Intelligent Cities

2016 DOE Solid-State Lighting R&D Workshop

Himamshu Prasad (HP)
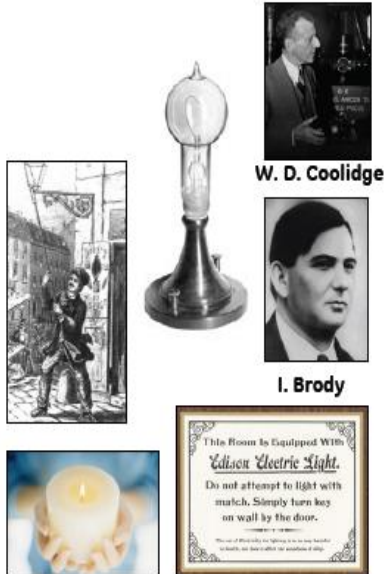**Global Product Manager – Outdoor Controls**
GE Lighting

Lighting Transformation

1st Transformation
More Light
(1879 - 1938)

W. D. Coolidge

I. Brody

2nd Transformation
Greater Efficiency
(1938 - 1990s)

I. Langmuir
W. R. Whitney

3rd Transformation
Environmental Responsibility
(1990s – Present)

4th Transformation
Intelligent Applications
(2014 - …)

✓ Intelligent Governance
✓ Intelligent Environments
✓ Intelligent Health
✓ Intelligent Mobility
✓ Intelligent Security
✓ Intelligent Communications
✓ Intelligent Utilities

| 1879 | 1909 | 1938 | 1961 | 1980's | 1990's | 21st Century |

LED

LED Efficiency Evolution

Efficiency Increasing
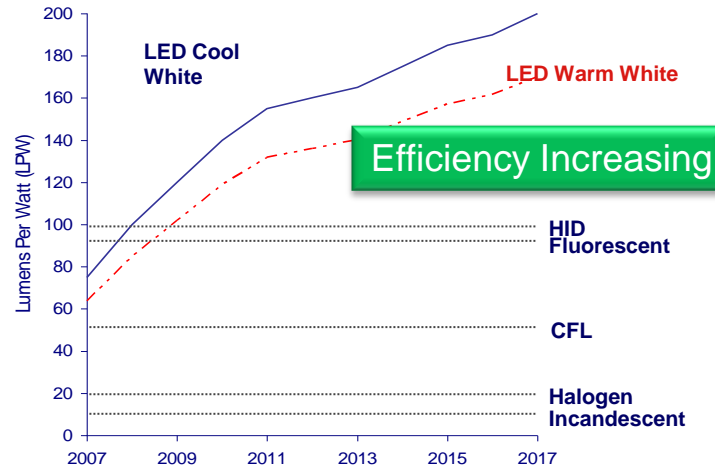
LED Cost Trajectory

Costs Decreasing
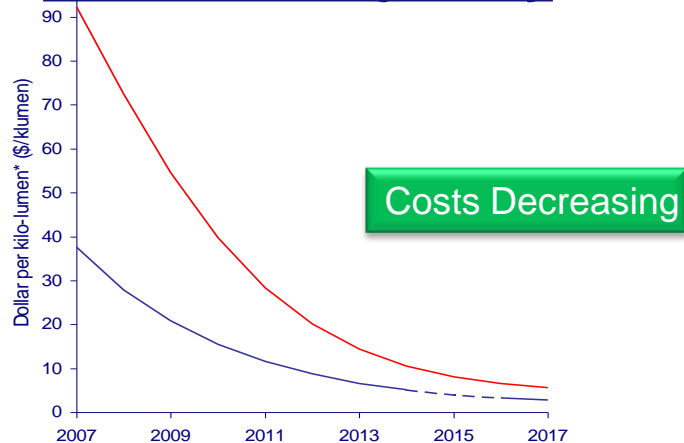
	Conventional	LED
Environment		🟢
Lumen Maintenance 50,000 hrs		🟢
Running Cost (10 Years)		🟢
Initial Cost	🟡	
Life		🟢
Uniformity (Light Pollution)		🟢
Vibration		🟢
Efficiency (LPW)		🟢
Energy Consumption (LPD)		🟢
Insect Damage (UV)		🟢

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Lighting Controls

✓ For remote monitoring, control and operation of all fixtures through a Web-enabled central management system

✓ Accurate, utility-grade energy measurement per pole

✓ GPS chip embedded into each node and gateway for easy commissioning and
asset management

Node

Cellular Modem

Fixture

RF Mesh
802.15.4
6LoWPAN

Cellular Backhaul

Gateway

Wireline
Backhaul

Central Management
System
(Hosted or Installed)

Web Application
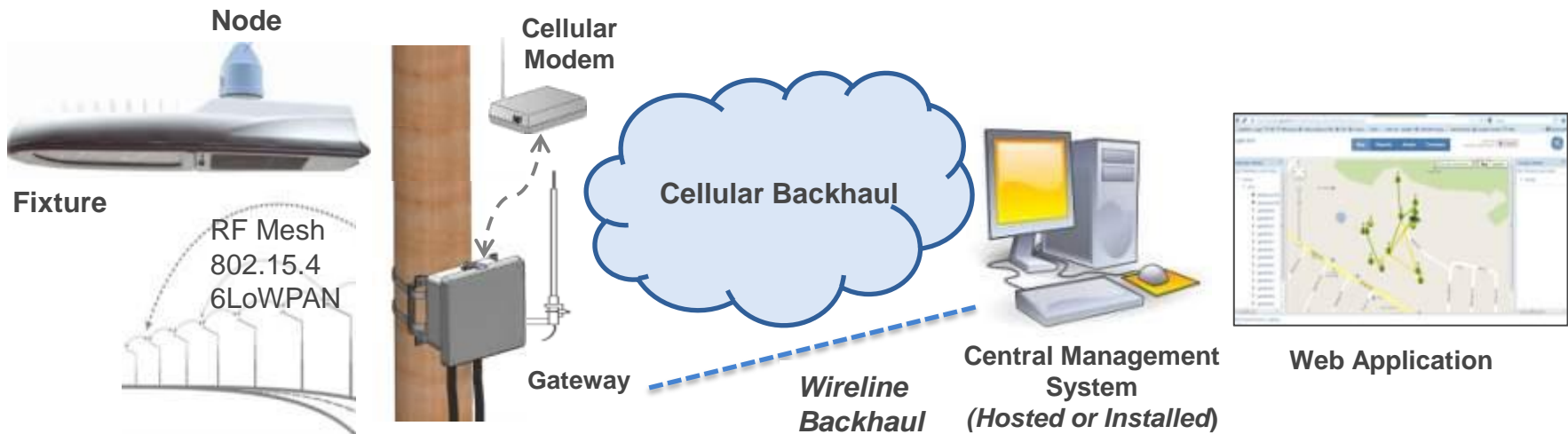
Cities face some tough challenges.

Street lighting costs the U.S. upward of

$8 Billion/Yr

Traffic congestion costs the U.S. economy

$100 Billion/Yr

Lighting accounts for nearly

1.9 Billion

Tons of CO_2 per year

131.8 Million

people live in U.S. counties receiving an F for ozone or particle pollution

Variation in U.S. economy associated with weather variability is estimated at

$485 Billion

Air pollution causes

200,000

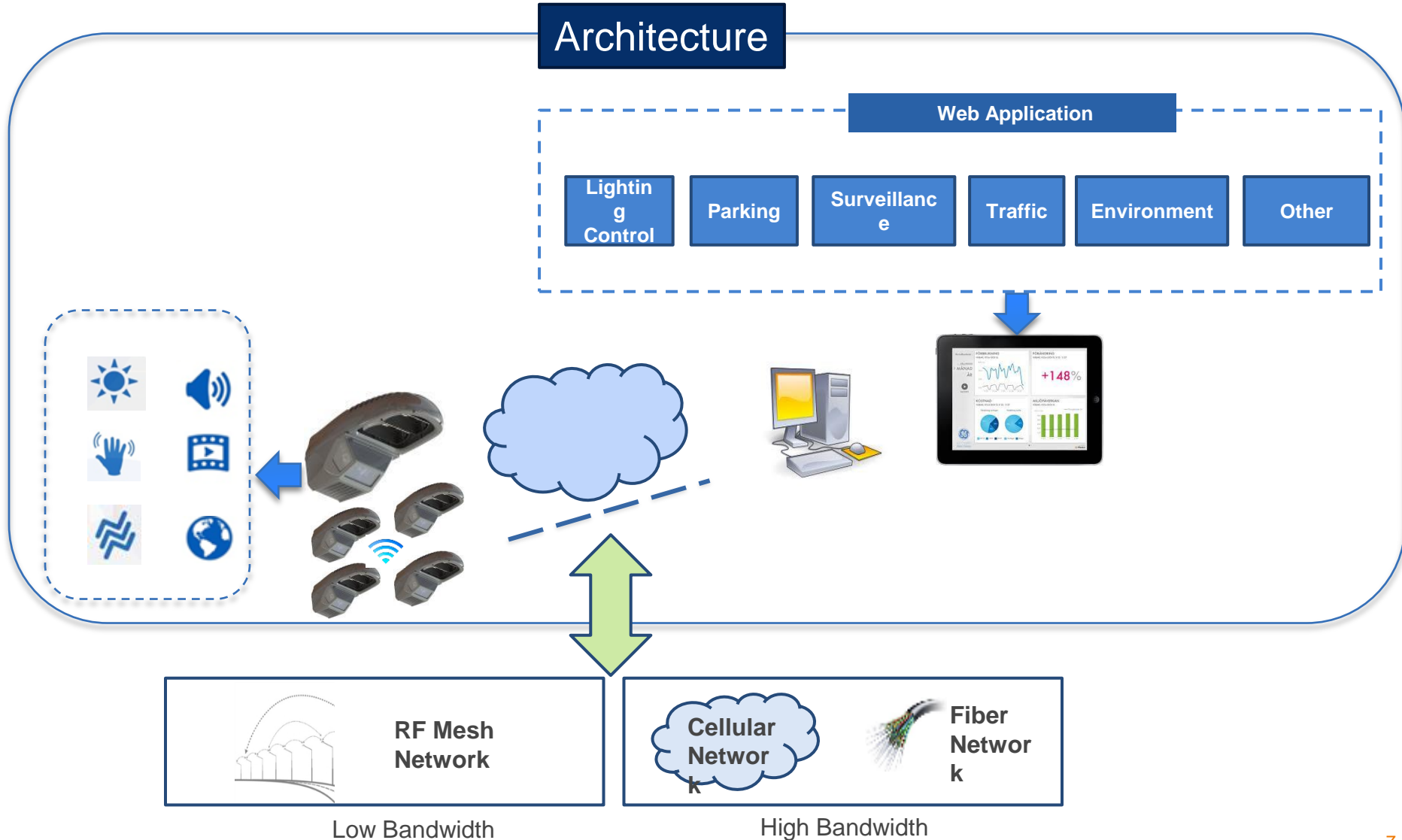early deaths annually in the U.S.

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Intelligent Environments

Internet of Things

Intelligent Machines

Big Data

Analytics

Output
Optimized solutions

- Advanced Lighting Control
- Surveillance
- Parking Optimization
- Environmental Monitoring & Analysis
- Traffic Optimization
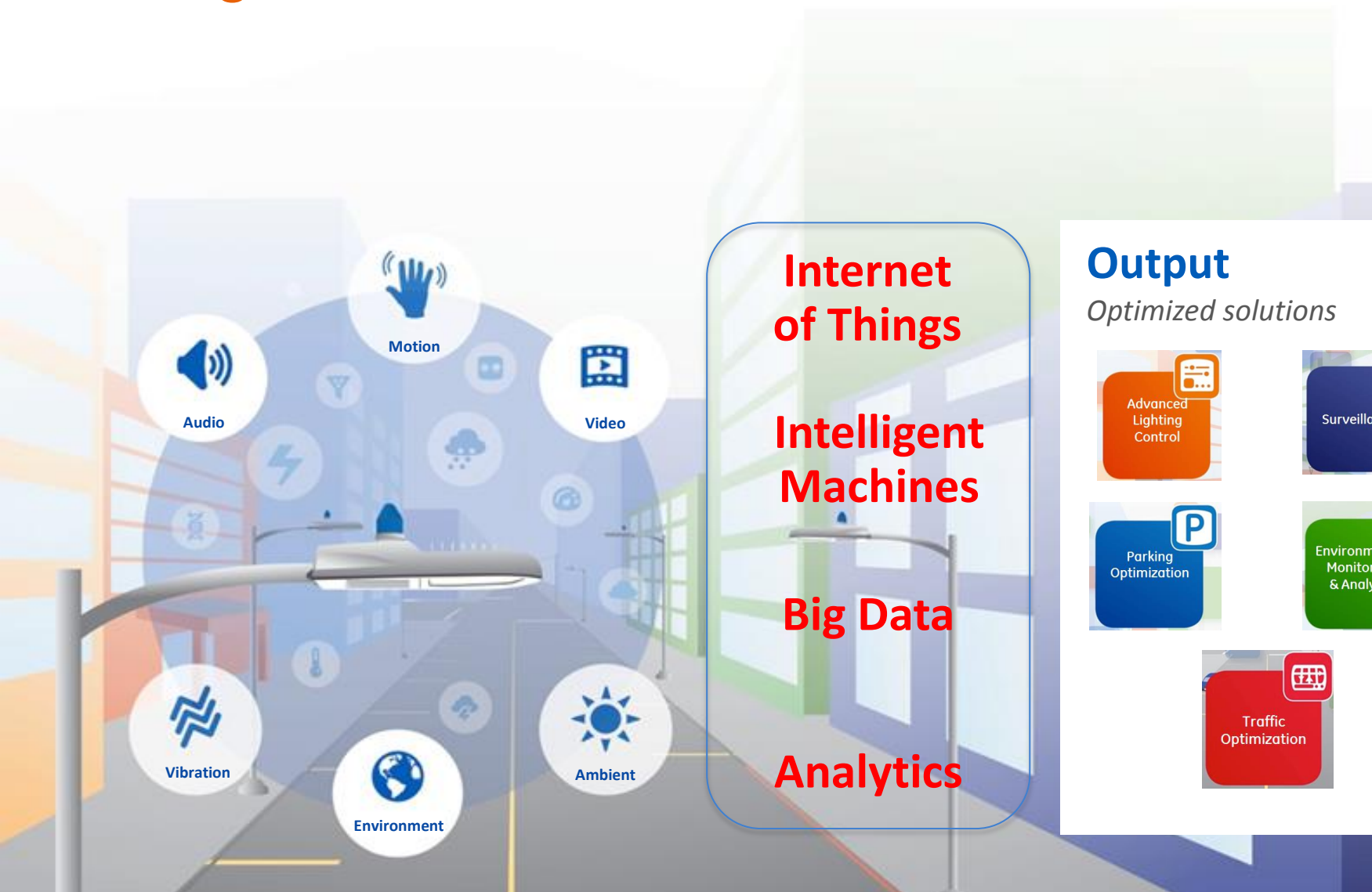
Intelligent City Architecture

Architecture

Web Application

| Lighting Control | Parking | Surveillance | Traffic | Environment | Other |

RF Mesh Network

Cellular Network Fiber Network

Low Bandwidth

High Bandwidth

+148%

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Cloud for efficiency and agility

Going mobile: anytime/anywhere **Access**

End-to-end **Security**

Predictive insights from **Big Data**

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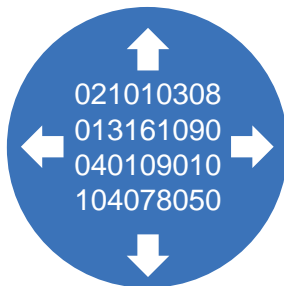
Industrial Internet platform requirements

Cloud based Integrated **Asset Data Management**

Crowd Source Applications Development **Open Data**

Consistent and meaningful **User experience**

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LED -> LED + Controls -> Intelligent Fixtures

ANSI Receptacle
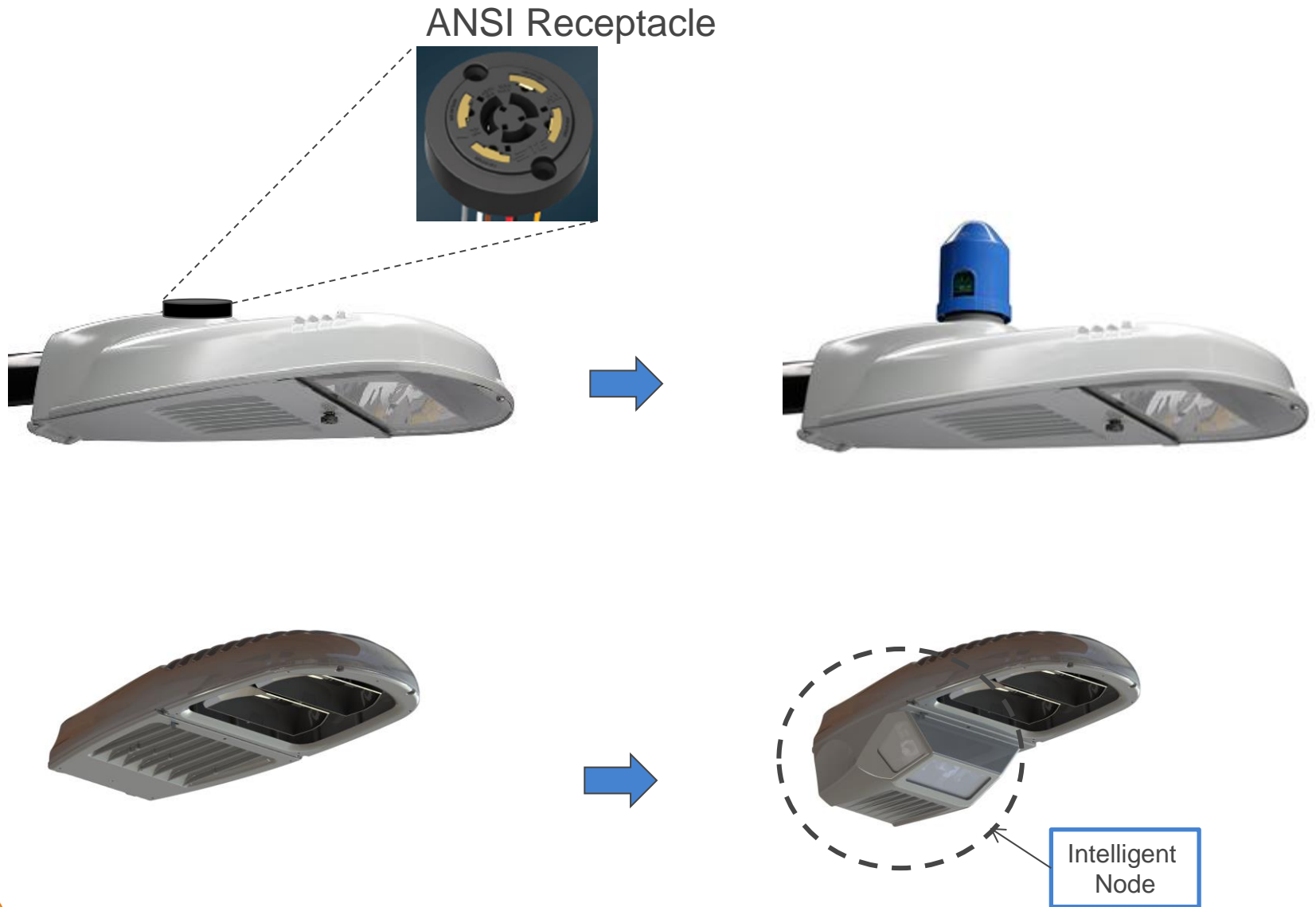
Intelligent Node

Research Topics

- Video Analytics – Machine Learning…

- Cost Effective way to "Move Data"

- Dense Network Optimization

- Harmonization of Standards
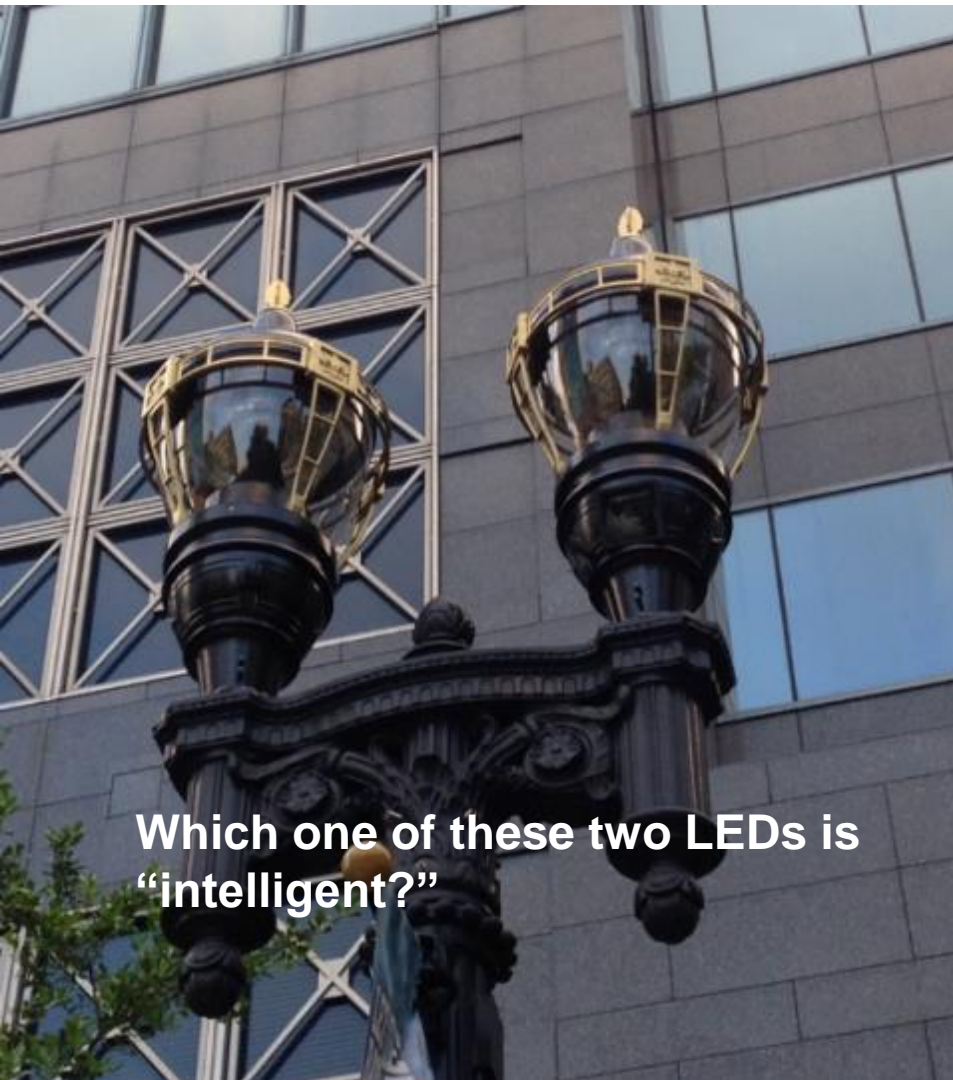
Which one of these two LEDs is "intelligent?"