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› Europe

Cabling Architectures for Smart Buildings

By Kirk Krahn, Senior Product Manager, Leviton Network Solutions

Smart building technology plays an increasingly important role in enterprise networks. While the global pandemic has been a disruptive force for office environments, many businesses are continuing to make changes to workspaces to incorporate smart building initiatives — not only as a short term response to the pandemic to keep people safe and comfortable, but also as a long-term strategy to improve workplace environments and productivity.

In fact, more than half of organizations plan to increase their investment in smart building technology and energy efficiency in 2021, according to Johnson Controls' October 2020 Energy Efficiency Indicator survey.

In this issue, as part of our ongoing look at networks for smart buildings, we will outline the two main cabling approaches for connecting and powering smart devices: **fixture centric and node centric**.

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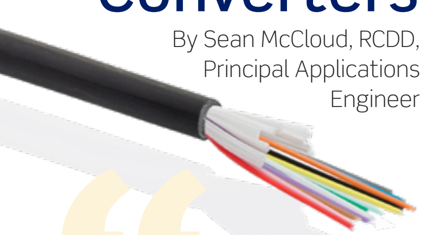
Design Considerations with Passive Media Converters

By Sean McCloud, RCDD, Principal Applications Engineer



Fiber optic cable can have an impressive lifespan. Many existing campus and inter-building backbone systems still rely on multimode OM3 or lower fiber grades. However, while many older fiber grades may be sufficient for 1 gigabit ethernet applications, 10 Gb or greater applications now drive the need for modifications or upgrades to the physical cabling infrastructure. The Passive Media Converter (PMC) is a newer technology promoted as a way to achieve higher bandwidths. It is a non-powered (passive) single-mode device that is said to extend the life of an installed multimode cable plant.

PMCs eliminate the modal dispersion that occurs over multimode fiber optic cabling. The existing multimode fiber is fusion spliced or mechanically input fiber to the PMC device. At the remote end, an additional termination and PMC might be required. This effectively converts the signal to a single mode fiber transmission at the "last mile" prior to arriving at the recipient device.

Some manufacturers claim that a PMC is a viable, lower-cost alternative to upgrading an existing multimode infrastructure or installing a new single-mode infrastructure to obtain higher performance or longer reach. New trenching, vault work, concrete cutting/coring can be cost prohibitive, and removal of legacy cabling from these existing pathways can be time consuming and disruptive to operations. While PMC devices may be the only cost-effective option to mimic single-mode fiber, they should only be considered as a last resort. Before adopting this technology, there are several important risk factors to consider.

> While PMC devices may be the only cost-effective option to mimic single-mode fiber, they should **only be considered as a last resort**.

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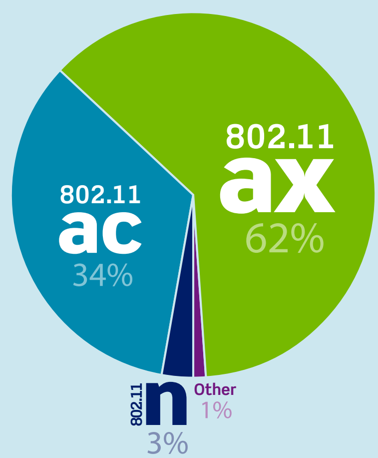
LEVITON POLL

Which type of wireless access point do you expect to install in the next three years?



From a November 2020 survey of 175 network professionals

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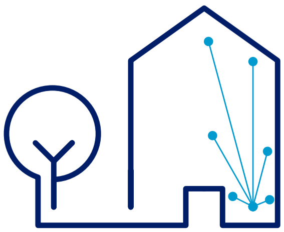
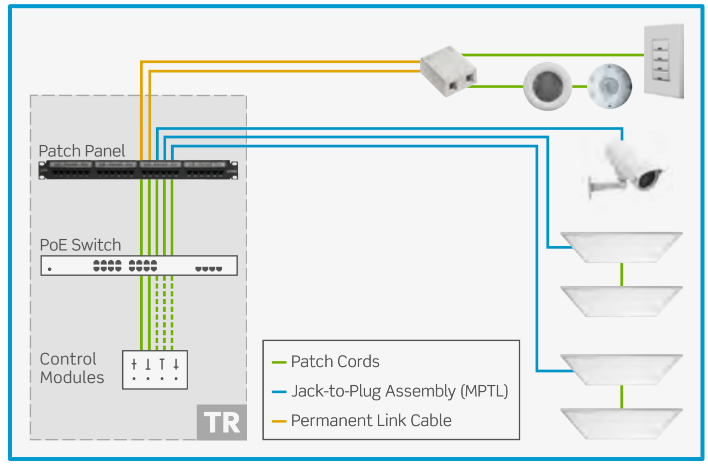


Fixture Centric

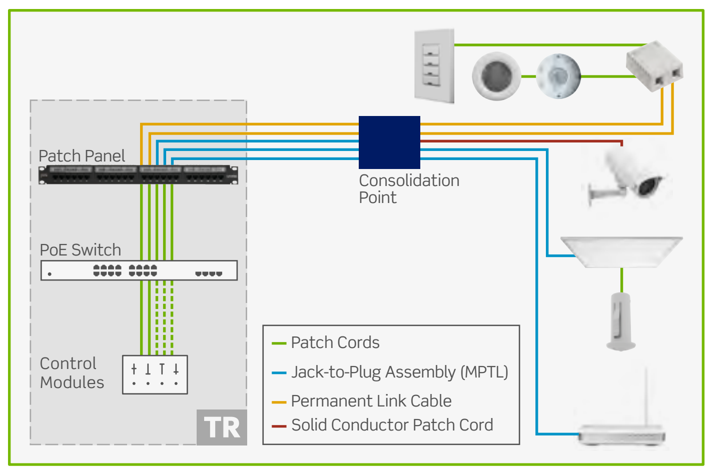
In a fixture centric design, all devices use home run cabling from the device back to the telecommunications room (TR). This is more common for remote devices such as security cameras. It centralizes all the active equipment in the TR, which can simplify maintenance and make it easier to supply back-up power to critical systems.



The downside to a fixture centric design: it is less flexible when performing moves, adds, and changes, as reconfiguring home run cabling is typically time-consuming and expensive. These links are most often installed above drop ceilings or inside walls, and accessibility can become an issue. Also, in some cases the home runs can be very long and changes may involve reworking the entire link all the way back to the TR. For example, if the security camera needs to be moved five feet closer, there might not be an issue, but if it moves five feet farther out, there might not be enough cable and the entire link will need to be reworked.

Node Centric

Also known as zone cabling, a node centric architecture inserts a consolidation point (CP) into the design. Instead of a cable running directly from the TR to the end device, the permanent link stops at the CP. This adds flexibility, so if devices need to be moved in a room, the only change happens to the connecting patch cord, while the CP and permanent link stay in place.



Node centric designs also provide the opportunity to incorporate fiber optic cabling into the network for higher bandwidth applications or extended reach requirements beyond 100 meters. Fiber can run to the CP, where a media converter can be used to convert to copper Ethernet to connect to the end device.

The most common cabling installation is a node centric architecture with a passive CP — where all active equipment is located in the TR. There are some scenarios where installations use an active CP and the introduction point for power is at the CP. This could be in the form of a PoE switch inside the CP. The active CP design often becomes a choice when newer switches already exist in the TR but are not PoE enabled, or fiber is run to the CP, where a media conversion occurs to deliver power and data to end devices. One potential downside to an active CP: there is the possibility for unwanted noise from added cooling fans, which could be an issue when located directly above workspaces.

Daisy Chaining — As shown in both fixture centric and node centric schematics, daisy chain implementations can be made in both types of installations. Daisy chaining — where numerous end devices are connected in a series via patch cords — is a common scenario in the electrical world but has not historically been used much in the networking world. However, more smart devices are now designed to be daisy chained, especially for PoE light fixtures that are relatively close together.

There is no simple answer to which design is best for networking smart buildings and IoT devices; it ultimately comes down to the priorities of the network and the application requirements. When it comes to cabling, there are some cost differences between the options. While costs can vary based on the length of cable runs and other variables, a node centric design will typically cost 10% less than a fixture centric design, as it uses less cable and fewer home runs. Node centric designs may see increased costs from more active equipment and lower switch port utilization, but cabling costs will be less expensive.

Learn more about infrastructure for smart buildings, including telecommunications room rack and space requirements, in the Leviton on-demand webinar "**Smart Buildings: What Infrastructure Do You Need?**"

Design Considerations with Passive Media Converters

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Additional insertion loss in the channel — Passive Media Converters use filters to perform the removal of modal dispersion that occurs in multimode fiber. Insertion loss occurs in these devices at up to 3 dB per connection. The accumulated channel loss over multimode fiber can easily approach or exceed the functional limits of common longer reach or higher data rate Ethernet applications. Also, depending on the length of the overall channel, a second far-end PMC device may be required. This adds additional loss against the transceiver maximum allowable limit.

> **...accumulated channel loss** over multimode fiber can easily approach or exceed the functional limits...

Migration to higher data rates — As companies and campus environments see increased bandwidth requirements, they will likely need a network strategy to migrate to speeds higher than their existing infrastructure supports. As identified in the insertion loss factors above, the loss budget of channel is reduced at the higher data rates. When higher data rate applications like 100 Gb/s are required, the existing cabling infrastructure may be insufficient and need to be upgraded anyway.

> ...the **existing cabling infrastructure may be insufficient** and need to be upgraded anyway.

Reduced rack density — Real estate is a high commodity in many telecommunications rooms and rack/cabinet spaces. PMC devices require additional rack unit space and often have very low port density to facilitate the transition that occurs in the device. Port density can be as low as 12 fibers per rack unit. As the logical option would be to patch or splice from the existing infrastructure to the PMC, additional rack space beyond what was already installed is required. For example, a 48-strand campus backbone cable that already consumes 1RU of rack space can require as much as an additional 4RU of space for the PMC devices.

> PMC devices require **additional rack unit space** and often have very low port density...

Cost — There are additional costs incurred with PMCs. A 12-fiber PMC device can cost as much as $10,000. In addition, there will likely be additional costs incurred during installation to purchase or rent specific bit error ratio (BER) test equipment that is required to certify the installation in order to get a system warranty from the manufacturer. If BER testing produces a failure, the system may not be warrantable causing potential need to recable. While the incurred costs of successfully adding PMCs could solve short term issues, it might not address longer-term issues that would again require recabling.

> A 12-fiber PMC device can **cost as much as $10,000.**

Lack of switch vendor support — A multi-million-dollar investment to upgrade the speed of your network switches may not be supported or warranted if there are any compatibility issues with the old fiber cabling in use with a PMC device. It is undetermined if transmission over multimode fiber will meet recommended IEEE and MSA transceiver performance requirements for data rates of 100 Gb/s or greater, as they are just now becoming available. Switch provisioning and network troubleshooting may need to be supported from resources other than your switch vendor.

> It is **undetermined** if transmission over multimode will meet recommended IEEE and MSA transceiver performance requirements for 100 Gb/s or greater......

Single-mode is the best overall solution — While the addition of PMC devices may be a cost-effective option to mimic single-mode fiber, they should only be considered as a last resort. While replacing the multimode cabling infrastructure with single-mode is a capital cost today, it corrects and eliminates all the issues addressed above and provides essentially limitless distance and data throughput in the passive optical cabling infrastructure moving forward.

> **Single-mode** provides essentially limitless distance and data throughput in the passive optical cabling infrastructure.

Read our **Application Note** for more details about the complexities of a PMC installation and the Leviton recommended solutions.

Standards SNAPSHOT

Below are some highlights of projects from recent committee meetings. For a comprehensive list of the latest updates from IEEE, ISO, and TIA committees, read the **Q1 2021 Leviton Standards Report** (pdf).

IEEE

Beyond 400 Gb/s Ethernet Study Group — This Study Group was formed to investigate physical layer specifications greater than than 400 Gb/s. Data rates investigated are likely to be 800 Gb/s and 1.6 Tb/s.

Single Pair Ethernet Enhancements Study Group — This Study Group was formed to evaluate enhancements for SPE point-to-point applications, including the addition of TSN (time sensitive networking) to the current SPE specifications, and longer term to evaluate higher data rates for the next generation point-to-point SPE (T1L).

IEEE P802.11ax High Efficiency WLAN (Wi-Fi 6) — IEEE P802.11ax D8.0 was ratified by the IEEE Standards Association Standards Board in February 2021. This document will become IEEE Std 802.11ax™-2021, with expected publication in May 2021.

ISO/IEC

ISO/IEC 18598: 2016 (Automated Infrastructure Management) has been reaffirmed without changes.

ISO/IEC 18598 AMD1: 2021 has been published.

ISO/IEC TR 24704 Guidelines for Wireless Access Point Cabling has been withdrawn. Content is included in ISO/IEC 11801-6.

ISO/IEC TR 24746 Guidelines for Mid-Span DTE Cabling has been withdrawn.

TIA

Recently Published or Re-affirmed — TIA-5021 Guidelines for the Use of Installed Category 5e and Category 6 Cabling to Support 2.5GBASE-T and 5GBASE-T has been reaffirmed without any changes.

TR-42.7 Telecommunications Copper Cabling Systems — A 3rd Industry ballot for TIA-568.5 (SPE components) will circulate for review at the June 2021 meeting, where it is very likely that this document will be approved to publish.

A new project has been activated for **TSB-5070** Guidelines for Supporting Power Delivery over Balanced Single Twisted-Pair Cabling.

NEWS YOU CAN USE

INDUSTRY

MORE THAN 30 PERCENT of the world's countries now have 5G in some shape or form, according to a Viavi Solutions "State of 5G" report, released in February 2021. The annual report found a 350% increase in the number of cities with 5G coverage over the previous year's report.

SALES OF ETHERNET TRANSCEIVERS in 2020 increased 33% over 2019, according to the March 2021 High Speed Ethernet Optics Report from LightCounting. Demand for all products, from 1 Gb/s to 400 Gb/s exceeded expectations for 2020.

PRODUCT

Leviton has expanded its portfolio of **PRE-TERMINATED COPPER TRUNK CABLES** with new Cat 6, Cat 6A, Cat 7 and Cat 8 rated options, and now offers additional bundle sizes for greater flexibility. The new trunks allow for faster network deployment to bring new equipment online quickly and minimize downtime during moves, adds and changes.

The expanded line of copper trunks comes at a time when data centers and offices are looking to limit foot traffic in facilities due to the global pandemic. This makes pre-terminated assemblies an even more appealing option, since they significantly reduce deployment time on-site compared to field-terminated installations.

Learn more at Leviton.com/ns/emea/mto.

YESTERDAY'S NEWS

1990: Responding to a challenge from colleagues at the Interop conference, software engineer John Romkey presented a toaster that could be turned on and off over the internet. That toaster is now considered the first IoT device.


Photo Courtesy of IEEE Consumer Electronics Magazine 2017

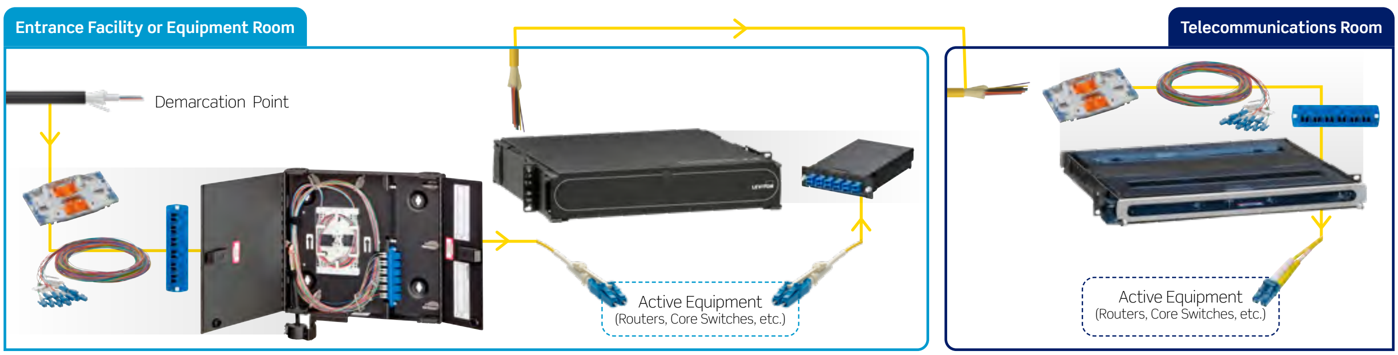
TECH TIPS

Get an Enterprise Fiber Channel Walkthrough

See how Leviton provides a complete fiber optic cross-connect channel with our new enterprise fiber channel overview. The overview includes a helpful video walkthrough that covers solutions from the entrance room to the telecommunications room, as well as additional resources and video demos for each product included.

Opt-X SDX enclosures, adapter plates, and splice modules — along with Leviton assemblies and cable — provide enhanced connectivity and ideal storage for enterprise networks. We offer both pre-terminated and field-terminated options to simplify cable routing and organization while supporting fast installations.

Learn more about the enterprise fiber solutions at Leviton.com/ccwalkthrough.



ASK THE **EXPERTS**

Q: Are there any issues with using shielded patch cords in our unshielded system?

A:

Using shielded patch cords in otherwise unshielded channels is not only an acceptable combination but offers numerous benefits to the customer.

Strictly from a standards perspective, there is no requirement that all components within the channel be either UTP or shielded. Neither ISO/IEC or TIA have any requirements that a channel be constructed of either all screened or unscreened elements.

One concern we hear is whether shielded patch cords act as an antenna since they are not grounded. In an ungrounded condition, a screen/shield will have increased attenuation at a higher frequency because of the low-pass filter formed by its resistance, distributed shunt capacitance and series inductance. However, based on our internal lab tests, the coupling between two adjacent U/UTP cables is still a minimum of 20 dB worse than the interaction between two ungrounded F/UTP cables. Therefore, even under worst-case ungrounded conditions, the UTP cable behaves more like an antenna than the F/UTP cable.

Ultimately, the key issue comes down to whether using shielded patch cords in the channel yields consistently good performance. For more than ten years, Leviton has been selling Cat 6A patch cords that are shielded only, and they are often used in UTP channels. During this time, we have collected many sets of channel performance data — including third-party, internal, and field test data — that show Cat 6A cords provide outstanding channel performance. And they include benefits over UTP cords, including smaller outside diameter and better alien crosstalk protection.

See our full range of copper patch cords, including Cat 5e, 6, 6A, and 8, at Leviton.com/CopperPatchCords.

Questions? Comments? Ideas?

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