

**The future of lighting is smart**

INTELLIGENT MODULES BY  
**XICATO**

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# What is a smart light and smart lighting?

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## **Smart lights:**

- Light quality
- Monitors internal operating conditions and responds autonomously to fault conditions
- Peer to peer two way communications capability to receive commands and sensor inputs, responding autonomously, and transmit status and event information
- Able to be programmed to modify response to sensor inputs
- Tracking, storing and reporting operating history

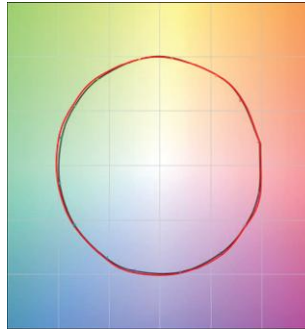
## **Smart lighting:**

- A combination of smart lights and the software program(s) used to set-up and configuring an installation to behave as we want when an event happens

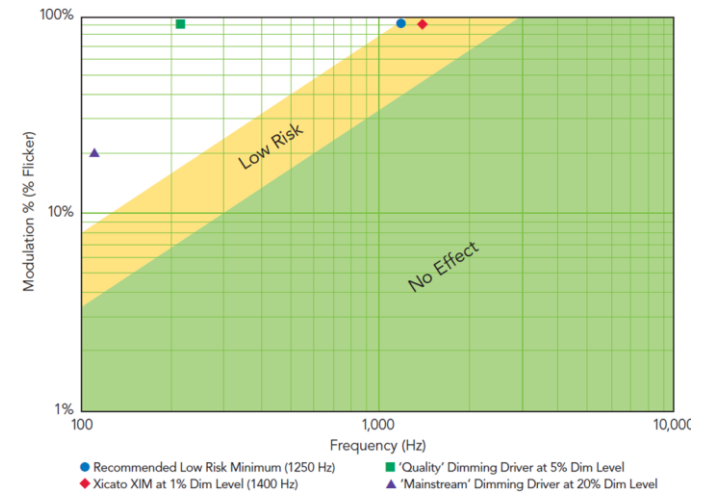
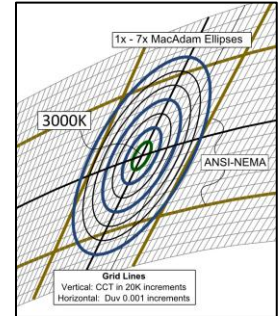
# Quality of Light



Color Vector Graphic



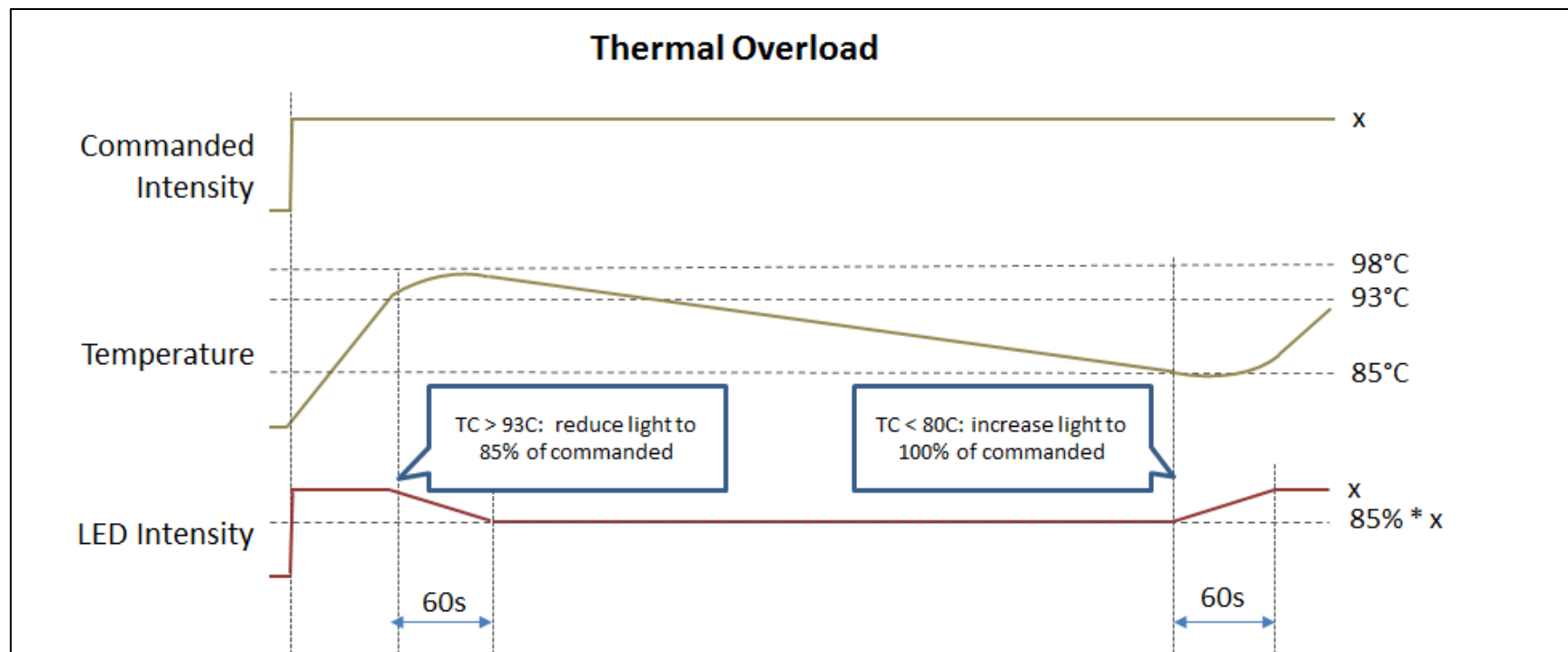
Red line: Xicato source  
Black line: reference illuminant



# Monitors internal conditions and responds autonomously to faults

## Thermal Foldback example

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# 2-way communication

## Comparing DALI and BLE

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### DALI – is it smart?

- YES, in that 2 way communication is possible
- But limited:
  - No autonomous responses to external events. Everything via Master.
    - Very difficult to build multi-layered causal relationships between devices
    - Latency issue - can be unacceptably slow
  - Programming and data collection possibilities limited to DALI standards and what the DALI Master supports
- Provisioning / commissioning far large installations is complex:
  - All processing for every sensor response takes place in a central place
  - Expansion beyond 64 services requires bridging between DALI bus Masters

# 2-way communication

## Comparing DALI and BLE

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### DALI Compared with BLE

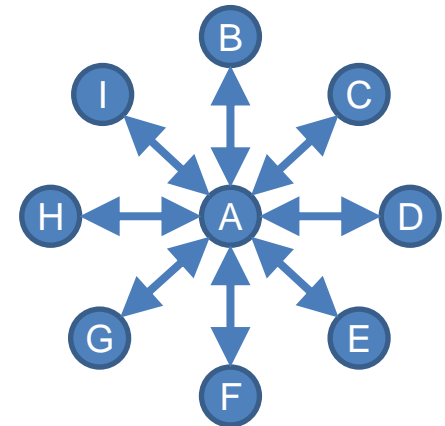
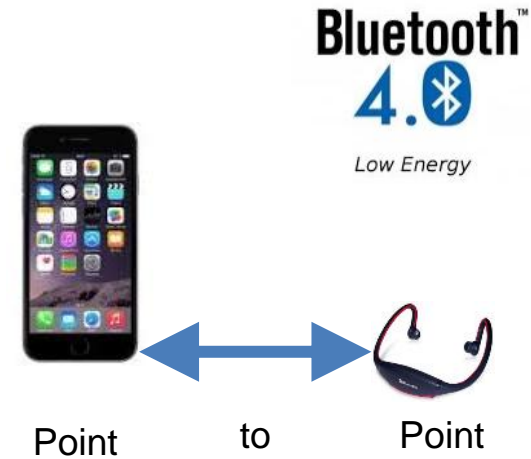
- BLE solves these issues, and:
  - Allows for possibility for indoor positioning services
  - Allows for web or app based developments
  - Advantages of wireless systems ito no 'above the ceiling' expense
  - No 64 device limit on a single interface
- BUT:
  - Requires addition security layers
  - Suitable for local networks: for wider systems gateways needed.

# Bluetooth Low Energy – a Brief Introduction

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BLE is different from traditional Bluetooth

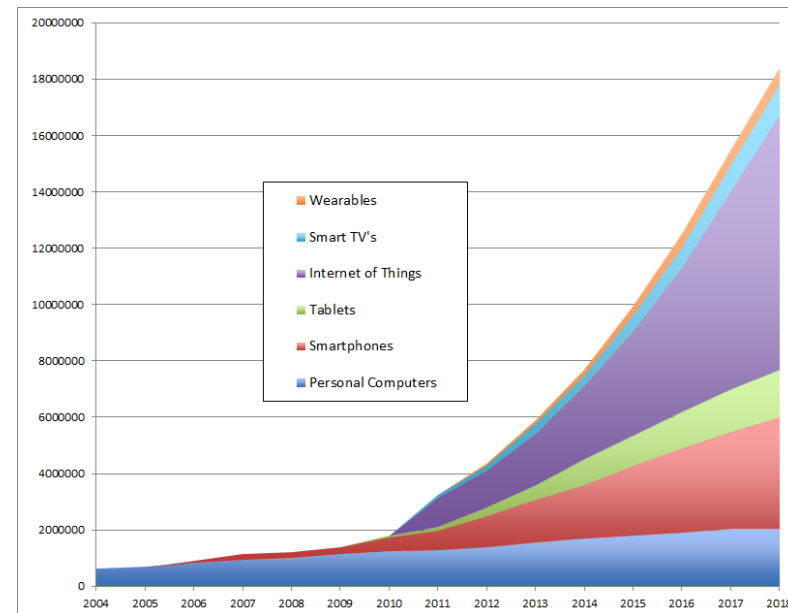
- Traditional Bluetooth
  - Dedicated pairings. Point to point connections.
  - Designed to support data streaming (e.g., voice/audio)
- Bluetooth Low Energy
  - No dedicated pairing – peripherals advertise presence and availability to support connections
  - Star connection topology
  - Small data transfers
    - Device state information (temperature, device ID, light level, turn on, turn off, etc.)
    - Not for large data transactions – e.g., file transfers, streaming, etc.





# Why Bluetooth LE?

- Ubiquitous support on Smartphones/Tablets
  - Natively supported by iOS, Android, Windows 8, OSX, Linux and Blackberry
- Technology underlying iBeacon, Physical Web, Eddystone
- Strong momentum driven by IoT
- Easy to integrate into embedded devices
- Open Standard
  - Free to join SIG
  - Standards available for no charge
  - No licenses, etc.



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# BLE operating principle



0	AD Flags
1	
2	
3	Field Length <0x1B>
4	Field Header <0xFF>
5	Xicato Company ID
6	0x0253
7	Device/Package Type
8	
9	Device ID
10	
11	
12	Sequence ID
13	
14	RFU
15	Module Intensity
16	
17	Module Status
18	Module Power
19	Status/Power Extension
20	LED Temperature
21	PCB Temperature
22	Input Voltage
23	Input Voltage Ripple
24	Voltage Extension
25	RFU
26	
27	
28	
29	
30	Data Protection



- BLE foundation layer and protocols
- OTA codes and APIs
- Advertising packets, scan responses and connections

## Communication: lighting services

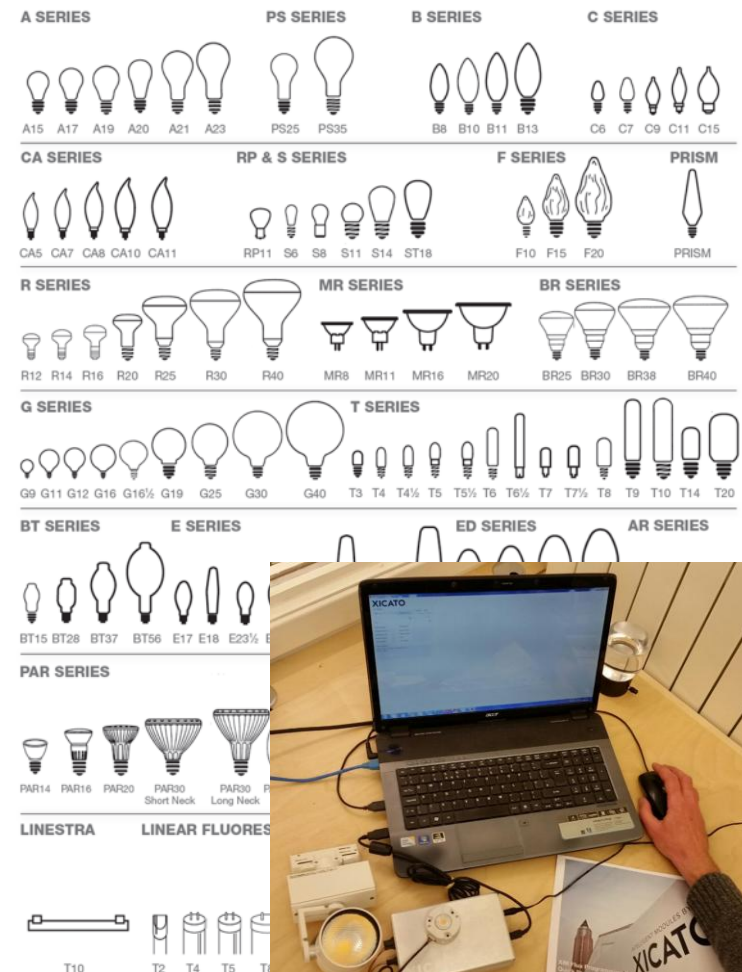
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# Applications: OEM configuration

**Context:** For OEMs to deal with the huge variation of lamps has always been an ordeal.

Configurable smart modules?

- **Max flux, min flux**
- **Fade-rate**
- **Dimming curve**
- **End of life behavior** (when, how manifested)
- **OEM / fixture information**
- **Security in operation** (eg thermal capability of luminaire cannot be exceeded)

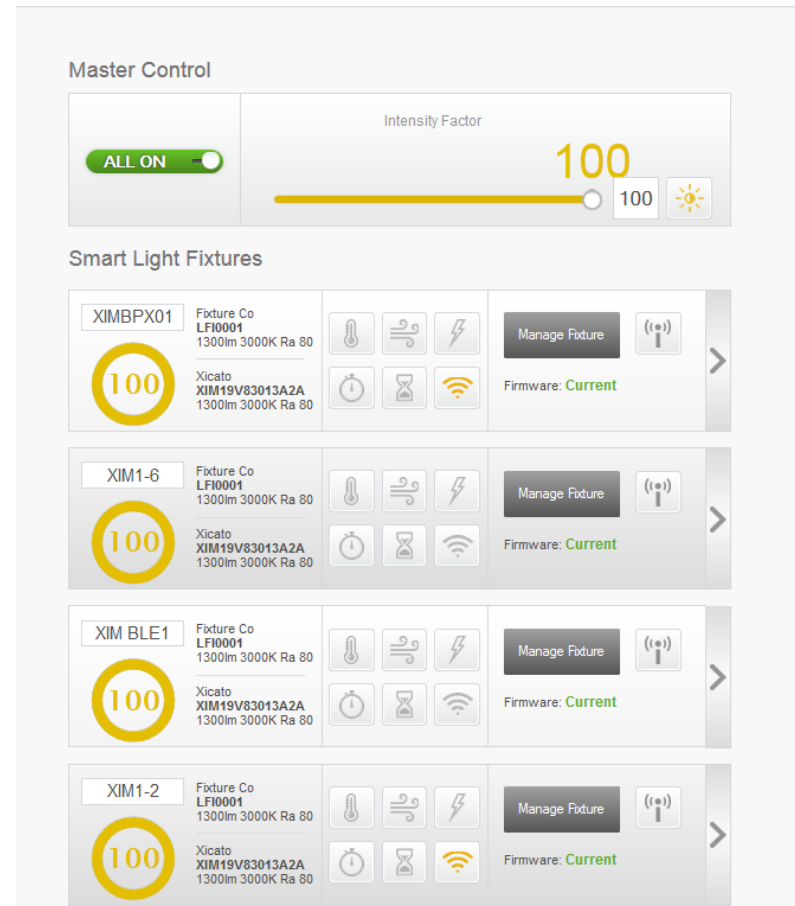


# Applications: commissioning and usage

**Context:** low adoption of lighting controls to date but at the same time as tighter energy conservation requirements

- Detect or set **Location** address
- Define **groups** and scenes
- **Binding** to switches and sensors
- Set **security access** levels
- **Configure network** connection (DALI, Wi-Fi, Zigbee etc.)

## XICATO

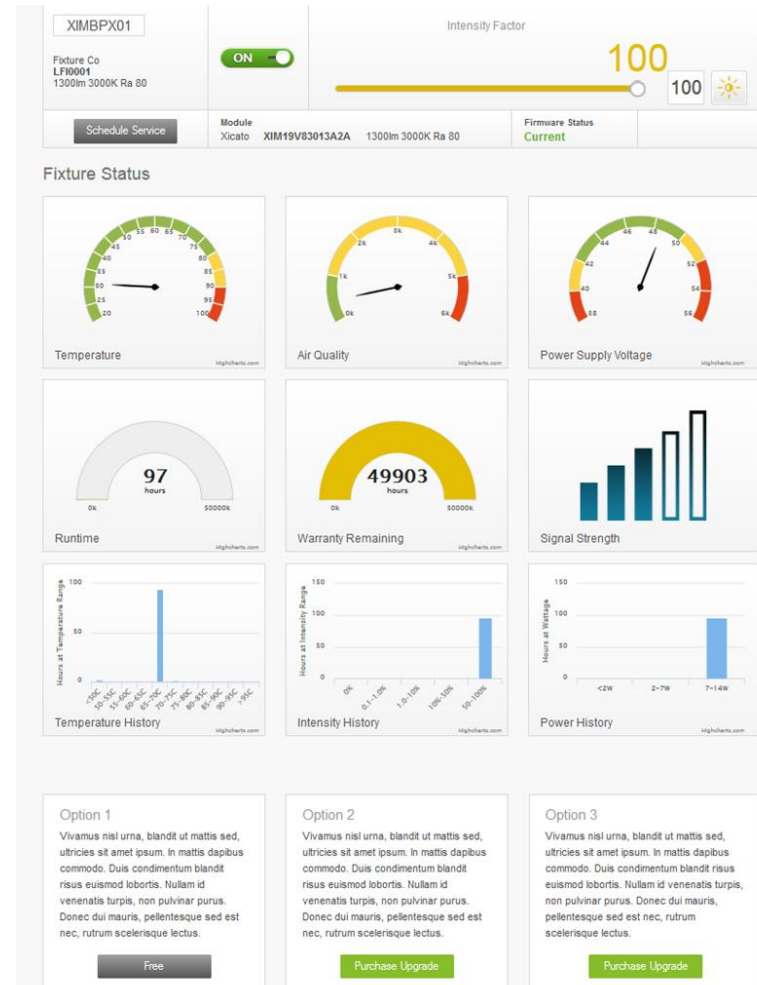


# Applications: maintenance and diagnostics

**Context:** maintenance is expensive, especially where image is concerned, eg retail. Constant surveillance, stock keeping of spares, keeping track on warranties ....

With smart diagnostics:

- Instantaneous information on running status
- Historical data
- Warranty options
- BIM





## Communication: New Services

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# Indoor Location / Proximity Detection

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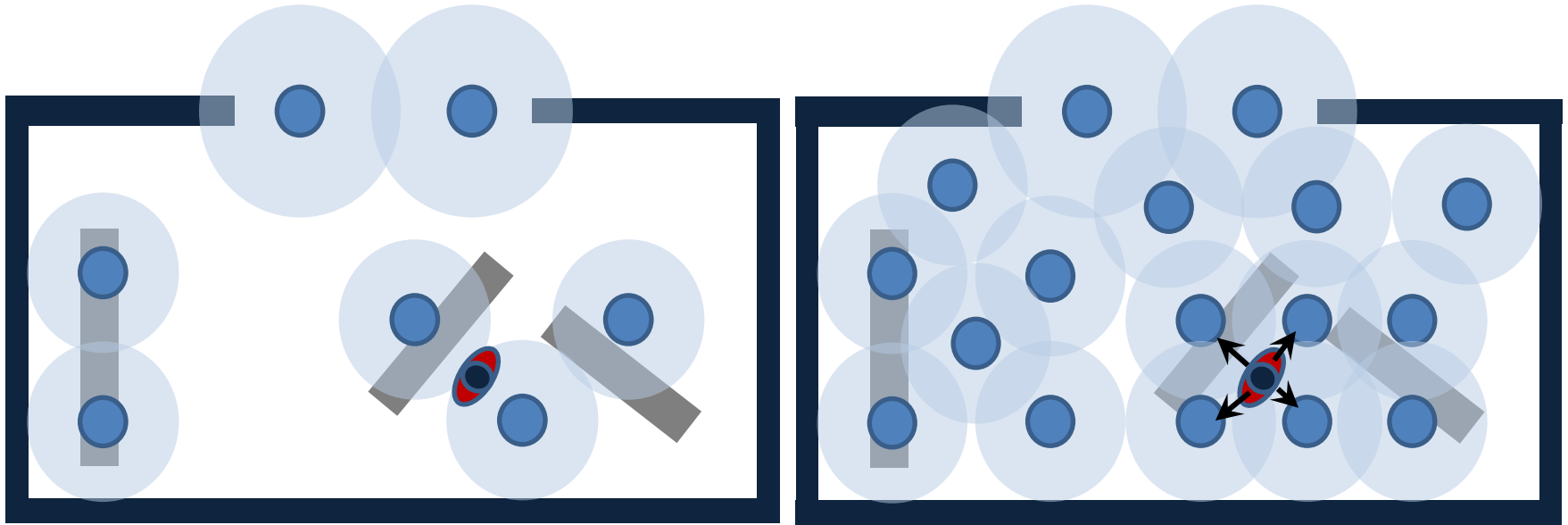




# Indoor location services and analytics

## Beacon placement

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Lighting allows for **greater coverage** of the space c/w separate boxes. Less cluttered ceilings, less hardware to install and maintain.

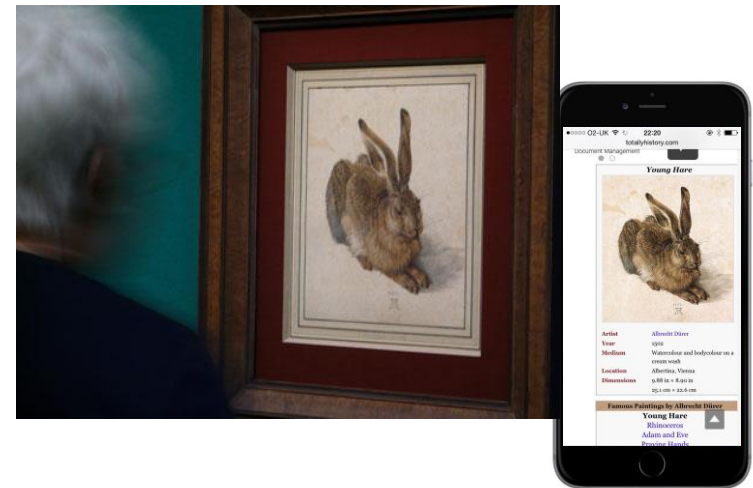
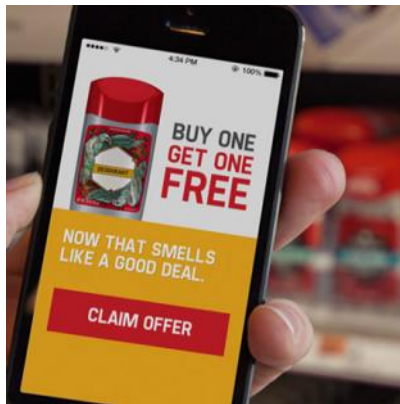
Location becomes **more precise** as multiple beacons can be seen by a device

# Indoor location services and analytics.

If the user is *this* close to *this* Beacon, then do *this*.

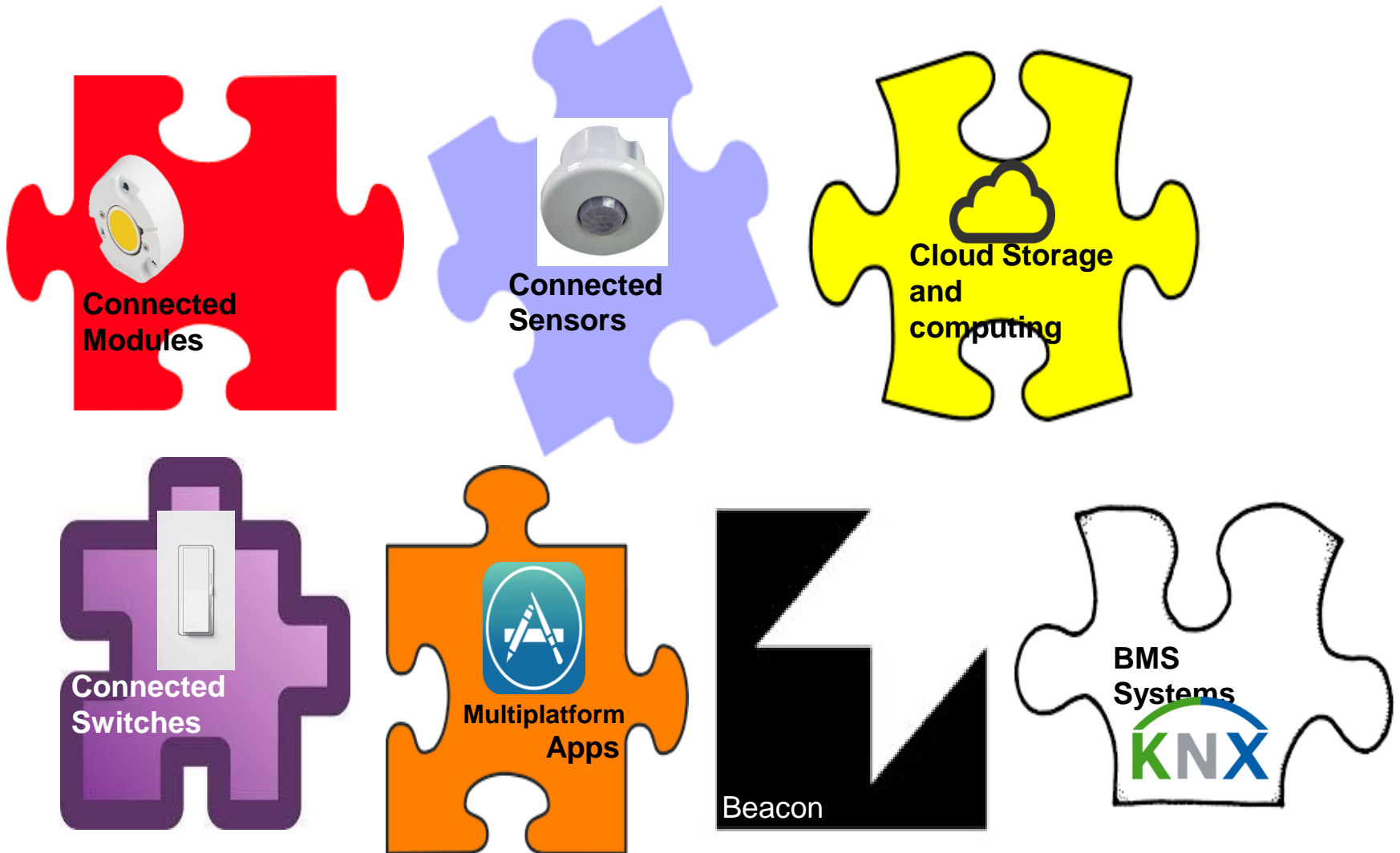
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- **Interaction:** information on merchandise, works of art etc
- **Analytics:** tracking people's movements, how long they stay, where they linger.  
Space management
- **Way finding** – especially airports, conferences
- **Emergency** phone services
- **Asset tracking**



# State of Connected Lighting

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# The Big Picture - Interoperability

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