

Designers Light Forum

Power-over-Ethernet (PoE) Lighting –
Enabling Integrated, Automated Buildings

Randy Jones, H.E. Williams, Inc.

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Course Description

This session will present how PoE lighting can be a fundamental platform for smart environments. Well planned building integration allows a flexible, scalable lighting system to collect the data that ultimately brings more value to the building owner.

Learning Objectives

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

1. The relationship between Division 25 Integrated Automation and PoE Lighting.
2. How a PoE lighting system is a scalable and adaptable building connectivity platform.
3. The differences between full interoperability protocols and APIs and how each facilitates building system integration.
4. How the end-user can realize additional value propositions through data collection.

A Few Basics

Ethernet

- 1973 Ethernet invented for digital communications
- 1983 IEEE standard 802.3 adopted
- Billions of ports installed globally
- Internet Protocol (IP) - based communication dominant



LEDs

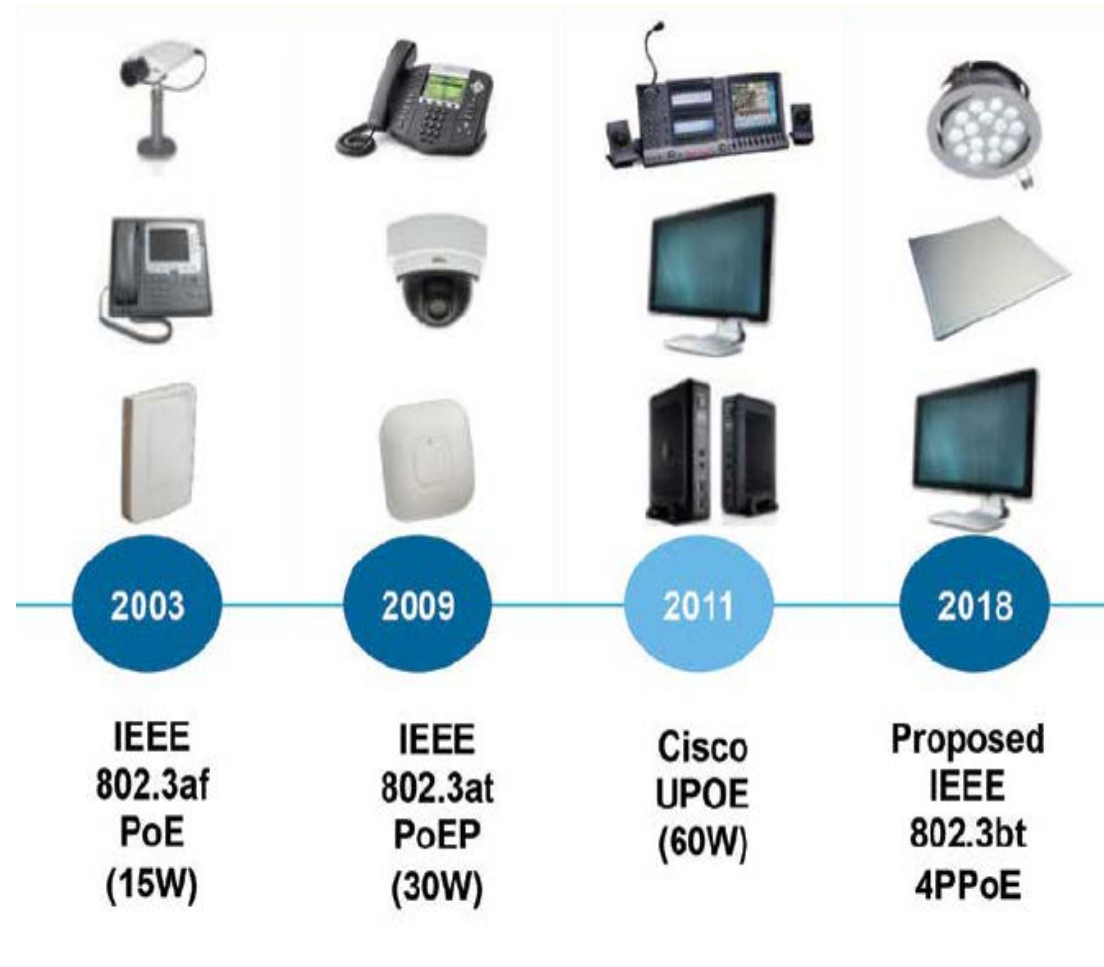
- 1962 - first commercially available visible-light (red) LED (a digital device that best operates on DC power)
- 1996 - first white LED commercially available, using phosphor-converted blue LED
- 2016 - 874 million LED products installed in the USA, accounted for 12.6% of all installed lighting¹

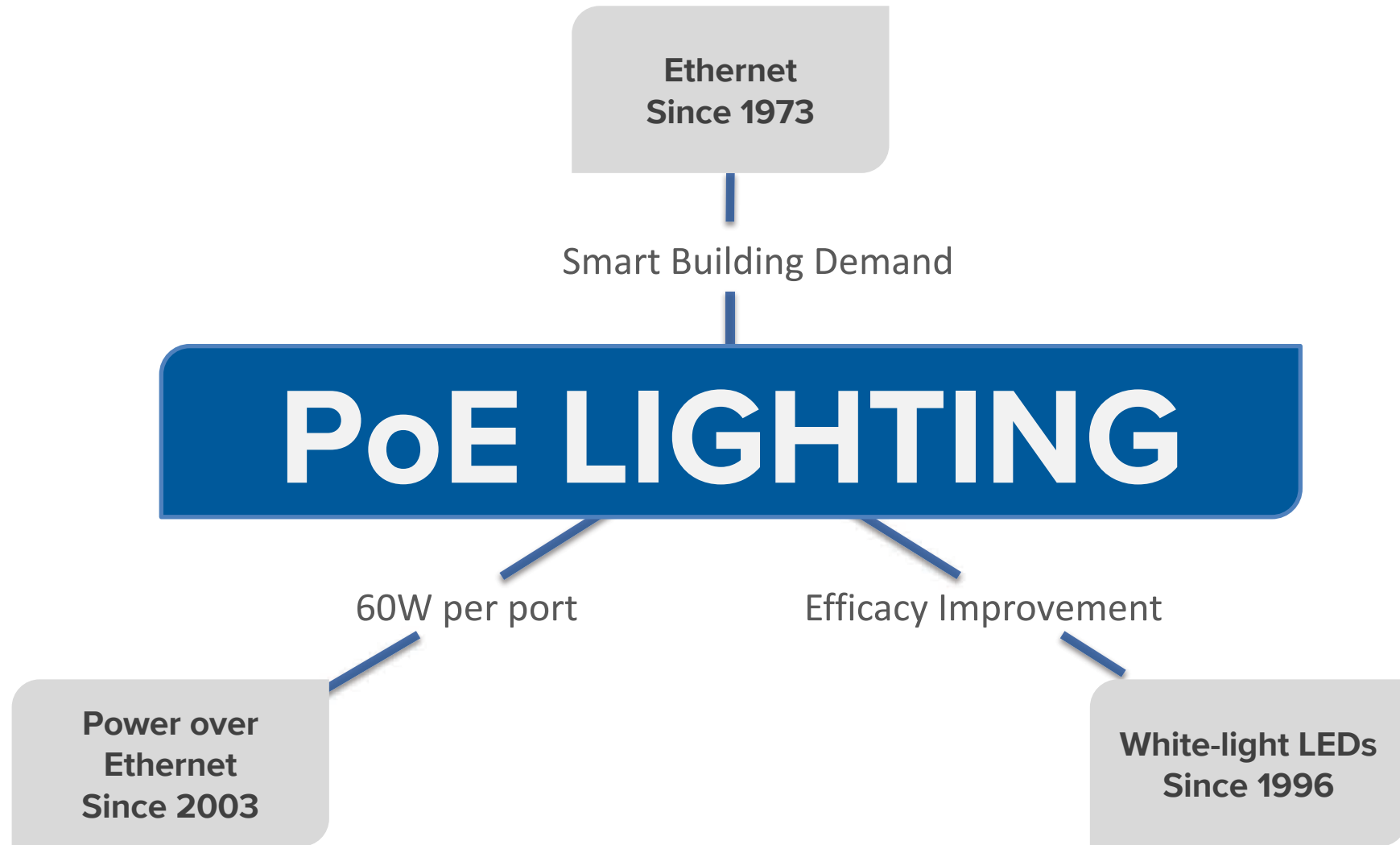


¹ https://energy.gov/sites/prod/files/2017/08/f35/led-adoption-jul2017_0.pdf

Power-over-Ethernet

- **2003** – 15W per port standard adopted, combining DC power and digital communication
- **2009** – 30W per port standard adopted, setting the stage for...
- **2011** – UPOE products released, providing 60W per port
- **2018** – adoption of IEEE 802.3bt, enabling more 60-100W/port product development





PoE Lighting – Technical Updates

- Standard for PoE cabling, minimum requirements approved May 25, 2017
- Practical power is >50 watts of connected load per port with Cisco CDB products and unmanaged mid-span power injectors
- A fixture-level, UL924 PoE emergency battery kit now commercially available
- UL924 emergency PoE node/drivers available today
- Centralized emergency power for PoE coming soon

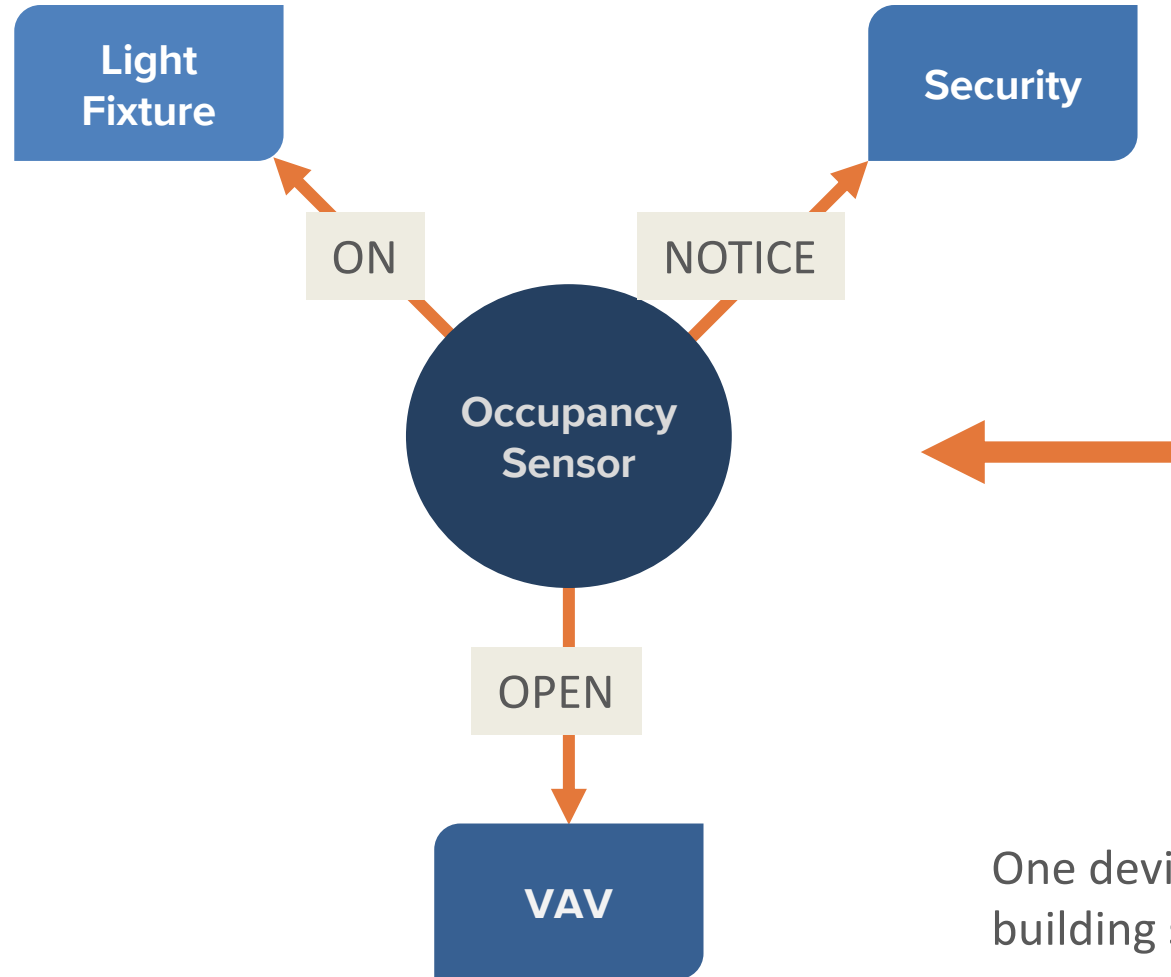


ANSI/NEMA C137.3-2017



Learning Objective #1: Integrated Automation

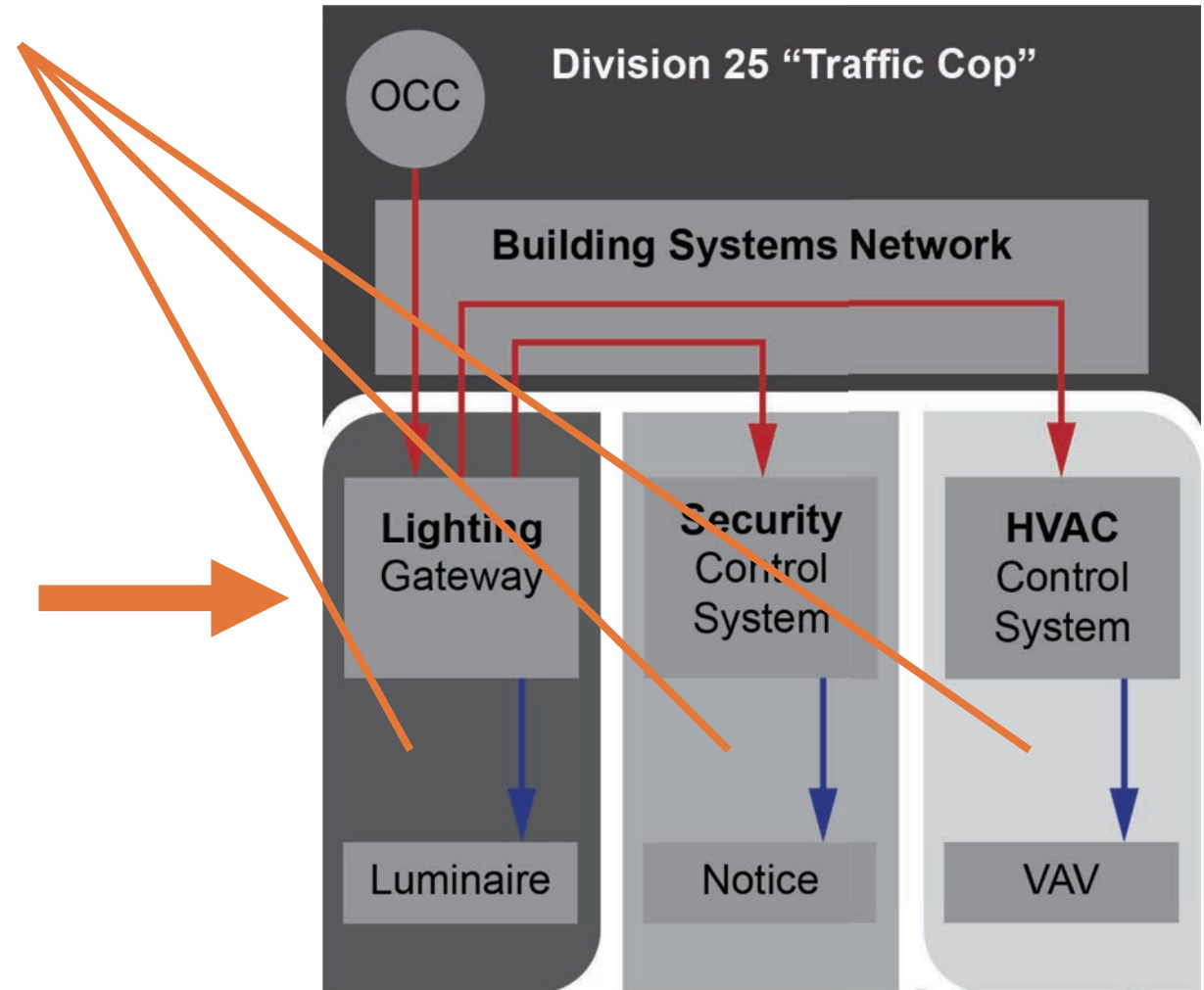
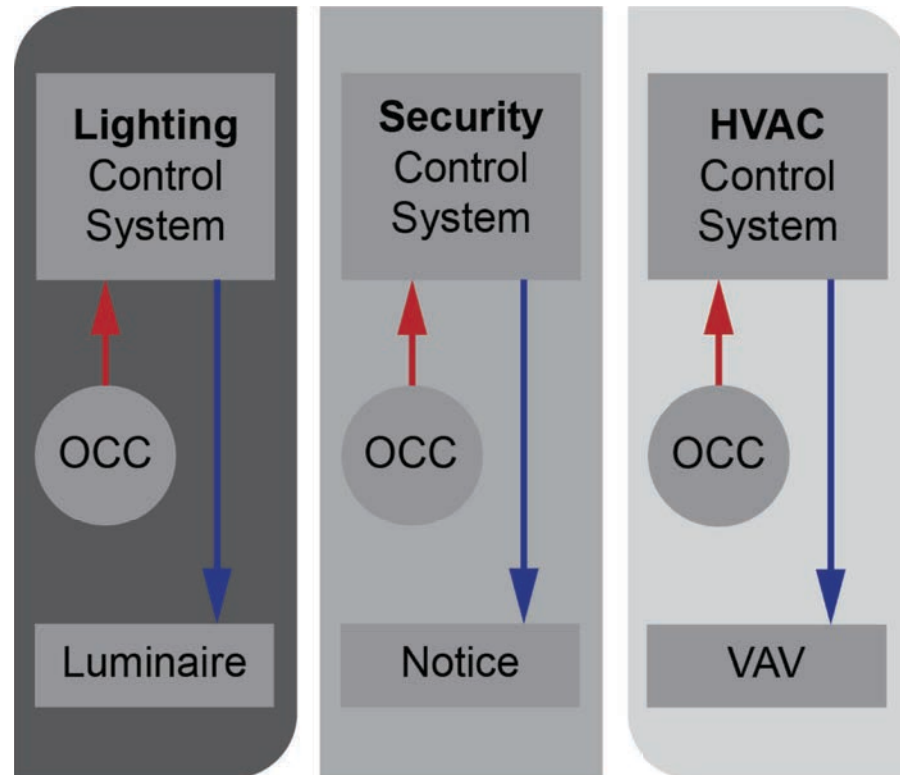
Integrated Automation



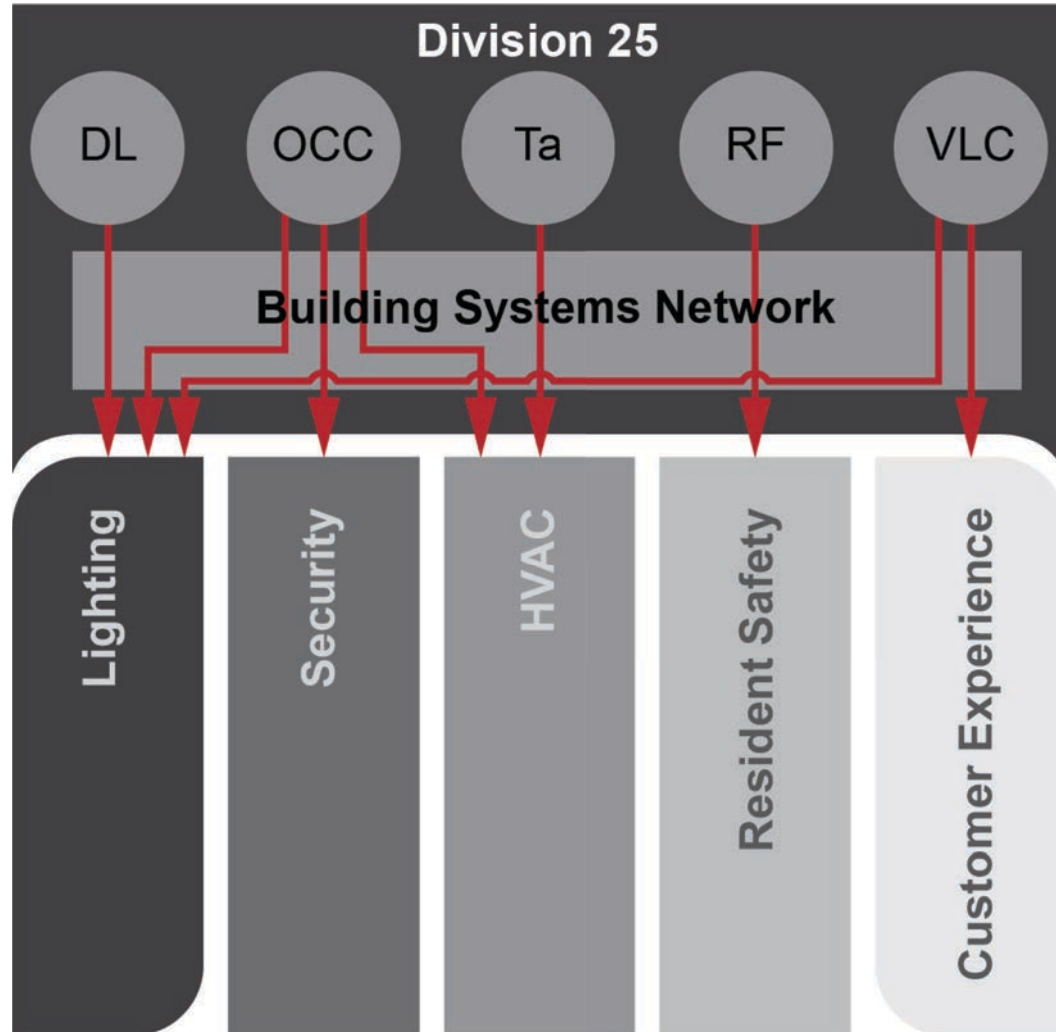
One device triggers action in multiple building systems

Integrated Automation

Reduced sensors & control points =
reduced install costs & maintenance

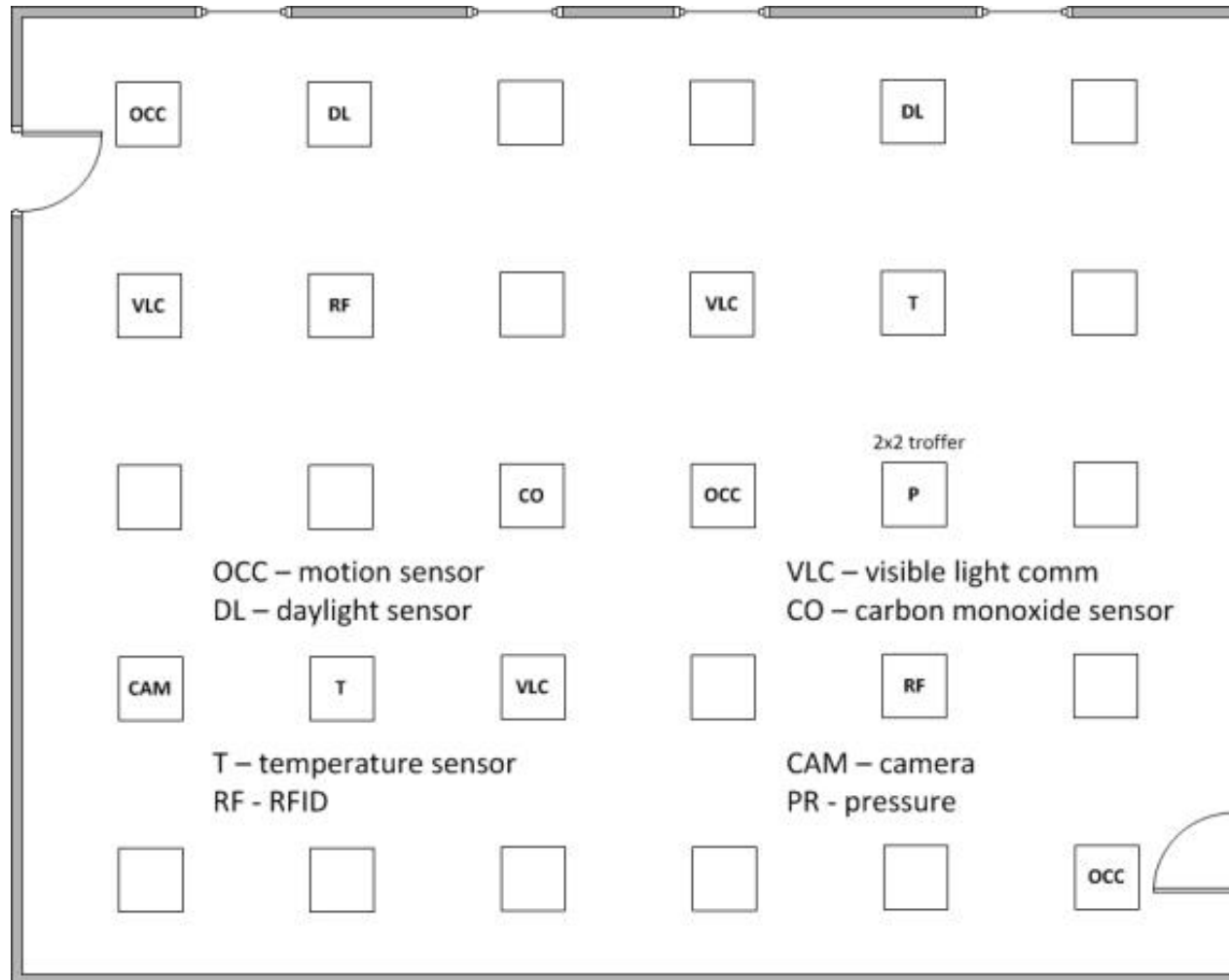


Integrated Automation



- Control actions defined in Division 25
- Establish priority of the actions
- Define the Division 25 contractor responsibilities
- Consolidation of building data input devices can quickly compound the savings

Integrated Automation



- People = lights = sensors
- Sensors are the eyes, ears, and nose of the building
- An open lighting platform enables optimized building automation because of sensors

Key Take-Aways

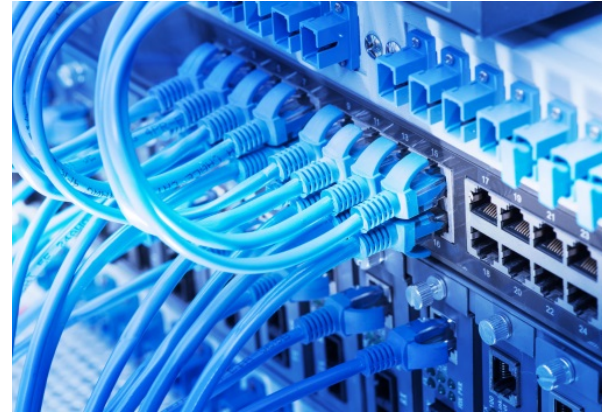
- Optimized smart buildings are facilitated by use of Division 25
- Sensors are the data inputs to automated buildings
- Lighting is the natural pathway for sensors to the building system network

Learning Objective #2: Scalability and Adaptability

Scalability and Adaptability

Focus on Scalability

- Network
- Devices
- Low-voltage lighting



DC

Scalability and Adaptability

Network - Hardware

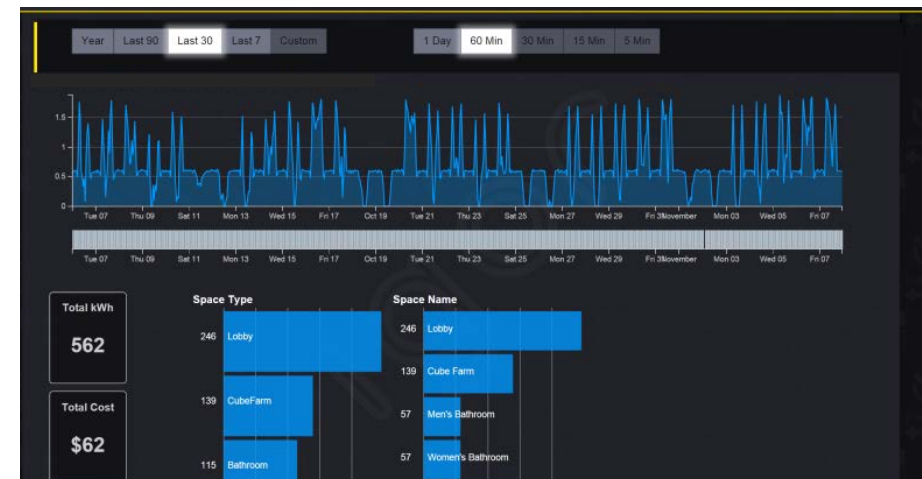
- PoE switches and data switches are common and understood by data/communications professionals
- Networks can be expanded and reconfigured by many owner's IT staff
- New in-ceiling, plenum rated PoE switches allow new ports to be added when data closets are full
- Don't underestimate the need to utilize network engineers for specification and certified contractors to install and commission!



Scalability and Adaptability

Network - Software

- Software packages are designed to control tens of thousands of luminaires and sensors in a building
- Internet access, enterprise level monitoring and data analysis allow global expansion
- PoE lighting devices, network, software, and internet needs should be included in the site cybersecurity planning!

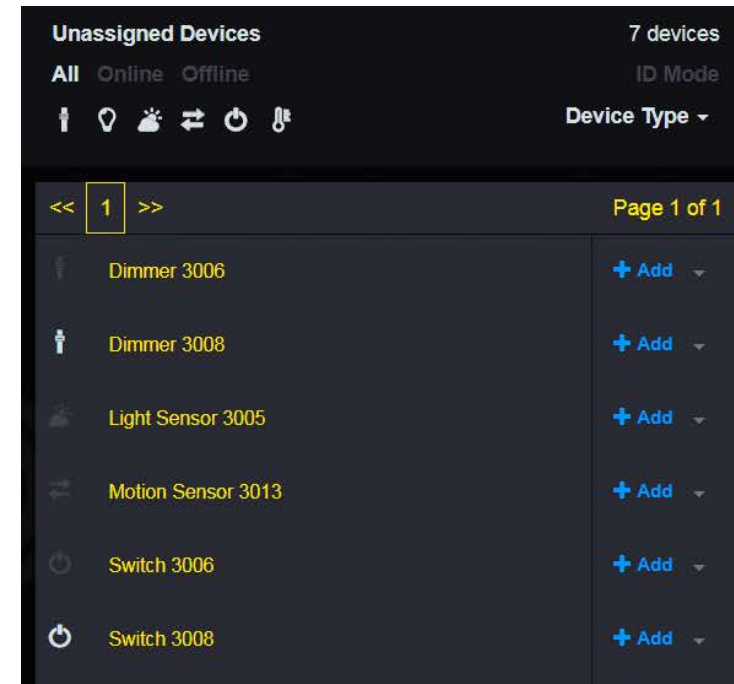


Scalability and Adaptability

Devices

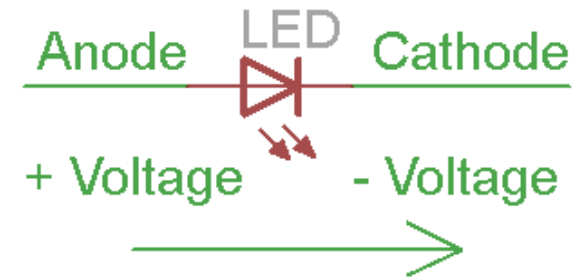


- Standardized cabling allows plug-and-play connection to the network
- Good control software will automatically recognize and identify the new device
- Integration of non-PoE devices and fixtures onto the network
- Should not assume all PoE devices will work directly from any PoE system



DC Lighting Fixtures

- LEDs are direct-current devices, meaning LED luminaires really only need DC power
- Conversion of AC luminaires to DC PoE-ready luminaires is relatively easy
- The number of PoE luminaires can quickly increase with customer demand
- Since PoE fixtures are UL Class 2 they can be relocated without hazardous rewiring



Scalability and Adaptability

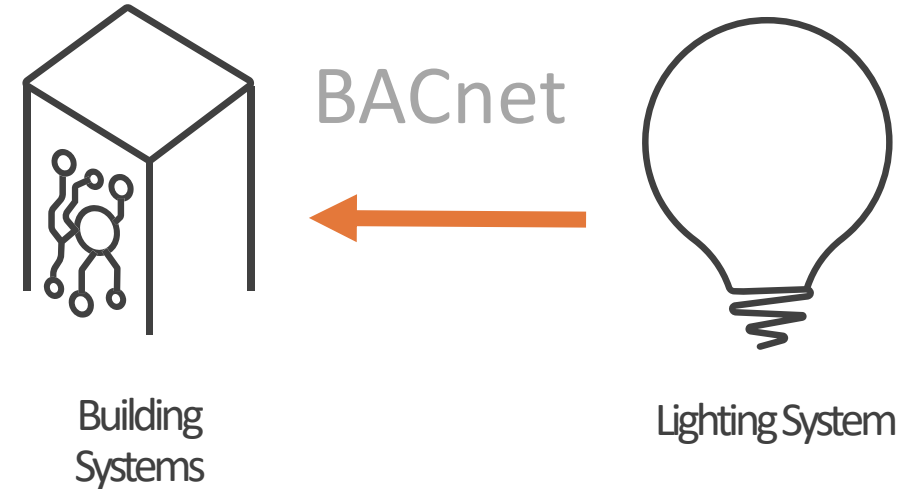
Key Take-Aways

- By utilizing existing Ethernet equipment and standards, PoE lighting networks are highly scalable
- Category cabling allows simple connection to and good software automatically recognizes new devices
- LED fixtures are naturally DC and PoE fixtures can be relocated without hazardous rewiring

Learning Objective #3: Interoperability and APIs

Traditional Systems Integration

- Only very knowledgeable programmers in the building automation industry currently understand BACnet
- BACnet is extremely difficult to understand
- BACnet varies between vendors
- BACnet is a set of communication patterns, not easily secured or manageable

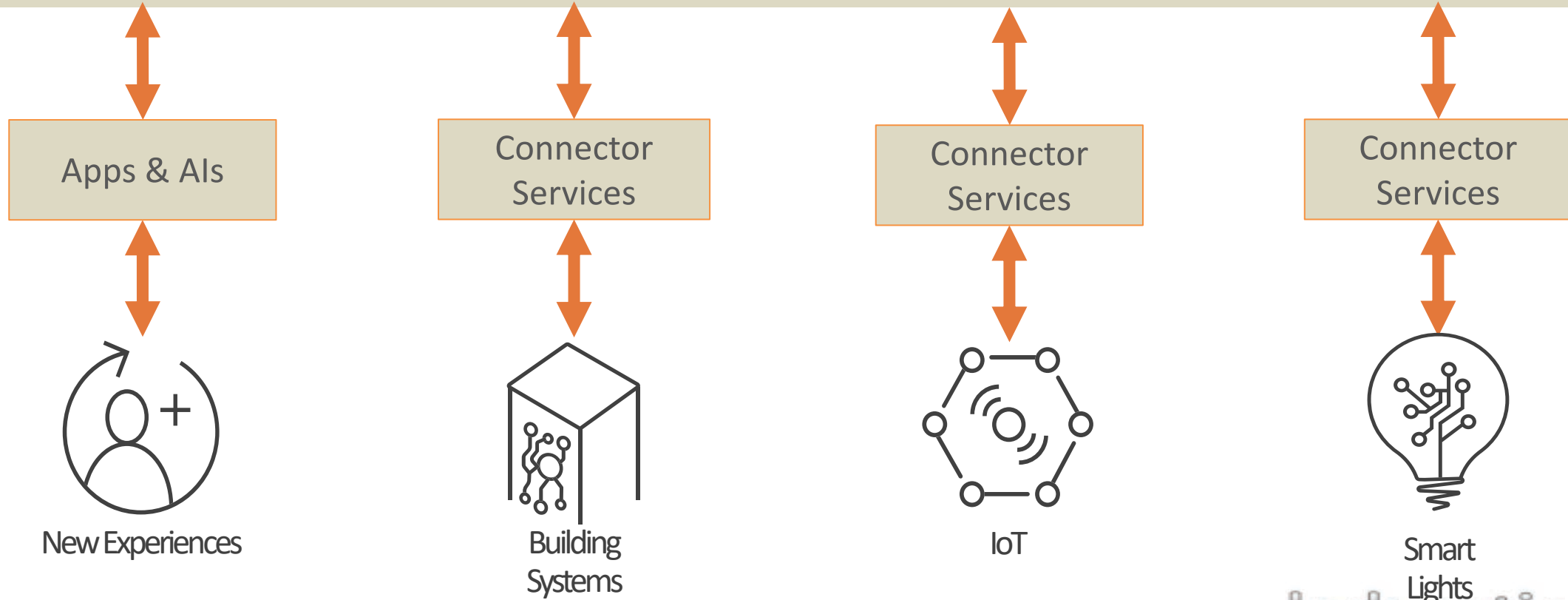


Interoperability and APIs

Connected Building Platform

Secure APIs

Convergence of technologies, devices, and protocols



Interoperability and APIs

Connected Building Platform	Typical systems
Natively IT data-driven Universal IT compatibility & support	Peer-to-peer or proprietary protocols Only work with vendor's devices & support
Intelligence at software Benefits any and all devices	Intelligence at device Inconsistent behaviors (versions and vendors)
Simple RESTful API Nearly any programmer can do it	Proprietary protocols (e.g. BACnet) Very difficult learn, develop, and test
Secure API Withstands unsecured network traffic	Typical BAS integration has no security No passwords, or default passwords
Compartmentalized API Manage integrations independently	Typical BAS integrations share one password Can't manage or evaluate individual integrations
Real-time API events Instantly run 3 rd party code upon an event	Standard APIs Require continuously requesting updates

Interoperability and APIs

Key Take-Aways: APIs and Protocols

- Use a protocol-agnostic platform
- APIs are much more important than protocols
- APIs provide sales multiple value streams

Learning Objective #4: The Value of Data

Status-Quo:

Buildings are meticulously planned custom collections of fixed assets.



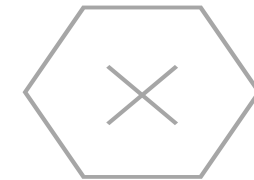
Limited

Simple illumination
Proprietary choices
No intelligence



Expensive

Labor-intensive
Wasteful
Rarely fully operational



Inflexible

Difficult to modify (AC)
Not software-defined
No platform

Status-Quo:

Can't Analyze + Can't Adapt =

Unempowered

Evolve or Die

Over 40% of all businesses in operation will fail in 10 years because they will be outcompeted by more nimble, adaptive companies.

- John Chambers, Former CEO Cisco Systems, 2015

The Need: Adaptive Architecture

“... adapts to their environments, their inhabitants and objects ... entirely driven by internal data”

- Holger Schnädelbach, Adaptive Architecture - A Conceptual Framework, 2010

Lean & Agile:

Plan &
prioritize



Bite-sized
deployments



Quantify
results



The Desired Outcome:

Low risk

Low waste

Low cost

Accelerate

Lean & Agile

Accountability

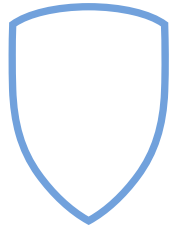
High return

Pivot easily

Iterate

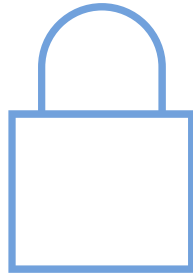
The value of data

Apps:



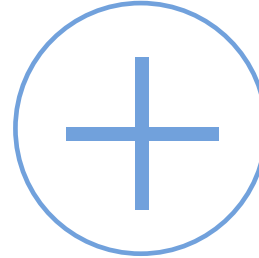
Safety

Tornado / Fire / Intruder
alarm chase mode lighting;
Silent alarms;
Color as a signal;
Light level reporting



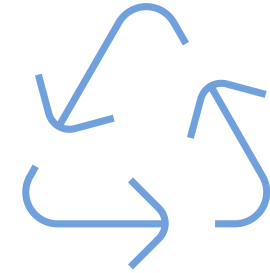
Security

Motion-triggered forced
Illumination



Health

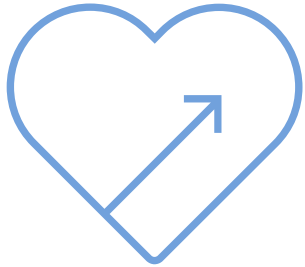
Circadian rhythm;
Temperature-triggered HVAC
control



Green

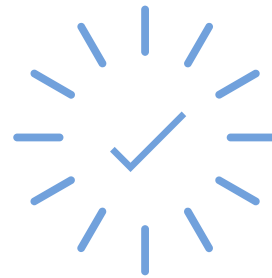
Analytics-driven continuous
improvement;
Cost savings up to 90%

Apps (cont.):



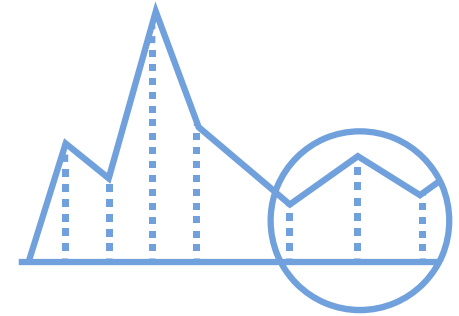
Comfort

Full occupant control from
anywhere



Entertainment

Churches, Casinos, Hotels,
Restaurants, Cruise Ships, Art
Amazing spectacle of light



Awareness

Asset tracking;
Space utilization

Comparison: New Value

Connected Building Platform	Typical systems
Plug-and-Play Buildings become data-driven lean & agile assets	Fixed AC wiring Hard to change, even with actionable data
Continuous improvement Measure, adjust, repeat	Fixed install No data or generic data
High-value tailored applications Full API allows continuous & rapid innovation	Energy savings only End customer value is constrained

The Value of Data

Key Take-Aways: New Value

- PoE enables lean & agile buildings
- Lean & agile buildings fully unlock the value of data
- Unlimited value with a lean, agile, multiple-protocol, API platform

This concludes The American Institute of Architects
Continuing Education Systems Course



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