PoE Lighting: Unleashing IoT and Opportunity in the ICT Industry

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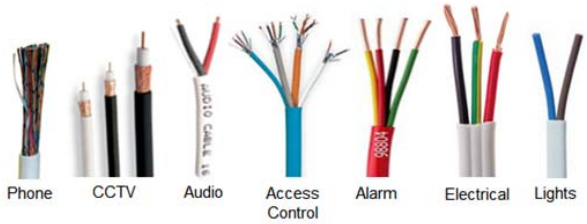
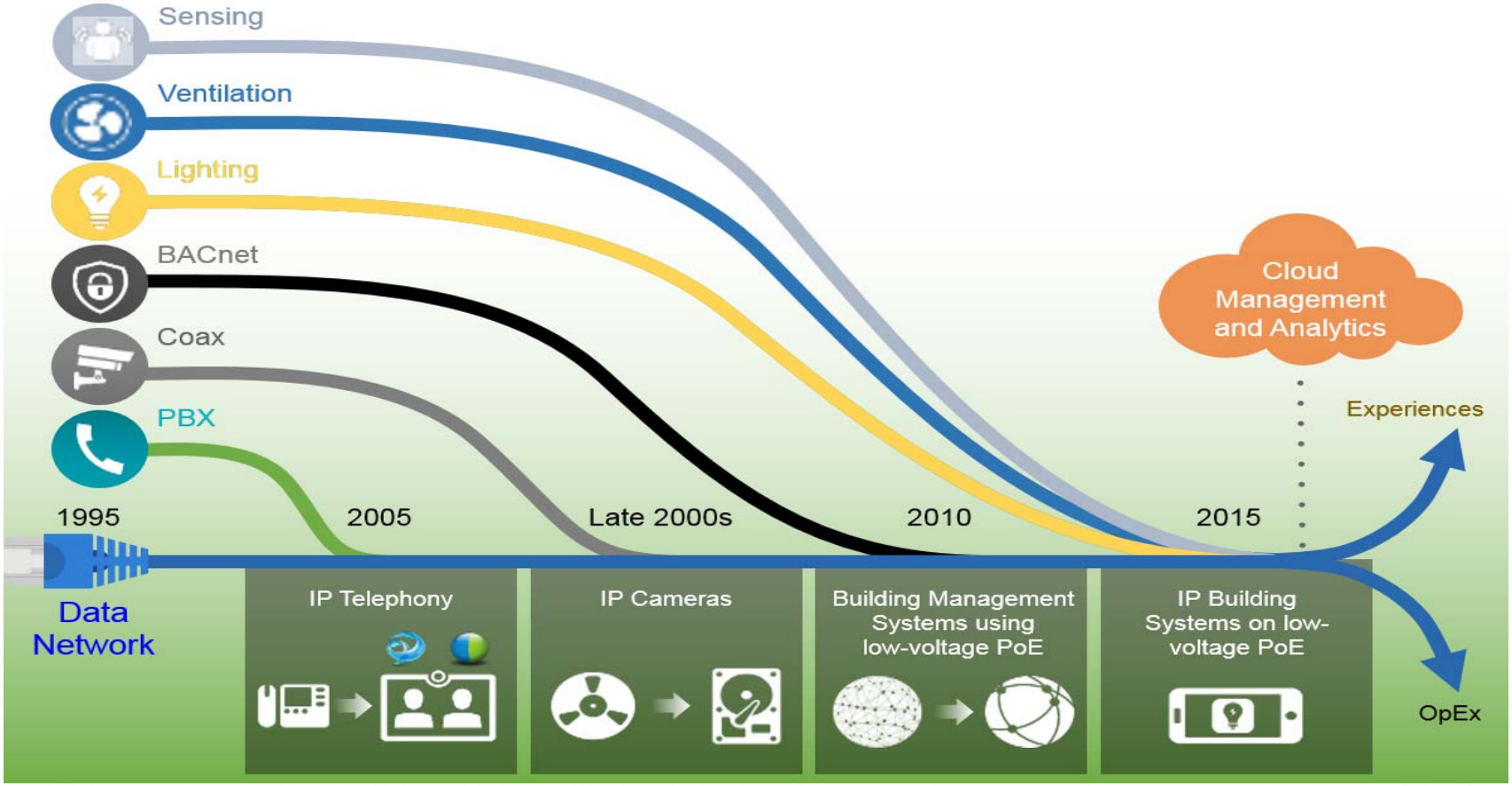
There’s a Revolution Happening in Our Buildings!

- 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



Moving Towards IP Convergence

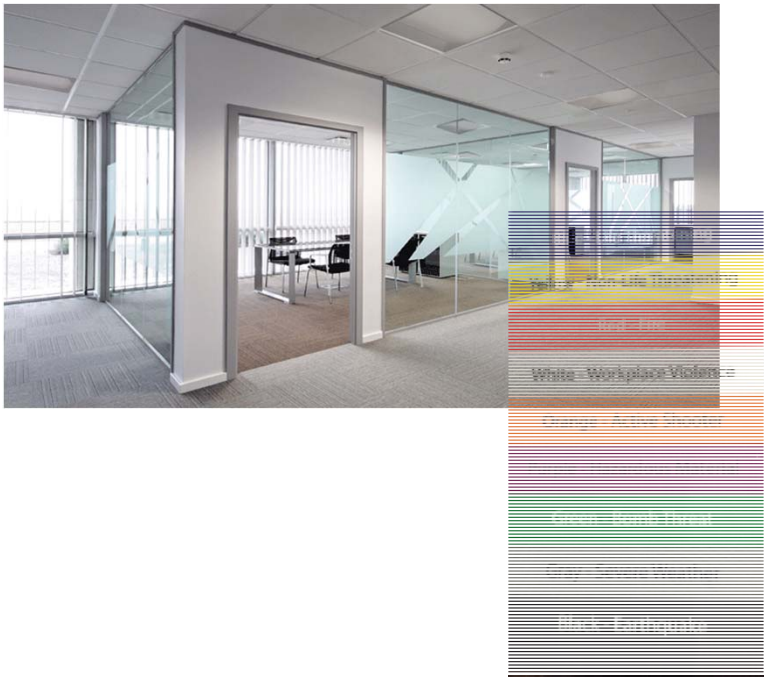


Multiple IP Systems Over a Single Infrastructure

- 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

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



Cost Savings with PoE Lighting

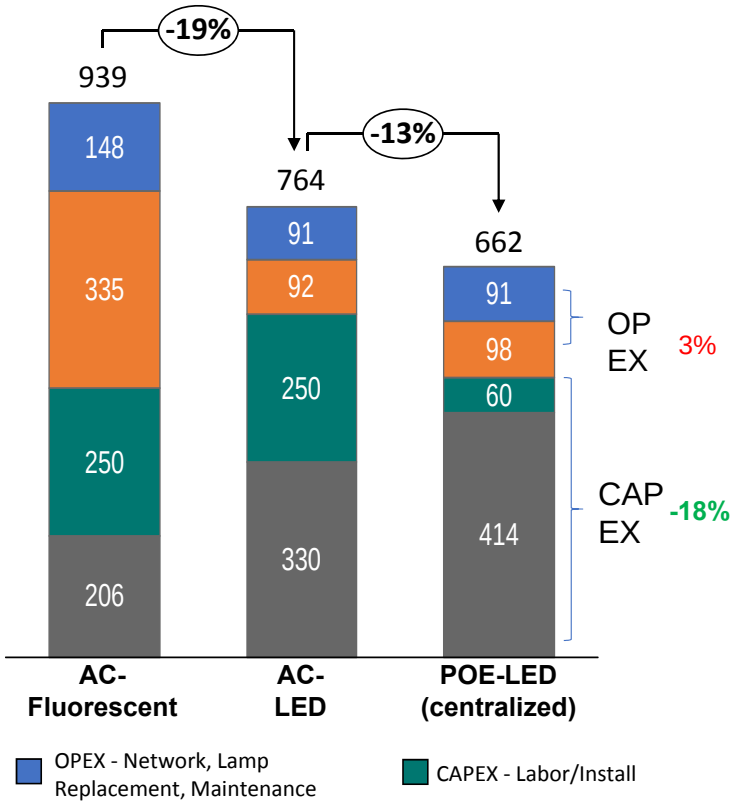
Traditional AC Lighting

- 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

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

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

PoE Lighting

Harry Aller

Innovative Lighting

PoE Lighting

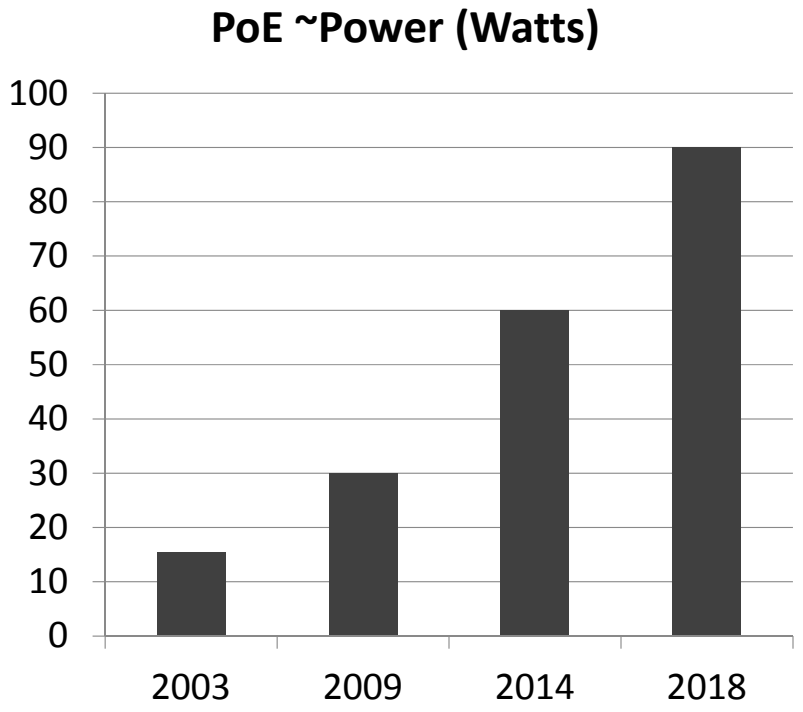
Power over Ethernet lighting uses optimized LED fixtures that are both

Powered & Controlled

via a simple category cable.

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



Node Centric – Max Power!

1:1

Fixture Centric

One to One
More Powered Ports
More Costly

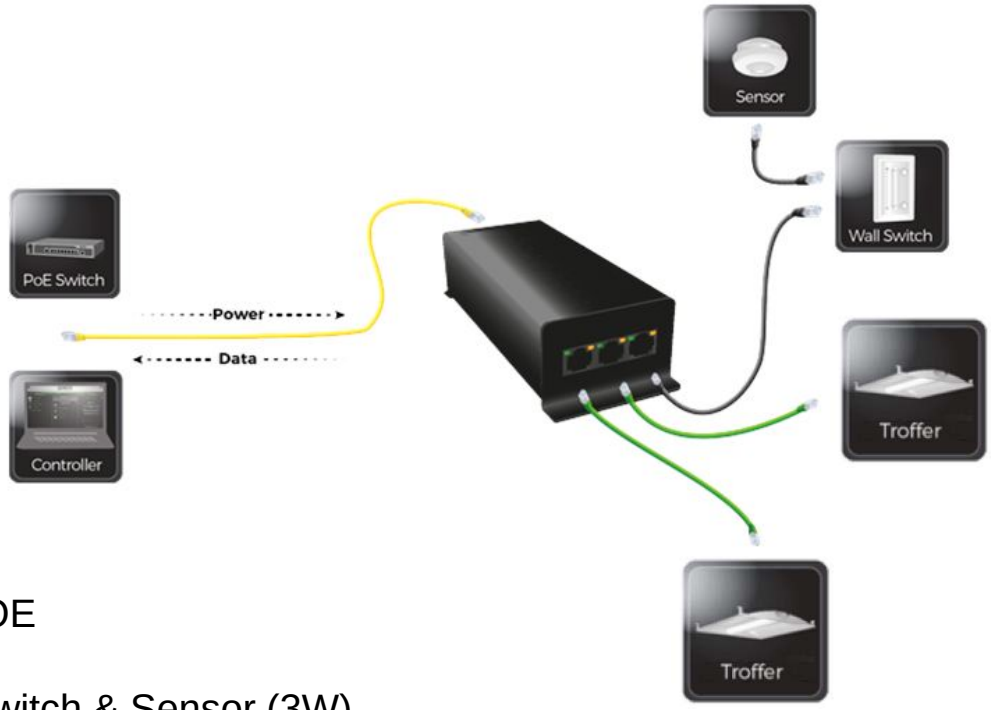
Node Centric

One to Many
Less Powered Ports
Less Expensive

1:N

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

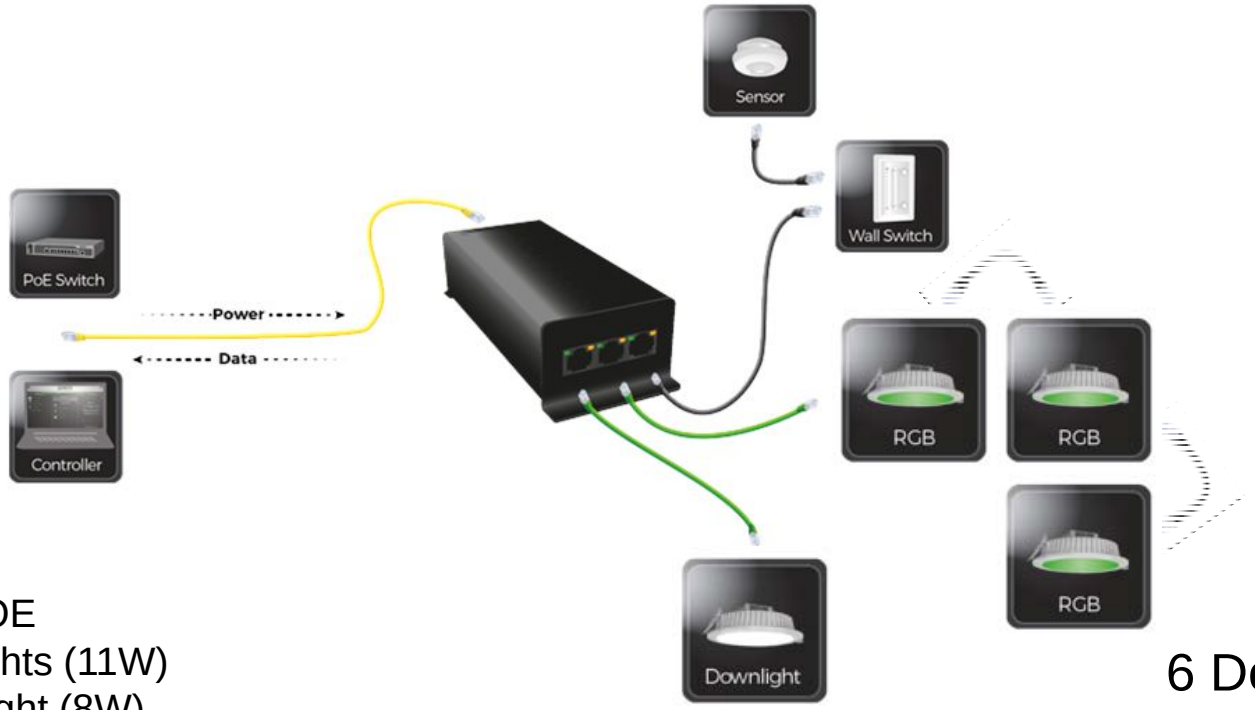
Node Centric



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

4 Devices
49 Watts

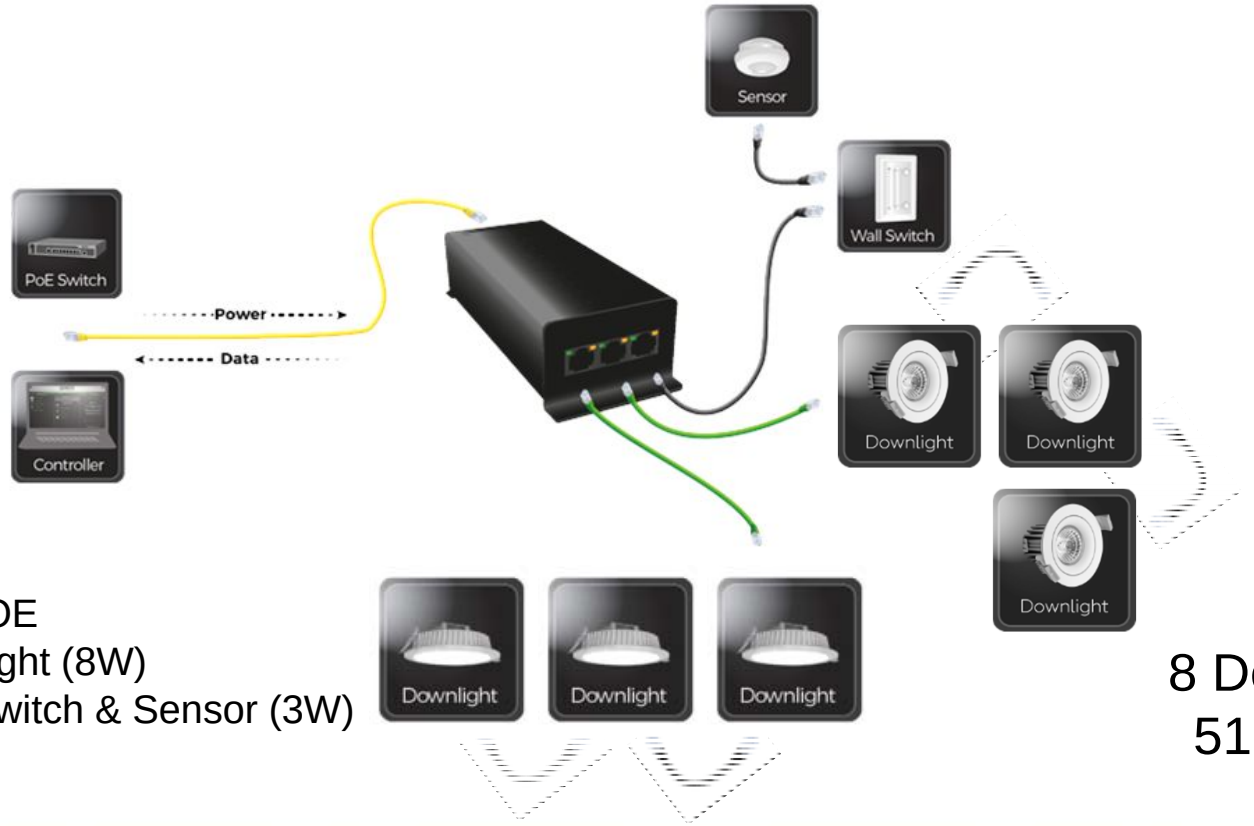
Node Centric



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

6 Devices
44 Watts

Node Centric



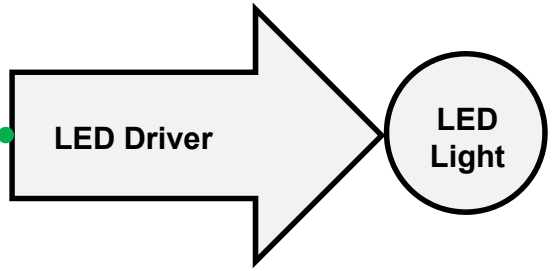
Node Centric : UPOE
- 6x White Downlight (8W)
- 1x Node, Wall Switch & Sensor (3W)

8 Devices
51 Watts

Maturing Systems – Fixtures

Power Over Ethernet (PoE)

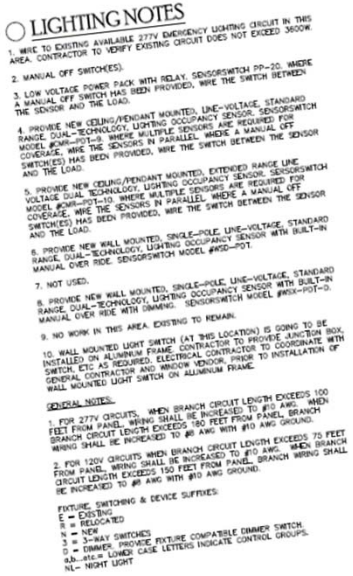
Low-Voltage, Direct Current & Wired (Ethernet)



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

Building Requirements for Buildings

ASHRAE 90.1
IECC 2015
CEC - Title 24


LIGHTING NOTES

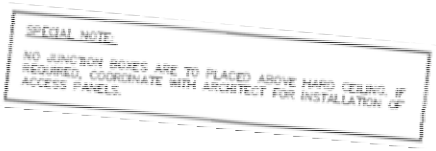
1. WIRE TO EXISTING AVAILABLE 277V EMERGENCY LIGHTING CIRCUIT IN THIS AREA. CONTRACTOR TO VERIFY EXISTING CIRCUIT DOES NOT EXCEED 3600W.
2. MANUAL OFF SWITCH(ES).
3. LOW VOLTAGE POWER PACK WITH RELAY. SENSORSWITCH PP-20. WHERE A MANUAL OFF SWITCH HAS BEEN PROVIDED, WIRE THE SWITCH BETWEEN THE SENSOR AND THE LOAD.
4. PROVIDE NEW CEILING/PENDANT MOUNTED, LINE-VOLTAGE, STANDARD RANGE, DUAL-TECHNOLOGY, LIGHTING OCCUPANCY SENSOR. SENSORSWITCH MODEL #CMR-PDT-9. WHERE MULTIPLE SENSORS ARE REQUIRED FOR COVERAGE, WIRE THE SENSORS IN PARALLEL. WHERE A MANUAL OFF SWITCH(ES) 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 #CMR-PDT-10. WHERE MULTIPLE SENSORS ARE REQUIRED FOR COVERAGE, WIRE THE SENSORS IN PARALLEL. WHERE A MANUAL OFF SWITCH(ES) 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 #WSD-PDT.
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 DIMMING. SENSORSWITCH MODEL #WSX-PDT-D.
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 180 FEET FROM PANEL, BRANCH WIRING SHALL BE INCREASED TO #8 AWG WITH #10 AWG GROUND.
2. FOR 120V CIRCUITS WHEN BRANCH CIRCUIT LENGTH EXCEEDS 75 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 WITH #10 AWG GROUND.

FIXTURE, SWITCHING & DEVICE SUFFIXES:
E = EXISTING
R = RELOCATED
N = NEW
3 = 3-WAY SWITCHES
D = DIMMER. PROVIDE FIXTURE COMPATIBLE DIMMER SWITCH.
a,b...etc.= LOWER CASE LETTERS INDICATE CONTROL GROUPS.
NL= NIGHT LIGHT

Occupancy
Vacancy
Daylight Harvesting
Load Control
On Demand Response


SPECIAL NOTE:

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

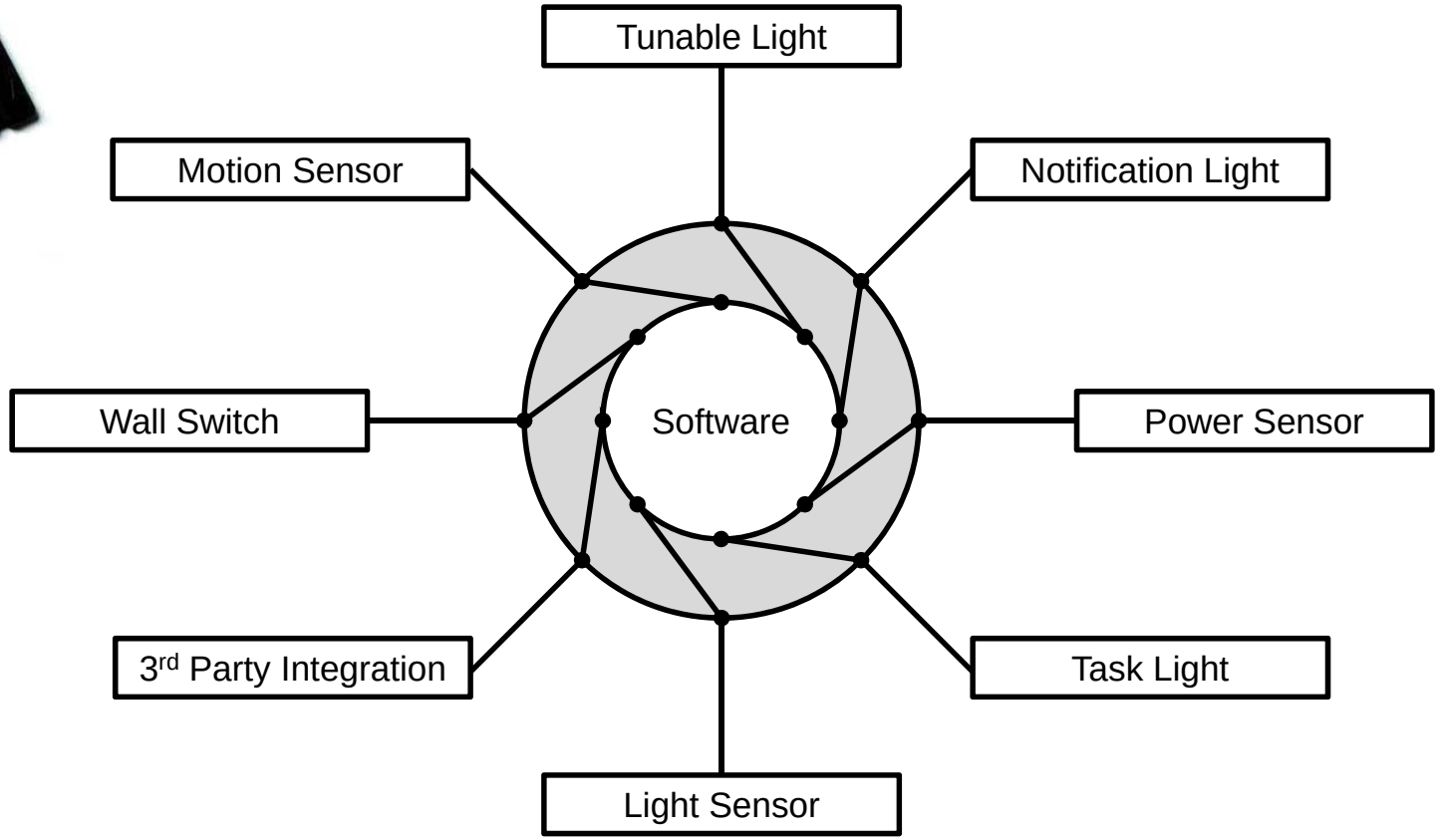

2015 IECC CONTROL REQUIREMENTS:

1. ALL LIGHTING WITHIN OFFICE AND BREAK ROOMS IS TO BE MANUAL ON (VACANCY MODE), AUTOMATIC OFF.
2. DAYLIGHTING 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 ENTIRE LIGHTING CONTROL SYSTEM. ALL COMPONENTS (LOW-VOLTAGE AND LINE VOLTAGE) ARE TO BE PROVIDED FOR A FULLY FUNCTIONALY LIGHTING CONTROL SYSTEM COMPLIANT WITH 2015 IECC REQUIREMENTS.
4. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL OTHER TRADES FOR CONNECTION 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.

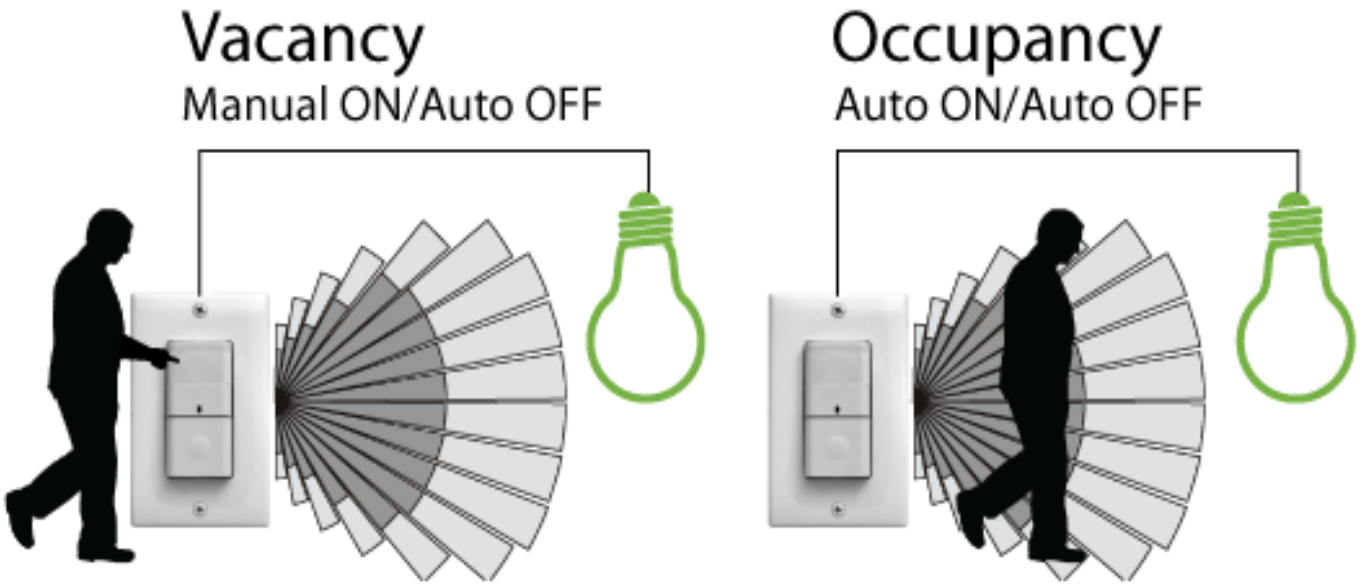
NATIVE!

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

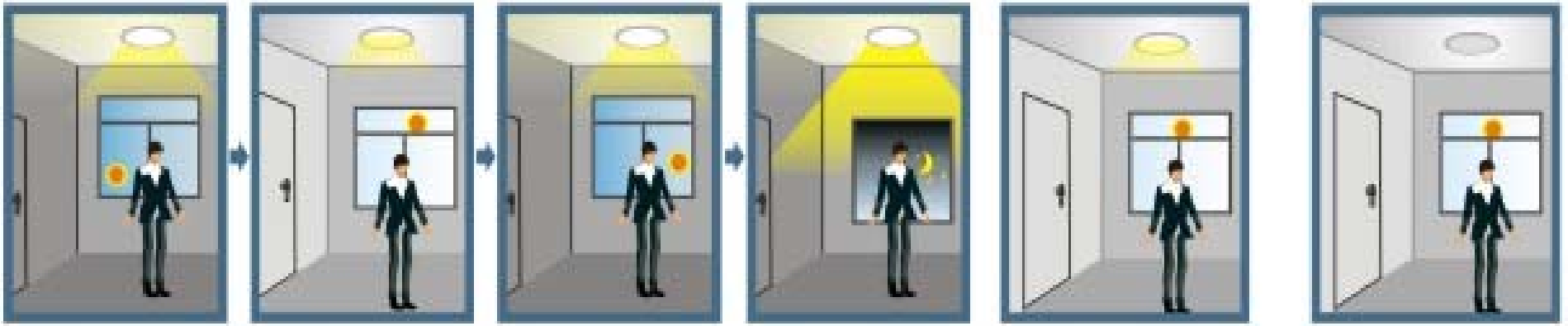
Software Enabled - Features



Auto On, Auto Off



Daylight Harvesting



The lamp lights on 100% illumination or dims to maintain the preset illumination level against ambient light.

The lamp dims to minimum light level but never turn off even if with sufficient ambient light.

Users can switch off the light manually.

Low Trim, High Trim - Layered

No motion detected, the lamp remains at a low light level all the time.

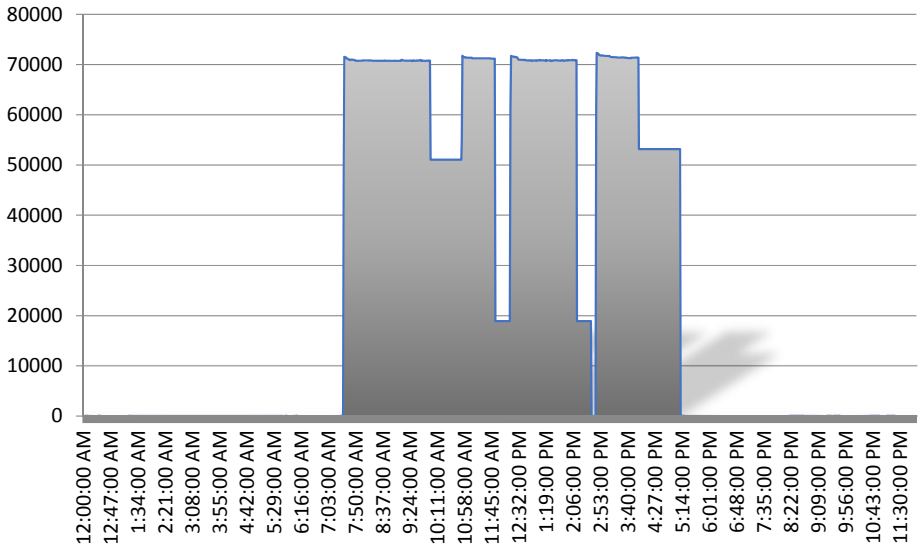
When motion is detected, the sensor brightens the lamp to 100% illumination.

After the hold time, the sensor dims the lamp at the preset low light level if no motion is detected.

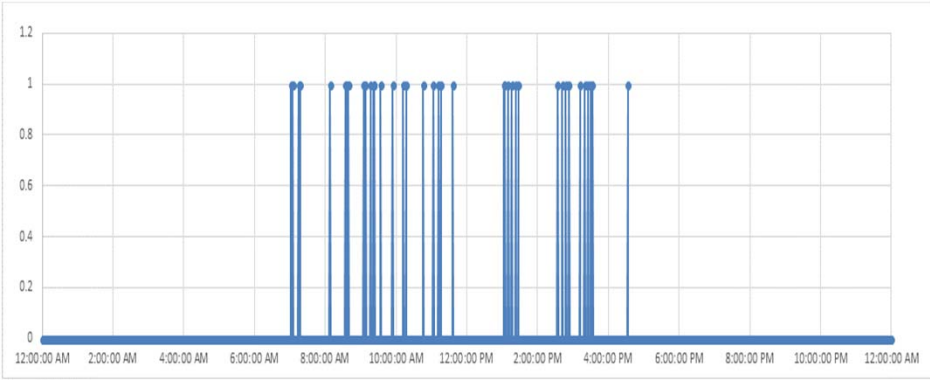
Rhythm

Data - BiDirectional

Office : Tuesday, August 15, 2017
Power Usage (mW)



Front Entry: Thursday, February 21, 2018
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

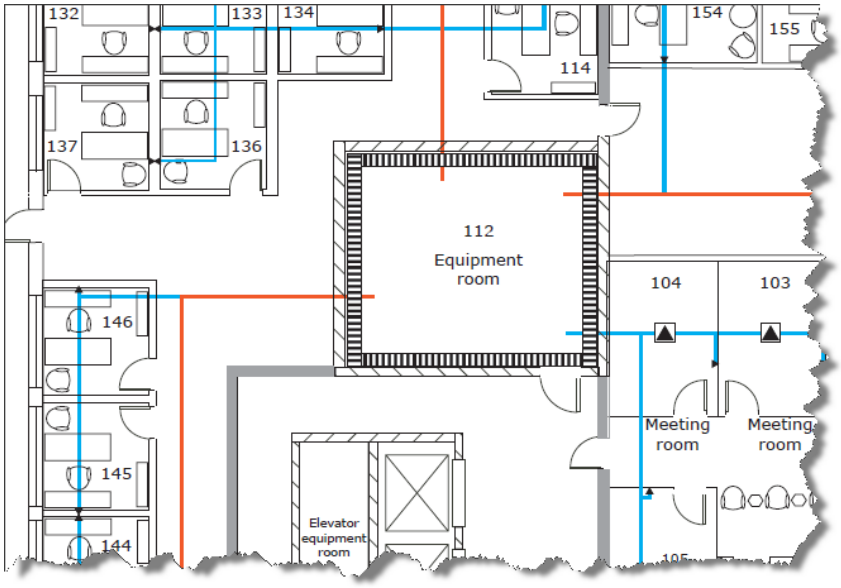
Cabling for PoE Lighting

Dave Valentukonis, RCDD/NTS

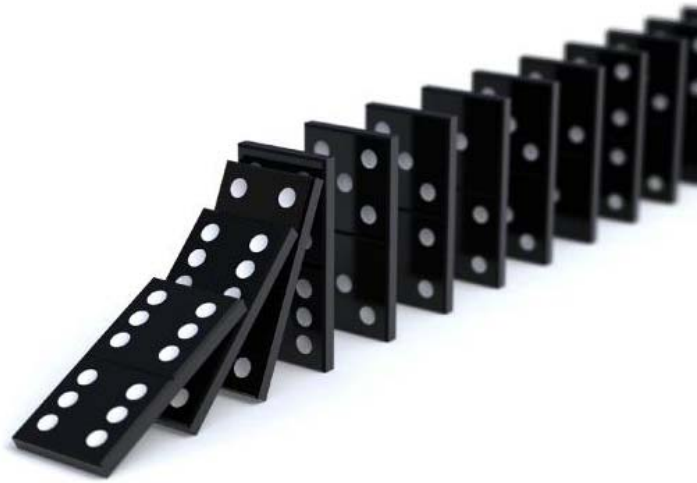
Siemon

Infrastructure Challenges

- Network Design Decisions
  - Centralized vs. Decentralized
  - Zone Cabling Layout vs. Point to Point
- Application Criteria
  - Node vs. Fixture
- Cable Type
  - Distance, Bandwidth, Power
- Power Options & Considerations
- Outlet Configuration
  - Structured Cabling vs. MPTL



Implications of Remote Powering



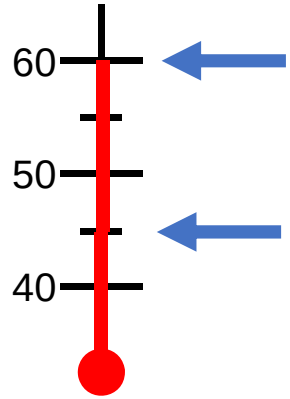
1. **Cable**
   - Heat builds-up within cable bundles
   - Bundle sizes may need to be reduced to improve heat dissipation
   - Overall channel length may need to be reduced to offset increased insertion loss resulting from a higher operating temperature
2. **Connectivity**
   - Contact arcing occurs when un-mating pairs under load and may affect connecting hardware reliability

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*

TIA TSB-184-A-2017

- Category 6A or higher performance 4-pair balanced twisted-pair cabling is recommended for new installations delivering remote power
- Larger conductor sizes and shields reduce DC loop resistance and improve both energy consumption and heat dissipation
- The maximum ambient temperature along the link (length of at least 1m) should be used as the basis for the calculation



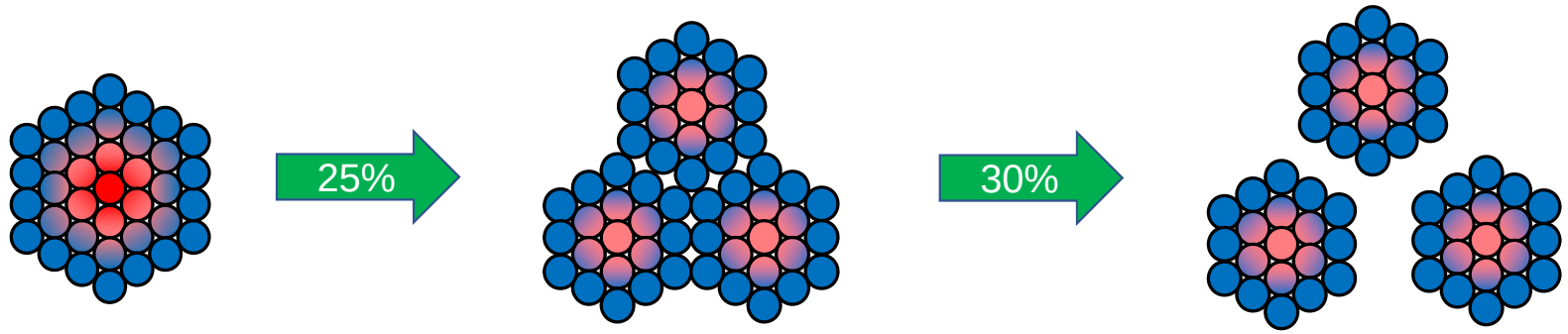
Mitigation Recommendations

- Use Category 6A or higher-performing 4-pair balanced twisted-pair cabling
- Install shielded cables
- Reduce channel length, as necessary, to offset increased insertion loss
- Minimize cable lengths in order to reduce dc loop resistance

AWG	Ohms/100m (solid)
23	7.32
24	9.38
26	14.8

Mitigation Recommendations

- Leave cables unbundled
  - If bundling, smaller bundles are recommended



  - Limit the number of cables per bundle to 24

Mitigation Recommendations

- 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
- Reduce maximum operating temperature
- Mix unpowered cables with powered cables

TIA-569-D-2-2018

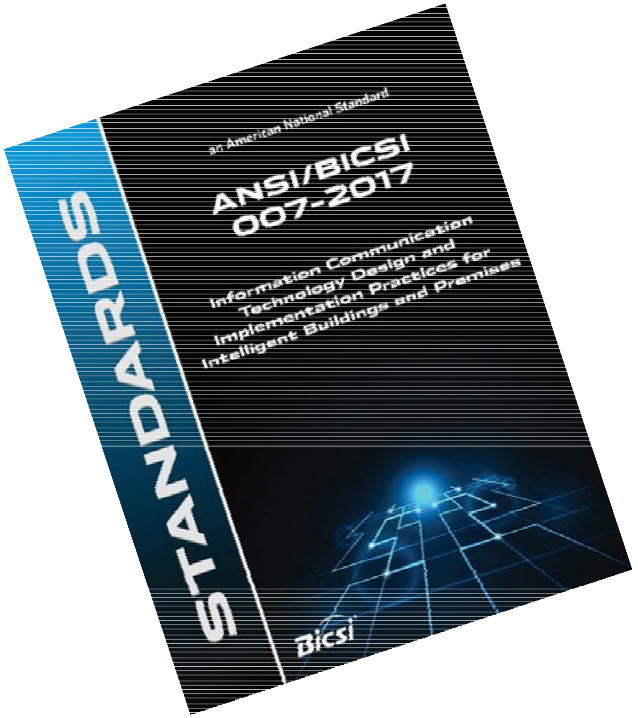
- *Additional Pathway and Space Considerations for Supporting Remote Powering Over Balanced Twisted-Pair Cabling* (July 2018)
- Pathways differ in regard to geometry and contact area between cables, pathway, and air
- Provides general guidance on heat dissipation of various pathways by bundle size

Pathway Type	Cable Routing	Cable Quantity			
		1-37	38-61	62-91	> 91
Non-continuous	Bundled	High	High	High	N/A
	Unbundled	High	High	High	N/A
Conduit (Metallic & Non-metallic)	Bundled	Low	Low	Low	Low
	Unbundled	Medium	Low	Low	Low
Sealed Conduit	Bundled	Low	Low	Low	Low
	Unbundled	Low	Low	Low	Low

Tray Type	Fill Depth (in.)		
	1	2	≥ 3
Wire Mesh/Ladder	High	High	High
Ventilated	High	Medium	Low
Unventilated	Medium	Medium	Low

ANSI/BICSI 007-2017

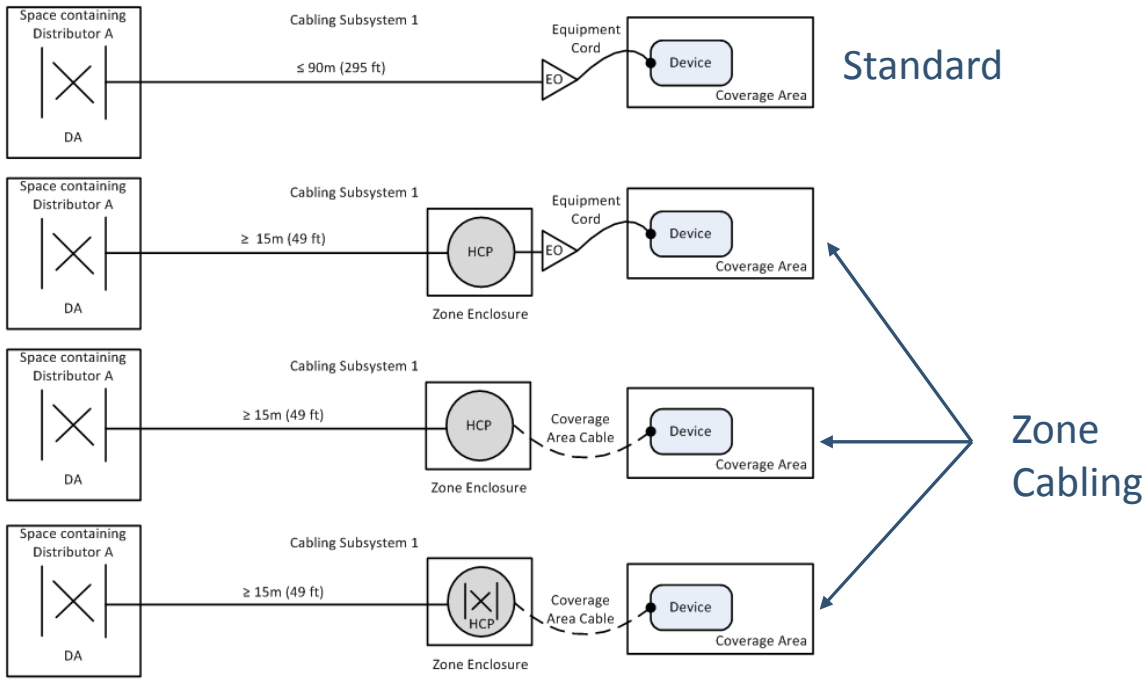
- *Technology Design and Implementation Practices for Intelligent Buildings and Premises*
- Communications Infrastructure & Network Integration
- Design Considerations (Power, Data, Zone Cabling)
- Building Systems (Lighting, Digital Signage, Vertical Transportation, Sound Systems, ESS, etc.)
- Building Monitoring Systems
- Commissioning



ANSI/TIA-862-B-2016

- *Structured Cabling Infrastructure Standard for Intelligent Building Systems*
  - Formerly known as Building Automation Systems
- General substitution of the term “intelligent building system” for the previous term “building automation system”
- Addition of guidance for cabling for:
  - Wireless systems
  - Remote powering over balanced twisted-pair cabling
  - Smart lighting

ANSI/TIA-862-B-2016 Topology Options



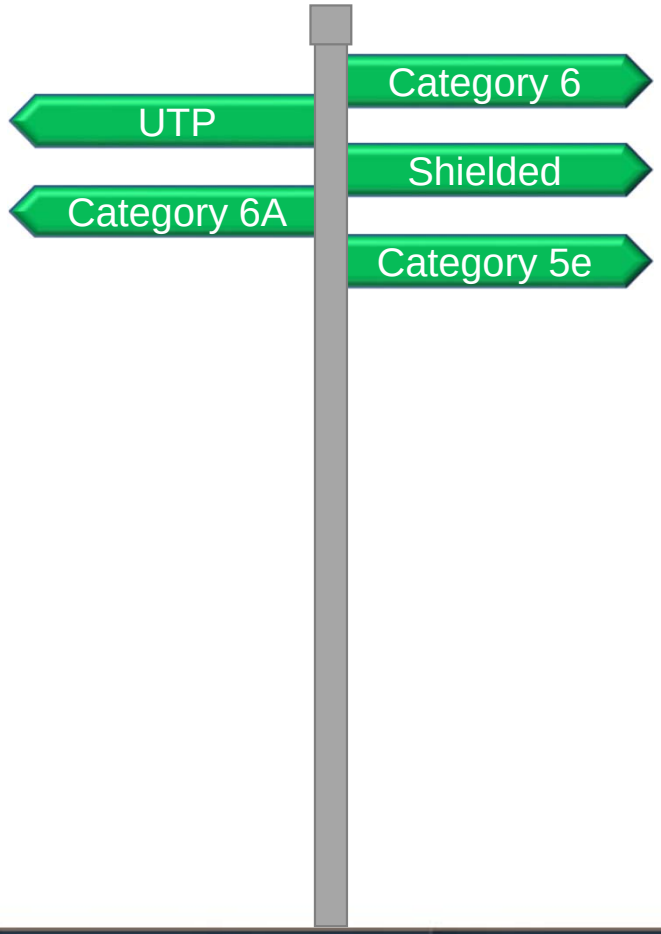
Terminology

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-568-0.D	Telecommunications Outlet (TO)[1]
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 (EO)[2]

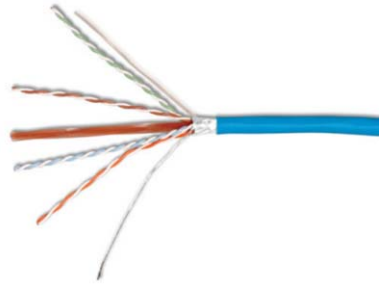
[1] *A TO must always be present even if a CP is present*
[2] *An EO is optional if an HCP is present*

Media Selection

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



Benefits of Shielded Cabling



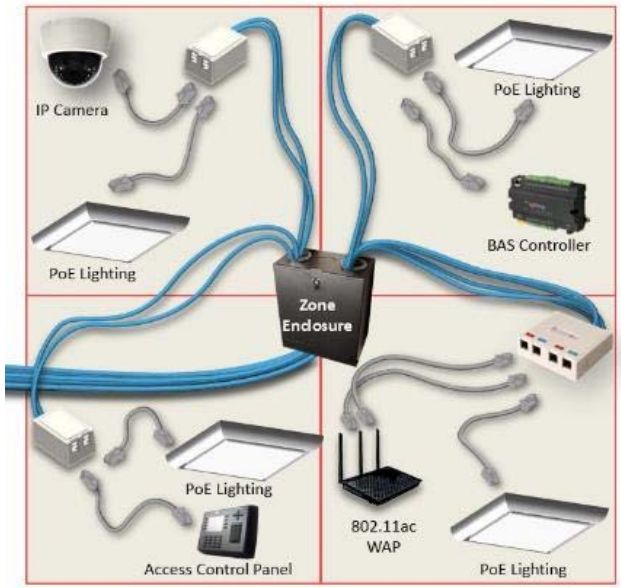
- Typically qualified for higher temperature (75°C) operation
- Reduced length de-rating
- Superior heat dissipation supporting larger bundle sizes

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

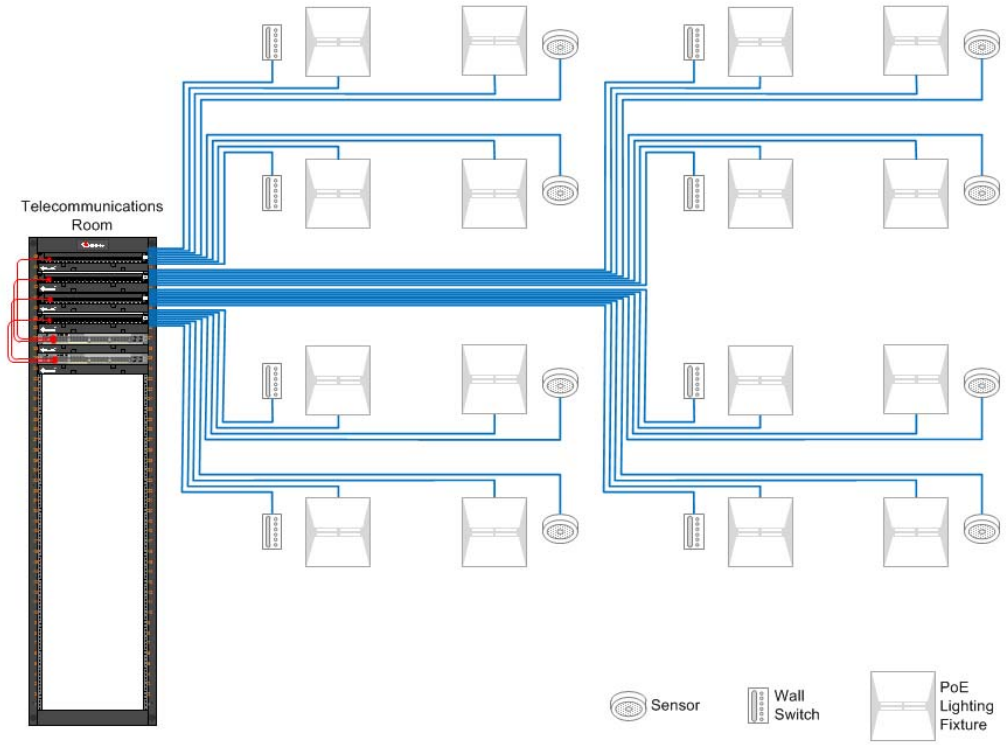
Zone Cabling Methodology

- Zone cabling is a standards-based approach to support convergence of devices
- Consists of cables run from connections in the telecommunications room (TR) to outlets housed in a zone enclosure servicing coverage areas
- Shorter cables run from outlets in the zone enclosure directly to devices or to outlets servicing devices

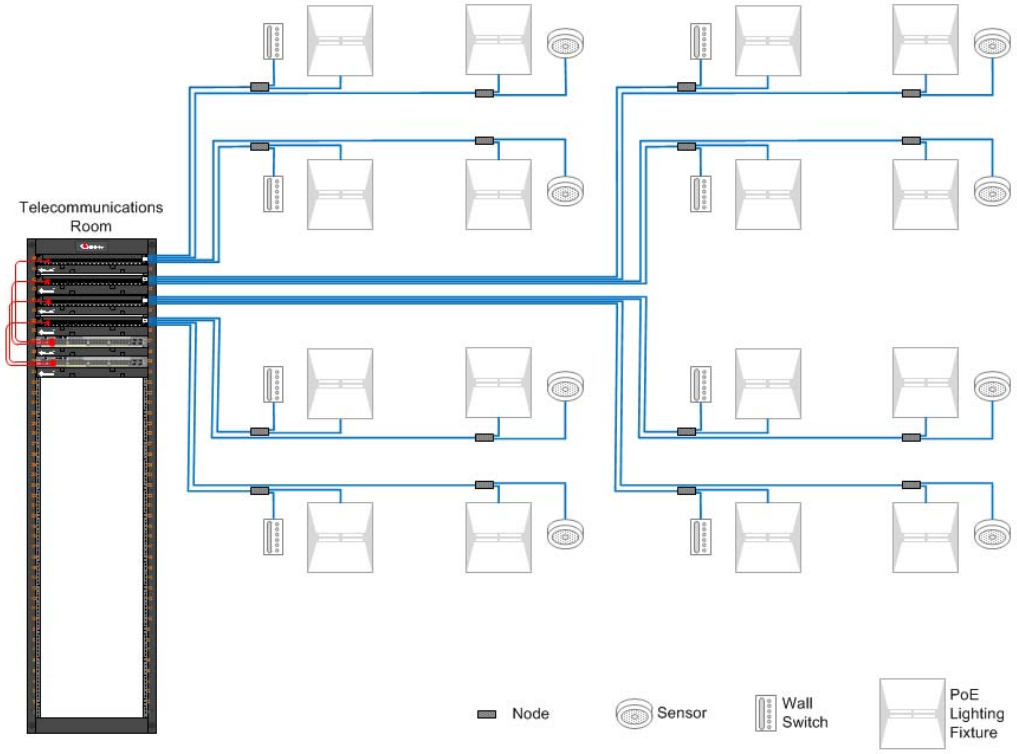


- Creates a flexible, “futureproof” infrastructure for voice, data, building devices, and wireless access points
- Supports rapid reorganization and deployment of new devices and applications
- MAC work costs less, is faster and less disruptive
- Improved pathway utilization

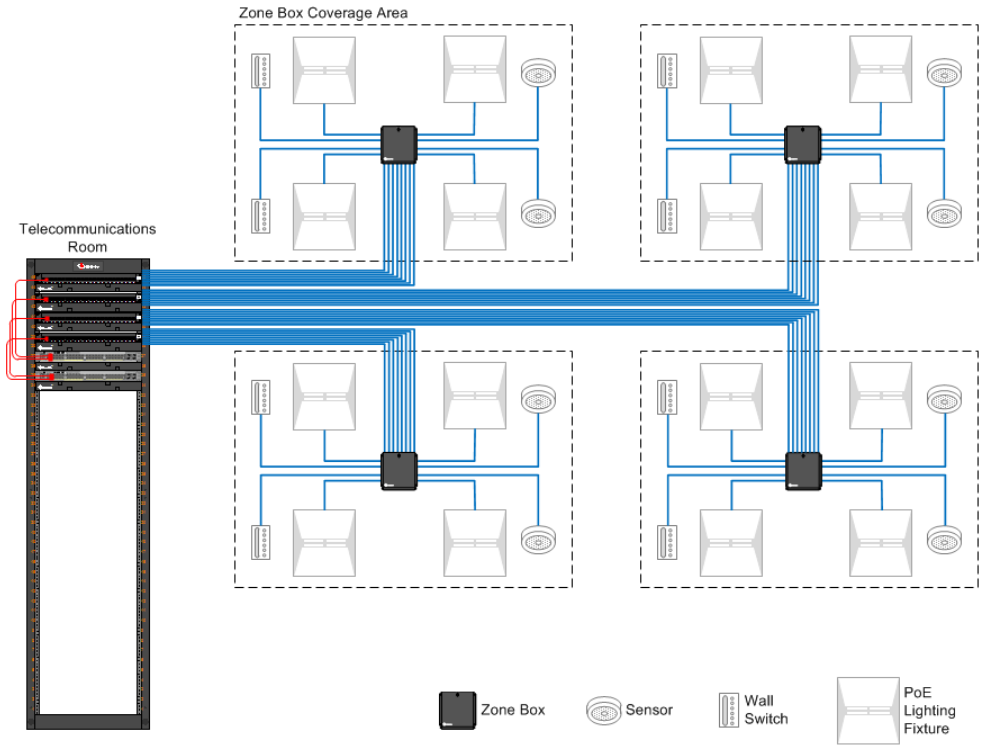
Centralized – Fixture Centric



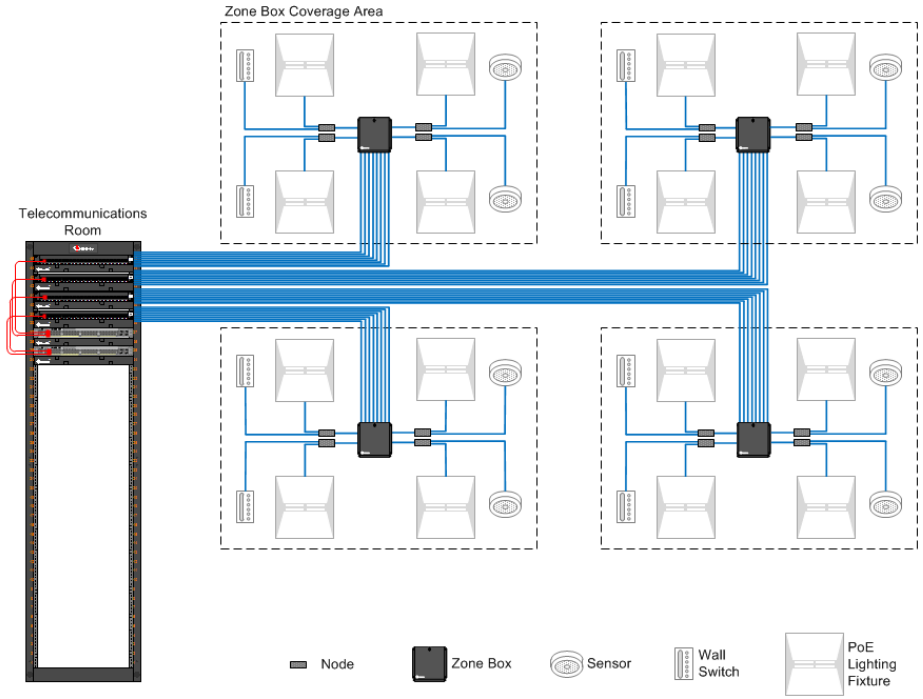
Centralized – Node Centric



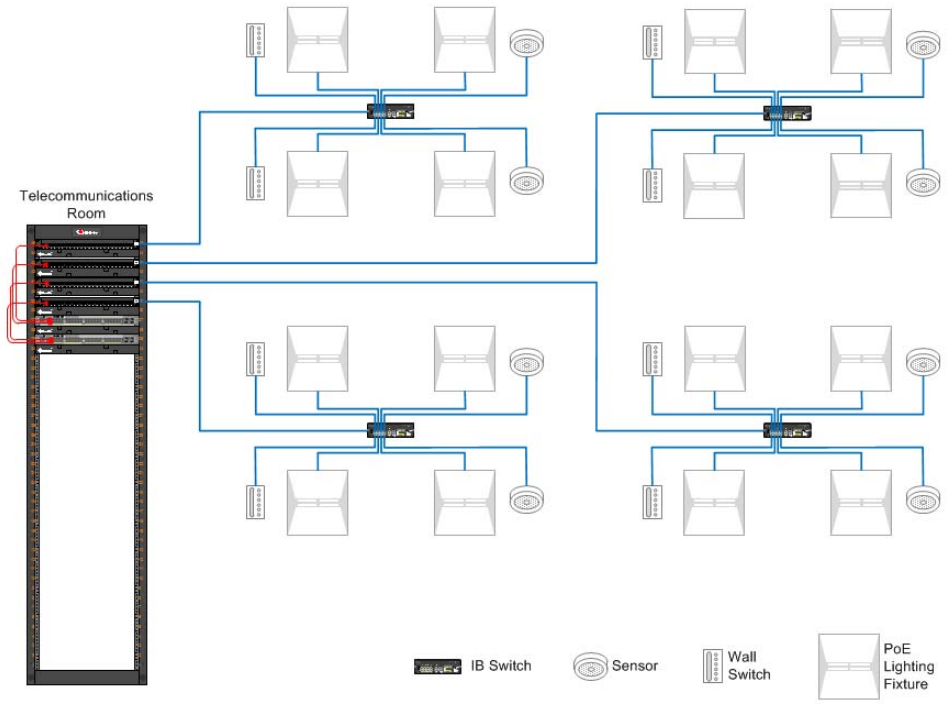
Centralized Zone - Fixture Centric



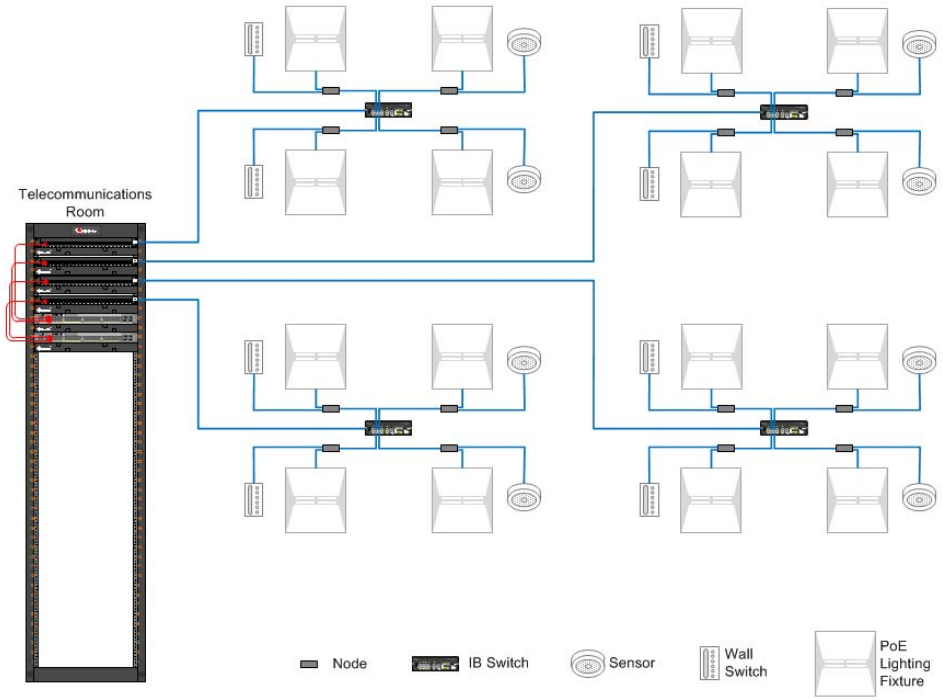
Centralized Zone – Node Centric



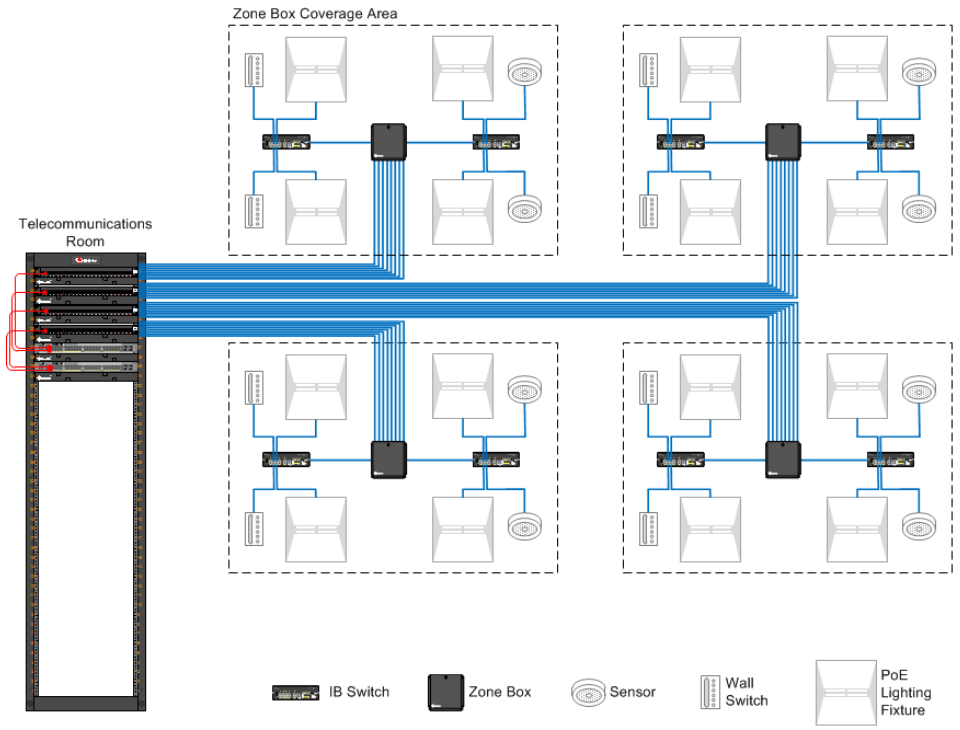
De-centralized – Fixture Centric



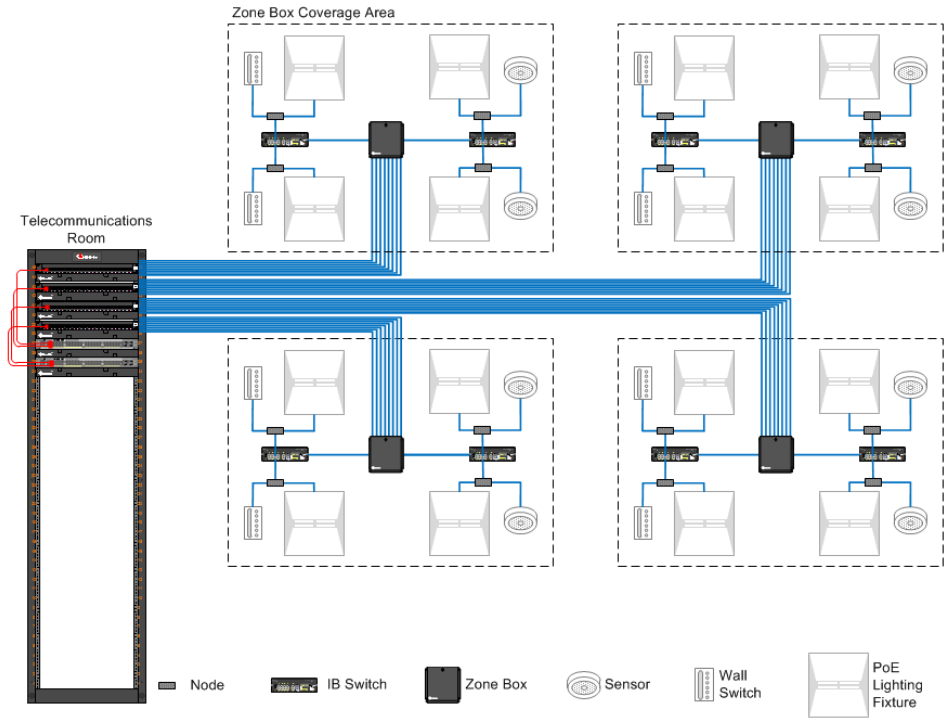
De-centralized – Node Centric



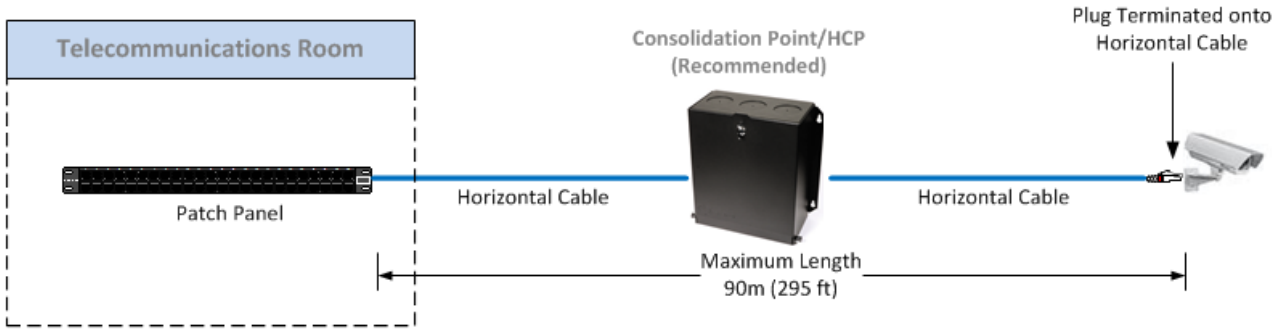
Decentralized Zone – Fixture Centric



Decentralized Zone – Node Centric



Modular Plug Terminated Link (MPTL)



- The MPTL is constructed by direct field termination of horizontal cabling at the device end with a modular plug - replacing the TO/SO and associated Work Area (WA) cord.
- 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 or required to be directly connected by the AHJ

What are the 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

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.

- 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

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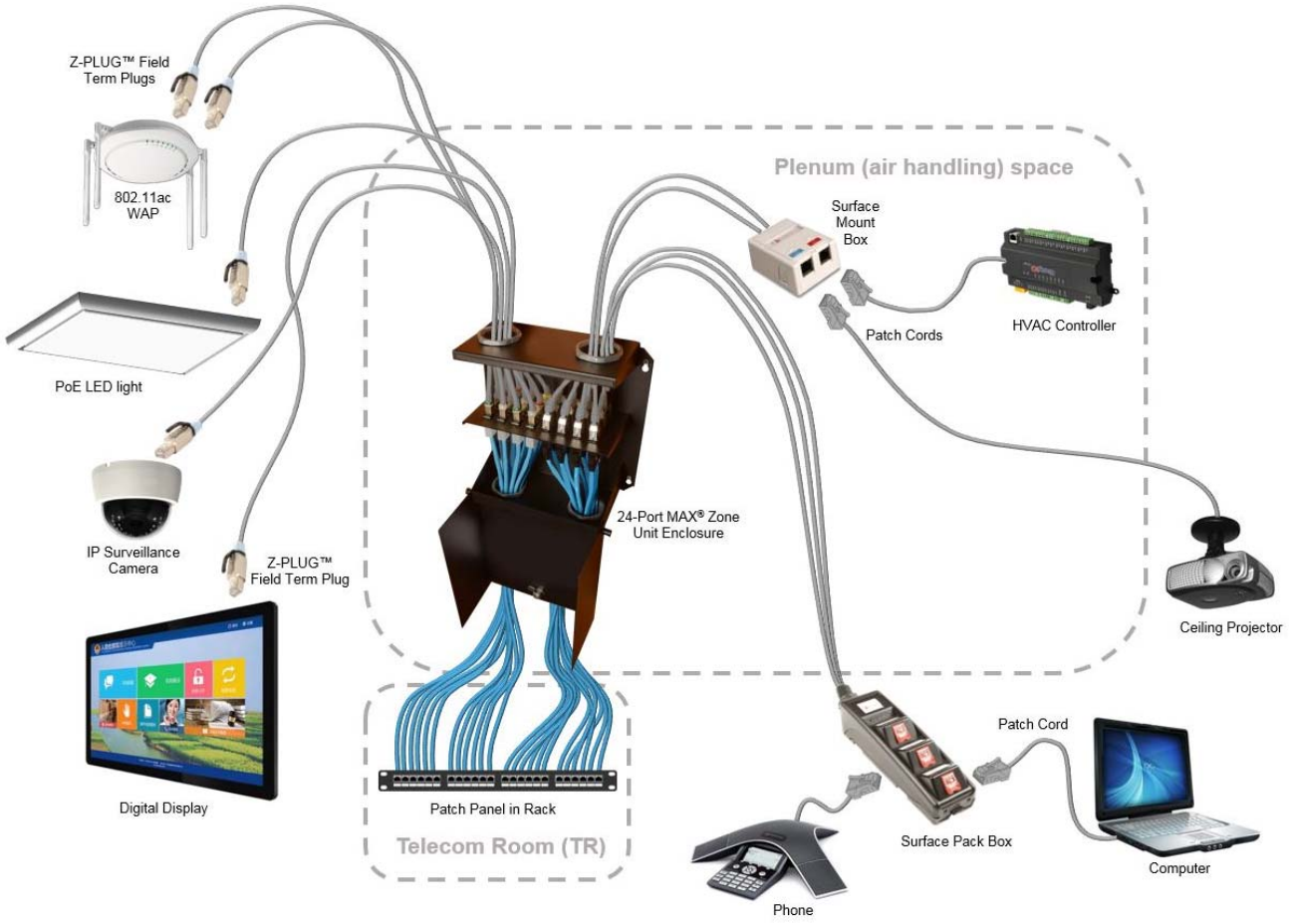

Summary

- 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

Thank You

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