



# PoE Lighting: Unleashing IoT and Opportunity in the ICT Industry

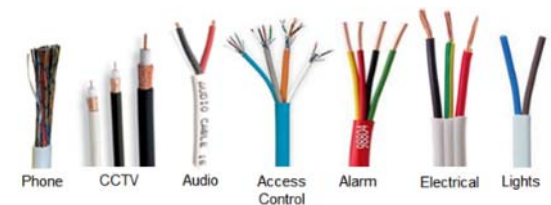
**Bob Allan, MBA, LEED GA**  
Global Business Development Manager  
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 @ballan32



# There's a Revolution Happening in Our Buildings!

- Traditional building communication use a vast array of different protocols and cabling systems
  - Difficult to administrate with extensive inventory requirements
  - Different departments working autonomously with disparate networks, software, servers and support
  - Each system requiring dedicated power, infrastructure, operation and maintenance
- Buying multiple networks in the same building to perform the same basic functions = wasted dollars for redundant servers, switches, cable and conduit
- Siloes inhibit or prevent interoperability

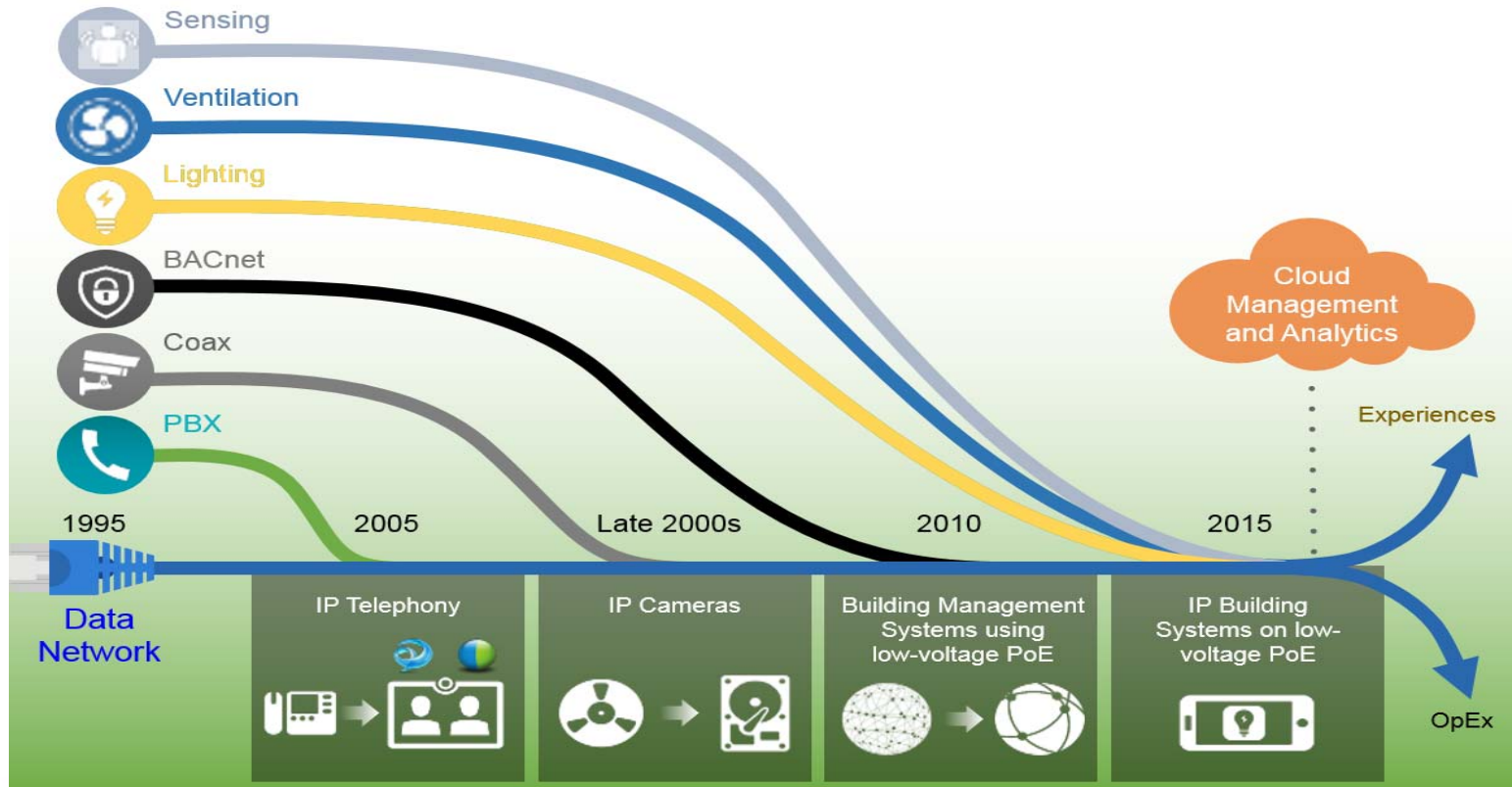


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# Moving Towards IP Convergence



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# Multiple IP Systems Over a Single Infrastructure

- Consolidates cabling and reduces unnecessary pathways and material cost
- Reduces subcontractors and labor costs
- Universal connectivity and cabling means less costly moves, adds and changes
- Power and control over one infrastructure
  - PoE cuts power delivery costs by 75%
- Enables integrated systems to improve building control, management and security
  - Can lower energy consumption by up to 50%
- Improves overall customer and employee satisfaction, engagement and retention
- Increases employee productivity via improved comfort, air quality and lighting



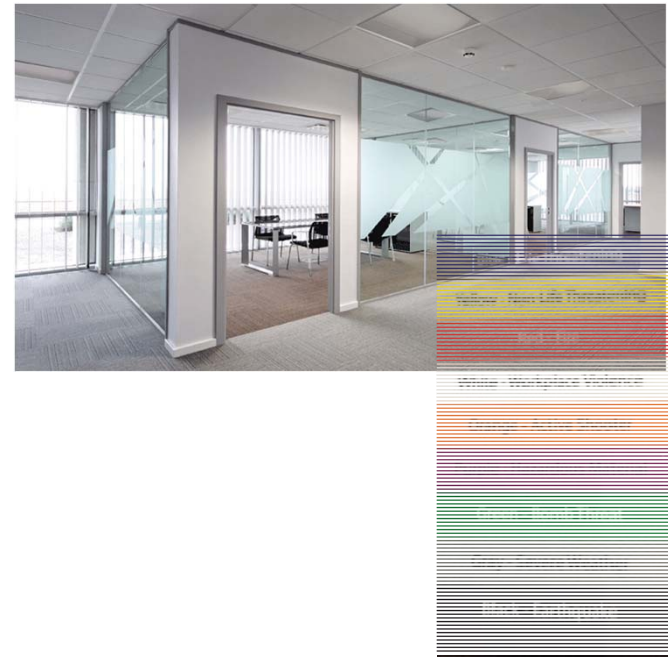
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# PoE Lighting is One of the Biggest Opportunities in the ICT Industry

- Connects via common category twisted-pair cabling
- Average number of devices per 10,000 sq. feet is 115
- Safe extra-low voltage (SELV) application with no safety risk
- Provides strategic placement for advanced sensor technologies and other devices (e.g. speakers)
- Supports future Li-Fi where wireless data is sent via light beams
- Can receive centralized back-up power from the telecom room
- LED technology supports different colors to indicate different status for security purposes or aesthetics



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# Cost Savings with PoE Lighting

## Traditional AC Lighting



- Conduit, wire and a back box for each
- Electrician wage rates
- Electrical code
- ~ \$1,000 per light

## PoE Connected Lighting



- Safe low-voltage installation with cabling and connectors
- Cabling contractor wage rates
- Established cabling standards
- ~ \$250 per light

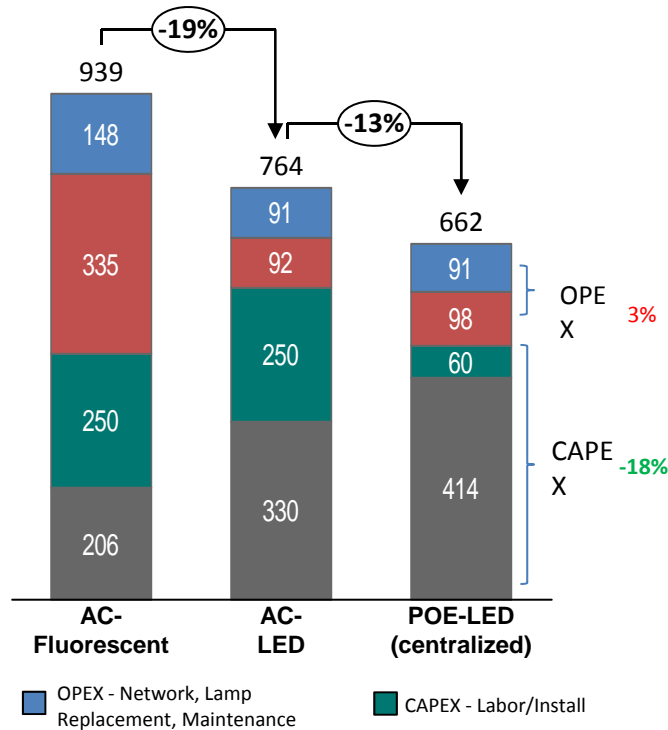


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# 10-Year TCO - \$USD (per fixture basis)



\*US NYC customer, 35K Sq Ft space

## Factors driving lower TCO

- Lower installation costs
- Incremental energy savings
- Future PoE light fixtures will cost less

## TCO expected to improve

- LED price/performance increase 20% per year
- LED luminosity efficiency will continue to improve

# Proven Savings

## CompuCom 151,000 sq ft. global headquarters in Charlotte, NC

- 16% less expensive to operate
- Fully integrated building systems with IoT analytics
- Exclusively powered by PoE with only PoE lighting
  - Saved \$275,000 in electrical labor
- Integrated occupancy and daylight harvesting sensors and natural light “mimicking” technology
  - Maintains circadian rhythms and improve productivity and satisfaction
- PoE lighting is programmed to flash and change color in the event of an emergency
- Eliminated batteries in sensors, alarms and emergency exit signs for reduced TCO



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# More Cost-Saving Examples!

**50,000 sq. ft. manufacturing space with 700 lights = \$202,750 savings**

- \$25 saved per light for a total of \$17,500
- \$185,250 saved for PoE structured cabling system vs. traditional AC power

**23,000 sq. ft Erie, PA fully integrated intelligent office building = \$490,637 savings**

- Hard-wire/integrate 8 disparate systems = \$970,937
- Converged systems = \$480,300
- Systems included: HVAC, LV lighting (Infrastructure, controls, reduction of circuit breakers, reduction of conduit), generators, UPS, elevator, access control, utility meters and fire life safety
- Possible additional integration and savings: IP video, PoE Computers, clocks, CCTV, time and attendance, battery charges for phones and PDAs, vending machines, point of sale (PoS) and additional HVAC controllers



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# PoE Lighting

Harry Aller

Innovative Lighting



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# PoE Lighting

Power over Ethernet lighting uses optimized LED fixtures that are both ***Powered & Controlled*** via a simple category cable.



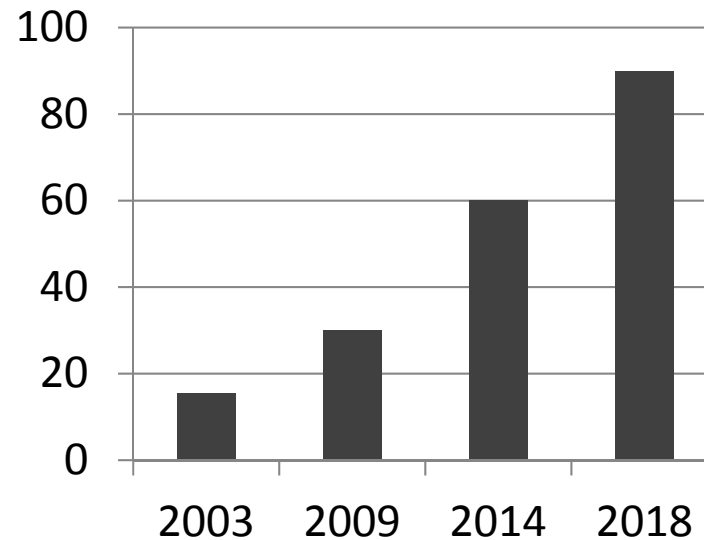
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# PoE - Data and POWER!

- IEEE 802.3af (PoE)
  - 2003
  - 15.4W, 13W
- IEEE 802.3at (PoE+)
  - 2009
  - 30W, 25.5W
- Cisco (UPOE Prestandard)
  - 2014
  - **Four-Pair : 60W, 51W**
- IEEE 802.3bt (PoE++, 4PPoE)
  - 2018
  - **Four-Pair : 60W, 51W**
  - Four-Pair : 90W, 71.3W

PoE ~Power (Watts)



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# Node Centric – Max Power!



## Fixture Centric

One to One  
More Powered Ports  
More Costly

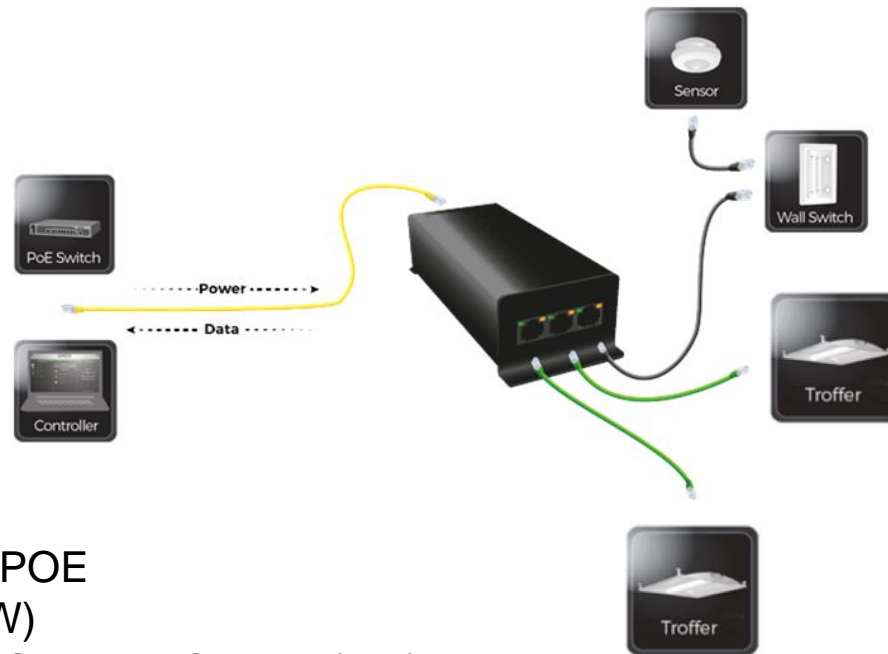
## Node Centric

One to Many  
Less Powered Ports  
Less Expensive



Where N fixture(s) power requirements are less than the supplied PoE power

# Node Centric

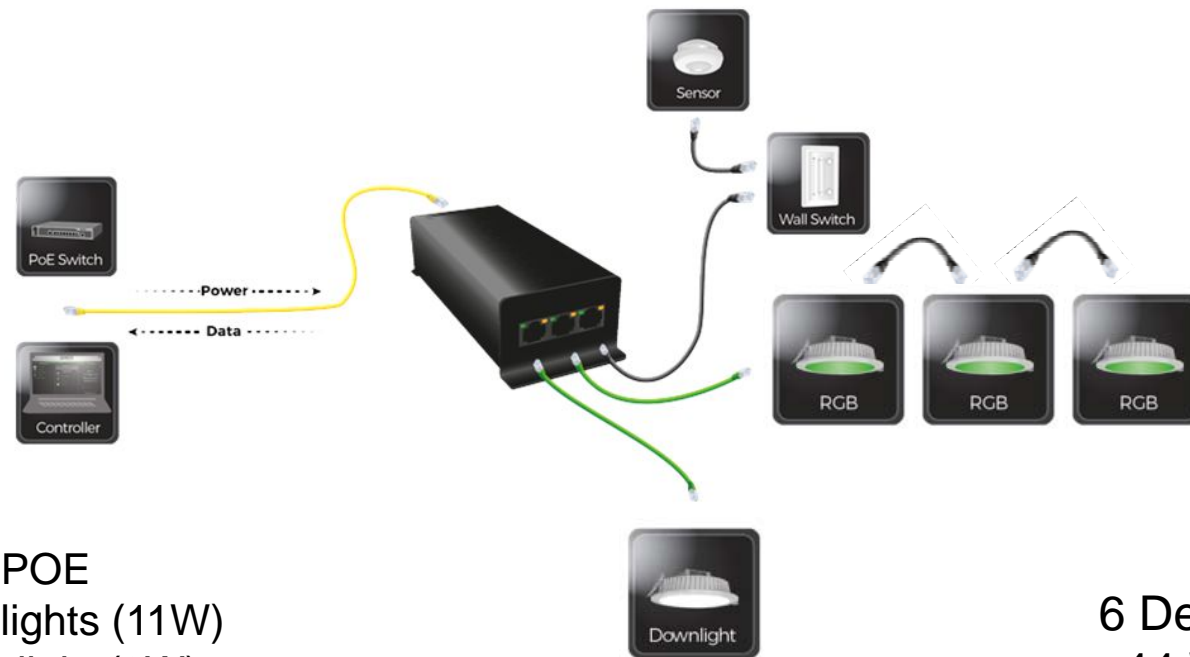


Node Centric : UPOE

- 2x Troffer (23W)
- 1x Node, Wall Switch & Sensor (3W)

4 Devices  
49 Watts

# Node Centric

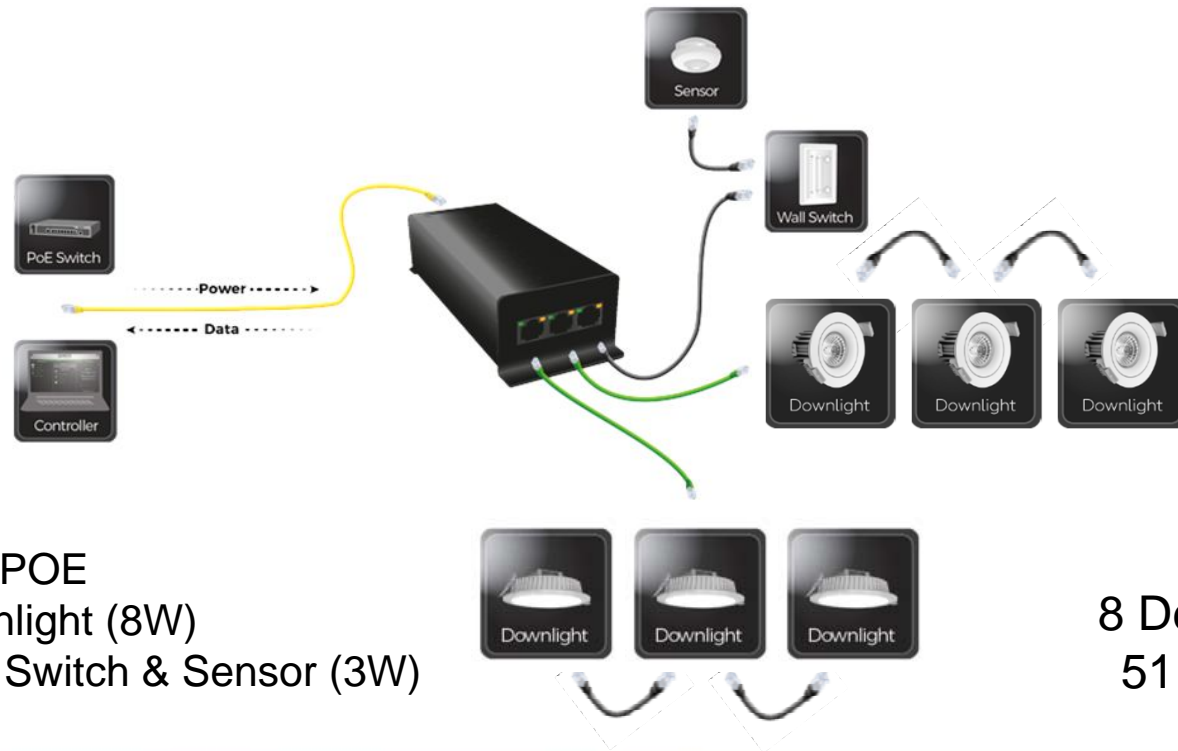


## Node Centric : UPOE

- 3x RGB Downlights (11W)
- 1x White Downlight (8W)
- 1x Node, Wall Switch & Sensor (3W)

6 Devices  
44 Watts

# Node Centric



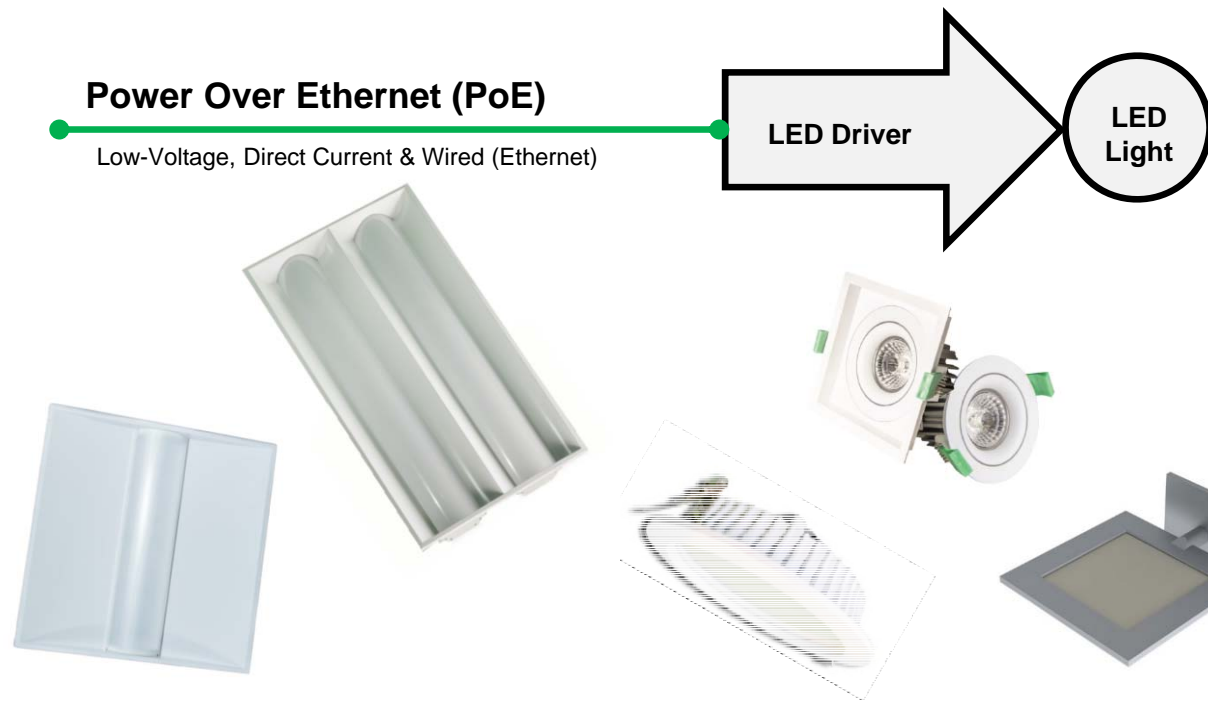
Node Centric : UPOE

- 6x White Downlight (8W)
- 1x Node, Wall Switch & Sensor (3W)

8 Devices  
51 Watts



# Maturing Systems – Fixtures



Classifications : UL 1598 (Luminaires) : UL 2108 (Low Voltage Lighting Systems) : UL 8750 (LED Equipment)

# Building Requirements for Buildings

## LIGHTING NOTES

1. WIRE TO EXISTING AVAILABLE 277V EMERGENCY LIGHTING CIRCUIT IN THIS AREA. CONTRACTOR TO VERIFY EXISTING CIRCUIT DOES NOT EXCEED 3000W.
  2. MANUAL OFF SWITCHES)
    1. LOW VOLTAGE POWER PACK WITH RELAY. SENSORSWITCH PR-20. WIRE A MANUAL OFF SWITCH HAS BEEN PROVIDED, WIRE THE SWITCH BETWEEN THE SENSOR AND THE LOAD.
  4. PROVIDE NEW CEILING/PENDANT MOUNTED, LINE-VOLTAGE, STANDARD RANGE, DUAL-TECHNOLOGY, LIGHTING OCCUPANCY SENSOR. SENSORSWITCH MODEL #RMR-10T-3. WIRE MULTIPLE SENSORS ARE REQUIRED FOR COVERAGE, WIRE THE SENSORS IN PARALLEL, WIRE A MANUAL OFF SWITCHES) HAS BEEN PROVIDED, WIRE THE SWITCH BETWEEN THE SENSOR AND THE LOAD.
  5. PROVIDE NEW CEILING/PENDANT MOUNTED, EXTENDED RANGE LINE-VOLTAGE, DUAL-TECHNOLOGY, LIGHTING OCCUPANCY SENSOR. SENSORSWITCH MODEL #RMR-10T-3. WIRE MULTIPLE SENSORS ARE REQUIRED FOR COVERAGE, WIRE THE SENSORS IN PARALLEL, WIRE A MANUAL OFF SWITCHES) HAS BEEN PROVIDED, WIRE THE SWITCH BETWEEN THE SENSOR AND THE LOAD.
  6. PROVIDE NEW WALL MOUNTED, SINGLE-POLE, LINE-VOLTAGE, STANDARD RANGE, DUAL-TECHNOLOGY, LIGHTING OCCUPANCY SENSOR WITH BUILT-IN MANUAL OVER RIDE. SENSORSWITCH MODEL #RMR-10T-3.
  7. NOT USED.
  8. PROVIDE NEW WALL MOUNTED, SINGLE-POLE, LINE-VOLTAGE, STANDARD RANGE, DUAL-TECHNOLOGY, LIGHTING OCCUPANCY SENSOR WITH BUILT-IN MANUAL OVER RIDE WITH SHIMING. SENSORSWITCH MODEL #RMR-10T-3.
  9. NO WORK IN THIS AREA. EXISTING TO REMAIN.
  10. WALL MOUNTED LIGHT SWITCH (AT THIS LOCATION) IS GOING TO BE INSTALLED ON ALUMINUM FRAME. CONTRACTOR TO PROVIDE JUNCTION BOX, SWITCH, ETC AS REQUIRED. ELECTRICAL CONTRACTOR TO COORDINATE WITH GENERAL CONTRACTOR AND WINDOW VENDOR. PRIOR TO INSTALLATION OF WALL MOUNTED LIGHT SWITCH ON ALUMINUM FRAME.
- GENERAL NOTES:**
1. FOR 277V CIRCUITS, WHEN BRANCH CIRCUIT LENGTH EXCEEDS 100 FEET FROM PANEL, WIRING SHALL BE INCREASED TO #10 AWG. WHEN BRANCH CIRCUIT LENGTH EXCEEDS 150 FEET FROM PANEL, BRANCH WIRING SHALL BE INCREASED TO #8 AWG. WHEN #10 AWG AND GROUND.
  2. FOR 120V CIRCUITS WHEN BRANCH CIRCUIT LENGTH EXCEEDS 70 FEET FROM PANEL, WIRING SHALL BE INCREASED TO #10 AWG. WHEN BRANCH CIRCUIT LENGTH EXCEEDS 150 FEET FROM PANEL, BRANCH WIRING SHALL BE INCREASED TO #8 AWG. WHEN #10 AWG AND GROUND.
- FIXTURE, SWITCHING & DEVICE SUFFIXES:**
- E = EXISTING
  - R = RELOCATED
  - N = NEW
  - 3 = 3-WAY SWITCHES
  - D = DIMMER. PROVIDE FUTURE COMPATIBLE DIMMER SWITCH
  - AL, ALL = UNDER CABLE LETTERS INDICATE CONTROL GROUPS
  - NL = NIGHT LIGHT

## ASHRAE 90.1 IECC 2015 CEC - Title 24

- Lighting
- Shading
- Scheduling
- Nested Zoning
- Data Collection
- Daylight Rhythm
- Power Reporting
- User Management
- Daylight Harvesting
- Occupancy / Vacancy
- High / Low Level Trim
- On / Off / Color / Dim
- On Demand Response

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**SPECIAL NOTE:**  
NO JUNCTION BOXES ARE TO BE PLACED ABOVE HARD CEILING. IF REQUIRED, COORDINATE WITH ARCHITECT FOR INSTALLATION OF ACCESS PANELS.

**2015 IECC CONTROL REQUIREMENTS:**

1. ALL LIGHTING WITHIN OFFICE AND BREAK ROOMS IS TO BE MANUAL OR (VACANCY MODEL) AUTOMATIC OFF.
2. DAYLIGHT ZONES EXTEND INSIDE THE BUILDING BASED ON THE HEIGHT OF EXTERIOR GLAZING. LIGHTS IN THIS ZONE ARE TO BE AUTOMATICALLY DIMMABLE WITH NO OVERRIDE SWITCH.
3. CONTRACTOR IS RESPONSIBLE FOR FULLY PROGRAMMING AND COMMISSIONING OF BATTING LIGHTING CONTROL SYSTEM. ALL COMPONENTS (LOW VOLTAGE AND LINE VOLTAGE) ARE TO BE COMPLIANT WITH 2015 IECC REQUIREMENTS.
4. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL OTHER TRADES FOR CONSTRUCTION REQUIREMENTS AND SEQUENCE OF INSTALLATION.
5. LIGHTING CONTROL FOR PUBLIC SPACES IS INTENDED TO BE OPERATED 24/7 FOR SECURITY PURPOSES. CONTROL OF THIS TYPE OF LIGHTING IS EXEMPT FROM ON/OFF OPERATION.

American Society of Heater, Refrigerating and Air-Conditioning Engineers : International Energy Conservation Code : California Energy Commission

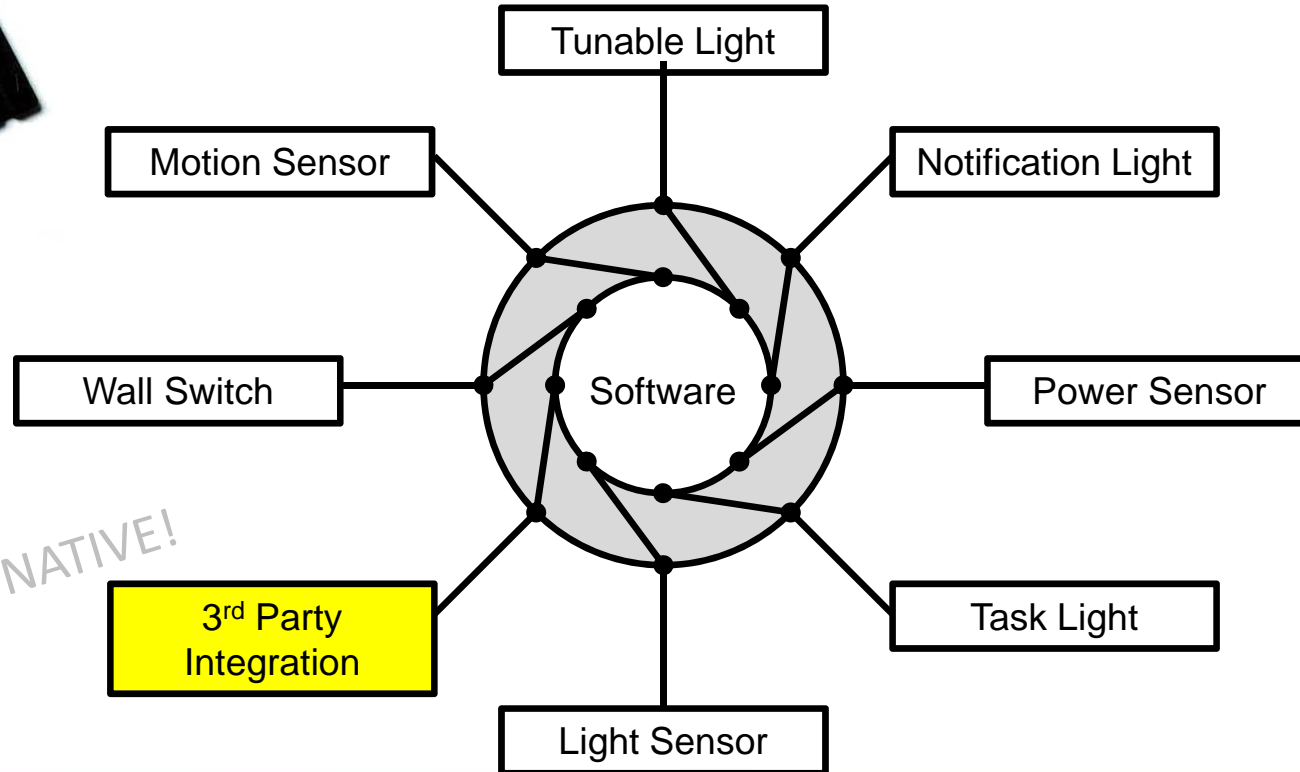


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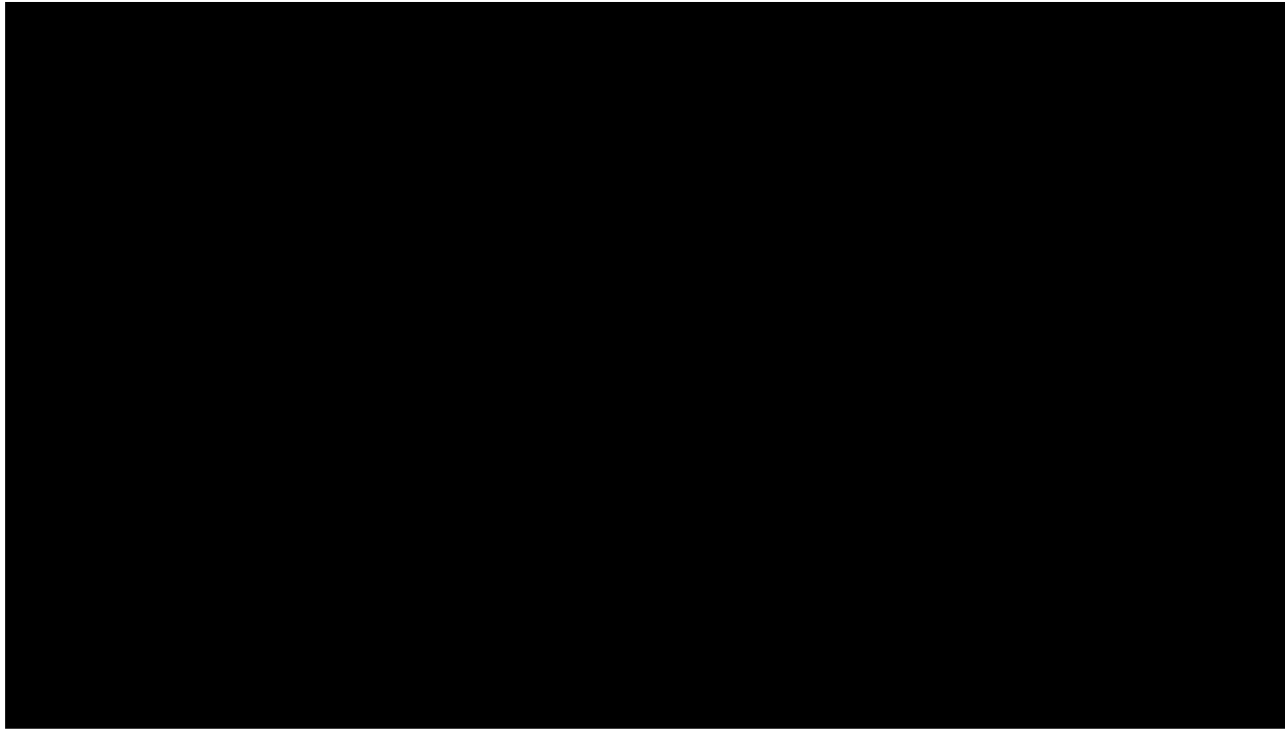


# Software Enabled - Features



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# Auto On, Auto Off

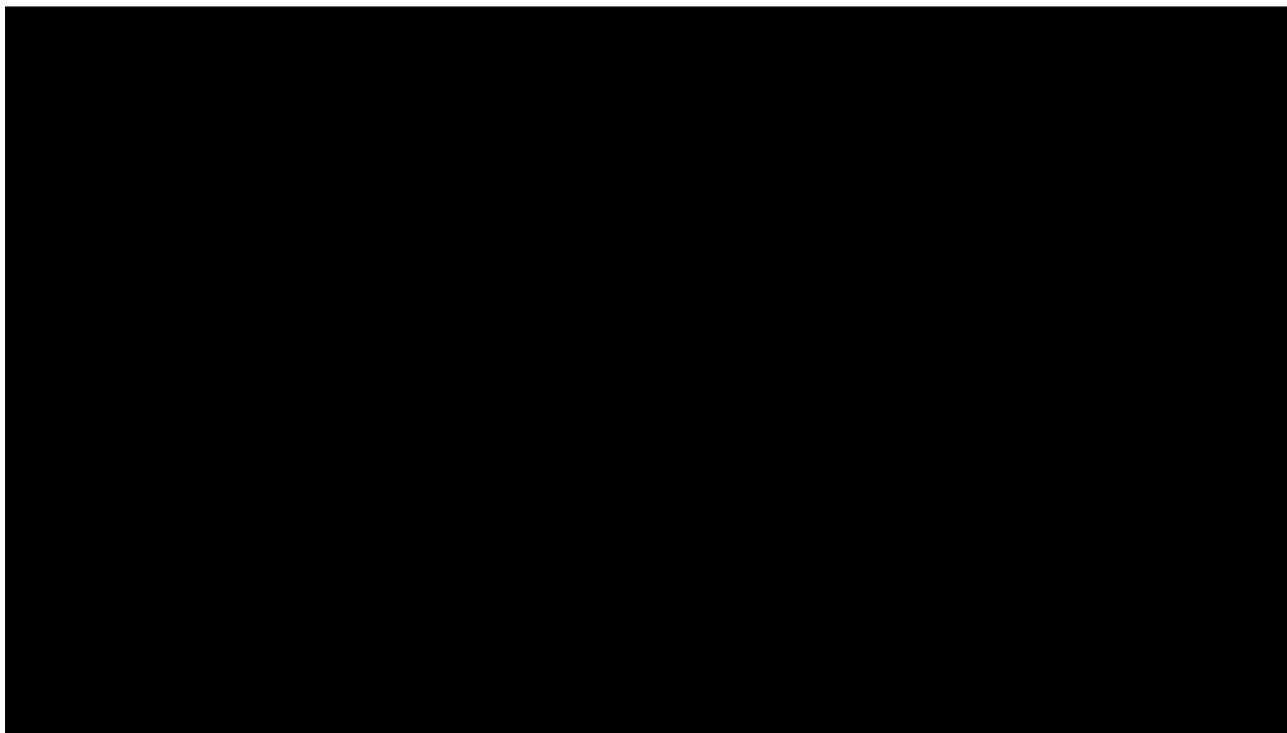


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# Daylight Harvesting



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# Color Tuning, Rhythm



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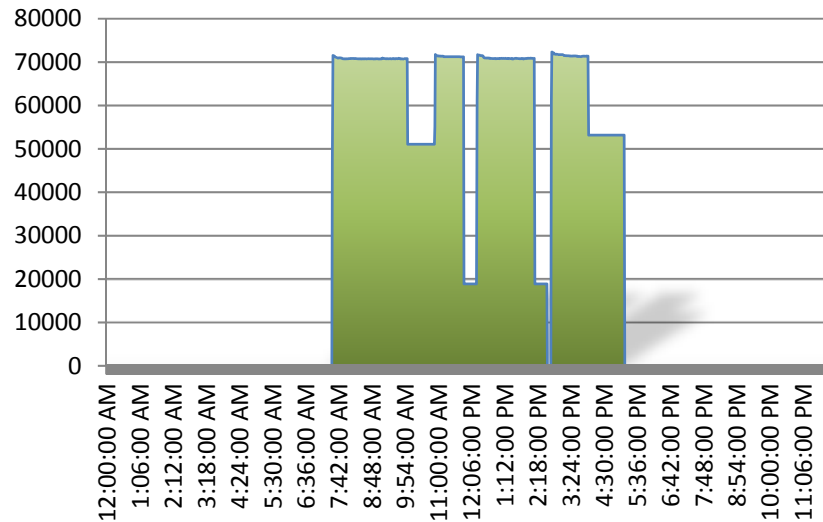


# 3<sup>rd</sup> Party Control

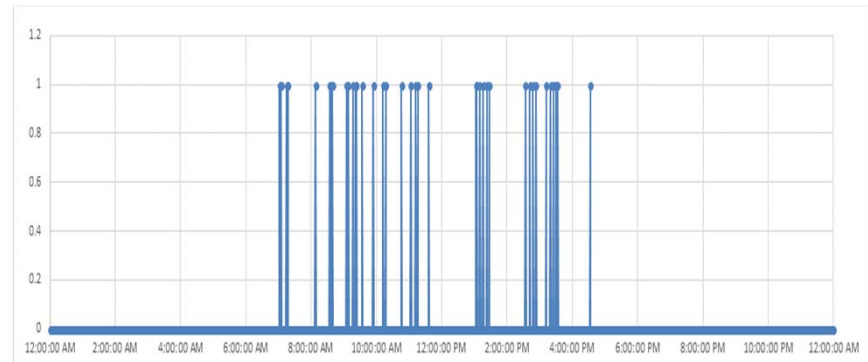


# Data – BiDirectional

## Power Usage (mW)



## Motion Detection





# More than Just Lighting

## Financial Sense



**CAPEX & OPEX Savings**

## Environmental Sense



**Maximum Sustainability**

## Personnel Sense



**Health and Wellness**

## Business Sense



**Impacts all Cost Centers**



# Cabling for PoE Lighting

**Carol Everett Oliver, RCDD, ESS**

Network Cabling Specialist

The Siemon Company



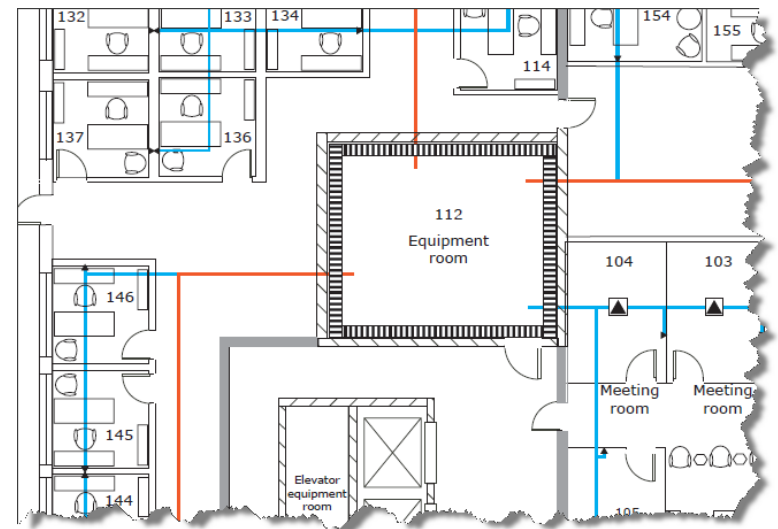
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# Infrastructure Challenges

- PoE Effects on Cable/Connectivity
- Standards Update
- Infrastructure Considerations and Layouts
  - Cable Selection
  - Zone Cabling
  - Direct Connect/MPTL



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# Applicable Standards

- TIA TSB-184-A-2017
  - *Guidelines for Supporting Power Delivery over Balanced Twisted-Pair Cabling*
- ANSI/TIA-862-B
  - *Structured Cabling Infrastructure Standard for Intelligent Building Systems*
- BICSI 007-2017
  - *Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises*



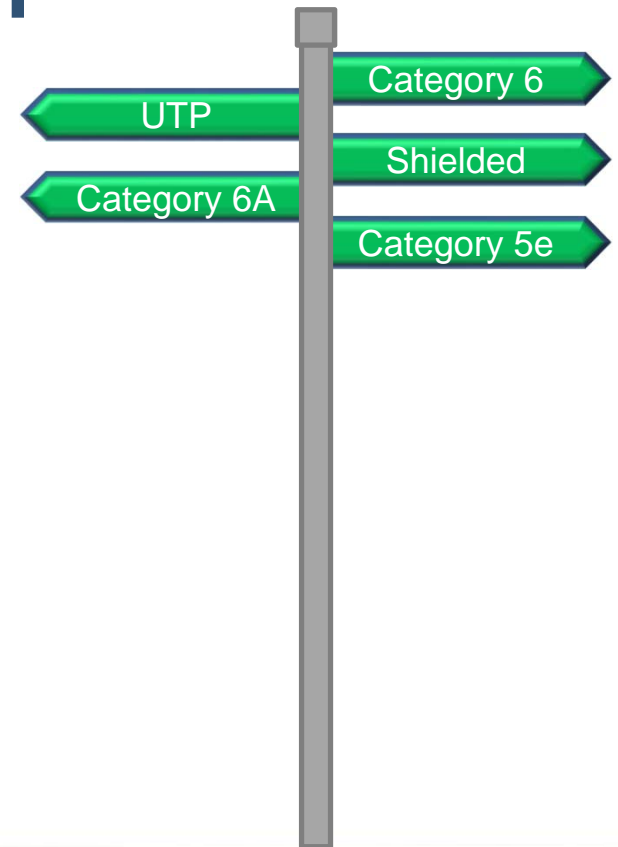
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# Media Selection

- TIA-862-B-2017
  - Category 6; category 6A recommended
- TIA TSB-184-A-2017
  - Category 6A recommended
- BICSI 007-2017
  - Category 6A recommended
- ISO/IEC 11801-6 Ed1.0
  - Class E<sub>A</sub> or higher



# PoE Effects on Cabling and Connectivity

- **Cable**

- Heat builds-up within cable bundles
- Bundle sizes may need to be reduced to improve heat dissipation
- Overall channel length may need to be reduced to offset increased insertion loss resulting from a higher operating temperature

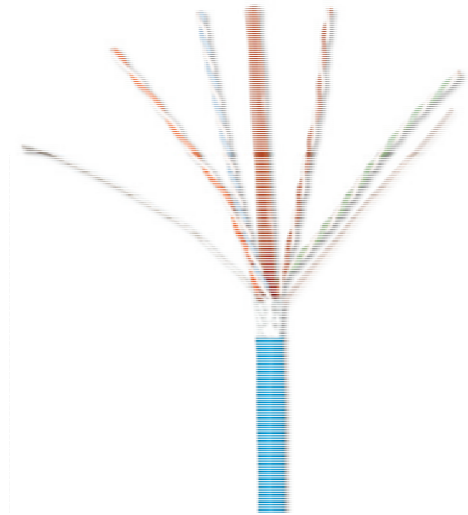
- **Connectivity**

- Contact arcing occurs when un-mating pairs under load and may affect connecting hardware reliability



# TIA TSB-184-A-2017 Recommendations

- Use Category 6A or higher-performing 4-pair balanced twisted-pair cabling (larger AWG)
- Install shielded cables
- Reduce channel length, as necessary, to offset increased insertion loss



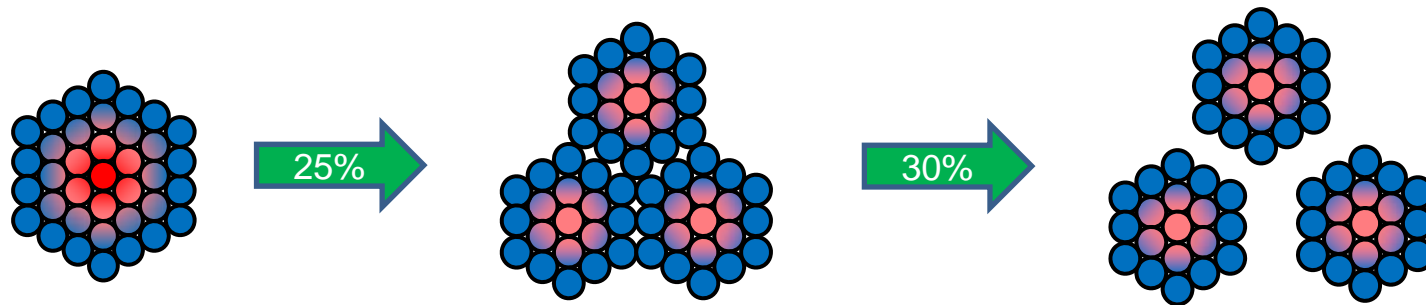
**Category 6A F/UTP**

- *Typically qualified for higher temperature (75°C) operation*
- *Superior heat dissipation*



# Mitigation Recommendations

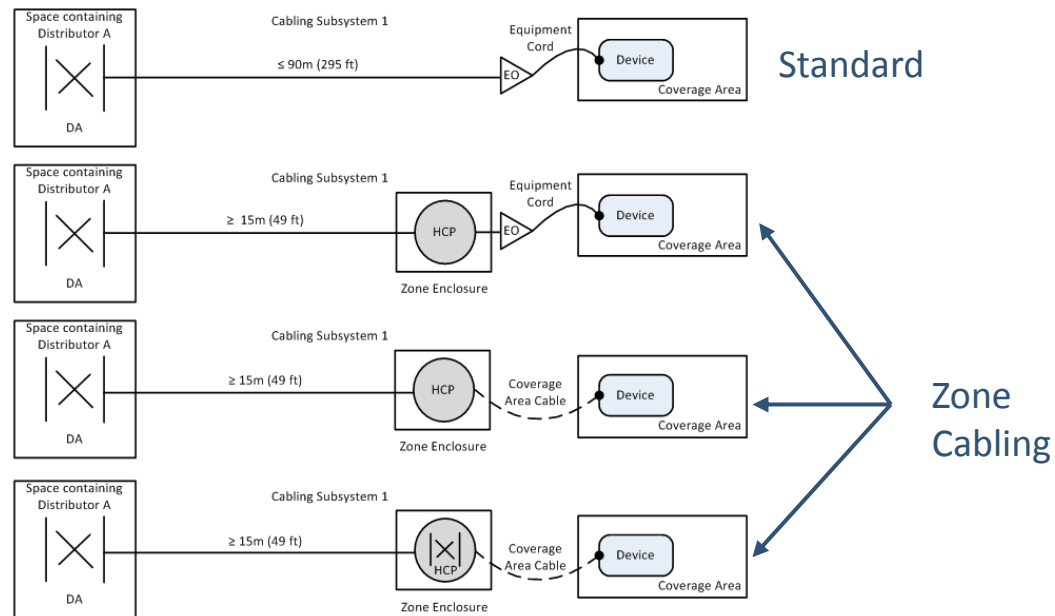
- Leave cables unbundled or smaller bundles
  - If bundling, smaller bundles are recommended – limit to 24



- Use open wire tray or similar cable management that provides for largely unrestricted airflow around the installed cables
- Disperse cables evenly across the width of the tray
- Mix unpowered cables with powered cables



# ANSI/TIA-862-B-2016 Topology Options

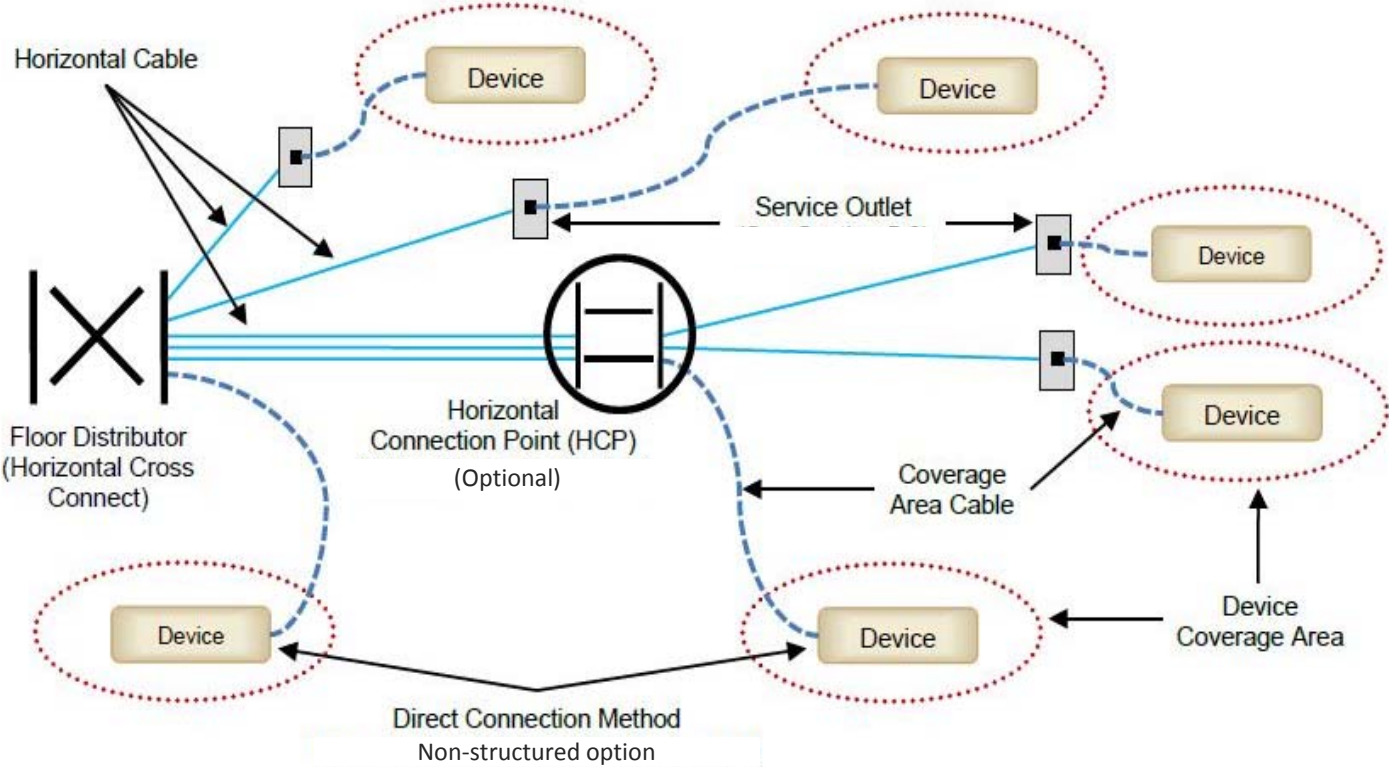


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# BICSI 007: Horizontal Cabling Topology



# Different Terminology

Location/Device	TIA Standard	Terminology
Intermediate connection location in a zone cabling topology supporting a voice/data device	ANSI/TIA-568-0.D	Consolidation Point (CP)
Outlet connecting to a voice/data device	ANSI/TIA-568-1.D	Telecommunications Outlet (TO) <sup>1</sup>
Intermediate connection location in a zone cabling topology supporting a building device	ANSI/TIA-862-B	Horizontal Consolidation Point (HCP)
Outlet connecting to a building device	ANSI/TIA-862-B	Equipment Outlet or Service Outlet (EO/SO) <sup>2</sup>

<sup>1</sup> A TO must always be present even if a CP is present

<sup>2</sup> An EO is optional if an HCP is present



# What is Zone Cabling?



Zone cabling supports convergence of data and voice networks, wireless (Wi-Fi) device uplink connections, and a wide range of sensors, control panels, and detectors for lighting, security, and other building communications



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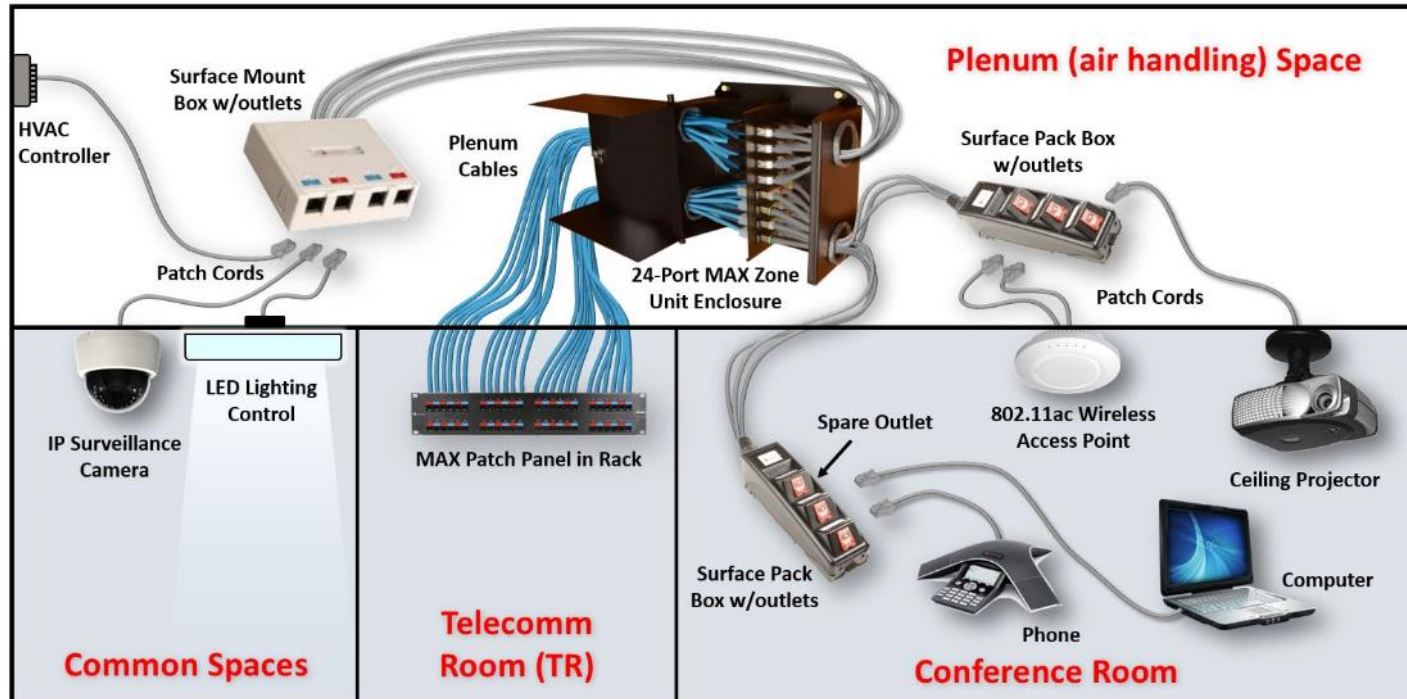
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# Zone Cabling Planning

- Must be in a permanent and easily accessible location
- Should not serve more than 96 building system links
- Should be located at least 15 m (50 ft) from the distributor in the TR or TE



# Plenum Products



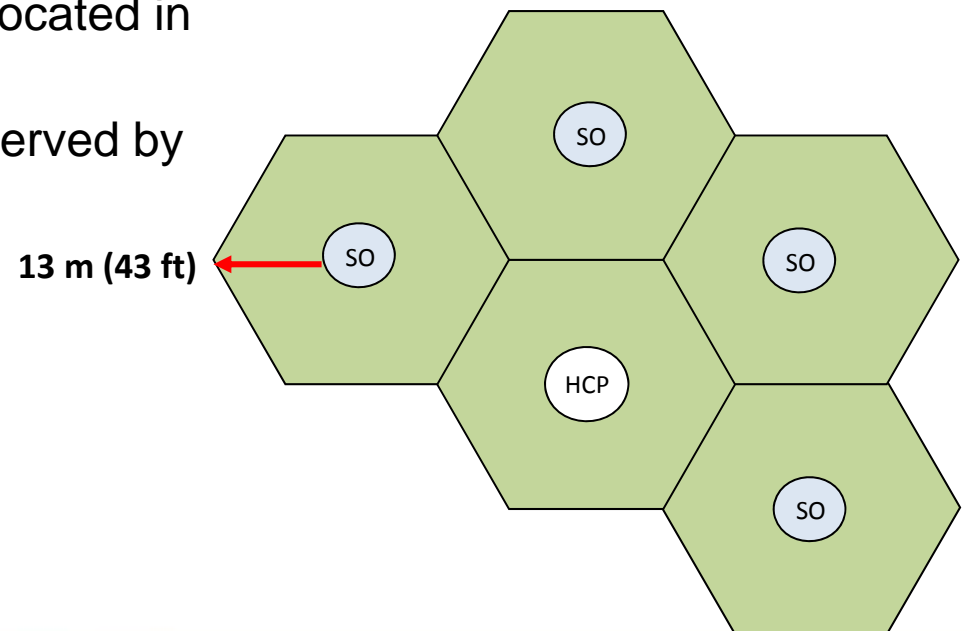
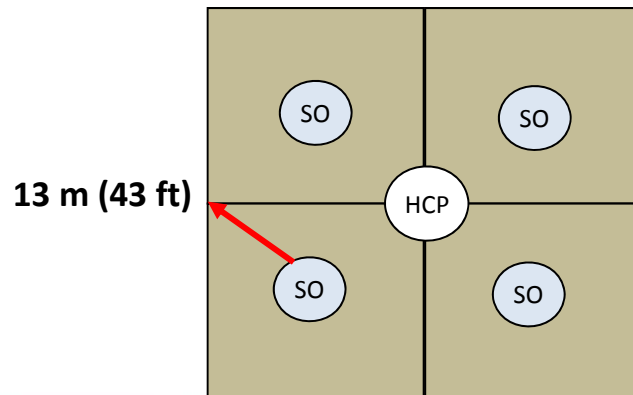
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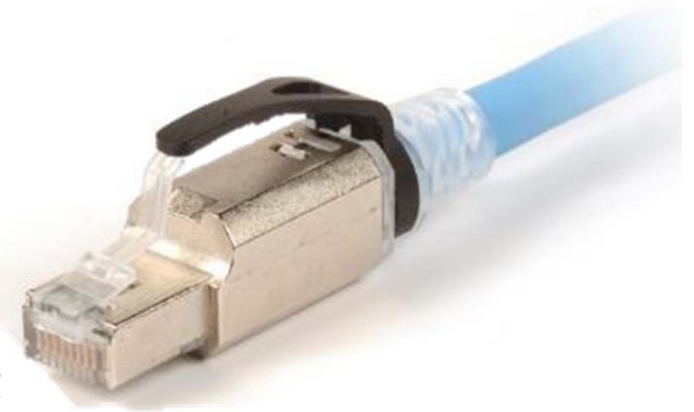
# Zone Cabling Planning

- Different patterns may be used but the radius should not exceed 13m/43 ft.
- Zone enclosures should be centrally located in their coverage areas.
- A zone area refers to multiple areas served by a zone enclosure.



# Modular Plug Terminated Link (MPTL)

- ANSI/TIA-568.2-D requires that horizontal cable be terminated onto a TO. In certain cases there may be a need to terminate horizontal cables directly to a plug.
- ANSI/BICSI-007 recognizes the MPTL and refers to it as a direct connection method, with or without an HCP.
- ANSI/TIA-862-B-2016 recognizes direct connections – should be limited to devices in fixed locations that are not expected to be replaced



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# Benefits of an MPTL?

- Custom length, quick connections in the field for direction connection to devices
  - Ideal for a zone cabling design methodology
  - Can be plugged into the zone enclosure on one end and terminated to outlets on the other end for computers, phones, etc.
  - Simplifies project bill of materials and eliminates the need for predetermined patch cord lengths
- Improves performance and allows for more efficient power delivery by eliminating patch cords and outlets
- Improves security for devices like surveillance cameras by eliminating exposed patch cords



*Photo taken at McCarran Airport in Las Vegas by our awesome marketing person – Anyone could jump up and pull out the patch cord to the surveillance camera and wireless access point.*

# Cabling Layouts for PoE and LED Lighting

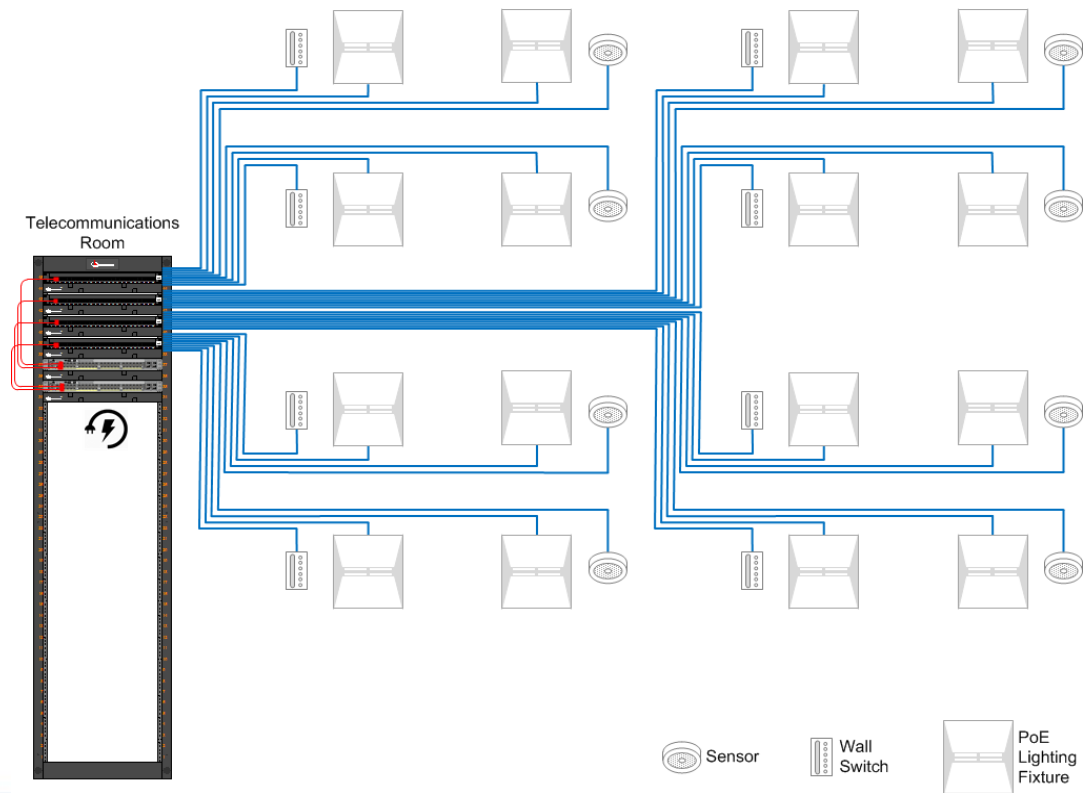
Centralized



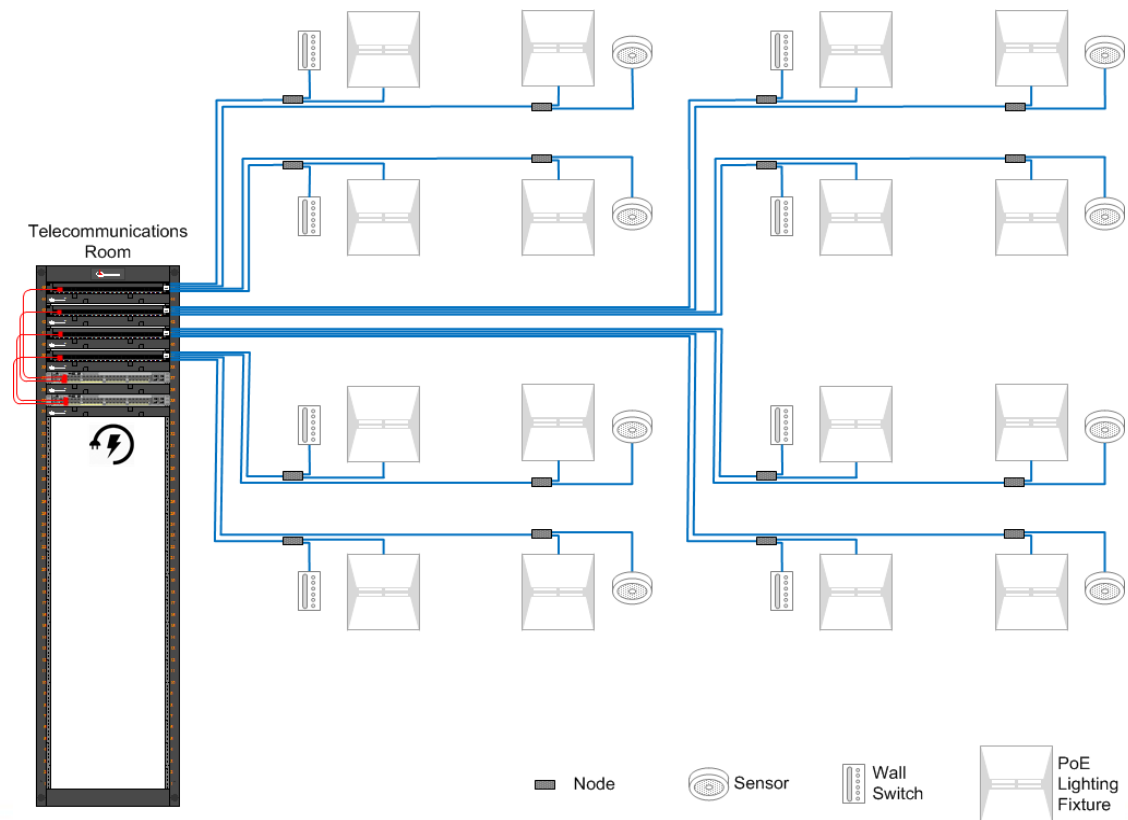
Decentralized



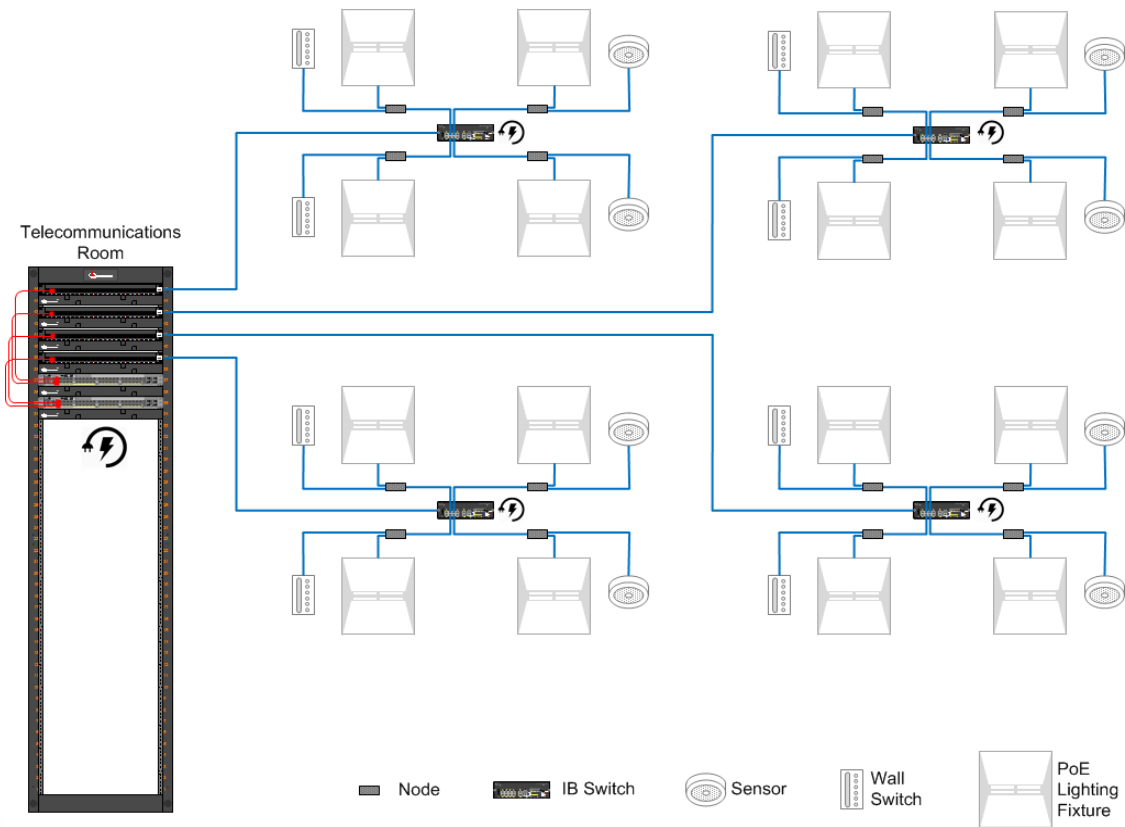
# Centralized – Fixture Centric



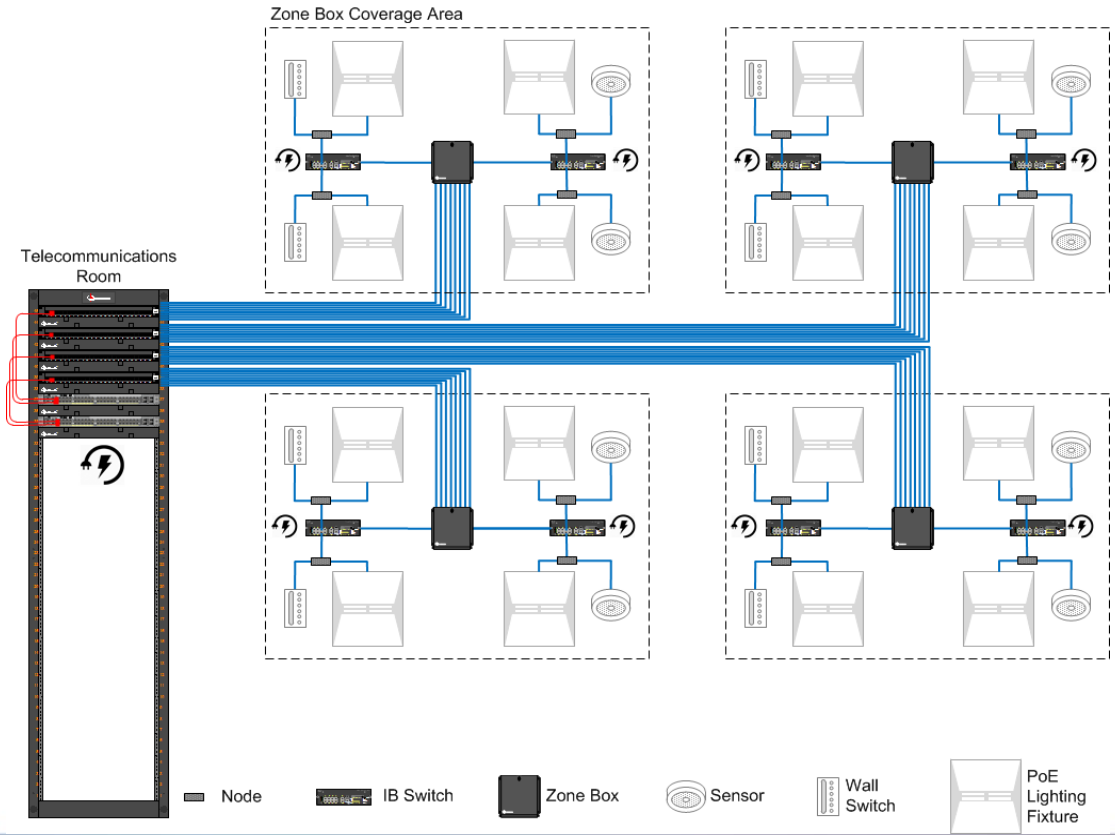
# Centralized – Node Centric



# Decentralized – Node Centric



# Decentralized Zone – Node Centric





- Remote powering places increased demands on network cabling systems
- Zone cabling provides a flexible infrastructure
- Be aware of the various topologies based upon PoE lighting technologies
- Modular plug terminations have a role



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# Thank You



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