco. As far as I can tell, Jew makes these standards efforts on his own time and his own dime. He does this work because it will benefit the industry as a whole.

The world seems to have gone from "What-have-you-done-for-me-lately" to "What-are-you-doing-for-me-right-now-and-what's-taking-you-so-long?" For anyone reading this, there's a good chance that Jonathan Jew is doing something right now that will be to your benefit. Even if you're reading this in the middle of the night, a global standards meeting could be taking place halfway around the world from where you are.

Congratulations to Jonathan Jew, a very worthy recipient of the 2010 Harry J. Pfister Award.

Fiber connectors compatible with VFL

Leviton Network Solutions (www.leviton.com/networksolutions) has enhanced its FastCAM prepolished fiber-optic connectors; the SC and LC versions of the FastCAM are now compatible with a visual fault locator (VFL) to test for fiber continuity. Additionally,



the connectors now allow termination of 250-micron, 900-micron, 2-mm, and 3-mm fiber cable.

The pocket-sized VFL assists in diagnosing optical-fiber damage by using a bright red laser to locate faults, which include tight bends, breaks, and defective connectors. The tool includes a 2.5-mm ferrule, 1.25-mm adapter, and a carrying case.

Leviton also announced it now offers two new tool kits for FastCAM terminations. One includes the LYNX cleaver, lint-free dry wipes, alcohol pads, a jacket stripper, and a pocket to hold the VFL. The second includes those items plus a work tray and gooseneck LED.

Slim Gig-E cable optimizes rack, floor space

The AMP Netconnect (www.ampnetconnect.com) business unit of Tyco Electronics recently introduced the "ultra-slim" RD MRJ21 Gigabit Ethernet cabling system. At 0.36 inches in diameter, the cable is about the size of a Number 2 pencil. The RD (Reduced Diameter) MRJ21 weighs 40% less than comparable four-pair cabling systems, Tyco says, occupies

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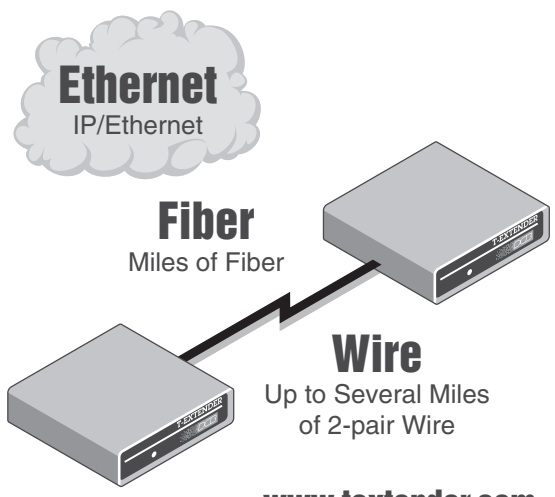


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Paul Woods, global director of marketing for AMP Netconnect, said the following when the product was introduced: "Our ultra-slim RD MRJ21 cabling system is the thinnest Gigabit Ethernet cable available from Tyco Electronics. We're excited to bring this innovative cabling technology to our customers and to the marketplace. It's the perfect solution for today's server-crowded data centers where space is at a premium. Tighter IT budgets coupled with escalating power costs are driving technology selection. The ultra-slim design of our RD MRJ21 cable improves airflow, dissipates heat more efficiently, and reduces overall power consumption."

According to the company, the system installs six to ten times faster than four-pair cabling and frequently reduces the cable management and routing problems of bundled cabling systems. Designed to support more posts per rack, the MRJ21 cabling system supports six ports of Gigabit Ethernet interface, which the company says dramatically increases the number of ports customers can include in a single rack.

From the fringe

In late January the Harrison Daily Times in Harrison, AR reported that cabling installers working inside a school building during school hours escaped harm when a student grabbed a cable—presumably a twisted-pair construction—from the ceiling, stripped back the wires (with his teeth), and stuck the stripped cable into an electrical outlet.

The student got into legal trouble because of what could have happened to an installer, or anyone else, who might have grabbed the other end of the cable. Interestingly, the newspaper reported that the installation crew planned to go ahead and use the once-chewed cable as planned. After completely installing and testing it, they'd determine whether or not the incident adversely affected the cable's performance.

It's easy for me to say that cabling projects inside schools should be carried out while school is not in session. But I know the realities of scheduling. So I'll steal a line from an old TV show: Let's be careful out there.

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The Fibre Channel over Ethernet (FCoE) specifications have been developed with much fanfare and promise for efficiency in data center networking. Now that the FCoE standard is complete, discussions can center on the nuts-and-bolts requirements to support the highly anticipated protocol. This web-delivered seminar examines FCoE as a technology of promise, but also as another example of an application that will require specific performance from a cabling infrastructure.

Presentation 1: LANs and SANs in the data center

Providing a tutorial on data center layout, this presentation describes the two primary networks—local area network (LAN) and storage area network (SAN)—that run in data centers.

Presentation 2: The Fibre Channel over Ethernet protocol

This presentation discusses the FCoE specification as it has been spelled out by the INCITS T11 Committee, tracing the standard's origin and the rationale behind its development.

Presentation 3: Cabling requirements & recommendations for FCoE

An organization that chooses to deploy FCoE will have to ensure it has the appropriate infrastructure to support the protocol. This presentation describes the first-layer requirements for FCoE transmission, paying specific attention to the cabling media's performance level and construction type.

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