

Connecting Buildings to a Smart World with IoT, Cloud Computing and Digital Ceiling

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Smart Buildings

Intelligent Lighting

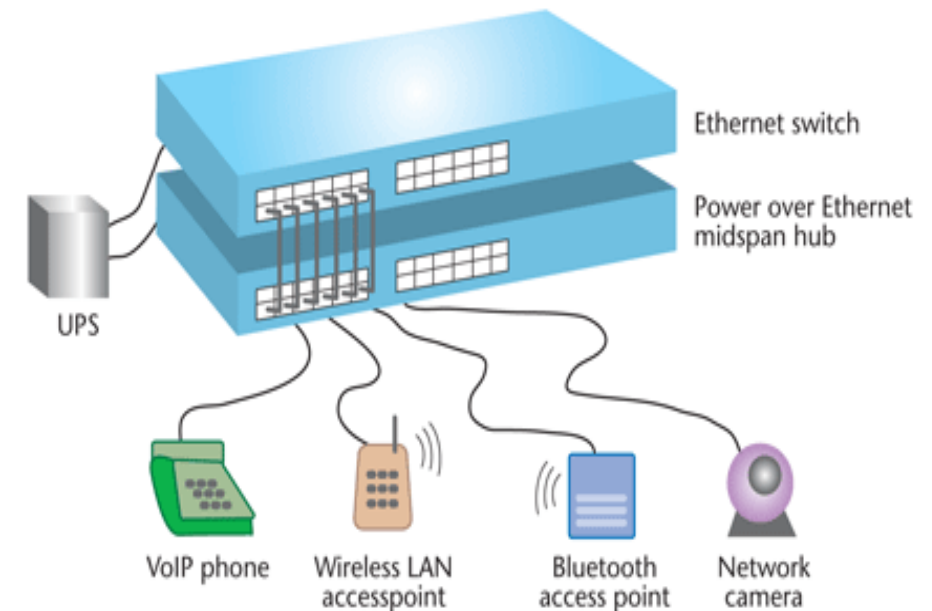
Digital Ceiling

Power-over-Ethernet

IoT & Cloud Computing

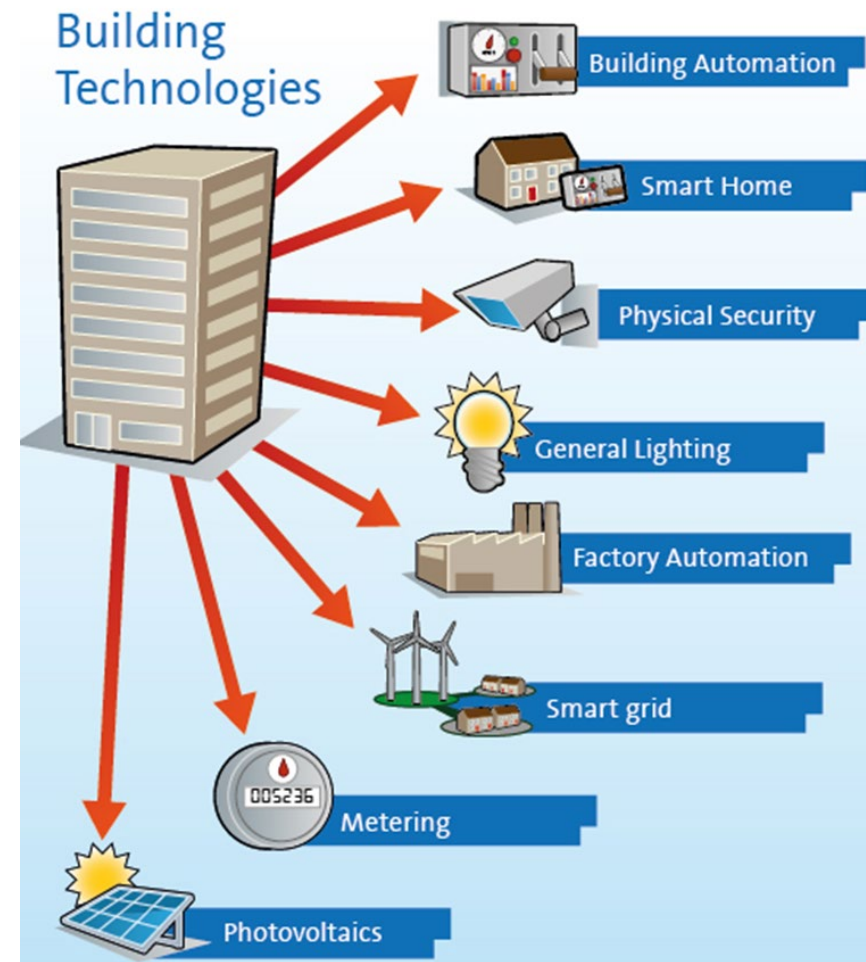
Smart Buildings - Main Considerations

- Green Building concepts
- Technology & Comfort for employees
- Office's experience
- Traditional costs reduction
- Preparing for the future



Smart Buildings - Technologies

- Building automation devices
- Building automation integration systems
- Building Analytics
- Remote monitoring services
- Smart lighting and connected lighting
- IoT: Connectivity, Devices, Software and Services

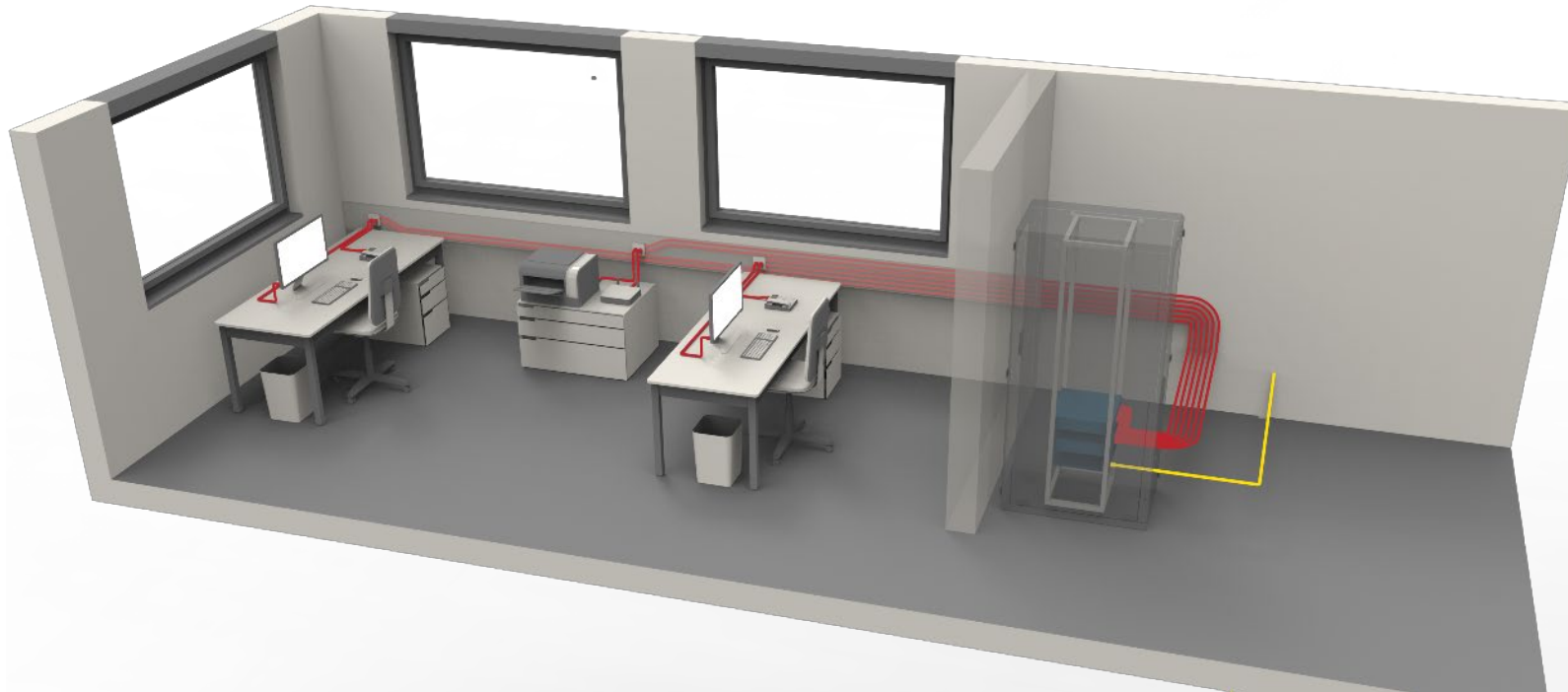


Smart Buildings – Evolution 1.0

Structured Cabling

Cabling for work area:

- IT devices only



Smart Buildings – Evolution 2.0

Structured Cabling

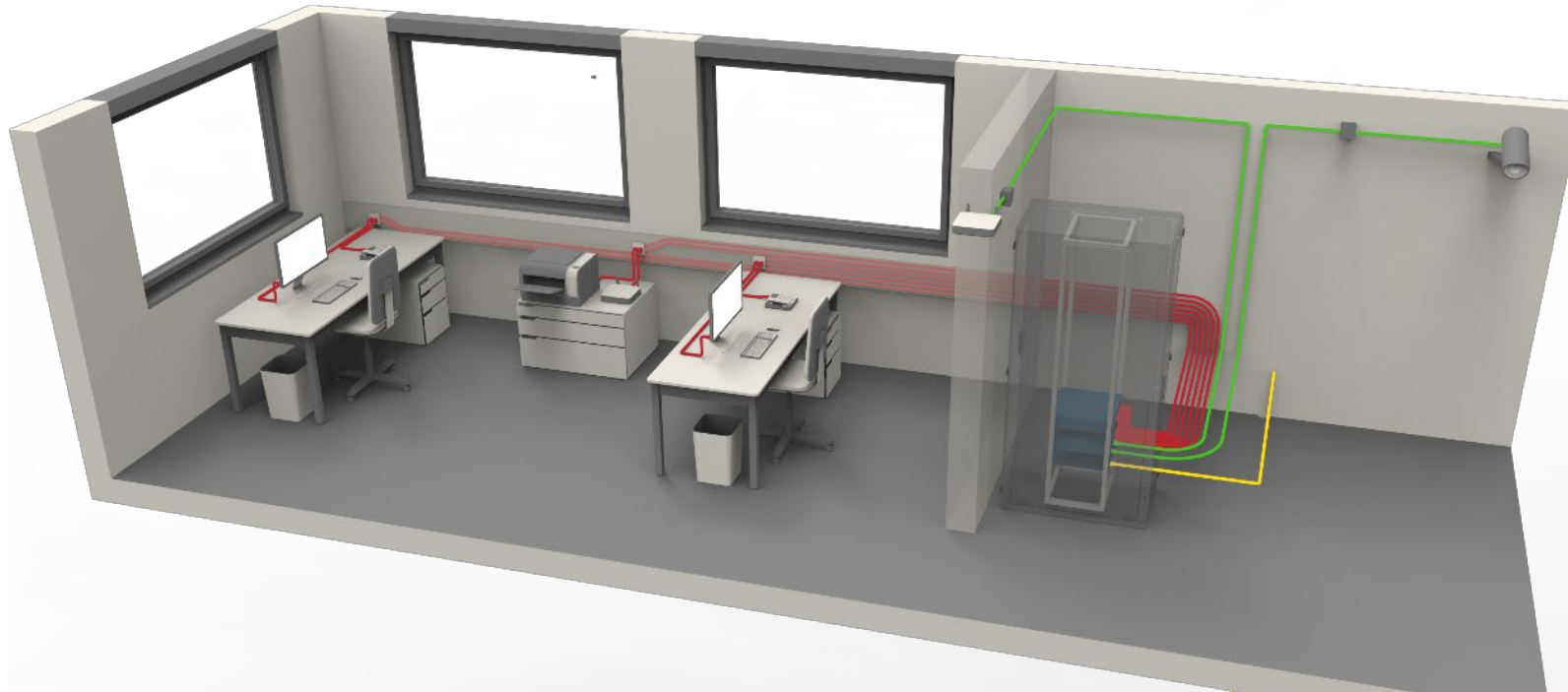
Power over Ethernet

Cabling for work area:

- IT devices only

Occasionally add devices:

- WAP and CFTV



Smart Buildings – Evolution 3.0

Structured Cabling

Cabling for work area:

- IT devices only

Power over Ethernet

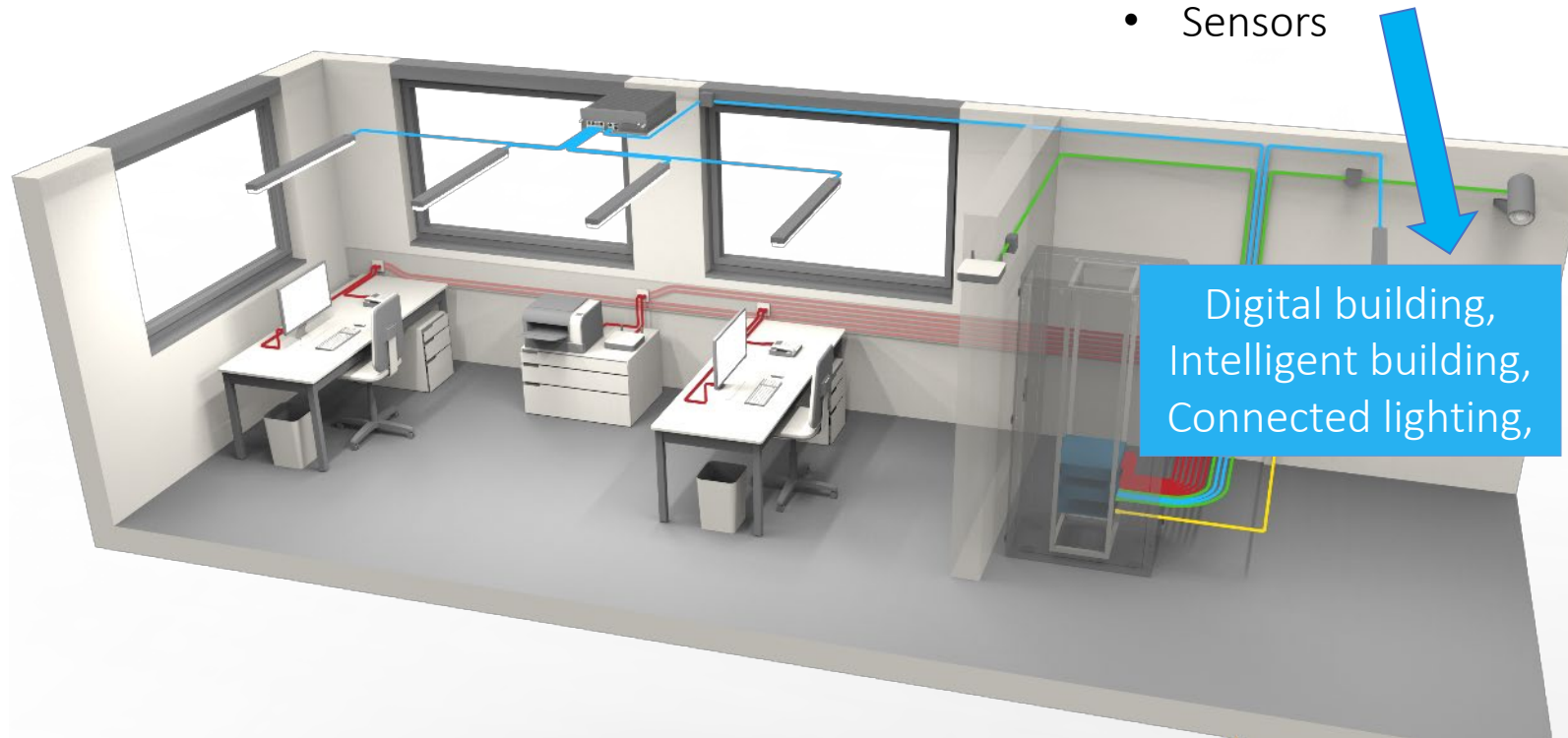
Occasionally add devices:

- WAP and CFTV

Digital Ceiling

Structured cabling for building automation devices:

- LED Lighting
- Sensors



Smart Buildings – Evolution 4.0

Structured Cabling

Cabling for work area:

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Power over Ethernet

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Digital Ceiling

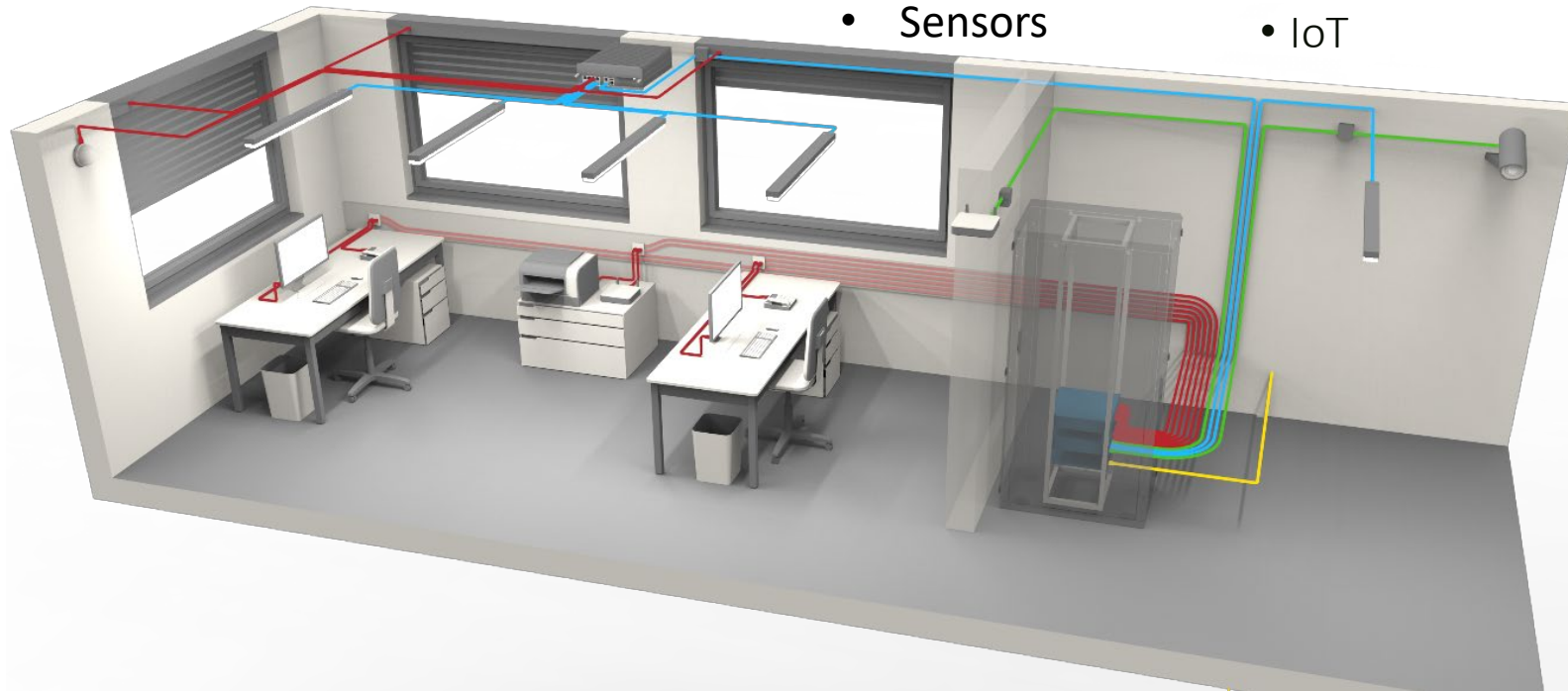
Structured cabling for building automation devices:

- LED Lighting
- Sensors

Converged Network

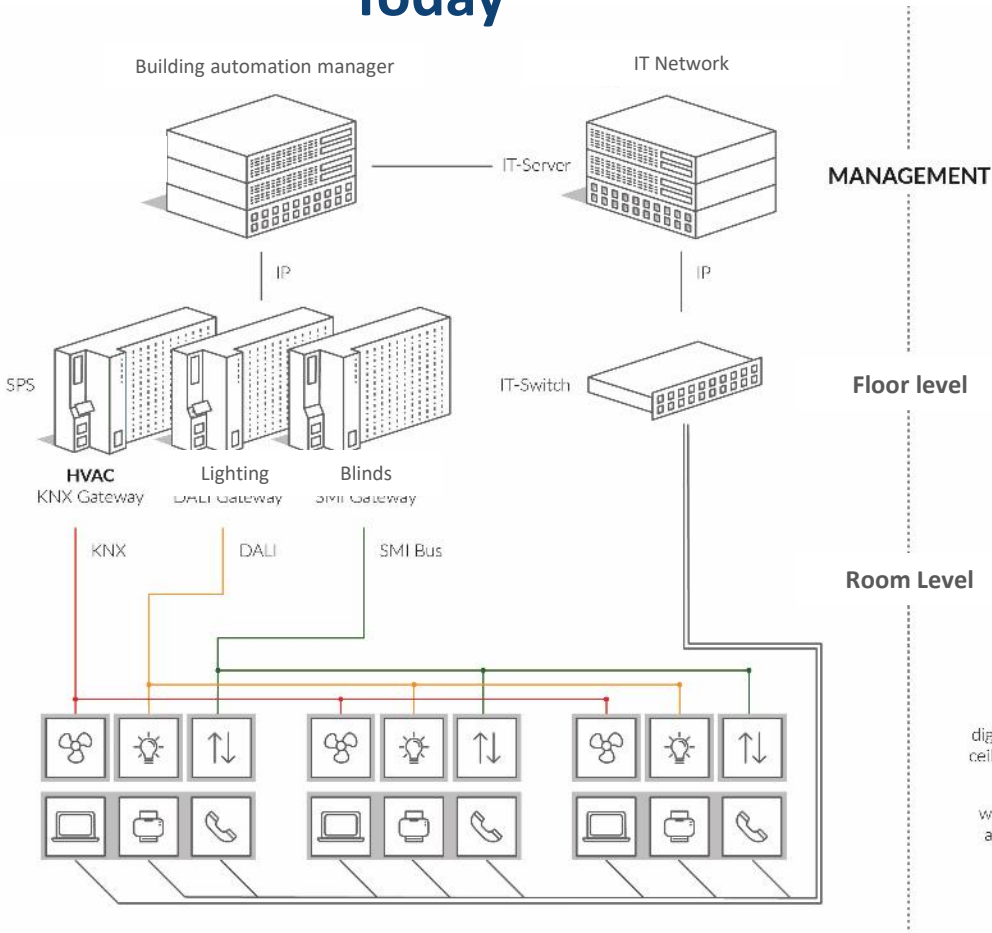
Full Integration:

- All assets and protocols over IP network
- IoT



Smart Buildings – Automation and IP Integration

Today





Smart Buildings

Intelligent Lighting

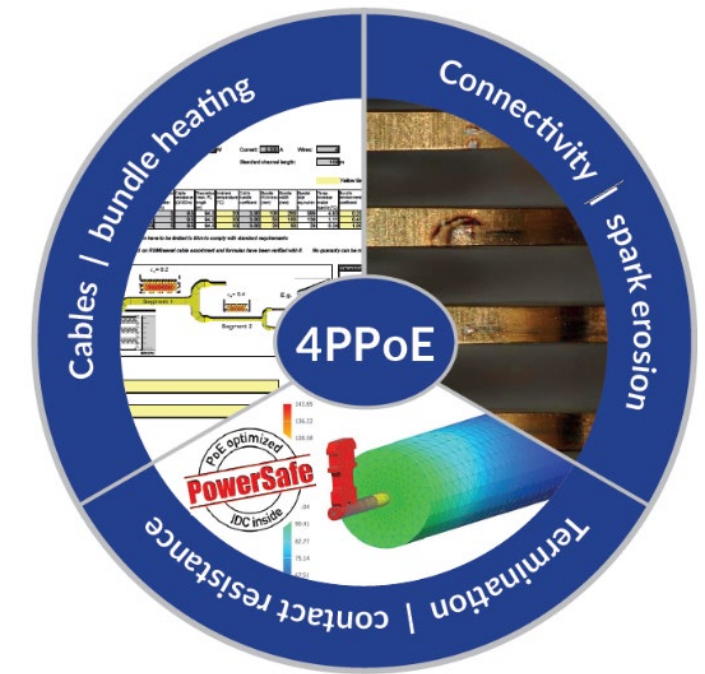
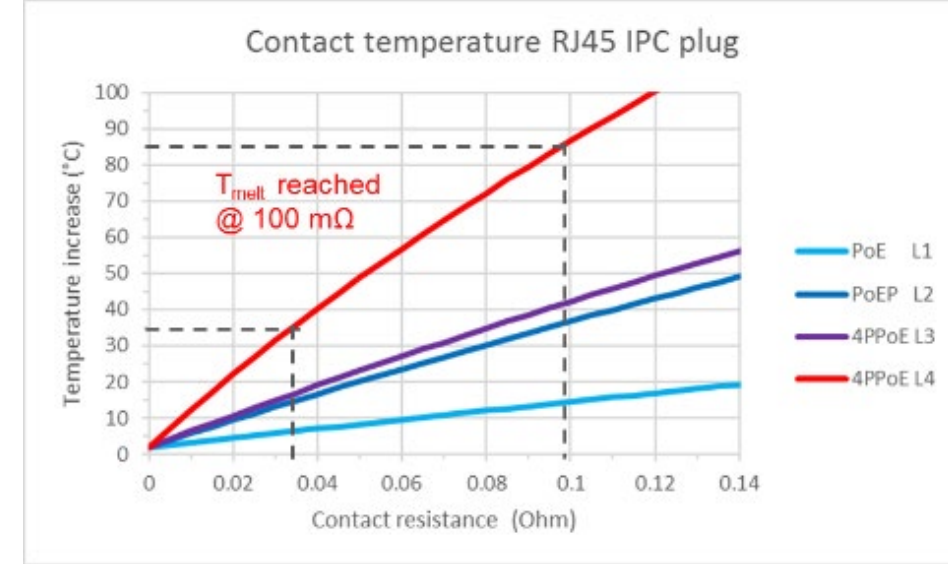
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IoT & Cloud Computing

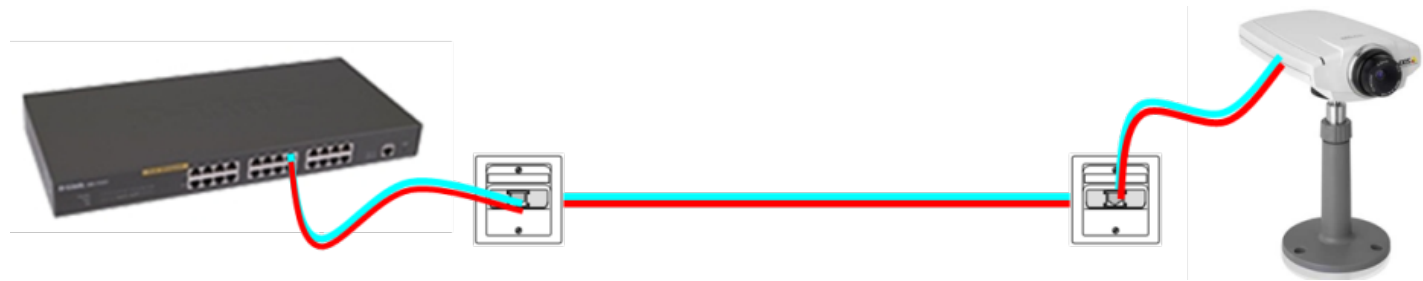
Power-Over-Ethernet (PoE)

- PoE is still one of the most discussed topic in the LAN industry nowadays;
- The version with 90W (4PPoE) is being introduced by IEEE;
- The PoE subject is critical for discussion including in pre-project phase, product purchasing and mainly during implementation



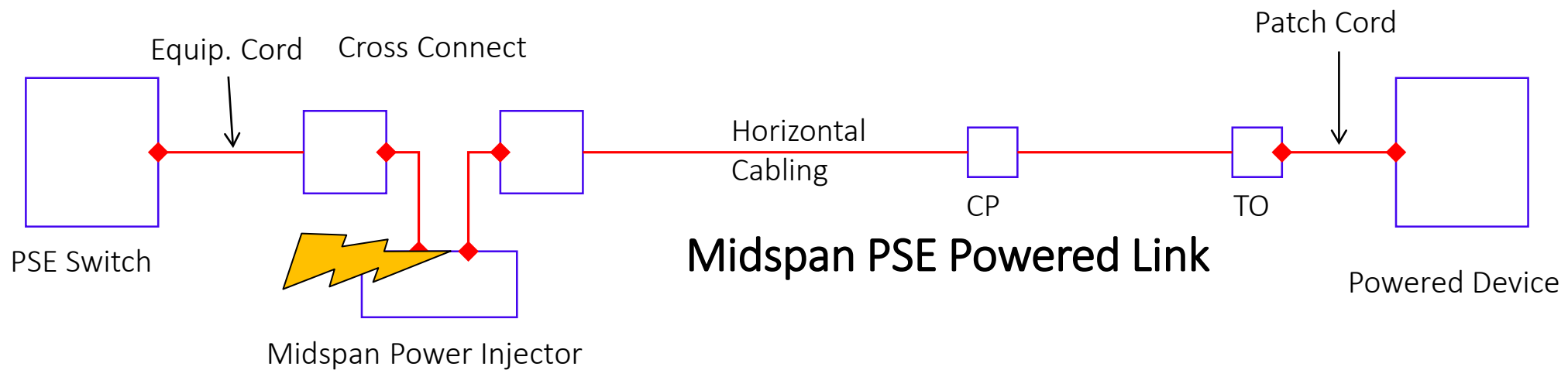
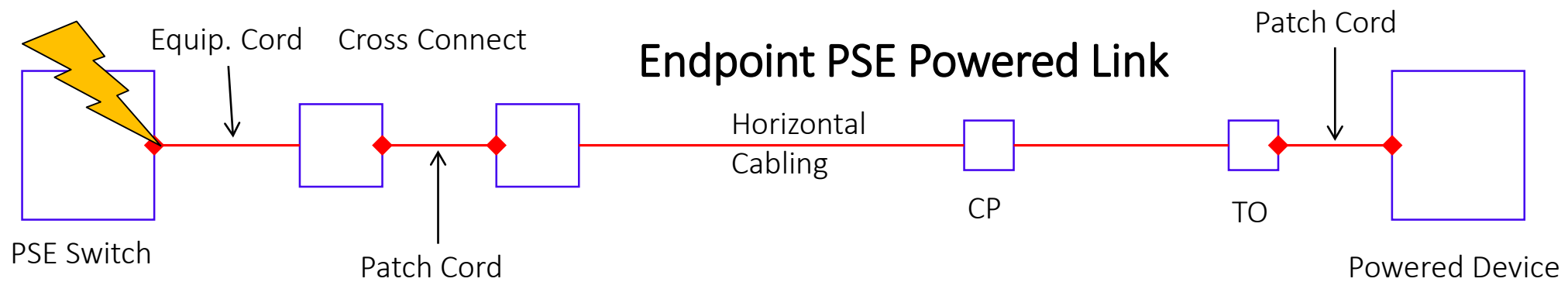
PoE: Quick Basics Overview

- PoE was already simply considered a way to deliver power to VoIP phones
- Nowadays a lot of devices are using PoE:
 - CFTV Cameras
 - Wi-Fi Access Points
 - VoIP communication systems
 - Data Center lightning
 - Building Automatic Systems



- The PoE capacity has increased enormously over the years

PoE: Powering options



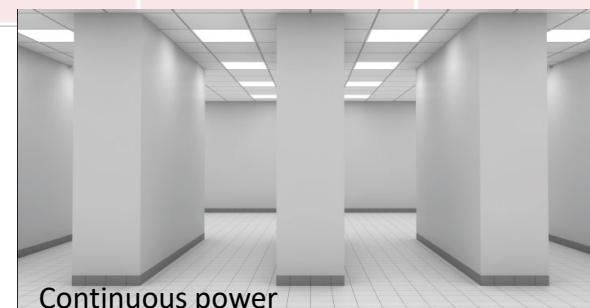
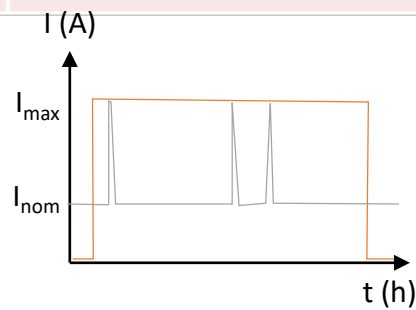
PoE: Protocols evolution

- Powering increasing:

	Power	Name	Code	IEEE
Level 1	13 W	Power over Ethernet	PoE	802.3af
Level 2	25 W	PoE Plus	PoEP	802.3at
Level 3	55 W	4-Pair PoE	4PPoE	802.3bt
Level 4	90 W	4-Pair PoE	4PPoE	802.3bt

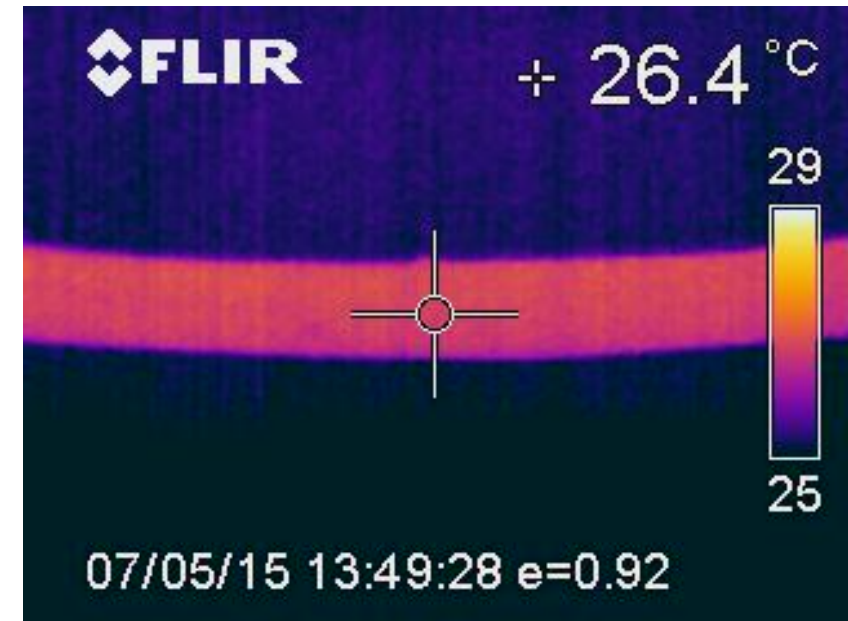
PoEP: 2,600 mA / pair

4PPoE: 4,100 mA / pair



PoE: Impact on Cabling Infrastructure

- Due to the conductors resistance, PoE generate powering and significant heat
- Depending on the installation conditions (cables bundle and environmental conditions) the cable temperature can increase
- High temperatures in the cable impact on increased link attenuation



An aerial photograph of a winding asphalt road with yellow lane markings, set against a backdrop of dense green vegetation and hills. The road curves through the landscape, and several text labels are overlaid on the image, representing different smart infrastructure technologies. The most prominent label is 'Intelligent Lighting' in large orange font at the top right. Other labels in white font include 'Smart Buildings' on the left, 'Digital Ceiling' on the right, 'Power-over-Ethernet' at the bottom left, and 'IoT & Cloud Computing' at the bottom right. The overall scene is bright and clear, suggesting a sunny day.

Intelligent Lighting

Smart Buildings

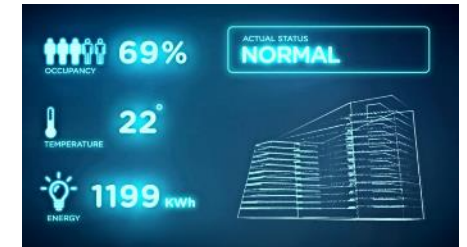
Digital Ceiling

Power-over-Ethernet

IoT & Cloud Computing

Intelligent Lighting: Advantages

- The luminaire can become a sensor platform for smart buildings automation
 - Temperature & Air Quality
 - Presence & Occupation
- The building management systems can provide a increased comfort and power savings
 - Custom environmental settings
 - Air conditioning and lighting based on the occupation
- Indoor positioning system (modular lighting)
 - Functions "Where I am" and "Where to go"
 - Heat Map



Intelligent Lighting: Power Savings

Relative power consumption and impact on costs:

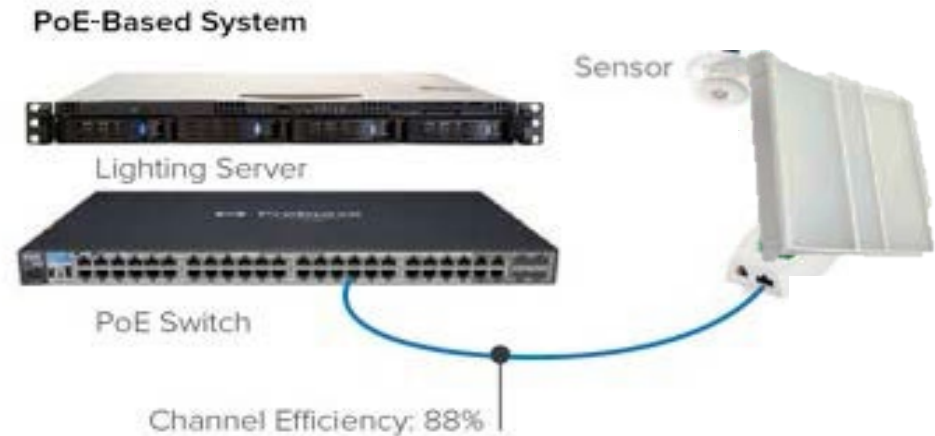
	Light bulb	LED	Intelligent LED
Lightning	100%	10%	6%
Environment Control	100%	100%	70%
Operational Costs	100%	95%	66%
Building Efficiency	100%	100%	133%

Source: Phillips, Cisco; R&M

Experts say that up to 40% savings in operating costs can be achieved in a smart building

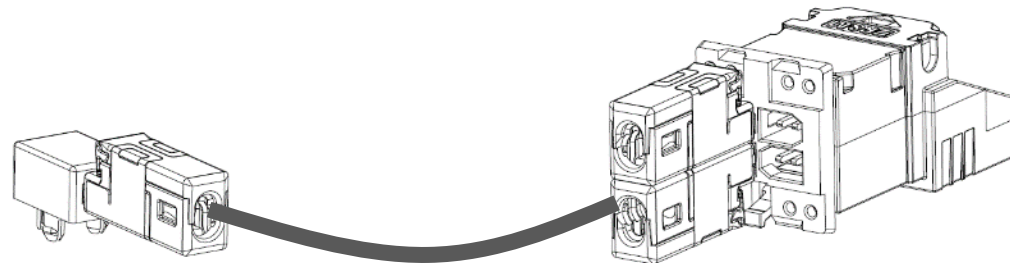
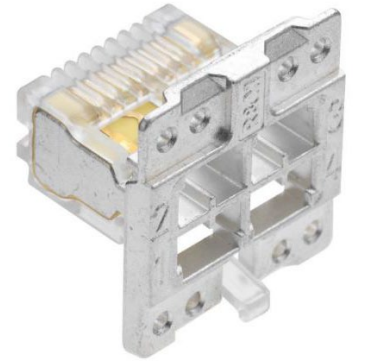
Intelligent Lighting: Ethernet Implementation

- The LED light spots require approximately 30W
- Proprietary lighting systems
 - Centralized intelligence
 - Centralized electronic LED
 - Distributor centralized on floor
- Lightning PoE based systems
 - Distributed intelligence (lighting system with IP address)
 - The light spot can act as sensor for building automation
 - Distributed active devices



Single Pair Ethernet (SPE)

- Ethernet Single Pair is the next step in the concept of digital ceiling. If there are several devices, RJ45 can be replaced by SPE in the ends
- Some microsplitter are available in the market through some manufacturers allowing compatibility with previous versions of RJ45
- SPE aims to replace existing systems for building automation and bus connections, such as: KNX, EIB, DALI, Digital Strom, BACnet, LON, Profibus, AS-Interface, VARAN, INTERBUS





Smart Buildings

Intelligent Lighting

Digital Ceiling

Power-over-Ethernet

IoT & Cloud Computing

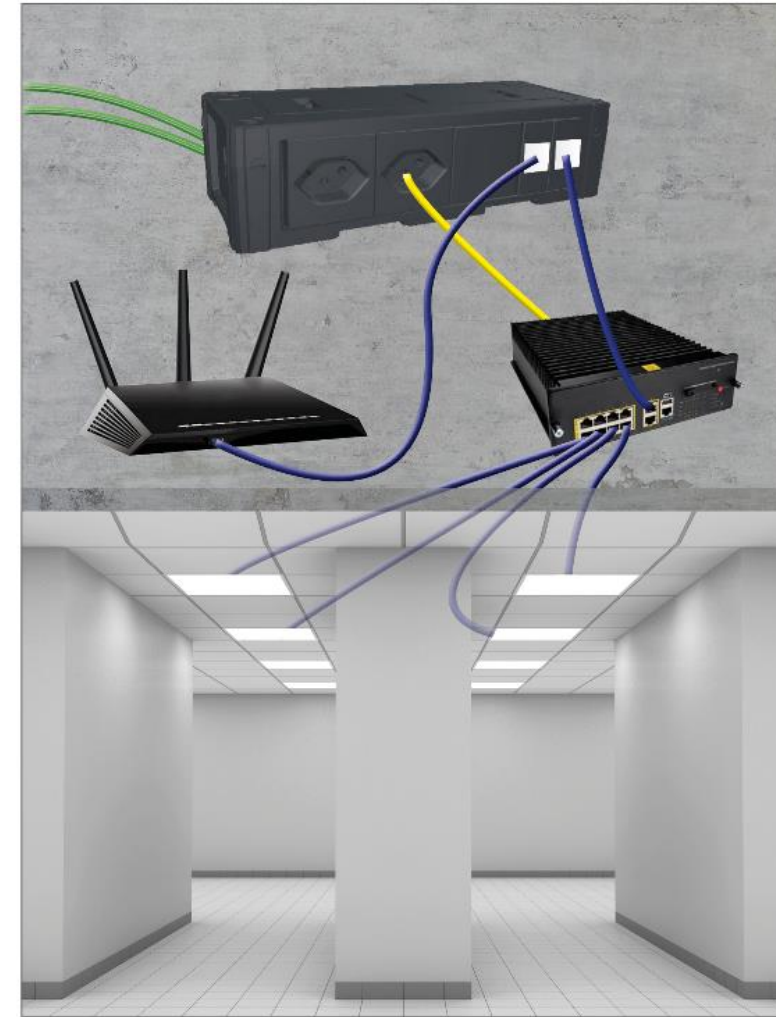
Digital Ceiling: Overview

- Unified service outlets for all building automation applications
- Works as a consolidation / distribution point
- The network equipment and patch panels are located in the technical room and each link connects over there
- Connection to luminaires by patch cords
- Routing of cables to comply with 4PPoE, managing the length of the PL (temperature and IL)

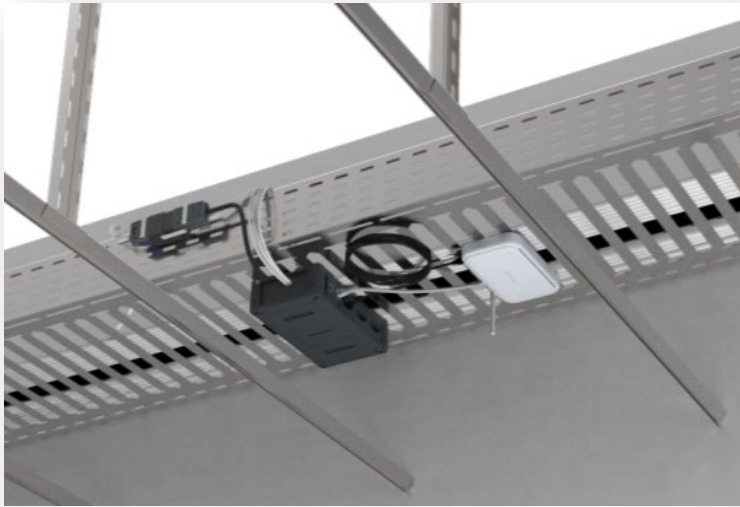


Digital Ceiling: Alternative solution using zone switch

- Capacity of at least 30W of continuous power per port
- Maintenance free (Fanless)
- Only uplinks connection from switch to technical room
- Luminaires connected to the switch in the area through patch cords



Digital Ceiling: Pictures and Examples

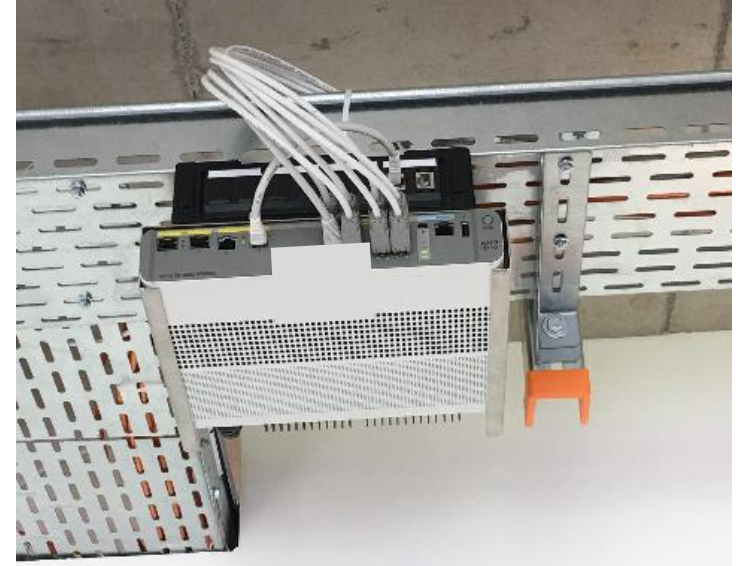


Mouting Example



Field Termination with Plug

- Demand for field plugs are increasing
- The new cabling standards are allowing permanent link with a unique female connector
- The adjustment of cables lengths are essential for an adequate installation
- Solutions are already available in the market for performance levels up to Cat.6A





Smart Buildings

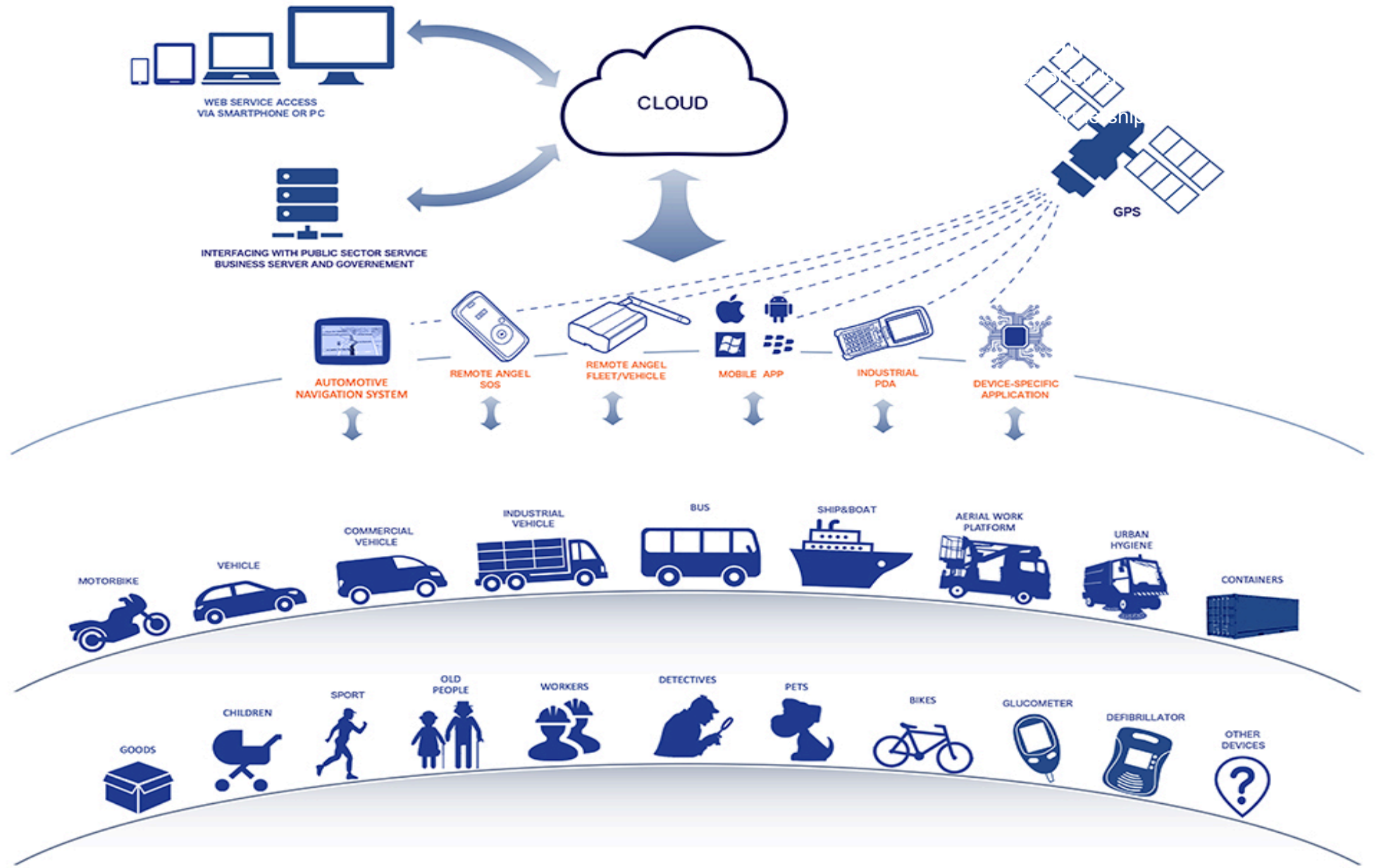
Intelligent Lightning

Digital Ceiling

Cloud Computing

IoT

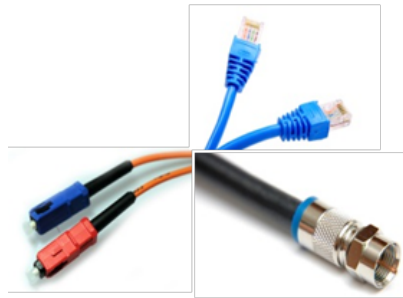
IoT: Applications



IoT: Protocols

Wired

- Ethernet, Coax, Fiber, etc. considered as a single category



WPAN

- ANT+
- *Bluetooth*® – Classic & Smart Ready
- *Bluetooth*® Smart
- **NFC**



W-Mesh

- ZigBee PRO
- ZigBee RF4CE
- ZigBee Multi-Protocol
- EnOcean
- ISA100.11a
- WirelessHART
- Z-Wave
- Other 802.15.4

- 6LoWPAN



WLAN

- 802.11a/b/g
- 802.11n
- 802.11ac
- 802.11ad
- Other 802.11
- DECT ULE
- Other 2.4GHz
- Other Sub-GHz

WWAN

- 2G Cellular
- 3G Cellular
- 4G Cellular
- **Neul**
- **LoRaWAN**



LoRaWAN™

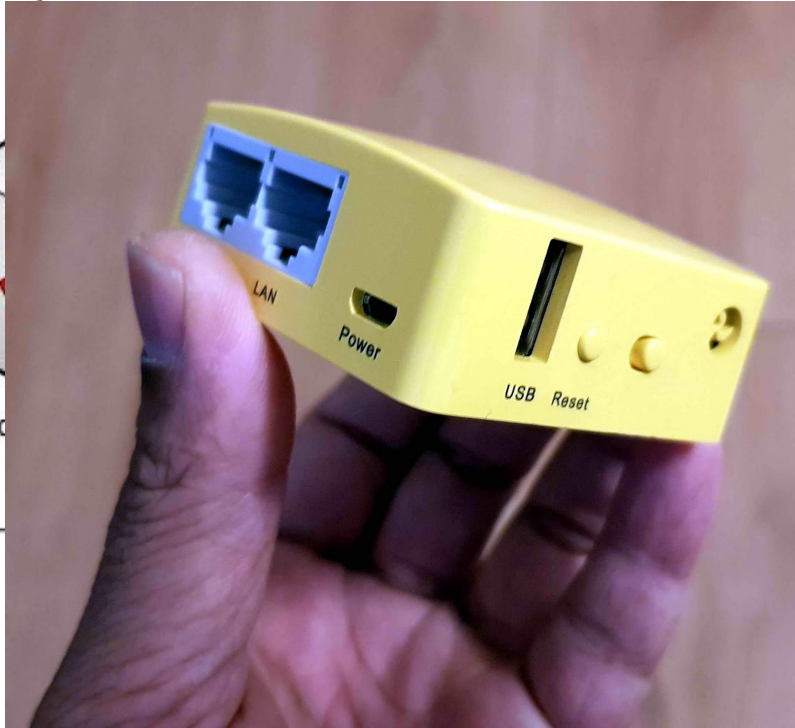


IoT: Architecture



LAN/PAN

Device



LAN/WLAN/PAN



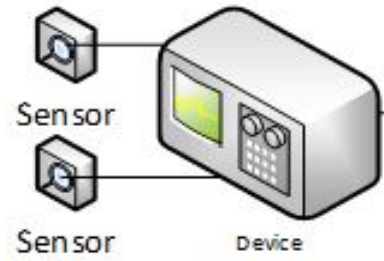
Cloud



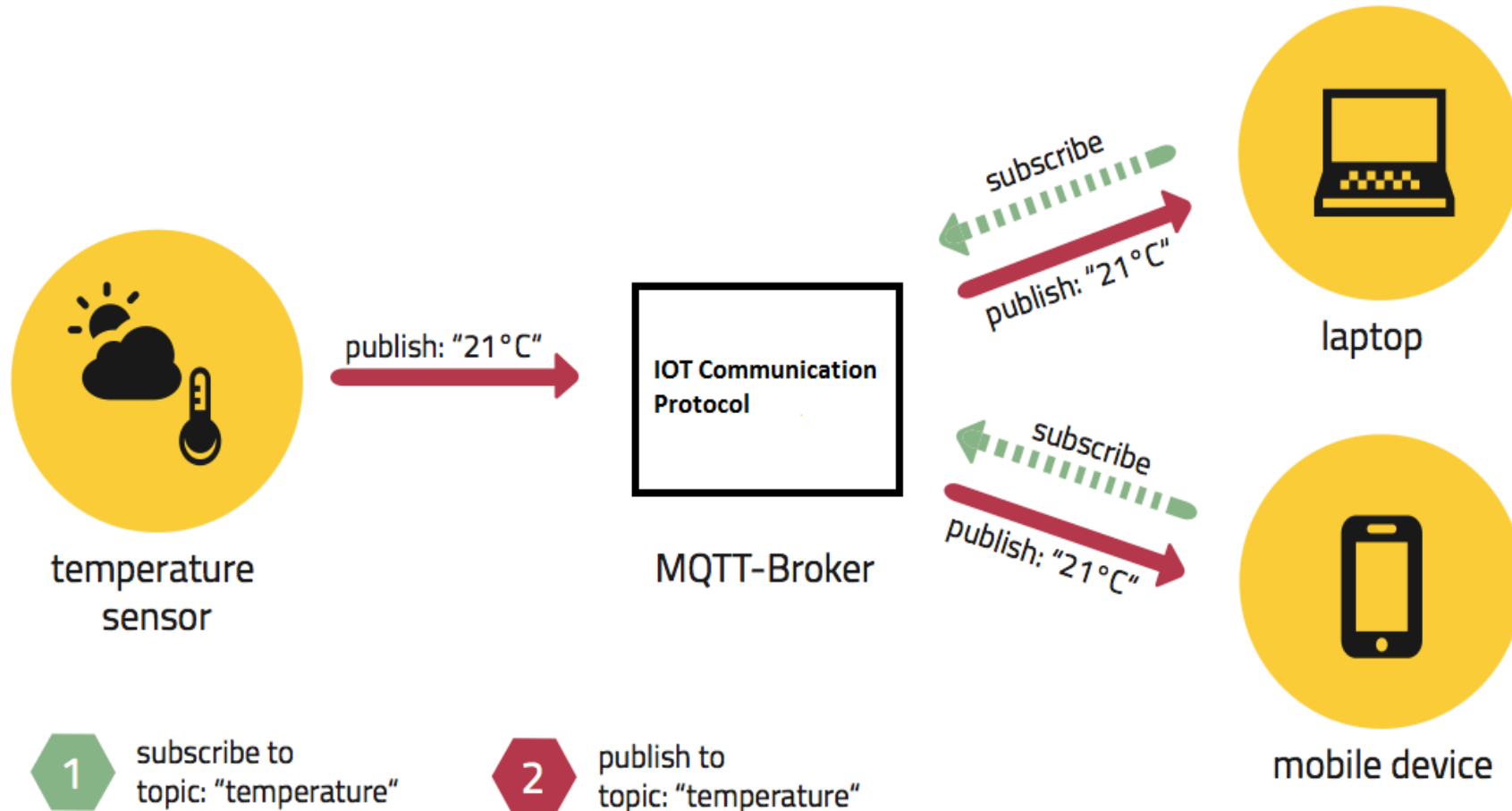
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Device



IoT: Communication Protocol





Intelligent Lighting

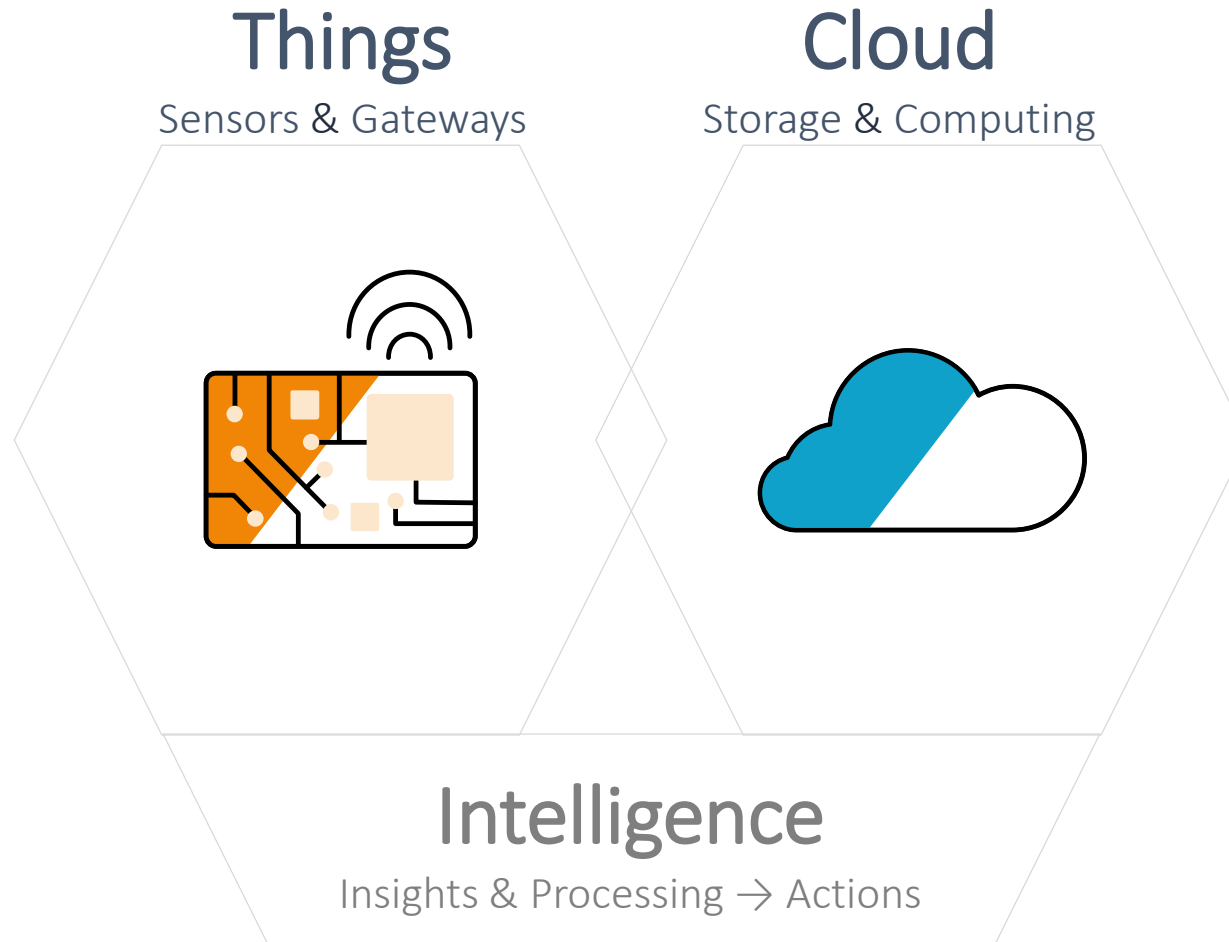
Smart Buildings

Digital Ceiling

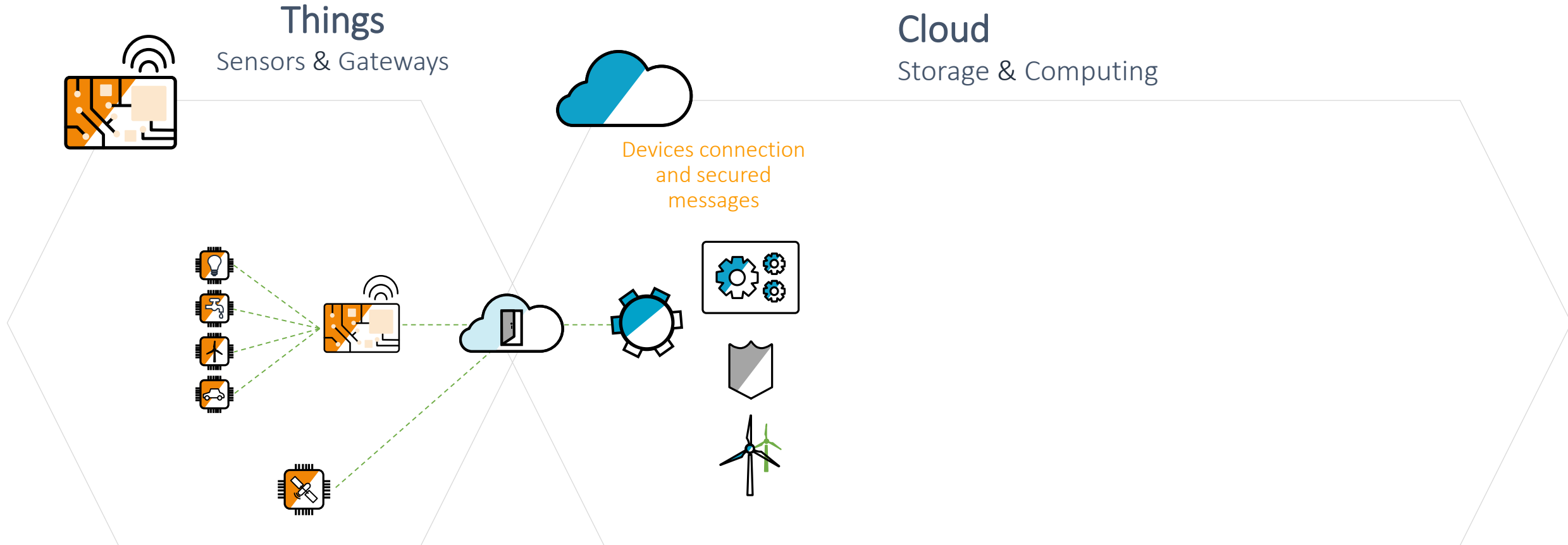
Cloud Computing

IoT

Cloud Computing: IoT Integration



Cloud Computing: IoT Integration



Cloud Computing: IoT Integration

Things

Sensors & Gateways

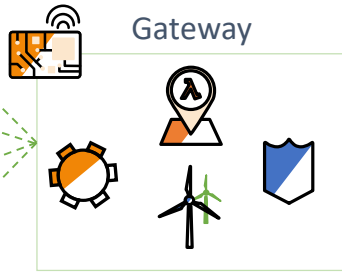


Data Sync with local security featuring

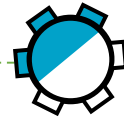
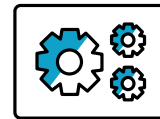
Endpoints



Gateway



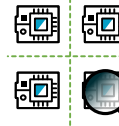
Devices connection and secured messages



Cloud

Storage & Computing

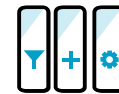
Devices provisioning, management and SW updates



Devices securing and auditing



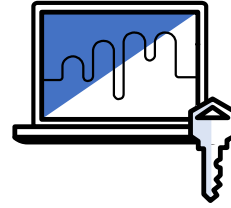
IoT Data Analytics and Intelligence



Cloud Computing: IoT Microcontroller



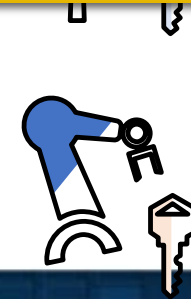
Cloud Computing: Connecting IoT Gateway to Cloud



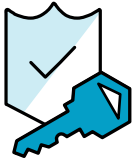
- Long-term connections
- Auth based on SigV4, X.509 and tokens
- TLS 1.2 for messages encryption
- MQTT, WebSockets, HTTP

MQTT vs HTTPS

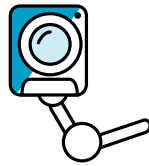
- 93x faster throughput
- 11.89x less battery to send
- 170.9x less battery to receive
- 50% less power to keep connected
- 8x less network overhead



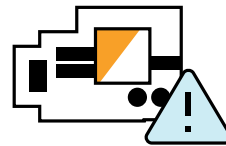
Cloud Computing: IoT Devices Management



Devices Configuration
Update



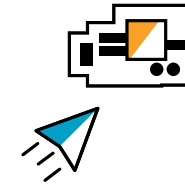
Behavior Devices
Monitoring



Anomalies
Identification



Alerts
Generation



Security Patches
Deployment

The Future ...



Smart Buildings, IoT, Cloud Computing and Digital Ceiling

The Future

- Building automation systems will deliver the benefits beyond energy efficiency
- Smart cities will drive the development of smart buildings
- Smart buildings will optimize the occupants' experience
- The implementation of the climate change policy will demand efficiency in buildings



Questions?

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