IoT Networks

IoT LPWANs

IoT LPWANs

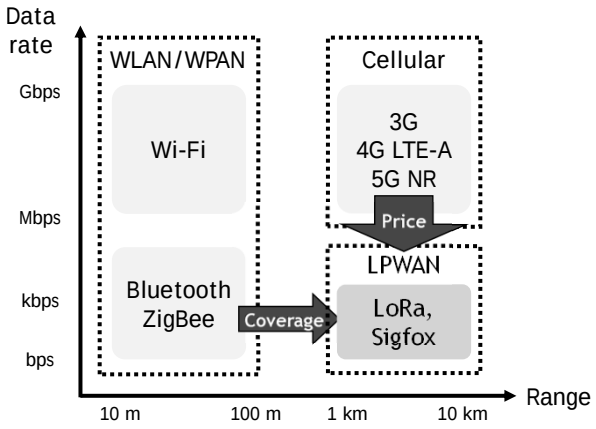
❖ LPWAN (Low-Power Wide Area Network)

- Wireless telecommunication network designed for long range communication at low power and low bit rates
- LPWAN Types
  - LoRa based networks
  - UNB (Ultra Narrow Band) networks
    - Sigfox, NB-IoT (3GPP), etc.

IoT LPWANs

❖ LPWAN (Low-Power Wide Area Network)

- Types of wireless communication



IoT LPWANs

❖ LPWAN (Low-Power Wide Area Network)

- Types of wireless communications

	Local/Personal Area Network	Low Power Wide Area Network	Cellular Network
Strong	Well established standards	Low power consumption Low cost	High data rate Coverage
Week	Battery life Network cost	Low data rate Emerging standards	Total cost of ownership
Standards	Bluetooth, Wi-Fi, ZigBee	LoRa, Sigfox	3G, 4G LTE, LTE-A, 5G

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❖ LoRa / LoRaWAN

- Wireless modulation technology that can support Long Range communication links
  - Single gateway or base station can cover an entire city (hundreds of square kilometers)
  - CSS (Chirp Spread Spectrum) radio modulation
  - Uses license-free radio frequency bands
    - 169 MHz, 433 MHz
    - 868 MHz (Europe)
    - 915 MHZ (North America)

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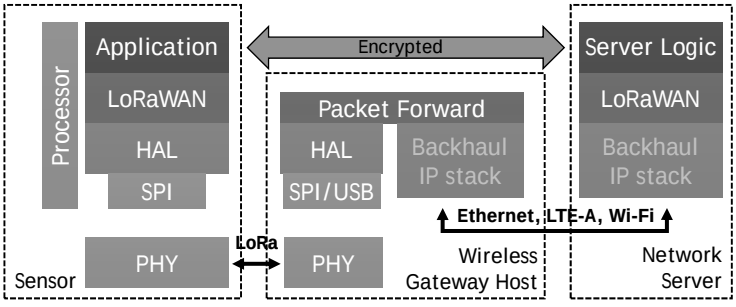
❖ LoRa / LoRaWAN

MAC: Medium Access Control
HAL: Hardware Abstraction Layer
SPI: Serial Peripheral Interface

- LoRaWAN defines the network communication protocol (MAC) and system architecture
  - Version 1.1 released in October 2017



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❖ LoRaWAN Characteristics

- More than 10 km range with high link budget
  - longer than cellular, deep indoor coverage
- 10-20 year battery lifetime
  - 10x greater than cellular M2M
- Low data rate from 0.3 ~ 50 kbps
- Integration with the backhaul IP network
- LoRa Alliance based standardization
  - Cisco, IBM, Semtech, Swisscom, Kerlink, etc.

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❖ Sigfox

- Sigfox is a LPWAN technology that uses UNB (Ultra Narrow Band) modulation
- Suitable for low data rate, lightweight device based IoT services
  - UNB modulation (D-BPSK) + low bit rate
    ➔ High BS (Base Station) receiving sensitivity

IoT LPWANs

❖ **Sigfox**

- Small and lightweight messages
  - Uplink max. 12 octets for payload
  - Downlink max. 8 octets for payload
  - 14 octets for the header
- Maximum 140 transmissions per day with a data rate of 100 bps

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❖ **Sigfox**

- Sigfox uses the license free ISM (Industrial, Scientific & Medical) RF (Radio Frequency) bands
  - 868-869 MHz in Europe
  - 902-928 MHz in the USA

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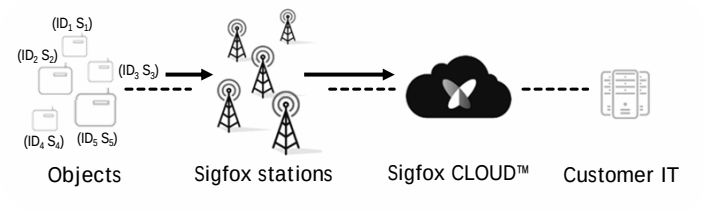
❖ Sigfox operation

- Sigfox network architecture

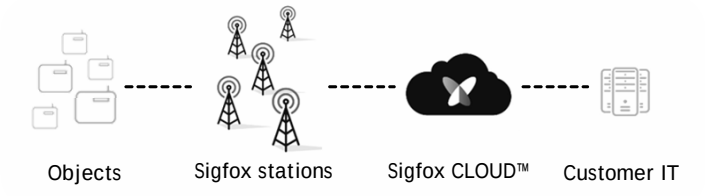


- Each Sigfox device and station has a unique Sigfox ID
  - ID and Signature are transmitted for authentication of each device

IoT LPWANs

❖ Sigfox operation

- Sigfox network architecture

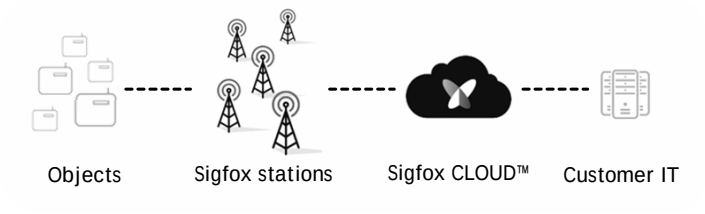


- Objects transmit data to a Sigfox station
- Sigfox stations are directly connected to a single Sigfox CLOUD™

IoT LPWANs

❖ Sigfox operation

- Sigfox network architecture



- Sigfox stations detect, demodulate, and report the message to the Sigfox CLOUD™
- Sigfox CLOUD™ pushes the message to the user application or customer platform

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