Illuminating ENGINEERING SOCIETY

IES STREET & AREA LIGHTING CONFERENCE 2018 37 years

IES Montréal Lunch-Éclair

L'Internet des Objets (IoT)

Une nouvelle platform ouverte de l'industrie de l'éclairage qui ouvre les portes sur le monde de l'IoT.

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Speaker

Introduction

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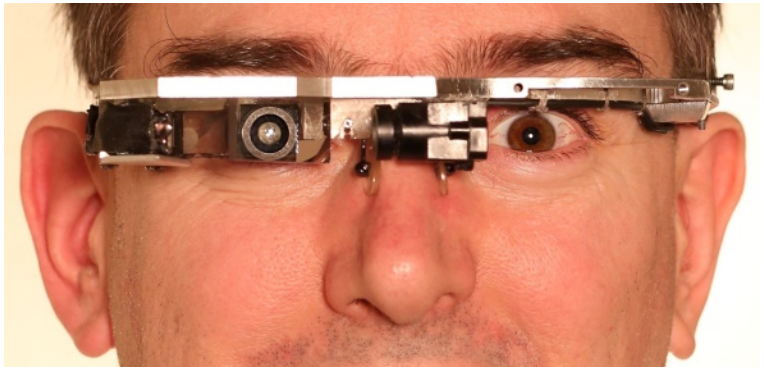
The Internet of Things – What

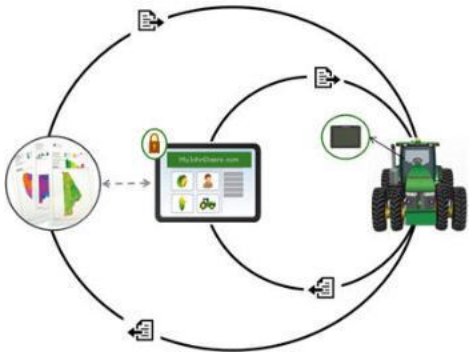
The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data

Source: Wikipedia

The Internet of Things – When

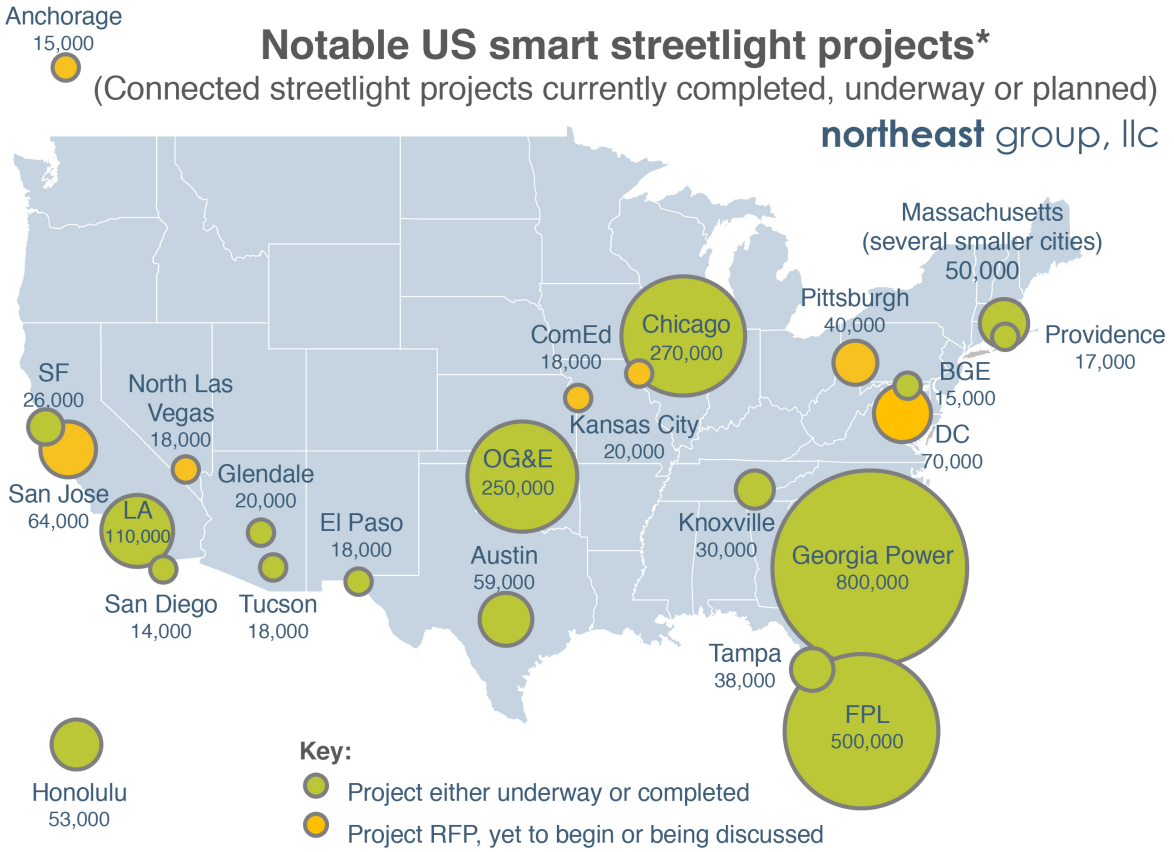


The Internet of Things - Where



The Internet of Things - Where

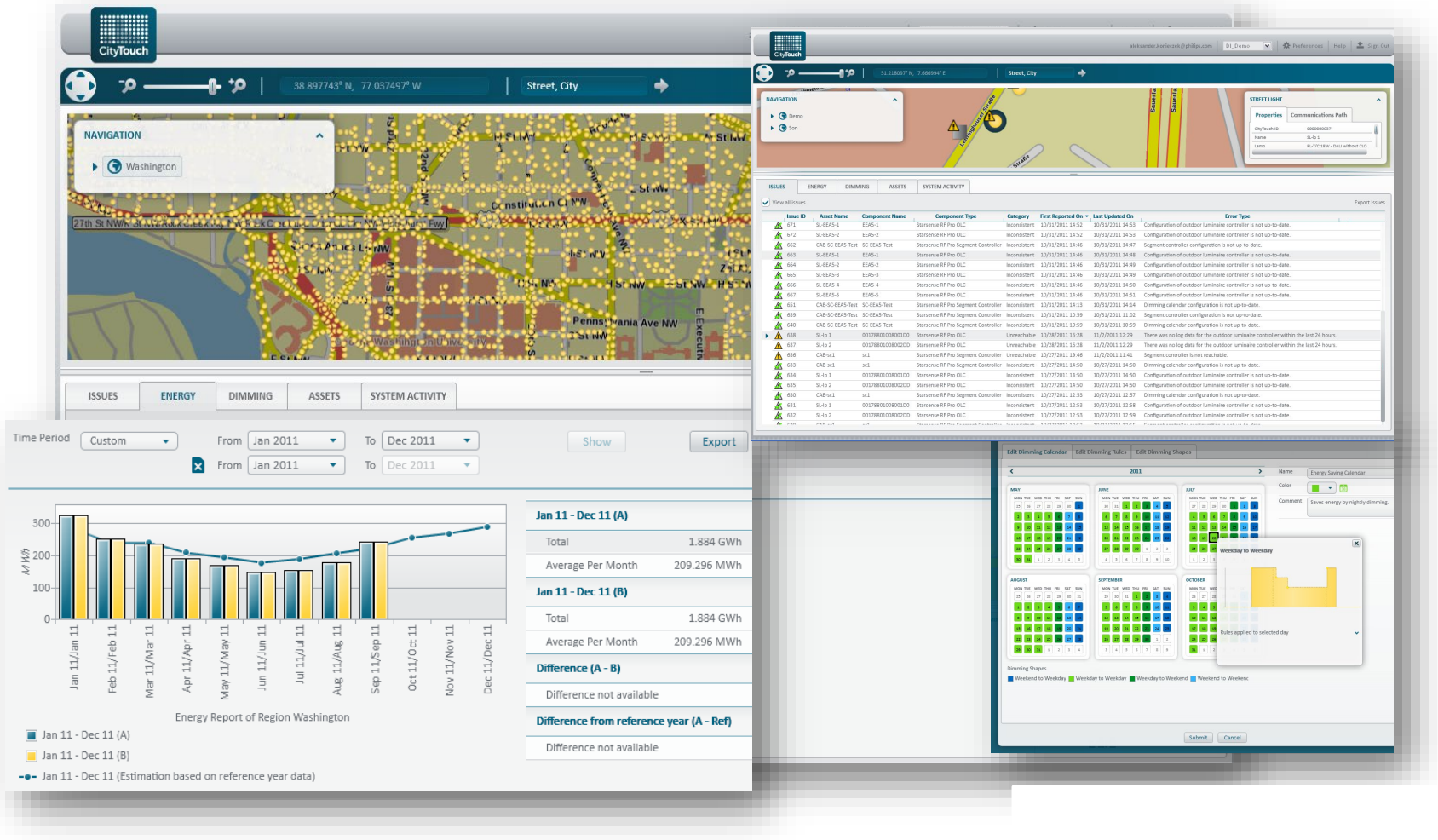
The Internet of Things - Where



**Non-exhaustive: in addition to these larger projects, there are dozens of other projects at smaller cities and municipalities (typically under 10,000 streetlights each)*

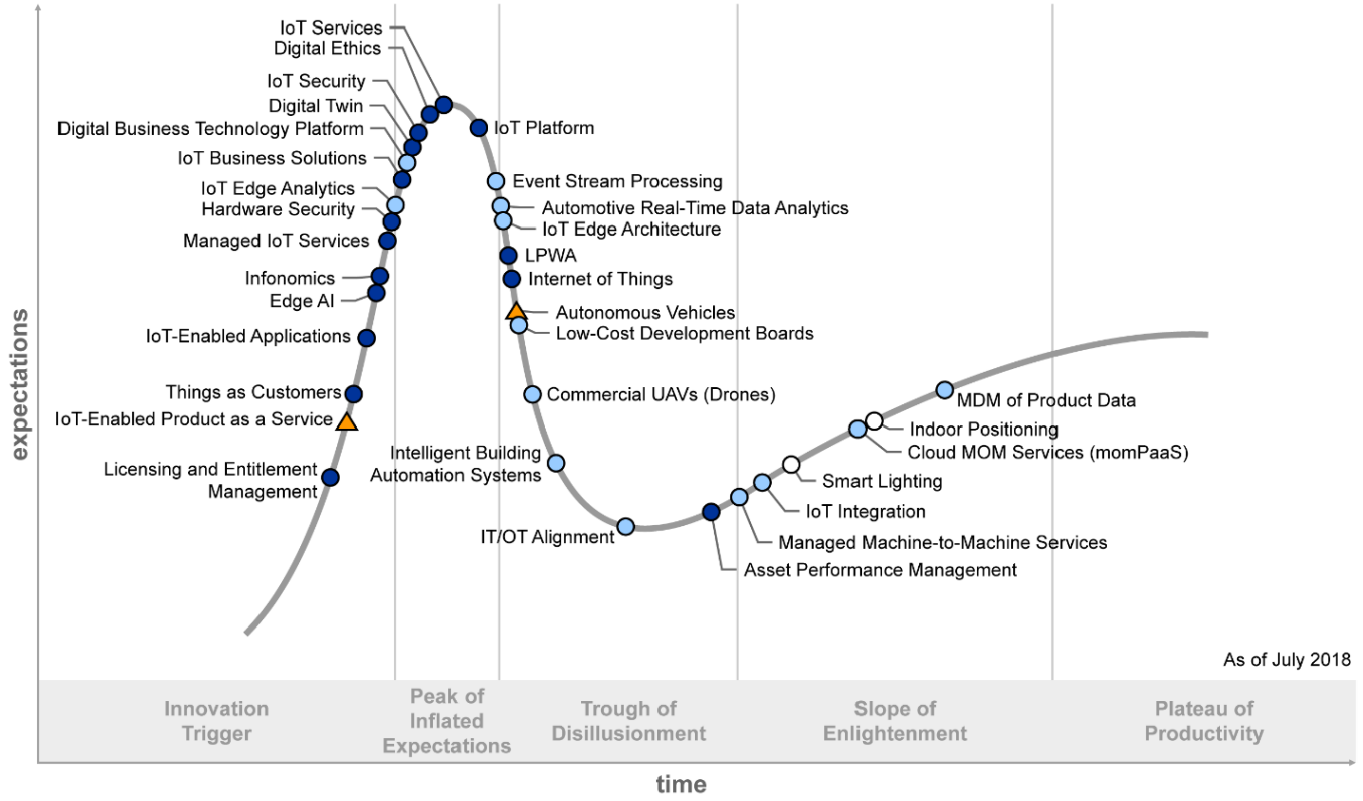
Source: Northeast Group

The Internet of Things - When



The Internet of Things - When

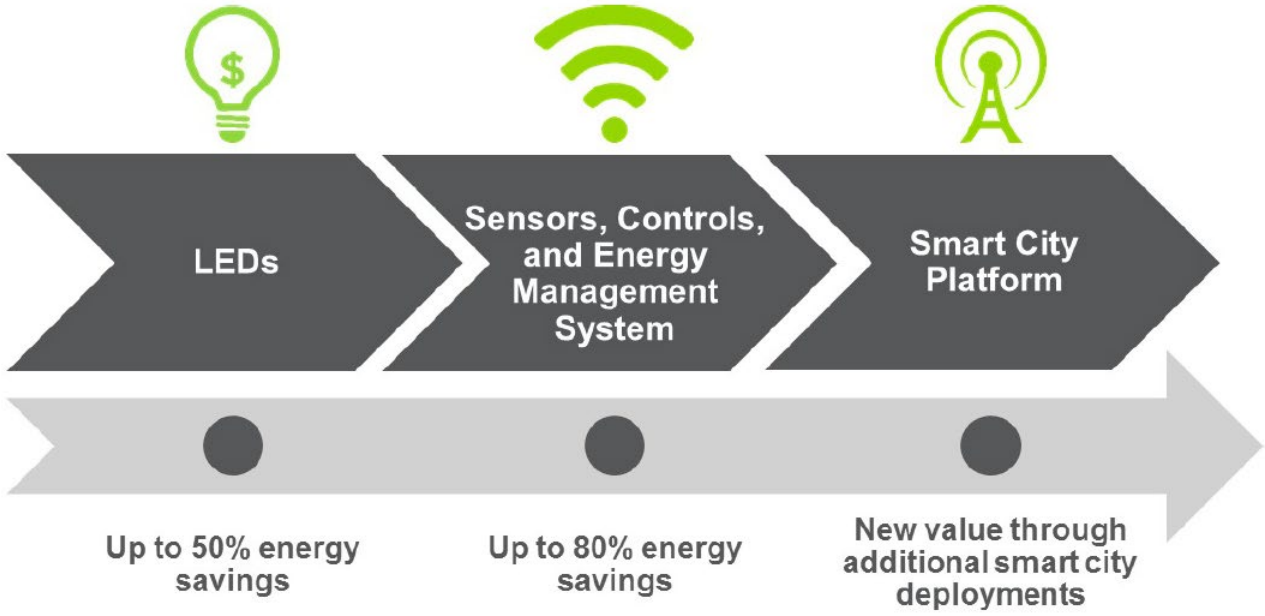
IoT and smart lighting in emerging technology Hype curve



Source: Gartner Hype Cycle for emerging technologies, Published August 2018

The Internet of Things - When

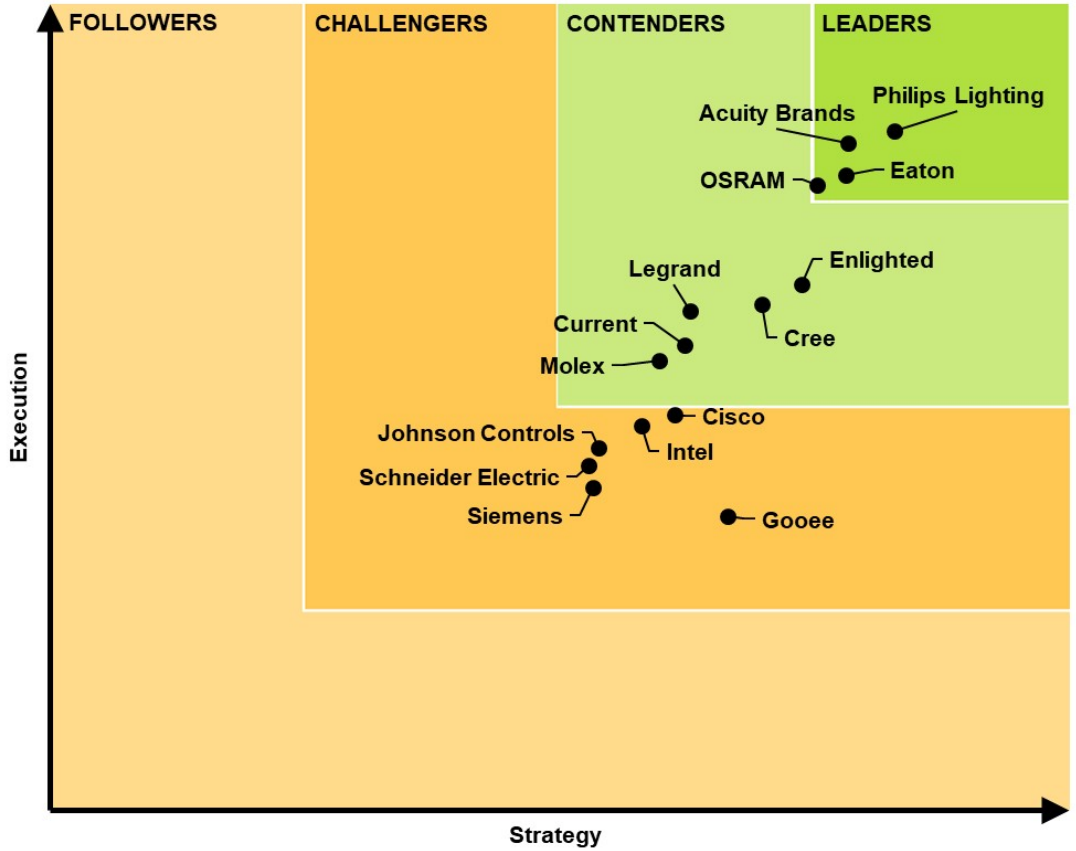
From LEDs to Networked Controls and Smart City Platforms



Source: Navigant Research Leaderboard : Smart Street Lighting 2018

The Internet of Things - When

Lighting manufactures positioning for IoT in Lighting



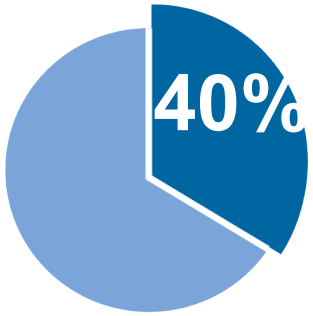
Source: Navigant Research Leaderboard : Smart Street Lighting 2018

The Internet of Things - When

Public lighting is everywhere… and is transitioning to digital technology

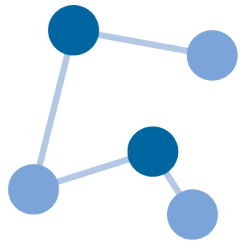
~300

million street lights worldwide, approx. 15% in the North America 1



Lighting can account for up to 40% of a city's total energy consumption 2

On average, public lighting is more than 20 years old 3



28% of street lights in the US are LED but only 2% of installed systems are connected, expected to reach 35% by 2025 3

[1] Northeast Group, *Global LED and Smart Street Lighting Forecast* 2015-2025
[2] European PPP Expertise Centre (EPEC), European Commission, *Energy Efficient Street Lighting*, 2013
[3] Philips market analysis, US Dept. of Energy

The Internet of Things - What

Connected Lighting and city monitoring: the benefits

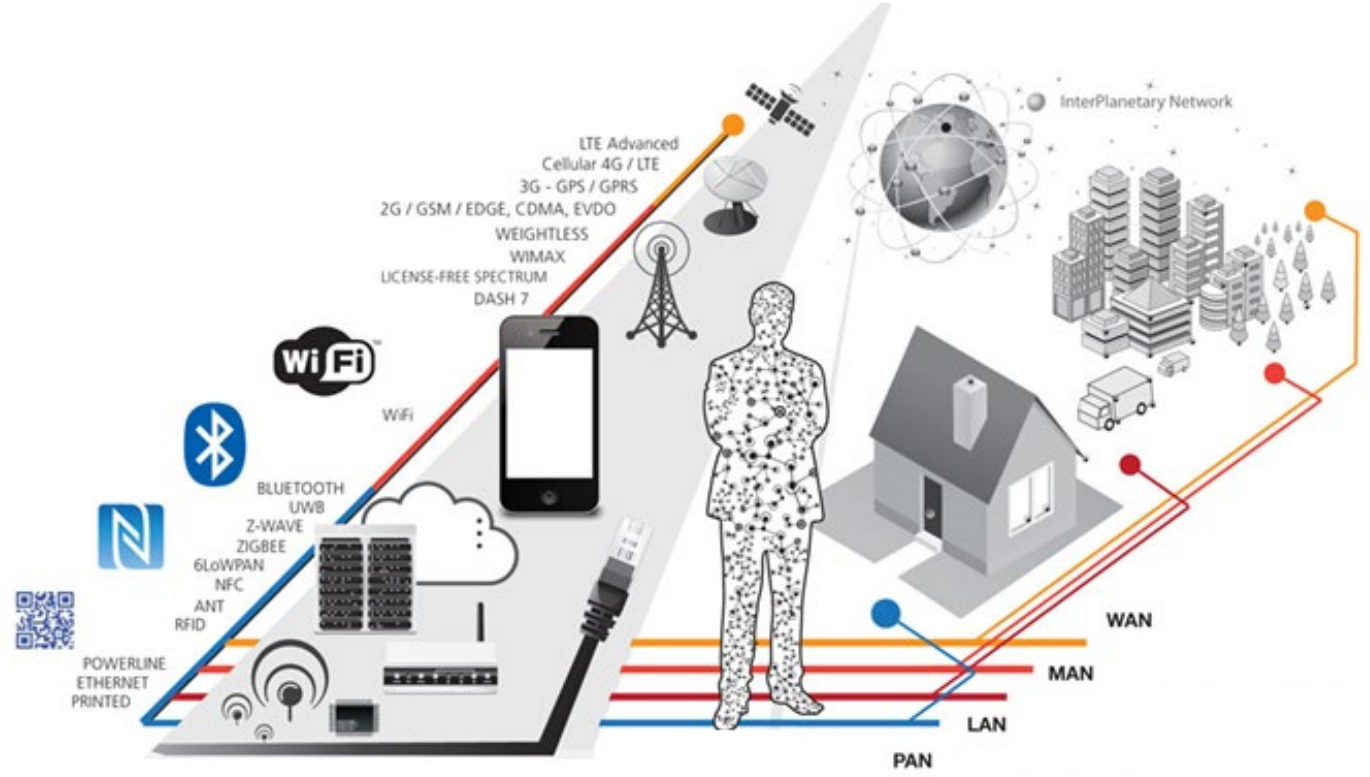
- Modest investment that leverages the existing connected lighting infrastructure
- Modular system at hardware and software level to explore new use cases
- Support better decision making for city planners with data-driven insights
- Enable revenue streams for real estate industry and government
- Provide transparency for citizens on city operations and local environmental status

Connected lighting and city monitoring

The Internet of Things - How

The Internet of Things - How

Outra-luminaires communication



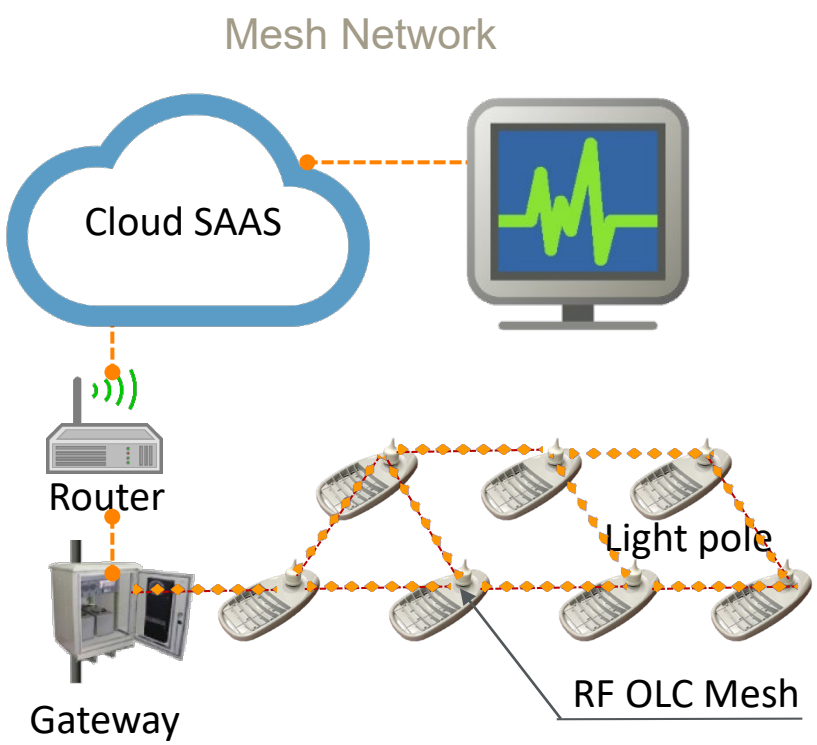
The Internet of Things - How

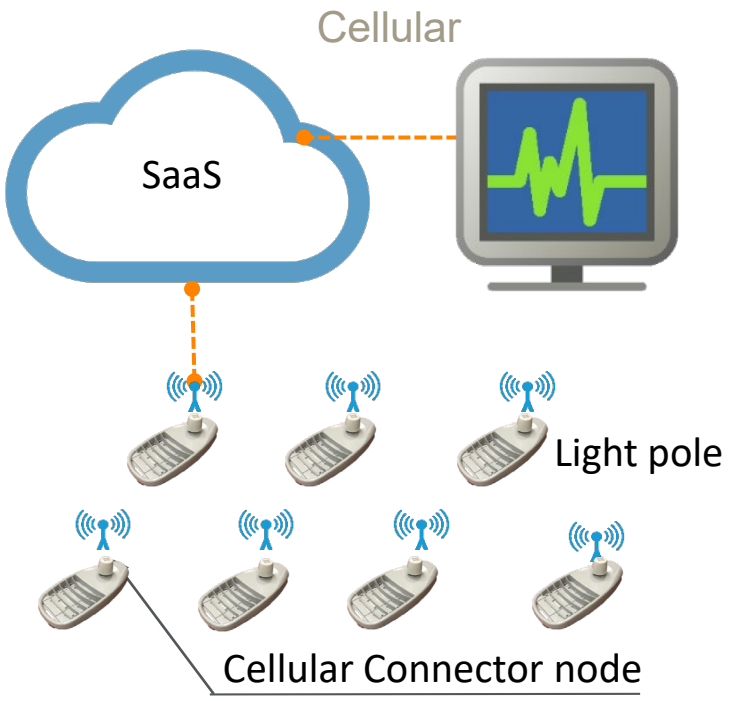
Outra-luminaires communication

Wireless Network Technology	Frequency	Range	Data Rate	Use Case / Advantage
Bluetooth LE 4.x	2.4 GHz	10 - 80 m	1 Mbps	Low cost, low power / good battery life
Bluetooth LE 5.0	2.4 GHz	50 - 200 m	125 Kbps - 2 Mbps	Low cost, wider range, wider data rate, better battery life
Wi-Fi	2.4 GHz & 5GHz	30 - 200 m	Upto 1 Gbps	High data rates, to be used in higher bandwidth applications such as video
Zigbee	2.4 GHz	50 - 150 m	250 Kbps	Low cost, used often in the Connected Home and Connected Building settings
LoRaWAN	868 MHz & 915 MHz	Upto 16 Km	< 50 Kbps	Long range, low bandwidth, very low power for extended battery life
3G	850/900/1900 MHz	14 - 18 Km	1 - 10 Mbps	Mature and commonly deployed longrange network
4G LTE - Cat 5	LTE bands	15 - 18 Km	300 Mbps	Long range - High bandwidth data application
4G LTE - Cat M	LTE bands	17 - 18 Km	1 Mbps	Long range - IoT application
NB-IoT	LTE bands	Upto 22 Km/35 Km	170/250 Kbps	Long range - IoT application
5G	3.5 GHz / 24-28 GHz	Max 100 Km	Upto 20 Gbps	New protocol with a large variety of use cases

The Internet of Things - How

Outra-luminaires communication





The Internet of Things - How

Intra-luminaires Communication

The Internet of Things - How

Intra-luminaires Communication

	0 – 10V	DALI	USB	I2C
Data & Power	Not Possible	2 Wire	4 Wire	4 Wire
Communication	Analog, Uni-directional, No Switch to Off	Digital, Bi-directional, Sufficient Speed	Digital, Bi-directional, Very High Speed	Digital, Bi-directional, High Speed
Portfolio Synergy	High	High	Low	Low
Eco System	Strong in NA, Declining in EU	Strong in EU, Emerging in NA	Stong Globally, but not yet in lighting	None
Ease of Design-in	High	High	Medium	Medium
Use Inside/Outside Fixtures	OK	OK	OK	Only Inside
Daisey Chain Multiple Units (1:N)	No	Yes	No	Yes
Cost	Low	Medium	Low-Medium	Low

DALI is the best option to build an intra-luminaire communications.

The Internet of Things - How

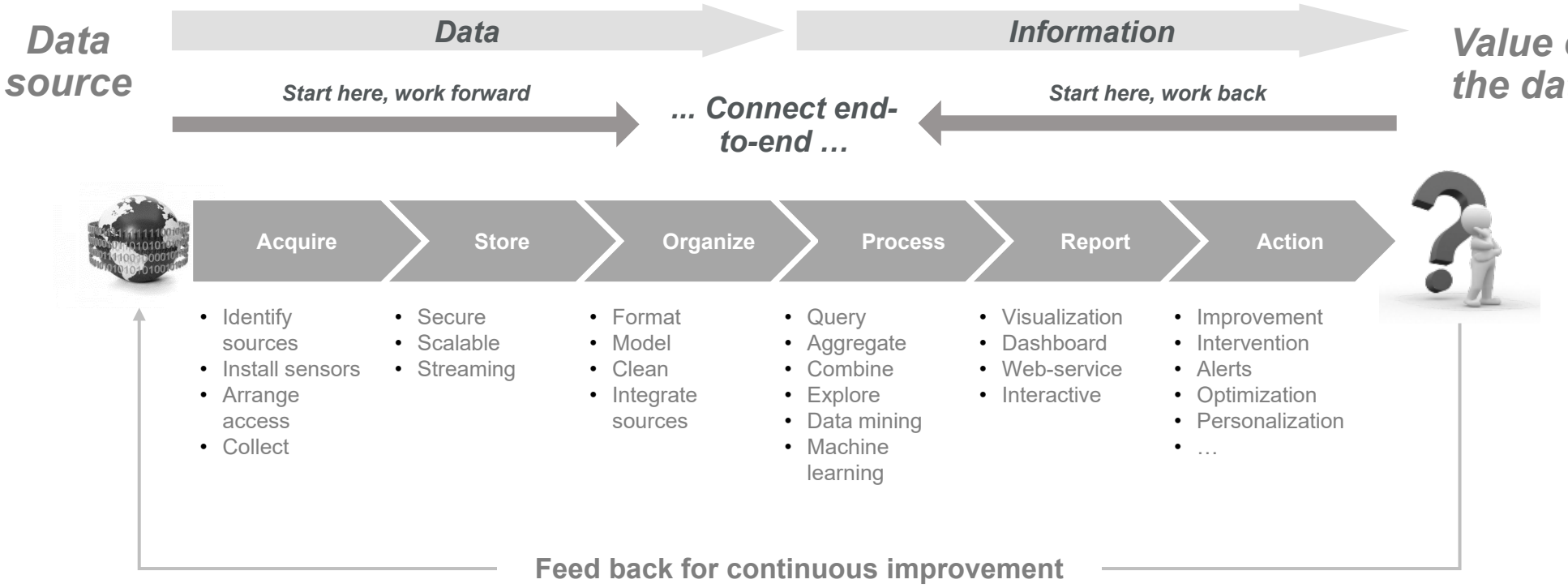
Intra-luminaires Communication

	Local Sensing	Basic Network Sensing	Advanced Networked Sensing
Use cases and technology	**Energy savings with** **Presence Detection** (PIR, Microwave) **Light Detection** (Cad)	**Activity Detection** (PIR, Microwave, Time of Flight, Camera, Bluetooth) **Weather Measuring** (Temperature, pressure, humidity, windspeed, fog, ice) **Accident Reporting** (Luminaire Tilt and Vibration)	Traffic reporting People counting Plate reading City air quality mapping Parking optimization Seismic event reporting Gunshot detection
Value	$	$$	$$$$

The Internet of Things - How

The Internet of Things - How

Data



The Internet of Things - How

Data

1. A sensor captures data...

2. ...that is processed locally (edge processing), converting the signal capture into a message for the sensor to hand-off...

3. ...to a communications chip running an Application Profile specific to the use-case of system. Some processing may be required before...

4. ...sending the data-value over the network to the coordinstor, who on receipt of the message resolves the network ID to a cloud ID, and possibly transform the data before...

5. ...pushing the data-value to the cloud API, which checks the security credentials, before letting the data-value in the door to...

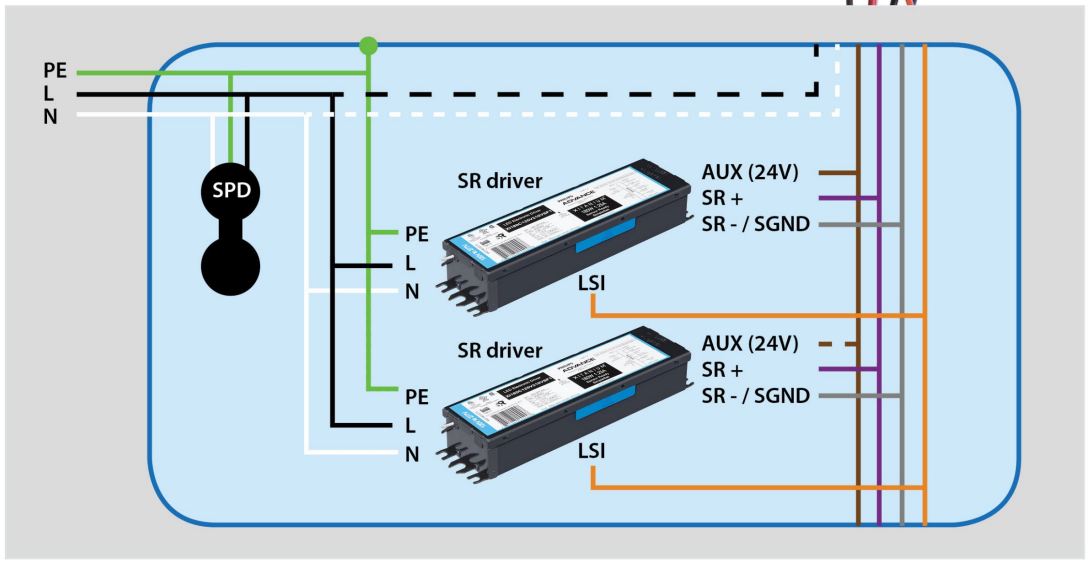
6. ...the property datastore, where all data-value are saved and processed for triggers. The data-value may need to pop-outside via the API, and also drops into...

7. ...the analytics stack, where it gets spliced up, put together with other data-value (multiple times) before being sent back out into the world as needed.

8. In the matter of seconds, the data-value has travelled thousands of miles, been transformed/processed 6 times by multiple programming languages and is ready to be consumed and read by 3rd party systems.

The Internet of Things - How

All together
ID, Communication, sensor and data

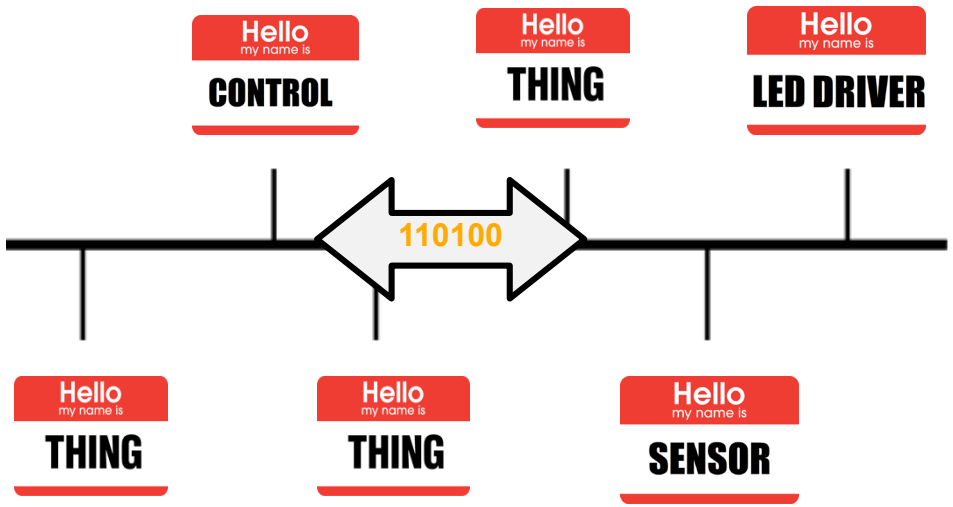


The Internet of Things - How

The Internet of Things - How

Value of an internal luminaire standardized IoT platform

- **Identification**
- Improved internal **communication**
- Multiple **sensors** support and improved **data**.



The Internet of Things - How

Assurance of **compatibility** with mutual interoperability testing with **partners** and **certification**.

The Internet of Things - How

Assurance of **compatibility** with mutual interoperability testing with **partners** and **certification**.

Sensor Ready Certified

SR Partner Program*

Indoor	Outdoor
Casambi	Algorab
Chesswise	Apkappa
CP Electronics Ltd.	Capelon
Digital Lumens	Cimcon
Enlighted	Citylight.net
Gooee	Coing
Lontri	CWJ
Lutron	Datek
Magnum Energy Solutions	DimOnOff
Nedap	Eluminocity
Silvair	eSave AG
Steinel	GlobalTronics
Thinnect	Gridens
Weinzierl	Lightronics
WiSilica	Lucy Zodion
ZQLab	MerryTek
	Nexiode
	Nedap
	Nordic Automation Systems
	Novaccess
	Signify
	SilverSpring
	Smartnodes
	SpaceLayer Technologies
	Synapse
	Telematics
	Telensa
	TELETRANS-ELCOMP
	Tellink Sistemas de Comunicación S.L.
	Tvilight
	UMPI srl
	Urban Control Ltd
	Urbana Smart Solutions Pte Ltd.
	WattStopper

The Internet of Things - How

Standardization of following for Interoperability

Communication	Agreement on protocol and data
Electrical	Assignment and V / I ratings
Mechanical	Determination of dimensions and tolerances

Sensor Ready certified

DiiA Consortium (DALI 2.0)

Zhaga Consortium (book18 v1.1)

ANSI (C137.4 C136.58 C136.41)

D4I certification

The Internet of Things - How

Zhaga and the DiiA : A cooperation between 2 Standards Development Organizations

Zhaga

Amphenol Commercial Products, Helvar, legrand, SAMSUNG, TE connectivity, BJB Your Connection to Light, Intertek, OSRAM, Schréder, Telensa, DEKRA, iGuzzini, Panasonic, signify, WAGO, ELECTRO TERMINAL, LEDiL, REGENT Lighting, TCI LED professional led applications, zumtobel group

An open industry consortium with 169 members

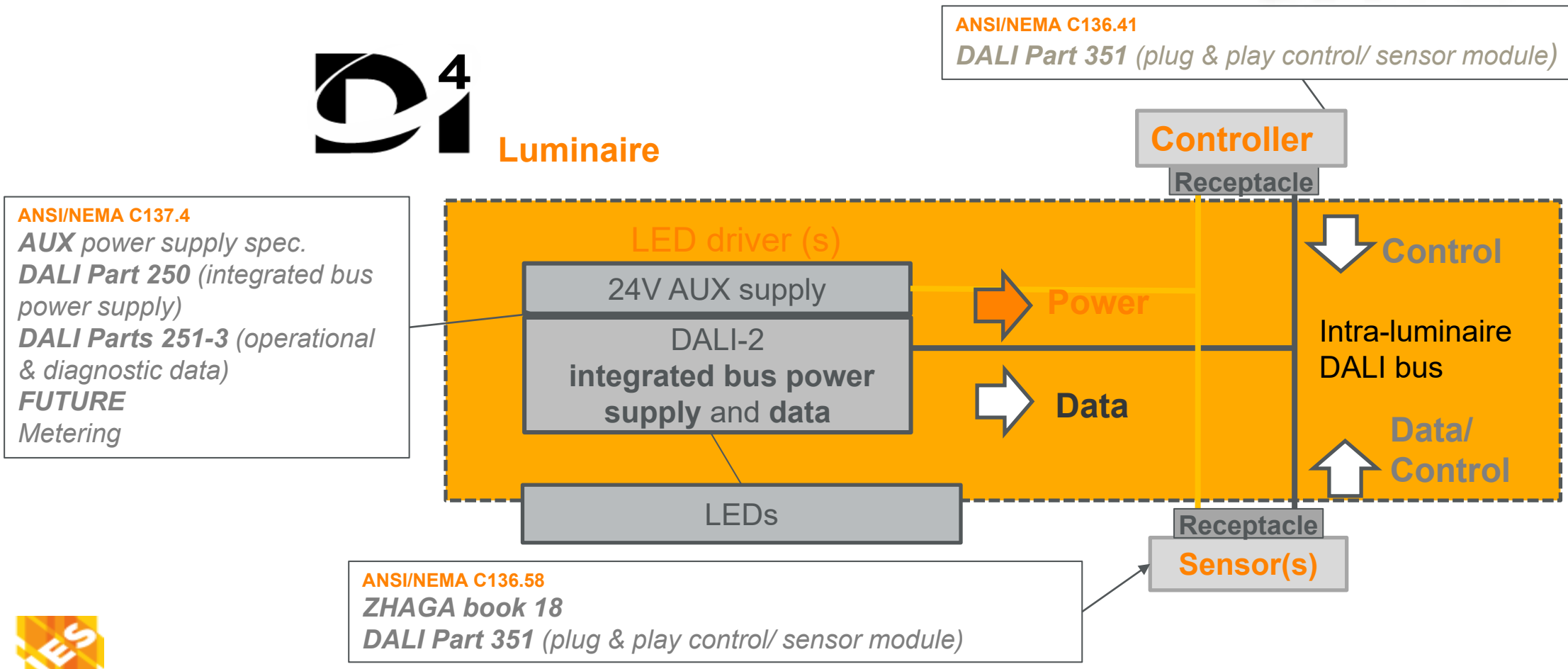
Digital Illumination Interface Alliance

AcuityBrands, BEGA, EATON Powering Business Worldwide, CP electronics ENERGY CONTROLS, DEKRA, DELTA Smarter. Greener. Together., ERCO, ESYLUX, Helvar, AUDACY, LEDVANCE, LEEDARSON, LUTRON, Ex-Or by Honeywell, OSRAM, Panasonic, SIEMENS, signify, SILVAIR, SIMMTRONIC, simon, STEINEL, Telensa, TRIDONIC, TRILUX GROUP, WAGO, zencontrol, DALI 2

An open industry consortium with 204 members

The Internet of Things - How

***Plug and play** interoperability based on Standards*



The Internet of Things - How

DALI-2 D4i **Driver**[1]

Zhaga-D4i **Node**[2]

Zhaga-D4i **Luminaire**[3]

D4i certification

Ensuring plug and play interoperability from July 2019 onwards

The Internet of Things - How

- **Identification** of asset and it's information.

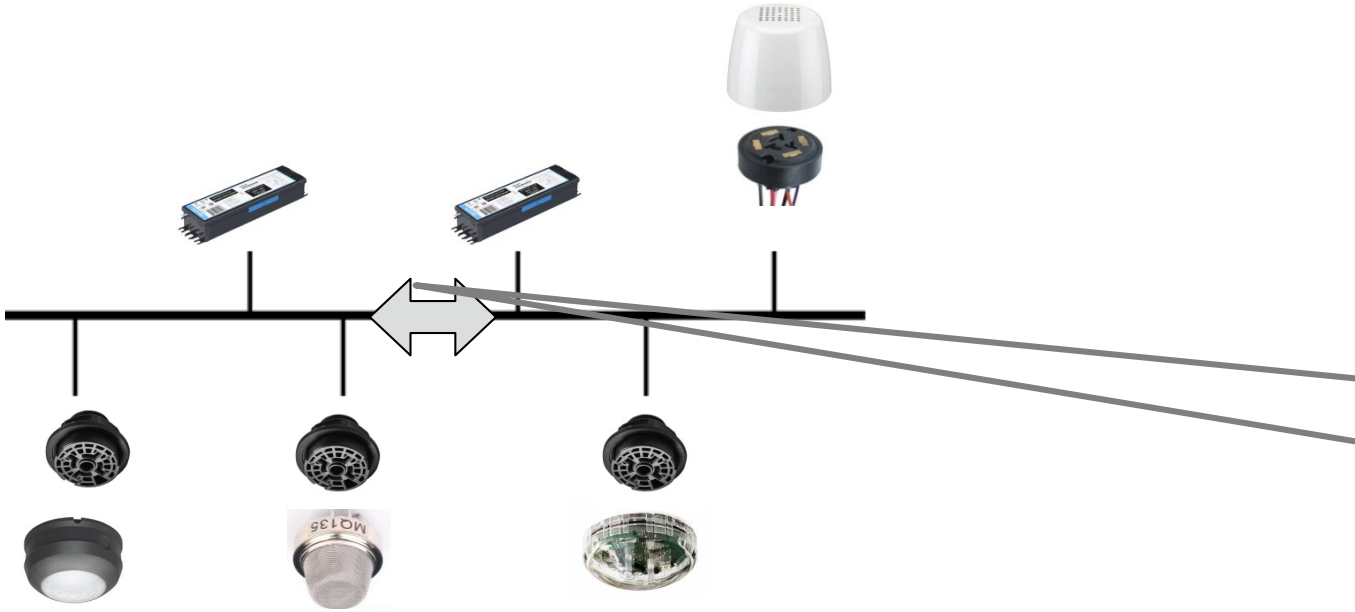
*A digital address in **memory bank** (MB1) for luminaire identification is included. It will included in ANSI C137.4 standard*

6.7.3 Luminaire information MB1

Address	Description	Default value (factory)	RESET value[b]	Memory type
[0x03, 0x08]	Luminaire manufacturer GTIN (6 bytes as per IEC62386-102) with manufacturer specific prefix to derive manufacturer name	0xFF	No change	NVM-RW (lockable)
[0x09, 0x10]	Luminaire identification number (8 bytes as per IEC62386-102)	0xFF	No change	NVM-RW (lockable)

The Internet of Things - How

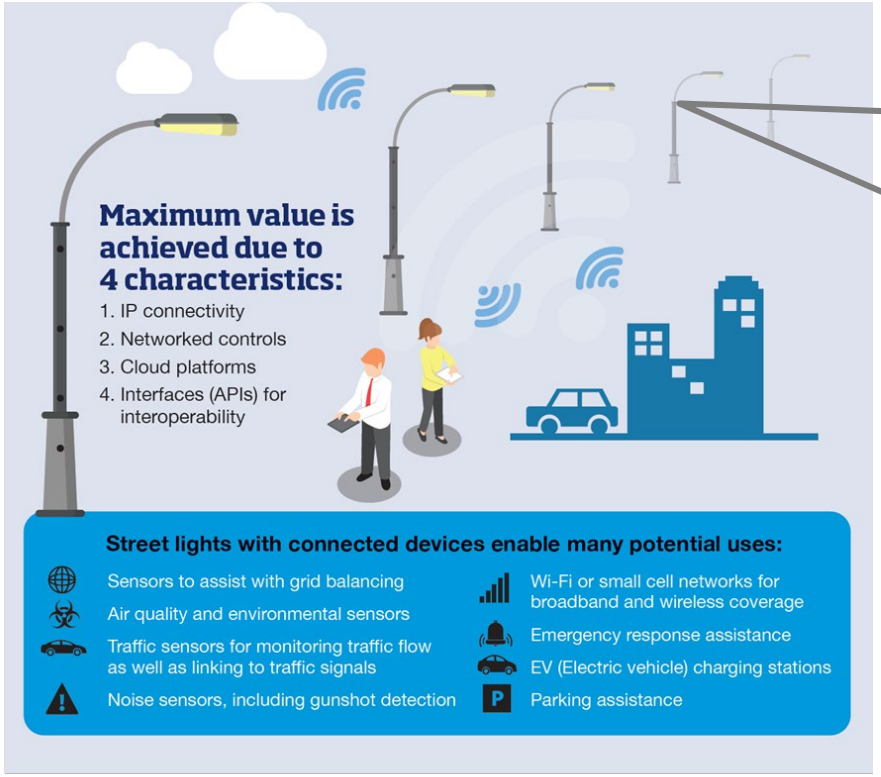
- Improved **communication** with bi-directional and digital communication between LED driver, controller and sensors.



Communication protocol, sometime referred to DALI 2.0 supported by DiiA program and ANSIC137.4.

The Internet of Things - How

- Expending of the sensing capabilities by supporting multiple **sensors** on a single luminaire and improved **data** extraction.



Source: IDC 2018.

ANSIC136.58 on Luminaires Motion Sensors targeting the Zhaga book 18 interface for the external sensors such as

Activity detection
City air quality mapping
Weather
Accident traffic reporting
People counting
Plate reading
Parking optimization
Seismic event reporting
Gunshot detection

The Internet of Things - How

Cyber Security in IoT lighting

DLC NLC Technical Requirements version 3.0

- UL 2900-1
- NIST IoT Cybersecurity Framework
- ISO 27001
- ISA/IEC 62443

DESIGNLIGHTS CONSORTIUM

NIST National Institute of Standards and Technology

ISA International Society of Automation (ISA)

UL Underwriters Laboratories

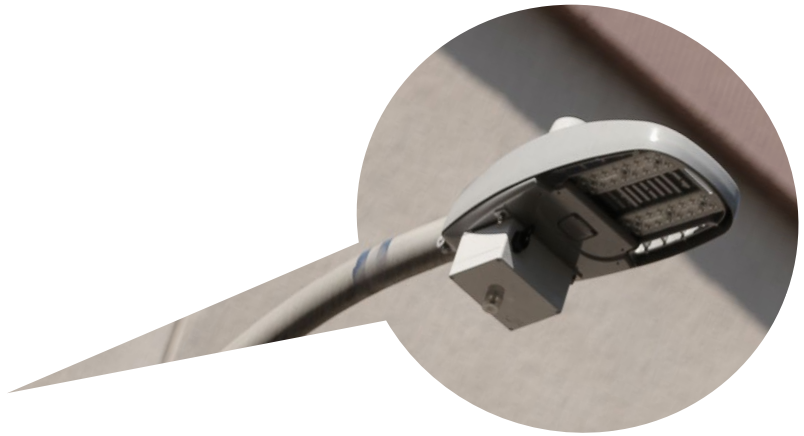
ISO International Organization for Standardization

IEC INTERNATIONAL ELECTROTECHNICAL COMMISSION

IES

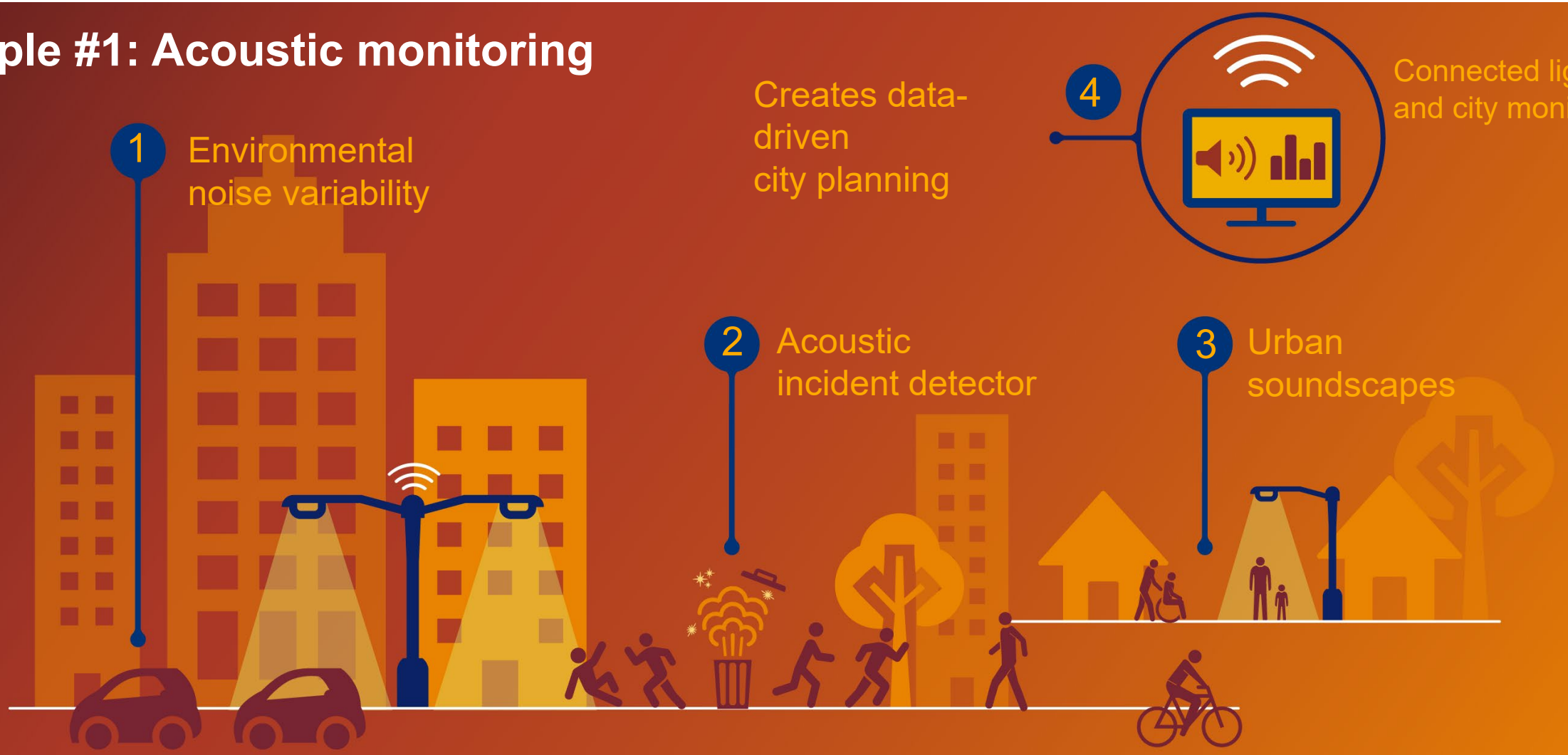
The Internet of Things - What

Smart City projects related to lighting examples!



The Internet of Things - What

Example #1: Acoustic monitoring



The Internet of Things - What

Exploring smart cities use cases

Los Angeles, USA

Los Angeles is shaping the future by exploring new smart city applications that build on the connected lighting infrastructure to realize additional value beyond illumination.

Environmental noise monitoring uses an acoustic noise sensor (microphone). Sound levels on the street can be monitored to understand activity levels, check compliance with regulations and support the well-being of citizens.

Grid health monitoring uses the connectivity offered by the lighting system to continuously assess the quality of the lighting network's power supply.

The Internet of Things - What

Public Safety with Acoustic Monitoring

Increased city safety

Operational efficiency gains

Better insights

Smart microphones with advanced pattern recognition SW can detect diverse safety-related incidents:

- Aggressive behavior
- Distressed citizens
- Gunshots
- Breaking glass
- Car alarm
- ….

The Internet of Things - What

Integration with other systems

Collaborate with surveillance camera experts and system integrators

Acoustic monitoring data supports the operation of video surveillance systems by assisting staff to focus on most relevant information.

Make relevant information streams (incidents, sound clips, etc.) accessible via APIs

Application development and integration into existing systems and workflows

The Internet of Things - What

Example 2: Air Quality Sensing

Leveraging the lighting infrastructure, measuring air quality attributes with higher granularity **generates valuable information to bring Air Quality insights to another level**.

For cities

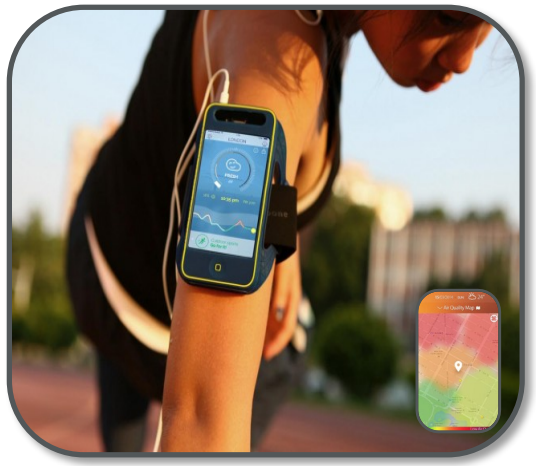
- Urban planning
- Policy assessment and validation
- Pollution control and mitigation
- Nuisance monitoring and complaint handling

For Citizens

- Personal pollutant exposure reporting
- Personal route and activity planning

The US Environmental Protection Agency (EPA) declared **Air Pollution as one of the highest environmental risks of the 21st century.**

Cost for the OECD is estimated to be a staggering **$1.7 trillion**.



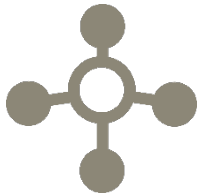
The Internet of Things - What

Best Technologically

- **IoT-ready**
  .
- **Improved communication**
- Ability to store **components manufacturers information**

Simple

- **Cost-effective**
- **Flexible**
- **Attractive**



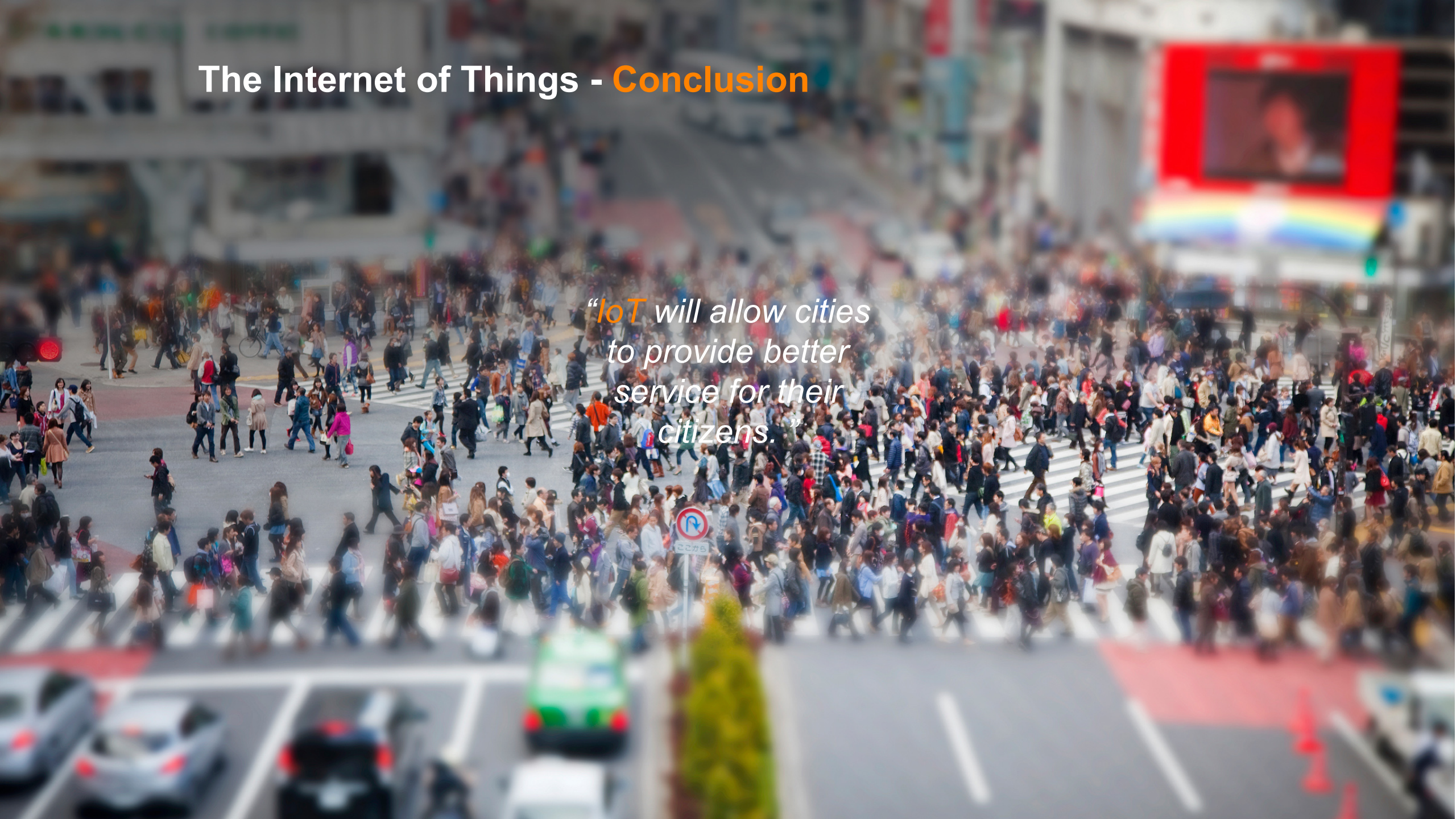
Open

- **No proprietary technology**
- **Freedom of choice**

Scalable

- **Future-proof**
  .
- **Ease of additions of multiple sensors** with improved information communication.
- **Higher reliability of the luminaire**

The Internet of Things - Conclusion



"IoT will allow cities to provide better service for their citizens."

Thank You

Questions?

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