INTELLIGENT BUILDING UPDATE:

HOW ZONE ENCLOSURE TOPOLOGY IS CHANGING THE INFRASTRUCTURE LANDSCAPE

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How Zone Enclosure Topology is Changing the Infrastructure Landscape

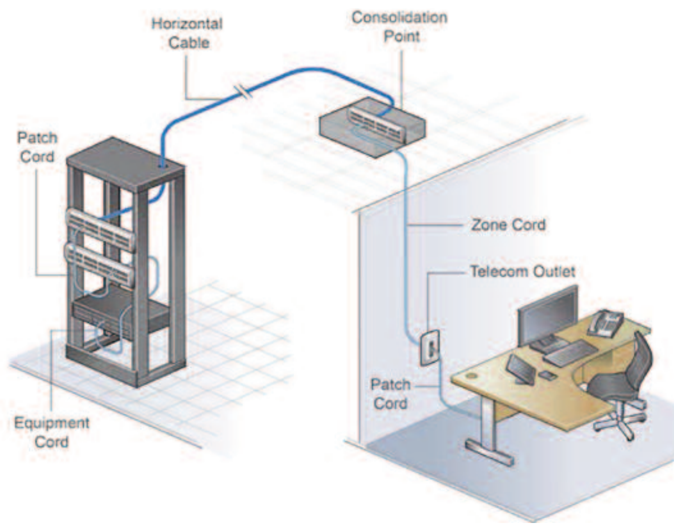
A “smart” or “intelligent” building refers to a structure (or multiple structures on a campus) that encompasses integrated building applications through IP (Internet Protocol) on over a common data network. These diverse and previously disparate applications can include HVAC, lighting, A/V and security, alongside voice and data. In addition, many of these applications employ low-voltage power through Power Over Ethernet (PoE). The benefits for converging data and PoE applications over the same network are numerous – improved system efficiency, performance and reliability. In addition, there is a significant environmental impact which results in reduced energy – in other words, making it more sustainable.

Prior to the 2020 pandemic and lockdown, the nationwide market growth rate for intelligent buildings was estimated between 12.6% to 15.3% compound annual growth rate (CAGR) from 2019 to 2026, with commercial buildings dominating the trend. As the country finds a new normal in the “post-COVID” era, the need for integrated systems controlled through sensors and touchless controls is contributing to a greater demand for intelligent buildings. The population will return to offices, schools, factories and hospitality facilities because intelligent buildings with integrated applications will create a better environment than conventional buildings or home offices.

The basic foundation to implementing an intelligent building is in planning, designing and installing of an efficient and flexible network infrastructure. The planning phase encompasses understanding the goals of the building owner and selecting the best suited network topology and associated equipment – passive and active. In the design and installation phase, the contractors can refer to the many industry standards to understand the challenges and solutions for the new and emerging technologies.

This white paper will examine the principles for planning, designing and installing a smart infrastructure for today and tomorrow’s evolving intelligent buildings. One of the most unique solutions in designing an efficient infrastructure includes a zone cabling layout as this allows connectivity to many of today’s applications while providing system flexibility to accommodate connectivity to additional future devices. FSR, a leading manufacturer of infrastructure equipment, is addressing zone cabling by engineering a line of zone enclosures for all environments and applications.

History of Zone Cabling – A Flexible Cabling Solution



Open office layout with Consolidation Point

Traditional structured cabling involves multiple horizontal runs (usually copper cabling) from the telecommunications room (TR) to each work area outlet (WAO). This is called a "homerun cabling topology," also known as "star topology," as it is point-to-point. For very small offices, this approach works fine. But in many large enterprise locations, traditional structured cabling can mean hundreds of lengthy copper cables that become difficult to manage, virtually impossible to change, and extremely arduous to remove when complying with building codes that require removal of abandoned cable during moves, adds and change (MACs).

The open office concept became popular in the mid-1990's. The purpose of this modular furniture "cubicle farm" was to fit more employees in a smaller space, reducing hard walls, and created flexibility to relocate personnel and easily reconfigure the space, as needed. But it introduced a challenge to deliver cable to these cubicles. The solution was to install a consolidation point (CP) between the TR and the work area outlets. The horizontal cable is then pulled from the TR and terminated into the CP, making it a passive cross-connection. Moves, adds and changes became much easier as the cable only had to be reterminated at the consolidation point location and a long patch cord or horizontal cable would connect to the work area in the modular furniture outlet. Open office cabling recommendations were intended to provide a cabling system that allows for easy and cost-effective reconfiguration of work areas (modular furniture), while providing a system that can be maintained and administrated without degrading the overall cabling system performance.


MUTOA

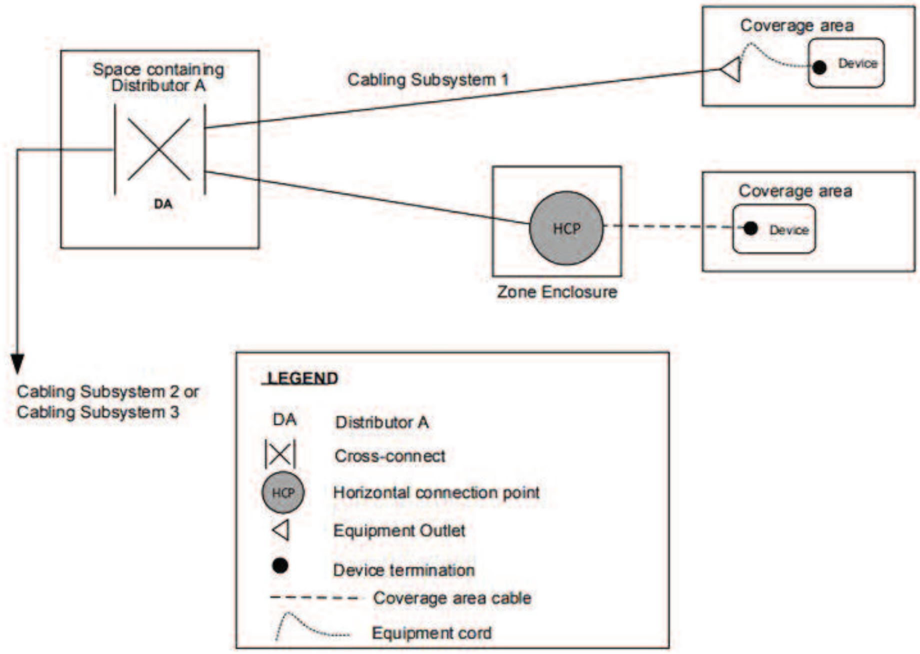
Note that there is a differentiation between a consolidation point (CP) in an open office configuration and a multi-user telecommunications outlet assembly (MUTOA). A MUTOA is based on the same principle but with some big differences. A MUTOA is a group of telecommunications outlets arranged in a single assembly housing – so technically a MUTOA is a work area outlet and not a cross connection point. Think of it like a power strip that allows many items to be plugged into it. Horizontal cable is routed directly to the MUTOA, which is not located in the ceiling but in a fully accessible, but permanent location, such as building columns and walls. Work area patch cords, sometimes routed through office-furniture pathways, connect network devices, such as a computer or phone, directly to the MUTOA. The user may attach work area cords (patch cords) from the MUTOA to the device without requiring a technician, whereas connecting cable to and from a CP requires a trained installer.

Fast forward to the dawn of intelligent buildings when non-data/voice applications, such as IP security cameras, started utilizing the Ethernet network. Once again, system designers were challenged with terminating telecommunications cabling to the many diverse device locations – such as IP cameras and sensors in the ceilings or access control systems at “belt level” on the wall. Zone cabling evolved utilizing the open office principles, but addressing connectivity to intelligent building applications. A properly executed zone cabling plan has many immediate and long-term benefits – resulting in a more manageable, accessible, and flexible cabling topology, which has a direct impact on material costs, labor, as well as simplifying future MACs and maintenance.

For open offices, the CP houses only passive termination equipment for data or voice applications. However, both power (PoE) and data can be delivered through the same horizontal Category cabling to intelligent building applications. Therefore, the term “horizontal connection point” (HCP) is designated to define the cross-connection midpoint location for intelligent building applications and differentiates from a CP. The zone enclosure located in the HCP can also house active equipment needed, such as network switch, media converters or nodes, depending on the device requirements.

Industry Standards – Best Practices for Design and Installation

In 1996, The TIA addressed open office cabling and published TIA TSB-75 Additional Horizontal Cabling Practices for Open Offices, which eventually was incorporated into ANSI/TIA/EIA-568-B.1. When zone cabling developed as an integral part of an intelligent building infrastructure, two separate (but similar) standards evolved to aid the system designers and installers addressing the unique cabling infrastructure. — ANSI/TIA-862-B-2016 *Structured Cabling Infrastructure Standard for Intelligent Building Systems* and ANSI/BICSI-007-2020 standard, *Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises*. Together these two documents complement each other to provide cabling installation planning, but may slightly vary in some of the recommendations.



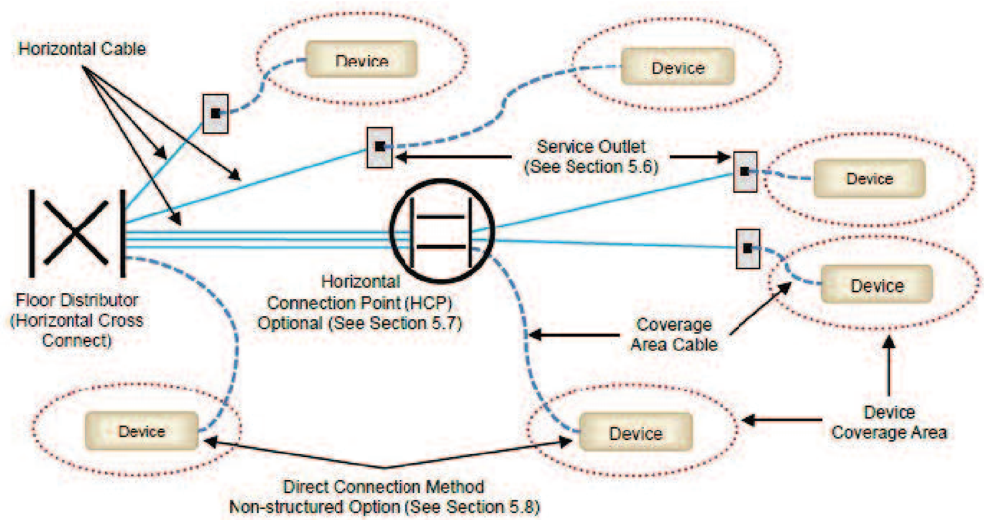
TIA-862-B Horizontal Cabling layout option – Cabling Subsystem 1

The ANSI/TIA-862-B-2016 addresses the cabling types, connectivity and testing of the cabling infrastructure. It also maps out the topology showing the horizontal cabling with an optional Horizontal Connection Point (HCP).

Here are some of the guidelines for the design of an HCP in the ANSI/TIA-862-B standard:

- HCPs shall be located in fully accessible, permanent locations.
- For balanced twisted-pair cabling, in order to reduce the effect of multiple connections in close proximity on NEXT loss and return loss, the HCP should be located at least 15 m (49 ft) from the distributor (or TR)
- The number of devices served by an HCP will depend on the number of coverage areas served and should be limited to a maximum of 96.
- No more than one HCP shall be placed in a single Cabling Subsystem 1 link. Each cable extending from the HCP shall be terminated to an equipment outlet or can act as a cross connect and terminate directly to the device. This is known as a Modular Plug Terminated Link (MPTL) where a horizontal cable is terminated with a plug and attaches directly to the device.

Similar to TIA, the ANSI/BICSI-007-2020 defines a zone cabling design to consist of horizontal cables pulled from the telecommunications room (TR) to the HCP. From the HCP, cabling is run to service outlets (SOs) versus work area outlets (WAOs) or telecommunications outlets (TOs) that are only used for data/voice applications.



BICSI-007: Building System Horizontal Cabling Elements within a Star Topology

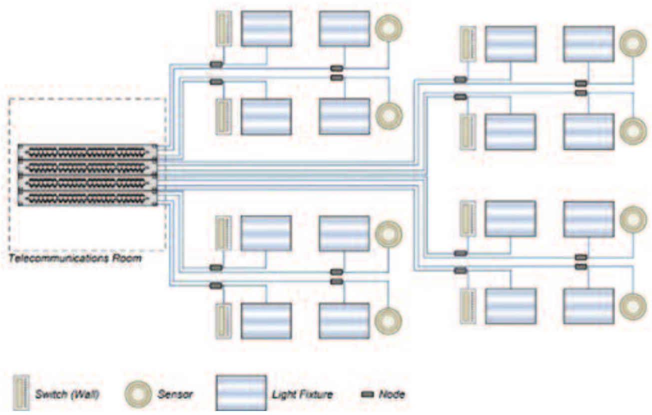
The differences between TIA and BICSI Intelligent Building Standards include the following:

- BICSI allows the HCP to house both passive and active equipment, whereas TIA recognizes that the HCP only contain passive cabling cross connects.
- Direct Connection: TIA allows the HCP to act like a midpoint service outlet and the cable to the end device can be a direct attach using an MPTL if using an HCP, BICSI shows the HCP as a cross connection and also that the horizontal cable from the TR can be directly terminated with a plug with or without an HCP. (ANSI/TIA-568-B-2 further defines the MPTL)

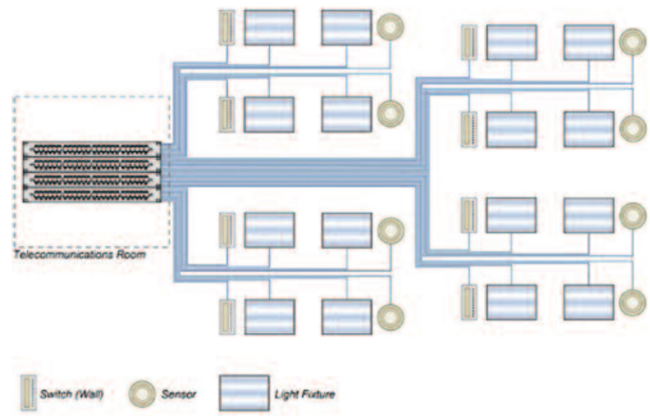
Addressing Unique Cabling Challenges for Today and Tomorrow's Intelligent Buildings

As the ICT industry moves forward into a new "post COVID" era, there will be more adoption of the intelligent/smart building concepts because of its many advantages. One of the greatest advantages are energy efficiency and saving energy costs – for instance, LED lighting vs. fluorescent lighting. In addition, with sensor technology and a well-designed Automated Infrastructure Management (AIM) system, which connects the devices (i.e., lighting sensors) to the computer hardware and software to perform functions such as collecting, processing, storing, transmitting and displaying information, many building systems can be controlled without touching a dial or a manual switch.

Buildings with the capability of operating applications through "touchless" interaction will continue to increase. As a result, architects, end users, building owners and system designers will look to incorporate an intelligent



BICSI-007-2020: Tree Topology Using Nodes for and LED Lighting System



BICSI-007-2020: Zone Cabling Deployment for LED Lighting

building. This, in turn, will expand the trend for zone cabling architecture because of its many aforementioned benefits, especially simplifying the addition of more devices to the network by pulling cable or patch cords from the existing HCP and integrating into the AIM system.

To demonstrate, the next two diagrams show the different cabling layouts for LED lighting systems that are connected to the network. The “tree” topology shows that the horizontal cabling runs from the TR to nodes. Many LED lighting solution providers use nodes as the controller and termination point between the PoE network switch, the cabling cross-connections and the end devices. From the nodes, the cable can be a copper patch cord or an 18 AWG/2 conductor type (18 AWG/2 conductor) wiring to the lighting fixtures and sensors. In fact, the cable can run as a daisy-chain because of the low wattage required by these end devices. The nodes and sensors located in the plenum space would be much more protected if they were housed in a zone enclosure .

The zone cabling layout diagram shows the horizontal cabling from the patch panels in the TR running to zone enclosures. From there either patch cords or horizontal cable connects to the devices (sensors, switches, light fixtures). In this diagram, 24 horizontal copper cables are pulled and terminated to each zone enclosure, yet only 8 devices are connected to each zone. In the future as other devices get added into the zone (also known as the coverage area) the installer would only need to pull a cable or equipment/patch cord from the zone enclosure to the device versus pulling the cable all the way back to the TR.

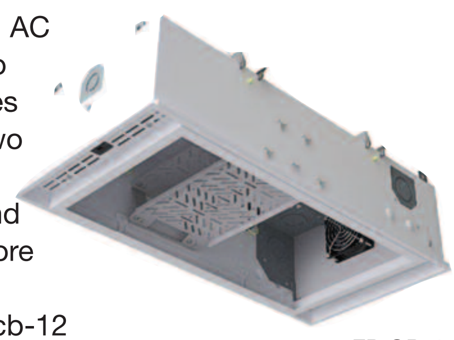
Zone Cabling and the FSR Advantage

With the increasing adoption of zone cabling architecture, the zone enclosure is a critical element to the reliability of the network and overall functionality of an intelligent building. FSR, a leading manufacturer of a wide variety of infrastructure solution products for Information and Communications Technologies (ICT) for all markets is well-positioned to become the leader in zone enclosures – both standard and custom designs. FSR can easily customize their ceiling boxes as zone enclosures to house passive cross-connections, as well as AC outlets and active equipment, such as nodes, network terminals and switches.

FSR is engaging with intelligent building device and connectivity manufacturers to engineer their product line to align with the current and future requirements for connectivity to the edge devices including wireless access points, LED lighting and nodes, security cameras, sensors and AV products.

Currently FSR offers three (3) separate designs of ceiling enclosures as part of their CORE (Cool Overhead Rack Enclosure) Series, which mount above a standard drop ceiling grid and are available in three sizes and models. All have the capacity to hold two (2) half-rack devices and up to four (4) full-width rack devices. All FSR ceiling boxes are constructed with steel and carry the UL 2043 rating for plenum spaces and UL 60590-1 safety rating for IT equipment.

- CB-12 –This 1' x 2' enclosure has an external AC receptacle to the ceiling surface and four (two duplex) additional un-switched AC receptacles inside the enclosure, two shelves to mount two half-rack devices for passive or active equipment and knockouts to allow cabling and wiring. An optional fan kit is available. For more details and specifications go to: https://fsrinc.com/fsr-products-listing/product/cb-12



FR CB-12

- CB-22 - This 2'x2' enclosure can accommodate two (2) full rack pieces of equipment or four (4) half-rack pieces on the built-in shelves. The unit includes an external AC receptacle and a switch/circuit breaker on the ceiling surface, and five AC outlets. A white rim door inserts into a ceiling tile into for a matching look. For more details and specifications, go to: https://fsrinc.com/fsr-products-listing/product/cb-22

FR CB-22

- CB-224 – The CB-224 series is a 2’ x 2’ high-capacity ceiling box designed to fit into a standard 2’ x 2’ or 2’ x 4’ drop ceiling. Available in 4 versions, including “smart” electronics, this model was designed to include a deeper design to accommodate applications requiring more internal equipment than the CB-12 and CB-22 models. The product's advanced deep box design has a pull-down 4 RU cage with gas-spring assisted ball-bearing slide. The CB-224 has six (6) AC outlets in the box and protects the cables’ bend radius. For more details and specifications, go to: https://fsrinc.com/fsr-products-listing/product/cb-224

FR CB-224

- The CB-12-PTF ceiling enclosure ensures the safety of the PoE nodes from the start. PoE lighting has changed the way we plan and execute IoT installations, besides the design, the implementation of the PoE lighting system is now done earlier in the construction process. https://fsrinc.com/fsr-products/product/ceiling-enclosures-for-poe-lighting-nodes/category_pathway-178

FSR partnered with Platformatics to secure lighting nodes in the ceiling boxes for zone cabling architecture.

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