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NAESCO
Midwest Regional Meeting
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Wireless Lighting Control Technology

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Enabling Wireless Technologies

- **IEEE 802.15.4**
  - –low data rate solution
  - –multi-month to multi-year battery life
  - –very low complexity
- **ZigBee**
  - –standards-based wireless platform

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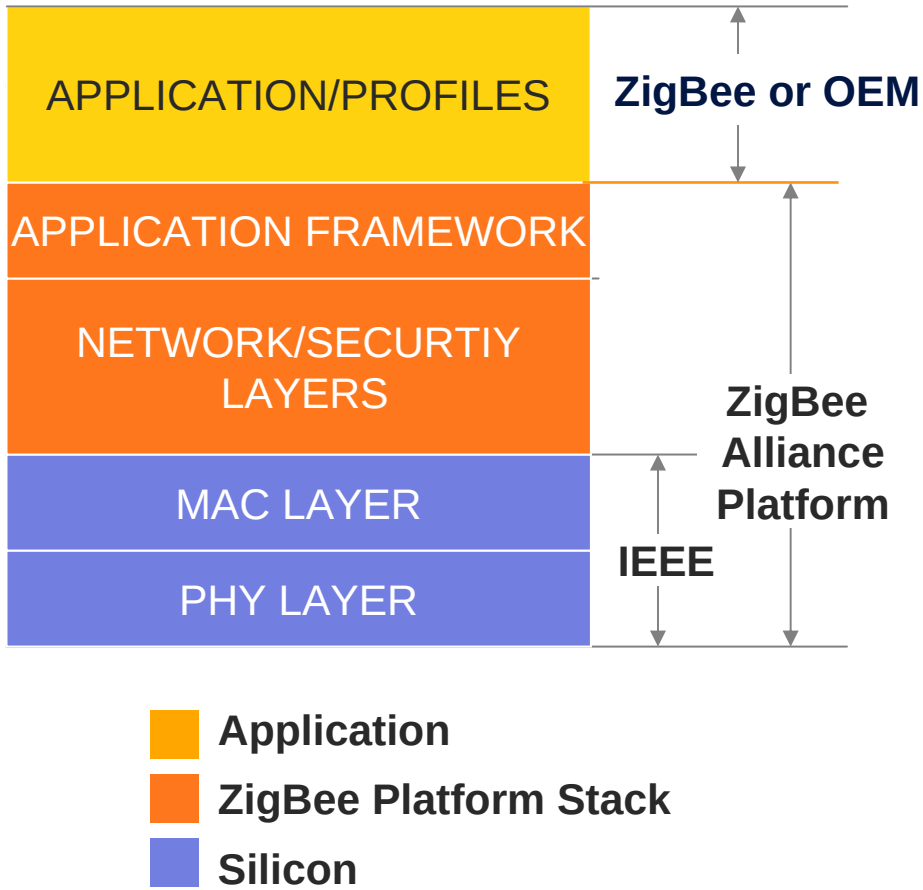
How is ZigBee related to IEEE 802.15.4?

- ZigBee takes full advantage of a powerful physical radio specified by IEEE 802.15.4
- ZigBee adds logical network, security and application software
- ZigBee continues to work closely with the IEEE to ensure an integrated and complete solution for the market

Protocol Stack Features

- 8-bit microcontroller (e.g. 80c51)
- Compact protocol stack
- Supports even simpler slave-only stack



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What is the ZigBee Alliance

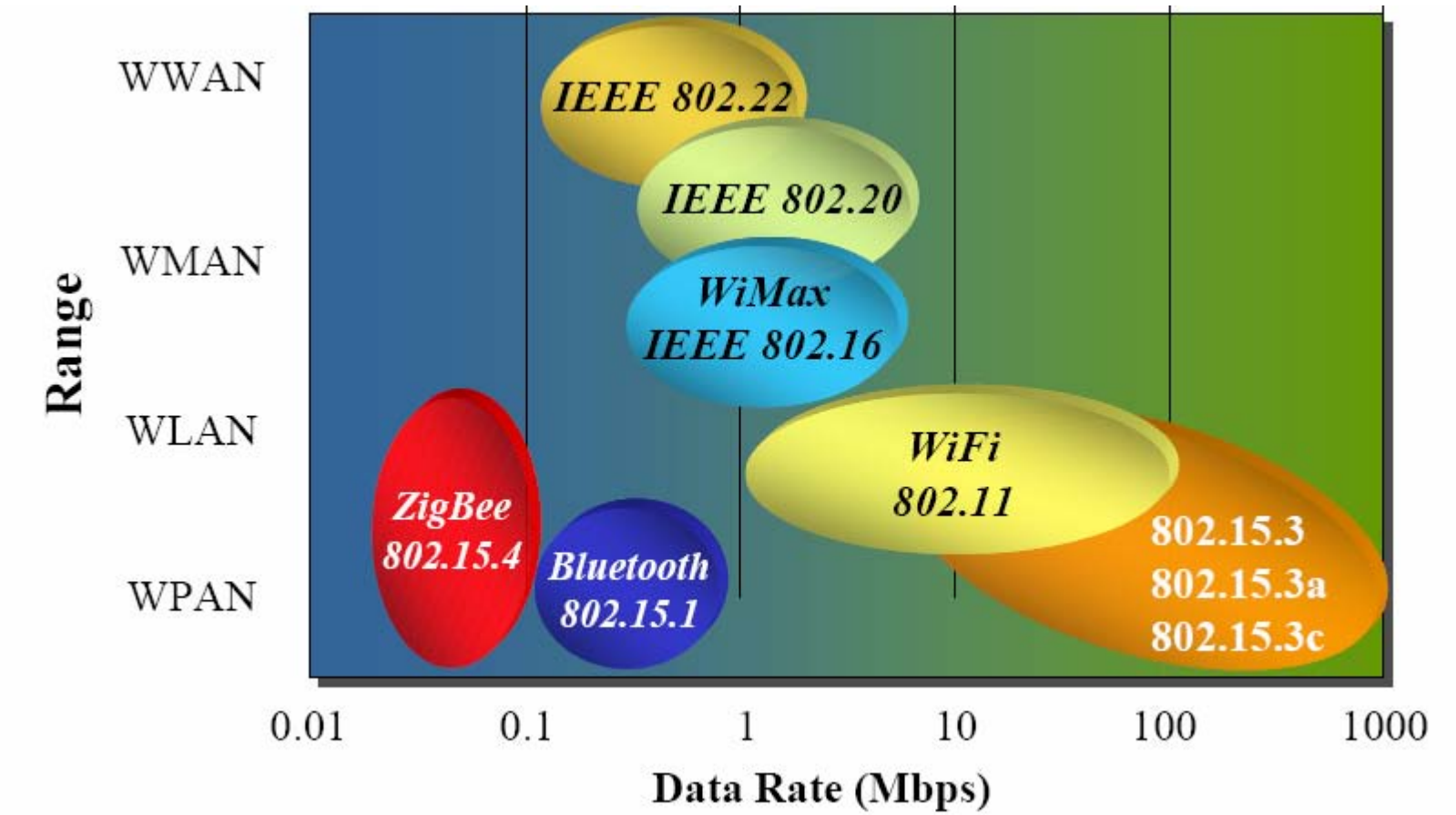
- An Organization with a mission to define reliable, cost-effective, low-power, wirelessly networked, **monitoring and control** products based on an open global standard
- Alliance provides
  - upper layer stack and application profiles
  - compliance and certification testing
  - branding
- Result is a set of interoperable solutions recognizable in the market

ZigBee Alliance Supporters

ZigBee Wireless Features

- Wireless for Communication
  - –802.15.4
  - –2.4 GHz (Worldwide), 868 MHz (Eur), 915 MHz (Americas)
- Battery Operation (up to 10 years)
- Scalable, flexible up to **65,000** network nodes
- Low latency (30 msec)
- Distributed Control of Lighting
  - –Open Protocol for communication – Zigbee

802 Wireless Space



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Evolution of Lighting Control (Light Switches)

- Standard Wired Toggle Light Switches are the most common type of Lighting Control
- Least initial cost; least efficient system.

Evolution of Lighting Control

(Contactors, Relays, and Smart Circuit Breakers)

- Wired Contactors, Relays, and Smart Circuit Breakers are mostly used in Commercial and Industrial Applications.
- 25% of Commercial and Industrial Buildings have one of these forms of Lighting Control.

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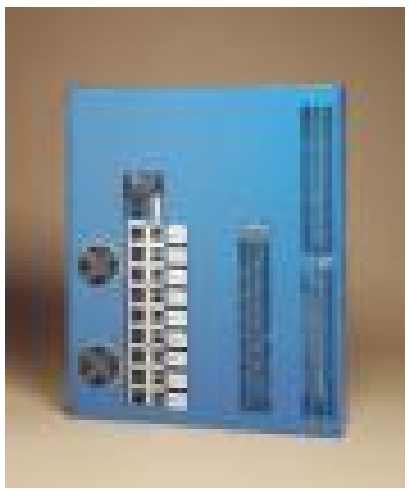
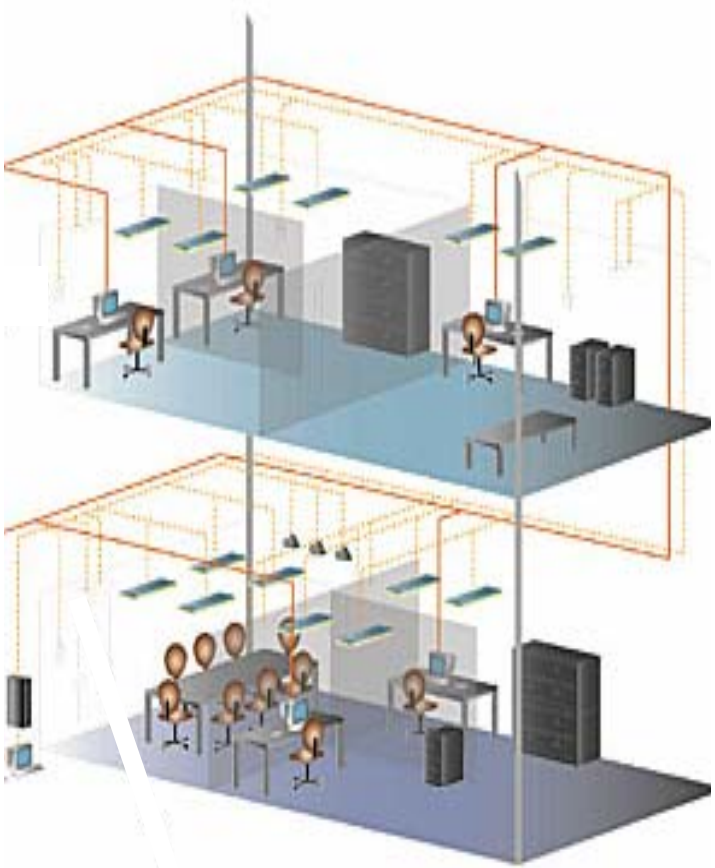
Evolution of Lighting Control
(Dimmers and Dimming Systems)



- Wired Dimmers and Dimming Cabinets are used in Residential, Commercial, and Industrial Applications.
- 15% of Residential, Commercial and Industrial Buildings have one of these Dimmers and Dimming Systems.

Evolution of Lighting Control
(Wired Digital Lighting Control)



- Wired Digital Ballast, Wall Controls, and Accessories are used in Commercial Applications.
- Penetration of Wired Digital Lighting Control into Commercial Buildings is <1%

Benefits of Digital Lighting

- **Operational**
  - –Control and automate lights through local control or remotely via internet
  - –Interoperability with other subsystems HVAC, BAS, security etc…
  - –Quickly and easily adjust or reconfigure the lighting system and/or lighting operation

- **Maintenance**
  - –Predictive diagnostic capability of lamps and ballasts.
  - –Individual addressability of ballast/lamp outages.

Benefits of Digital Lighting

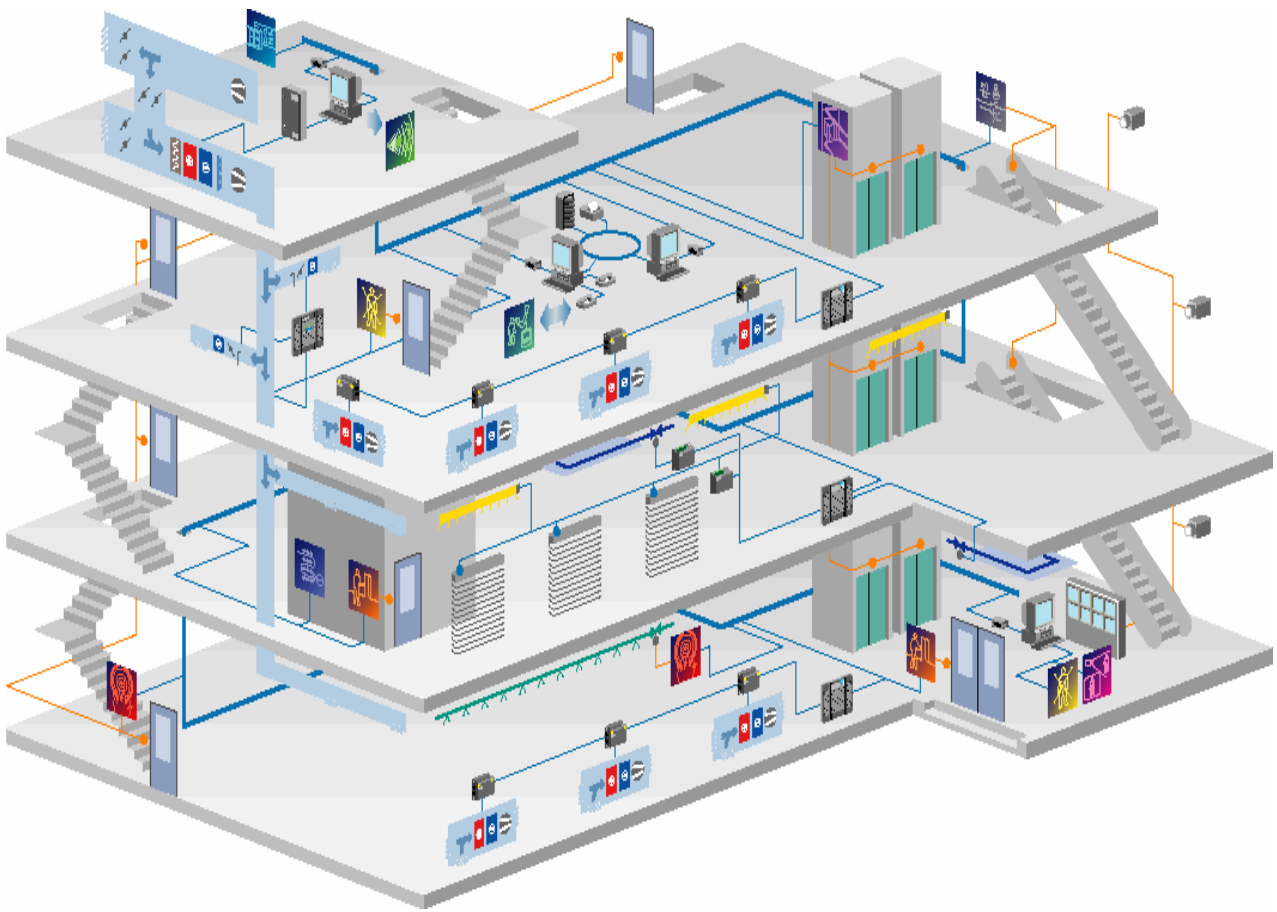
- **Energy Efficiency**
  - –Real time monitoring of lighting system energy usage
  - –Automate light level adjustments when employing daylight harvesting
  - –Load shedding capability during peak demand periods
  - –Tuning system to maximize potential for energy savings

Benefits of Digital Lighting

- **Personal Comfort/Safety**
  - –Personal control of of lights with virtual controls via an employee's PC/handheld or remote control
  - –Signal activated individual pathway and office space lighting.
  - –Enhance fire and life safety systems by providing automated emergency lighting functionality
  - –Integrates with building security systems to help enhance personal security.

Future Vision – Enabler of the Sustainable Building

- **Integration of physical structure with mechanical and electrical building systems**
- **Sub-System Interoperation**
- **Share and utilize data**
- **Provide exciting new benefits for occupant/owner/ environment**



CCTV
Access
Chillers
Fire Systems
Security
HVAC
Voice Response
General
Lighting
Lift Control
Paging

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Evolution of Lighting Control
(Wireless Digital Lighting Control)

- No communication wires!
- Ballasts, wall switches, remotes, function as network nodes.
- Software enabler of improved functionality
- More easily inter-operate with other systems.

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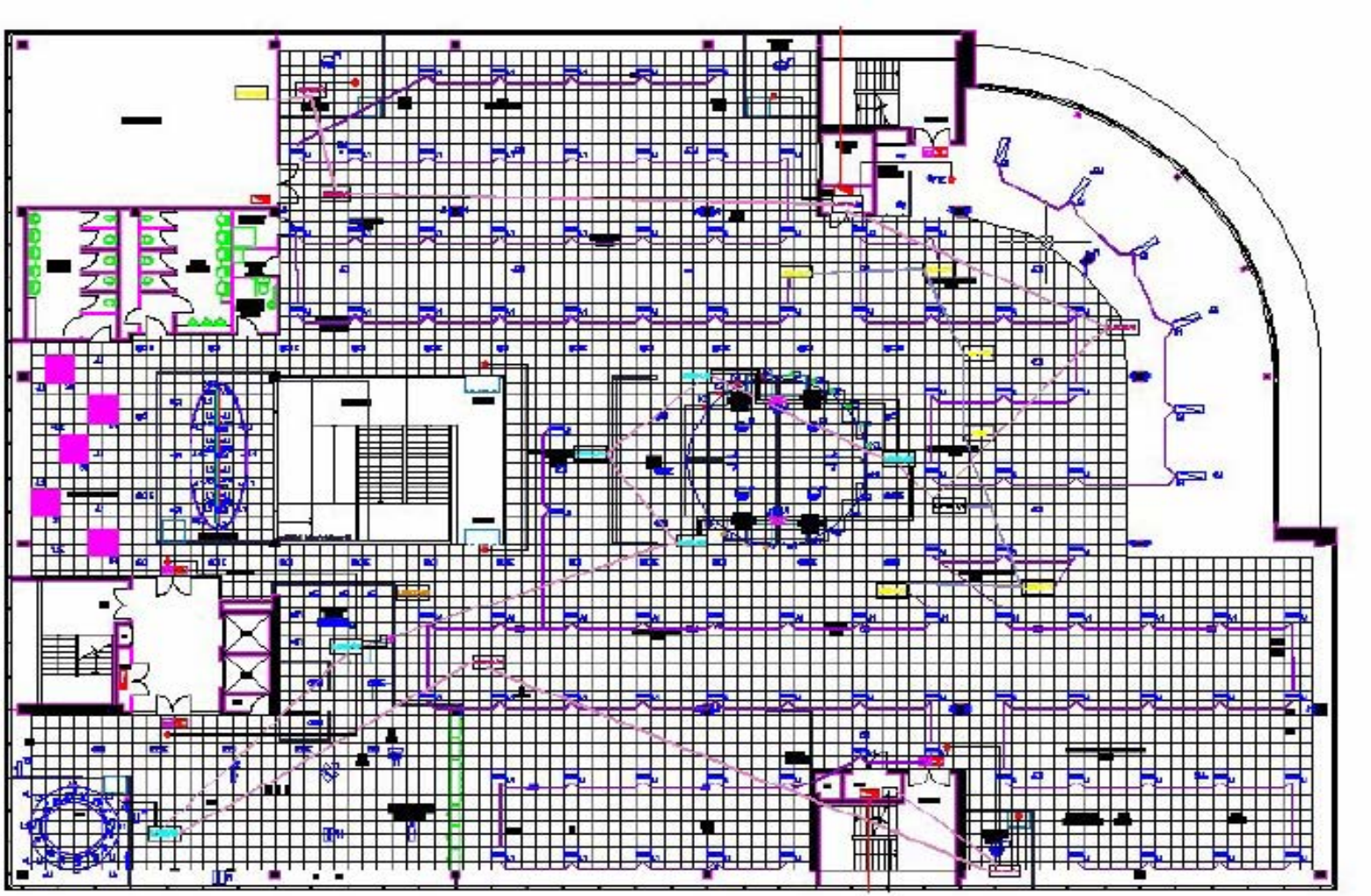
35K Sq Ft. Lighting Control Retrofit



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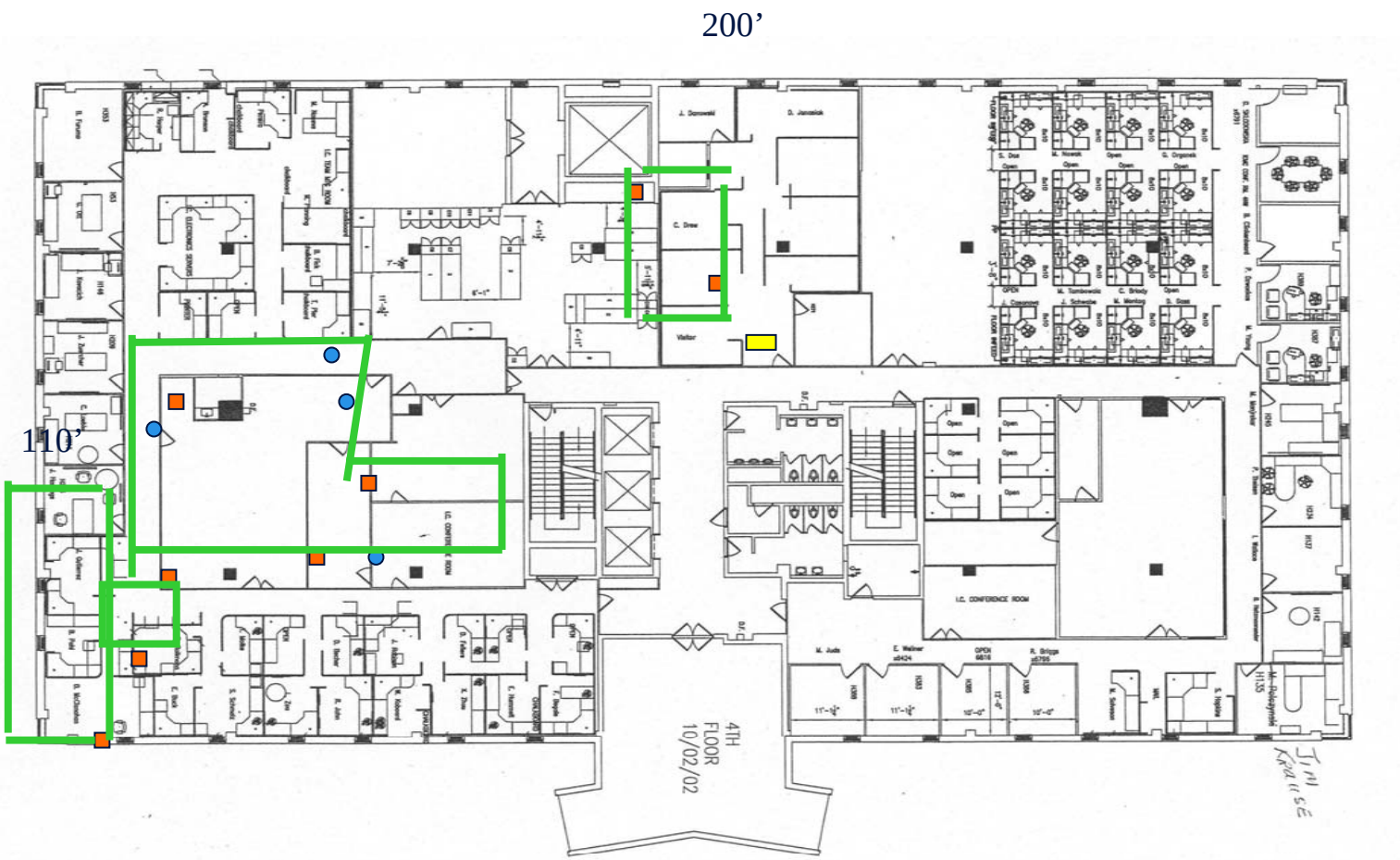
50k Sq Ft. Wireless Lighting Control Retrofit



53 Wireless Ballasts

9 Wall Switches

12 Motion Sensors

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Office Renovation

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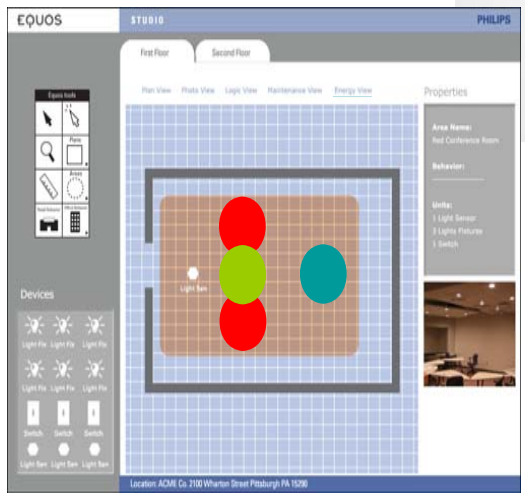
Wireless Lighting Control - Technology

- Core Technology
  - Wireless 802.15.4
  - ZigBee
  - Open Software
- Devices
  - Ballasts
  - Device Level Controls
  - System Controller
- Software

ZigBee

Wireless Control that Simply Works

BUILDING AUTOMATION



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Ballast as a network node

- Ballast form factor remains unchanged and no changes to fixture are required.

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Ballast as a network node

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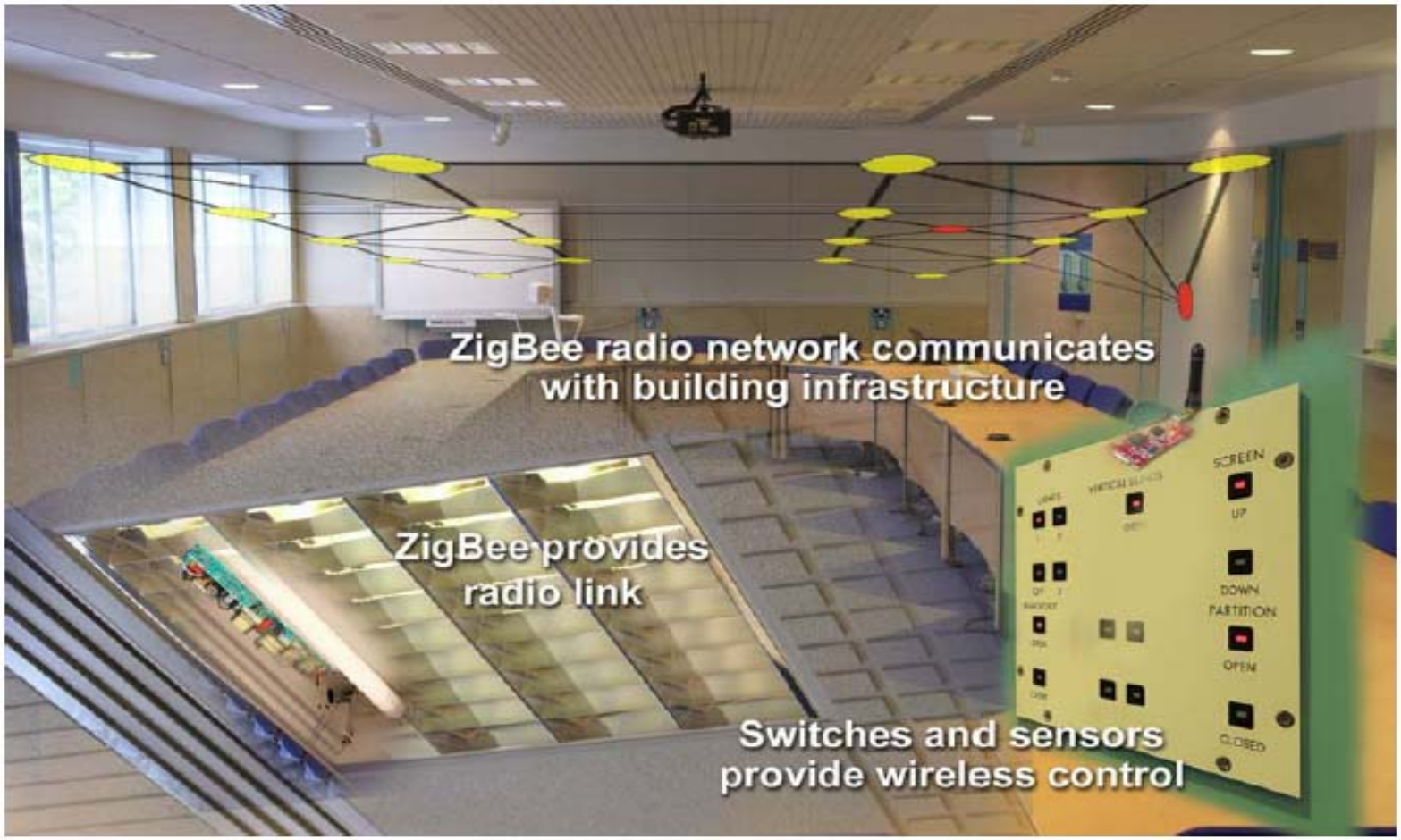
Wireless Lighting Control System



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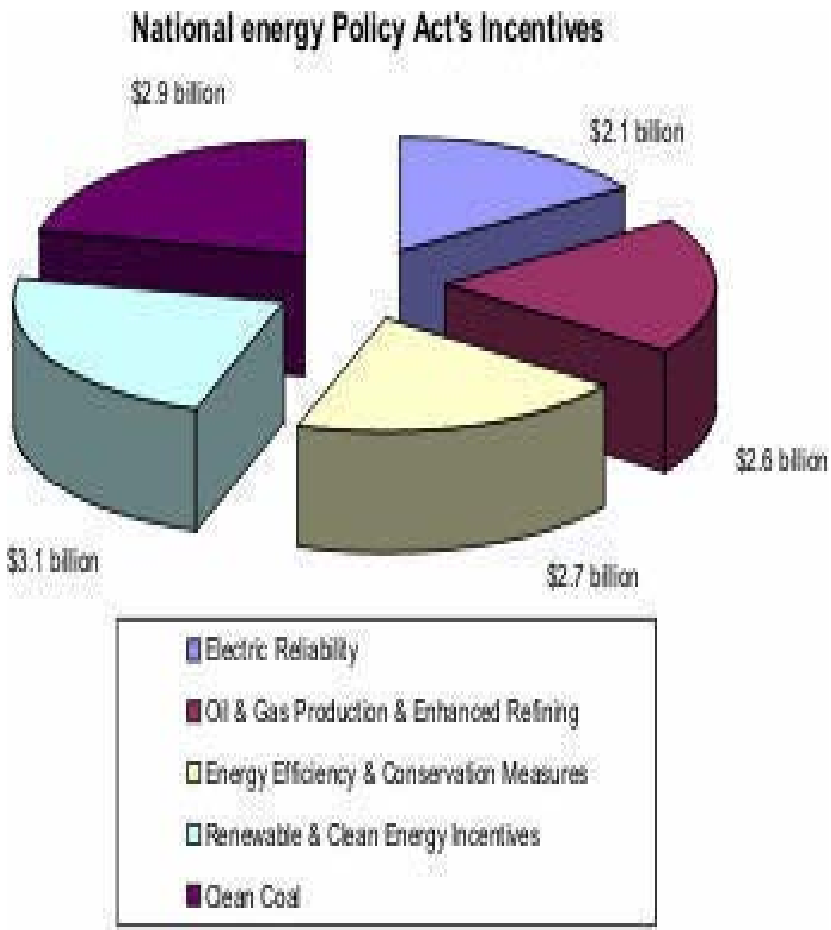
Market Drivers

- Energy Policy Act of 2005
  - $2.1B Electric Reliability
  - $2.7B Energy Efficiency



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Market Drivers

- ***Washington State Approves Green Building Law -*** Washington Governor Christine Gregoire signed a bill into law in early April that requires new public schools and other state buildings to meet green building standards (LEED)

- ***Arizona -*** Governor Janet Napolitano took a more direct route to encourage green building for new state buildings: in February, she issued an executive order. The order requires new state buildings to meet the Silver LEED standard

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Wireless Integrated Lighting Control

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Philips Equos™

- Beta Sites 2006
- Commercial Introduction 2007

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