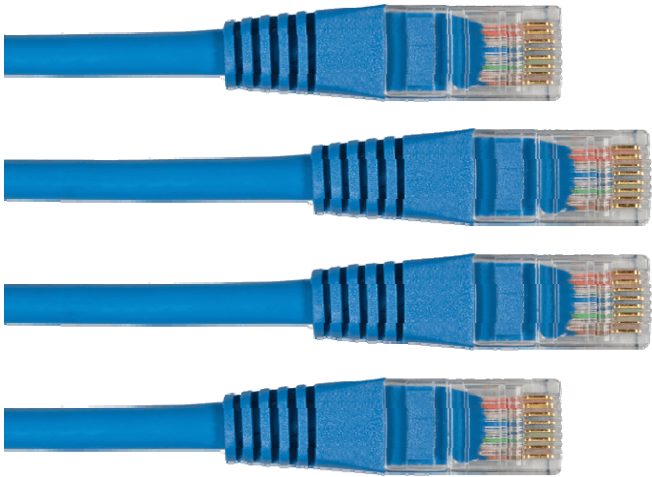**IES Montreal**
March 2017

Smart, Connected Lighting: a Look at the Value of Lighting Systems on Power over Ethernet

Shirley Coyle, Cree, Inc.

Smart, Connected = Intelligent Lighting

It is not a lighting control system.

It is a sensor network and operating system that enables applications far beyond light.

Value for people and for building management

Seamlessly improves the comfort, satisfaction, and productivity of **people** where they work, study, and heal

Increases the value, security, and operating efficiency of **buildings**

Sensors on every luminaire

Sensors on every light harvest rich data

That is communicated over the network

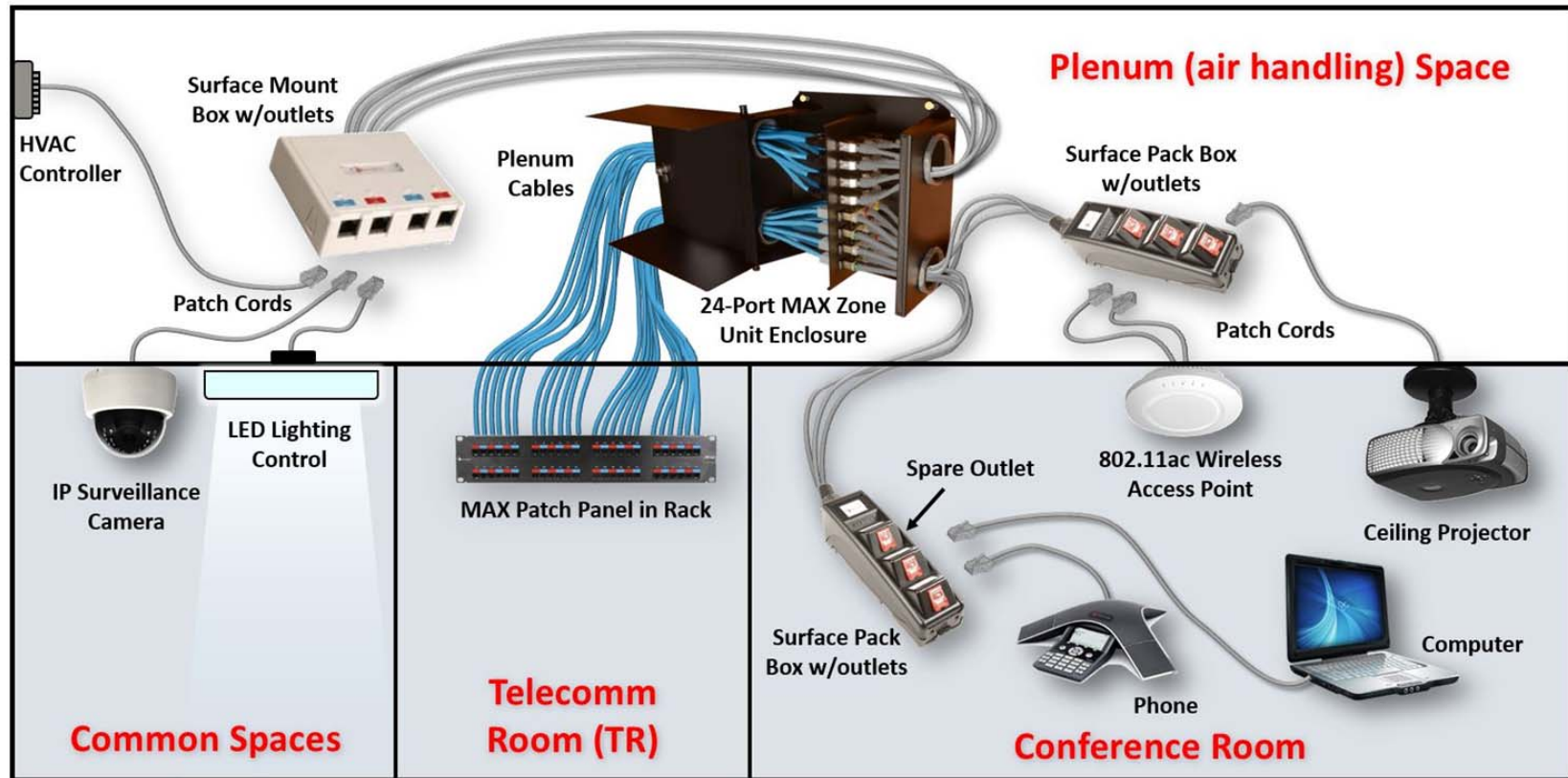To enable valuable software applications and services

What we will cover today

- Why Power over Ethernet (PoE) for lighting?
- System Overview
- Use Cases
- Considerations

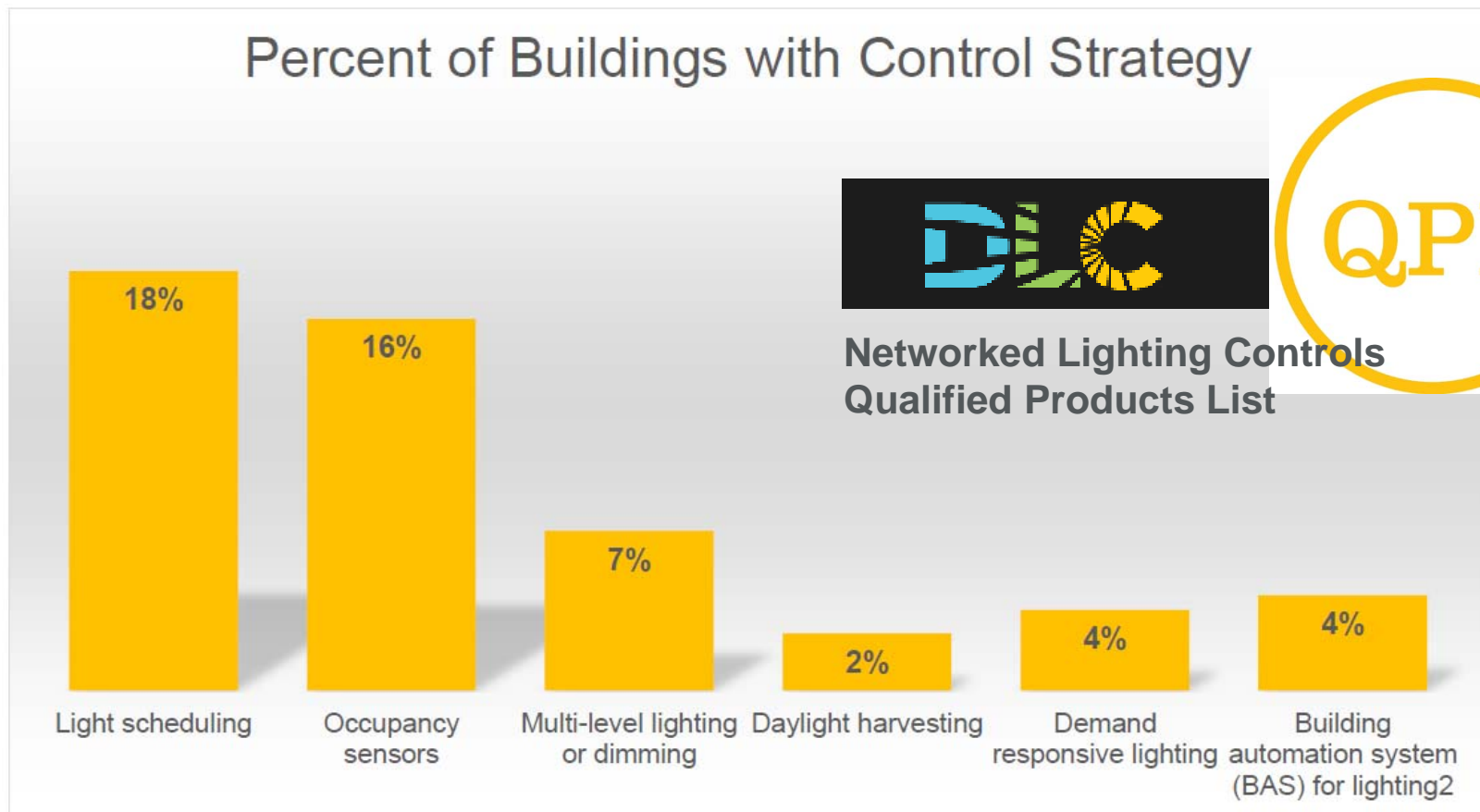# We are already living in a PoE World

6 Trends Driving Lighting on PoE

1. Energy Codes
2. Sensors
3. Improvements in LED Technology
4. Evolution of PoE Technology
5. Software Systems/Big Data Analytics
6. Building Systems Converging onto IP Network

Trend #1   Energy Codes Requiring Advanced Controls

Percent of Buildings with Control Strategy

Networked Lighting Controls Qualified Products List

- Light scheduling: 18%
- Occupancy sensors: 16%
- Multi-level lighting or dimming: 7%
- Daylight harvesting: 2%
- Demand responsive lighting: 4%
- Building automation system (BAS) for lighting2: 4%

Source: 2012 Commercial Buildings Energy Consumption Survey, US Energy Information Administration
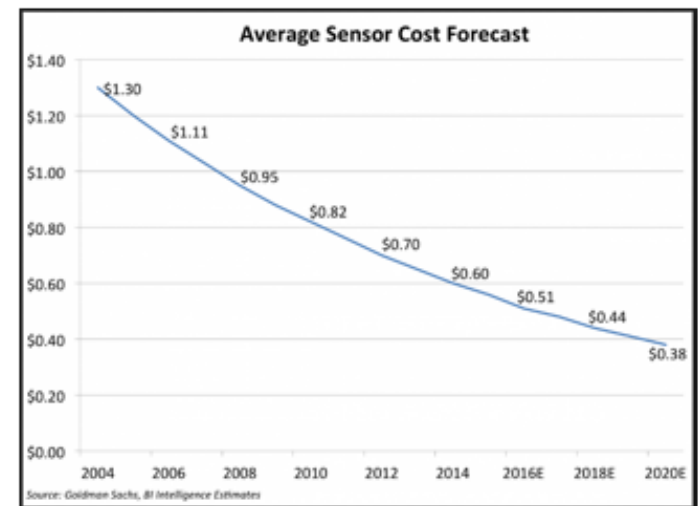
Trend #2   From Sensor Scarcity to Sensor Abundance

Traditional Lighting Control Schemes Rely on Few Precision
Sensors

Today's More Intelligent Control Lighting Systems Simplify Things
by Using Lots of Sensors

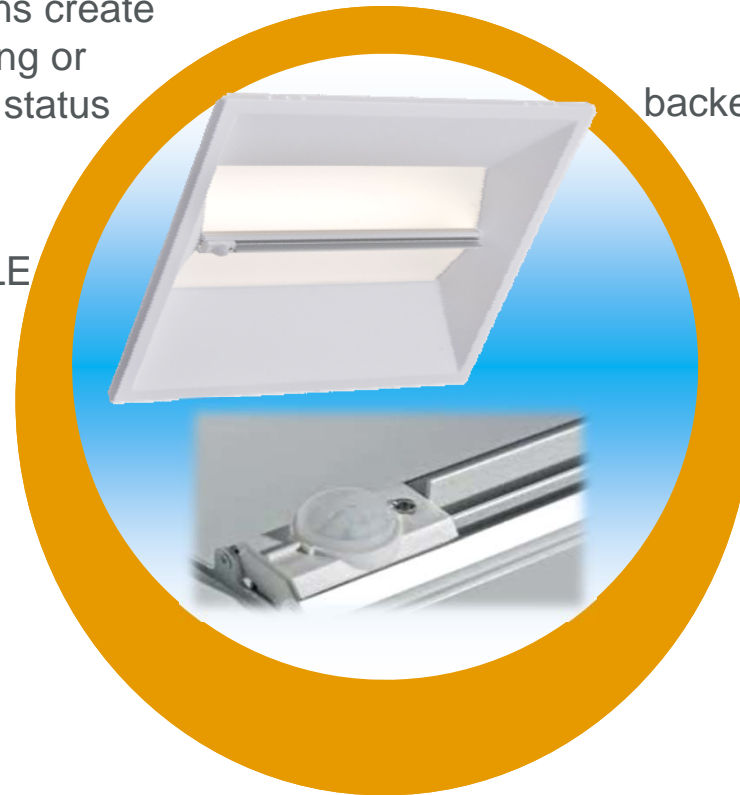Smartphone Analogy – Sensors Today are Abundant and Affordable

Accelerometer
Gyroscope
Magnetometer
Barometer
Proximity
Light sensor
Touch screen

GPS
WiFi
Bluetooth
GSM/CDMA Cell
NFC: Near Field
Camera (front)
Camera (back)

Source: Internet

14 sensors!

Average Sensor Cost Forecast

$1.30
$1.11
$0.95
$0.82
$0.70
$0.60
$0.51
$0.44
$0.38

2004 2006 2008 2010 2012 2014 2016E 2018E 2020E

Source: Goldman Sachs, BI Intelligence Estimates

The Digital Luminaire: Light plus data

Colour beacons create pathway lighting or indicate room status

Any light can be backed up with a UPS

Integrated BTLE for nearby devices

Integrated CO_2 and other gas or particle sensors
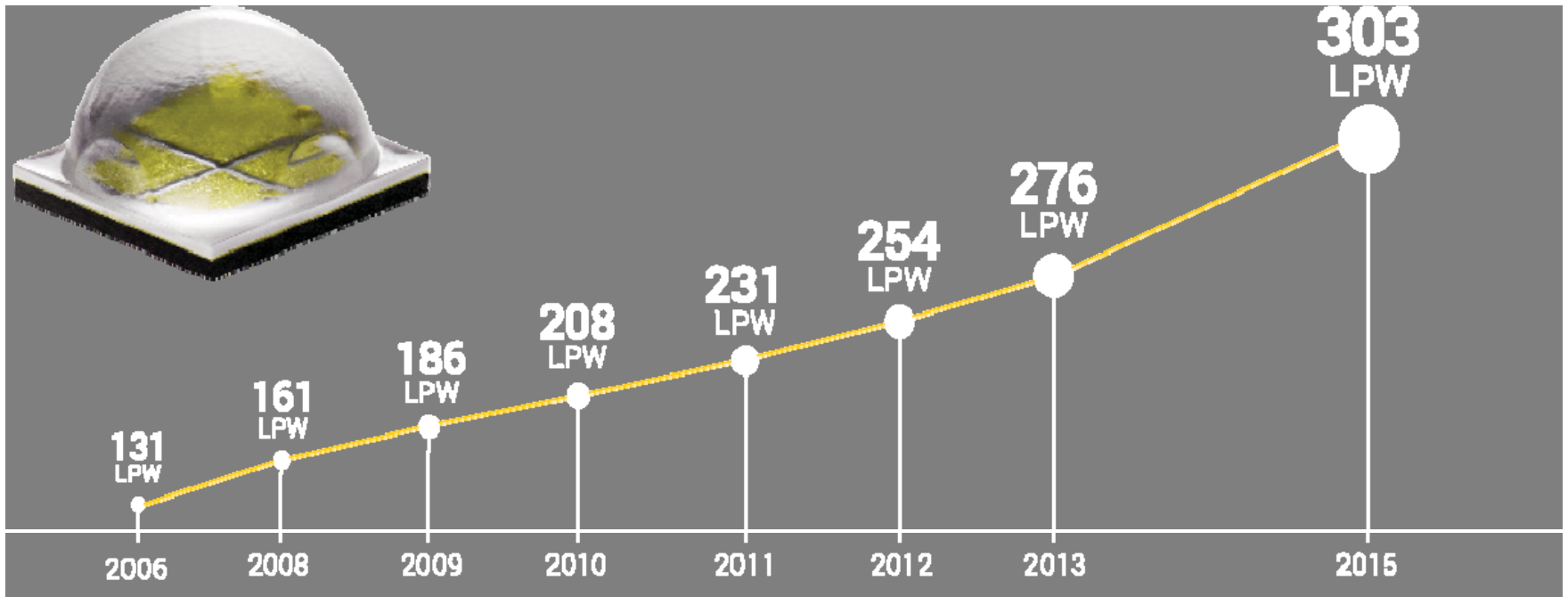
Integrated Speaker modules

LiFi to data streaming applications

Lighting provides strategic ceiling placement for advanced sensing technologies and other devices

Trend #3   LED lighting's improved efficacy & lower cost

303 LPW (2015)
276 LPW (2013)
254 LPW (2012)
231 LPW (2011)
208 LPW (2010)
186 LPW (2009)
161 LPW (2008)
131 LPW (2006)

~ 75% Price Reduction from 2007 – 2017 for Similar or Better Performance

DLC QPL Premium Troffer LPW Requirement = 125 LPW
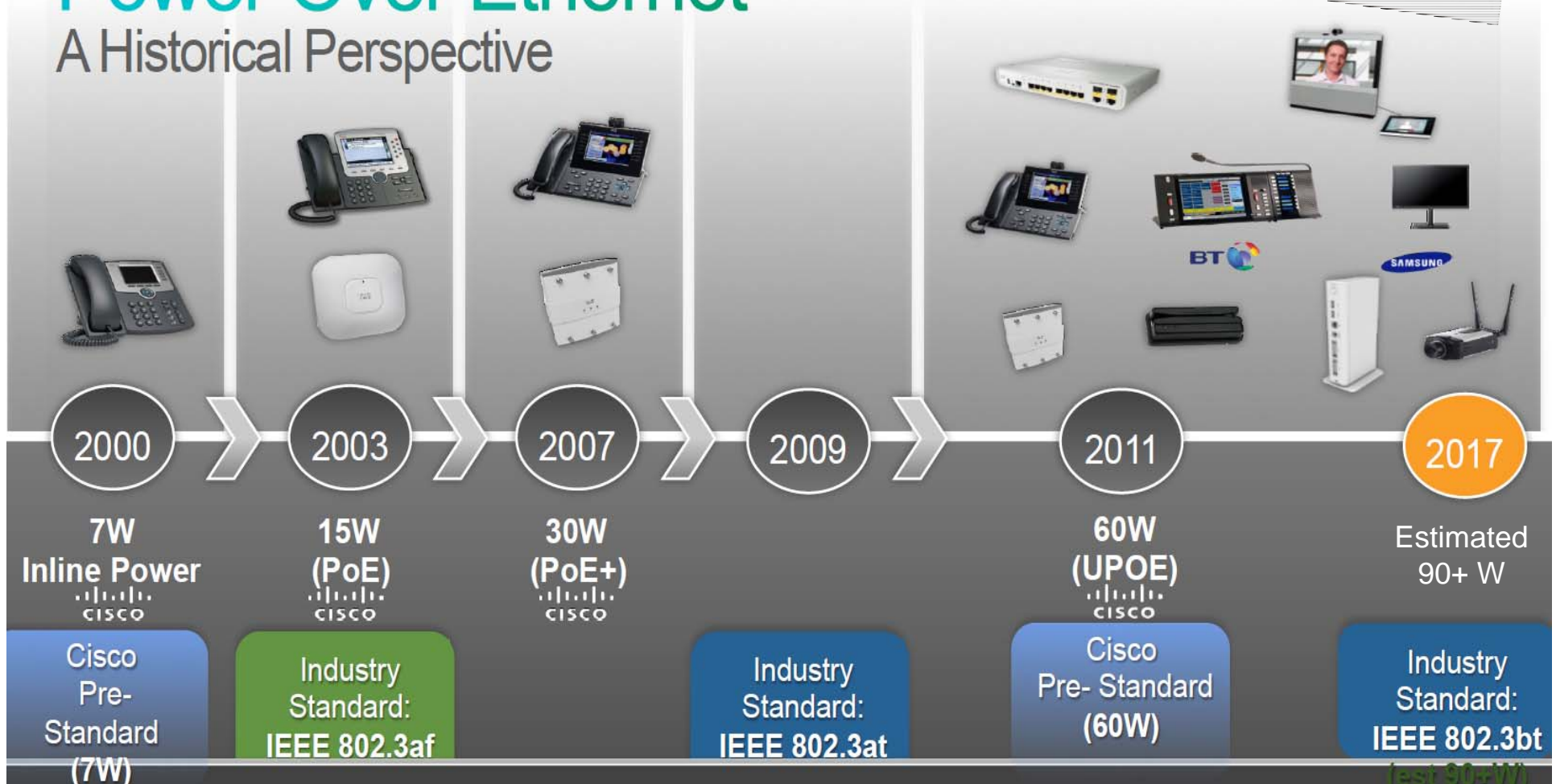**DLC QPL Standard Troffer LPW Requirement = 100 LPW**

Trend #4 Evolution of PoE Current Density


Power Over Ethernet
A Historical Perspective

2000	2003	2007	2009	2011	2017
7W Inline Power CISCO	15W (PoE) CISCO	30W (PoE+) CISCO		60W (UPOE) CISCO	Estimated 90+ W
Cisco Pre-Standard (7W)	Industry Standard: IEEE 802.3af		Industry Standard: IEEE 802.3at	Cisco Pre-Standard (60W)	Industry Standard: IEEE 802.3bt (est 90+W)

We can now power LED luminaires with PoE

Trend #5   Software Systems and *Big Data* Analytics

Increased Data Storage Capacity

Increased Computing Power

Chart: $ per gigabyte (GB) vs year (1992–2012), declining from $569 to $0.03
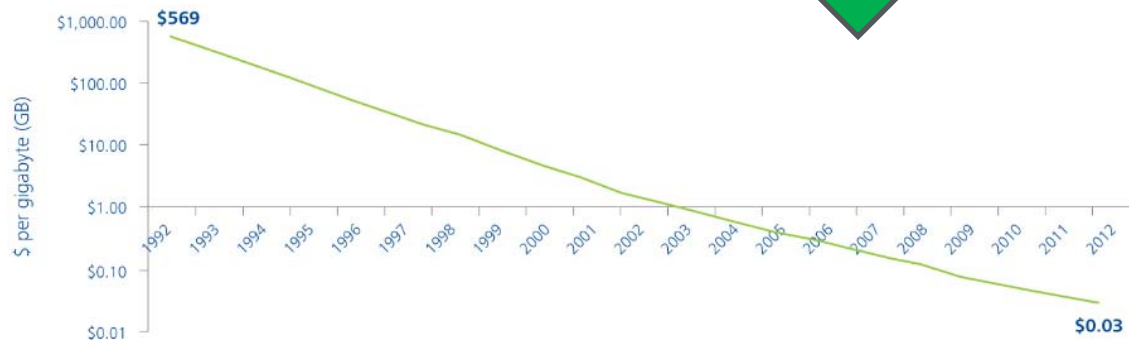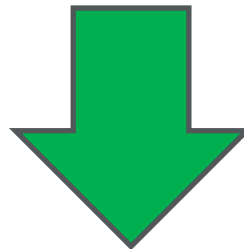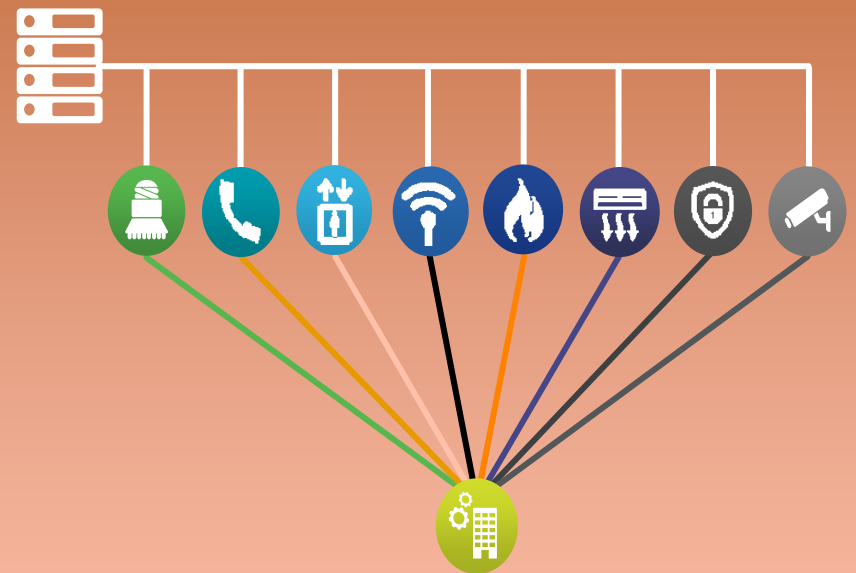
Trend #6   Building Systems Converging onto IP Network

Separate Building System Networks

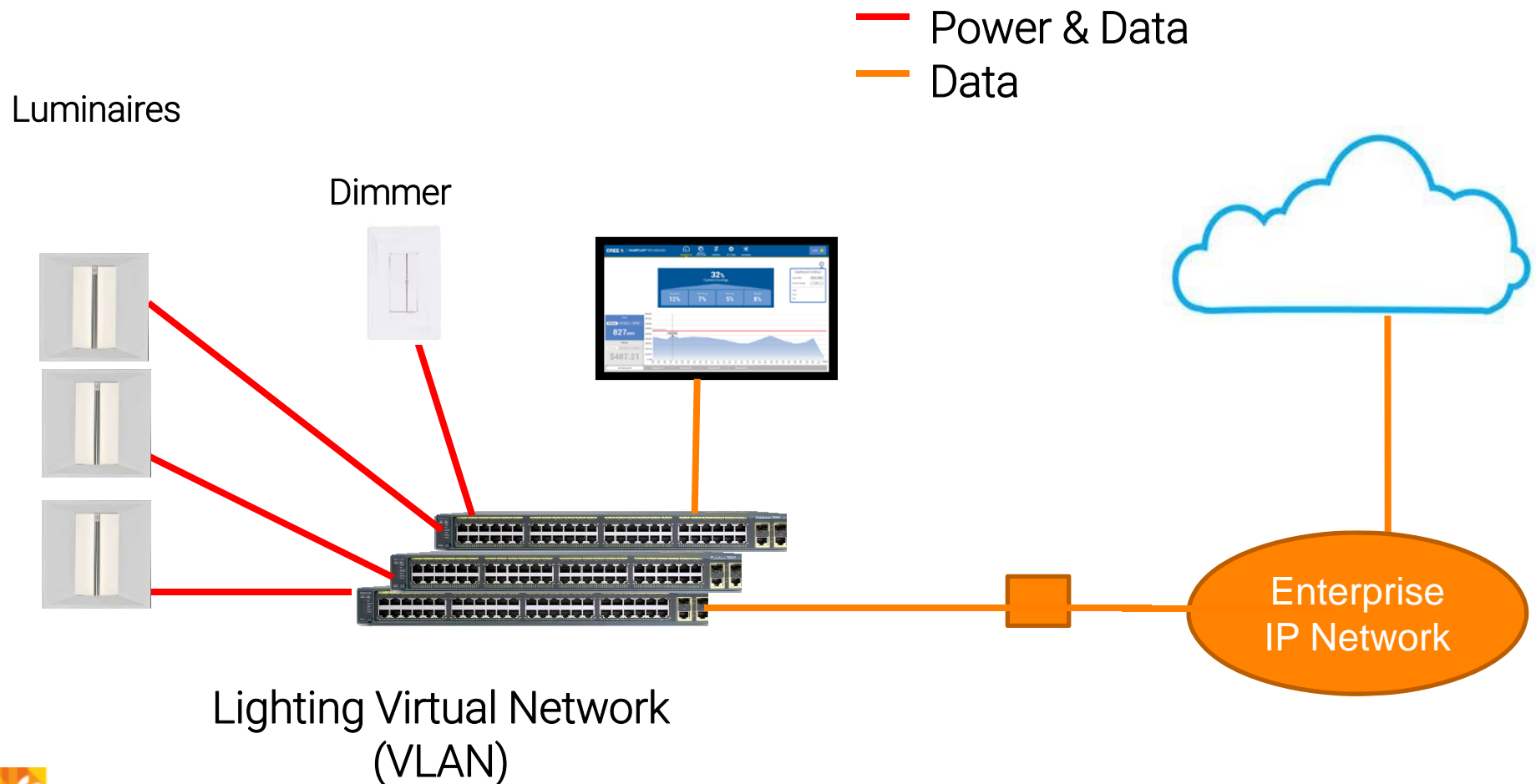Single Converged IP Network & Media

Simplified Management, Lower Cost

Why lighting is so valuable to PoE – it's everywhere

Example PoE System Overview

Power & Data
Data

Luminaires

Dimmer

Lighting Virtual Network
(VLAN)

Enterprise
IP Network

Use Cases: Where it's being used and why

Offices

Schools

Healthcare

Business Analytics

Analyze Traffic Patterns

Reallocate Space

Improve Security

Workspace Optimization with Presence Sensors

The 3 – 30 – 300 Rule

Energy
$3
SqFt/Yr

Real Estate
$30
SqFt/Yr

Employee
$300
SqFt/Yr

Enhance
User
Experience

Lower
Total Costs

Enable
Business
Analytics

How Could Enhanced User Experiences Work?

Enhance User Experience

Customized User Experience

Light On - Intensity and Color Adjusted Automatically

Room Temperature

Preset Phone & PC/Video Profile

Adapt Environment to Personal Preferences

Intelligent Light can help you find conference rooms

Photo Credit: Serraview and Eventboard

Occupancy data may be integrated with conference room scheduling apps.

Enhance User Experience

Network-powered Building Systems Communicate

Sensors Detect More People

Sensors Alert HVAC to Pipe in More Fresh Air

Automatically Optimize Environment for Group Comfort

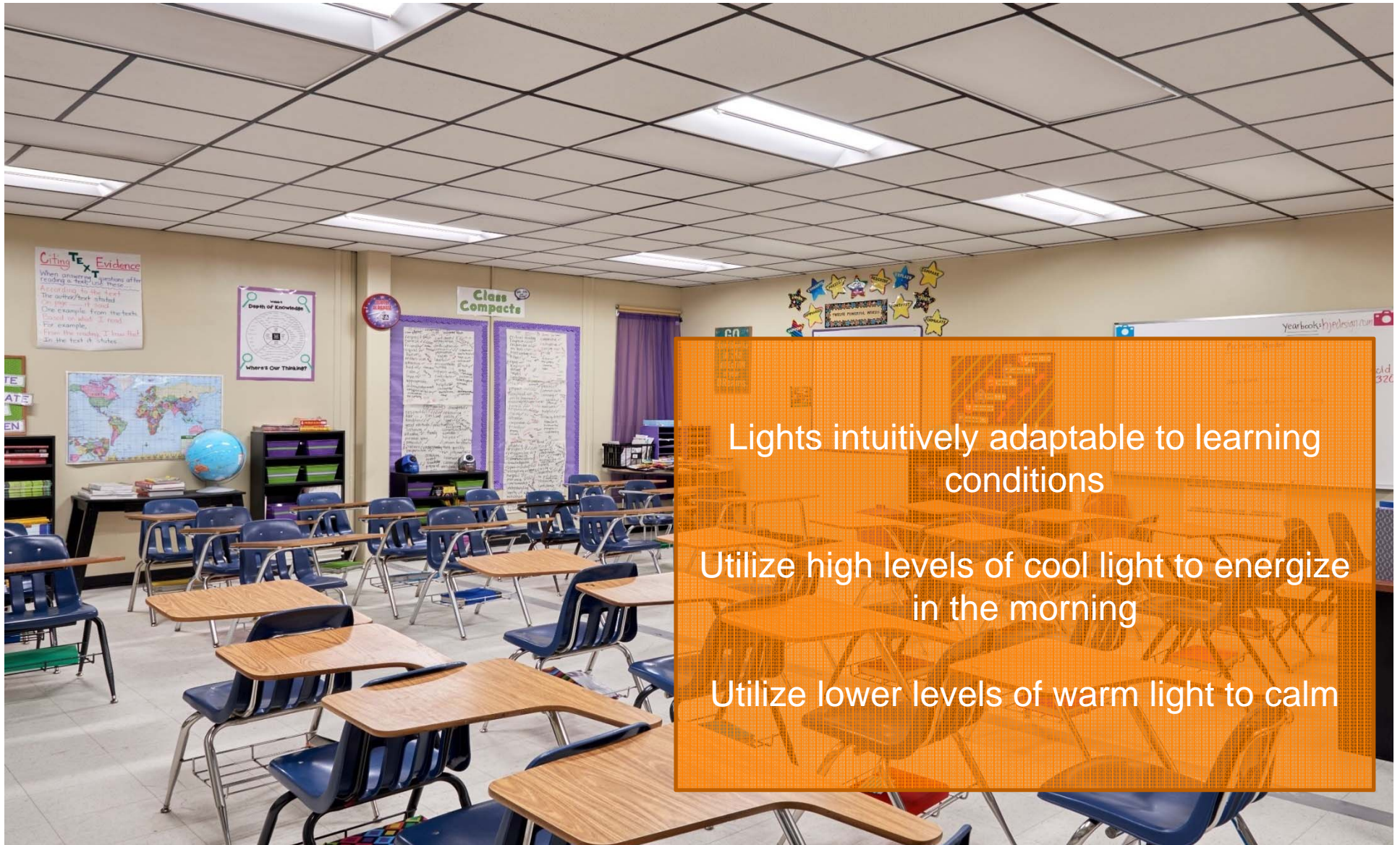## Intelligent Lighting can help keep buildings secure

Occupancy data from PoE Lighting may be integrated with security apps to detect abnormal activity and notify security electronically or with light

Intelligent Light can help students learn

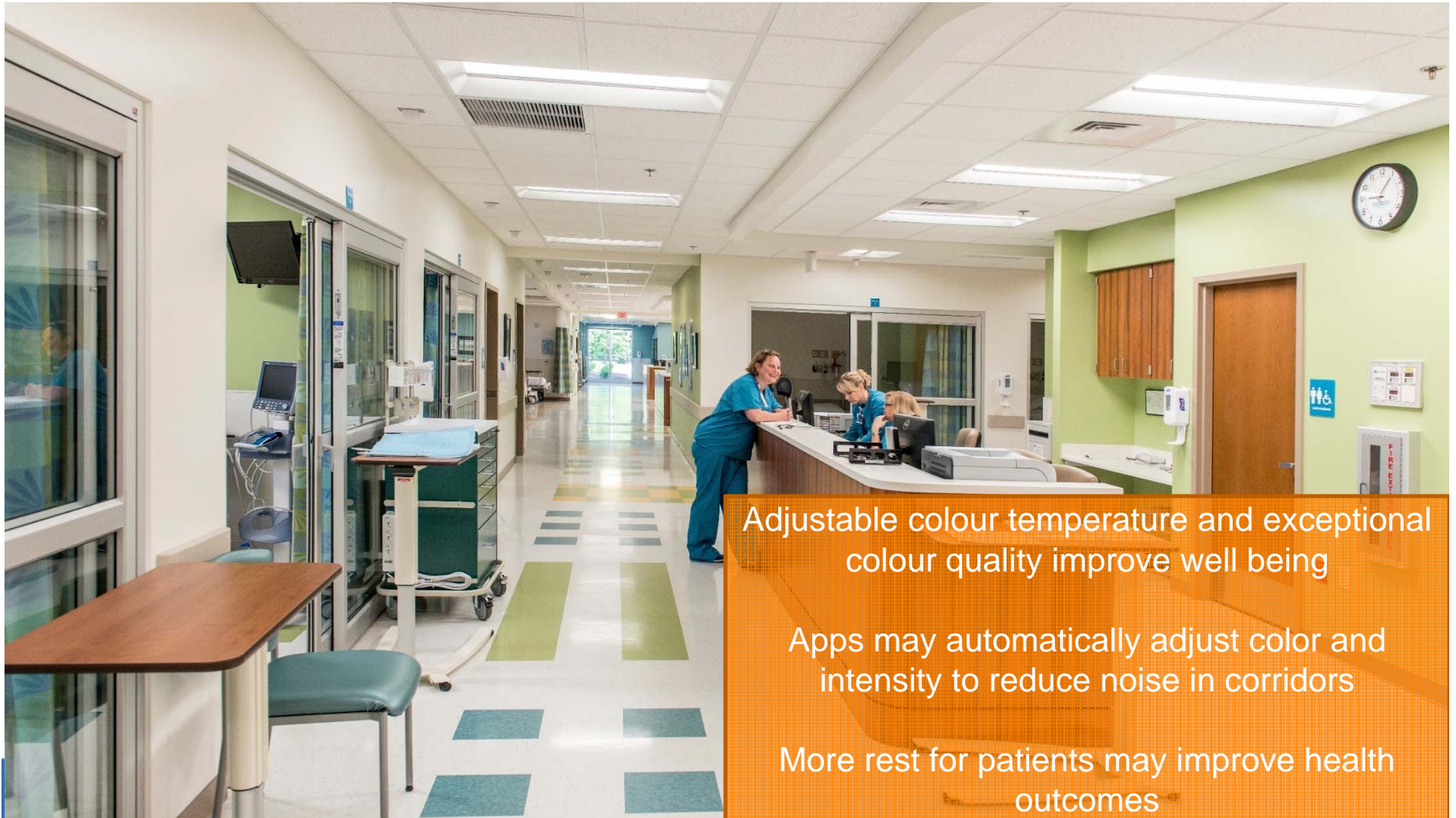Lights intuitively adaptable to learning conditions

Utilize high levels of cool light to energize in the morning

Utilize lower levels of warm light to calm

Intelligent Light can improve the patient and staff experience

Adjustable colour temperature and exceptional colour quality improve well being

Apps may automatically adjust color and intensity to reduce noise in corridors

More rest for patients may improve health outcomes

Considerations

1. New construction or deep retrofit
2. Sensor integration, one per luminaire
3. Secure – validated designs
4. IT and Facility teams
5. Open API (allows for third-party App's)
6. Scalability
7. Commissioning process

Land Rush – existing ceilings

- prime real estate for non-lighting companies

- interior and exterior

- fight for lighting quality – don't want the lighting
to become a footnote to the data

Intelligent Lighting is Rapidly Transforming the Lighting Industry

This transformation will be even more dramatic than the solid state lighting transformation.

Lighting is converging with IT to enable benefits WAY beyond light that make organizations more effective and profitable.

IES Montreal Mar 2017

Smart, Connected Lighting: a Look at the Value of Lighting Systems on Power over Ethernet

Shirley Coyle, Cree, Inc.