IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

# USE OF DNS FOR ROAMING BETWEEN LoRaWAN NETWORK SERVERS (LNS)


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# SUMMARY

- LoRaWAN Evolution in the Context of Roaming
- Existing IoT Roaming Architecture: IoTRoam
- IoT Roaming Architecture with DNS over HTTPS
- Ongoing Work & prospects

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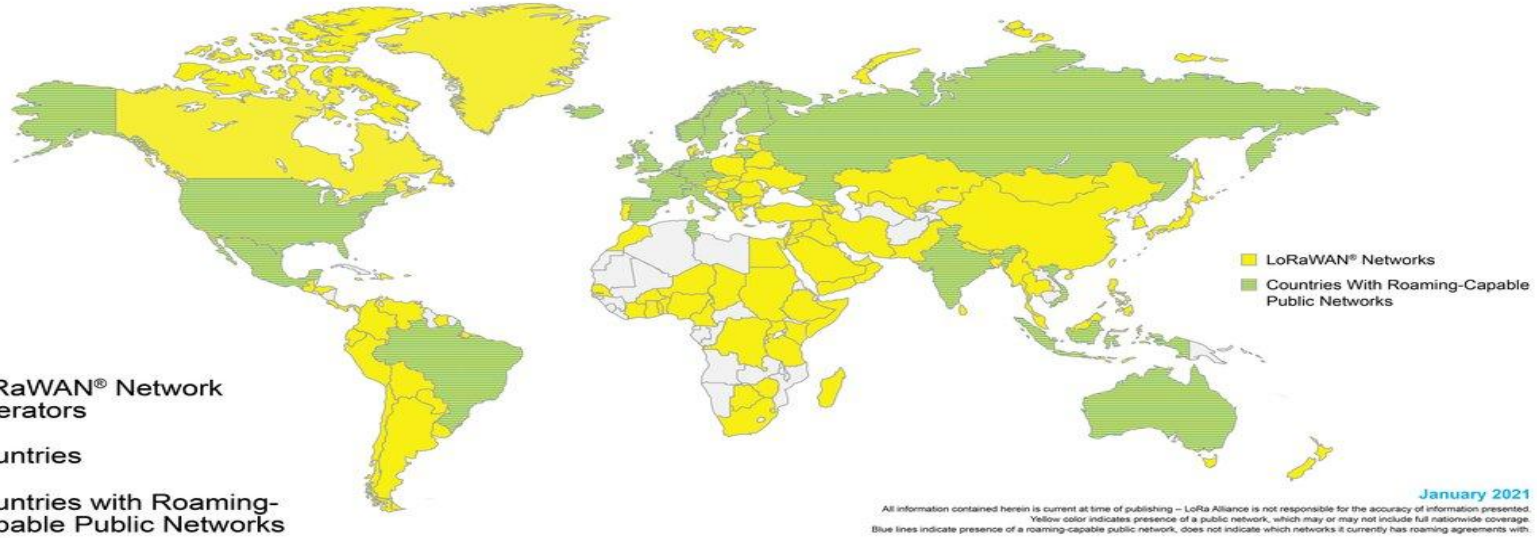
UMR IRISA

## Availability of LoRaWAN® Networks and Roaming Capability

LoRa Alliance®




**150** LoRaWAN® Network Operators

**163** Countries

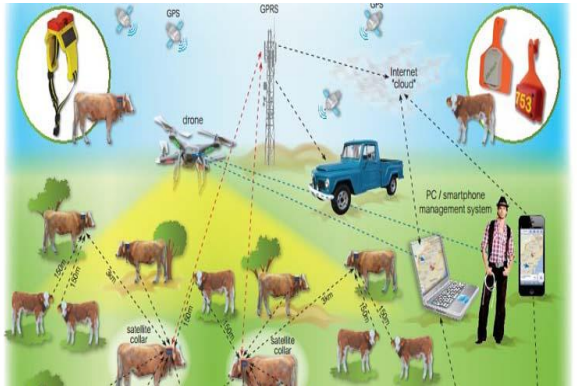
**27** Countries with Roaming-Capable Public Networks

# I. LoRaWAN Evolution in the Context of Roaming

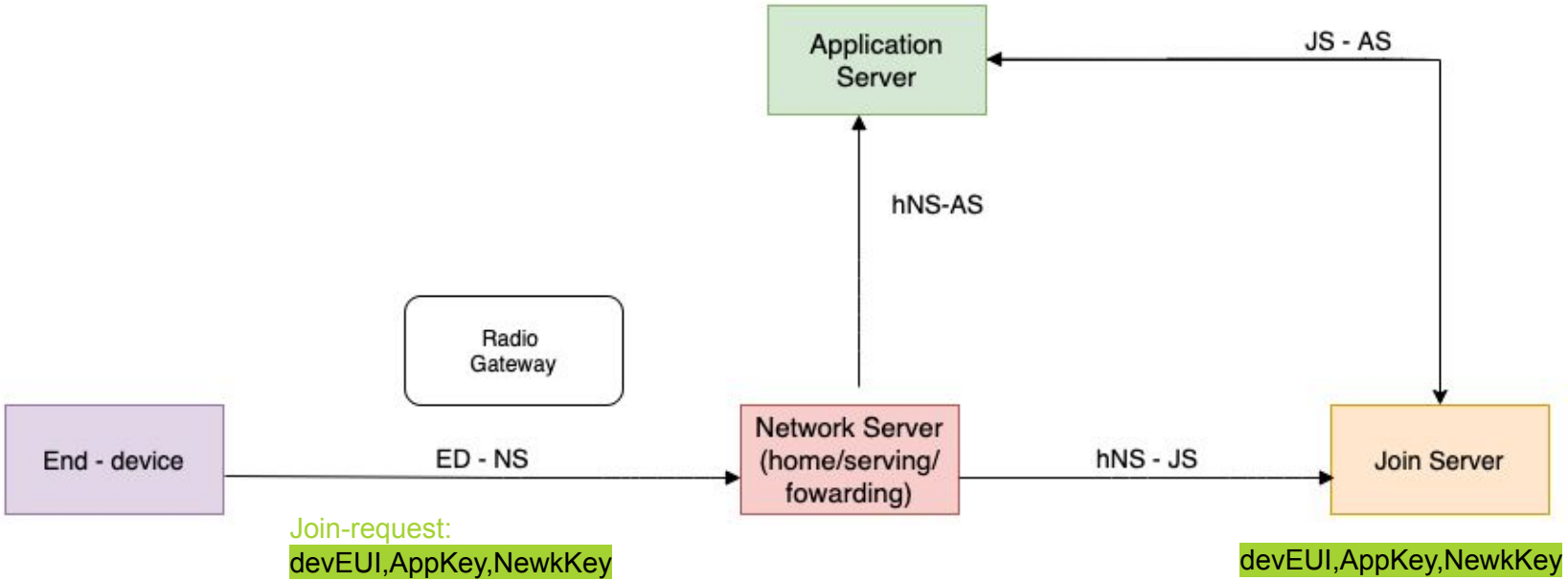
## 1.2 Usability of roaming for IoT [2,3,4]

The areas in which we will undoubtedly find a large number of connected objects capable of roaming:

- On parcels: Tracking a parcel or valuable item in motion
- On transport: tracking the position of vehicles (boats, cars, bikes, trucks, planes, ...)
- On the animals: determine the position and health of the animals that change environment according to the season.

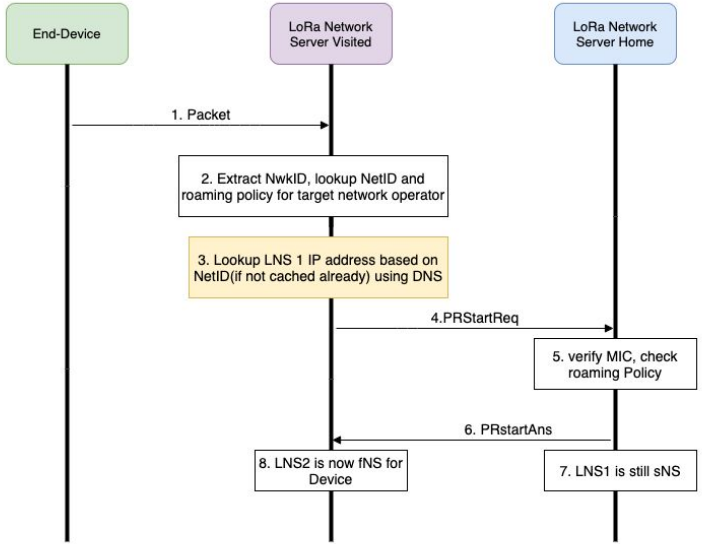



## 1.3 Reminder: Activating the device in its hNS

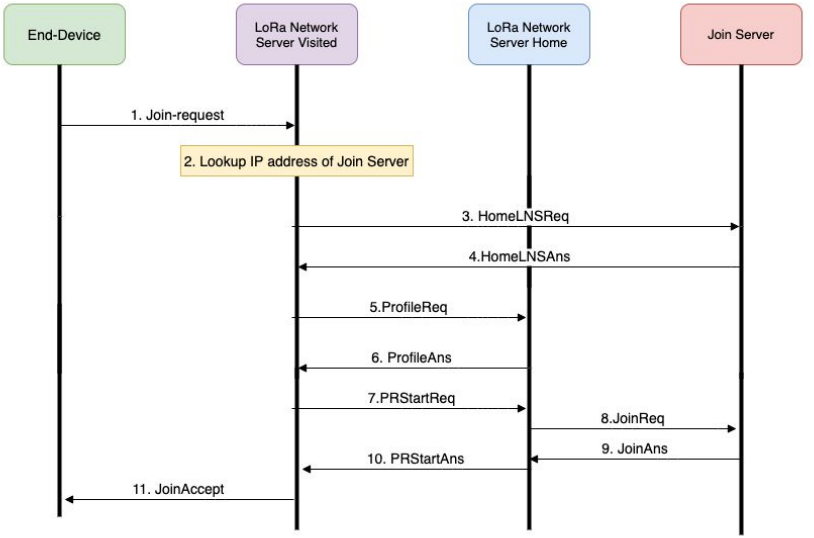


## 1.4 Steps of LoRaWAN Passif roaming

There are currently two types of LoRa roaming: Handover Roaming and Passive Roaming




A- Roaming Passif for an enabled End-device




B- Roaming Passif for a not enable End-device

# III. IoT Roaming Architecture existing: IoTRoam

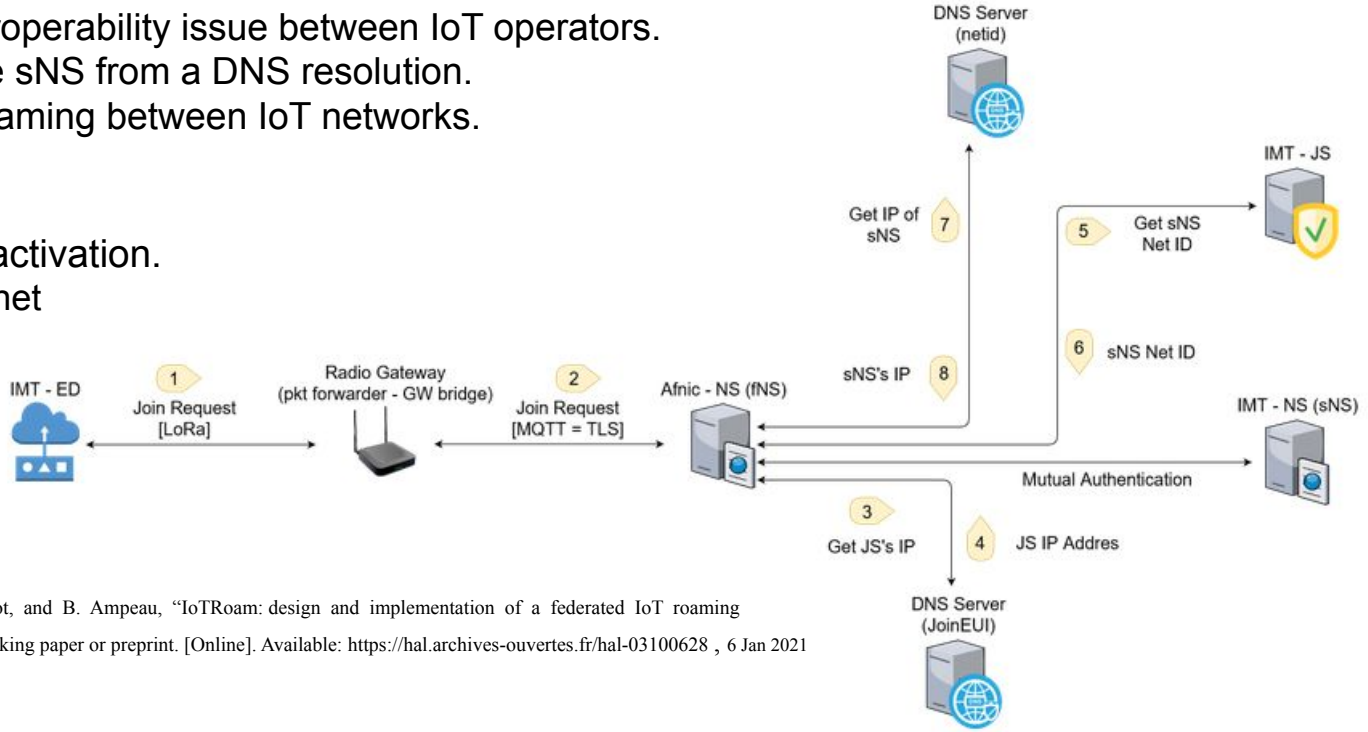
## 3.1 Brief description & Block Diagram [1]

### Main objectives:

- Managing the interoperability issue between IoT operators.
- Identification of the sNS from a DNS resolution.
- Management of roaming between IoT networks.

### Proposed solution:

- Passive roaming activation.
- Use joinEUI.iotreg.net




[1] Balakrichenan, A. Bernard, M. Marot, and B. Ampeau, "IoTRoam: design and implementation of a federated IoT roaming infrastructure using LoRaWAN," 2021, working paper or preprint. [Online]. Available: https://hal.archives-ouvertes.fr/hal-03100628 , 6 Jan 2021

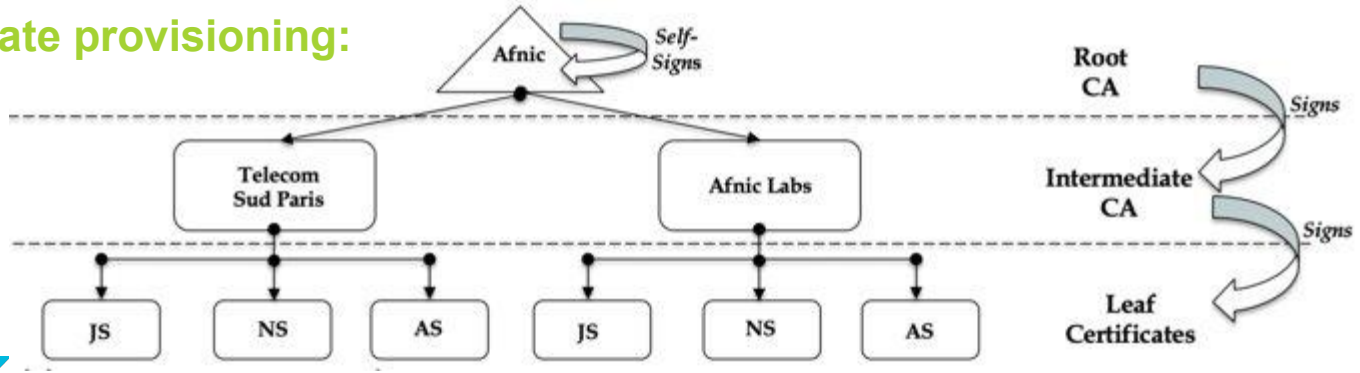
# III. IoT Roaming Architecture existing: IoTRoam

## 3.2 Limitations associated with this architecture [1]

### Limitations:

- The End-device owner has to have a unique JoinEUI which adds extra cost.
- Centralized provision of certificates between Network server.
- DNS queries during resolution are in the clear for:
  - JoinEUI.iotreg.net
  - NetID.iotreg.net

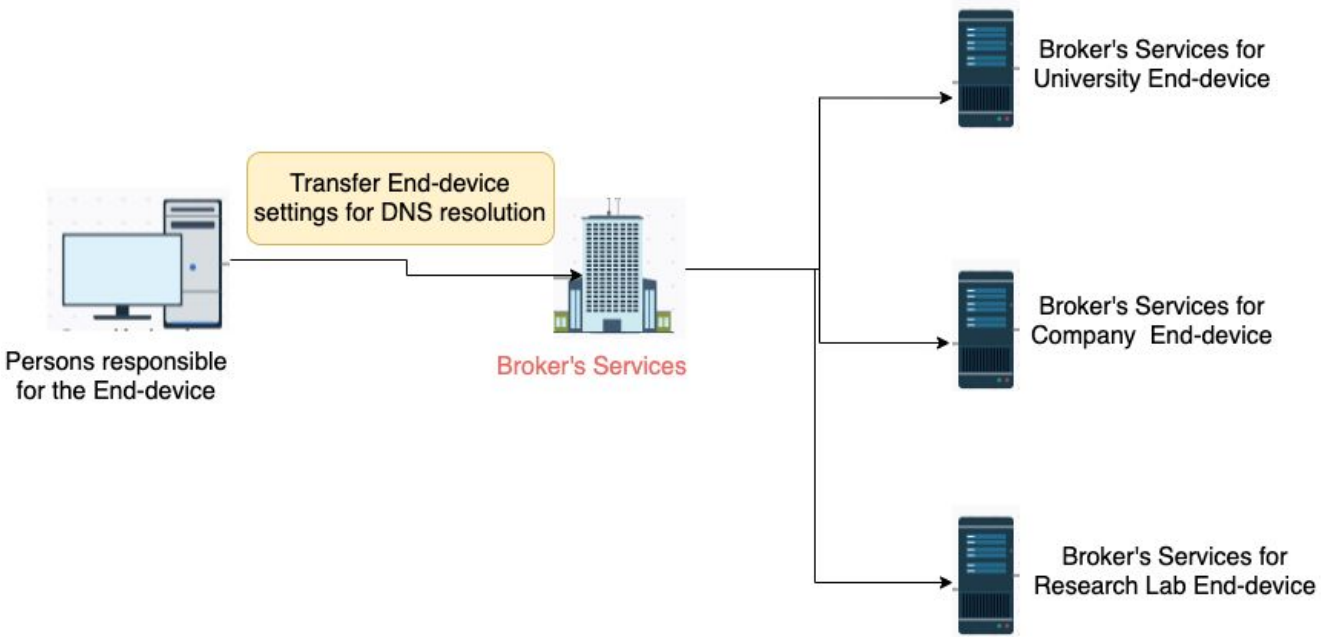
### Certificate provisioning:



# IV. IoT Roaming Architecture with DNS over HTTPS

## 4.1 Brief description of solution : Broker

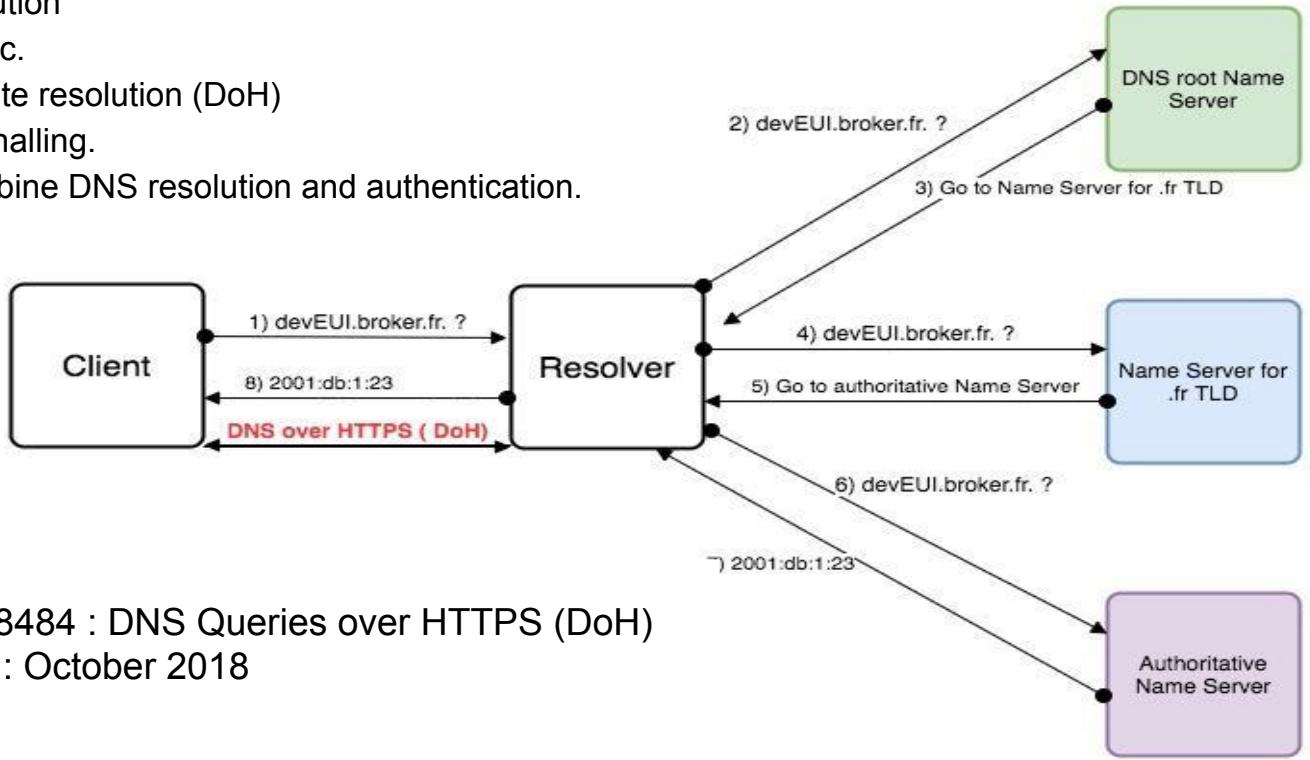




# IV. IoT Roaming Architecture with DNS over HTTPS

## 4.1 Brief description of solution : DoH

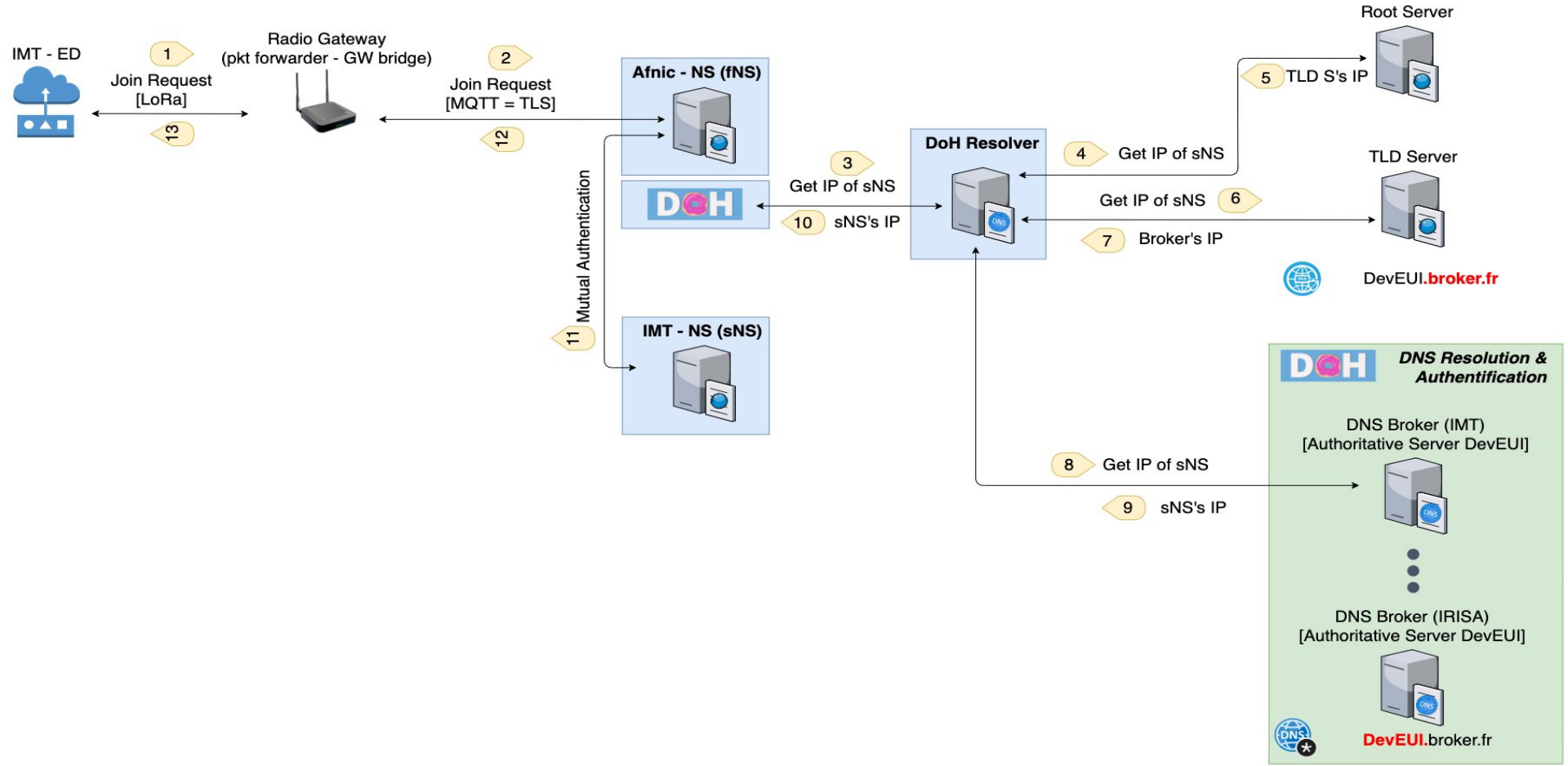
- DNS Resolution
  - Public.
  - Private resolution (DoH)
- Reduce signalling.
  - Combine DNS resolution and authentication.




RFC8484 : DNS Queries over HTTPS (DoH)
Year : October 2018

# IV. IoT Roaming Architecture with DNS over HTTPS

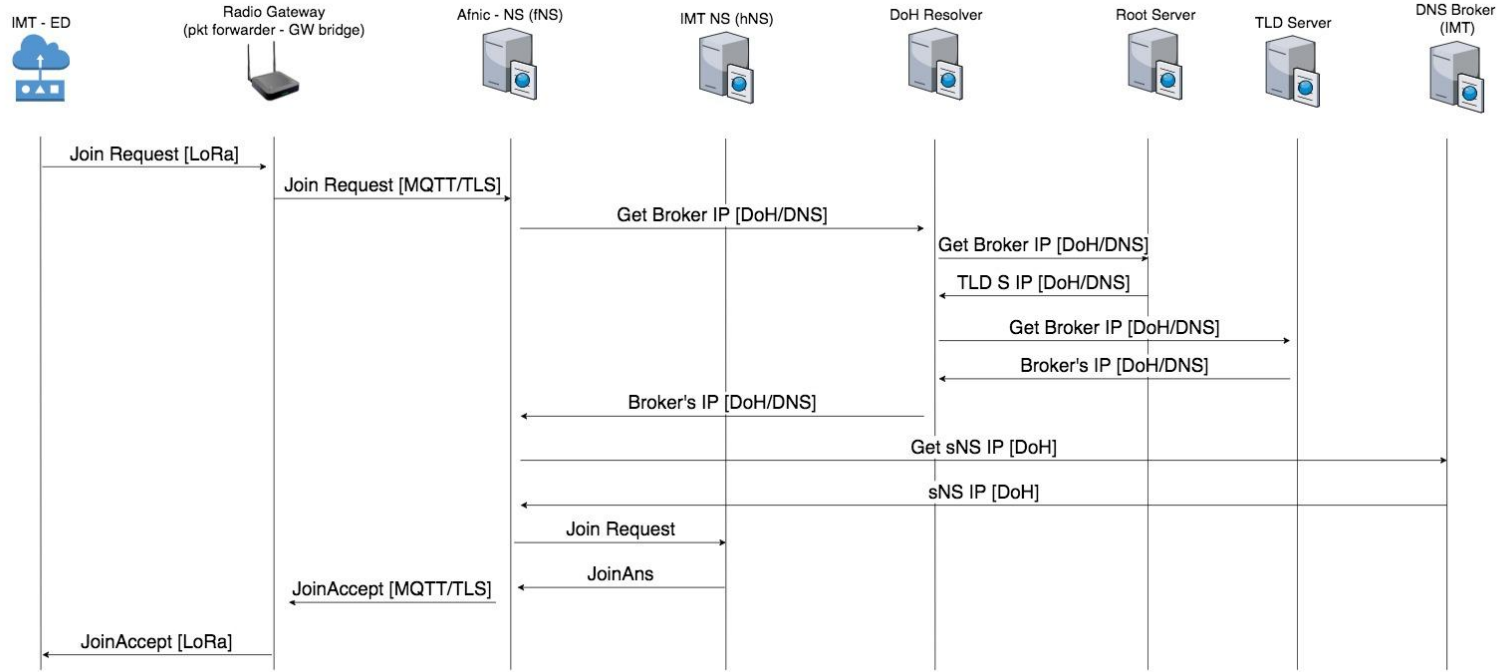




# IV. IoT Roaming Architecture with DNS over HTTPS

## 4.2 Flowchart (*ongoing work*)

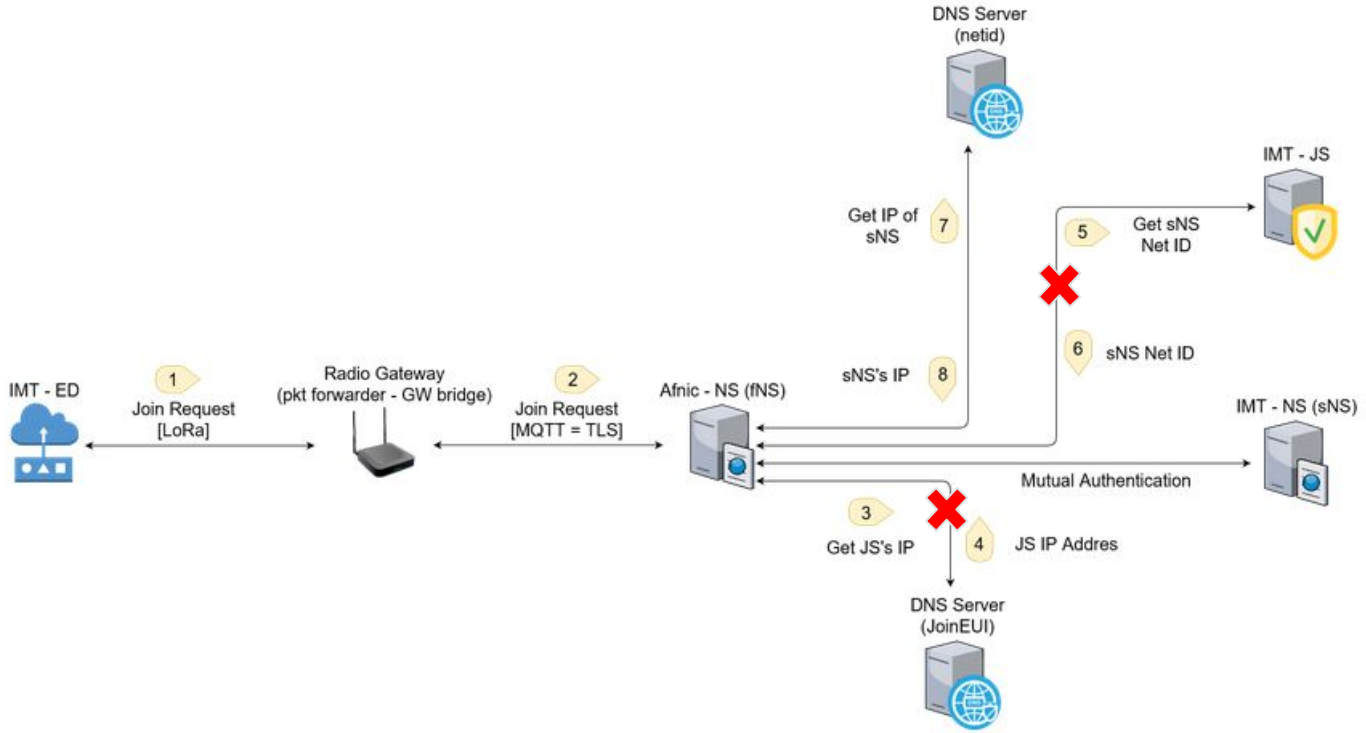




# IV. IoT Roaming Architecture with DNS over HTTPS

## 4.3 Reduction in the number of messages exchanged





# V. Ongoing Work & prospects



## Work done:

- Implementation of AFNIC's proposal
  - Creation of certificates
  - Chirpstack GW, NS and AS
- Partial implementation of PoC:
  - Architecture design
  - DNS Knot server and Knot resolver configuration using DoH.

## To be done:

- Complete implementation of the PoC.
  - Broker Managment
  - DoH client that can communicate with the chirpstack LoRa NS.
  - Creation of certificates
- Testing campaign of the PoC.
  - Security analysis
  - Performance evaluation

THANK YOU

# V. References



[1]. Balakrichenan, A. Bernard, M. Marot, and B. Ampeau, “IoTRoam: design and implementation of a federated IoT roaming infrastructure using LoRaWAN,” 2021, working paper or preprint. [Online]. Available: https://hal.archives-ouvertes.fr/hal-03100628 , 6 Jan 2021

[2] https://www.groupestarservice.com/blog/comment-liot-optimise-la-logistique-du-dernier-kilometre/, To be consulted on 29 June 2021

[3] http://univida fup.edu.co/bienestar/la-ganaderia-se-apunta-al-internet-de-las-cosas/, To be consulted on 29 June 2021

[4] https://www.thomasnet.com/insights/how-the-iot-is-improving-the-logistics-sector/; To be consulted on 29 June 2021