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Unifying LoRaWAN Networks by Enabling the Roaming Capability

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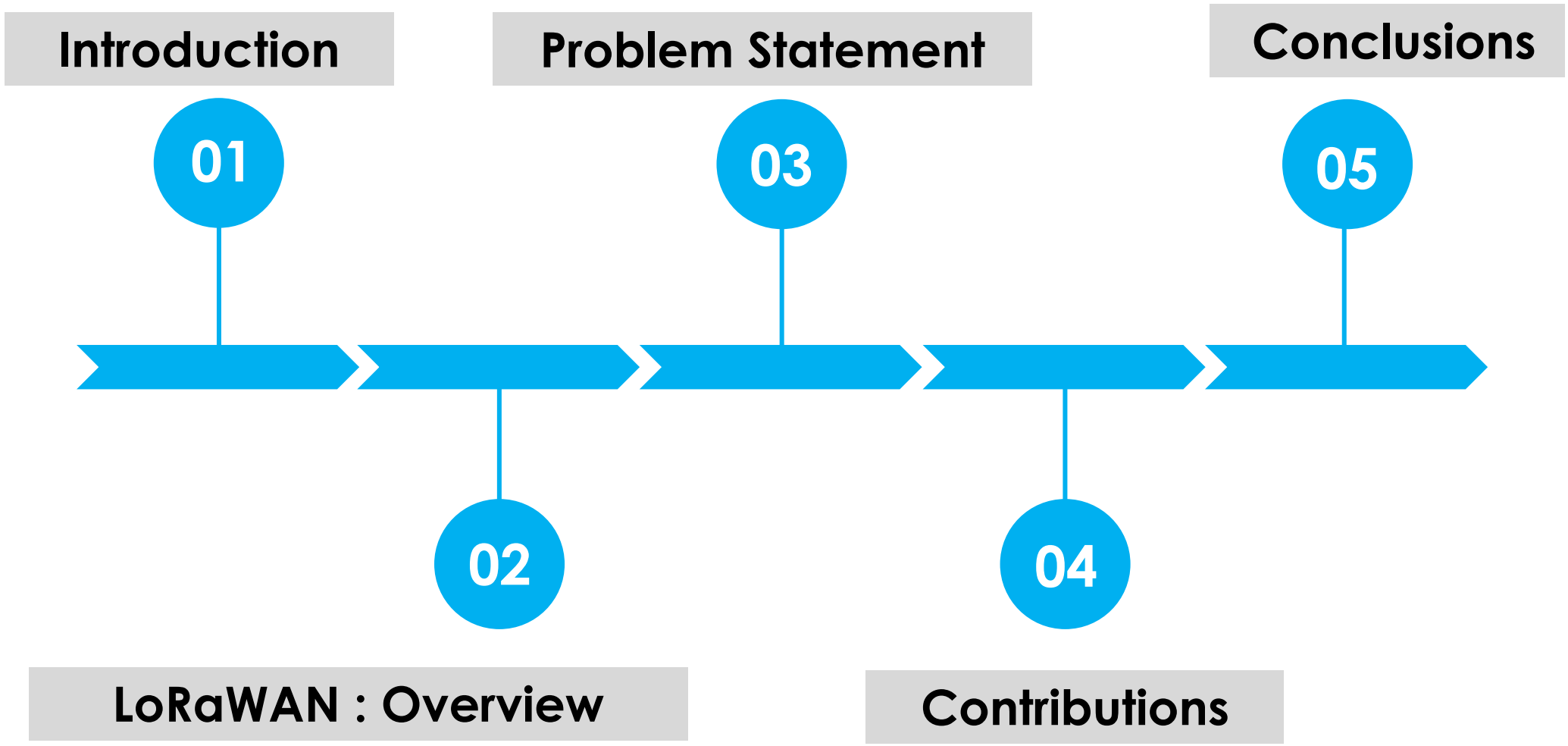
Journées LPWAN, 8-9 July 2021, Clermont-Ferrand

OUTLINE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01 INTRODUCTION

INTRODUCTION

It is itimated that more than 20% of IoT connections are made via LPWAN (NB-IoT,Sigfox,LTE-M,..)

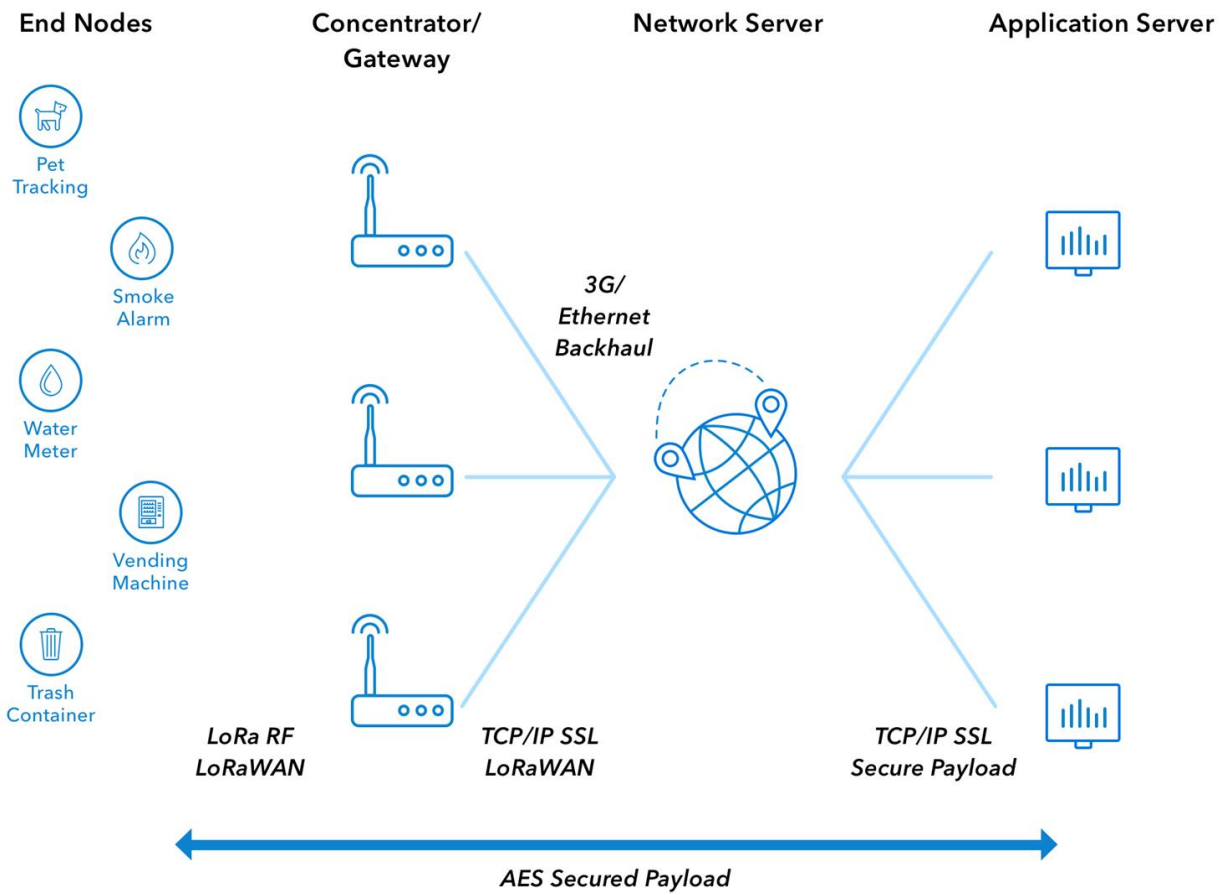
LoRaWAN has raised much attention in wireless communications communities due to its high promises

Long-range connectivity, low power, low data-rate, and low-cost end-devices

02

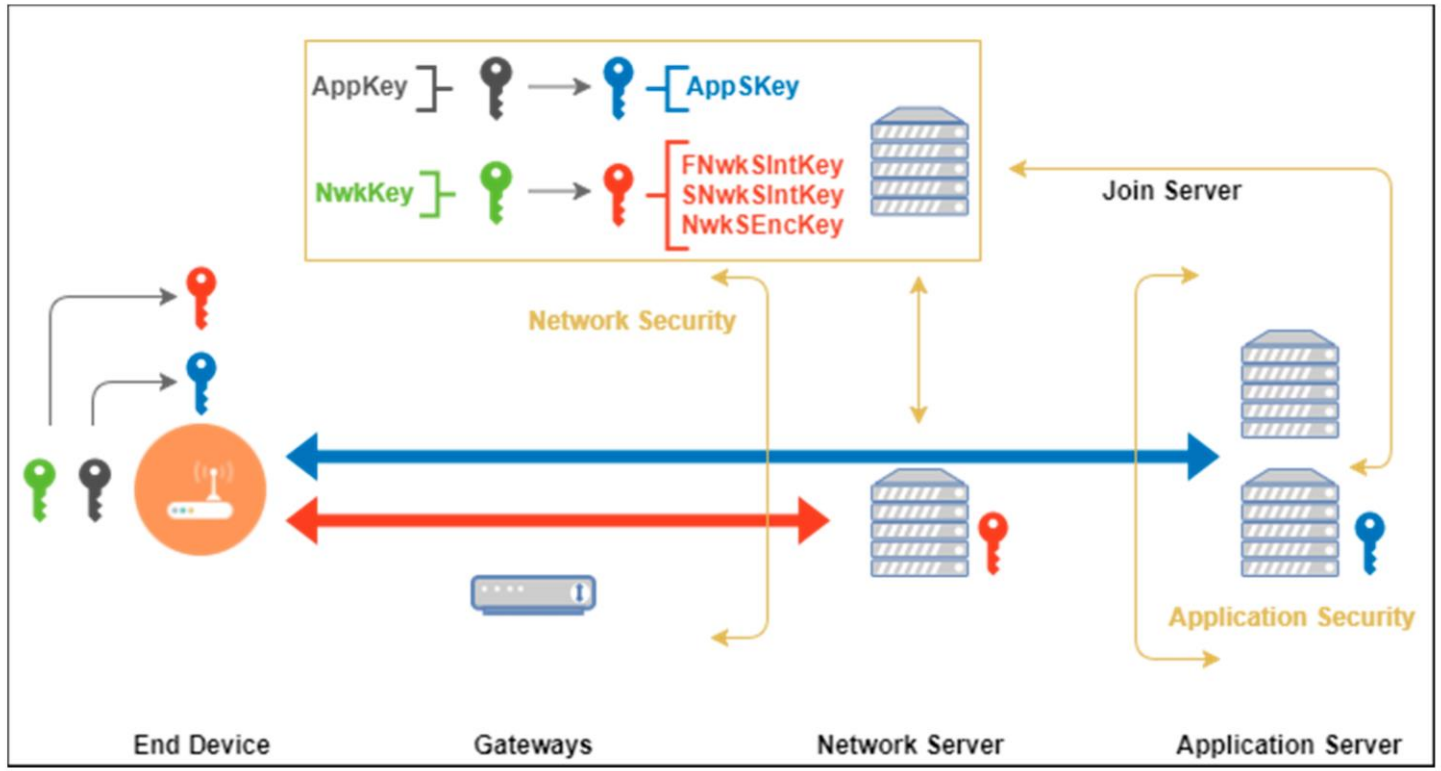
LoRaWAN: Overview

LoRaWAN Architecture



[T.T.Network]

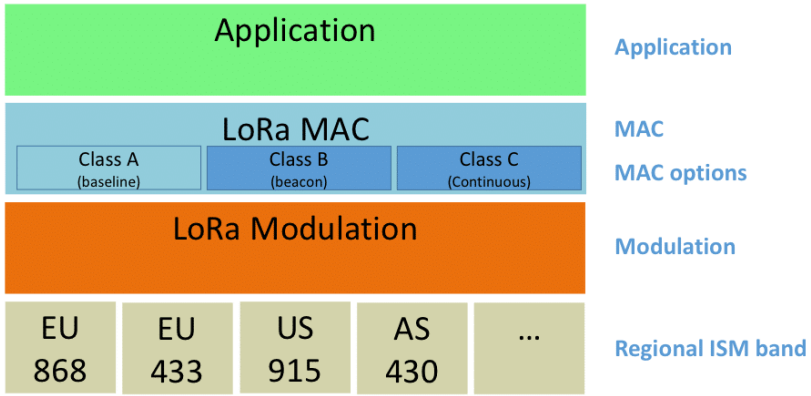
LoRaWAN Security



- OTTA Activation.
- LoRAWAN Spec 1.1

Roaming Methods :

- Passive Roaming (spec 1.0.x)
- Handover Roaming (spec 1.1)



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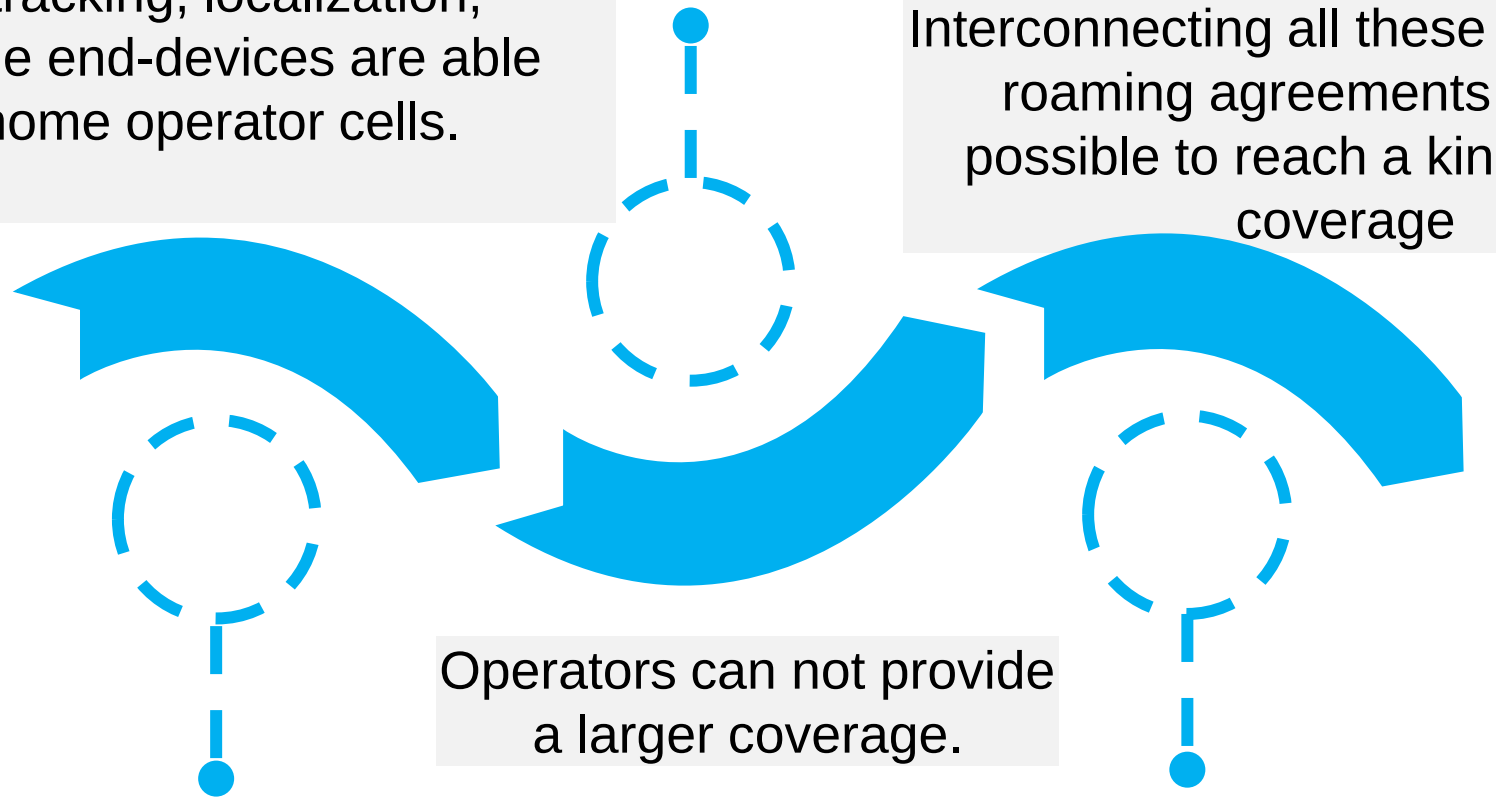
Problem Statement

Problem Assessement

For a set of applications like smart logistics tracking, localization, and monitoring, the end-devices are able to leave their home operator cells.

Interconnecting all these networks via roaming agreements makes it possible to reach a kind of global coverage



Operators can not provide a larger coverage.

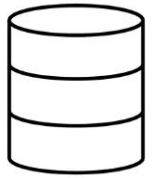
Problem Assessement

Unifying networks by enabling LoRaWAN roaming requires the ability :

1- To Check if the operator requests roaming for the end-device.

2- To find out the home network of the mobile end-device.

3- To retrieve the end-device keys context.



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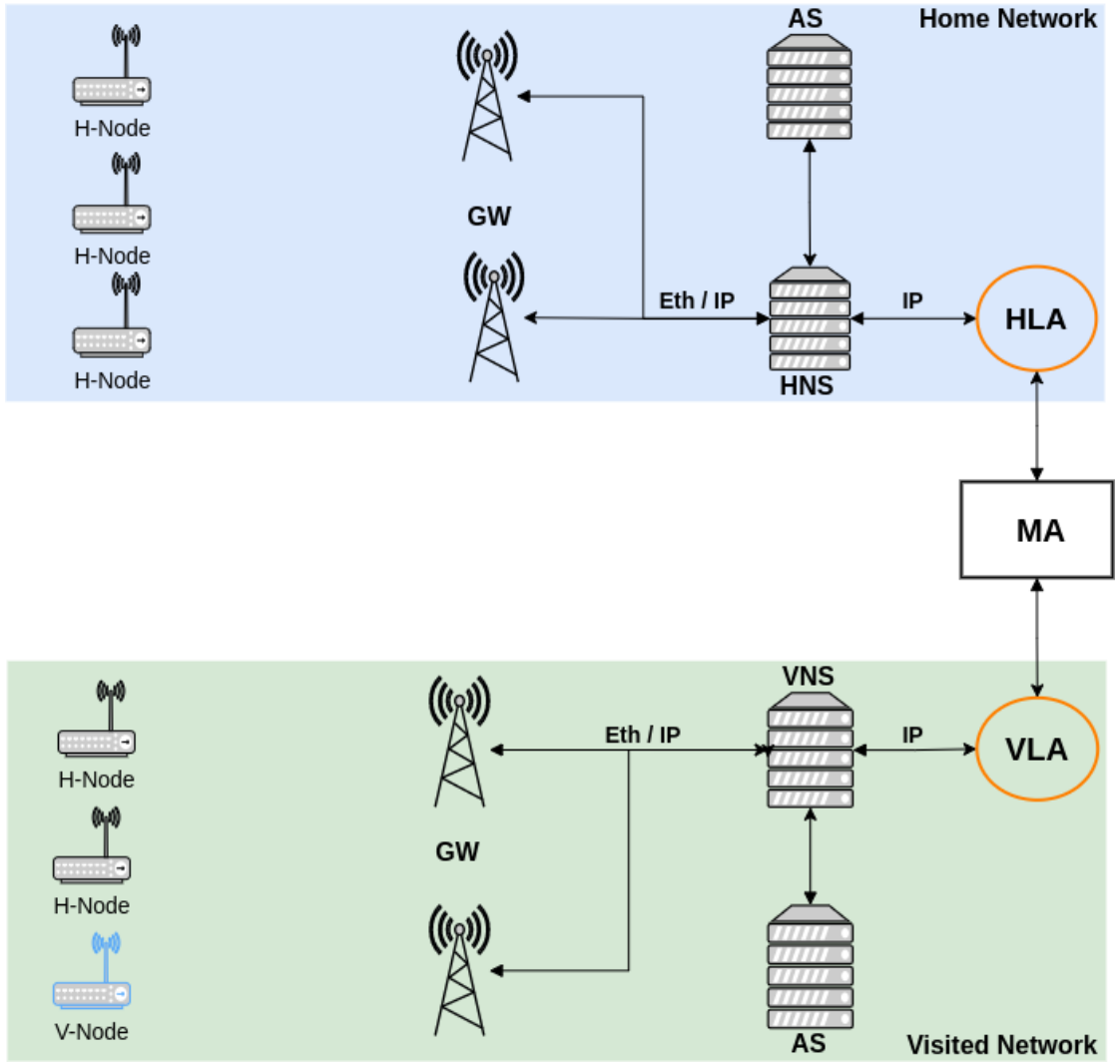
Contributions

LoRaWAN extended Architecture

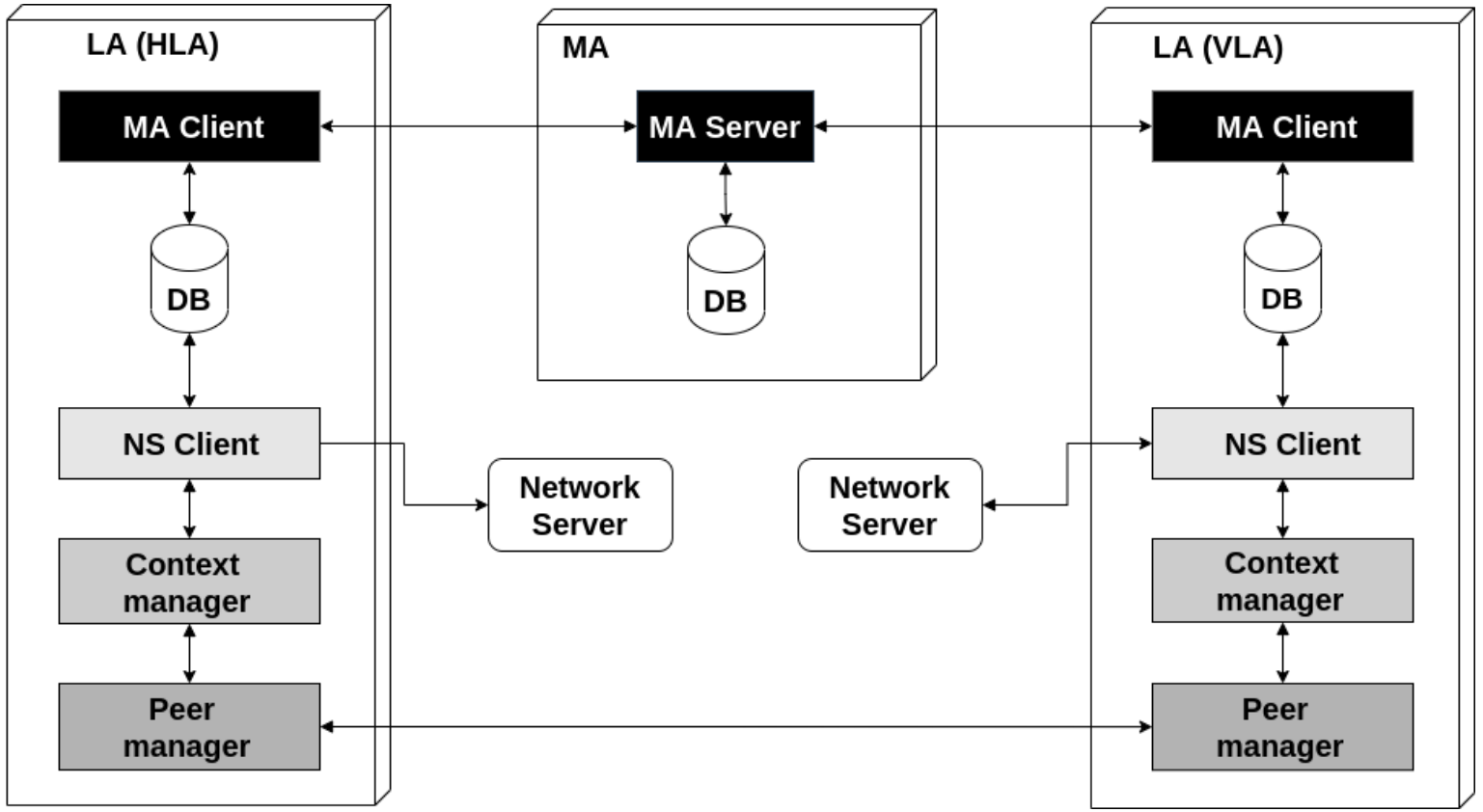


MA: Master Agent.
HLA: Home Local Agent.
VLA: Visited Local Agent.

LoRaWAN extended Architecture

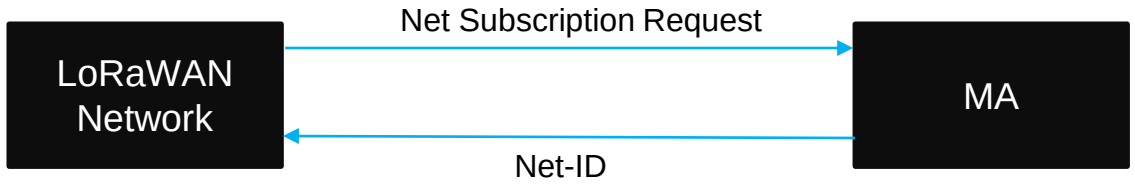
- **MA**:
  - Net-ID generation.
  - DNS Resolution.

- **VLA/HLA**:
  - JoinRequest Handling,
  - Context Retrieval and Storage,
  - Network Server Communication, ...



Network Subscription and Node Provisioning

1. Network Subscription



2. Node Provisioning

Field	MHD	MacPayload	MIC
Size (Byte)	1	18	4

Field	MType	RFU	Major
bit	7..5	4..2	1..0

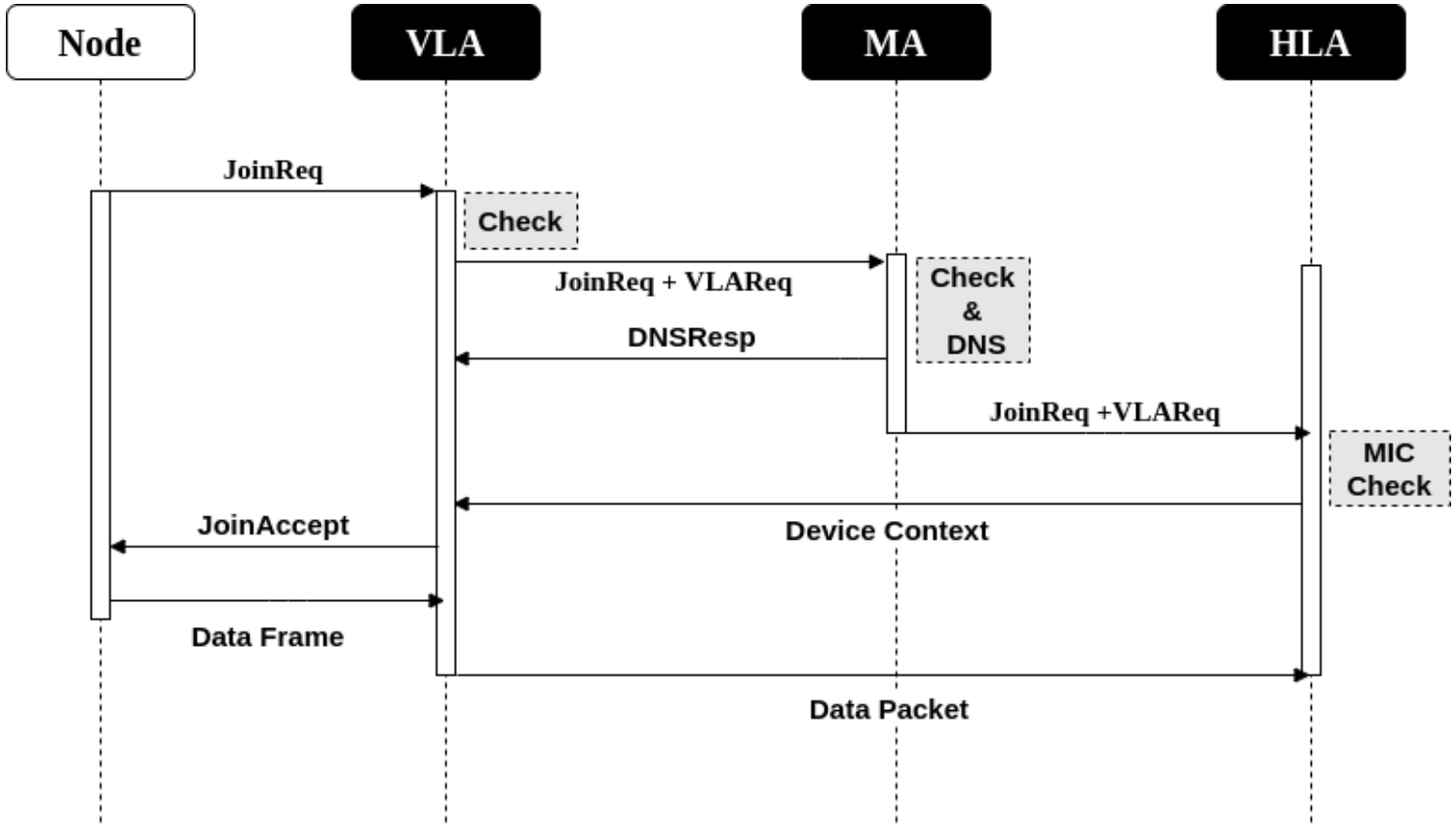
Field	JoinEUI	DevEUI	DevNonce
Size (Byte)	8	8	2

JoinEUI

Field	Net-ID	uuid
Size (byte)	4	4

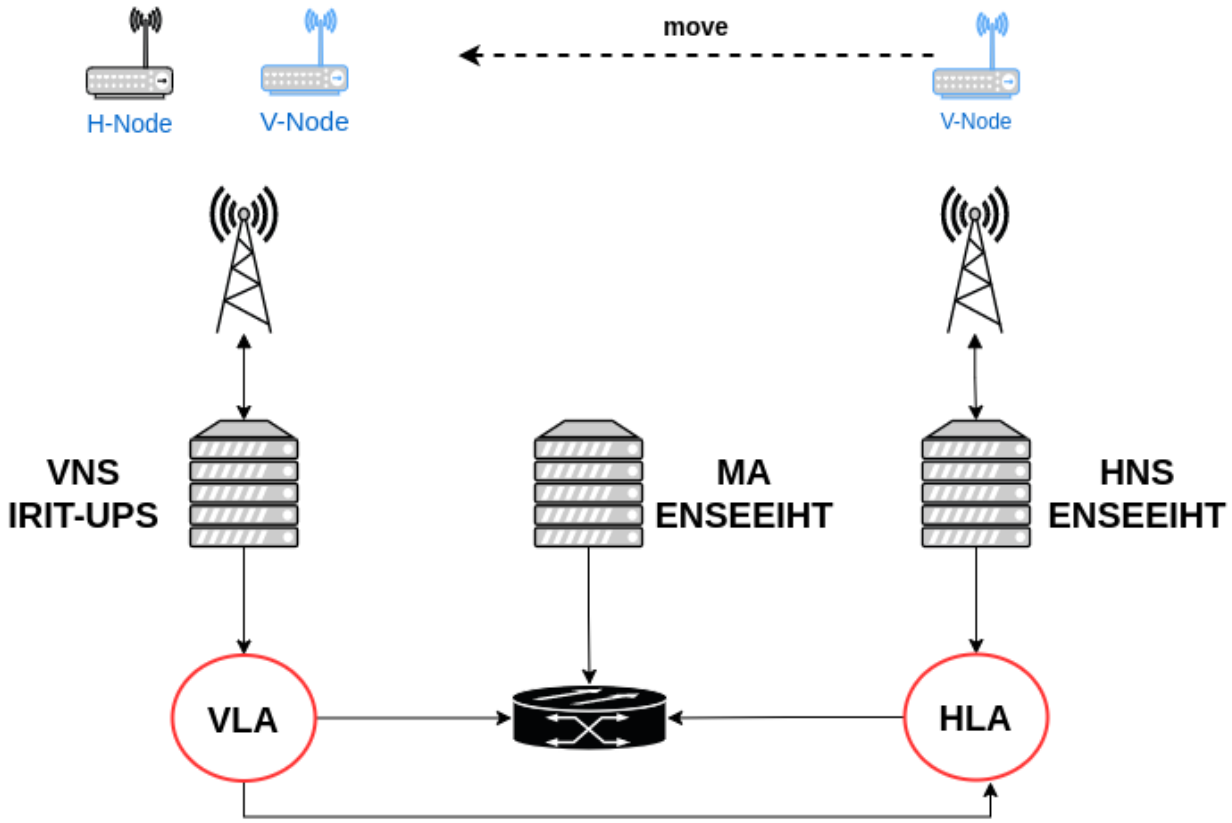
- JoinEUI: a global applicationID in IEEE EUI64 address space.
- JoinEUI based Net-ID generation.
  JoinEUI = Net-ID |uuid.
- Example : 4C683808E77E4E01

LoRaWAN Roaming Protocol



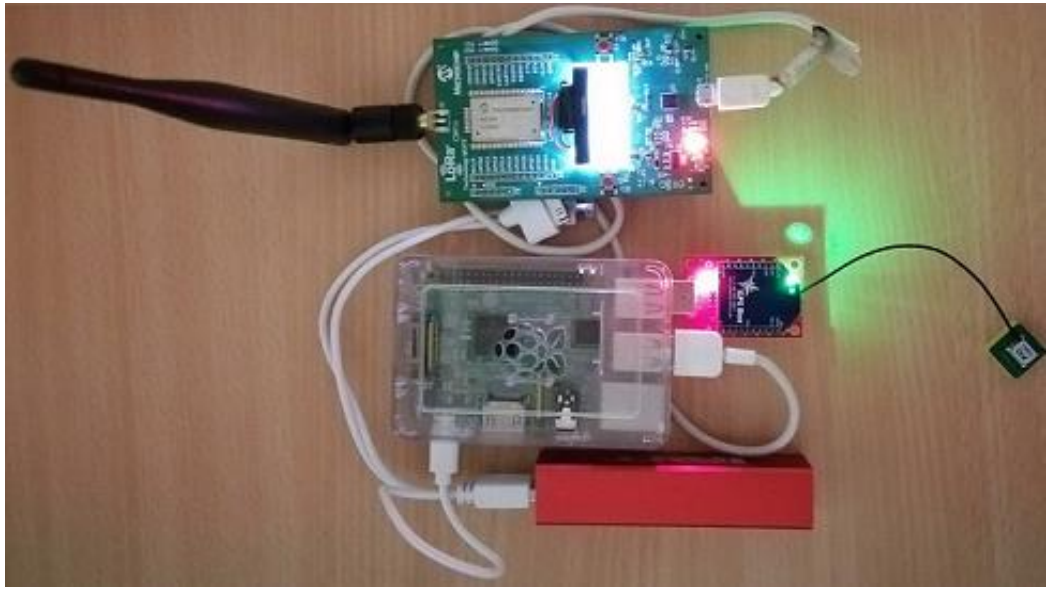
- **JoinReq:** JoinEUI | DevEUi |DevNonce.
- **VLAReq:** VNS ip@ |VNS Domaine Name.
- **DNSResp:** HNS ip@ | HNS Domaine Name.
- **Device Context:** Authentication Root Keys, Frame Counters.

Implementation and Validation

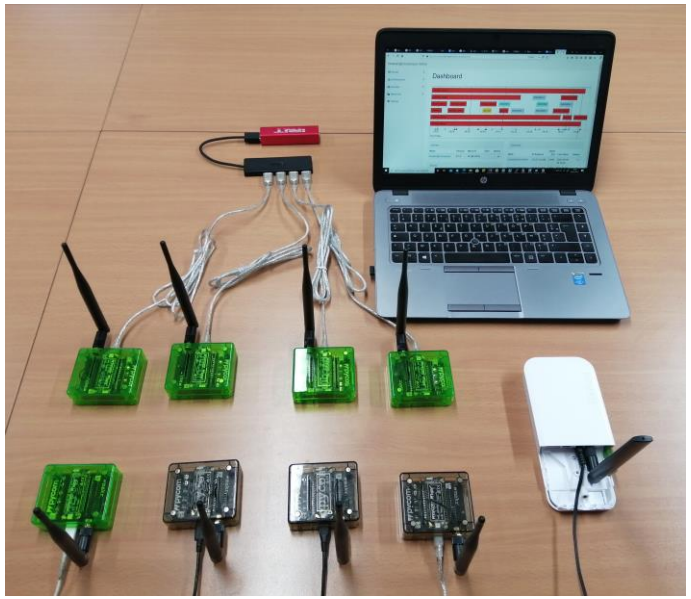


Network	Net-ID	Ip @	Domaine Name
hNS ENSEEIHT	4C683808	Ip @	Hns.com
vNS IRIT-UPS	CBEF7B6E	Ip @	Vns.com

Implementation and Validation

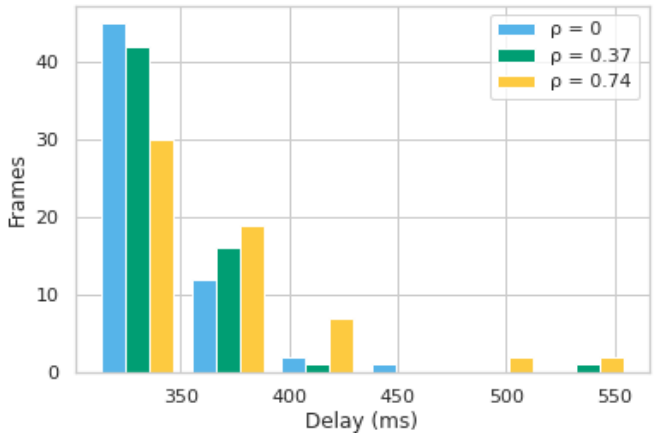


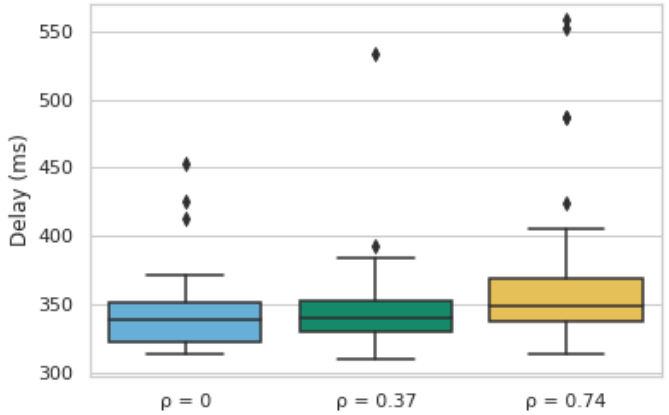
Nodes:
Pycom Lopy 4
Microchip RN2483
Gateway:
Mikrotik

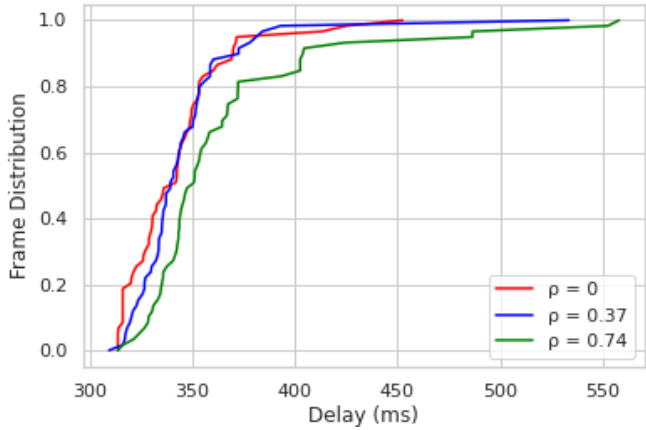


Node	DevEUI	JoinEUI
Lopy4-1	BEEFDEADBEEF0001	4C683808E77E4E01
Lopy4-2	BEEFDEADBEEF0002	4C683808A9713E0
Lopy4-3	BEEFDEADBEEF0003	4C683808C6768E03
Lopy4-4	BEEFDEADBEEF0004	4C683808E27DCE04
Lopy4-5	BEEFDEADBEEF0005	4C683808B09E5E05
Lopy4-6	BEEFDEADBEEF0006	4C68380 81F73E060

Implementation and Validation







The cumulative distribution function of the duration (T) needed for DNS resolution and context migration from the hNS to the vNS measured through multiple OTAA activations.

04

Conclusions

Conclusions

1. We investigated the inter-operator roaming capability based on DNS resolution and end-device contextmigration.
2. Proposed an extension to the LoRaWAN architecture.
3. The results of the experimental analysis suggest that the proposed mechanisms do not generate significant latency.

QUESTIONS?