

# Wireless Sensors and IoT: our understanding of needs and challenges

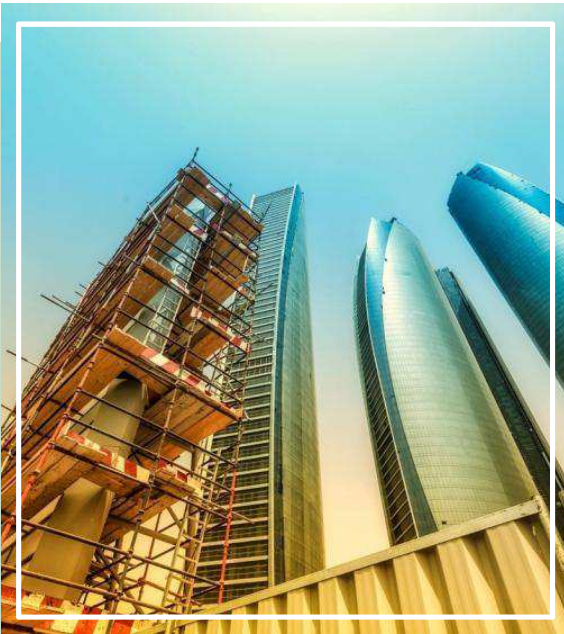
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# Three trends set to double energy demand by 2050

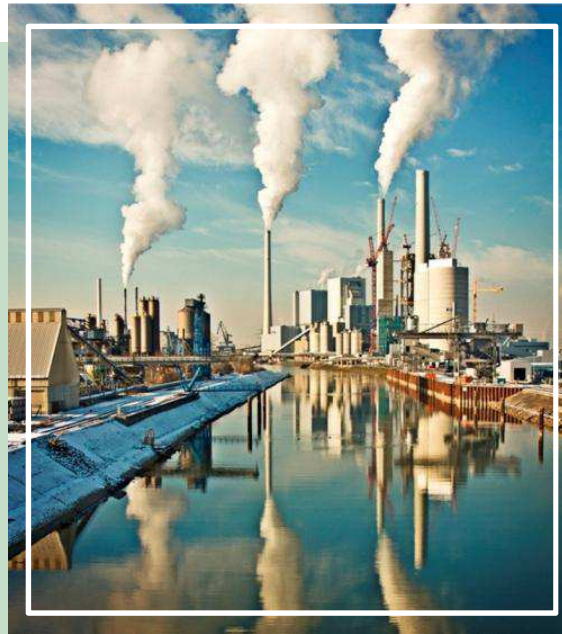
## Urbanization



### Challenges:

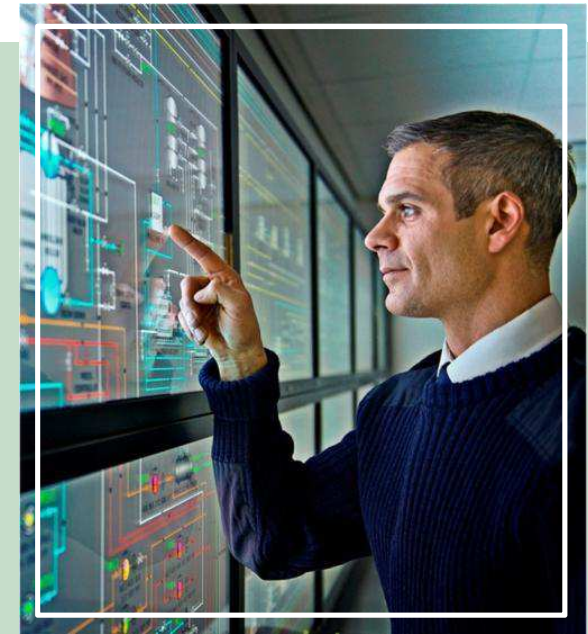
- > Increasing energy cost
- > Peaks in demand

## Industrialization



- > Pollution
- > City congestion

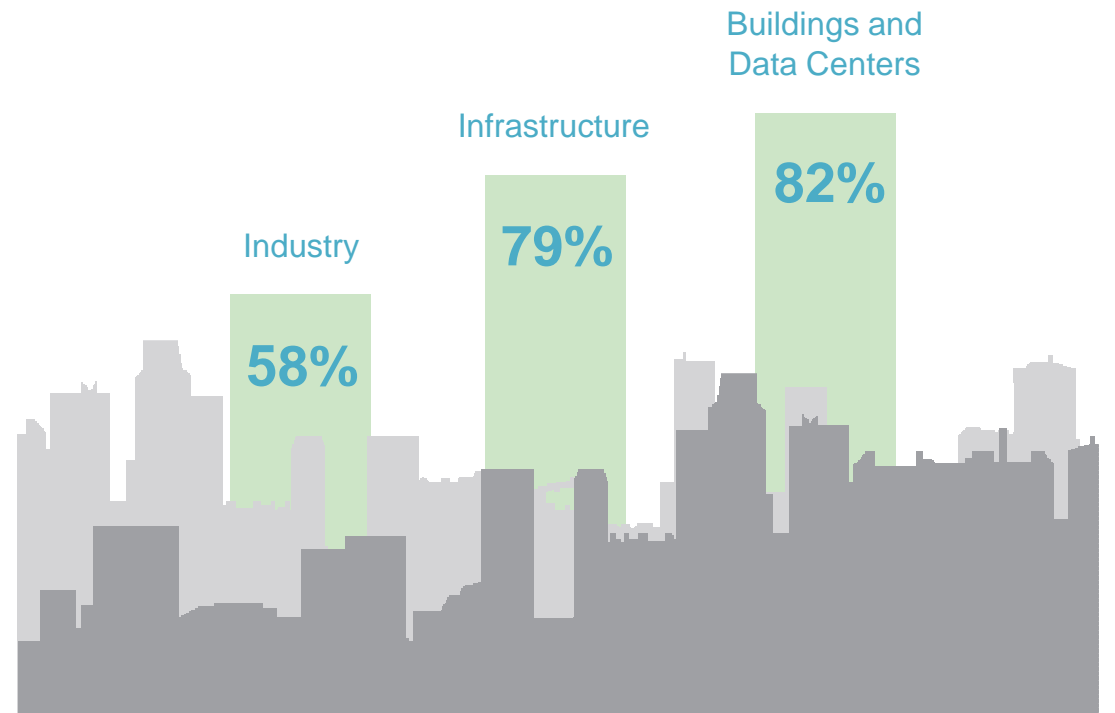
## Digitization



- > Climate change
- > Water scarcity

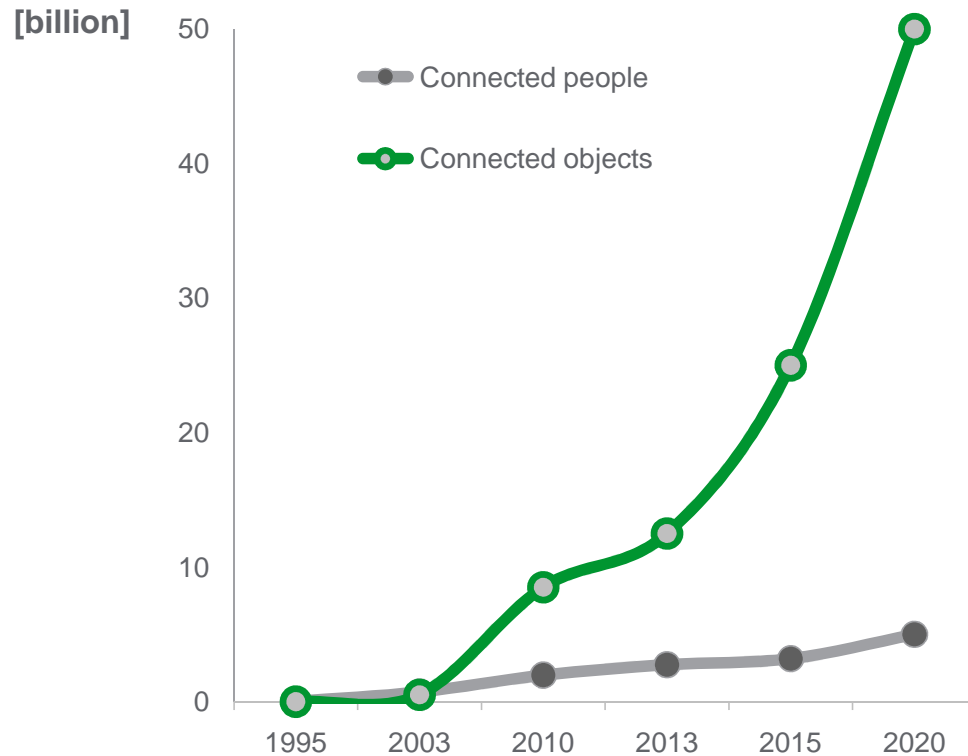
# Global consumption must be reduced and CO<sub>2</sub> emissions halved to avoid climate change

**Two thirds** of the economic potential to improve energy efficiency remains untapped<sup>1</sup>.



Untapped energy efficiency potential by segment

# Technology enables new levels of efficiency

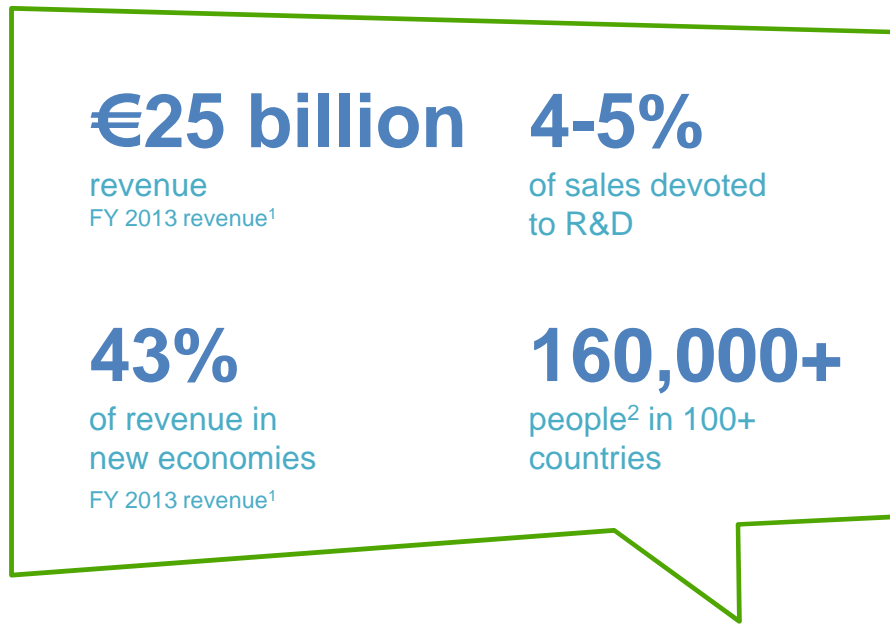


The convergence of IT and energy is enabling both process and energy optimization

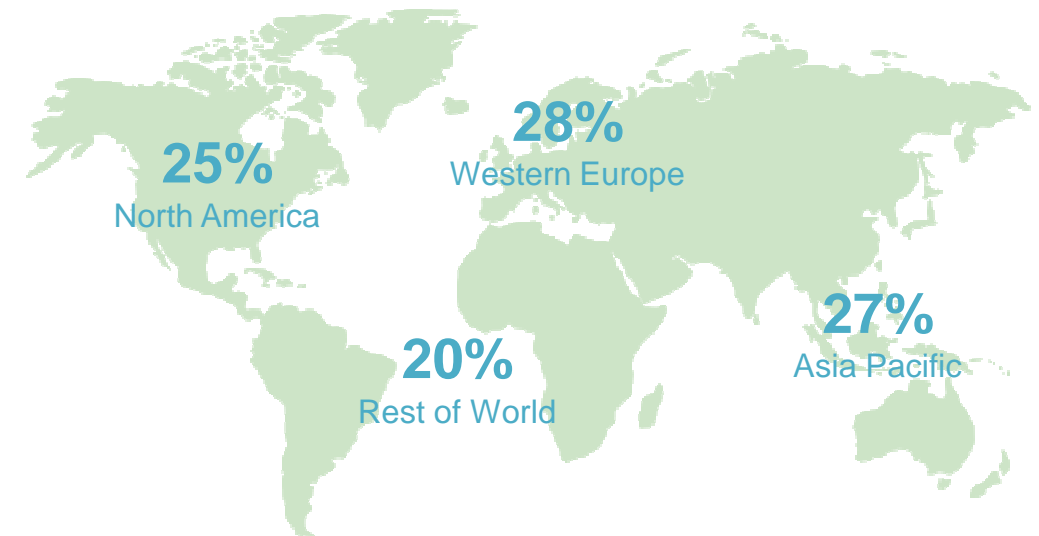
## The Internet of things: an increasingly connected world

(Source: Cisco IBSG April 2011 / Internet World Statistics)

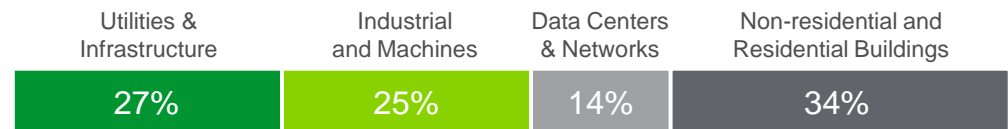
# Schneider Electric: the global specialist in energy management and efficiency technologies



## Balanced geographies – FY 2013 revenue<sup>1</sup>



## Diversified end markets – FY 2013 revenue<sup>1</sup>



# In the convergence of IT & OT

Customer requirements from sensor to big data

Enterprise

Operation

Control

Devices



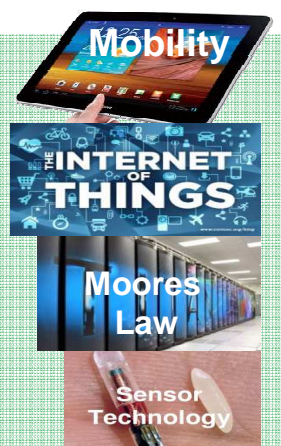
- Digital Services
- Analytics tools
- Virtual & Remote Operation

IT

Virtual IP Network

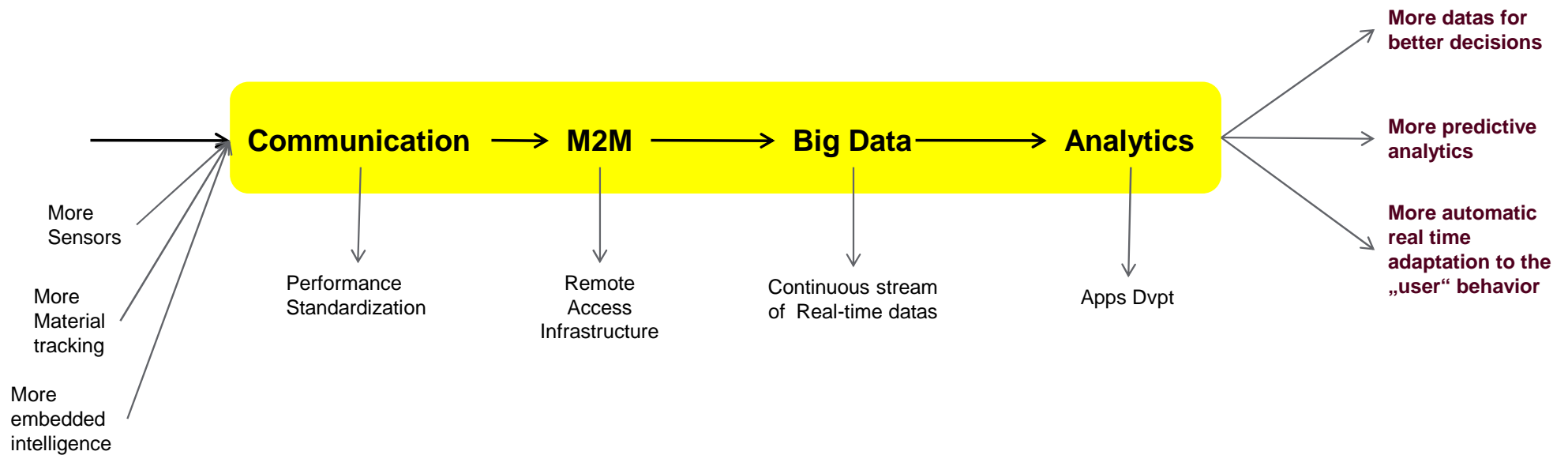
OT

- Advanced Mobile HMI
- Distributed Intelligence
- Integrated Engineering S/W
- Connected device to Eth/Web
- Optimized power conversion
- Sensor Miniaturization





# What does InternetOfThings means ?



**Benefits**  
Needs  
Roadblocks

# What do we need?

- Get a complete ecosystem of Wireless Sensors and Actuators to lower the cost of Automation with:
  - Long life time (> 10 Y)
  - Easy to install
  - Worldwide coverage
  - Interoperable
  - Small/Flat footprint for aesthetic
  - Low cost
- With some transmission range needs varying from applications/use cases
- For mass market deployment





# But with additional challenges: Embedded more and more intelligence within sensors when suitable?

- Need of more advanced sensors that require computation capability to run complex algorithm to send not anymore only data but rather relevant information
- An example is the “Video as a Sensor” to move from Kbytes of images transfer to send only relevant information:
  - To reduce the data to be transferred → benefit on transmission time (limiting bandwidth saturation, power consumption, system response time)
  - To reduce the data to be stored
  - Provide more flexibility in the control architecture with direct potential communication / control between sensors and actuators

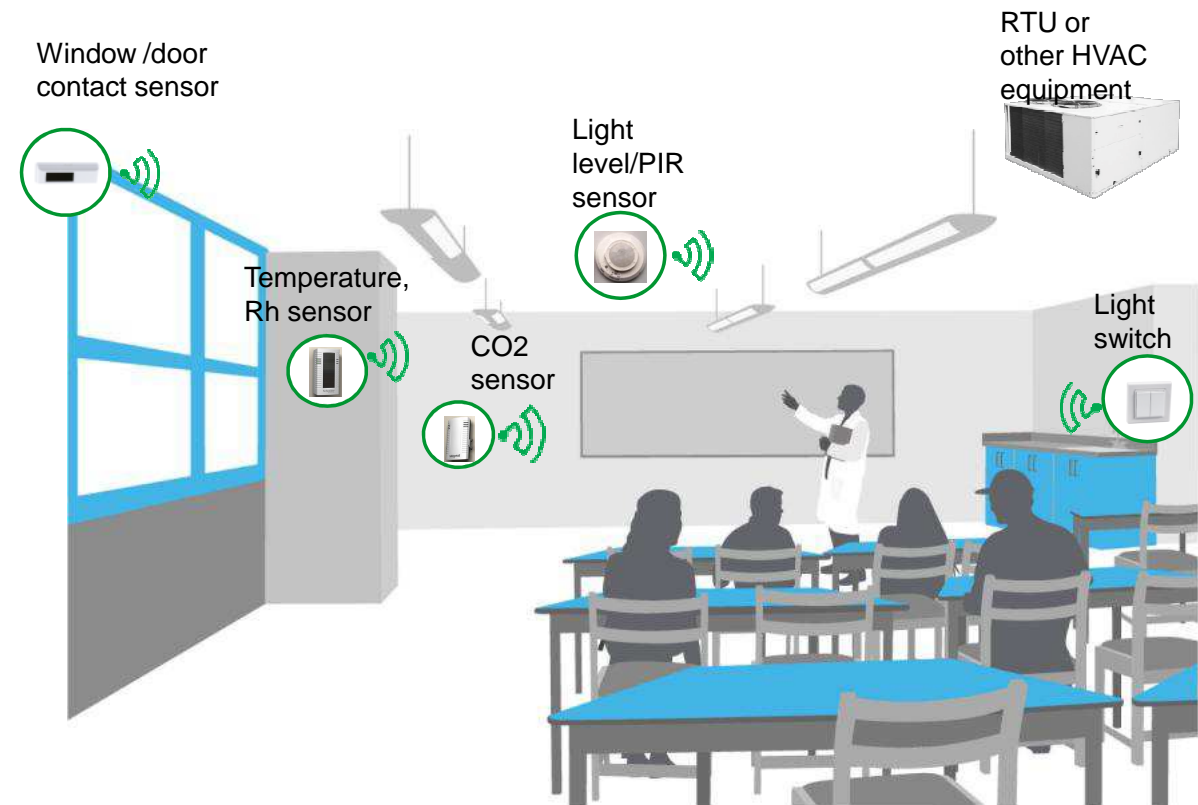
# What are the challenges

- Sensors itself: **additional/smarter sensing technologies**, lower cost, lower power consumption
- Power supply:
  - Power management
  - Energy harvesting, storage
- **RF transmission**: from **Short range** up to **Long range**
- **Low power constraint** at the sensor platform level
- **Low power MCU** with computation capability when required
- Simplify the commissioning

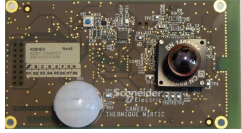
# Example 1: Low cost wireless sensors for Ambient

- Short range wireless sensors with 10 Y life time without maintenance

- Allowing to monitor temperature, Rh, CO2, Light, motion....
- Based on ULP sensor Platform with typical **1  $\mu$ A** average Power consumption
- **Long life time battery or solar cell (> 10Y)**
- ZigBee wireless communication (ZGP) with typical indoor transmission range from 20 to 30 m

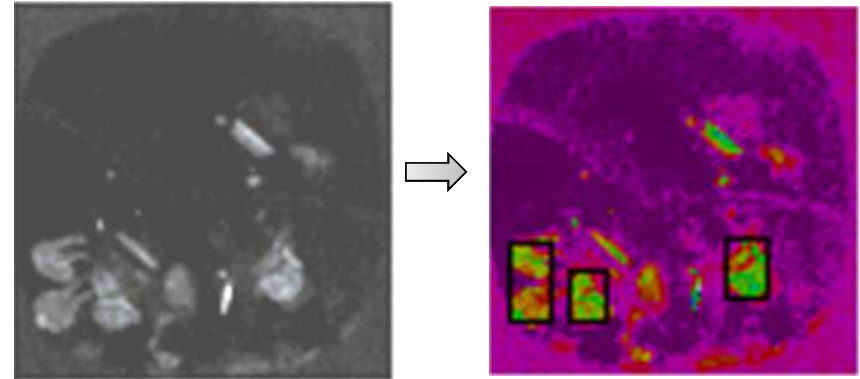


# Example 2: Advanced Occupancy Detection



- **Capability to process at the sensor level the data with relative complex algorithm for:**

- Real presence detection
- People counting and localization
- Posture recognition
- ...



- With power consumption constraint to make it run wirelessly ( $> 100 \mu\text{W}$ )
- Requiring optimized power management to provide required low noise voltage to polarize the IR imaging sensor with optimized time sequences
- MCU with resources and relative low power consumption for processing the algorithm + optimization of the code for lowering power consumption

# Example 3: Asset Monitoring sensor



- A **batteryless robust thermal sensor** that can run for 20 Y in harsh environment to monitor **electrical contact conditions on bus bar/cable/CB connections** by detecting overheating:
- Energized by 50Hz magnetic field surrounding busbars and cables
- Busbars temperature measured by means of thermistor component
- ZigBee wireless communication protocol to the Gateway for cloud interface
- Ultra low power electronics
  - Reduced leakage current even at high temperature (no DC/DC convertor...)
  - Withstand up to 125°C



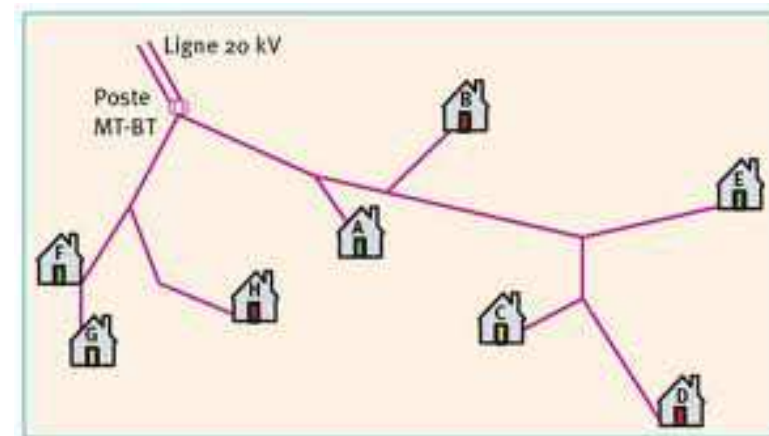
# Example 4: Long and Mid range wireless sensor

- More and more objects will be connected. Some of them are far from the networks and classical 2.4 GHz radios like Bluetooth, ZigBee or WiFi are not able to cover the long range.
- A large part of use cases and applications require a few among of data (a few bytes every hours or days). This allows very low data rate and long range radio communication.
- For long range communications, available current solution are GPRS or 3G: too expensive (RF module + subscription), not compliant with small batteries, made in order to transmit files (a few Kbytes every days).

## **New technologies are now ready in order to connect object:**

- Long Range
- Very low data rate
- Low Power
- Low Cost
- Small size of data
- Operated Networks or Private infrastructures

**Monitor voltage on LV networks and detect losses by measuring voltage at customer connection**



# Conclusion

- Sensors will play a critical role within IoT applications
- Trends is moving sensors to rather low cost, low footprint, long life time wireless sensors for mass deployment in the field
- More and more intelligence will be also distributed at the Sensors/Actuators level either for local control or for optimization of the data transfer (processed data)
- Technologies challenges have to be overcome even if today technologies is enhancing rapidly and is becoming more and more affordable allowing to tackle some of the challenges
- One of the key challenge highlighted by IoT is relative to the wireless communication standards, meaning how to ensure interoperability across applications/devices



**Help people make the most of their  
energy**

