Wirepas

Very very good IoT

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Wirepas

LPWAN DAYS

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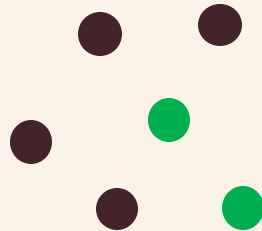# Network topologies

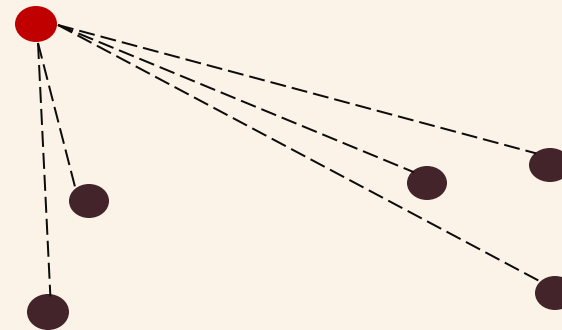| SMALL AND LOCAL	WIDE AREA	MESH
Local area and small installations with scale and reliability limitations - Zigbee, Thread, BLE Mesh, Z-wave	Wide area installions with limited bandwidth - SigFox, LoRaWAN. Data fee model resulting high OPEX – NB-IoT, LTE-M.	Autonomous, any scale, density, and location with positioning. Reliable with light gateway infrastructure (Cellular, WiFi, Ethernet…).
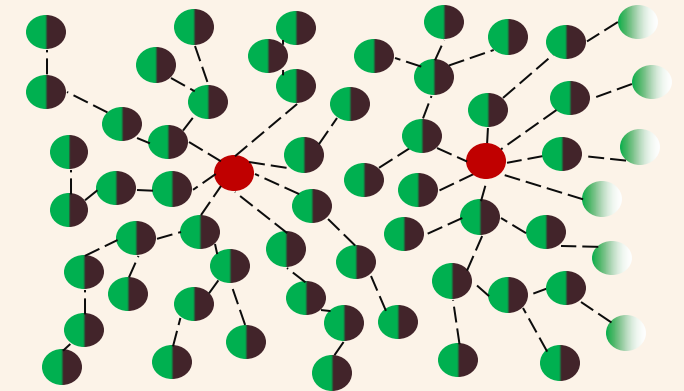
Centralized	Centralized	De-centralized
Design objective		
Connected home	**Cellular way for IoT**	**Buildings, Campuses, Cities**

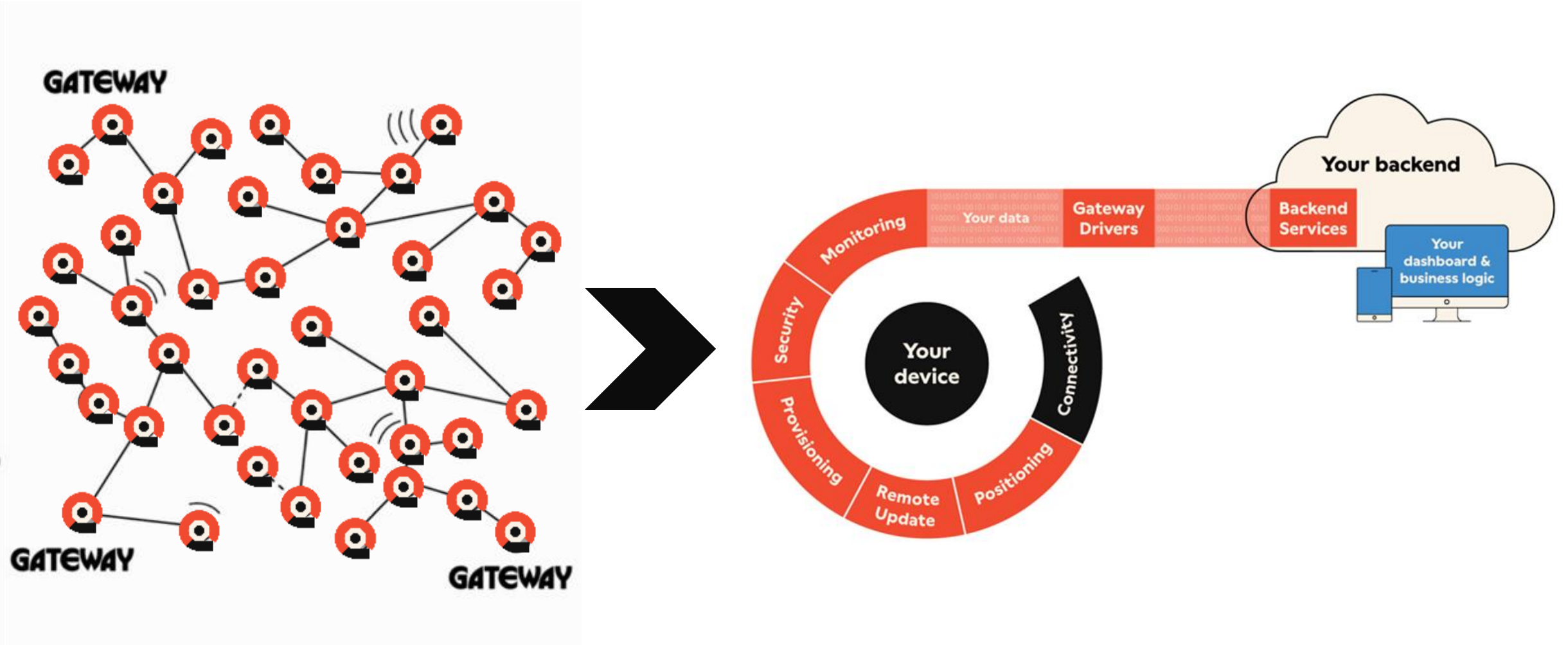🟢 Router function   ⚫ End device function   🔴 Gateway function

WIREPAS CONNECTIVITY SUITE

WIREPAS CONNECTIVITY SUITE

Wirepas Connectivity Suite combines our field-proven Mesh network with built-in end-to-end services

What makes Wirepas mesh unique ?

At the heart of our Connectivity Suite, we have our field proven massive and reliable multi hop mesh connectivity which enable:
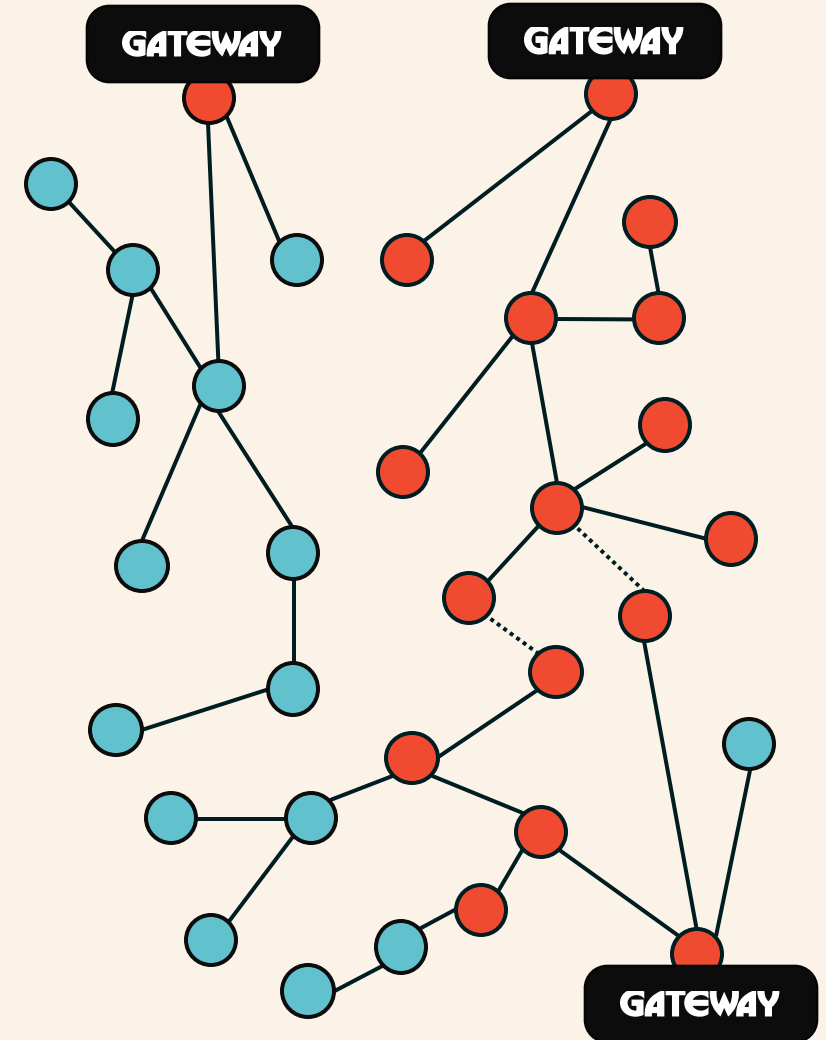
Massive like nothing else

Decentralized like nothing else

Reliable like nothing else

Versatile like nothing else

- Several radio profiles (Sub GHz, 1.9GHz or 2.4GHz) to select the best radio for a given use case.
- Low power (2.4GHz) or low latency routers.
- All communications directions are supported.

Wirepas Positioning Engine (WPE) 2.4 GHz profile

RTLS solver

— Computes position of mobile devices based on position of fixed anchors.

— Wirepas Massive Tracking allows a deployment of <u>fully battery-operated infrastructure</u>

— Anchors are used both as locators and mesh routers.

— Processing engine which providing a position (WGS84 / GPS) for every measurement taken by the asset.

WPE uses RSSI based trilateration and supports services to:

— Declare Anchors

— Declare Buildings, Area, Floors, Zones

— Provide Tag position with matching of Building, Floor, Zone
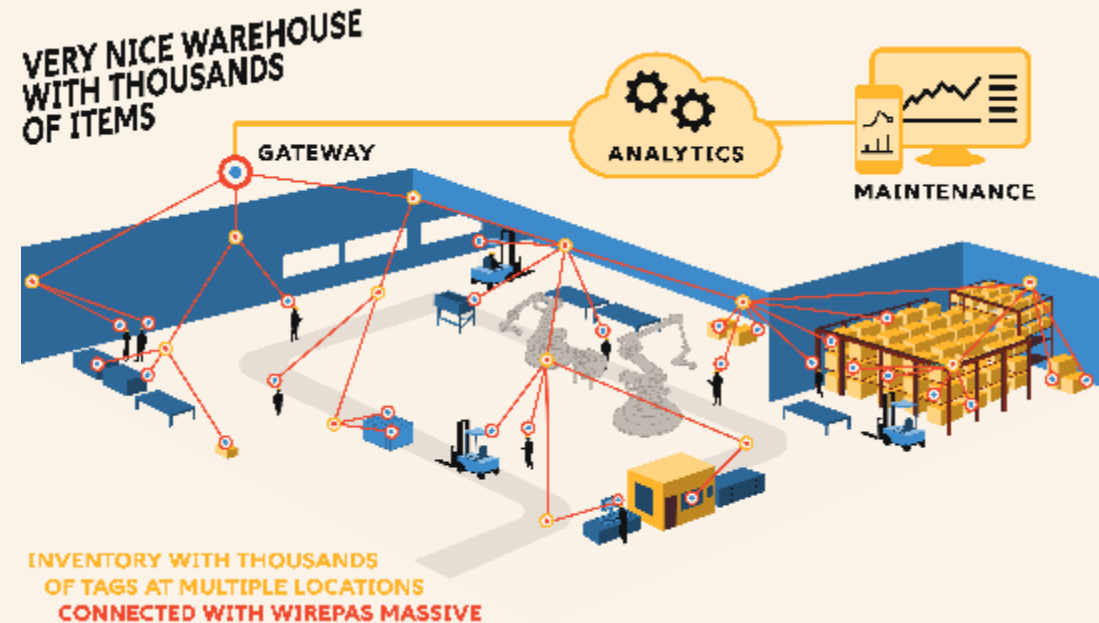
WHERE WE PLAY

Smart Tracking

Smart Building

Smart Manufacturing

Smart Energy & City

Around 10 millions devices deployed worldwide

WIREPAS MESH

## Technical advantages explained

Wirepas

Industrial Grade Reliability

Self-healing and auto-maintenance
- Nodes automatically re-organize to find alternate route regularly or in case of issue.

No Single point of Failure (SPOF)
- Any device can be router leading to multiple possible connections
- Gateways fully mutualized. In case of one drops another maintain connections.
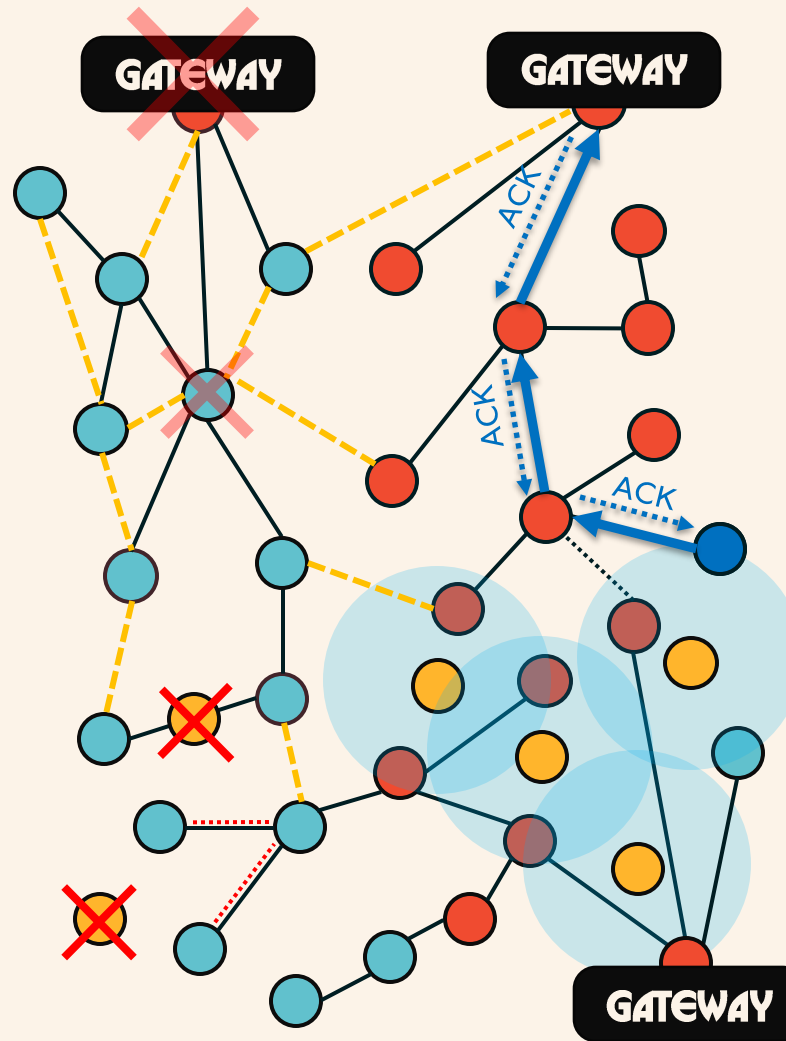
Hop by Hop Acknowledgment
- 99.9% SLA.
- In case a packet is not received, Automatic re-transmission of lost packet

**Minimize impact "To & From" others**
- Dynamically avoid using channels used by other radios.
- Frequency agility on 40 channels & short time on air (1Mbps).
- Listen Before Talk (LBT).
- Adaptive transmit power.
- Local multi-channel interreference avoidance.

Interfered channel →
Change channel and avoid using the interfered one

OK	Inter-ference	OK

Frequency

GATEWAY GATEWAY

ACK ACK ACK

GATEWAY

Device management
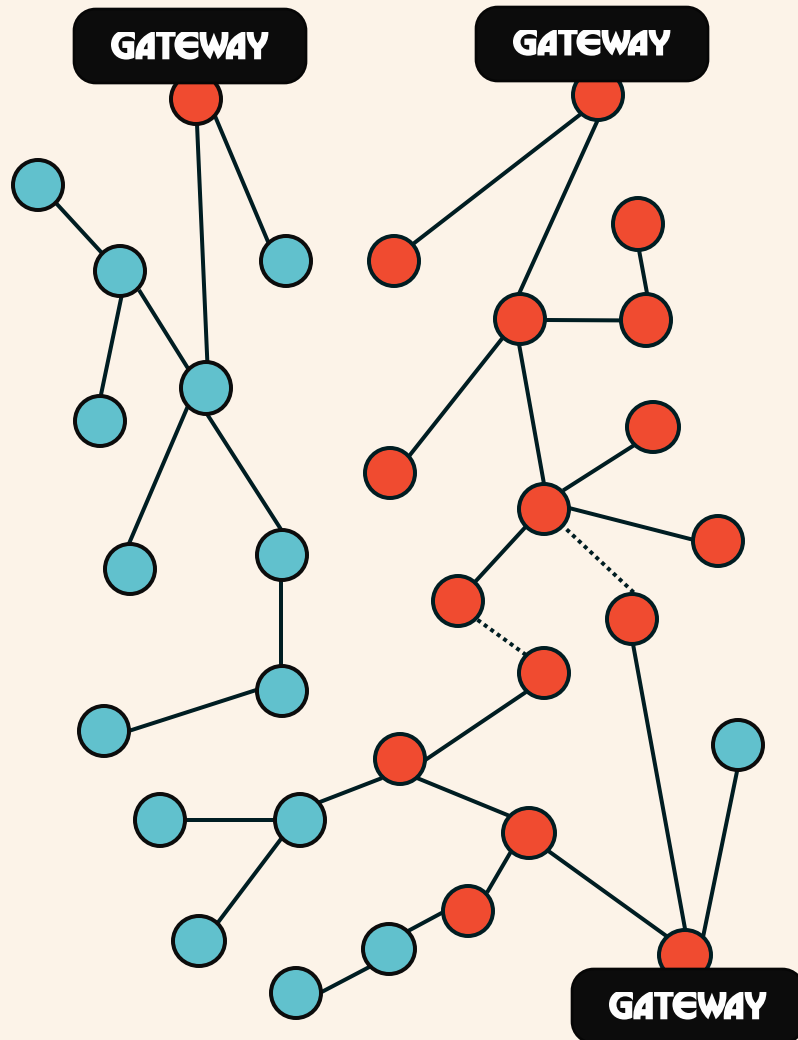
Shared app configuration

— 62 bytes shared inside the network for the application

OTAP

— Over The Air Programming
— GUI or API
— Stack, Application and/or persistent data

Open Joining

— Network can provide secured credentials delivery to the device
— On premise or cloud provisioning server
— Remote credentials erasure & re-provisioning

Remote API

— Ping
— Status
— Device management

— Reboot
— Role selection
— Time synchronization
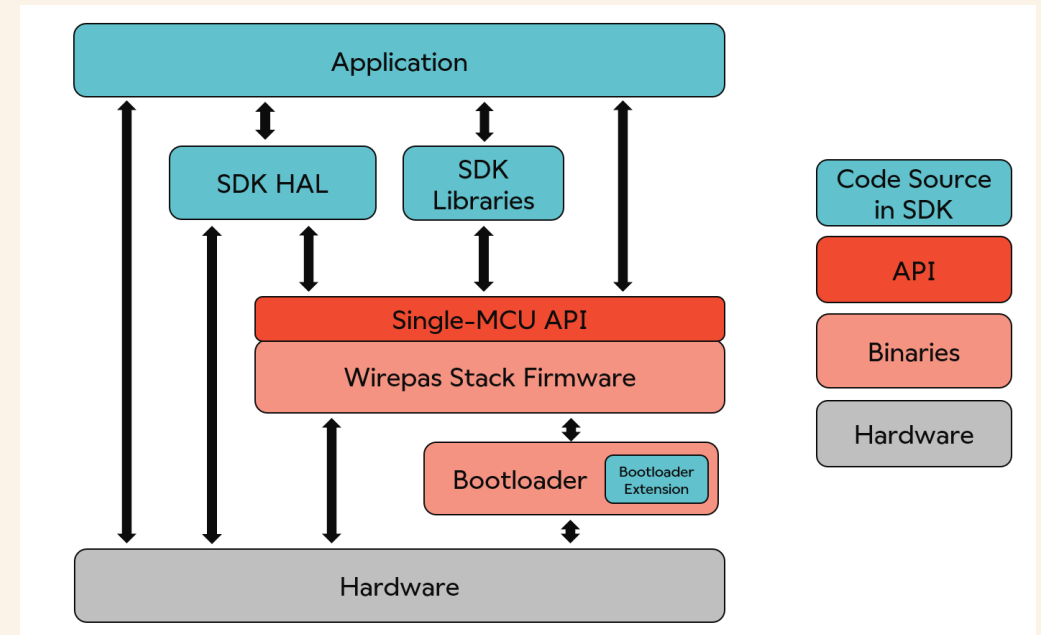
Wirepas abstraction

Single API for all MCU vendors

- Wirepas abstraction layer
- Stable API: backward compatible
- Easy port between MCU
- Easy port between radio profiles!

Integrated fragmentation up to 1500 bytes

- 102 bytes per packet for Sub-Ghz and 2.4 GHz profiles
- 180 bytes per packet in 5G Mesh
- Integrated in WNT, on-premise

Supports IPv6/UDP

Focus on security and operations

Firmware level

- Private network with own network and devices IDs
- AES128 & OMAC1 security elements

Built-in features

- Self healing network
- No single point of failure with multi gateways
- Diagnostics data
- Hop by Hop Acknowledgment
- OTA with encrypted firmware image
- Auto provisioning fully secured

Other

- Any additional security elements can be added at application level
- On premise installation possible

Large Scale and High Density

Decentralized operation
THE key feature of Wirepas Massive leading to large scale and high density
- Any device can be router (R) at any time.
- Nodes self-organize themselves dynamically and promote other devices to be routers.
- Role is dynamic and role can change when needed.

Short time on Air
- Use high radio data rate to minimize time on air. Enable less collisions for high density and high reliability.

TX TX   TX
Time

GATEWAY

GATEWAY

4dbm
0dbm
8dbm
4dbm
10dbm

GATEWAY
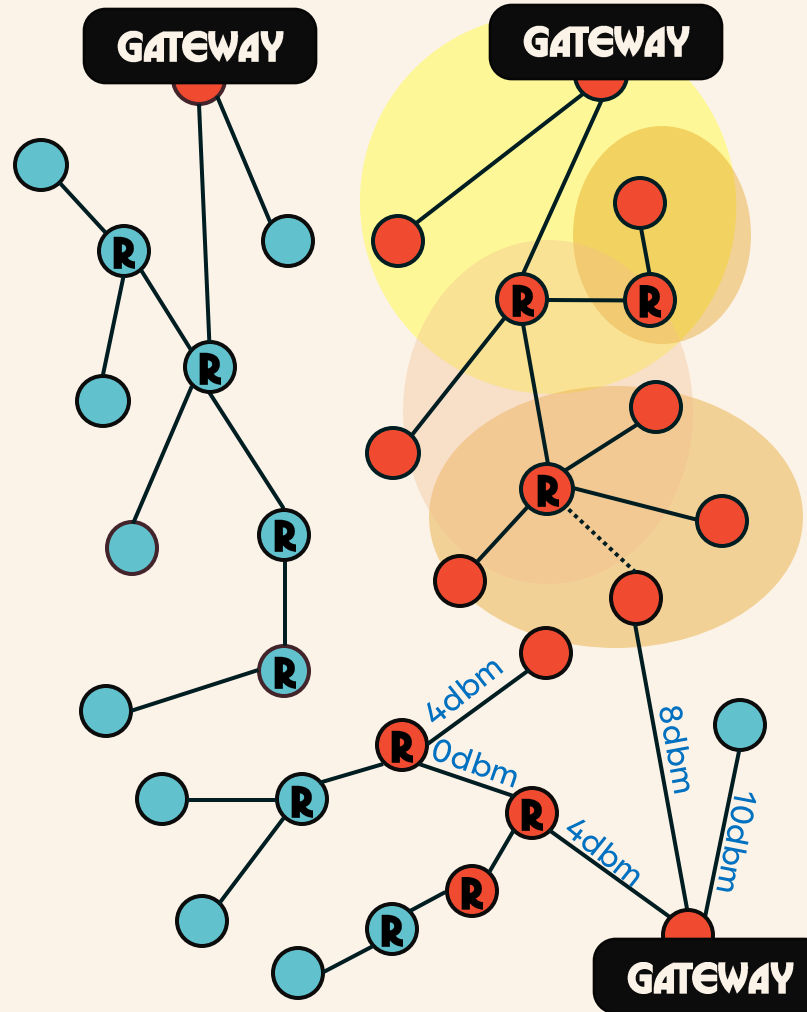
Locally synchronized point to point communication
- Nodes connect via locally synchronized channels on a specific timeslot (FDMA +TDMA).
- Best channel selection. No collision.
- Optimized peer to peer local communication.
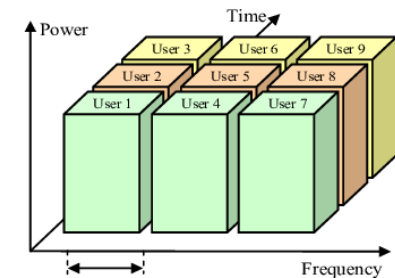
Adaptive Transmit Power
- Local and automatic transmit power adjustment.
- Adjust power to minimize power consumption & maximize spectrum usage for high density.

Low Installation & Maintenance Costs

## Efficient Over-the-Air (OTA) software update

Native OTA can be used to update either or both:
• Wirepas Massive firmware
• Application software

Efficient mechanism to manage new version update in the entire network:
• Disseminate update
• Indicate update download complete
• Command update into use
• Indicate update in use

Firmware image are encrypted.

GATEWAY

2) Authenticate

GATEWAY

1) Join request

3) Secured Provisioning packet
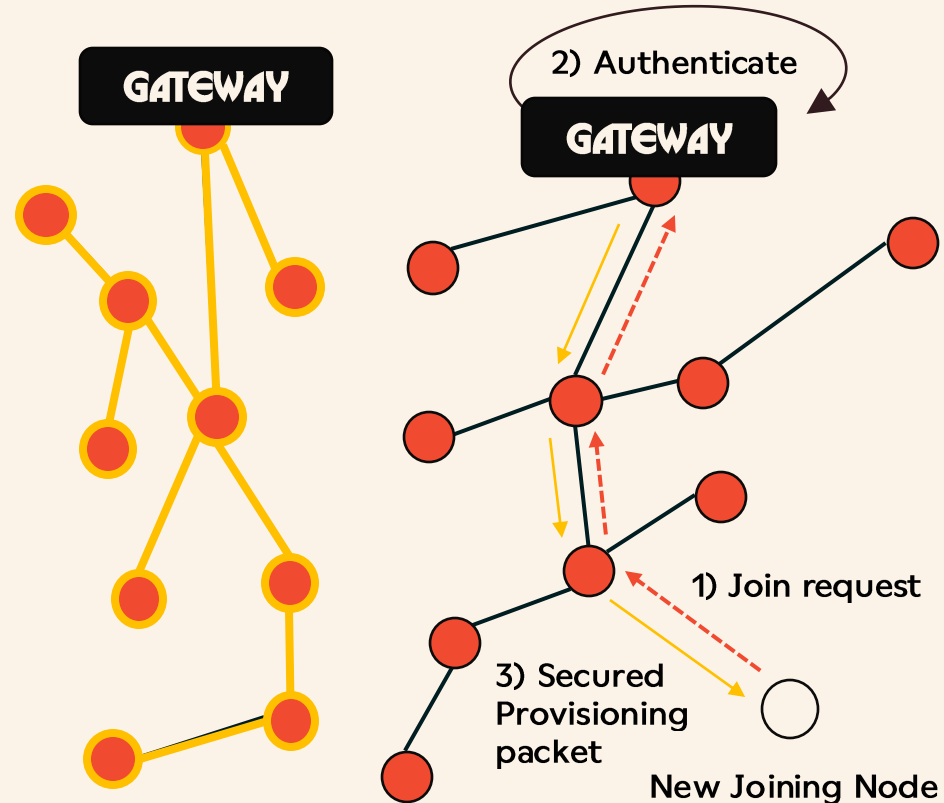
New Joining Node

Automatic Provisioning

Out of band provisioning supported (BLE, NFC).

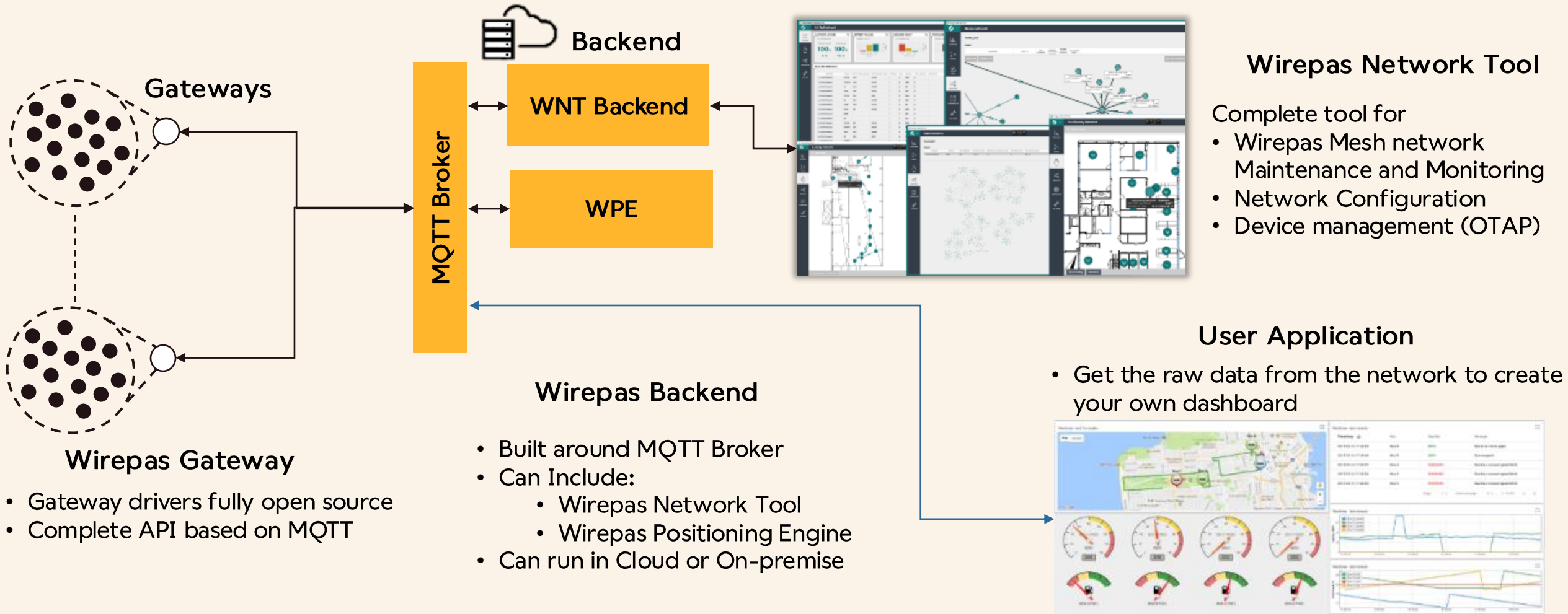Allows secure end to end automatic provisioning to be deployed.

A new Joining Node can establish a limited connection to the network to receive its parameters.

Provisioning does not disrupt network operation while new devices are added.

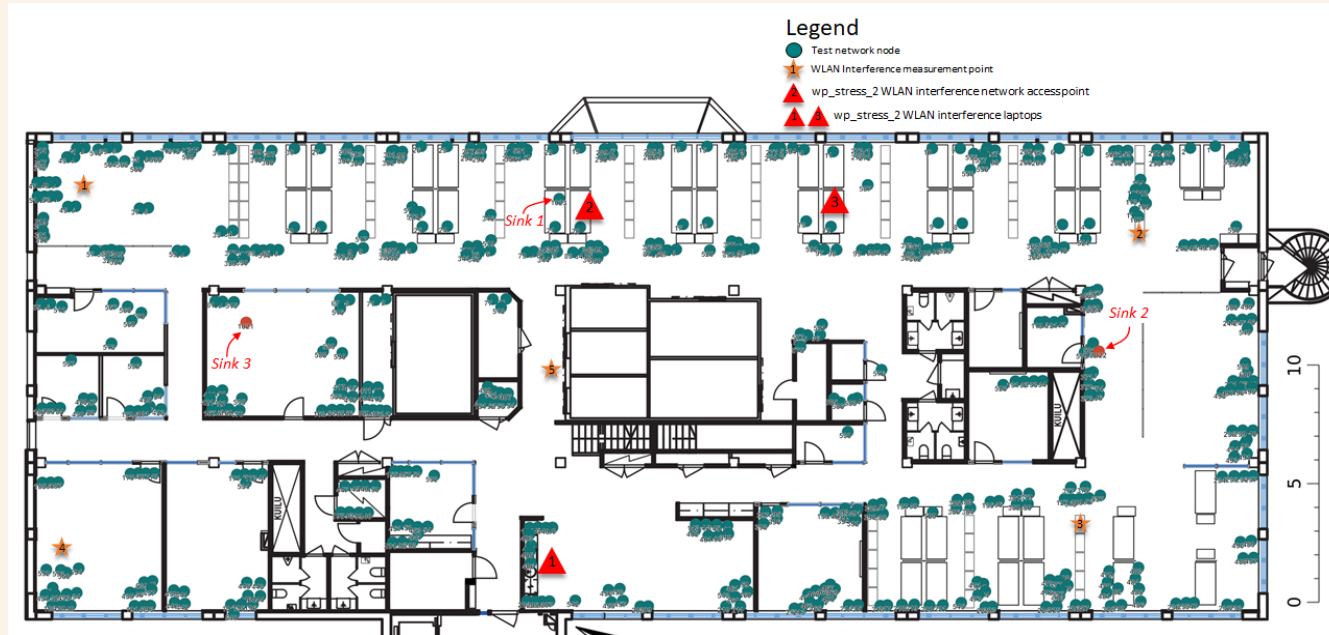# Add your value at device, gateway and backend level

Gateways

Backend

MQTT Broker

WNT Backend

WPE

Wirepas Network Tool

Complete tool for
- Wirepas Mesh network Maintenance and Monitoring
- Network Configuration
- Device management (OTAP)

User Application

- Get the raw data from the network to create your own dashboard

Wirepas Gateway

- Gateway drivers fully open source
- Complete API based on MQTT

Wirepas Backend

- Built around MQTT Broker
- Can Include:
  - Wirepas Network Tool
  - Wirepas Positioning Engine
- Can run in Cloud or On-premise

Network density – No bullshit

Dense network testbeds
- 1000 devices in a cubic meter
- 600 devices in a 1000m2 floor

Deployed by customers
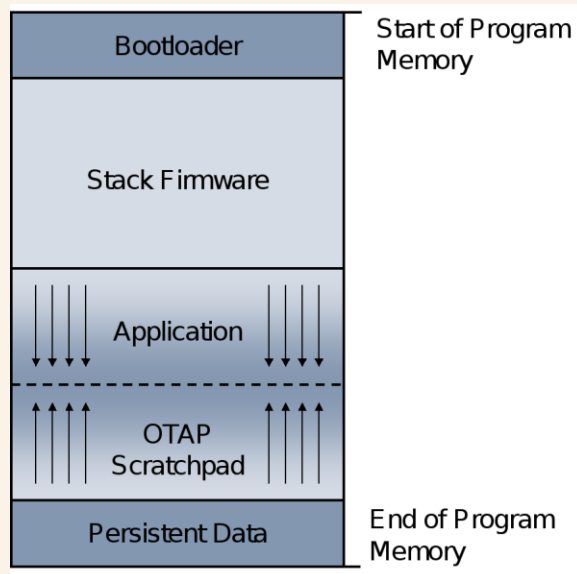- 1.1M devices in Oslo
- 5M in Nordics countries

Legend
- ● Test network node
- ★ WLAN Interference measurement point
- ▲ wp_stress_2 WLAN interference network accesspoint
- ▲ ▲ wp_stress_2 WLAN interference laptops

OTAP

Scratchpad is propagated automatically in the network

It can be applied
— Immediately
— After a pre-defined delay
— After a dedicated command

Any flash section can be updated

Security with authenticated and encrypted scratchpad
— Symmetric crypto
— Asymmetric crypto

Supported chipsets

Vendor	Part Number
NORDIC SEMICONDUCTOR	nRF52832
	nRF52833
	nRF52840
	nRF9161 or 9131 (supporting DECT NR+)
SILICON LABS	EFR32FG12P232F1024G M48/L125
	EFR32MG12P232F1024G M48/L125
	EFR32xG12
	EFR32xG22 (only for low power)
	EFR32xG21
	EFR32xG24

Note: Wirepas Massive requires 32kHz Crystal to operate.

Detailed hardware requirements are available from your sales representative.

THE FIRST 5G MESH TECHNOLOGY

Wirepas

‹ Back

World's first non-cellular 5G technology, ETSI DECT-2020, gets ITU-R approval, setting example of new era connectivity

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WORLD'S FIRST NON-CELLULAR 5G TECHNOLOGY, ETSI DECT-2020, GETS ITU-R APPROVAL, SETTING EXAMPLE OF NEW ERA CONNECTIVITY

Sophia Antipolis, 19 October 2021

ETSI DECT-2020 NR, the world's first non-cellular 5G technology standard, has been recognized by the WP5D of the International Telecommunication Union's Radiocommunication Sector (ITU-R) and included as part of the 5G standards in IMT-2020 technology recommendation. Dr. Günter Kleindl, Chair of the ETSI Technical Committee DECT, says: "*With our traditional DECT standard we already received IMT-2000 approval by ITU-R twenty-one years ago, but the requirements for 5G were so much higher, that we had to develop a completely new, but compatible, radio standard.*" Released last year, the standard sets an example of future connectivity: the infrastructure-less and autonomous, decentralized technology is designed for massive IoT networks for enterprises. It has no single points of failure and is accessible to anyone, costing only a fraction of the cellular networks both in dollars and in carbon footprint.

The IoT standard, defined in ETSI TS 103 636 series, brings 5G to the reach of everyone as it lets any enterprise set up and manage its own network autonomously with no operators anywhere in the world. It eliminates network infrastructure, and single point of failure - at a tenth of the cost in comparison to cellular solutions. It also enables companies to operate without middlemen or subscription fees as well as store and consume the data generated in the way they see best fitting for them (on premises, in public cloud or anything in between).
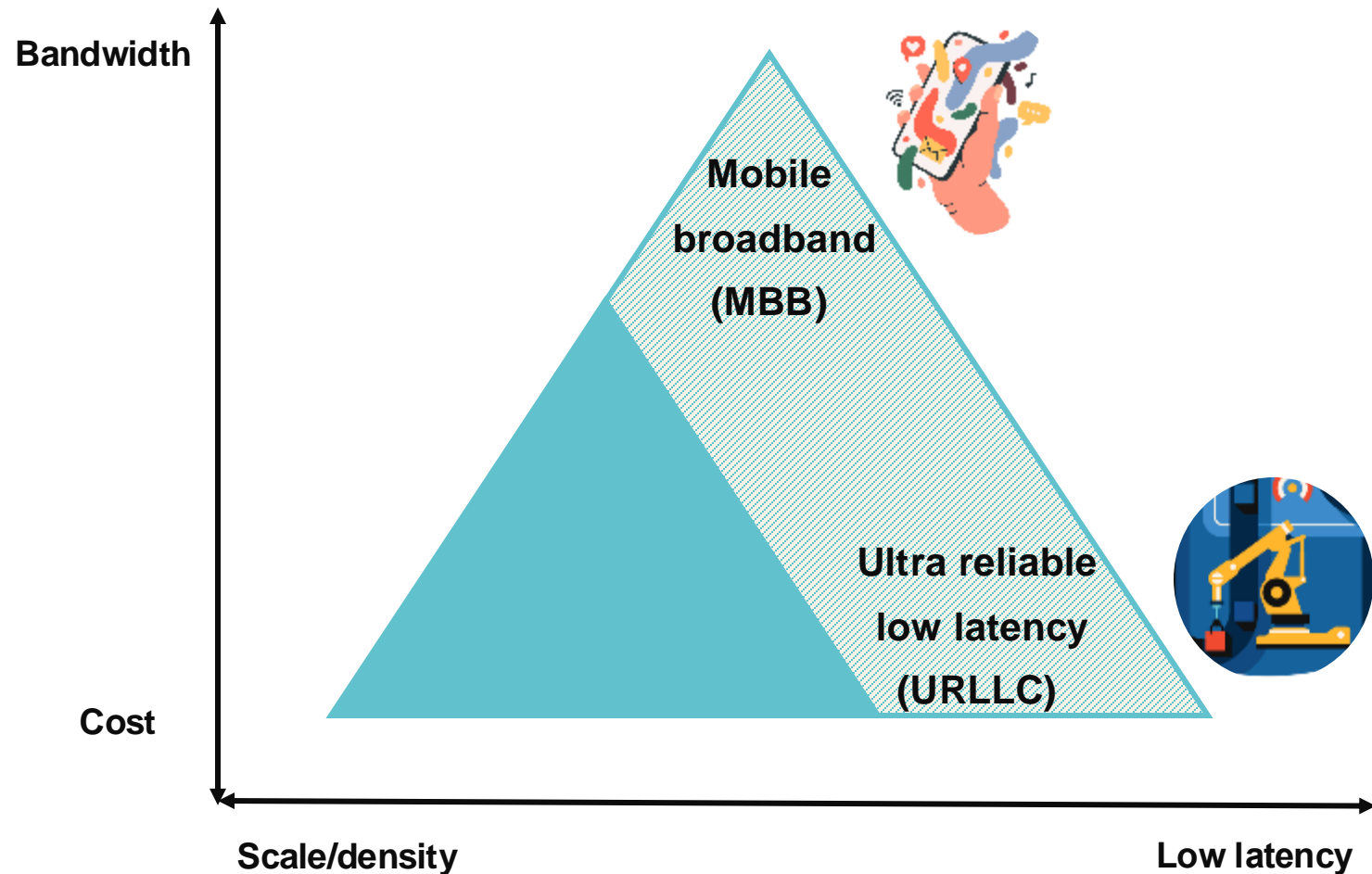
5G definition has three dimensions

Mobile broadband (MBB)

5G

Massive machine-type (mMTC)

Ultra reliable low latency (URLLC)
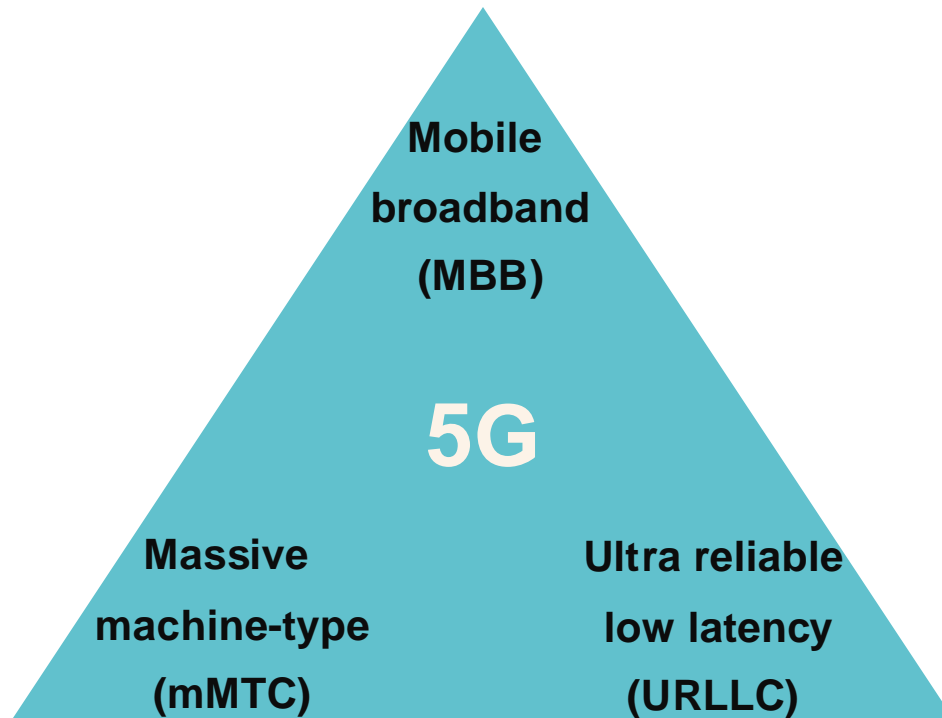
— 5G requirements are called IMT-2020.

— It includes all technologies meeting the 5G definition.

— For a technology to be included in 5G, it needs to meet at least two of the three dimensions.

3GPP main focus in 5G seems to be in MBB & URLLC

Bandwidth

Mobile broadband (MBB)

Ultra reliable low latency (URLLC)

Cost

Scale/density　　　　　　　　　　　**Low latency**

— 3GPP's main focus on MBB and URLLC has left massive networks without a cost-efficient solution.

— MBB
  — High speed and throughput to stream even more data

— URLLC
  — Low latency for most demanding, but niche use cases like robotics.
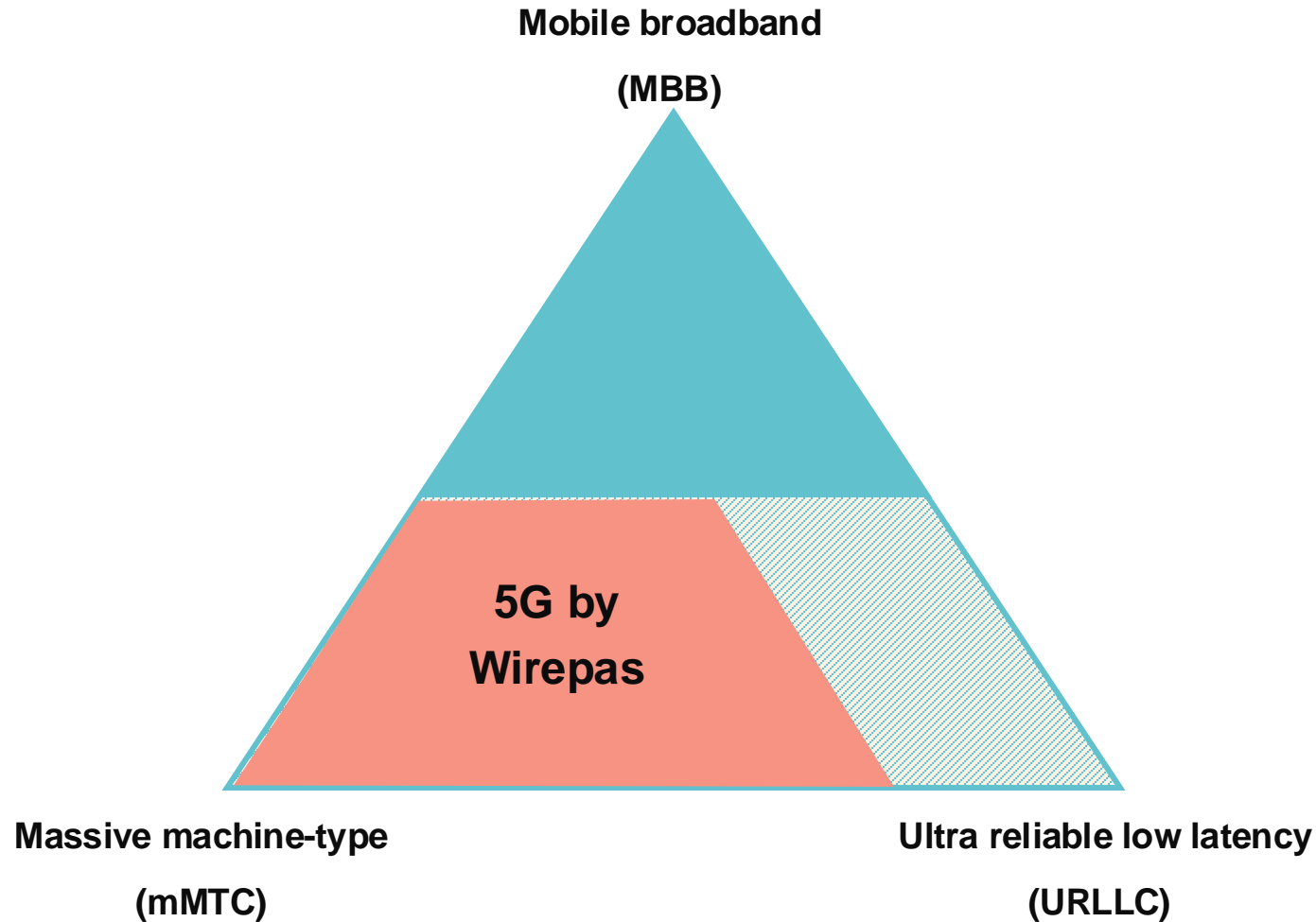
Massive IoT of 5G sits tight in mMTC corner

5G

Massive machine-type (mMTC)
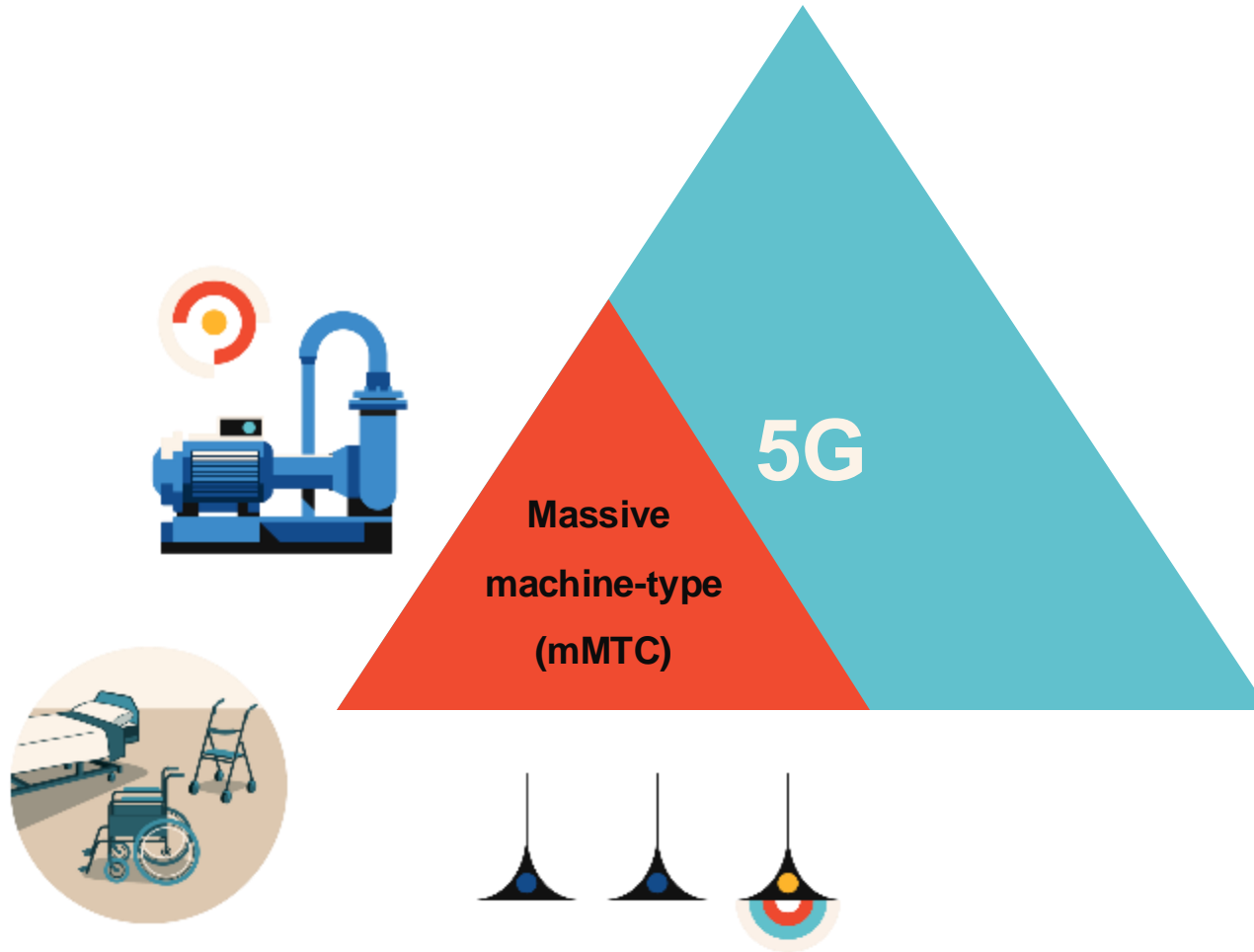
What is Massive IoT

— Thousands of IoT devices per site, like luminaires.

— Millions of devices build for purpose like read your Electricity consumption.

— Have real time inventory or locate all your assets with lowest cost wireless tag.

— Years of battery life required, even with the real time data transfer

— Fast and easy deployments

— Total Cost of Ownership, plays important role.

Wirepas focuses on massive networks

Mobile broadband

(MBB)

5G by
Wirepas

Massive machine-type

(mMTC)

Ultra reliable low latency

(URLLC)

— Wirepas makes 5G complete by bringing in a purpose-built, affordable alternative for massive IoT.

— Wirepas is the main contributor of the DECT-2020 NR standard.

NR+ the first non-cellular 5G for IoT

1. Global standard by **ETSI TC-DECT** – using DECT band (1,9GHz) for massive scale IoT

2. **5G and Mesh** under unlicensed frequency band
    1. Dimensioned to connect every IoT device on the planet
    2. Up to 3km range per hop (6km measured Line of Sight)
    3. Supports IPv6/UDP
    4. Designed for Low Power Routing

3. Making the DECT spectrum (1.9 GHz) freely available for IoT applications World-Wide
    — 1,9 GHz used to be known as "the golden frequency"
    — 10 to 20MHz band almost unused and freely available for IoT

NR+ coverage
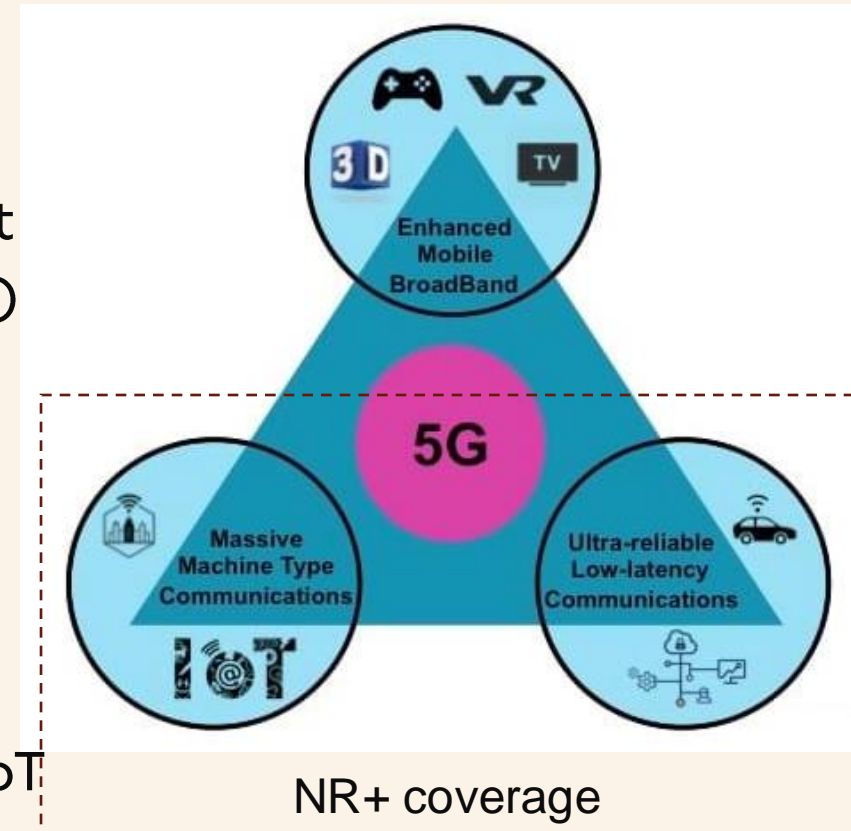
A global standard

Europe & Australasia*	**1880 – 1900 MHz** (potential extension in Europe to also include 1900 – 1920 MHz)
US & Canada	**1920 – 1930 MHz** ("DECT 6.0")
Japan	**1893 – 1906 MHz** ("J-DECT")
Latin America**	**1910 – 1930 MHz**
Brazil	**1910 – 1920 MHz**
South Korea	**1786 – 1792 MHz**
Taiwan	**1880 – 1895 MHz**

NR+ for private networks

- Can be deployed and operated by anyone and used anywhere.

- Self-forming, self-maintenance, and self-healing

- Can co-exist with other local networks sharing the spectrum.

- It supports:

  - Mesh where each device extends the range or increases communication reliability.

  - Point-to-point for control and provisioning

  - Star topology

Range vs. Environment

Environment:

Inside building	Dense Urban area	Urban **line of sight** or Rural area	Line of sight over rooftops.

Range:

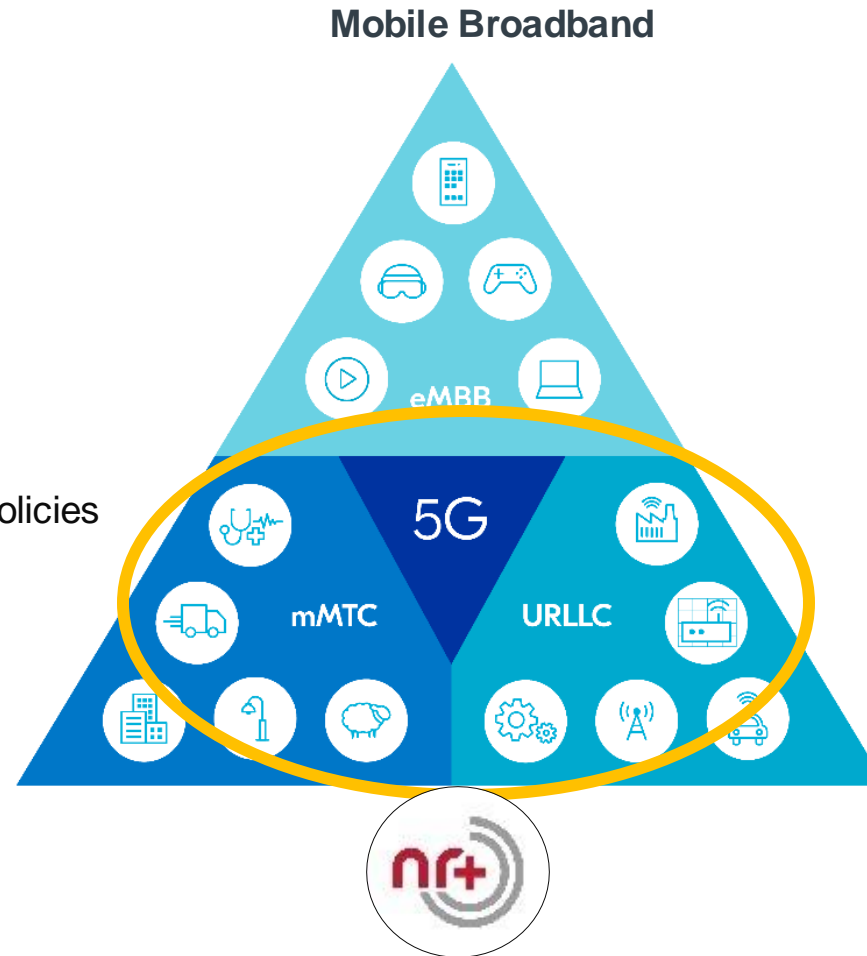| **> 200 m**	320 m	~2 km	7 km

SAME NR+ radio in all devices

NR+ use cases

Mobile Broadband

mMTC

- Scalability to 1 Million devices per km2
- Overlapping networks w/robust spectrum policies
- Self-forming, -maintenance, and -healing

Smart energy; utility meters
Smart city applications; streetlights
Smart agriculture: farming

URLLC

- 1ms latency between nodes
- Low cost, ultra-reliable private 5G

Building automation: Fire and safety
Smart factory: real-time sensing and control
Audio + Data devices

eMBB

5G

mMTC

URLLC

Nr+ scales to millions of devices in 1 Km²

By VTT Research Center

Senior System Engineer
Customer Success

Courtesy Google : Dharavi, Mumbai