Designers Lighting Forum

Wireless, POE, or… BOTH?

Carol Jones, Axis Lighting

Dwight Stewart, Igor

John Romano, Enlighted

18 August 2020

Carol Jones
VP Integrated Systems Development, Axis Lighting

Carol Jones is the VP of Integrated Systems Development at Axis Lighting. Her role is to proactively engage with multiple lighting control and sensor manufacturers to support thoughtful and functional integration with luminaires and applications. She is especially committed to supporting quality lighting along with high value IoT apps that benefit customers and occupants in commercial environments. One of her highest values and goals is simplicity and ease of use, and she leverages change in many directions to that end. She has been a leader in the transformation of the lighting industry with experience in lighting design, emerging technologies, human factors research, best practices, energy efficiency, customer insights, system innovation, and most recently, the Internet of Things. Carol has long been at the forefront of bringing higher value intelligent lighting into reality, and is enthusiastic about how it will change our world for the better. Prior to joining Axis, she worked at Enlighted, Philips Lighting, Pacific Northwest National Laboratory, and HLB Lighting Design. Carol has 30+ years of experience in lighting and has been committed to the progress and development of the industry through intensive professional association work as well as conference presentations and publications.

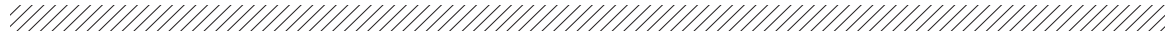**LEDucation**

Dwight Stewart
Founder, CTO, Igor

With 15 years of tech entrepreneurship, Dwight Stewart has a strong reputation as a successful entrepreneur, innovative technologist, and high-growth operator. Dwight consistently conceives transformative ideas and strategies; and makes them reality through constructing exceptional cultures and teams. He has founded two transformative companies: QAS, a building analytics leader, and Igor, a smart building IoT platform Cisco has labeled a "disruptor". Dwight's recognitions include: Clean Energy Challenge winner, Clean Tech Open winner, Midwest Energy 40 Under 40, and Commendation for U.S. Capitol Complex.

John Romano
VP of Channel and Product Sales, Enlighted

John Romano is a lighting and controls professional with 25+ years in the lighting, controls, and energy conservation field. He has been at Enlighted for 4+ years. Prior to Enlighted John spent five years in NYC specification market with Philips Lighting and Continental Lighting Sales (now part of Stan Deutsch Associates). He also has15+ years in the Energy Conservation industry as an owner of a design and implementation firm catering to needs of large ESCO's. John has an engineering and math kind of mind, capable of understanding all kinds of systems and architectures, but has the unusual talent of translating complex concepts to new audiences in ways that are easy to absorb.
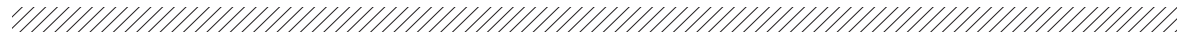
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Description

Connected Lighting technology options thus far have been a patchwork of "either/or's," with little overlap or interoperability. This session will objectively cover the pros and cons of both POE and wireless solutions. We will provide a framework for actionable decisions about how to achieve the true spectrum of lighting design, configuration, and IoT project goals, for multiple stakeholders. The near-term future for hybrid systems and interoperability will be covered, offering hope for specifiers and clients who want the best of both options and future proof solutions that aren't restricted by specific brands.
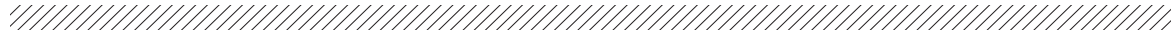
Learning Objectives

At the end of this course, participants will be able to:

1. Characterize benefits, features, risks, commonalities and differences between multiple types of POE and wireless connected and IoT capable systems.

2. Show how Control Narrative language along with owner's project requirements (OPR's) can guide decisions towards or away from POE and/or wireless systems.

3. Provide current information about hardware components, standards and protocols, along with software and platform evolution supporting hybrid systems and interoperability.

4. Provide a practical overview of the impact of connected systems and increasingly specific client and owner preferences on specifier roles and responsibilities.

Connected Lighting

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Liaison to Lingo, with examples

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API	DISTRIBUTED SYSTEMS	EDGE COMPUTING	GEOLOCATION

API

Application Program Interface: a set of routines, protocols, and tools for building software applications. Specifies how software components should interact, used when programming graphical user interface (GUI). Exports data, machine to machine interface.

DISTRIBUTED SYSTEMS

Computer networking scheme in which several inter-connected systems service their local needs and use their idle or spare capacity to attend to common workload. Workload is shared amongst many, no one computer is doing it all.

EDGE COMPUTING

Computing at the network edge, closer to or locally on IoT devices. Data can in many cases be processed more efficiently than if it needed to be sent to the cloud for processing. This can reduce increasingly massive amounts of data going between the cloud and IoT devices. Processing at the endpoint device.

GEOLOCATION

Geolocation is a term used to describe the capability to detect and record device locations, and often thereby people locations, and to use the information to enhance the desktop using an Internet-connected computer or device. Digitally placing sensors onto software maps to enable indoor location-based applications.

Definitions from: www.webopedia.com, www.wikipedia.com, www.businessdictionary.com

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Platform Components

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POE System 1	POE System 2	POE System 3
Separate gateway and driver.	**Combined** and **integral** gateway and driver	**Combined** and **remote** gateway and driver

FIXTURE LEVEL

Gateway

2"
1"
3- 29/32"

Driver

1- 21/32"
25/32"
3- 11/16"

PoE Node

1- 3/16"
14"
27/32"

Multi-Node

4- 1/2"
1- 1/2"
6- 1/2"

IT ROOM
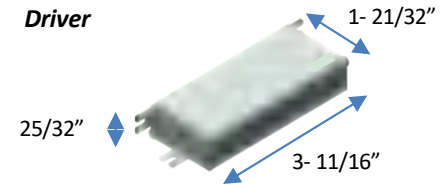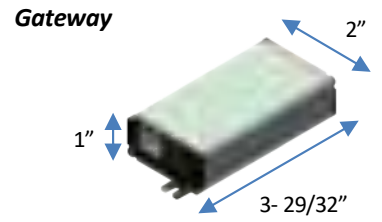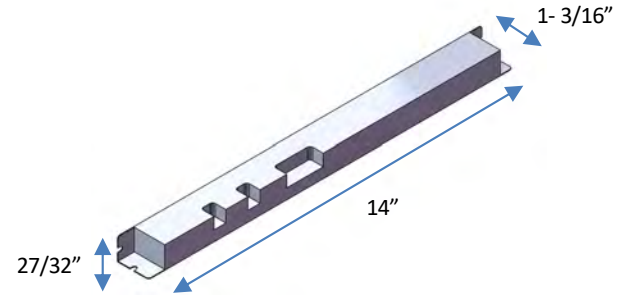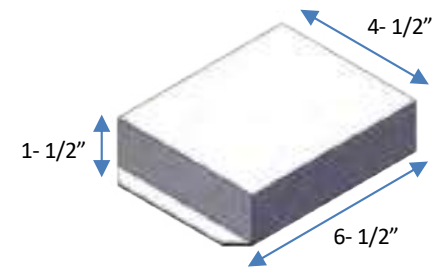
Dedicated Server	Dedicated Server and/or Area Controller	Dedicated Server

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Gateway 1

Gateway 2

Pendant Linear
Integral Driver

Sensor ~3w
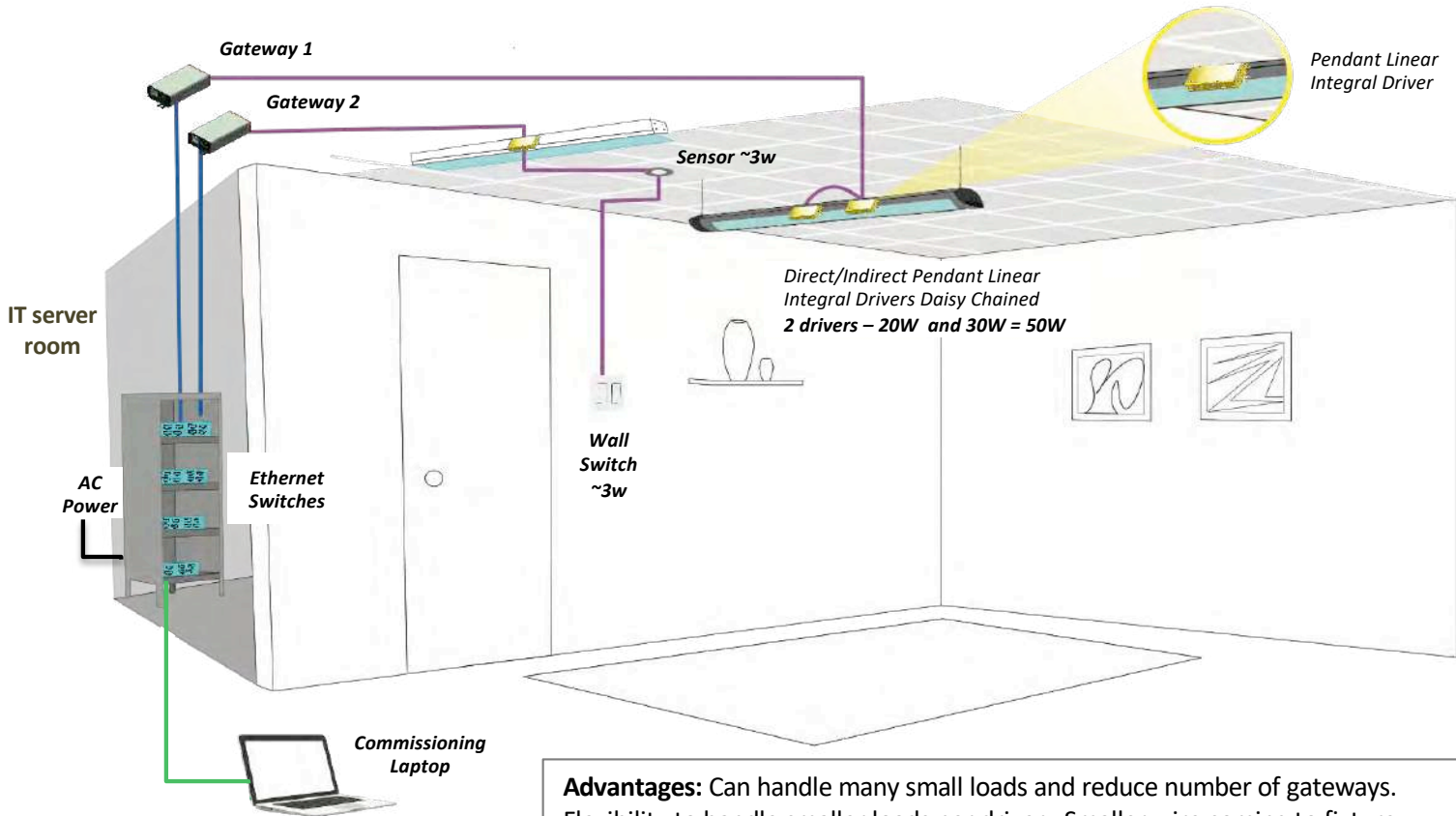
Separate gateway and driver.

Driver can be integrated into fixture.

Can daisy chain up to 8 drivers on a single gateway (*50W Switch Port limit must be respected, including peripheral devices).

Gateway is shipped separately to site and installed remotely.

Cable management is key, home runs from gateway to switch.

IT server room

Direct/Indirect Pendant Linear
Integral Drivers Daisy Chained
2 drivers – 20W and 30W = 50W

AC Power

Ethernet Switches

Wall Switch ~3w

Commissioning Laptop

Wiring legend

LAN/LAN
Power over Universal
RJ45 wire
Low voltage wire

Advantages: Can handle many small loads and reduce number of gateways. Flexibility to handle smaller loads per driver. Smaller wire coming to fixture.
Disadvantages: Separate gateway and driver components require more coordination in the field and architectural location of external devices.

*Note: Components are not to scale.

POE Technology: System 2

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Remote PoE Node Box, mounted above ceiling tile or in nearby IT/electrical closet

Pendant Linear Integral Node

Recessed Linear Integral Node
1 driver – 40W

Sensor ~3w

Pendant Linear Integral Nodes – Daisy Chained
2 drivers – 20W each

IT server room

AC Power

Ethernet Switches

Wall Switch ~3w

Commissioning Laptop or Security and Provisioning Server

*Note: Components are not to scale.

Combined gateway and driver called PoE node.

Form factor allowing for convenient **integration in fixture**.
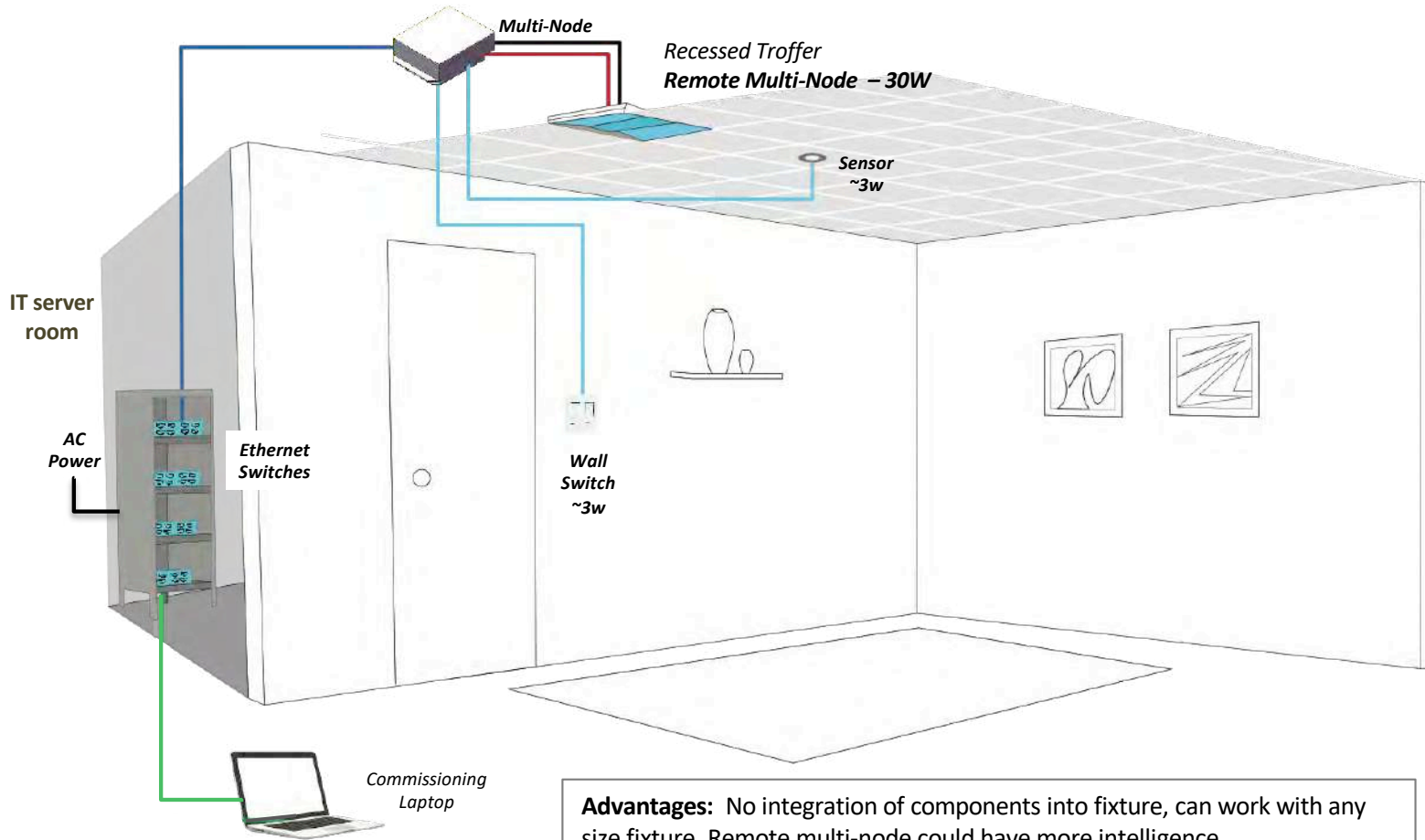
In Pendant applications, PoE node can be remote to provide aesthetic wiring to the fixture (replacing the thicker RJ45 cable).

Cable management is key, home runs from node to switch.

Can daisy-chain up to 5 nodes on a single port (*50W limit per PoE Switch Port including peripheral devices must be respected).

Advantages: Integrated components means less wiring inside fixture and less complexity. Good recessed solution. Less need for coordination and architectural locations of components.
Disadvantages: Slightly larger cable coming out of fixture for pendants.

POE Technology: System 3

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Multi-Node

Recessed Troffer
Remote Multi-Node – 30W

Sensor
~3w

IT server room

AC Power

Ethernet Switches

Wall Switch ~3w

PoE Multi-Node combines gateway and driver.

Larger form factor requires that multi-node be remote.

*50W per PoE Switch Port.

Commissioning Laptop

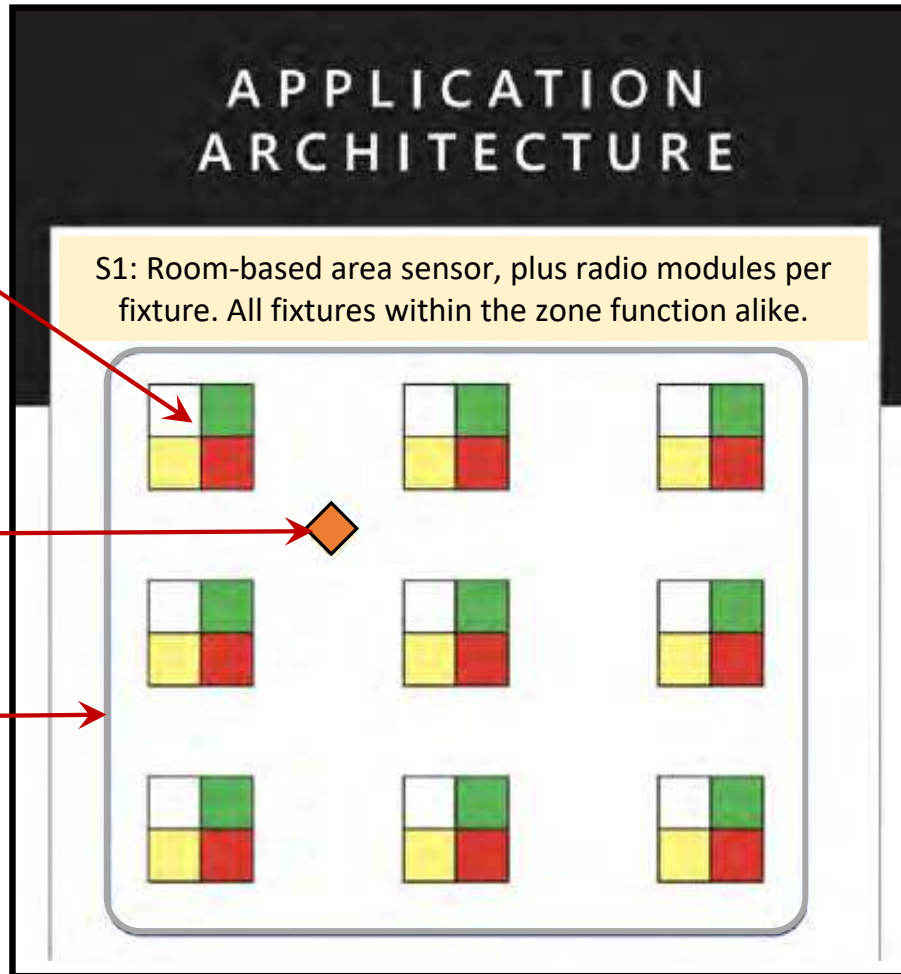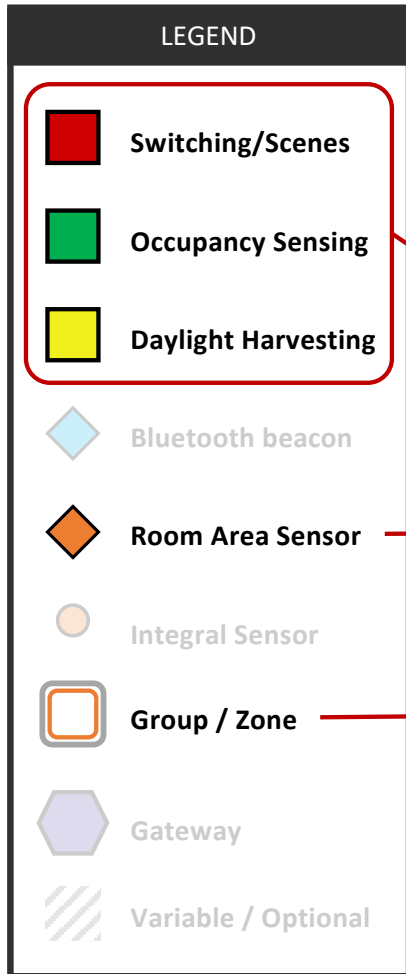**Advantages:** No integration of components into fixture, can work with any size fixture. Remote multi-node could have more intelligence.
Disadvantages: Remote requires extensive coordination and labeling. Challenge to align the required current with installation location.
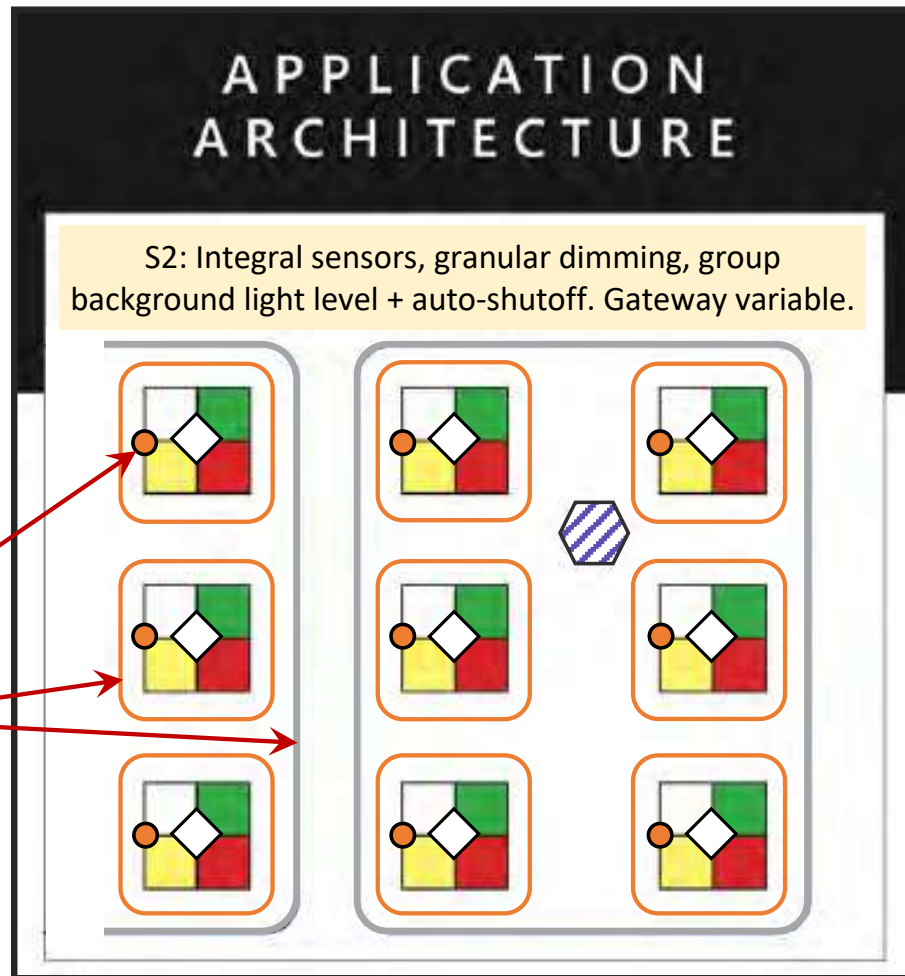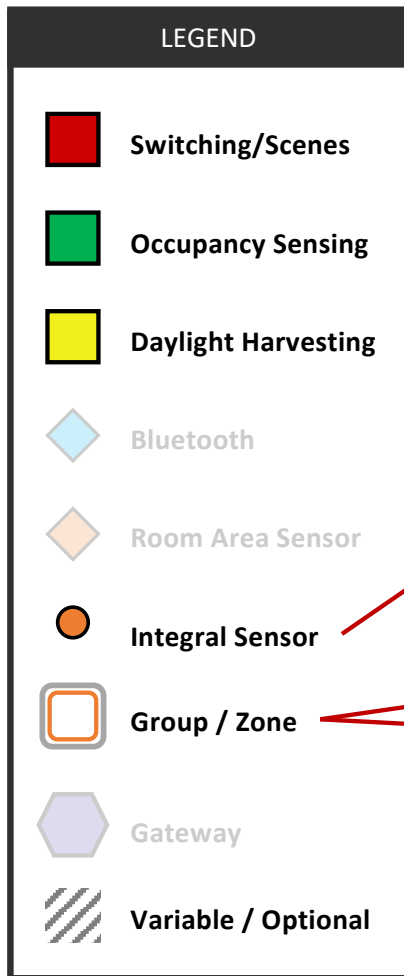
*Note: Components are not to scale.

Wireless Technology: System 1

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LEGEND

🟥	**Switching/Scenes**
🟩	**Occupancy Sensing**
🟨	**Daylight Harvesting**
🔷	Bluetooth beacon
🔶	**Room Area Sensor**
🔴	Integral Sensor
⬜	**Group / Zone**
⬡	Gateway
▨	Variable / Optional

APPLICATION ARCHITECTURE

S1: Room-based area sensor, plus radio modules per fixture. All fixtures within the zone function alike.

PROS

- VERY simple
- Inexpensive
- Functions like 0-10v controls, but without wiring
- Configurable by Electrical Contractor

CONS

- Not upgradeable
- No flexible zones
- Not IoT capable

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Wireless Technology: System 2

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LEGEND

🟥	**Switching/Scenes**
🟩	**Occupancy Sensing**
🟨	**Daylight Harvesting**
◇	Bluetooth
◇	Room Area Sensor
🟠	**Integral Sensor**
▢	**Group / Zone**
⬡	Gateway
▨	**Variable / Optional**

APPLICATION ARCHITECTURE

S2: Integral sensors, granular dimming, group background light level + auto-shutoff. Gateway variable.
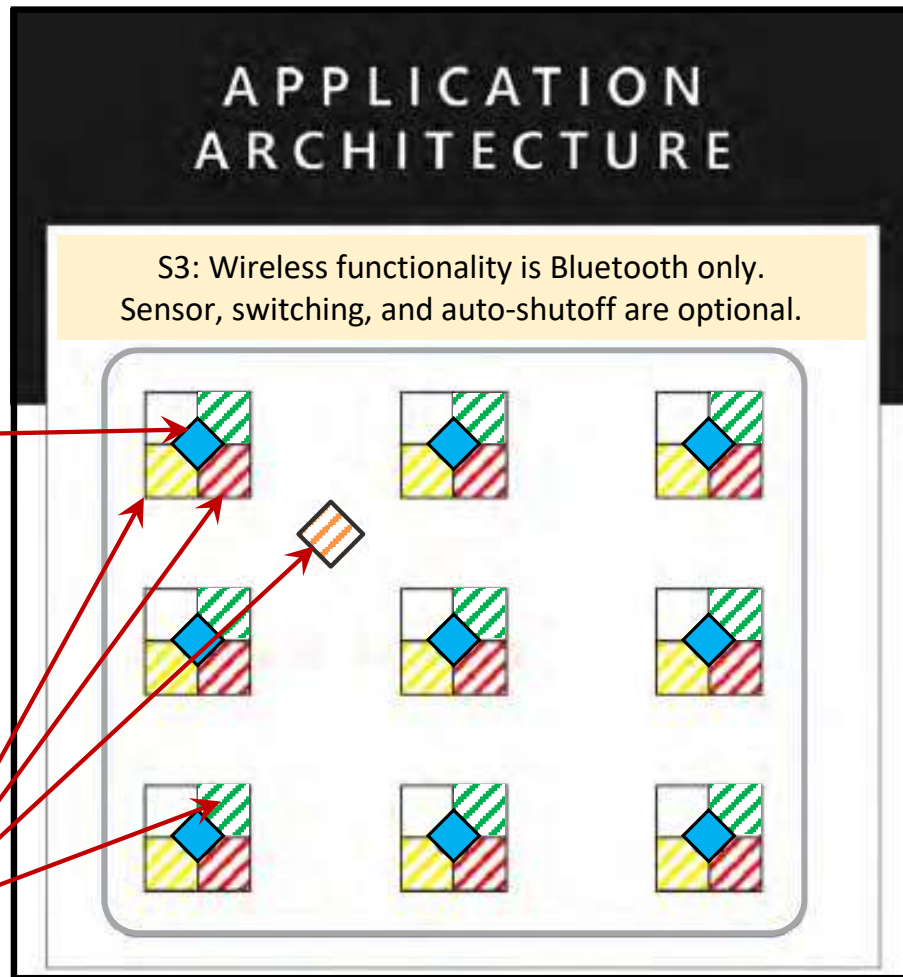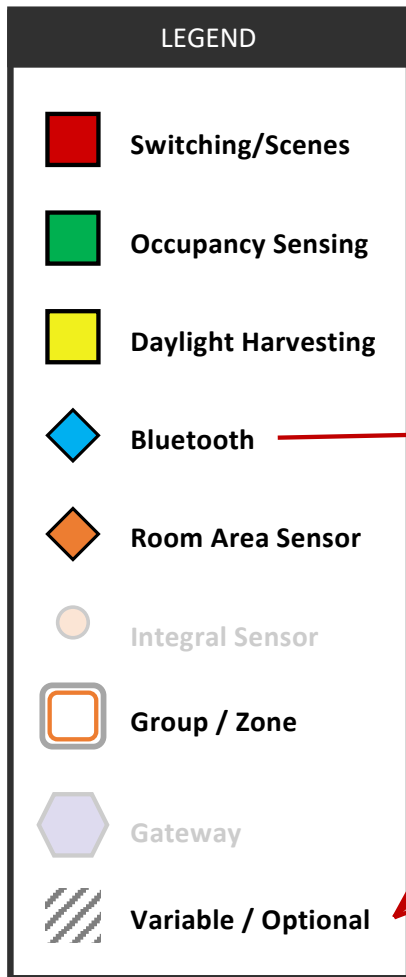
PROS

- Simple
- Less expensive
- Granular dimming *within* auto-shutoff group
- Configurable by Electrical Contractor

CONS

- No Bluetooth
- No map-based IOT functionality

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Wireless Technology: System 3

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LEGEND

- 🟥 **Switching/Scenes**
- 🟩 **Occupancy Sensing**
- 🟨 **Daylight Harvesting**
- 🔷 **Bluetooth**
- 🔶 **Room Area Sensor**
- ⚪ Integral Sensor
- ⬜ **Group / Zone**
- ⬡ Gateway
- ▨ **Variable / Optional**

APPLICATION ARCHITECTURE

S3: Wireless functionality is Bluetooth only.
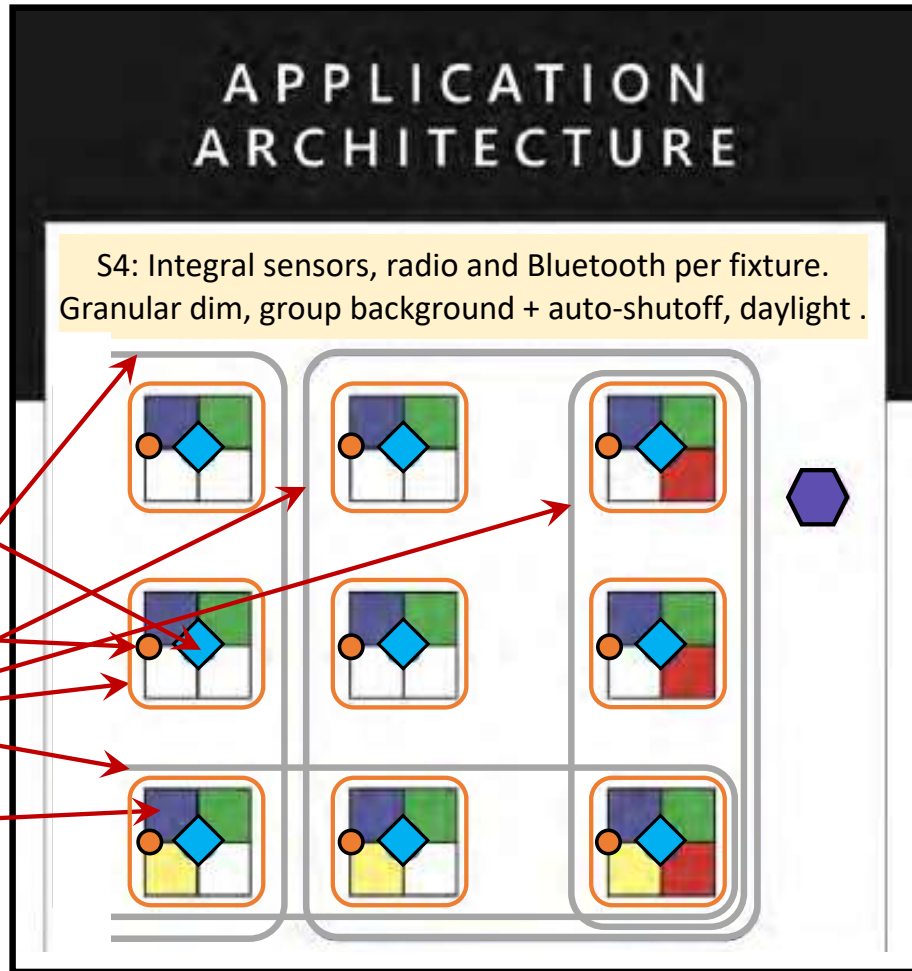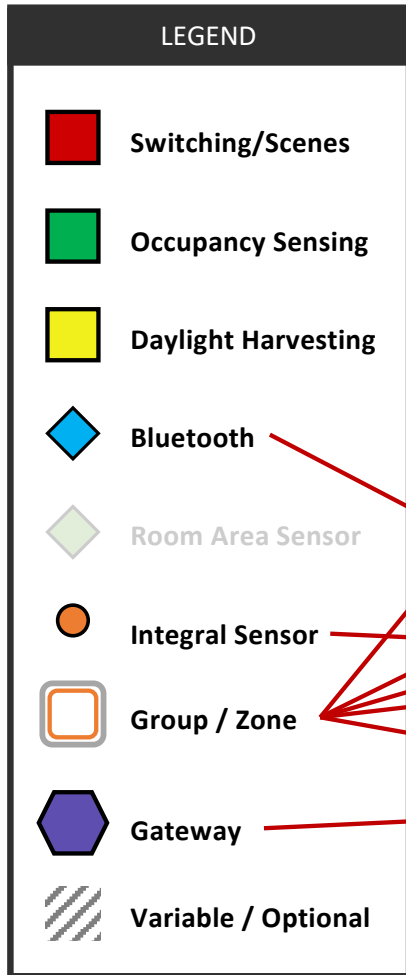Sensor, switching, and auto-shutoff are optional.

PROS

- Interfaces generally better
- Bluetooth capability can reach mobile devices
- Digitally flexible

CONS

- Not much availability in North America yet
- Can't provide primary IOT functions (yet...?)

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Wireless Technology: System 4

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LEGEND

🟥	**Switching/Scenes**
🟩	**Occupancy Sensing**
🟨	**Daylight Harvesting**
🔷	**Bluetooth**
◇	*Room Area Sensor*
🟠	**Integral Sensor**
▢	**Group / Zone**
⬡	**Gateway**
▨	**Variable / Optional**

APPLICATION ARCHITECTURE

S4: Integral sensors, radio and Bluetooth per fixture. Granular dim, group background + auto-shutoff, daylight .

PROS

- Powerful lighting functionality
- Total flexibility and maintainability
- Upgradeable, futureproof
- Has IOT functionality
- No single point of failure

CONS

- Learning curve to understand
- Requires expert configuration
- Requires sensor design

Wireless System 4 Delivers a Dense Sensor Grid
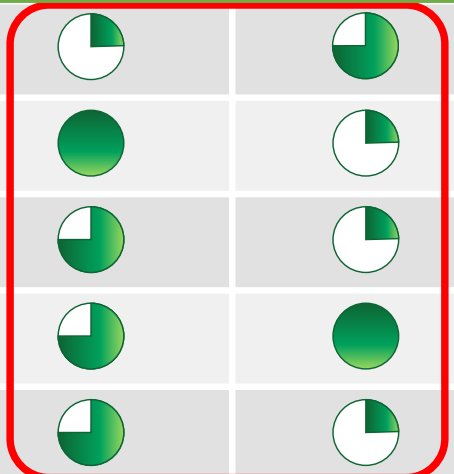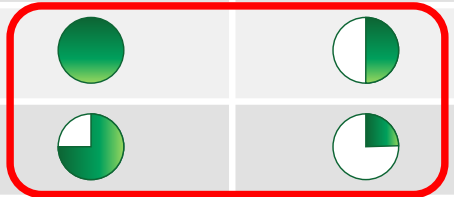
Dense sensor grid captures occupancy 24/7

Re-Evaluate Portfolios by Leveraging Utilization & HD Occupancy Analytics, Various Indoor Location Services become possible

Wireless System 4 Delivers a Dense Sensor Grid

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HYBRID

Feature / Benefit	WIRELESS SYSTEM 1 — Room Based Area Sensor, Large zone	WIRELESS SYSTEM 2 — Integral Sensors, Granular Sensing w/Background Group	WIRELESS SYSTEM 3 — Integral Beacon- BLE + opt. ZB or WiFi - 3rd party RB-sensor	WIRELESS SYSTEM 4 — Integral Digital Sensors, Granular, Radio + BLE	POE SYSTEMS 1-2-3 — Digital addressability + 3rd party RB-sensor	WIRELESS SYSTEM 4 + POE SYSTEMS 1-2-3 — Granular Sensing + Digital addressability
ENERGY						
Code Compliance	◕	●	◔	●	●	●
Energy Savings	◕	◕	◐	●	◐	●
Dimming Behaviors	◕	◐	◐	◔	◔	●
HVAC Integration	○	◐	◐	●	●	●
IOT VALUE						
System Integration	○	◔	◐	◔	◔	●
Space Utilization	○	◐	◐	●	◔	●
Real Time Location Services	○	○	○	◔	◔	●
Future Proof	○	○	●	◔	●	●
Wayfinding	○	○	●	◔	◐	●

POE & Wireless are Complementary Systems

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IOT Systems

- Endpoint= **Sensor** or Device
- Lighting Component: **Node** or Driver
- Communication = **Wired** or **Wireless**
- Software and Firmware
- Interfaces: Browser, Mobile device, Wall switch
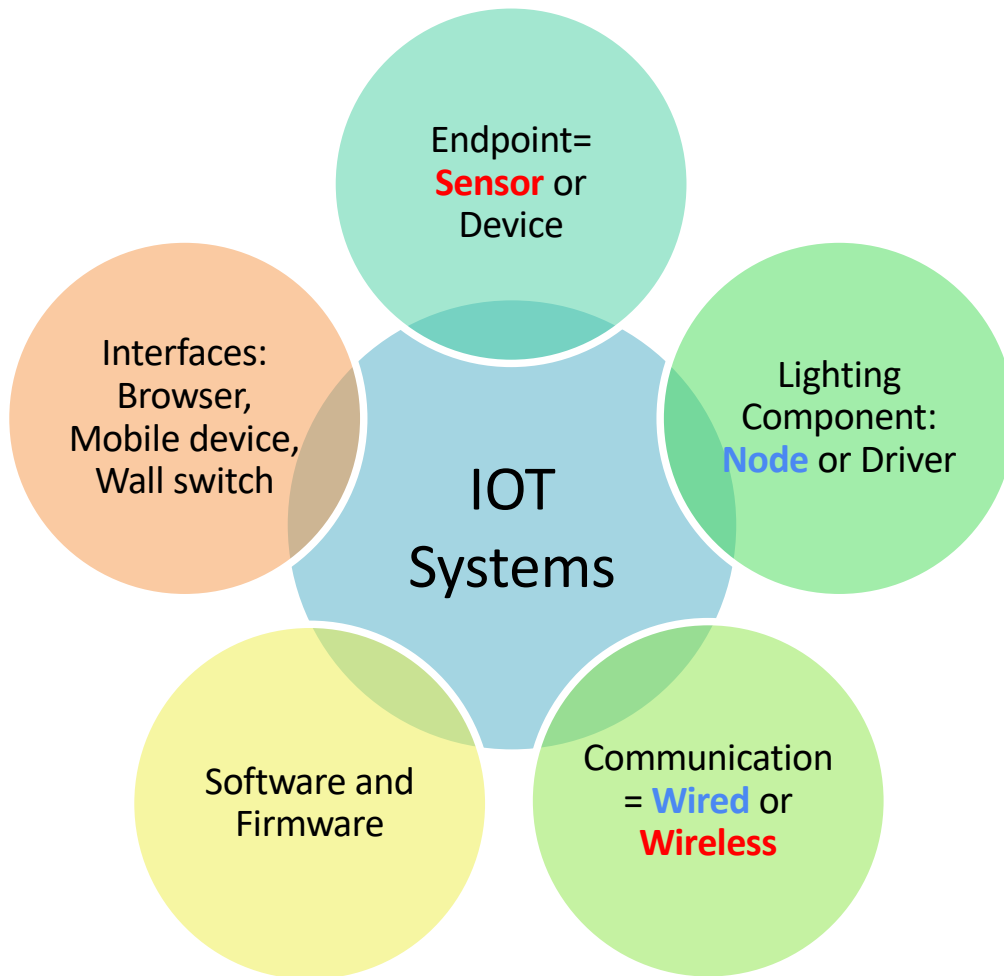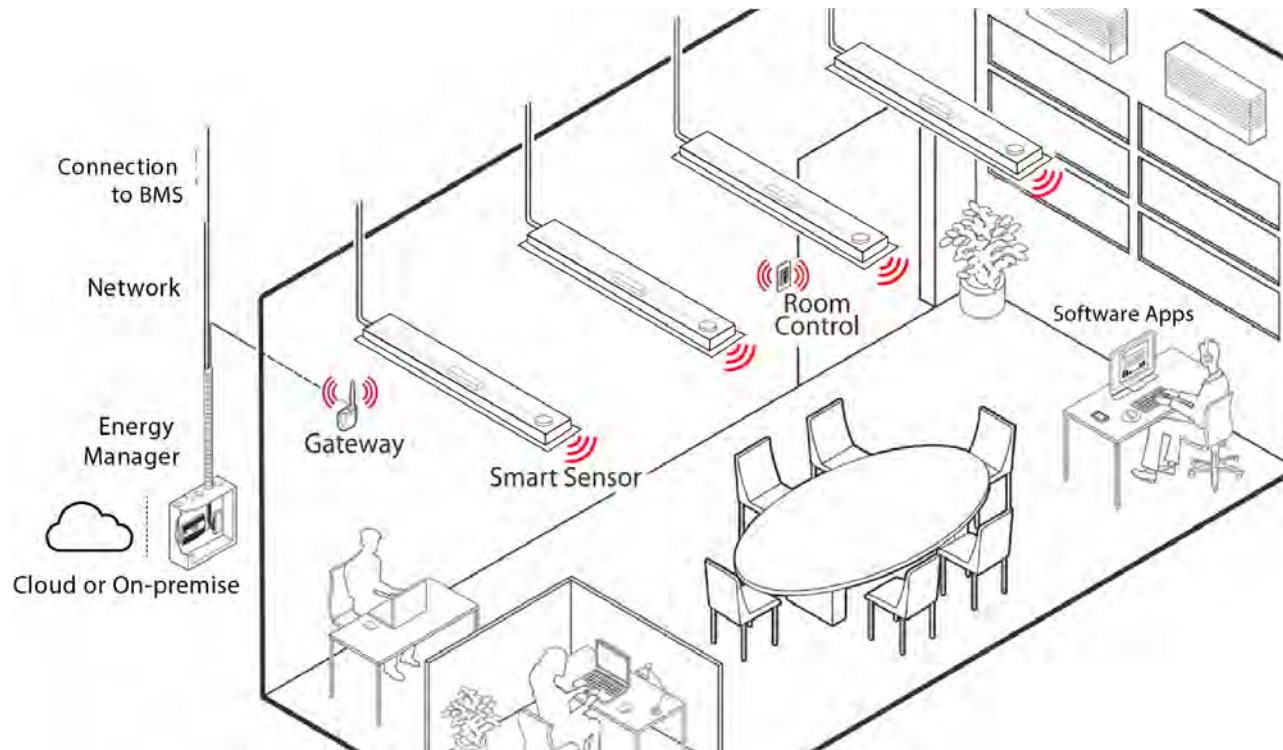
Definition of Hybrid

- a thing made by combining two different elements; a mixture.
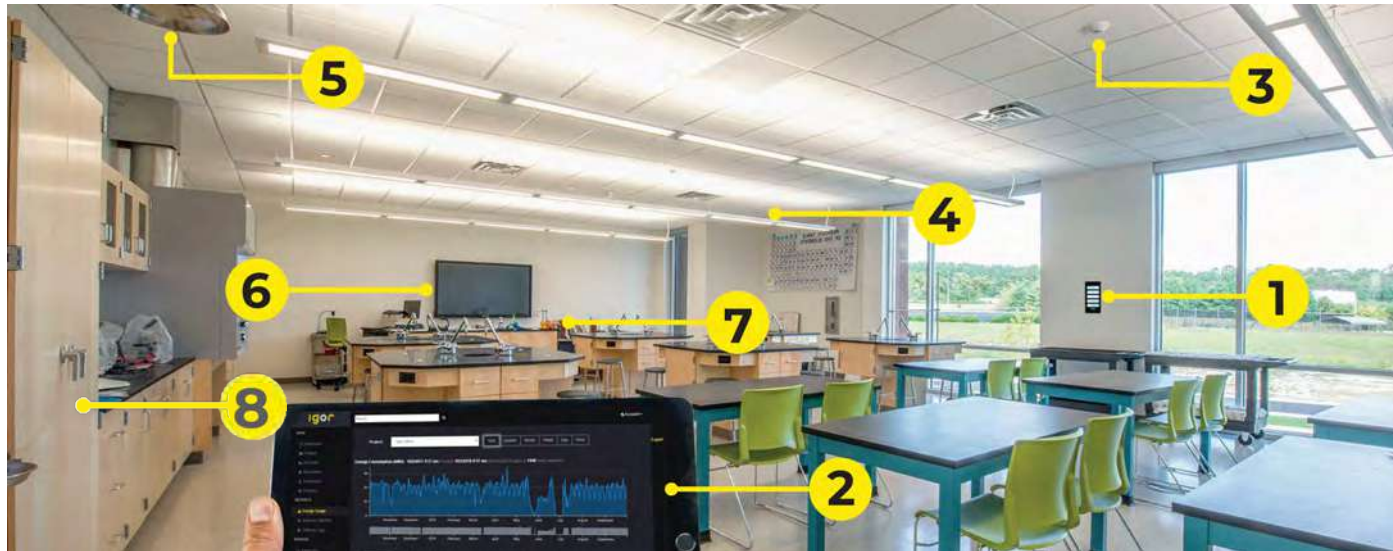
HYBRID IS ADDITIVE!

POE uses TCPIP to communicate, which allows easy integration of many endpoints, enabling a digital building. Think of TCPIP as speaking **English**.

A high-density **Wireless** Sensor Data Network with geolocation to a **map** enables Indoor Location Services and the many use cases and visualizations associated with that.

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Connection to BMS

Network

Energy Manager

Gateway

Smart Sensor

Room Control

Software Apps

Cloud or On-premise

PoE – Intelligent Education Solution

1 UVC Intelligent Disinfection	**4** Attendance Automation	**7** Integrated A/V Experience
2 Environmental Optimization	**5** Asset Tracking	**8** Gunshot/Lockdown
3 Special Needs Accommodation	**6** Enhanced Security	

PoE – Intelligent Healthcare Solution
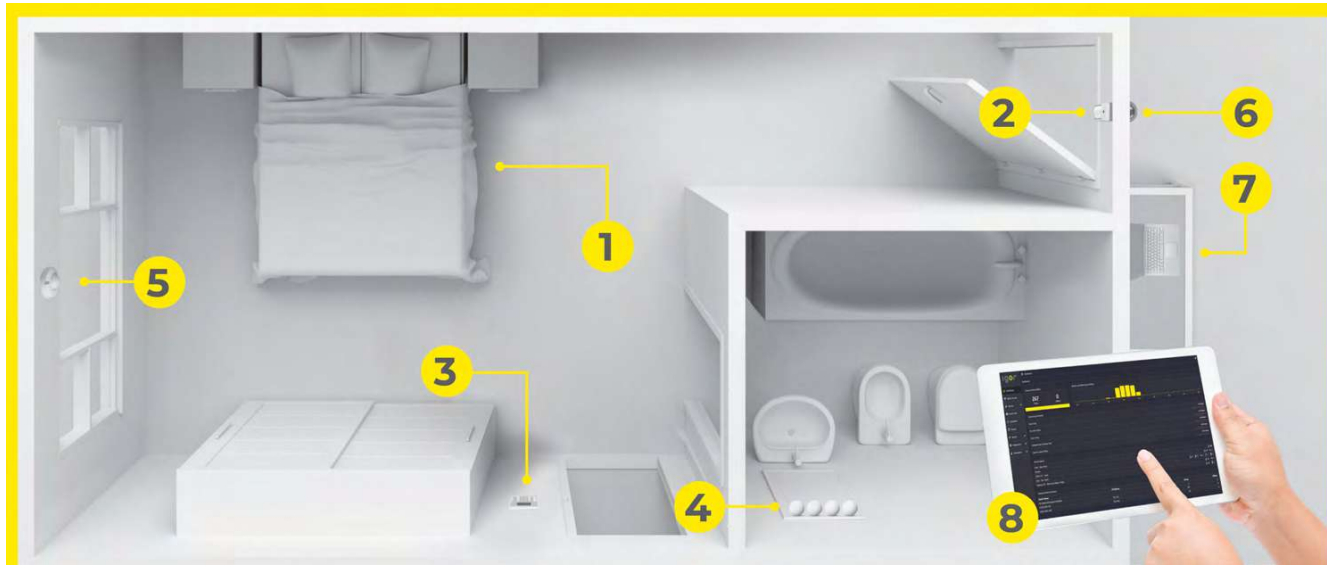
1 Intelligent Nurse Call	**4** Accessibility	**7** Operational Efficiency
2 Activity Monitor	**5** Biorhythm Health	**8** Family Portal
3 Environmental Optimization	**6** Access Control	

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PoE – Intelligent Workspace Solution

1 Task Lighting & Ceiling Lights	**4** Space Heaters & Outlets	**7** Personalization
2 USB Power Hub	**5** Access Control	**8** Workplace Statistics
3 Personal Control App	**6** Desk Fan & Climate Control	

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Wireless IOT Concept is to digitize the ceiling

We digitize buildings with IoT technology that is a sensory system

This captures real-time data about what is happening in the building, providing insight that was never possible before

We developed many use cases, but future proofing a building means making that building able to respond to critical needs as they arise

Key Capabilities of a Building IoT Platform

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Motion
Visualizations of aggregated movements through a floor

Bluetooth® LE
Transmit and receive Bluetooth data and beacons

HD Occupancy
Occupancy and utilization of areas, desks, floors, buildings, portfolios

Location
Real-time location of people and assets and location-based alerting
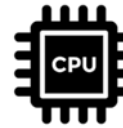
Motion -PIR

Light

Power

Temperature

Bluetooth LE

CPU

Processing

ARM processor, memory, upgradable software

Wireless Communications

802.15.4- Radio
802.15.1- BLE

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Use Cases for the Office Segment

Lighting Controls Intent

- Task Tuning
- Color Tuning
- Switching per code
- Daylight Harvesting
- Plug Load metering

Owner's Project Requirements

- Conference room reservations
- Desk hoteling / Hot-desking
- Employee experience
- Space Utilization
- HVAC Integration
- Wayfinding
- Fault Diagnostics
- Shading Integration
- Upgradeability
- Back to work, contact tracing

Use Cases for the Healthcare Segment

Lighting Controls Intent

- Task Tuning
- Color Tuning
- Switching per code
- Daylight Harvesting
- Nighttime Adaptation

Owner's Project Requirements

- Motion trails, workflow/people moving
- Space Utilization, specific rooms (e.g. operation rooms)
- Asset Tracking
- Wayfinding
- Fault Diagnostics
- Upgradeability
- Gated NICU
- Integration with security / access & phone

Use Cases for the Industry Segment

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Lighting Controls Intent

- Task Tuning
- Switching per code
- Aisle dim to background
- Daylight harvesting/ skylights

Owner's Project Requirements

- Pallet/Asset Tracking
- Wayfinding
- Fault Diagnostics
- HVAC Integration
- Building Security Integration

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Navigating the Controls & Connectivity Conundrum

① WHY — Lighting Controls Intent / Narrative AND Owners Project Requirements (OPR)

② WHO — Prioritize customers & stakeholders: Owner, Electrical Contractor, Property Manager, Occupant

③ WHERE — Segment, space type, new or existing for: Office, Education, Healthcare, Retail, Industrial, Institutional

Many factors should influence what types of controls are best.

④ WHAT — Which system can give you the Features and Benefits you need for Controls Intent + OPR for your project & people

⑤ HOW — Evaluate the system and application architectures for technologies to **understand how** they will deliver

⑥ WHEN — Does it exist **NOW**? Require proven track record, a sizable installed based, and/or system mockup of products & software

Requires strong understanding of technology and systems.

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This concludes The American Institute of Architects Continuing
Education Systems Course

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