

ORAMA-System

Connecting deep all



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iresne

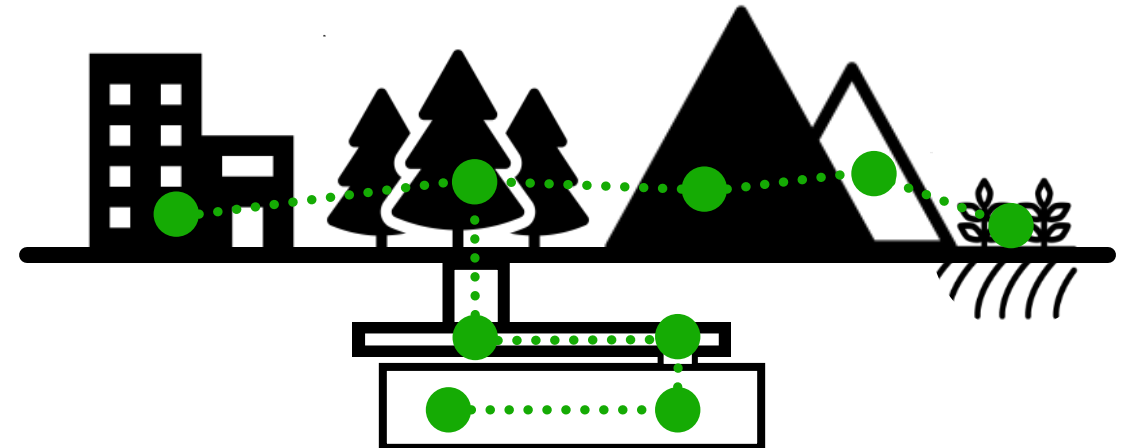


Usual LPWAN (Low Power Wide Area Network) under boundary conditions



Objects hard to connect & control
need to extend infrastructure

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Objects hard to connect & control
can rely on their neighbors

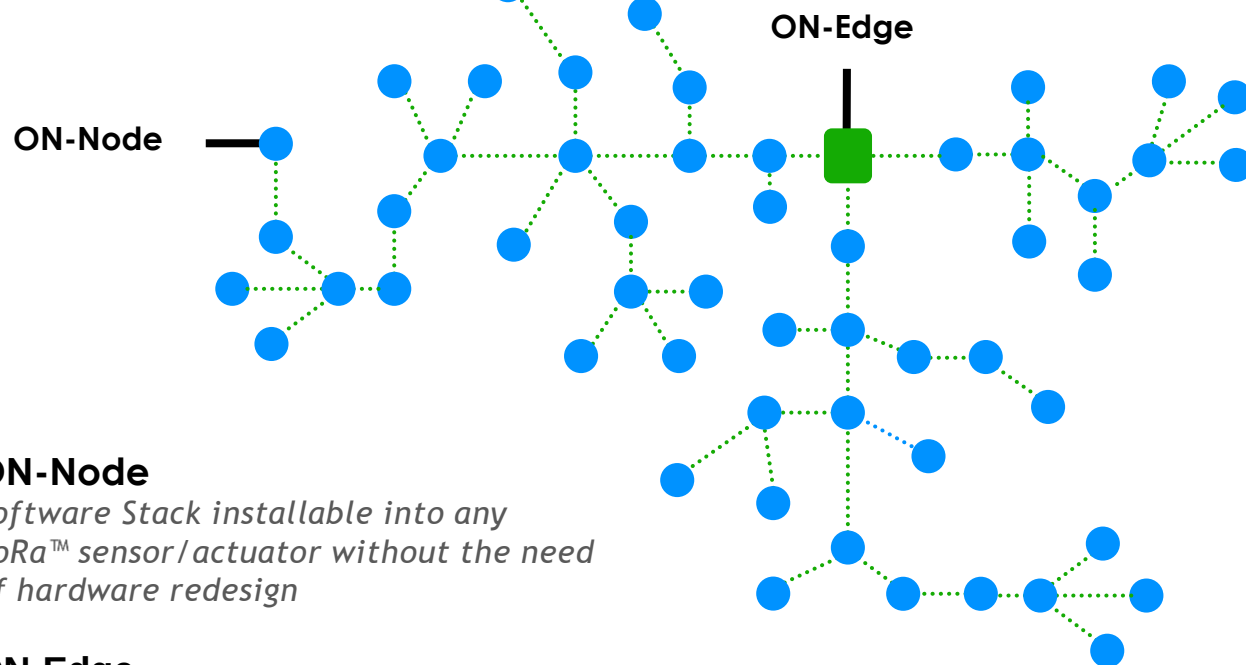
The 2 pillars of the solution

ORAMA-Net

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● User Device

■ User Orchestrator



ON-Node

Software Stack installable into any LoRa™ sensor/actuator without the need of hardware redesign

ON-Edge

ON-Node stack called by user application with extended features & privileges to manage the network cluster



1 km

Between objects



9 hops

from the Gateway

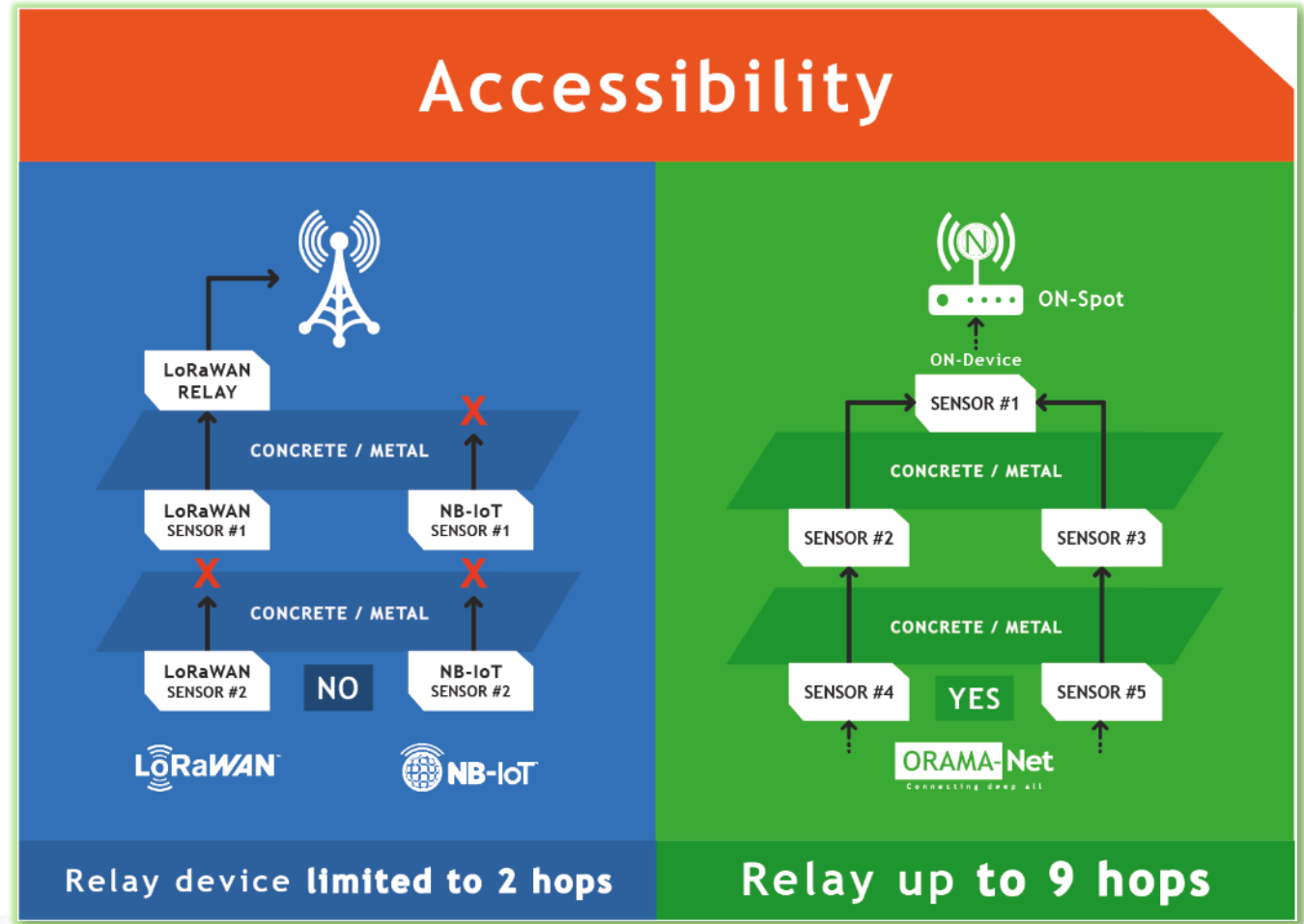
25000 ha
coverage

65K
Objects in the network

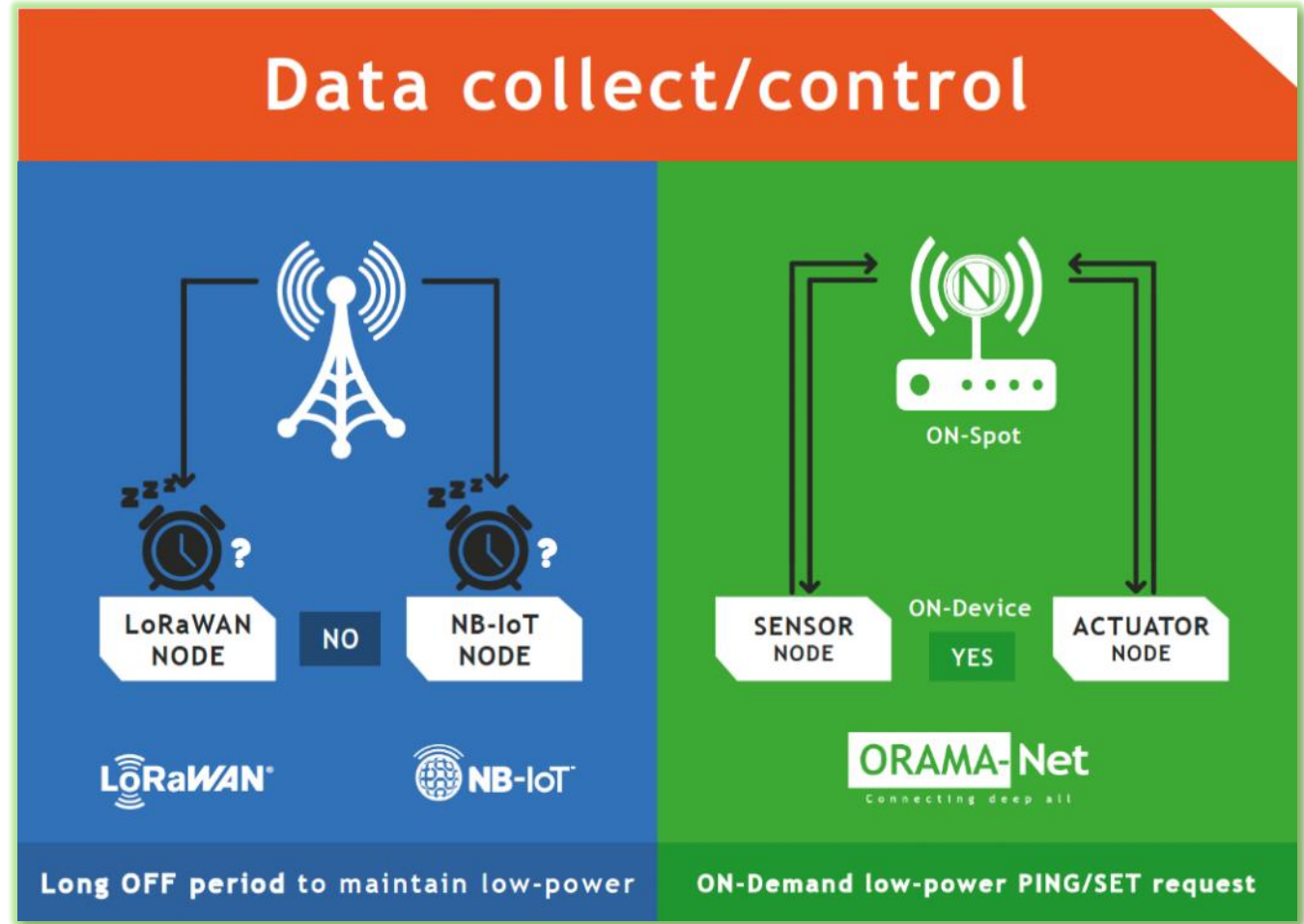
ORAMA-Net
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- ORAMA-Net is a LPMHN (LoRa™ Powered Multi-Hop Network)
- Combines LPWAN advantages with WSN (Wireless Sensor Network) topology flexibility
- Any ORAMA-Net sensor or actuator can act as a relay for others
- Up to 9 hops of 1km without need of additional Gateway or Base Station
- Radio coverage improved by native relaying bypassing obstacles → no need for tall antenna pole or pylon
- Self-Organizing & Self-Healing



- ORAMA-Net standard uses fixed LoRaWAN data rate DR6 (SF7/250KHz)
- Usual LPWAN NS (Network Server) must wait for a message from the sensor or actuator before sending a request
- ORAMA-Net sensor or actuator can be requested anytime with a latency of less than 20 seconds
- Patented TDD (*Time Division Duplex*) & low-power WOR (*Wake ON Radio*) with a floor consumption of 25µA.h
- Secure flow protected by an AEAD 256-bit PNK (Private Network Key) simultaneously signing & encrypting all radio packets (NIST Special Publication 800-38C)



- Bypass 1% duty cycle limitation in 868MHz band using (PSA + AFA) policy → *maximum number of messages less dependent to the TOA (Time On Air)*
- PSA is for Polite Spectrum Access → *each node listens before talk (LBT)*
- AFA is for Adaptive Frequency Agility → *each radio packet communication channel is pseudo-randomly chosen over full band (Frequency Hopping)*
- Still a limit defined by ETSI EN-300-220 → 100s / 1h giving 2.8% per 200KHz portion of spectrum
- With a TDD scheduling period of 20s and an occupancy time max. of 400ms, ORAMA-Net footprint on a channel over 1h never exceeds 72s (i.e. 2%)

Parameter	Limit	Notes
Minimum CCA interval	160 μ s	Minimum CCA listening period
Minimum deferral period	CCA interval	Minimum value of the deferral interval
Minimum unit of deferral period	See note 1	Smallest interval between two adjacent deferral periods
Dead Time	CCA declared time by the vendor but not exceeding 5 ms	Maximum time between the end of a listening interval and the start of a transmission
Maximum Transmission Duration $T_{on\ Max}$	1 s	For a single Transmission
Maximum Transmission Duration $T_{on\ Max}$	4 s	For a Transmission dialogue or a polling sequence
Max T_{cum_on} over 1 hour	100 s / 1 h per 200 kHz spectrum	Maximum allowed Cumulative On Time over a 200 kHz portion of spectrum per hour
Minimum T_{off_min} on the same Operating Frequency	100 ms	The minimum T-off time period where a specific transmitter shall remain off after a transmission on the same Operating Frequency
NOTE 1: The minimum unit of deferral period is declared by the manufacturer.		
NOTE 2: T_{DIS} is declared by the manufacturer without exceeding 5 ms.		
NOTE 3: Longer accumulated transmission time is possible by implementing more AFA channels.		

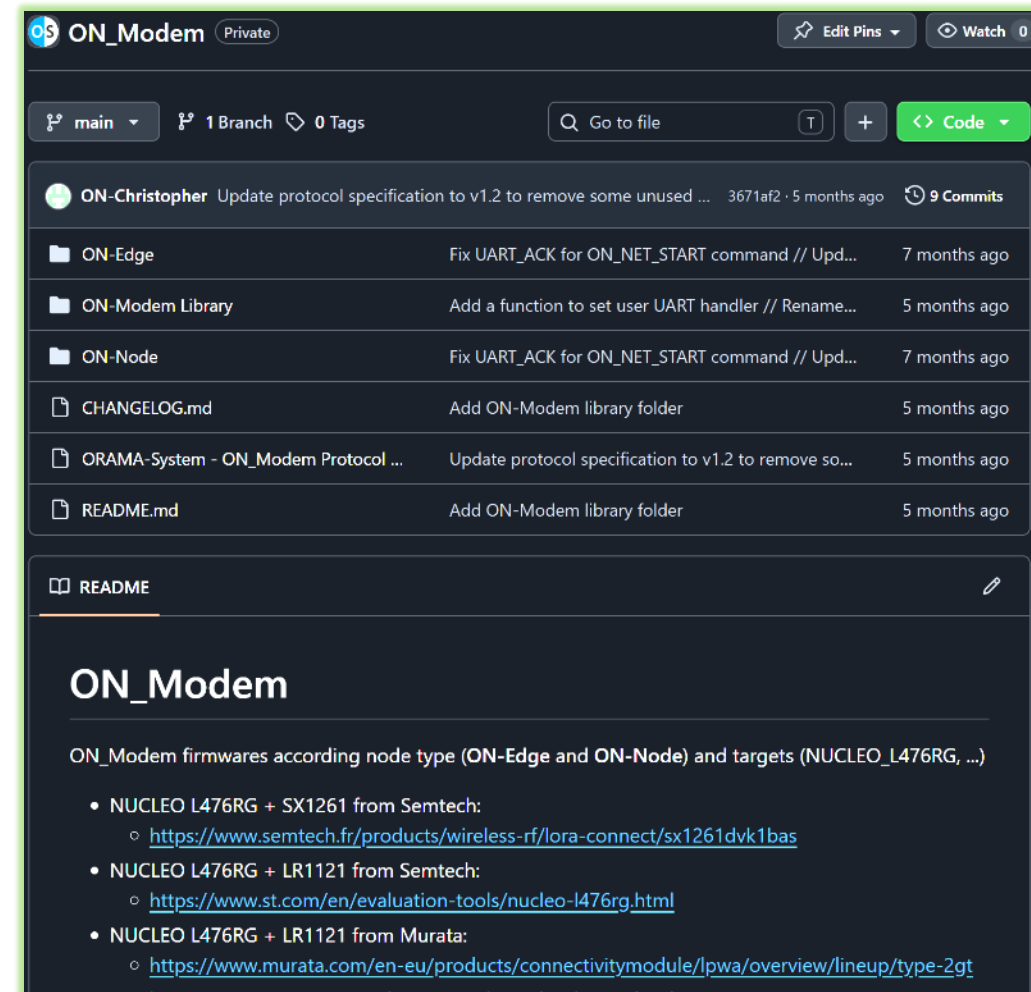
ETSI EN 300 220-1 V3.1.1 (2017-02) – PSA Table 48 §5.21.3.1

Note #1: EU868 ORAMA-Net default settings are similar to LoRaWAN DR6 (i.e. LoRa SF7/250KHz) defined in RP002-1.0.3

Note #2: EU868 ORAMA-Net uses (15 data + 2 beacon) = 17 contiguous channels of 325KHz (OCW) distributed across the 863-868.6MHz band

Note #3: ORAMA-Net (PSA + AFA) policy is also compliant with FCC part 15.247 for 902-928MHz US band

- Access to ORAMA-System GIT repository.
- Code templates with BSP (Board Specific Package) ready for various implementation (STM32L4 + SX126x/SX128x, STM32L4 + LR112x, STM32WLE5, ESP32-S3 + SX1262).
- 2 delivery formats:
 1. ON-Modem object file (.a) to be compiled & linked with device firmware → interface with user application thru ON-Lib API,
 2. ON-Modem executable file (.hex) to program a LoRa module referenced by ORAMA-System (RAK3172, RAK3112, Wio-E5, Wio-S3, etc.) → interface with user application thru UART.
- For each ON-Node & ON-Edge instance, ORAMA-System issues a unique activation certificate valid for the entire lifetime of the device



The ORAMA-Net Playground

LoRa™ Private Network

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MINING RISKS MONITORING



UNDERGROUND

RURAL ISOLATED VILLAGES



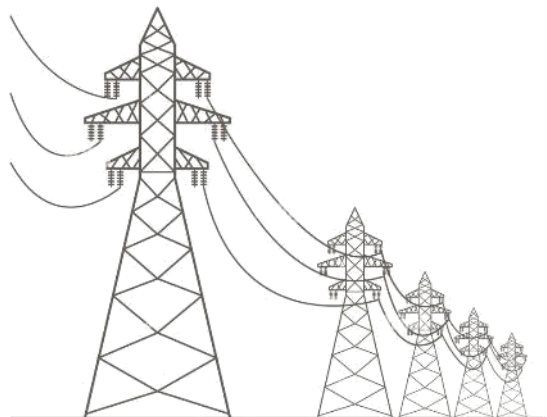
OPENFIELD

DRONE BASED 2-WAY COMMANDS



IN THE AIR

ELECTRICITY GRID



PIPELINES



ROADS




SEMTECH




MICROCHIP

 **ESPRESSIF**

muRata
INNOVATOR IN ELECTRONICS

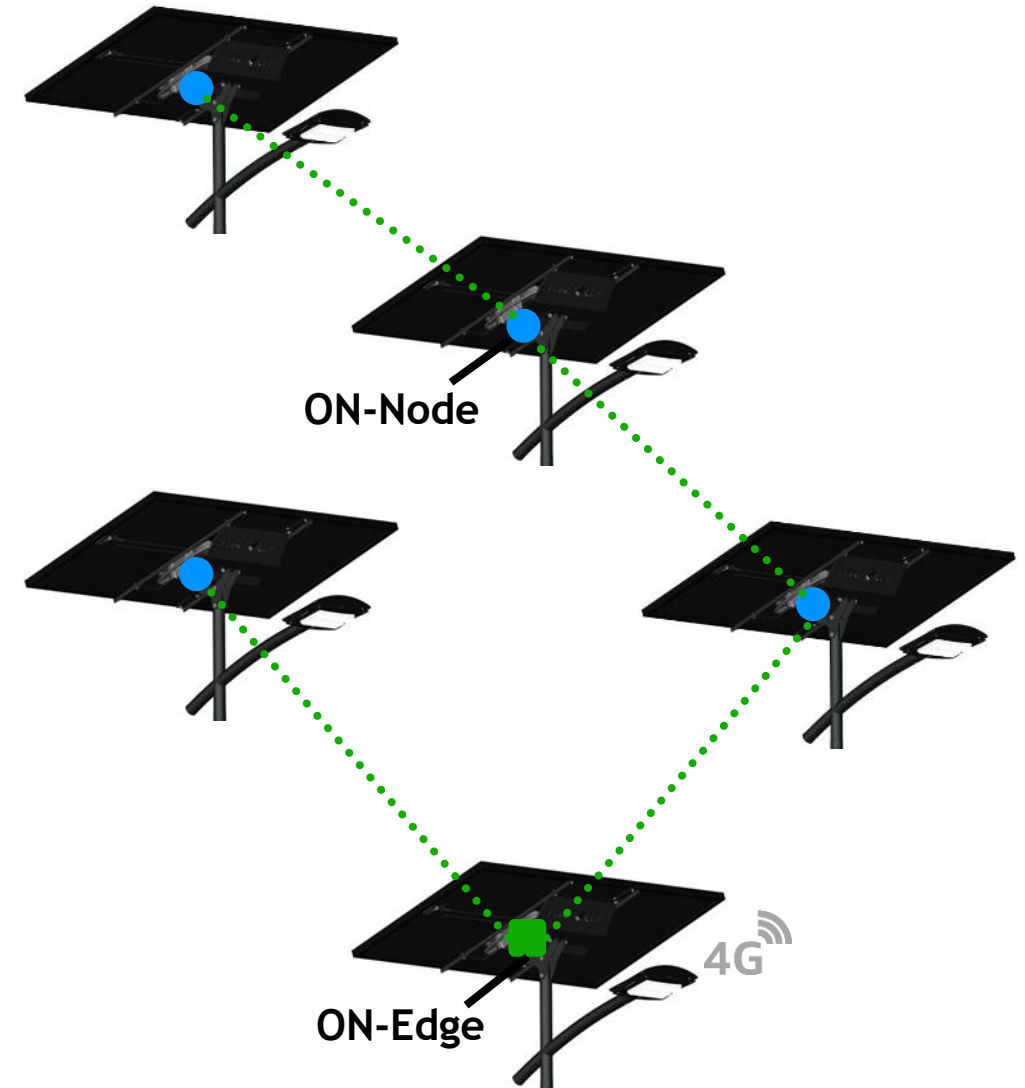
 **RAK**
IoT Made Easy


seeed

- 44 municipalities & more than 100,000 inhabitants.
- 20,000 lighting points spread over **650km²**.
- Multi-year program to replace 8000 conventional streetlights with **7000 photovoltaic streetlights**.
- 6K solar lighting points planned for end 2027.
- A preliminary theoretical study allows us to anticipate a maximum of **10-12 ON-Edge** instances to cover the entire territory.
- Large-scale pilot with 1 ON-Edge and approximately 500 ON-Node planned for early 2027 → ORAMA-Net will progressively replace LoRaWAN.



- A single lighting point acts as a gateway and executes the **ON-Edge** stack.
- Other lighting points executes the **ON-Node** stack.
- ON-Edge & ON-Node stacks run on the **same hardware** (i.e., no specific PCB & antenna) → no need for a dedicated gateway as for LoRaWAN.
- Gateway PCB just have to add a way to connect to the backend → any pre-equipped node can switch from ON-Node to ON-Edge on demand (backup).
- With a typical spacing of 30 meters between light points, ON-Edge gateway can handle a **corridor of typically 300 ON-Node**.
- With a cluster of 1K ON-Node & a 48 bytes payload uplink message each 15 minutes, ON-Edge load ratio does not exceed 10% for a data loss less than 10^{-8} .





C o n n e c t i n g d e e p a l l

➤ Location

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C o n n e c t i n g d e e p a l l

➤ More info

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➤ Contact

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Thanks