



Actility
Connecting with intelligence



What we've learned from LPWAN roll-outs on four continents

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Agenda

1. LoRaWan Introduction

2. Current market status and trends

3. Lessons learned

The Internet of Things is here

Gartner Says 4.9 Billion Connected "Things" Will Be in Use in 2015

In 2020, 25 Billion Connected "Things" Will Be in Use

50 billion connected IoT devices by 2020

Morgan Stanley: 75 Billion Devices Will Be Connected To The Internet Of Things By 2020

News & Analysis

Internet of Things: 50 Billion Is Only the Beginning

25 billion connected devices by 2020 to build the Internet of Things

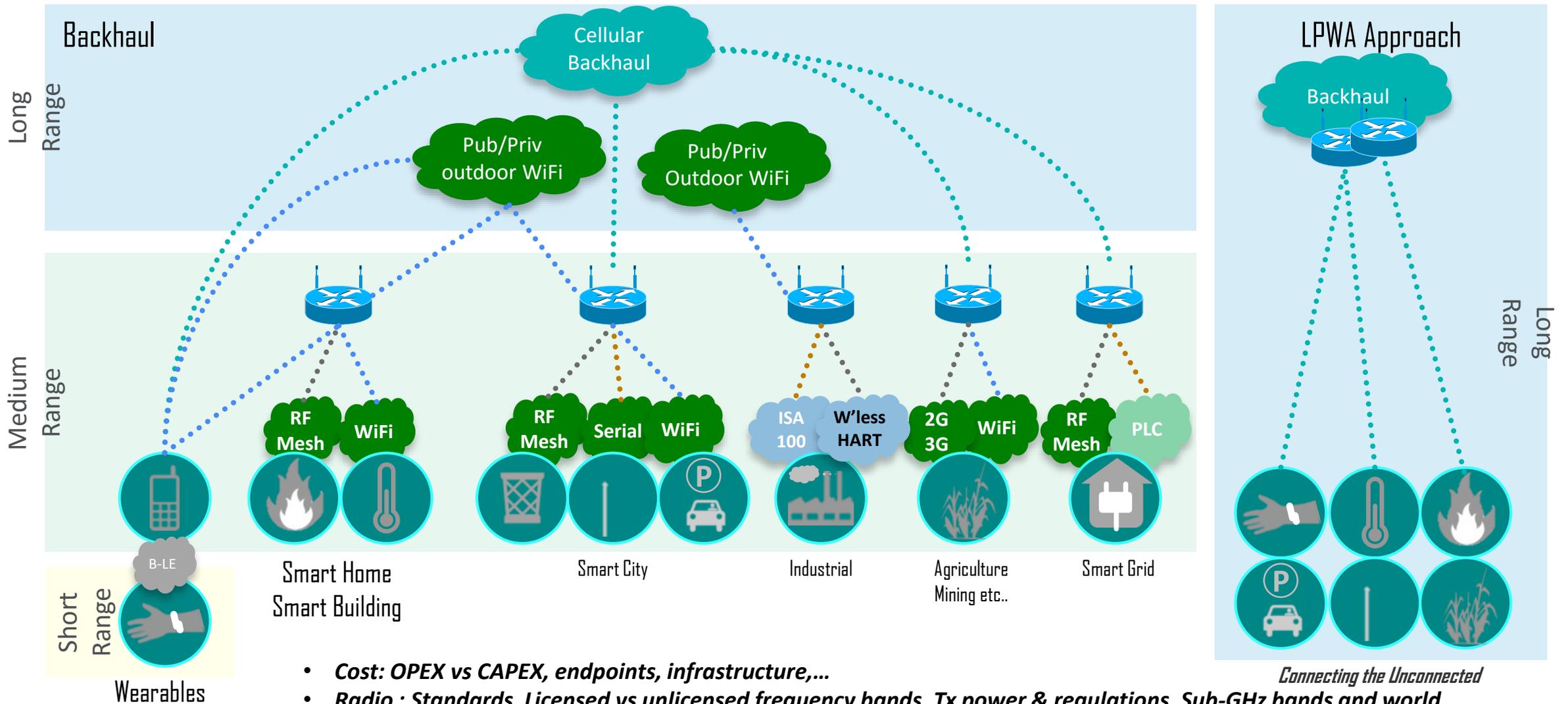
Ericsson backs away from expectation of 50B connected devices by 2020, now sees 26B

June 3, 2015 | By Phil Goldstein

Internet of things: \$8.9 trillion market in 2020, 212 billion connected things

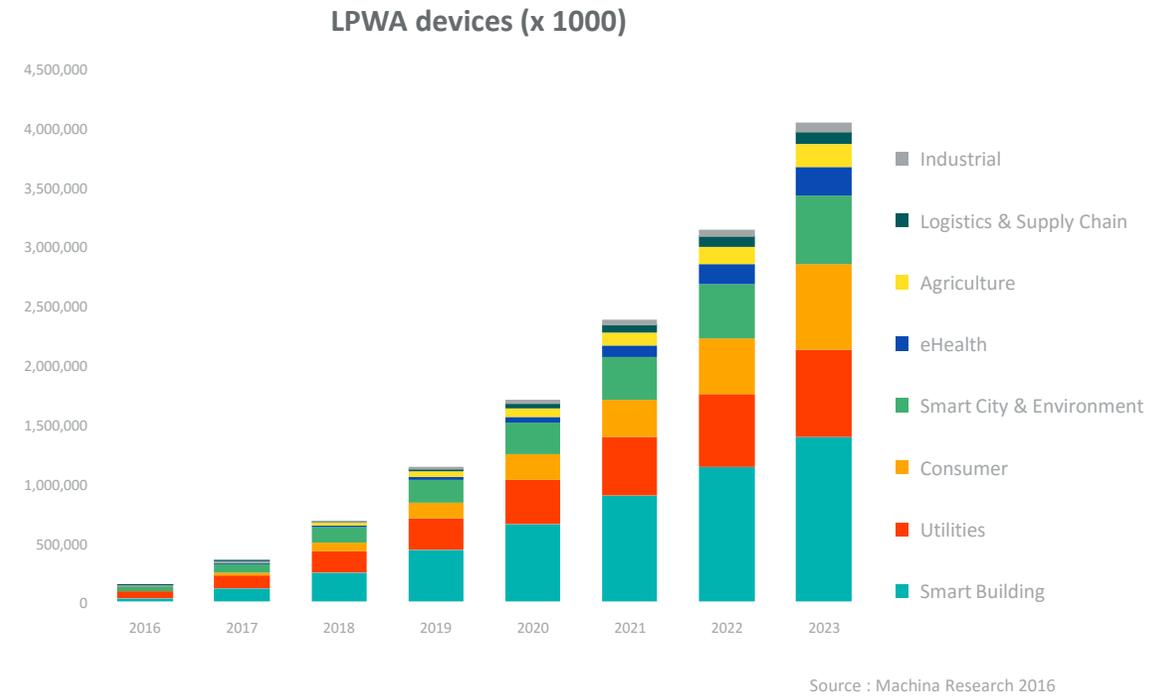
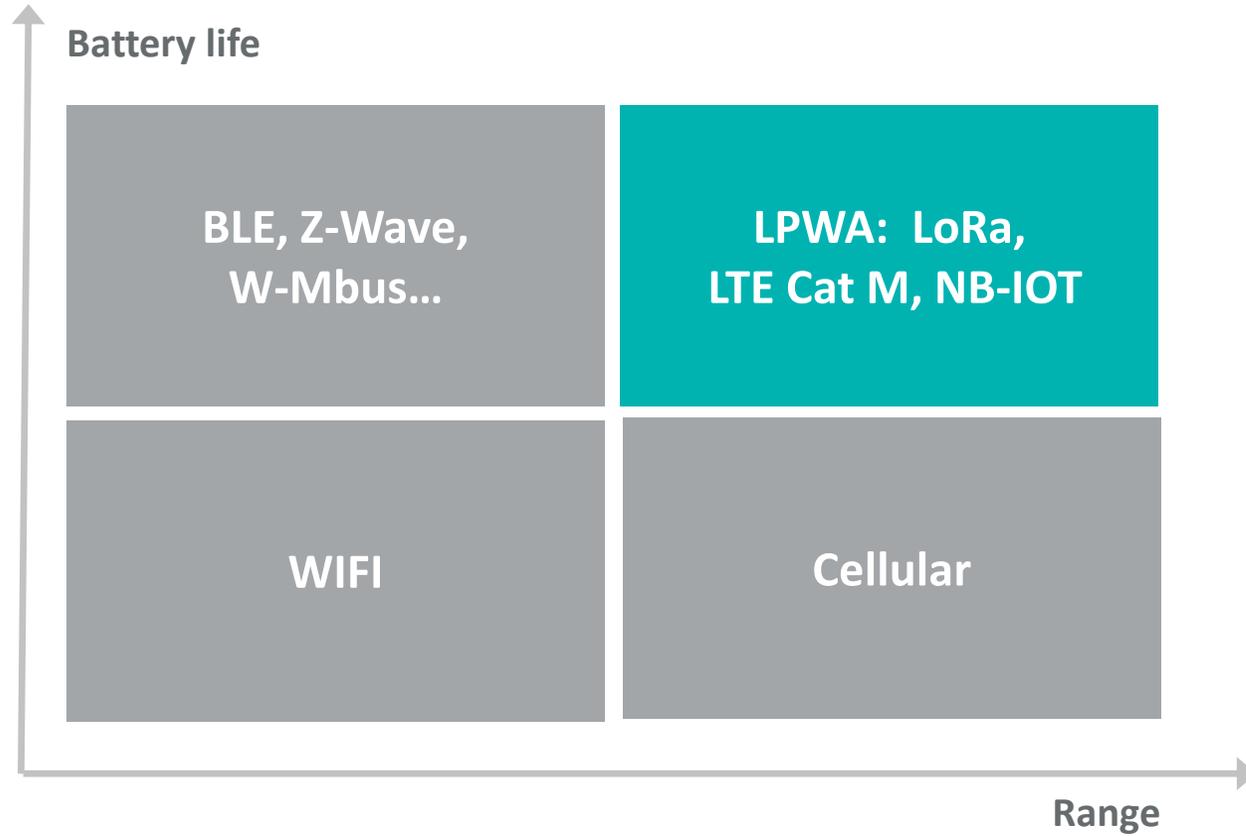
IDC tries to put a number on the Internet of things and while you may quibble over the forecast, the numbers are huge assuming multiple hurdles can be overcome.

IoT – Wireless Technologies Landscape



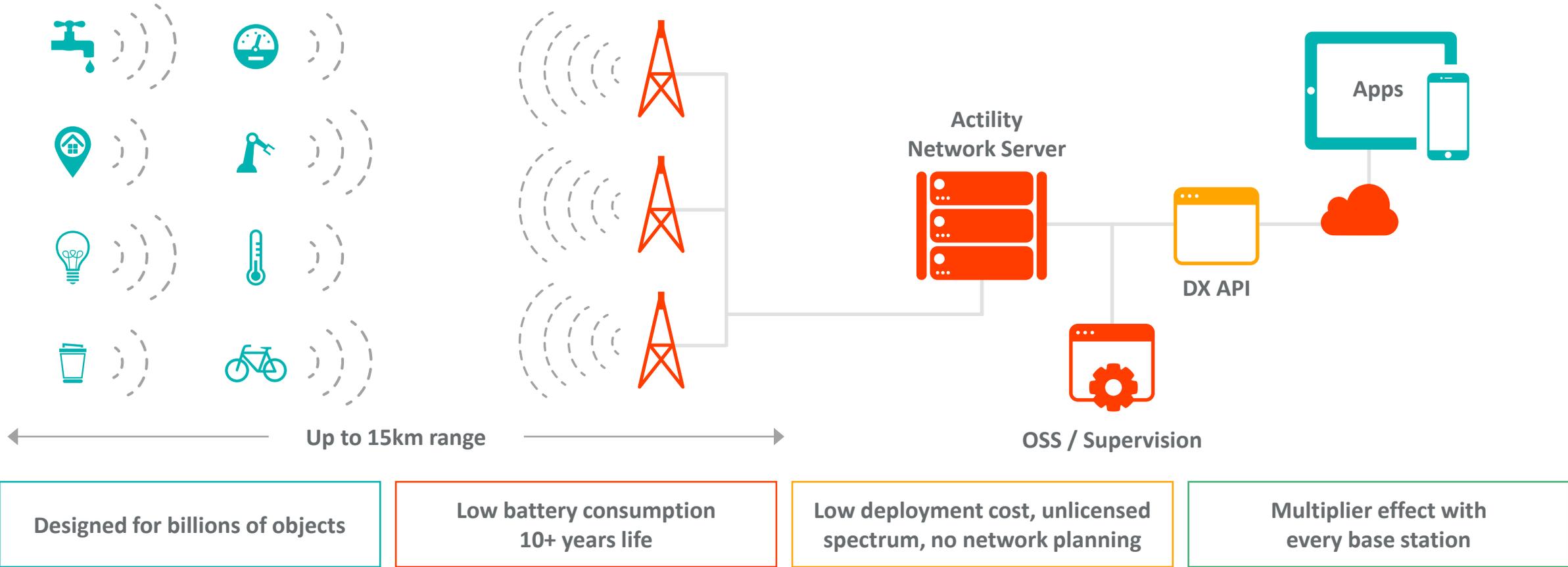
- **Cost: OPEX vs CAPEX, endpoints, infrastructure,...**
- **Radio : Standards, Licensed vs unlicensed frequency bands, Tx power & regulations, Sub-GHz bands and world regions, ...**
- **Operations: Data rate & capacity planning, RF planning, provisioning,...**

LPWA: the essential foundation of industrial IoT

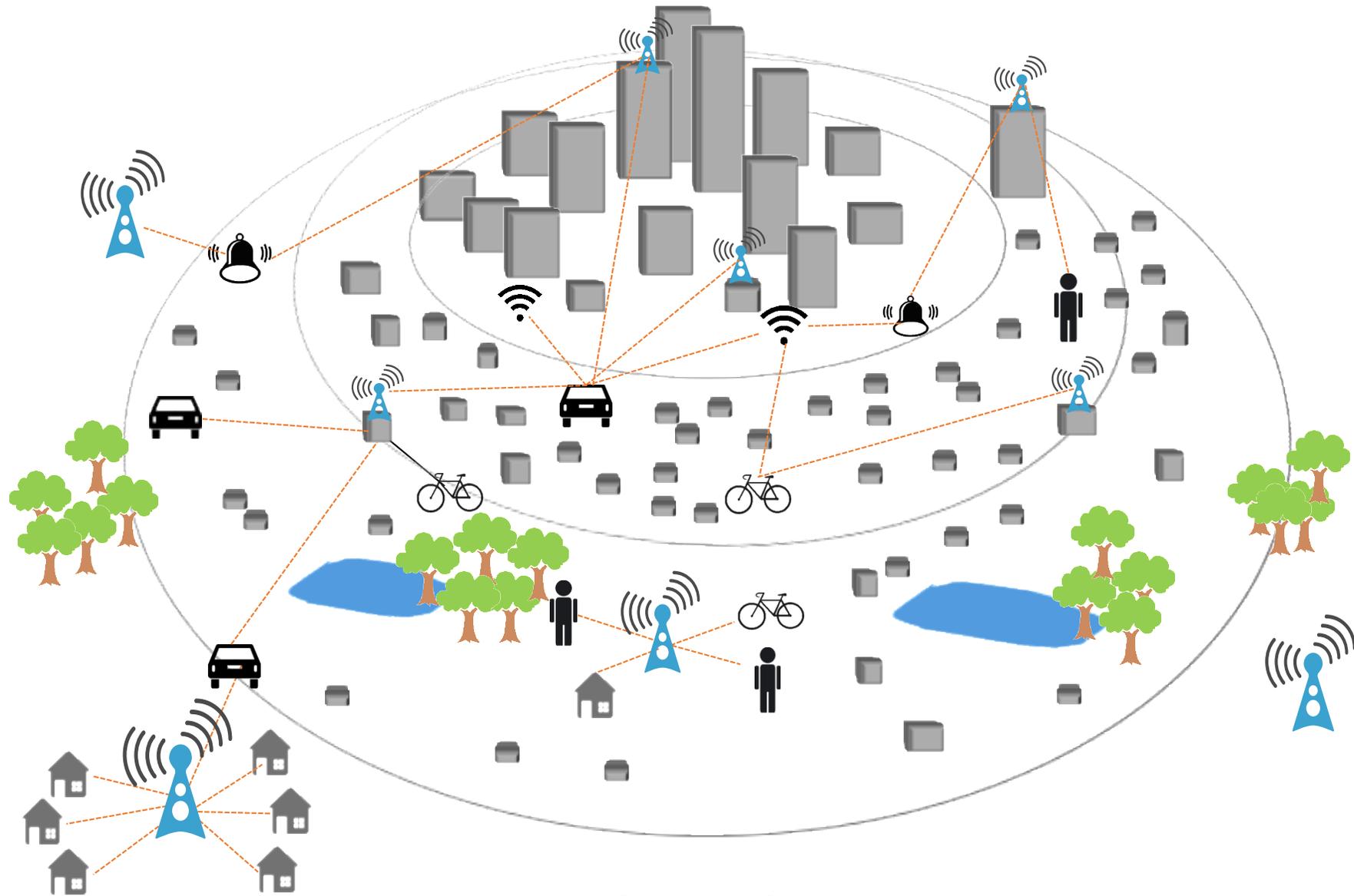


In 2023 there will be more than **4 billion** LPWA devices worldwide

Typical LoRaWan network structure



LPWA typical network



LoRa Radio Characteristics

Characteristics	LoRa RF
Data Rate	300 bps – 50 kbps (Adaptive Data Rate)
Gateway Sensitivity	-142 dBm/300bps
Deep Indoor Coverage	162dB uplink margin / 165dB downlink
Payload Size	0 – 255 bytes (variable)
Capacity	4M uplink/day/km2 with 2km gateway spacing
RX/Tx Current	10mA RX / 32mA (14dBm) TX
Bi-directionality	Yes (Ack, broadcast, synchronous unicast/multicast)
Security	End-to-end encryptions / authentication of every frame
Interference immunity	Good / Spread-spectrum w/ FEC
Scalability	Yes +Self Scaling Network capability through Adaptive Data Rate
Mobility	Yes with support for tracking
Location	Yes for outdoor & indoor

LoRa reach examples

Cell range at 125 kHz / SF12			
Area type	Outdoor (m)	Light indoor (m)	Deep indoor (m)
Rural	10 000	4 600	3 300
Suburban	4 000	2 000	1 300
Urban	2 500	1 000	700
Dense Urban	2 000	600	500

Warning: please note these values are only indicative values. Real results will depend on radio propagation conditions.

Assumptions:

- SF12 / 125 kHz
- Antenna height : 30m – Gain : 3dBi
- End-device antenna height: 1,5m
- Applicable regulatory rules : EU 868 MHz

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.

Agenda

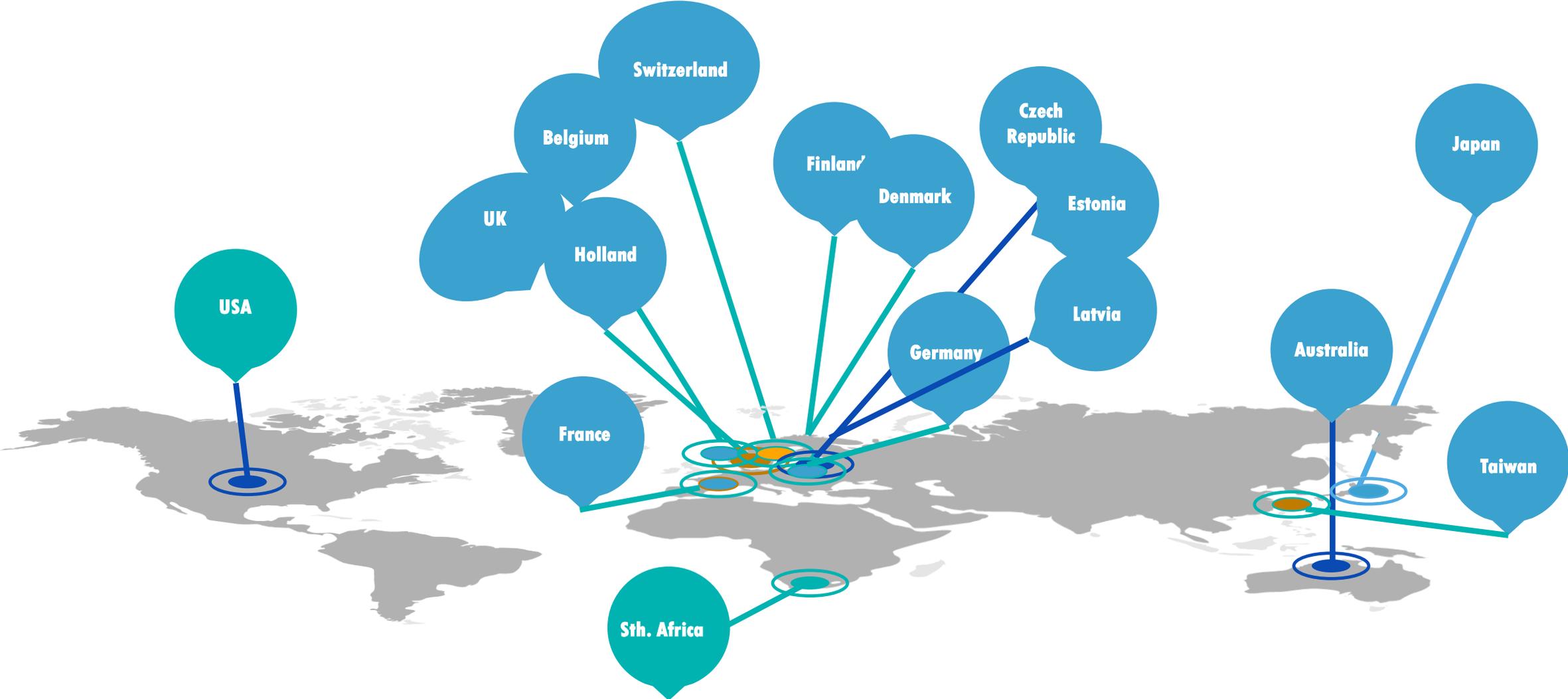
Characteristics

1. LoRaWan Introduction

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There are large-scale LPWA roll-outs in over a dozen countries



Major players have chosen LoRaWAN over other LPWA options



SoftBank



Fastest-growing IoT Eco-System



Low Cost of gateway roll-out for B2B & B2C



Scalable Capacity Model of Network



Supports key IoT use cases with bidirectionality and low-power management

Agenda

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Lesson
#1

Enabling a new breed of IoT Service Providers

COMCAST LAUNCHES
ENTERPRISE INTERNET
OF THINGS TRIAL
VENTURE

machineQ

Lesson #2

It's all about the eco-system

Partner Program

open innovation - online tools for solution design & interoperability validation

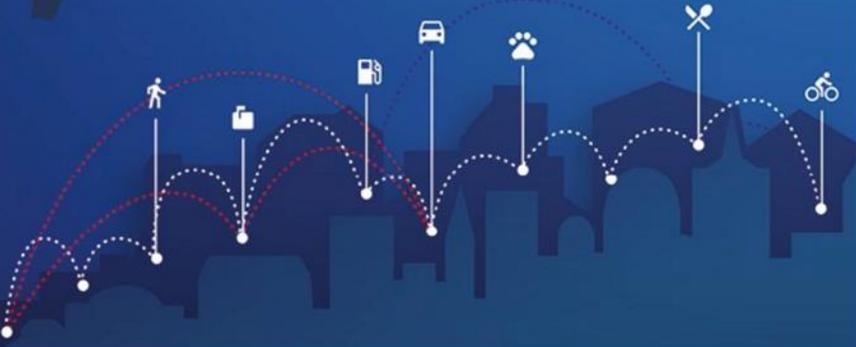
<p><i>Discovery Portal</i></p> 	<p><i>Documentation & Support</i></p> 	 <p><i>Device Testing Application Integration Validation</i></p>
<p><i>Development Account</i></p> 	<p><i>Self-service APIs & Testing tools</i></p> 	

DE



Low Power Network Boot Camp Fall 2016

Get Hands-on Experience!



Lesson #3

Deliver on the promise of an open horizontal IoT network



Intelligent Public Space Management

- Provides insight into the number of objects in public space
- Contributes to efficient working methods and increases road safety

An illustration of a public space with various objects and people. A street lamp, a signpost with a blue arrow pointing right labeled "Amsterdam 7", a red triangular yield sign, a pedestrian crossing sign, a bench, a trash can, a person walking, and a worker in a yellow safety vest kneeling next to a trash can are shown. Blue circles represent the IoT network's reach around these objects and people.

Lesson #4

Multiple Roll-Out Models for LPWA – National...

LoRa van KPN

De volgende stap in connectiviteit voor Internet of Things

Connectiviteit



M2M en LoRa:
Oplossingen van KPN

M2M = ■
LoRa = ■

Netstroom

Batterij (tot 15 jaar)

E-verbruik

Streaming & messaging

Messaging

Data capaciteit

✓

✓

Lokalisatie met netwerk

✓

2016

Landelijke dekking

Lesson #4

... or easy roll out models for dedicated Enterprise networks

- Remote industrial sites suffer from poor wireless coverage
- LoRa coverage can be achieved through dedicated easyLoRa Gateways

Centralized LoRaWAN Core for multi-site management



...supported by indoor LoRaWAN Nanogateways

Lesson

#4



Easy-to-deploy

- Easy-to-roll out
- Can be bundled in offers through Indirect B2B channels with Added Value Resellers or System Integrators



Densification

- Easy way to densify existing networks and to increase LoRa coverage for public and private networks leading to higher bit rate and less collisions on the PHY layer
- Denser network means better Spreading Factor thus better data rate and battery life
- Increased LoRa location precision (TDoA)



Indoor

- Small footprint for buildings / homes appliances
- Enhance deep indoor coverage
- Allows for indoor location (in combination w. other technologies BLE, Wifi...)



Hard-to-reach
areas

- For industrial & other « harsh » condition areas
- Allows for more reliable connectivity in areas with multiple propagation obstacles

Lesson #5

The network will enable new disruptive use cases

Smart Parking



The Happy Healthy Cow



Internet-of-Things now extended to 'Internet of Animals'.

16
MAR 2016

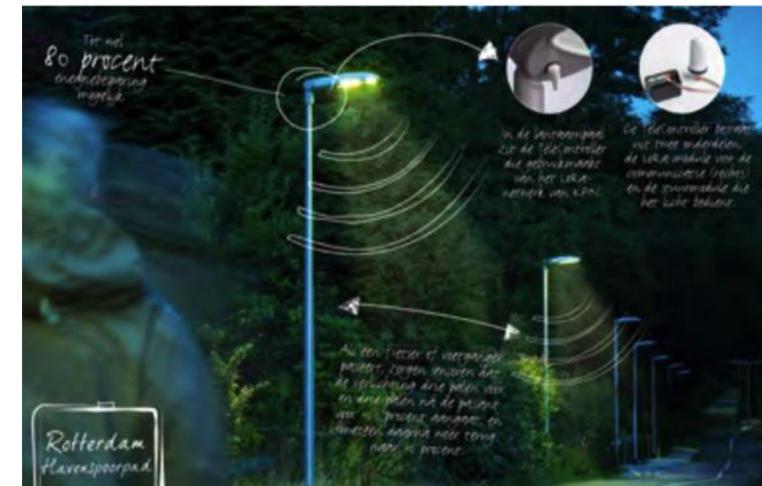
Today Utrecht University announced the 'Happy Healthy Cow' research project. This project has been awarded a substantial financial contribution by the Cor Wit Foundation of Royal Dutch KPN, to fund scientific research of...

Replace existing RFs with a more cost-effective LPWAN solution

Lesson
#6

Example from the Street lighting vertical

1. Streetlighting does not require **Low Power** (currently uses Powerline or Cellular 3G)
2. It can be however supported by **LoRaWAN Class C**
3. LoRa brings lower cost of roll out and provides cities with a network that can be used for other verticals



Lesson #7

The Market will need multiple lower power options

Jumping on the LPWA bandwagon with LoRaWAN

Longer battery life



Lower Cost of Sensors



Coverage in hard-to-reach areas



LoRaWAN

Building the Eco-system to address current LPWA Opportunities



Smart metering



Tracking



Smart building



Street lighting

Complementing LoRa connectivity with cellular

Cat 1

Cat M1

NB-IoT

Seven lessons

1. LoRaWAN creates opportunities for a new breed of IoT networks
2. Access to a global supplier eco-system and growing a local developer ecosystem are key success factors
3. Horizontal open networks beat vertical silos for IoT enablement
4. Enable all scales of network roll-out, from national deployments to small scale enterprise solutions... with “carrier grade” quality
5. LPWA networks will create new solutions and new businesses
6. LPWAN solutions can win even when low power is not key
7. LoRaWAN and 3GPP LPWA will be complementary in the market

THANK YOU

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