Lighting and the Internet of Things

2016 DoE Connected Lighting Workshop
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About Me

8 years
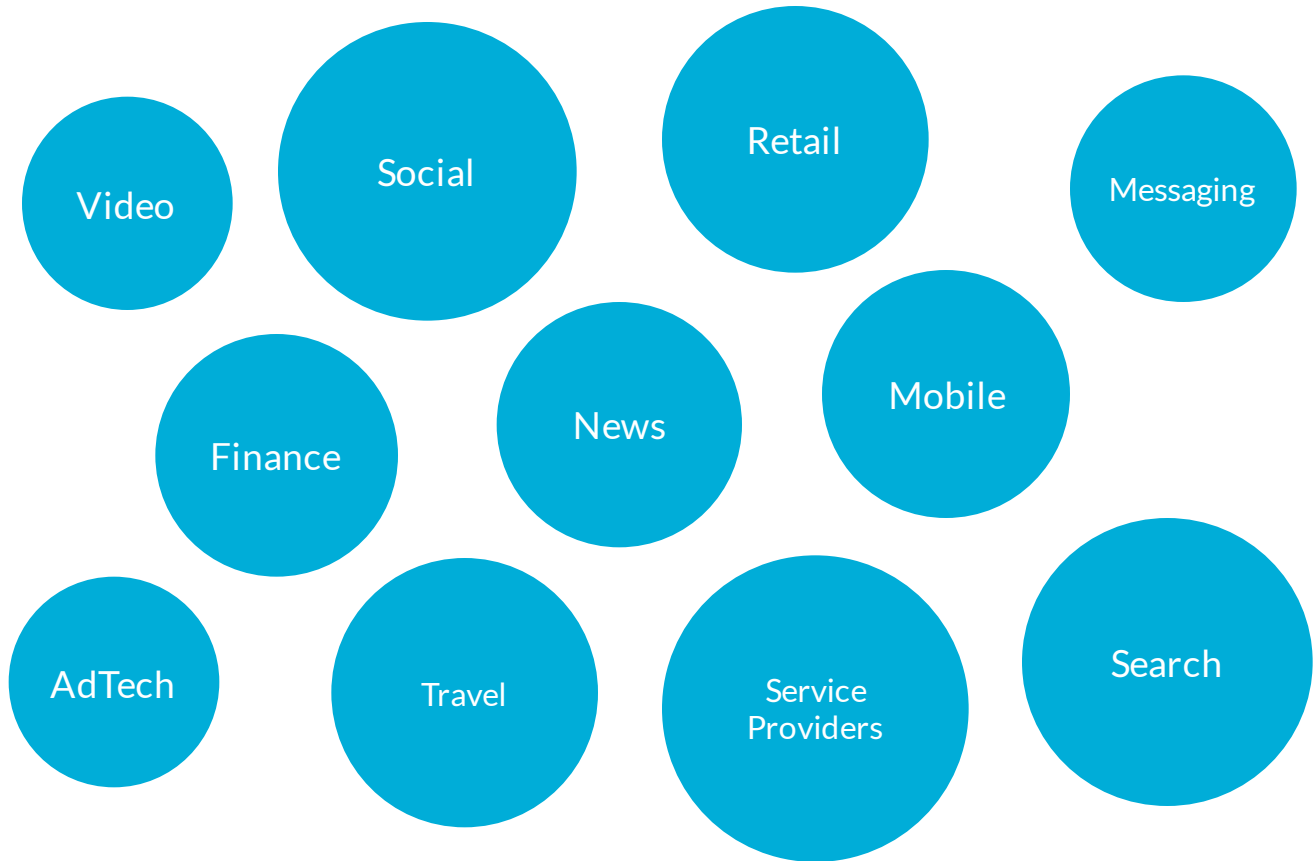
300M sq.ft. installed

45 countries

Geek

Color Kinetics

Robots

What I'll Cover

- The IoT is going to be huge

- Lighting is poised to play a pivotal role
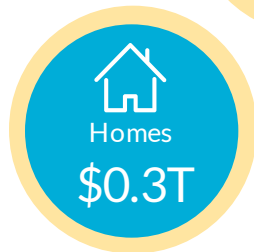
- Let's try not to screw it up

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"The Internet" : 1996 :: "The Internet of Things" : 2016

"The Internet of Things" in 2025

Segments with potential connected lighting impact

Retail
$1.2T

Factories
$3.7T

Vehicles
$0.7T

Cities
$1.7T

People
$1.6T

Offices
$0.2T

Homes
$0.3T

Outdoor
$0.9T

Work Sites
$0.9T

Icons designed by Freepik

IoT segment size estimates by McKinsey: http://www.mckinsey.com/business-functions/business-technology/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world

- **Information and analysis**
  - Tracking behavior
    - Monitoring the behavior of persons, things or data through space and time
  - Enhanced situational awareness
    - Achieving real-time awareness of physical environment
  - Sensor-driven decision analytics
    - Assisting human decision making through deep analysis and data visualization
- **Automation and control**
  - Process optimization
    - Automated control of closed (self-contained) systems
  - Optimized resource consumption
    - Control of consumption to optimize resource use across network
  - Complex autonomous systems
    - Automated control in open environments with great uncertainty

IoT application taxonomy by McKinsey: http://www.mckinsey.com/industries/high-tech/our-insights/the-internet-of-things

- ## Where do we put all these IoT devices?

  - ### Lighting is everywhere the IoT wants to be

- ## How do we power them?

  - ### As low-voltage, semiconductor technology, LEDs are inherently compatible with processing, sensing, and networking devices

- ## How do we connect them?

  - ### The networks being deployed for lighting can be leveraged to connect a wide range of IoT devices

- ## How do we pay for them?

  - ### Lighting is the only IoT platform that pays for itself

Three Potential Topologies

Nodes fully integrated into luminaires

   PRO: Easy installation; highest sensing granularity

   CON: Requires luminaire customization; higher cost

Nodes installed elsewhere, but sharing power and network

   PRO: No luminaire customization required

   CON: Have to mount nodes somehow; making remote can add interface cost

Nodes installed elsewhere, powered independently, but sharing network

   PRO: Cleanest solution; no impact on luminaires

   CON: Have to power nodes somehow; at this point why bother with lighting integration?

Lighting & IoT Convergence Themes

Health & Wellness

Active sleep management via wearables and tunable lighting

Clinical light therapy to treat depression and seasonal disorders

Safety & Security

Egress lighting that can interactively guide you to safety

City-scale sensor networks that help police identify emergencies

Tracking & Location Services

Retail lighting with integrated cameras to track shopper expressions

Indoor location services as reliable and pervasive as GPS

Process Optimization

Full-facility granular resource tracking built on top of lighting networks

Shift worker productivity management via spectral stimulus

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- More powerful, flexible and inexpensive sensors

- Research on physiological responses

- Low-cost wired and wireless networking

- Software and apps that make lighting easy to use

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- LEDs last a really really really long time

- The economics only work on initial replacement

- Once a socket is filled with a dumb LED, it's tough to justify an upgrade to an intelligent alternative
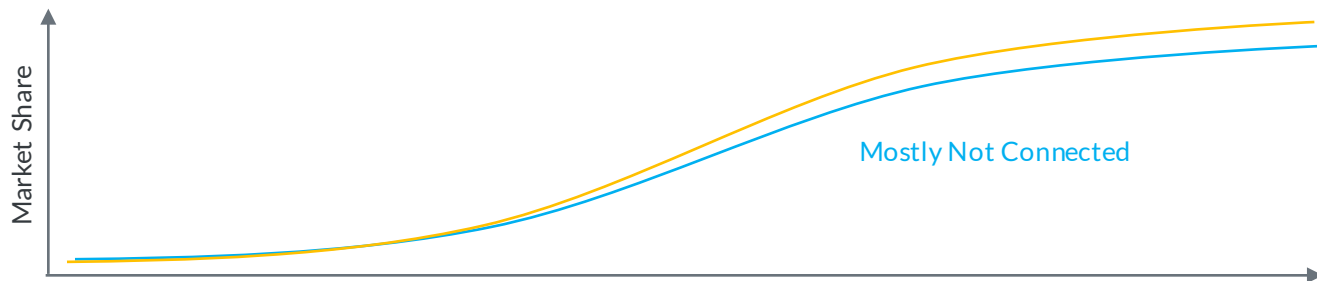
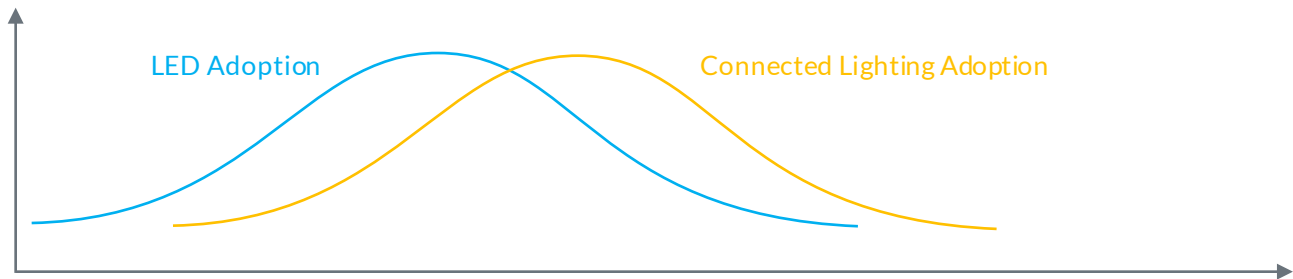- **We only get one shot!**

The S-curve of adoption
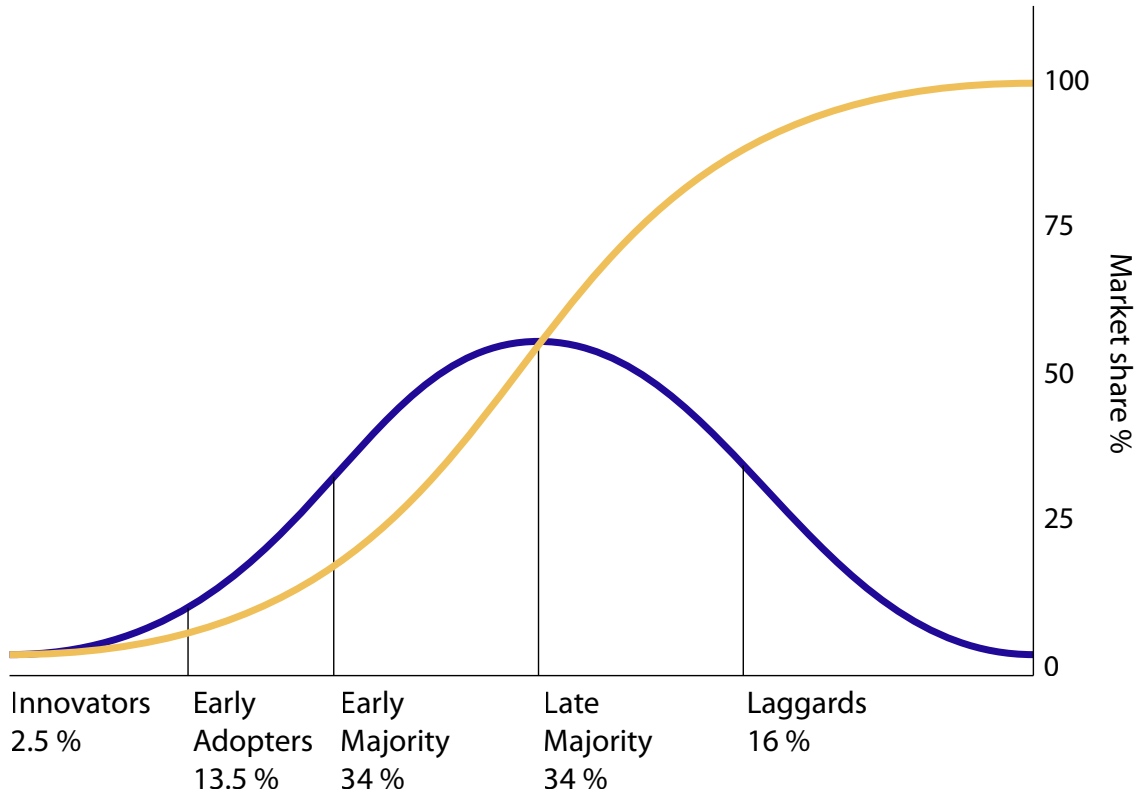
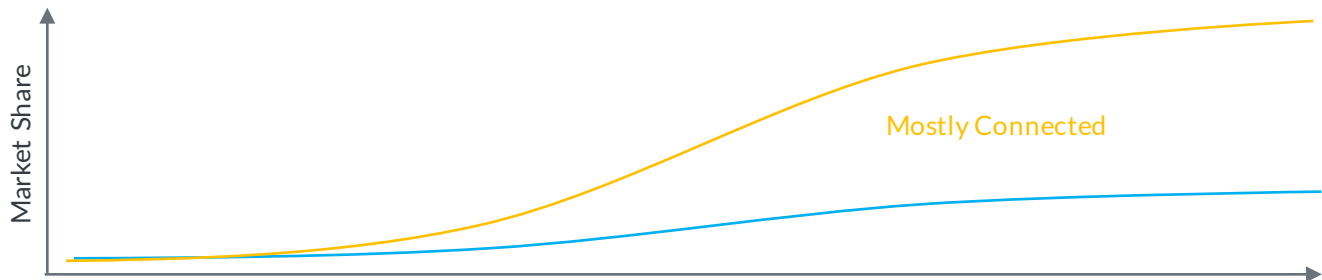Based on Rogers, E. (1962) Diffusion of innovations. Free Press, NY, USA.
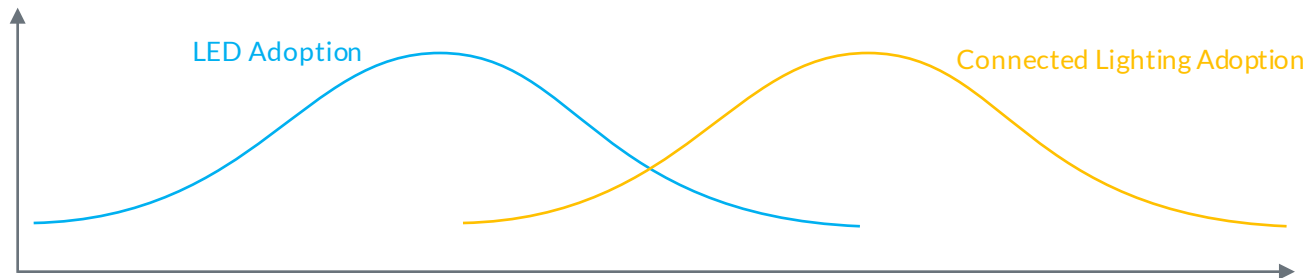
A lag in convergence means the install base turns over to LEDs, but very few are connected.

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LED Adoption

Connected Lighting Adoption

Connected systems end up with dominant market share when convergence happens sooner.

Market Share

Mostly Connected

5 mistakes not to make

Mistake #1: Underestimate other players

Building Automation Giant

"Lighting companies are dinosaurs. We own the building. If anybody's going to lead the convergence, it'll be us."*

IT/Networking Giant

"Lighting and building automation companies are both dinosaurs. Our products – routers, servers, and edge devices – are the real backbone of the modern building."*

IoT Pure Play

"All of these hardware companies are dinosaurs. We're going over the top with software and services."*

* - all quotes are fake!

Mistake #2: Focus on technical specs instead of end user value

Mistake #3: Rely exclusively on the current channel

Mistake #4: Ignore software and user experience

Mistake #5: Downplay interoperability

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Thank you!

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