STM32(and STM8) solution for (LoRa + Sigfox)

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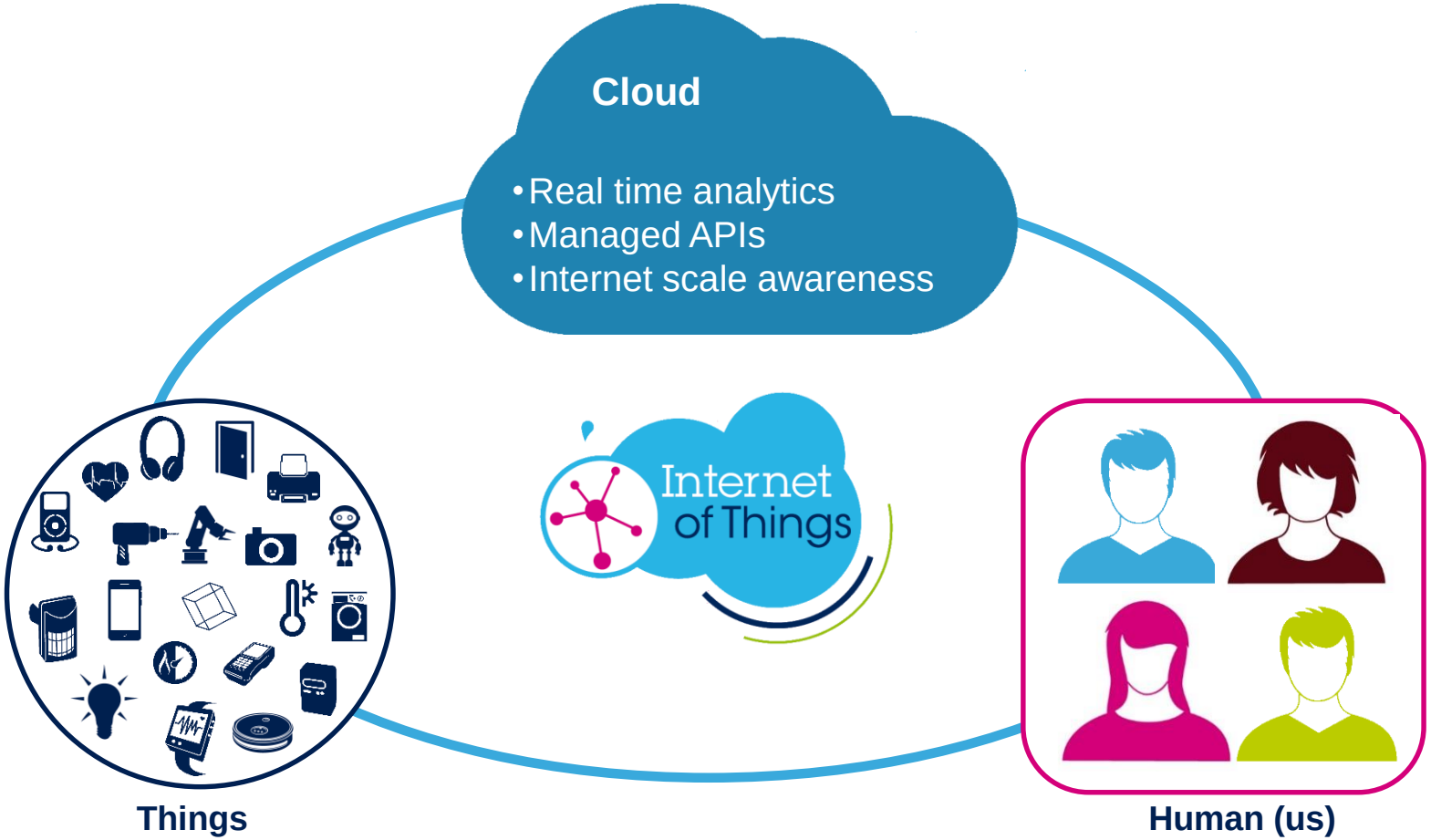
Summary

1. What is IoT ?
2. Communication Technologies – Overview
3. LPWAN
4. A word about Sigfox™ and LoRa™ / LoRa Alliance
5. LoRa™ Technology Modulation and LoRaWAN™ Network Protocol
6. STM32(STM8) solution for LoRa™ and Sigfox
7. Competition overview

What is IoT ?

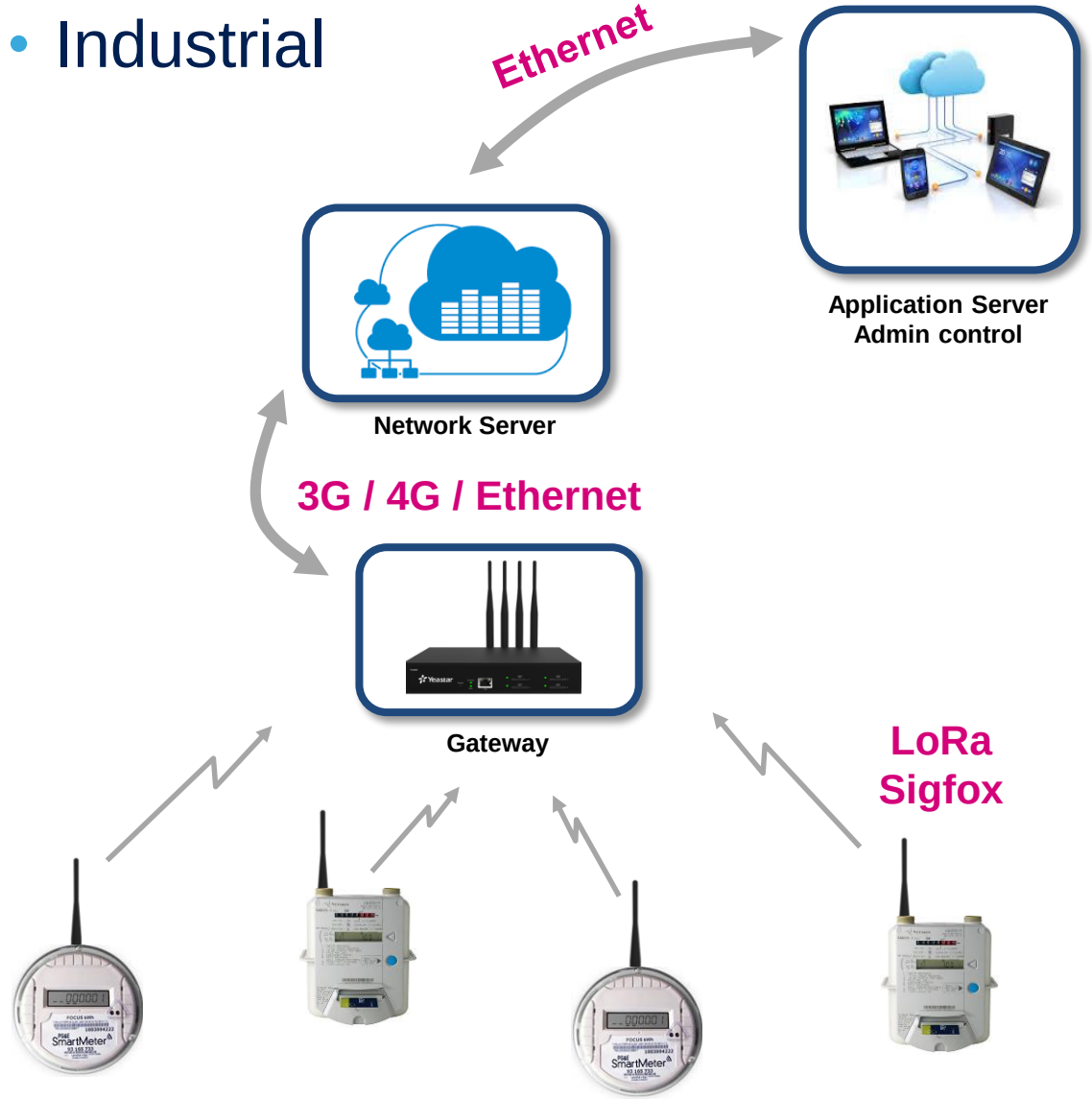
While M2M network connects machines in closed systems,
IoT enhances the exiting networks through an intelligent cloud.



IoT uses cases

- Consumer

- Industrial



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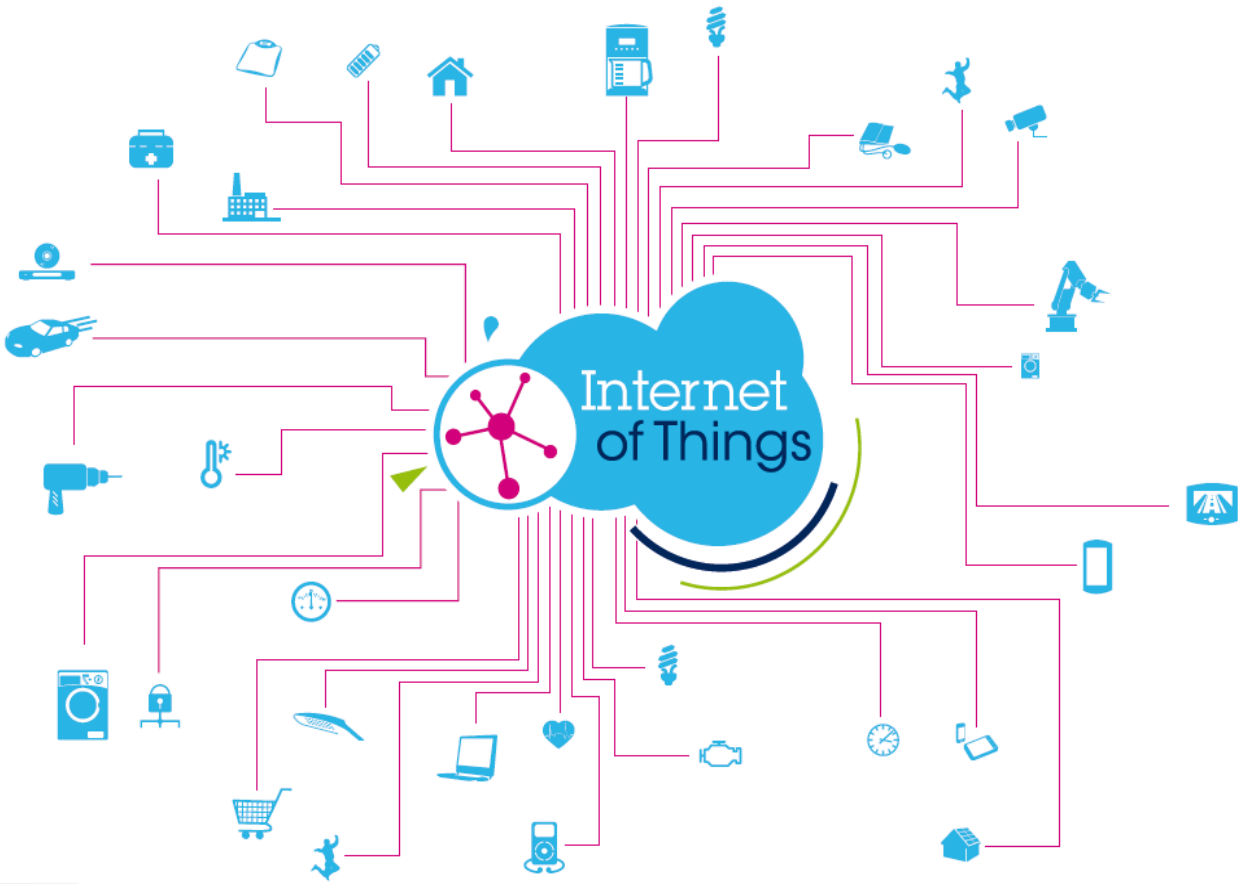
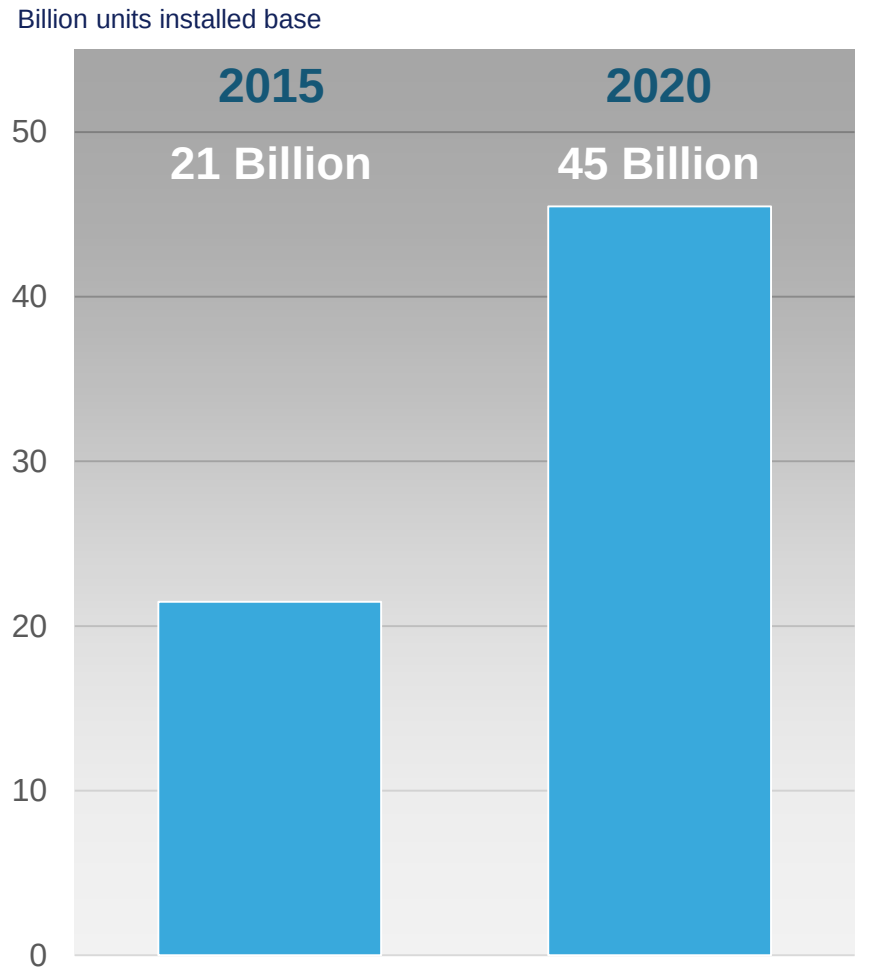
IoT - Driving the next Semiconductor Growth

There is expected to be 45 billion connected devices by 2020





Source : ABI, ST

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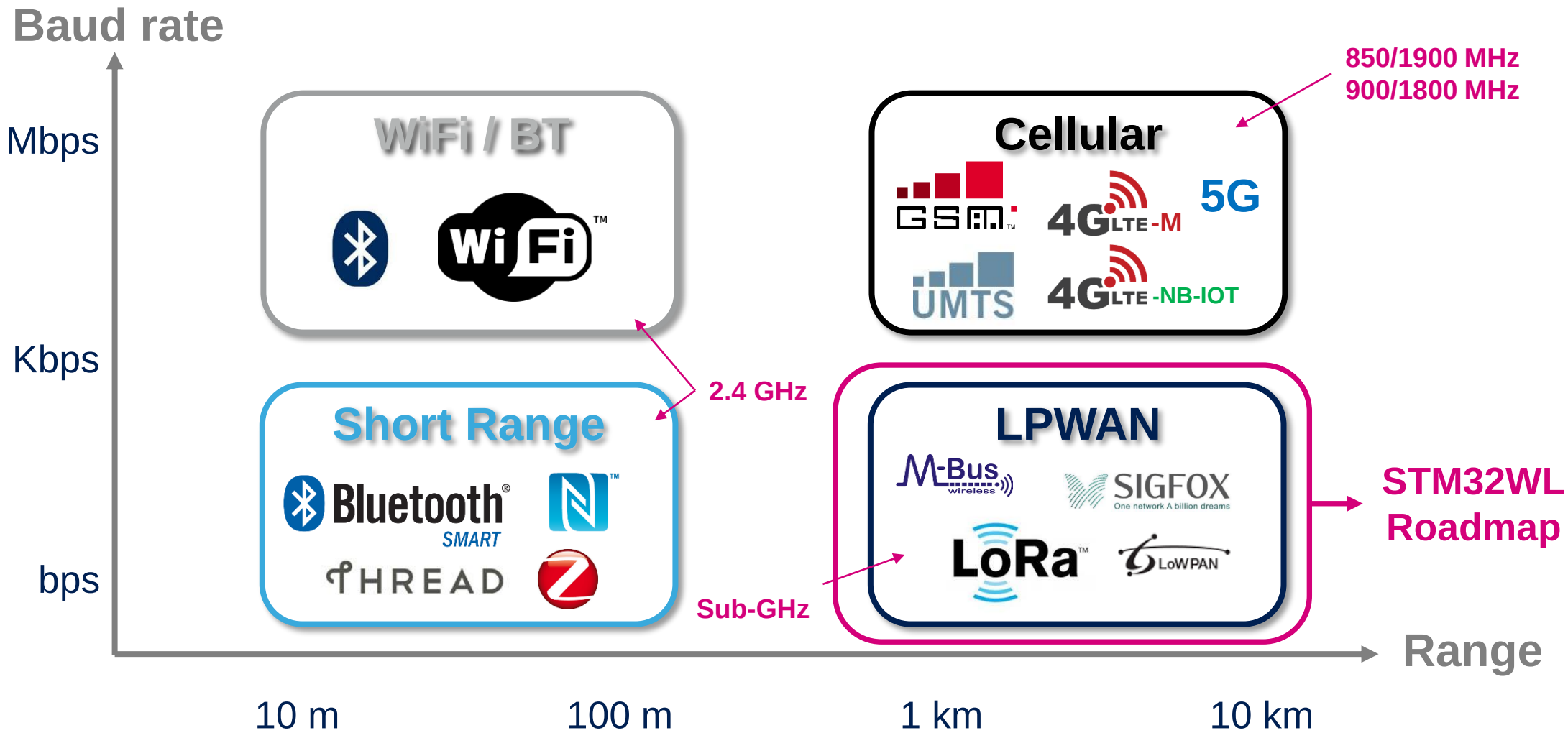
Communication Technologies overview

Communication Technologies - Overview



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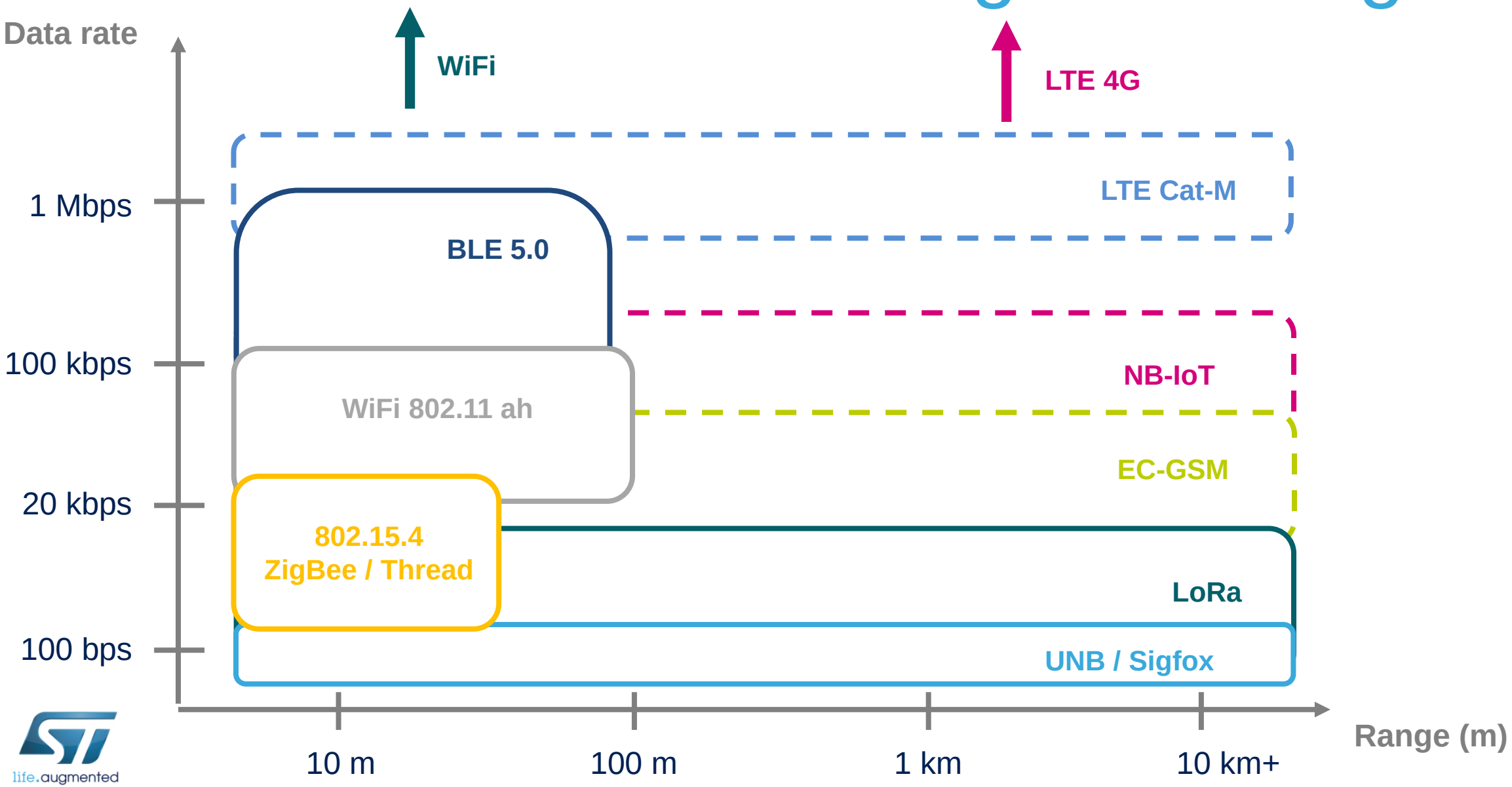
The existing technologies



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LPWAN

ISM Bands

UNB - LoRa™

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What does the connectivity represent today?

- Connectivity today is like a commodity energy…

Electricity

Gas

Oil

- Companies, banks, institutions, cities, homes, families cannot do without it…

GSM

Bluetooth

Wi Fi

Bluetooth SMART

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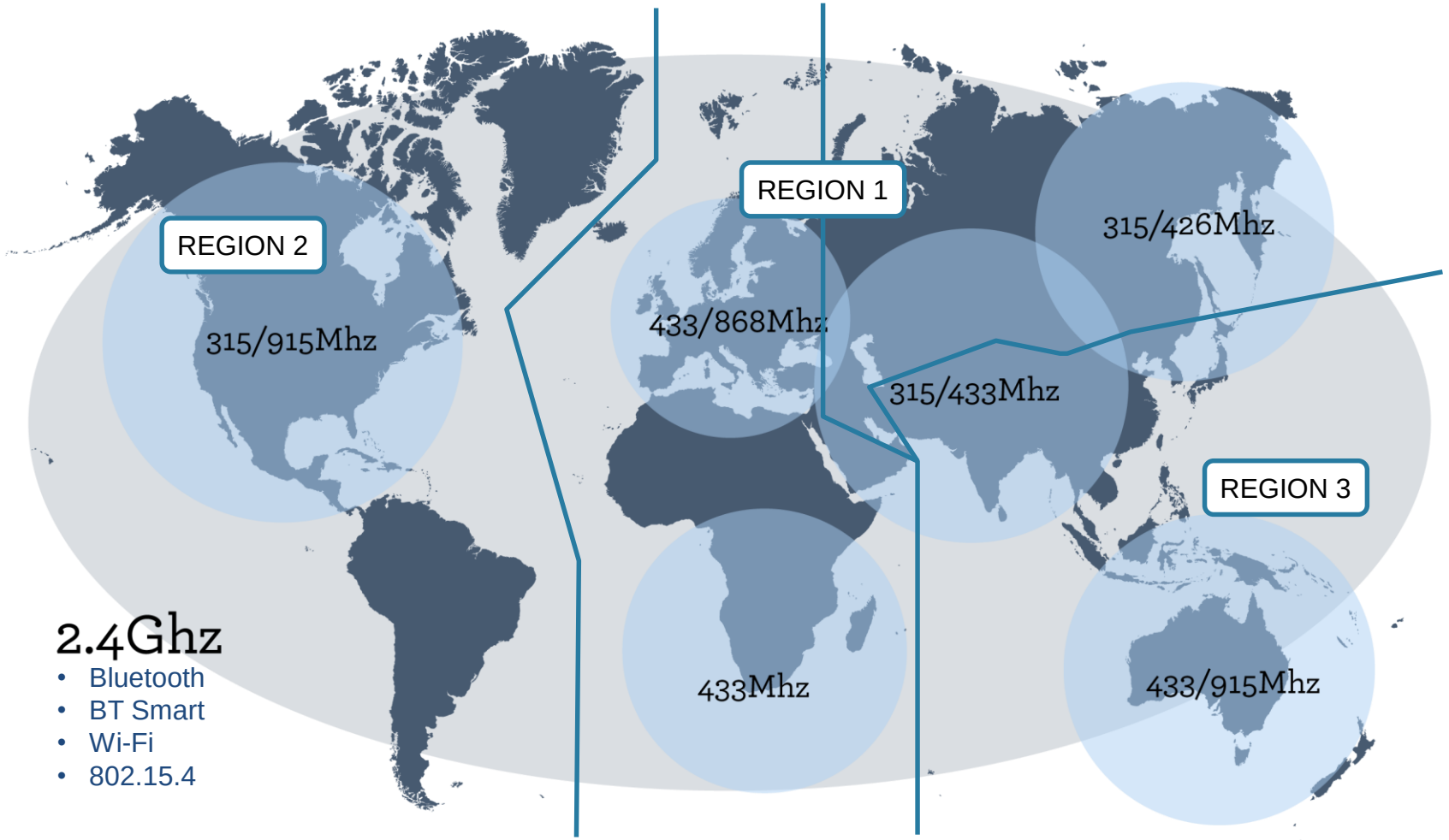
The aim of LPWAN

- Despite all those existing communication technologies some needs are still not answered:
  - The ratio range vs. $$ is still too high
  - The ratio cost/range vs. the device battery life time too low
  - Wastes on infrastructure (services, maintenance, management …)

➢Low-Power Wide Area Network is a key element to make the things Smart !

World wide frequencies regulation

2.4GHz is the only ww standard



- GSM cell phone Frequencies are split in 2 regions only.
- **North America** and South west are based on **850/1900** MHz
- The rest of the **world** is using **900/1800MHz** frequencies range

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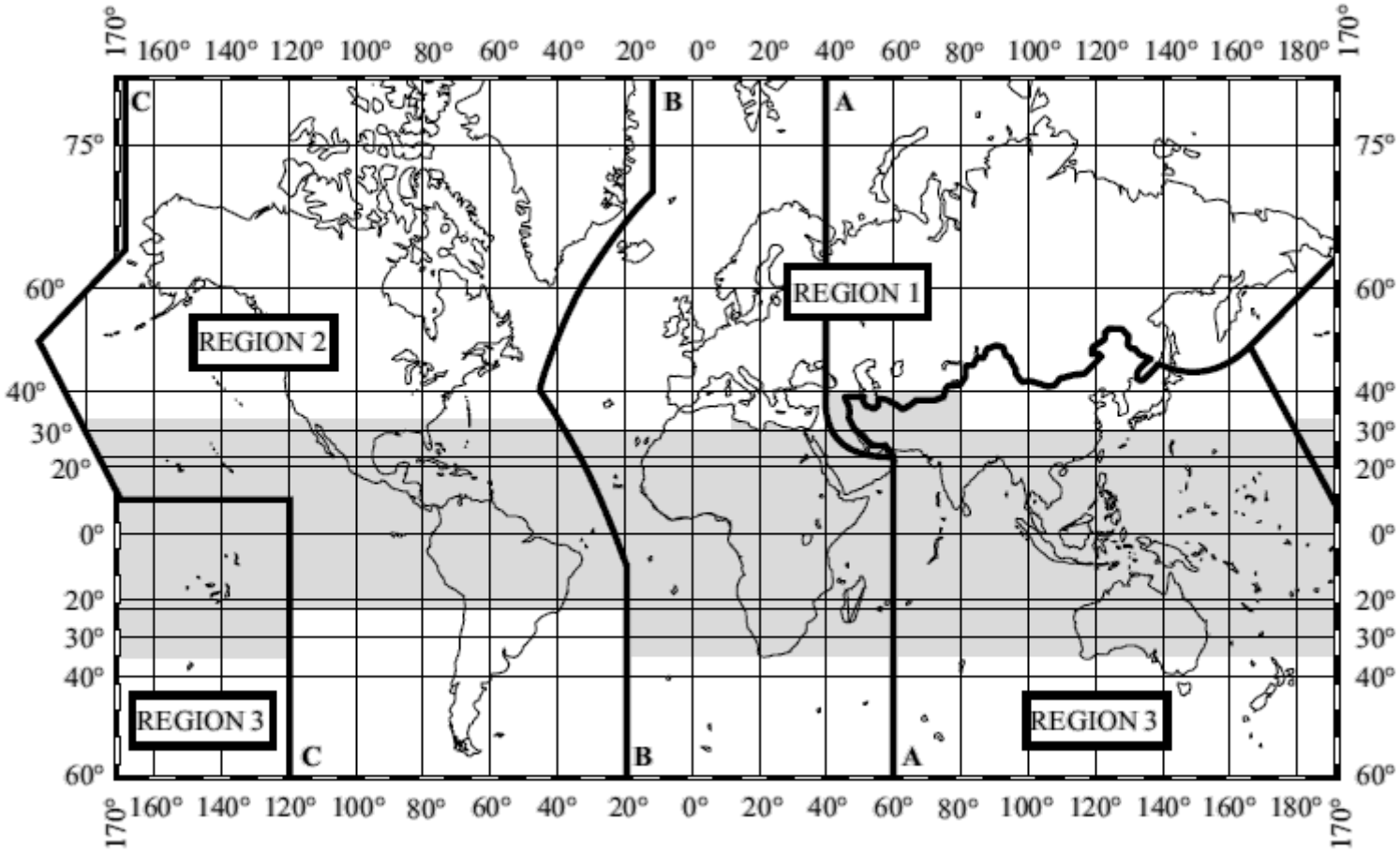
ISM World wide regulation

Output power vs Duty Cycle

Countries	Frequency Band Review	Max Output Power
EU	868MHz	14dBm
USA	915MHz	20dBm
Korea		14dBm
Japan		
Malaysia	862MHz to 875MHz	20dBm
Philippines	868MHz	
Vietnam	862MHz to 875MHz 315/433/.. TBC	
India	865MHz - 867MHz	
Singapore	922MHz	
Thailand	922MHz/868MHz TBC	
Indonesia	922MHz	
ANZ	915MHz to 928MHz	
Taiwan	920MHz to 925MHz	

China	470MHz to 510MHz	17dbm



A word about LoRa™ and Sigfox™

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Sub-GHz and IoT

The 2 solutions to address the IoT over LPWAN

- Sub-GHz is a fragmented segment with many dedicated protocols and solutions to address different needs
- An initiative of standardization is on going with LTE, LoRa®, Sigfox …
- A standardization will be an enabler for industrial applications (meters), Smart Cities …

What is LoRa™ ?

1. A Sub-GHz wireless technology enabling low data rate communication over long distances
2. Targeting M2M and Internet of Things, IoT applications
3. LoRa™ technology is a solution providing a WAN capability, using a MAC protocol named LoRaWAN

Long range

- Greater than cellular
- Deep indoor coverage
- Star topology

Max lifetime

- Low power optimized
- 10- to 20-year lifetime
- >10x vs cellular M2M

Multi-usage

- High capacity
- Multi-tenant
- Public network

Low cost

- Minimal infrastructure
- Low-cost end-node
- Open software

True location

- Indoor and outdoor
- Accurate

Bidirectional

- Bidirectional
- Scalable capacity
- Broadcast

Global mobility

- True mobility
- Seamless
- Roaming

Security

- Unique ID
- Application
- Network

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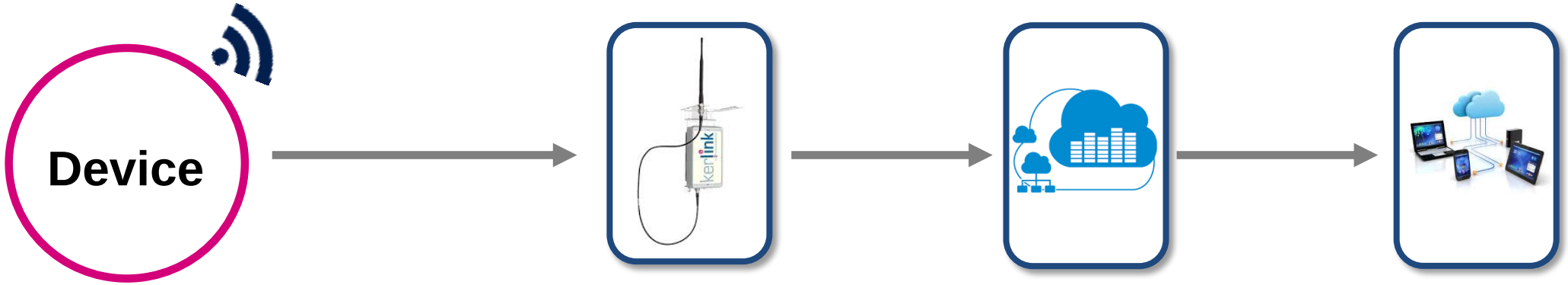
LoRa™ Network Protocol

Solutions providers



SILICON

SEMTECH

MODULES

muRata Innovator in Electronics

FOXCONN

MULTITECH

USI

NEMEUS

DEVICES

BOSCH

Mueller SYSTEMS

Schneider Electric

HOMERIDER SYSTEMS

GATEWAY

everynet

CISCO

SAGEMCOM

kerlink

MULTITECH

RISINGHF

NETWORK SERVER

IBM

hp

OrbiWise

actility

LORIOT

everynet

stream

SAGEMCOM

senet

APPLICATON SERVER

senet

intel

libelium

WIPRO Applying Thought

digimondo

iSECUR

myDevices

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● *Powered by STM32*

ST and the Alliance

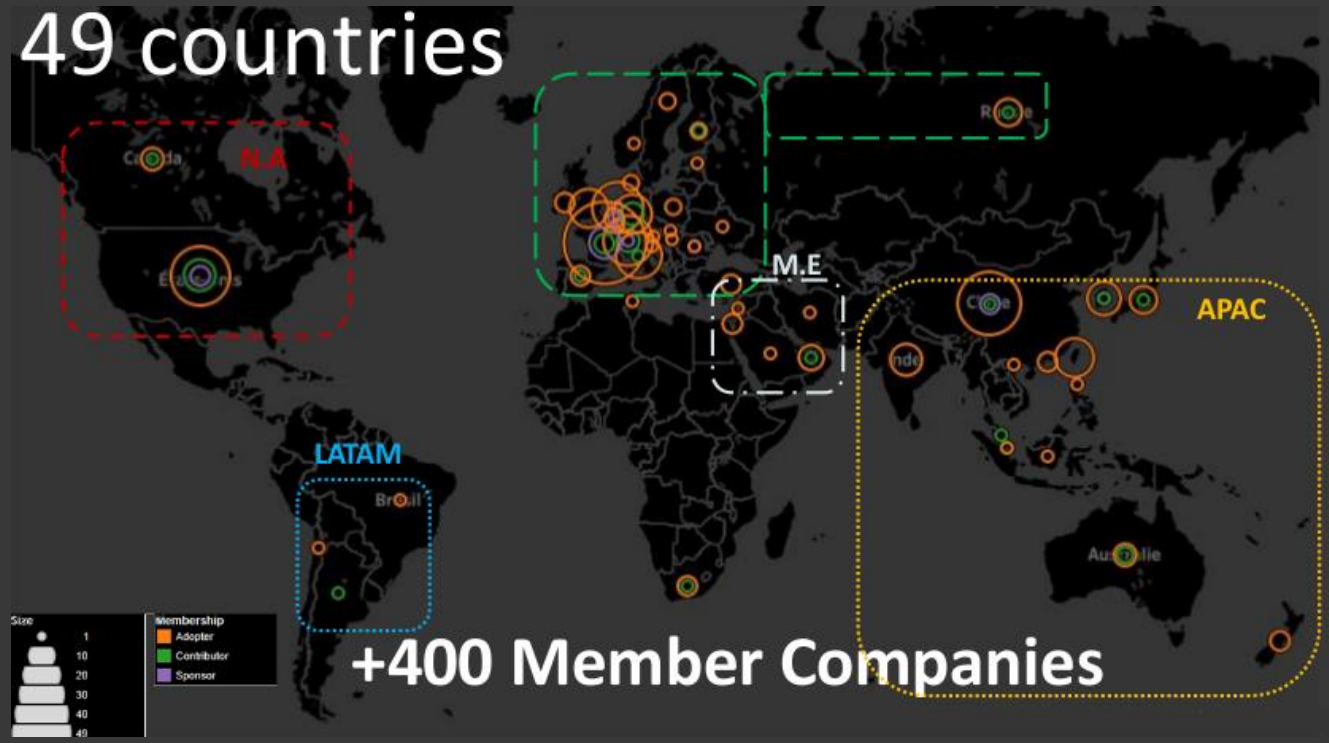
The Internet of Things era is now

ST is SPONSOR and Board Member

The LoRa™ Alliance is an open, nonprofit association of members. Its mission is to ensure that LoRaWAN™ is THE open global standard for SECURE, CARRIER GRADE IoT LPWA connectivity.
Visit https://www.lora-alliance.org/

The LoRa™ Network Deployment

The Alliance



kpn · COMCAST · senet · orange · Objenious by Bouygues Telecom · TELE2 · DIGITA · a2a · swisscom · TATA · SoftBank · Kotahi.Net · everynet · euromicron telent service • commitment • value · 亞太電信 Asia Pacific Telecom · telenor group · UNIDATA · FastNet · DIGIMONDO · SK telecom · proximus · ČESKÉ RADIOKOMUNIKACE · Gemtek · bluesky · NORAnet LoRaWAN® network

LoRa® Alliance
Wide Area Networks for IoT

27 Announced national deployments > 150 regional or city deployments

LoRa-Alliance.org

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LoRa™ Technology Modulation and LoRaWAN™ Network Protocol

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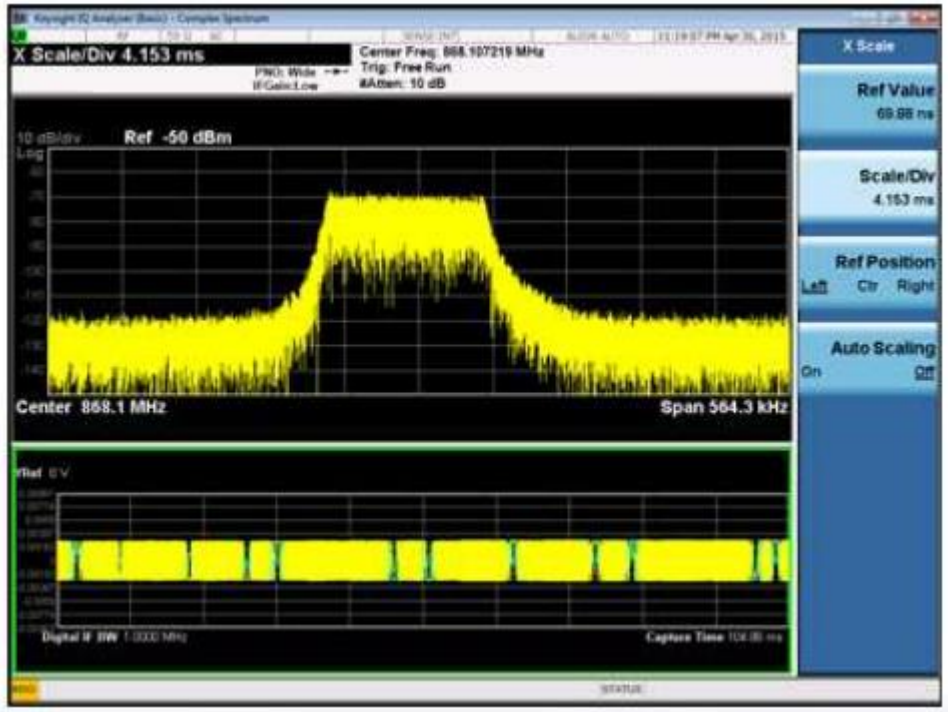
LoRa™ Technology Modulation

- LoRa™ technology is based on the Spread Spectrum Technology
- LoRa™ have been developed by Cycleo then acquired by Semtech
- It is a Chirped Frequency Modulation
- LoRa™ Spread Spectrum technology means:



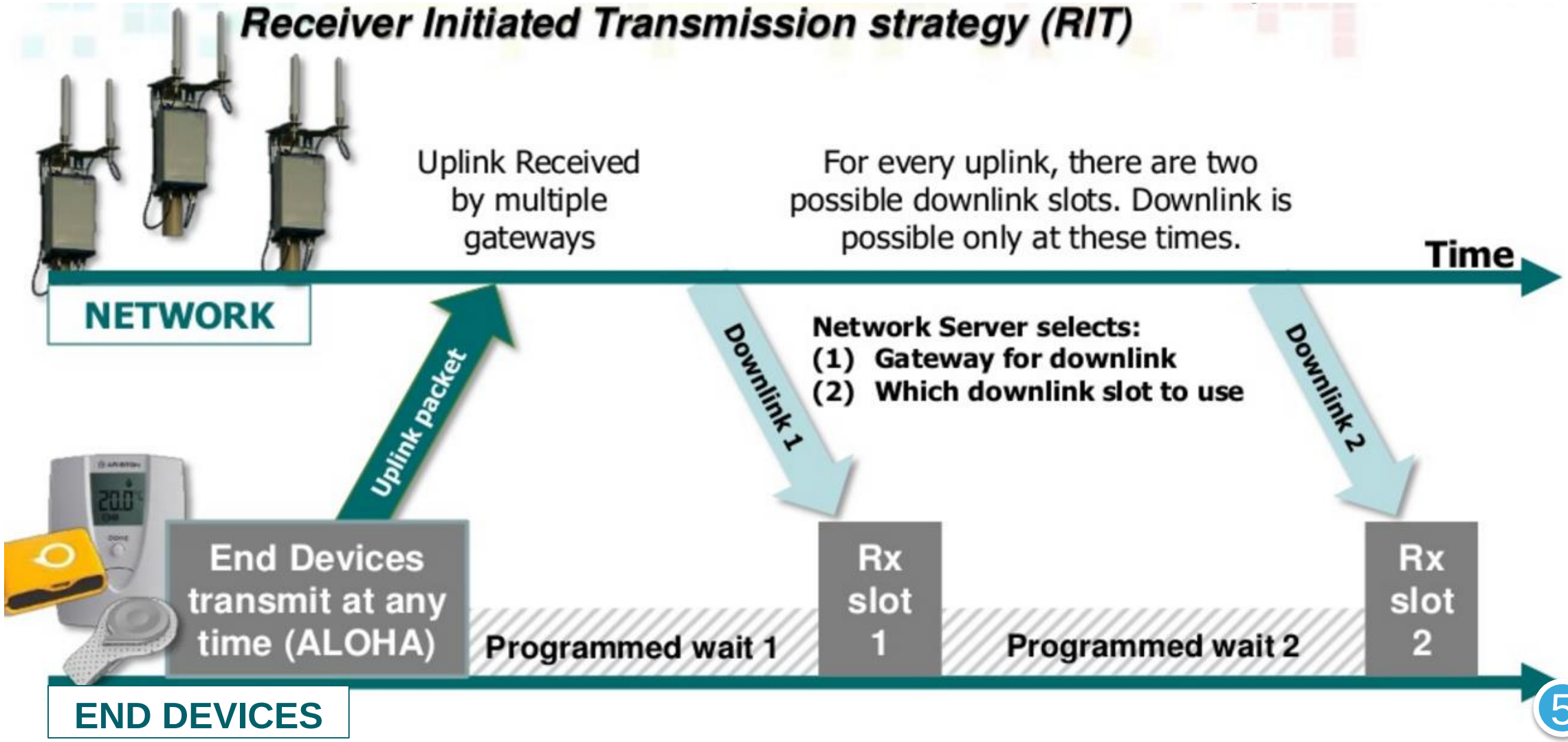
LoRaWAN™ Devices Classes

3 classes to cover all the use cases

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	***Mainly uplink with two potential downlink slots after each uplink***
B (« beacon »)	**Battery powered actuators** Energy efficient communication class for latency controlled downlink. Based on slotted communication synchronized with a network beacon.	***Programmed downlink slots to allow control within certain latency limits***
C (« continuous »)	**Mains powered actuators** Devices which can afford to listen continuously. No latency for downlink communication.	***Lowest latency command and control for less power critical devices.***

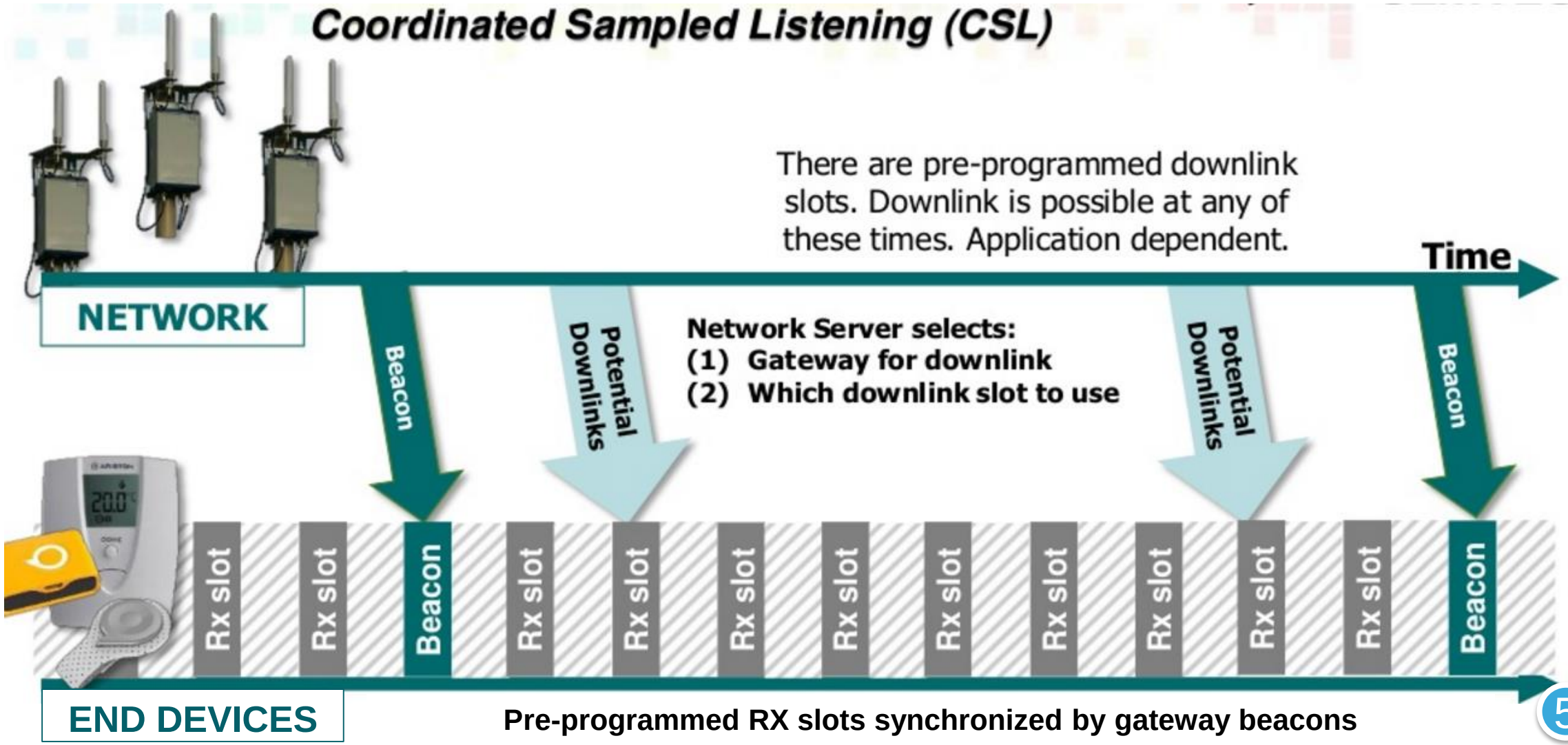
LoRaWAN™ Devices Classes

Class A – Bidirectional Communication



LoRaWAN™ Devices Classes

Class B – Bidirectional Communication



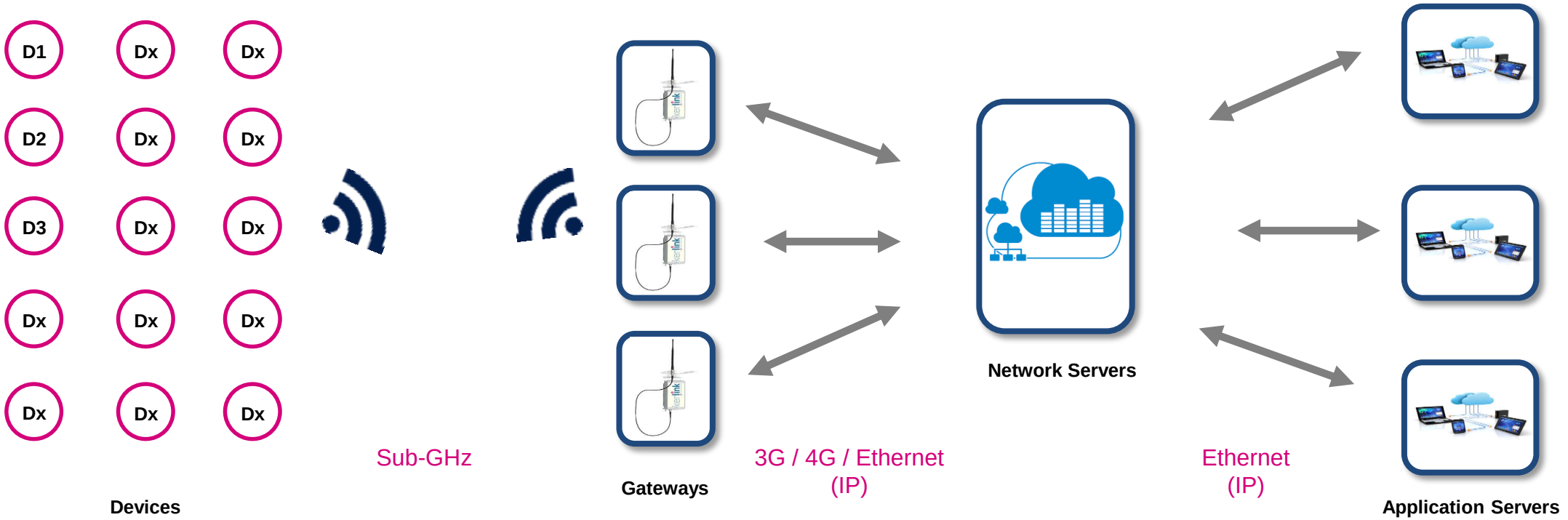
LoRaWAN™ - Security

A native AES 128-bit security network protocol

- Device Address (DevAddr) is a 32-bit identifier
  - Unique within the network
  - Available in each data frame and shared between end-device, N.S and A.S
- Network Session Key (NwkSKey) is a 128-bit AES encryption key
  - Unique per end-device and shared between end-device and N.S
  - It allow message integrity communication between end-device and N.S
- Application Session Key (AppSKey) is a 128-bit AES encryption key
  - Unique per end-device and shared between end-device and A.S
  - It is used to encrypt / decrypt A.S server messages to the end-device
- To increase end-device authentication and security a secure can be added in the Device

LoRa™ Network Protocol

Real Network Topology Deployed



STM32(and STM8) solutions for LoRa™ and Sigfox™

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ST and Semtech LoRa™ Agreement

- Semtech Corporation and STMicroelectronics announce **agreement on Semtech's Lora®** long-range wireless RF technology

- Intends to **boost STM32 MCUs with LoRa®** technology to target internet of things deployments by mobile network operators and large-scale private networks

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http://www.st.com/web/en/press/c2790

LoRa® powered by STM32™

www.st.com/stm32-lrwan

Available today

USI® Module
AT command

Murata® Module
All-in-one Open

Cost optimized solution

Flexible design architecture
More than **1000** P/N of **STM8/STM32**

All-in-one LPWAN (LoRa, Sigfox and more …)

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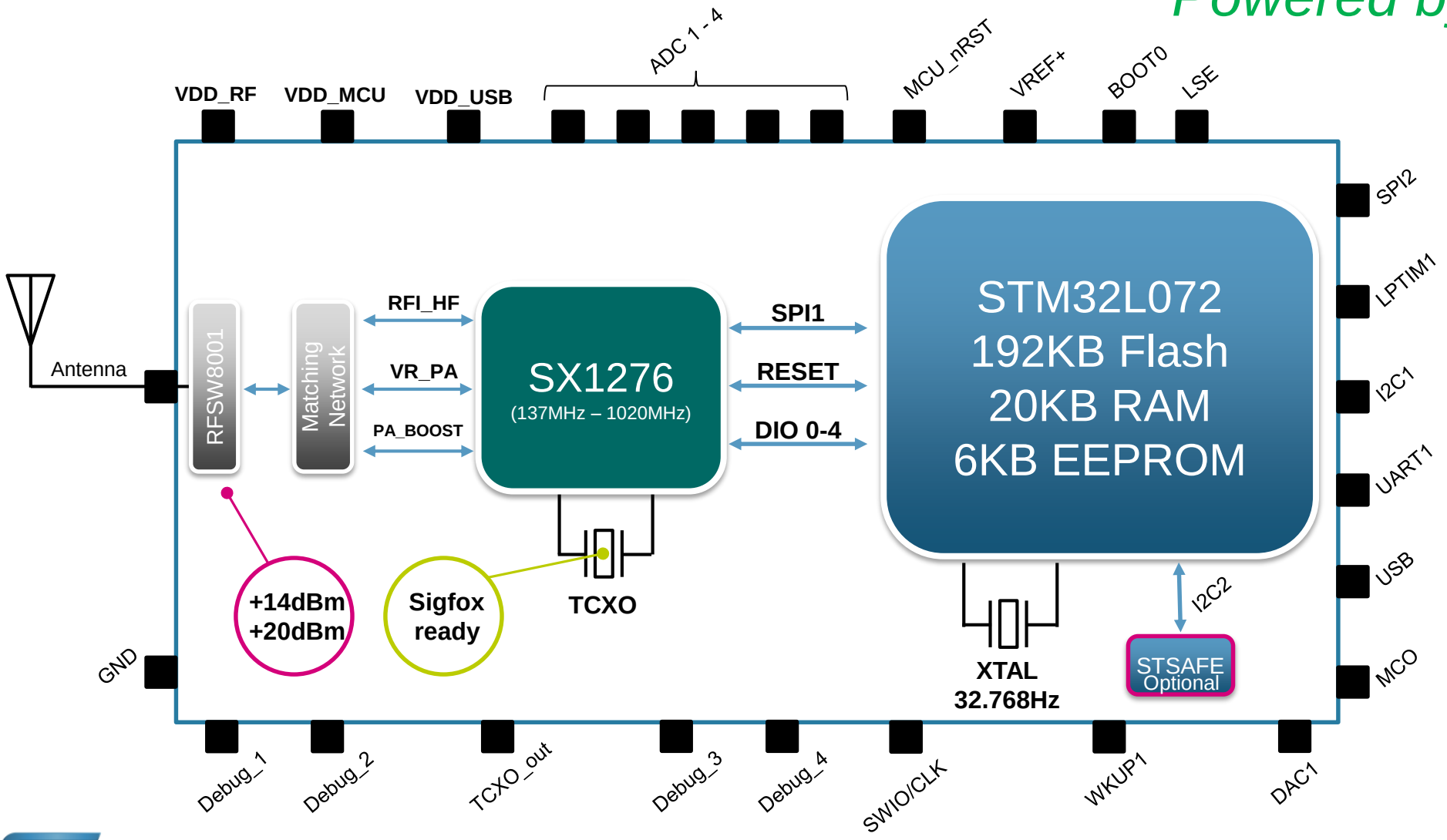
Open Murata® LoRa® module

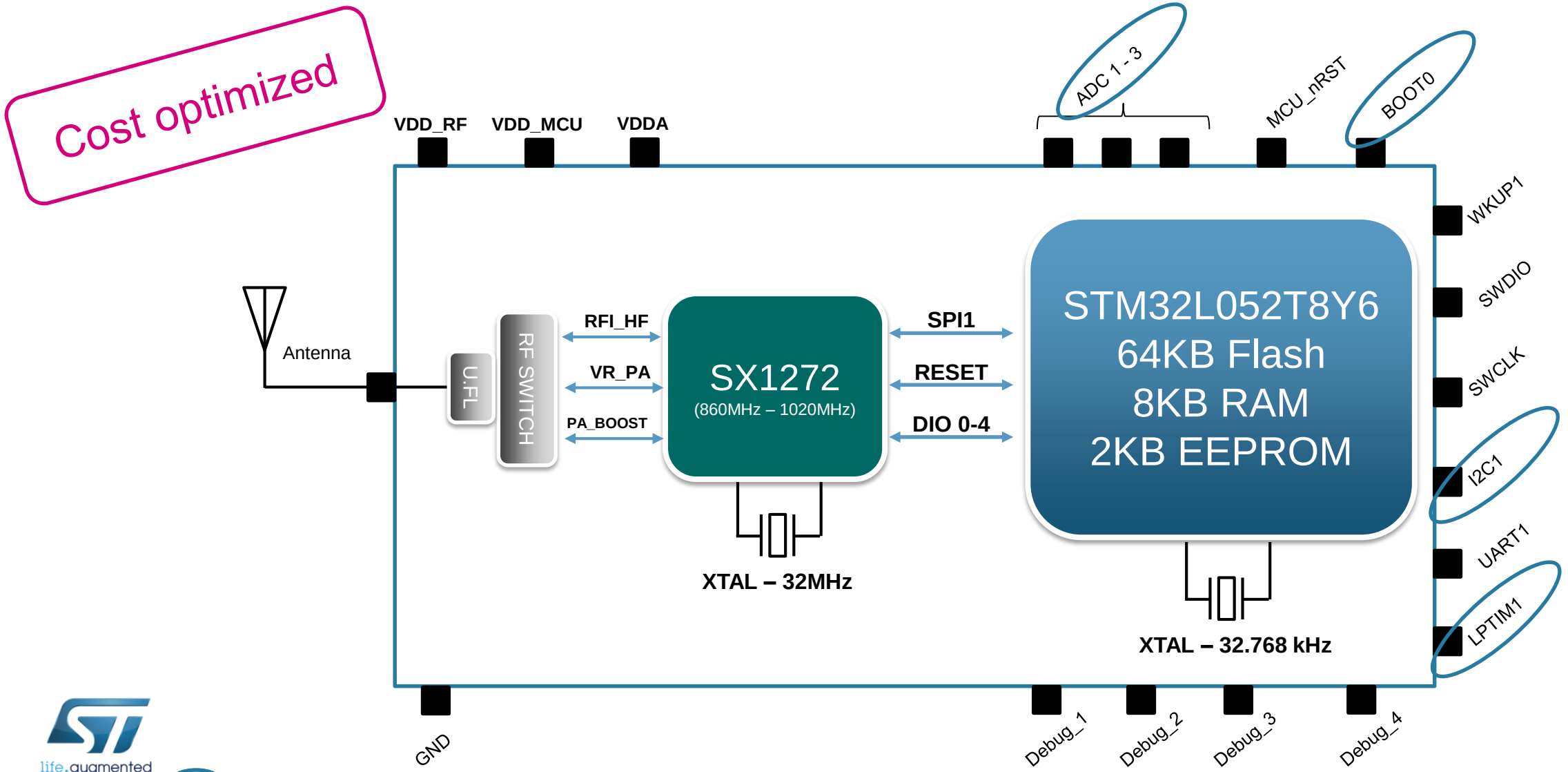
Powered by STM32L0



Open LPWAN Module

USI® LoRa™ module - AT command set

Powered by STM32L0

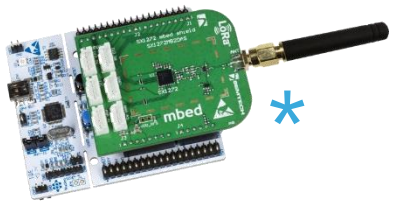


Let's Get Started

With a wide and existing ecosystem

(Click on the icon or link)

HW tools



Nucleo pack

ST and Semtech

P/N: P-NUCLEO-LRWAN1

Expansion board

ST and USI®

P/N: I-NUCLEO-LRWAN1

Discovery board

ST and Murata®

P/N: B-L072Z-LRWAN1

Dev tools

STM32CubeMX

ST-Link Utility

Partners IDE

KEIL™ Tools by ARM

ARM mbed enabled

System **Workbench** for STM32

IAR SYSTEMS

LoRaWAN™ stack

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I-CUBE-LRWAN

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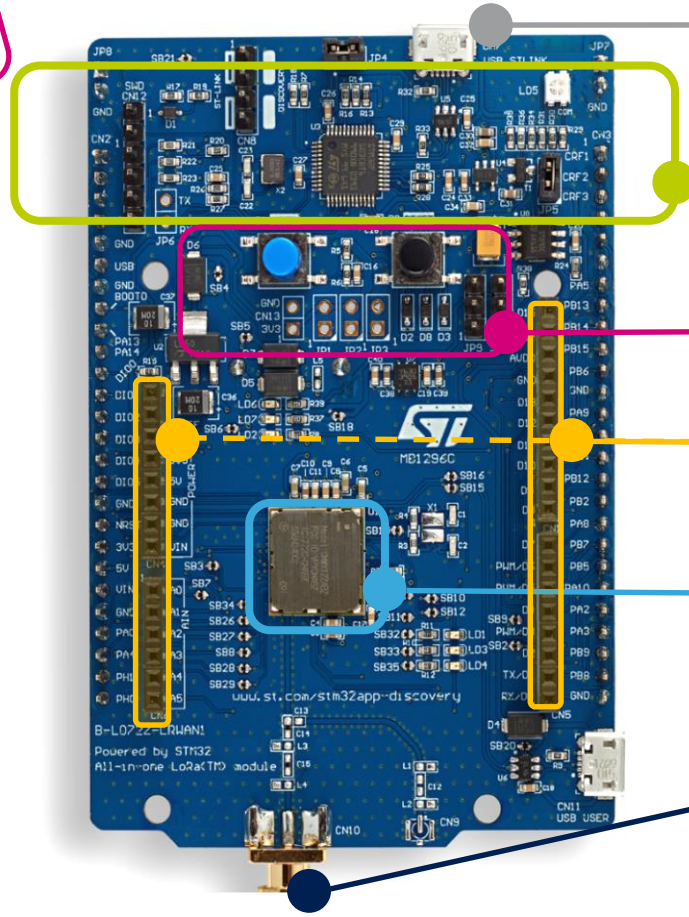
∗ **Semtech board can be ordered in standalone at digikey or mouser. P/N:SX1272MB2DAS**

New Hardware tool

B-L072Z-LRWAN1: STM32 and LoRa® Discovery kit

Available now!

ARM mbed enabled



- Flexible board power supply : through USB or external source
- Integrated ST-Link/V2-1: mass storage device flash programming
- 2 push buttons, 2 color Leds, Jumper settings
- Arduino™ extension connectors : easy access to add-ons
- Murata module
- SMA Antenna connector

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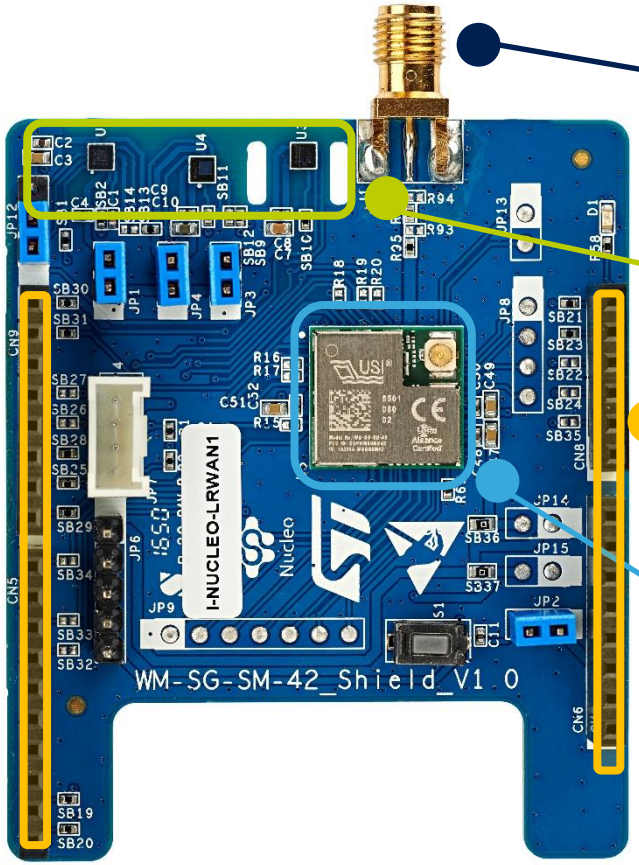
New Hardware tool

I-NUCEO-LRWAN1: USI® STM32™ Nucleo expansion board for LoRa®



SMA antenna connector

Sensors: Pressure, Humidity, Temperature, 3D MEMS

Arduino™ extension connector

USI module

LoRa® technology powered by STM32

The widest ecosystem-ever now available !

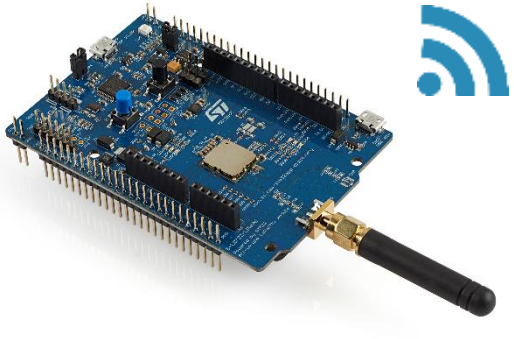
Best-in-class in ultra-low-power and Long Range

Widest HW and SW ecosystem

Easy to use

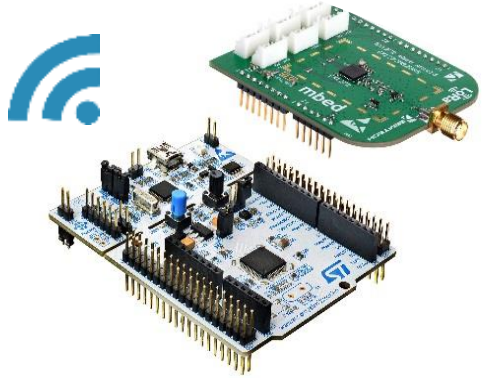
LoRa® Gateway STM32F7 based

Available Demo



B-L072Z-LRWAN1
LPWAN Discovery kit

I-NUCLEO-LRWAN1
LoRa® + Mems Shield



P-NUCLEO-LRWAN1
LoRa® Nucleo Pack

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with the new STM32

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