Introduction aux réseaux LPWAN avec LoRaWAN

Réunion FRNOG 32

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Actility at a glance

Actility is the world leading company in deploying, scaling and enriching low power IoT networks. Leveraging technologies such as LoRaWAN or cellular IoT, Actility enables public and private operators to deploy cost-efficient use cases and disrupt the industral Internet of things market with a scalable and carrier-grade platform

Company funded
2008

Headquarters
Paris
France

Products in
50+
countries

Actility
Connecting with intelligence

PROFILE

110 people with a mix of seasoned managers and experienced R&D teams

100 M€+ funding raised with investors like Orange, Cisco, Bosch, Swisscom, Creadev, Foxconn, Inmarsat etc.

10 Country locations including France, UK, US, Benelux, Singapore, China, Japan and Australia

20.000+ LoRaWAN gateways connected on different Actility-supplied networks

PRODUCT & SERVICES PORTFOLIO

Deploy
- ✓ LoRaWAN network server
- ✓ Professional services & radio planning
- ✓ Carrier-grade OSS/BSS for gateway & device management
- ✓ Join servers for easy device activation

Scale
- ✓ Key Management System for enhanced security & large scale device activation
- ✓ Firmware-over-the-air update for devices on the field
- ✓ Ecosystem adoption speed-up through device marketplaces and partner programs

Enrich
- ✓ Geolocation services using a combination of technologies like LoRa network location or AGPS
- ✓ Access to Roaming hub for easy device roaming
- ✓ Fully integrated end-to-end solutions marketplace to accelerate go-to-market

CLIENTS & PARTNERS
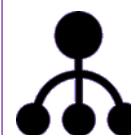
Public operators
31 large scale operators deployments in Europe, North America and APAC including Orange, Comcast or NTT

Enterprise networks
Dozens of enterprise network deployments in Smart cities, Manufacturing, Oil & Gas, Facility management or Tracking and Logistics
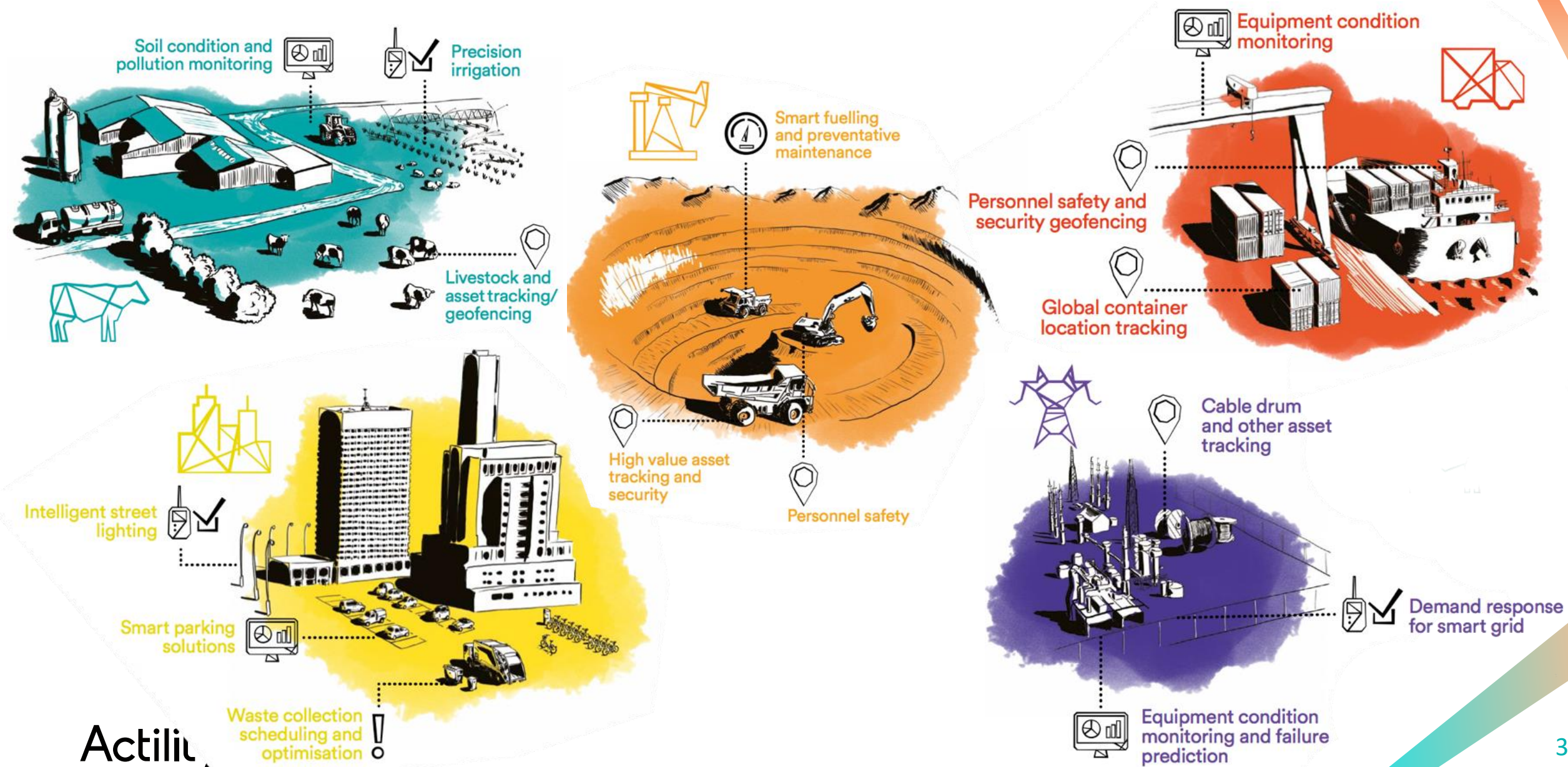
Distributors & resellers
Actility is distributed world wide by a dedicated network of distributors including CISCO or OBS, allowing a worldwide business reach
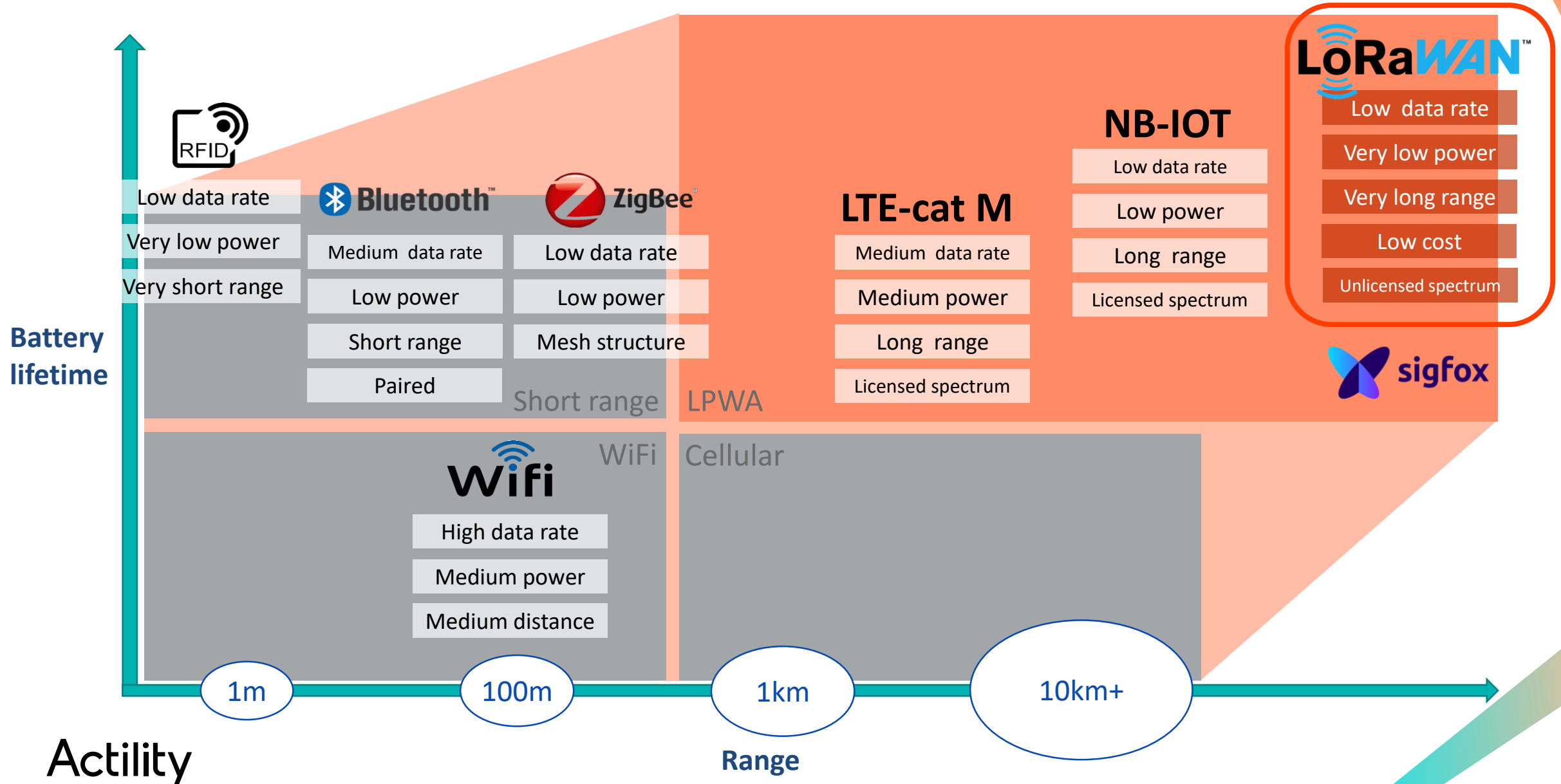
Solution partners
Actility is enabling vertical solution providers supplying devices and/or applications with integrated connectivity, to propose fully integrated end-to-end solutions

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A world of opportunities for industrial IoT

LPWA is the essential foundation of industrial IoT

Battery lifetime

RFID
- Low data rate
- Very low power
- Very short range

Bluetooth™
- Medium data rate
- Low power
- Short range
- Paired

ZigBee®
- Low data rate
- Low power
- Mesh structure

Short range

WiFi
- High data rate
- Medium power
- Medium distance

WiFi

LTE-cat M
- Medium data rate
- Medium power
- Long range
- Licensed spectrum

NB-IOT
- Low data rate
- Low power
- Long range
- Licensed spectrum

LoRaWAN™
- Low data rate
- Very low power
- Very long range
- Low cost
- Unlicensed spectrum

sigfox

LPWA

Cellular

| 1m | 100m | 1km | 10km+ |

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Range

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Driving the global success of LoRaWAN

The LoRa Alliance

The fastest growing global technology alliance

https://lora-alliance.org/

**500+** Members

2015 — 2018

What is LoRa ?

LoRa® is the physical layer or the wireless modulation utilized to create the long range communication link.

❖ chirp spread spectrum modulation

❖ Channel becomes wide enough for a quartz receiver : symmetrical bidirectional communication becomes possible

❖ This techniques offers a better resistance to natural interference, noise and jamming

❖ Information is recovered with negative SNR (up to -22dB)
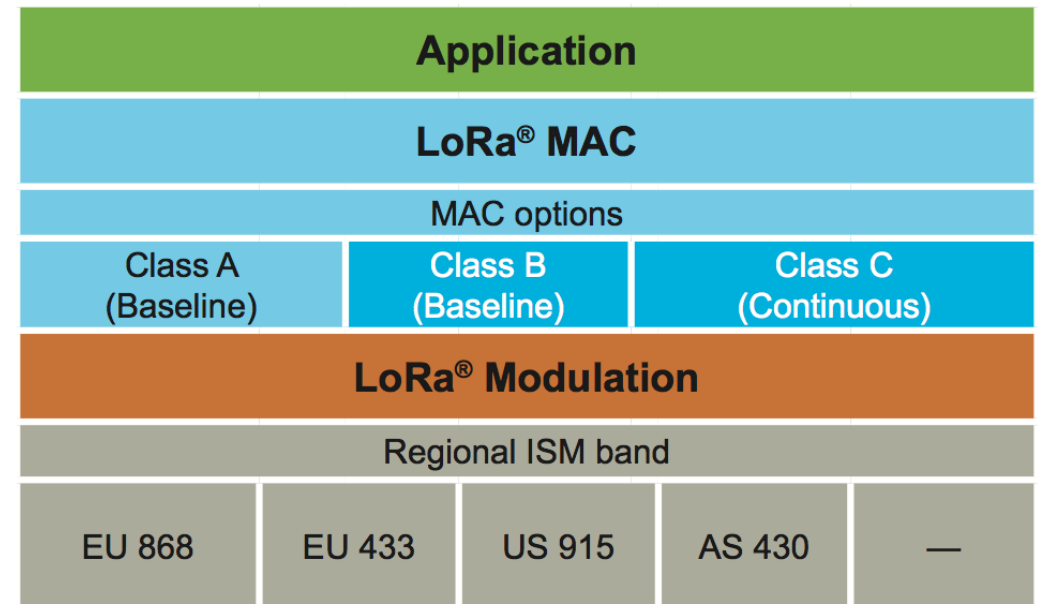
❖ Technology developed by Semtech

UNB

Spread Spectrum
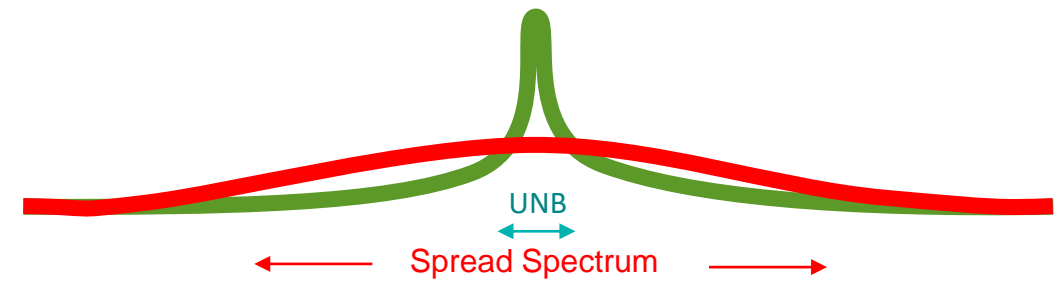
LoRa stands for Long Range
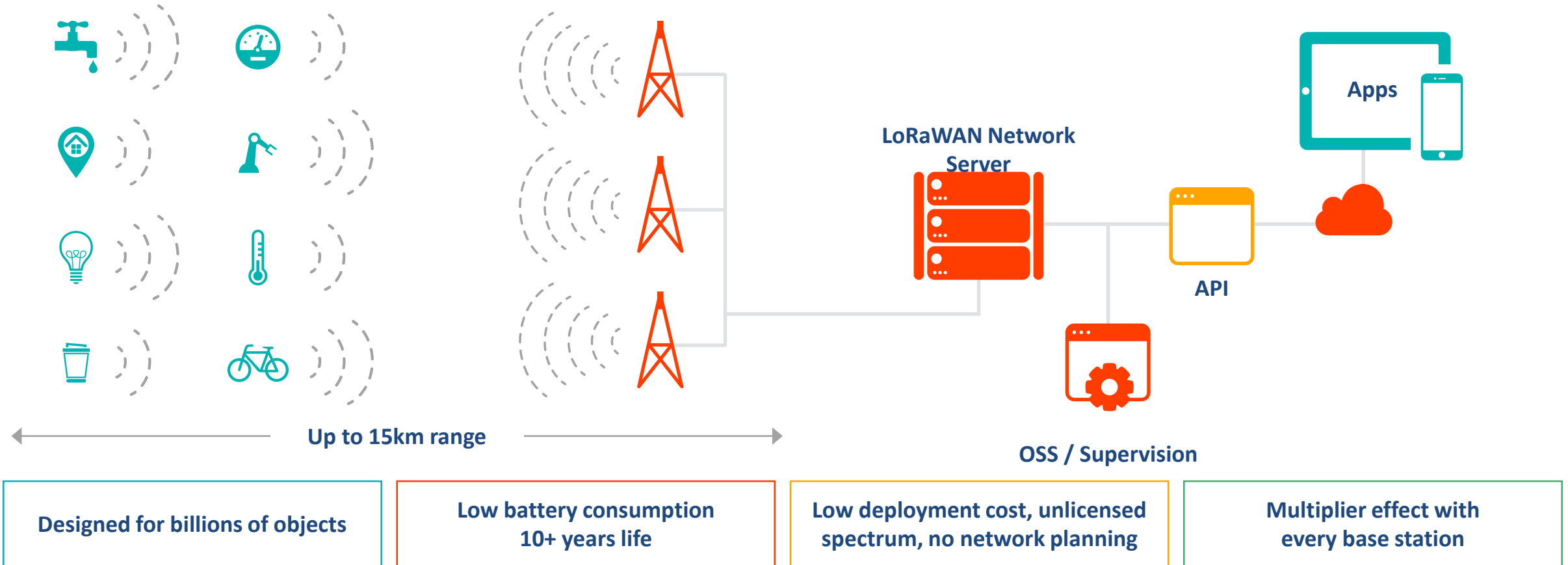**Cell range can go further than 15 km**

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What is LoRaWAN ?

LoRaWAN™ defines the communication protocol and system architecture for the network while the LoRa® physical layer enables the long-range communication link

❖ A Protocol optimized for low data rate communications

❖ Defines the MAC layer to provide key features :
  - ❖ Channel management
  - ❖ **Adaptative Data Rate**
  - ❖ Devices enrolment
  - ❖ security (encryption)
  - ❖ Roaming
  - ❖ Network based localization

❖ Defines classes of devices to adapt to different use cases : sensor, actuators, …

❖ Leverages regional ISM bands, which makes it suitable to private network deployments

Application				
LoRa® MAC				
MAC options				
Class A (Baseline)	Class B (Baseline)		Class C (Continuous)	
LoRa® Modulation				
Regional ISM band				
EU 868	EU 433	US 915	AS 430	—

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Standard LoRaWAN network achitecture

LoRaWAN Network Server

Apps

API

OSS / Supervision

Up to 15km range

Designed for billions of objects	Low battery consumption 10+ years life	Low deployment cost, unlicensed spectrum, no network planning	Multiplier effect with every base station

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LoRaWAN device classes

Class name	Intended usage
A (« all »)	**Battery powered sensors**, or actuators with no latency constraint Most energy efficient communication class. Must be supported by all devices
B (« beacon »)	**Battery powered actuators** Energy efficient communication class for latency controlled downlink. Based on slotted communication synchronized with a network beacon.
C (« continuous »)	**Mains powered actuators** Devices which can afford to listen continuously. No latency for downlink communication.

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EU Data rates, Time On Air and Sensitivity

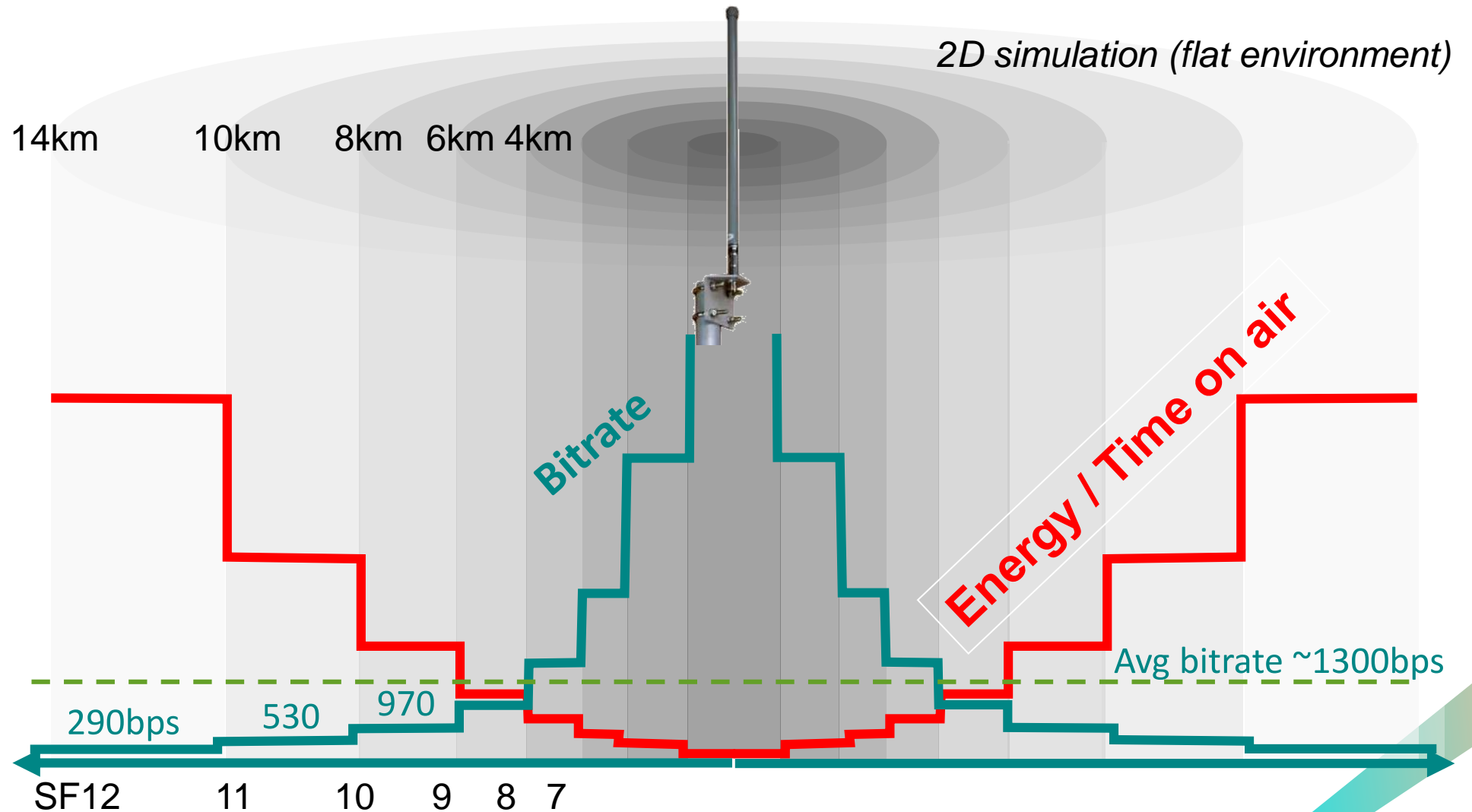| EU Data rate	Payload Data rate (bit/s)	Time on Air (mS)	Gateway sensitivity (dBm radiated)	End-device sensitivity
DR0 (SF12 / 125kHz)	293	1400	-147	-138
DR1 (SF11 / 125kHz)	540	740	-144.5	-135.5
DR2 (SF10 / 125kHz)	980	370	-142	-133
DR3 (SF9 / 125kHz)	1760	200	-139.5	-130.5
DR4 (SF8 / 125kHz)	3125	100	-137	-128
DR5 (SF7 / 125kHz)	5470	56	-134.5	-125.5
DR6 (SF7-250kHz)	11000	28	-131.5	-122.5
DR7 (FSK50)	50000	6	-116	-107

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**Gateway figures assume +6dBi antenna
User applicative payload = 10 bytes**

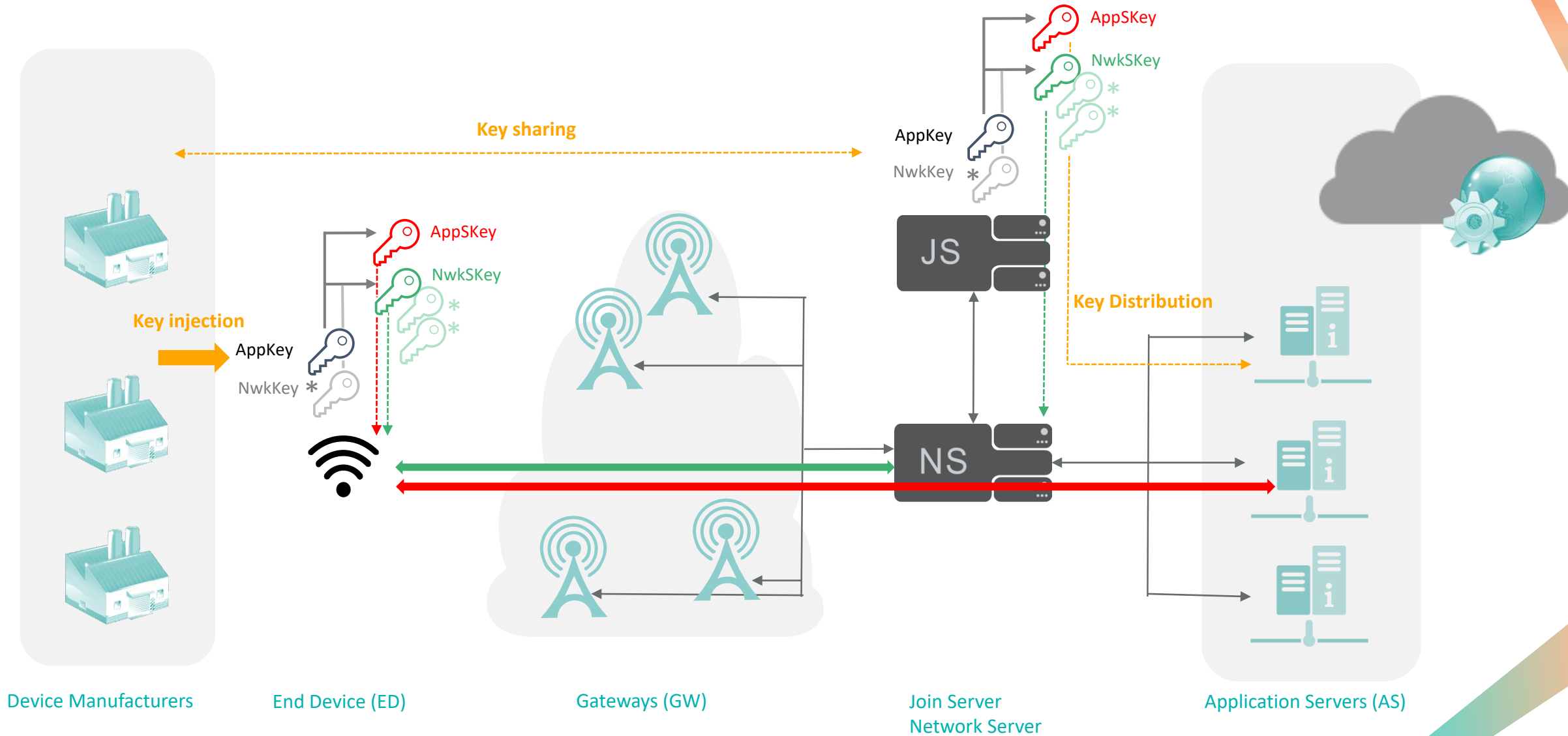# Adaptive Data Rate allows easy network scalability

ADR

Adaptive Data Rate is the procedure by which the network instructs a node to perform a rate adaptation by using a requested DR (e.g. DR0), a requested TX Power (e.g. 11 dBm)
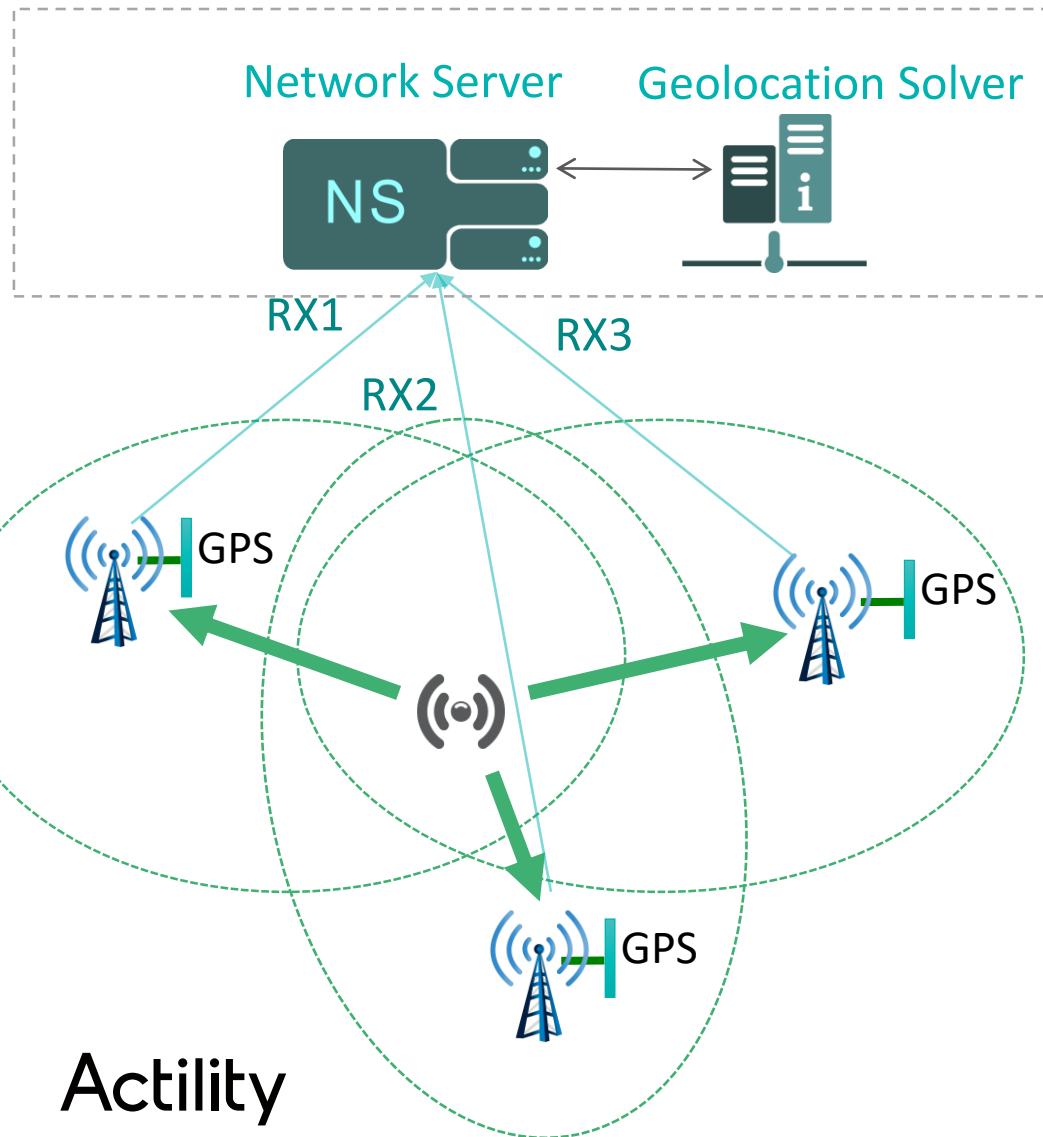
2D simulation (flat environment)

14km   10km   8km   6km 4km

Bitrate

Energy / Time on air

Avg bitrate ~1300bps

290bps   530   970

SF12   11   10   9   8   7

LoRaWAN™ ensures end-to-end security

Device Manufacturers   End Device (ED)   Gateways (GW)   Join Server
Network Server   Application Servers (AS)

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LoRaWAN enables Network based location services using TDOA

Network Server   Geolocation Solver

NS

RX1

RX3

RX2

GPS

GPS

GPS

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- Gateways (v2 ref design) are synchronized in time with GPS at nanosecond precision to give a common reference

- Timestamping is performed by Gateways on UL data transmissions from sensors, and requires Semtech decryption key

- BS also adds RSSI, SNR, frequency error, Logical channel, GPS sync information to fine timestamp

- LNS gather all metadata including timestamps together and forwards it to Geolocation Solver

- Geolocation Solver estimates sensor position based on all metadata history using Time Difference Of Arrival (TDOA) algorithm and/or RSSI (Receive Signal Strength Indicator) algorithm

LoRaWAN enables network collaboration via the LoRa Back End Interface

Passive Roaming vs. Handover Roaming

Compatible with LoRaWAN 1.0 devices

Passive Roaming

Requires LoRaWAN 1.1 devices

Handover Roaming

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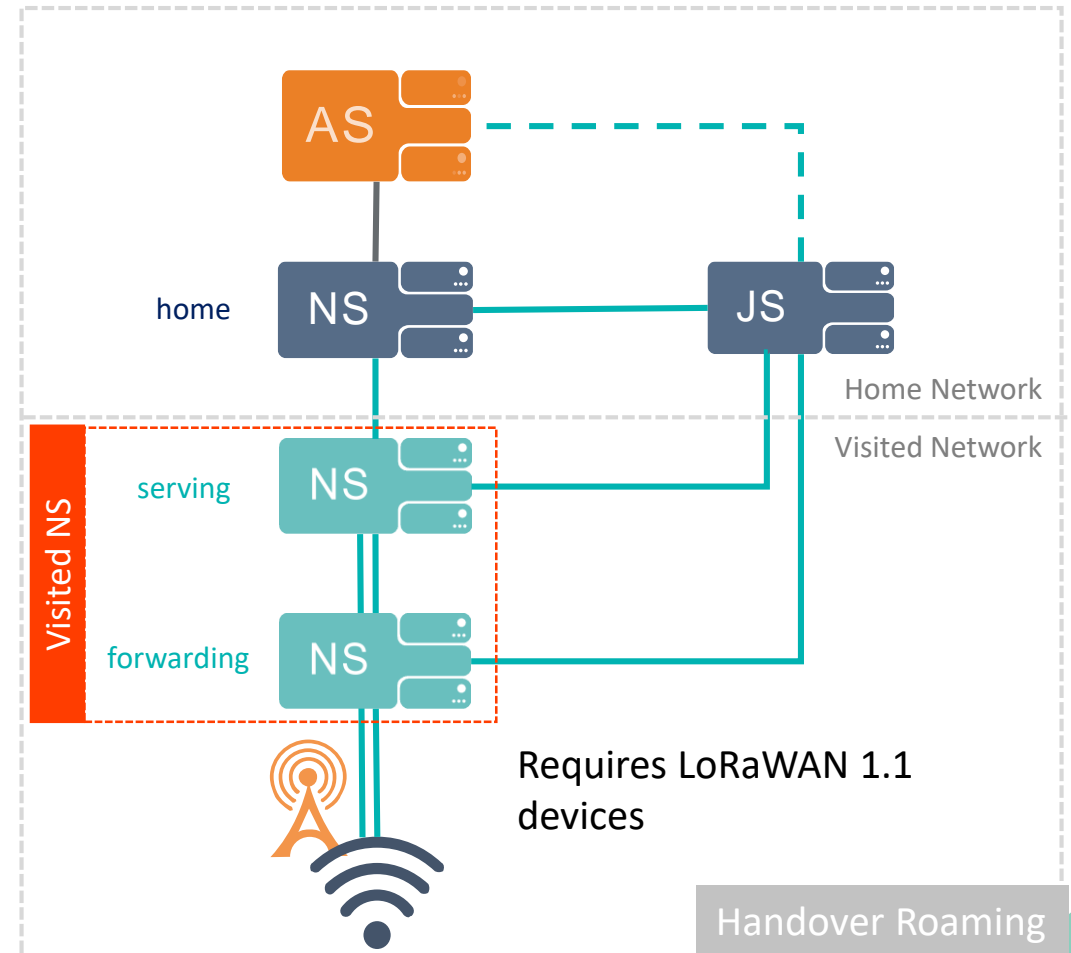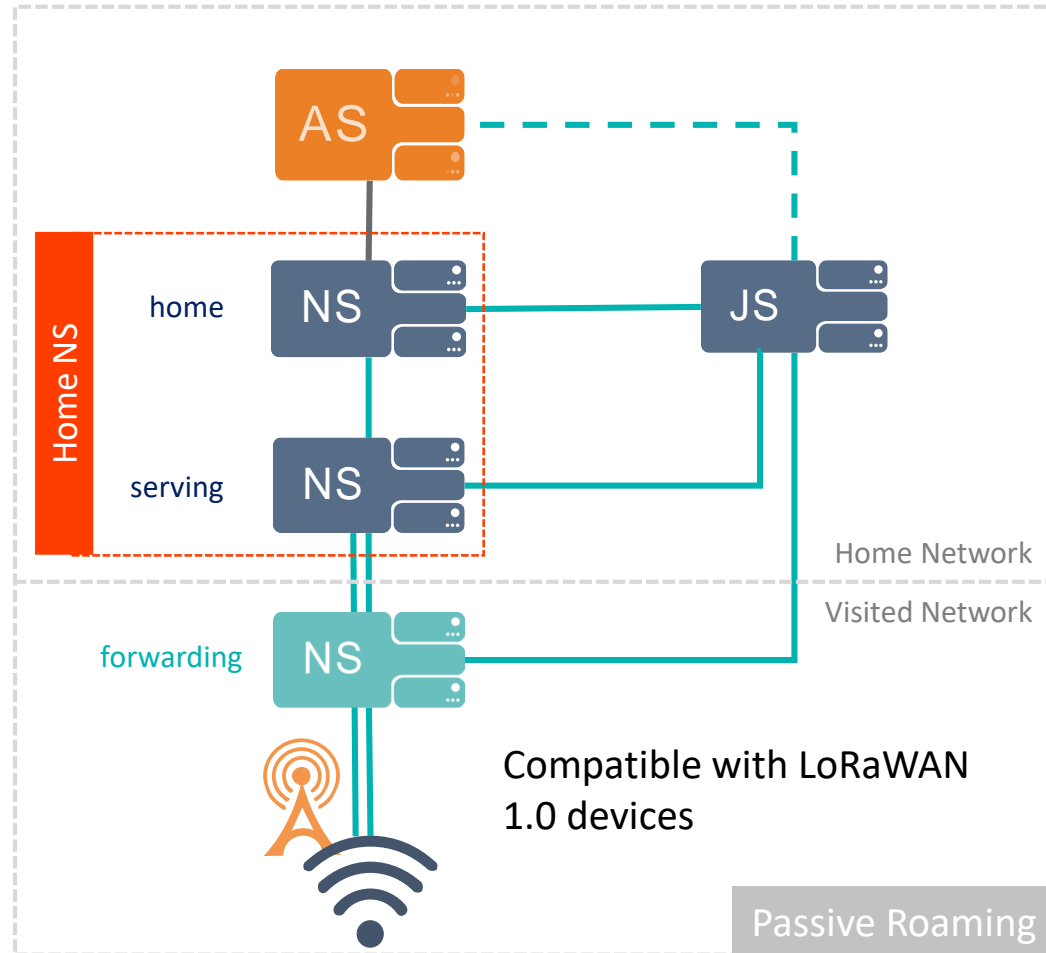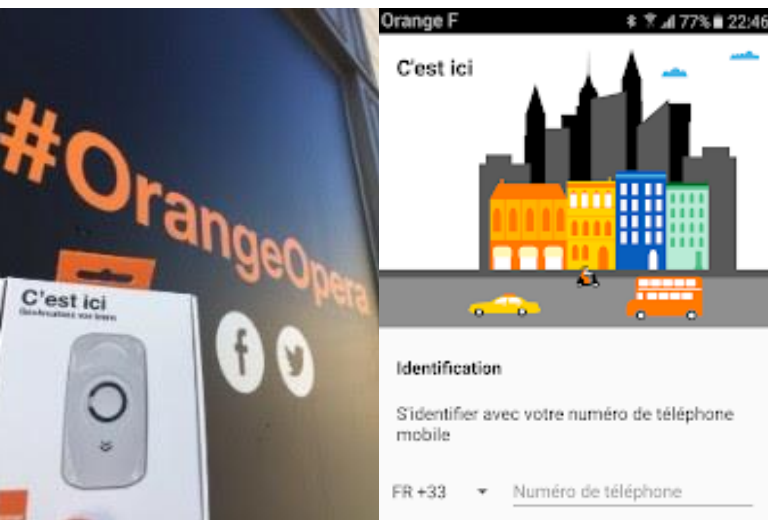
Consumer tracking with Orange

- Small trackers using LoRaWAN to geolocate people, animals and goods, allowing long autonomy and reliability, unlike the regular cellular GPS-based devices

- To address consumer needs in France, Orange launched in October 2018 a mass-market consumer tracking offer, with Orange-labeled Abeeway Micro Tracker and Orange mobile application "C'est ici".

Benefit: safety and security for children, the elderly or pets, and reassurance for Orange customers

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Thank you

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