Sept. 21 2022

Utilisation du DNS pour l'optimisation d'infrastructure et services IoT"

Sandoche BALAKRICHENAN

Internet made in France

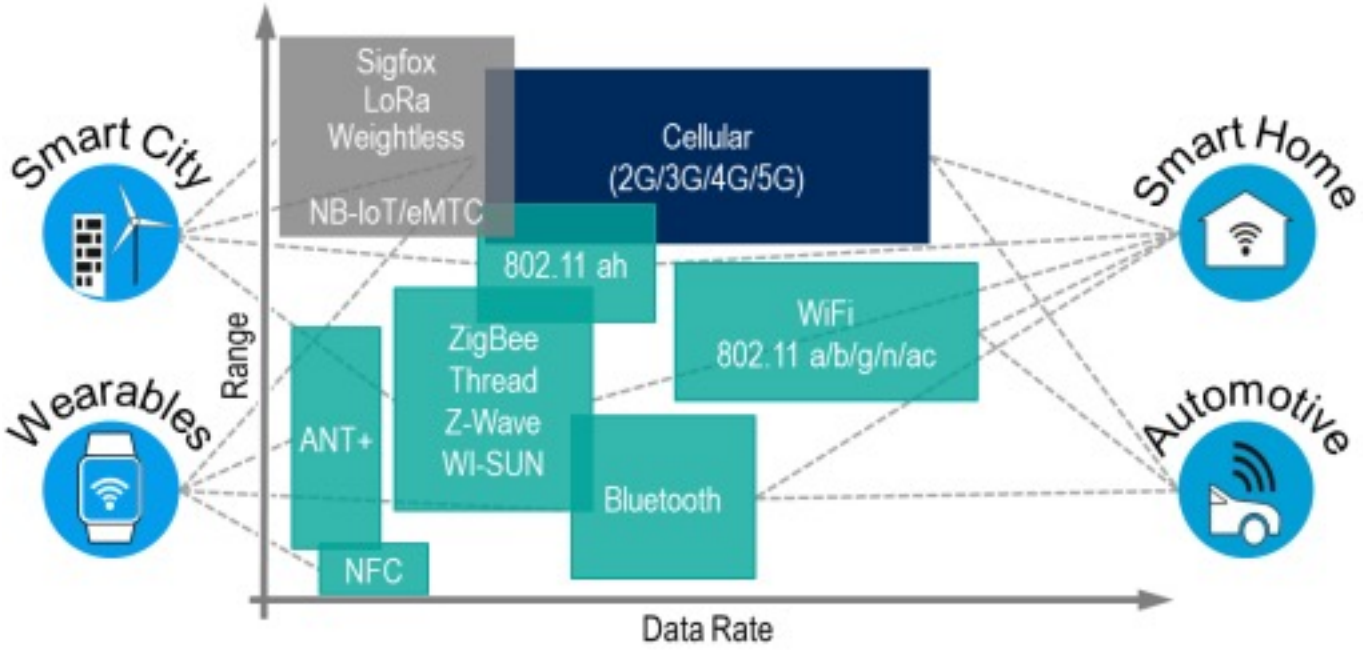
Presented at E4C 2022

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Summary

- **IoT Challenges**
- **Interoperability and device mobility**
  - Building a Roaming Federation
  - Prefetching DNS information
- **Performance challenges**
  - Compressing Headers
  - Minimize network traffic
- **Afnic Vision**

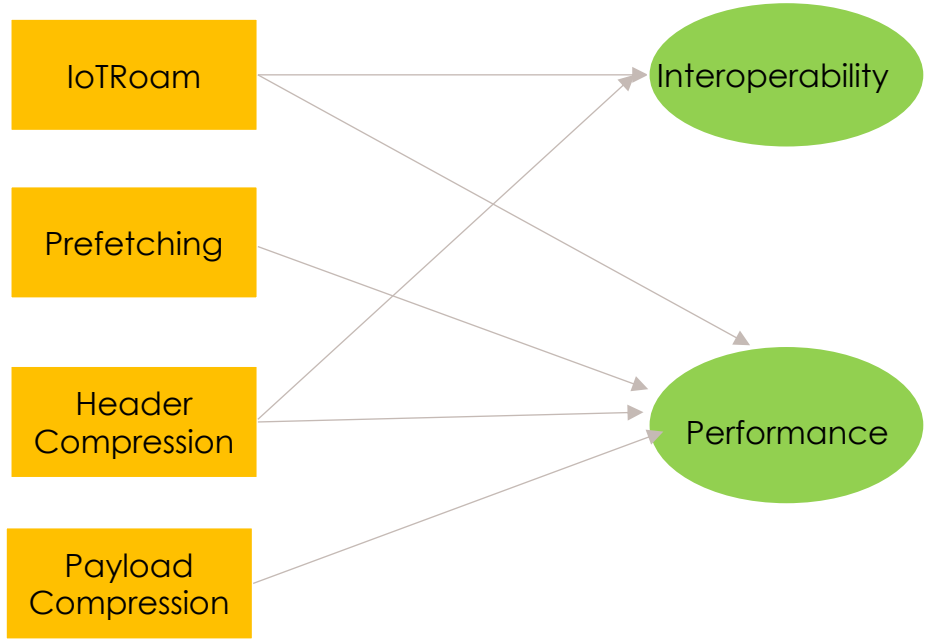
IoT – Diverse technologies & problems



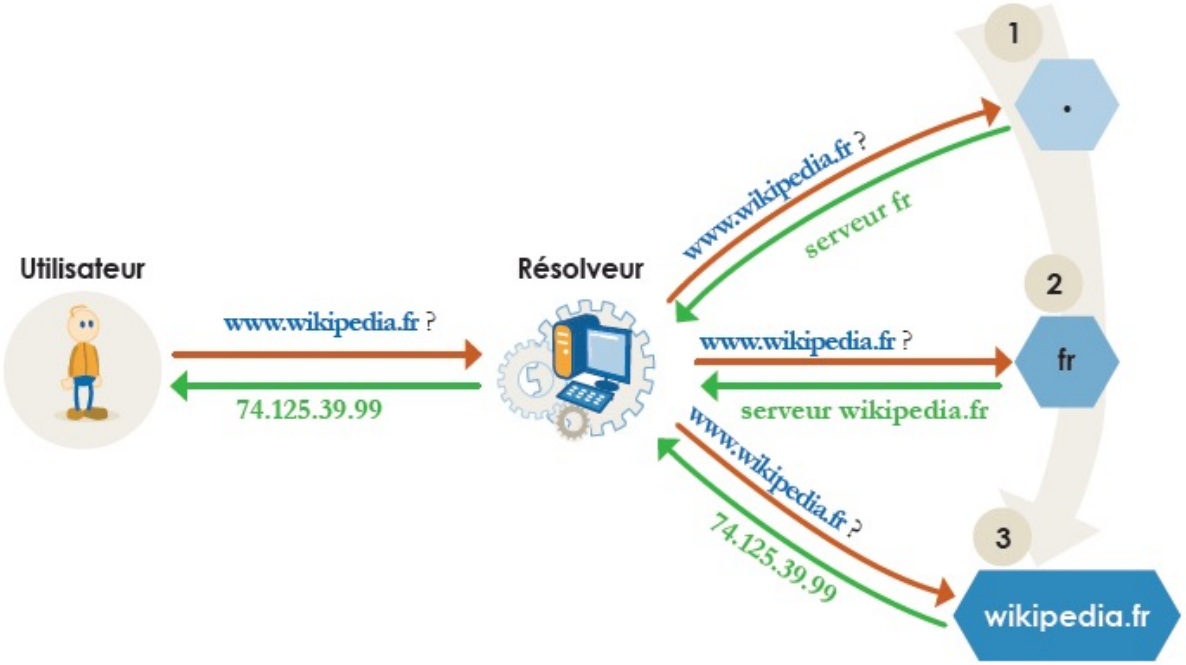
Source: Whitepaper Rhode & Schwarz

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Two main focus points

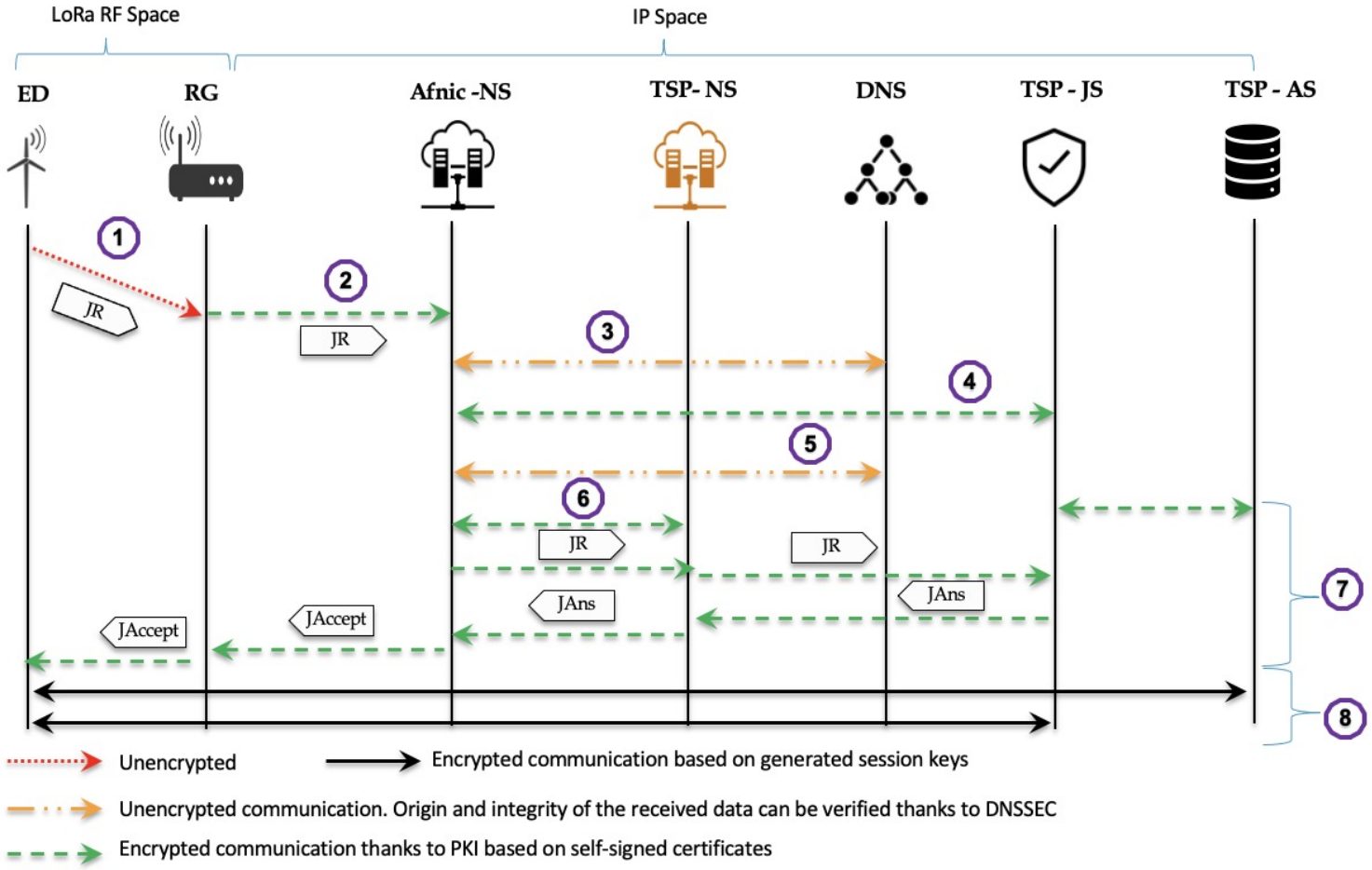


afnic | Labs **DNS**

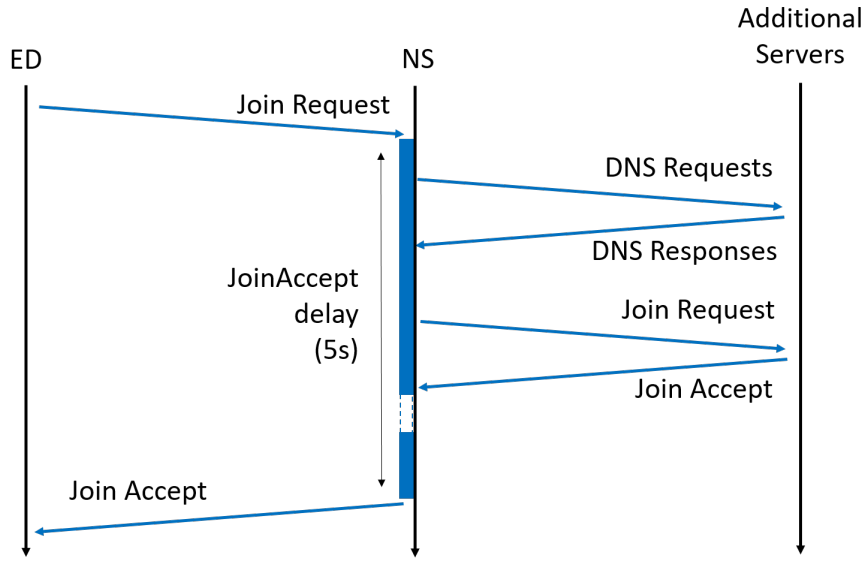


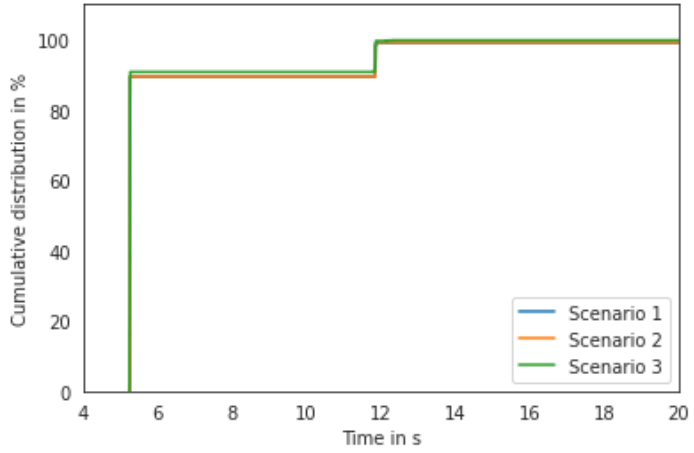
Enabling Interoperability

IoTRoam – LoRaWAN Roaming



Does DNS resolution add latency?

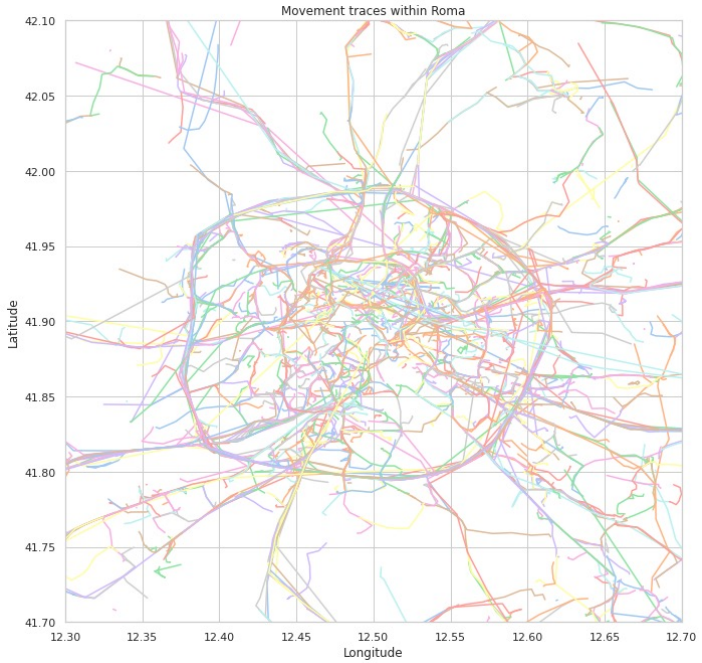


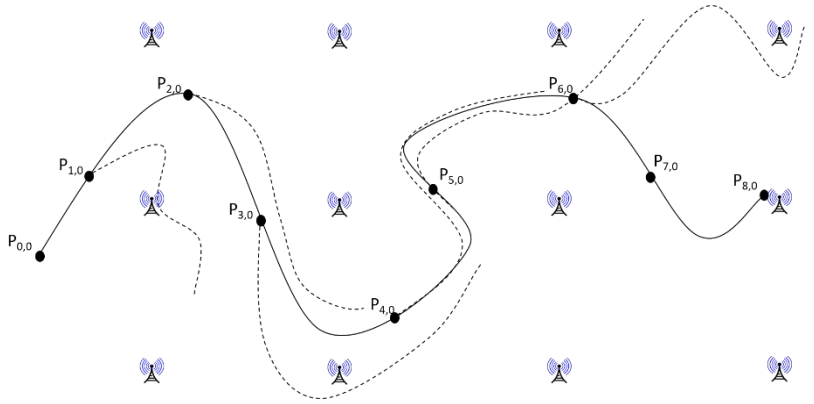


- **1. No Roaming**
- **2. Passive Roaming**
- **3. Passive Roaming with additionnal encryptions**

Improving IoT Device mobility – DNS Prefetching

Methodology - Traces



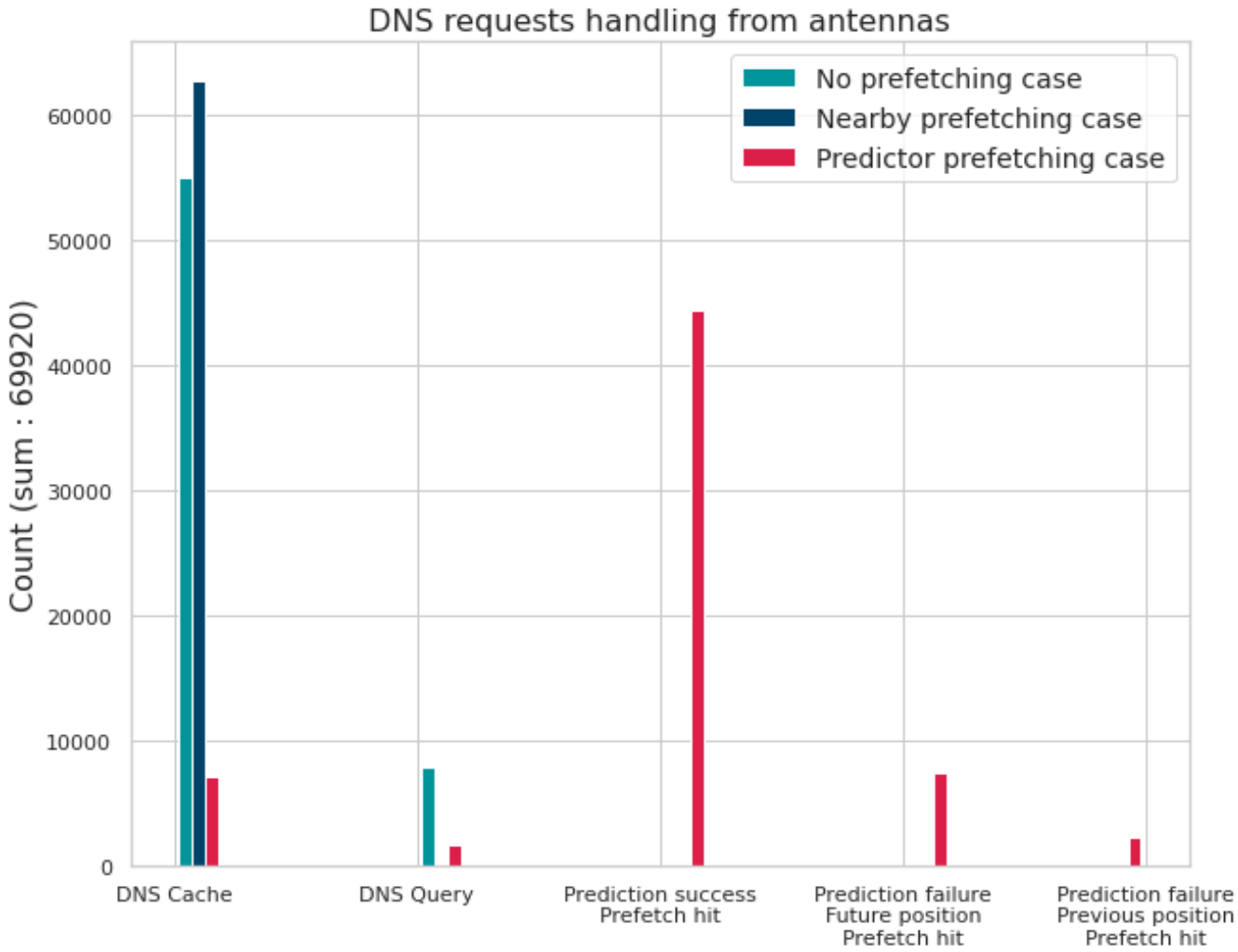


Methodology - Scenarii

3 SCENARII

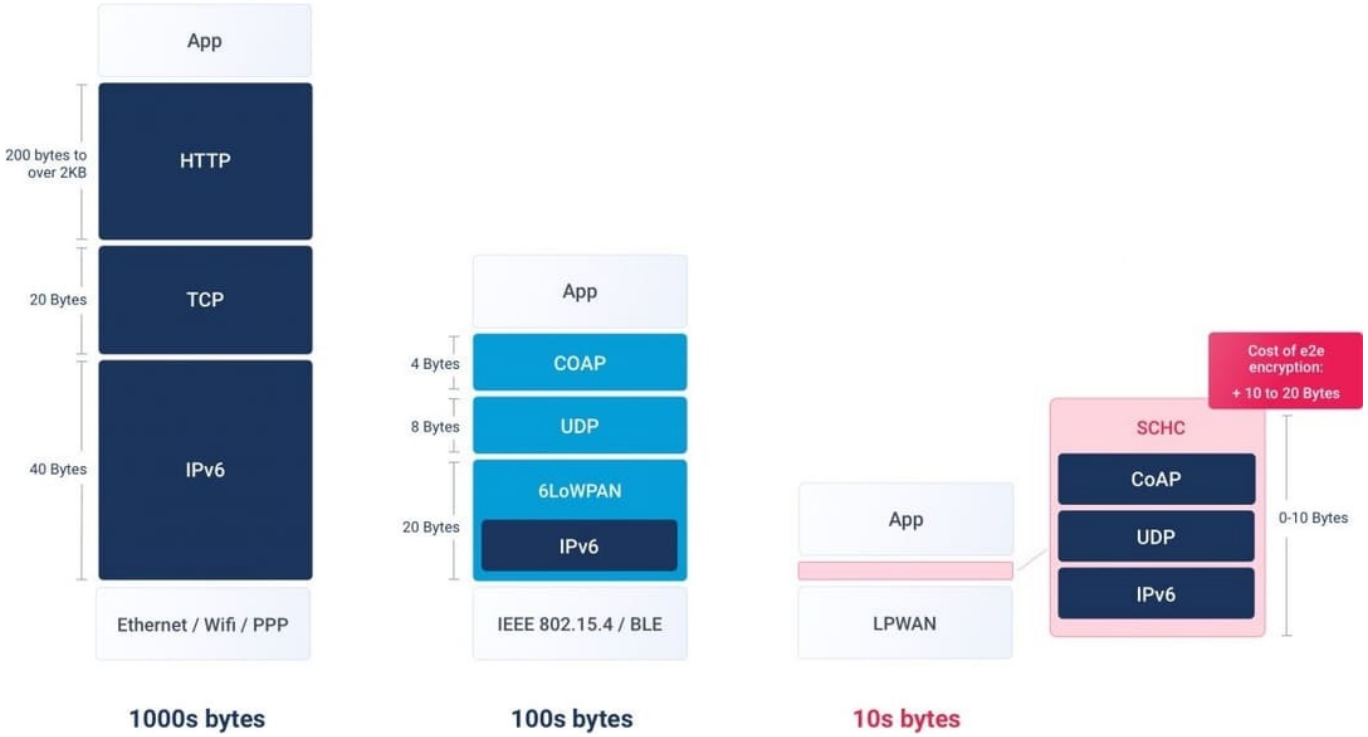
- No DNS Prefetching
- DNS prefetching on nearby gateway
- DNS prefetching using ML predictor

Results


DNS requests handling from antennas
No prefetching case
Nearby prefetching case
Predictor prefetching case
Count (sum : 69920)
0
10000
20000
30000
40000
50000
60000
DNS Cache
DNS Query
Prediction success
Prefetch hit
Prediction failure
Future position
Prefetch hit
Prediction failure
Previous position
Prefetch hit

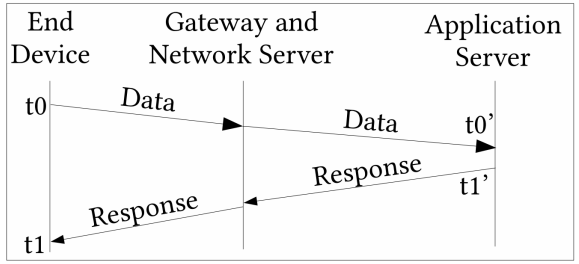
Compression – Header Compression

Why Compress Headers?

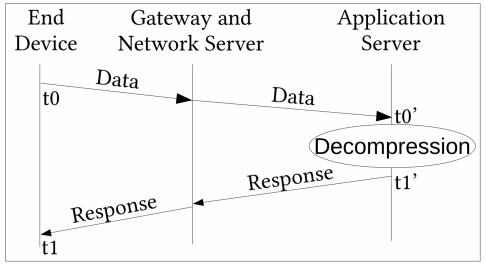


Source : https://www.ackl.io/technology/schc

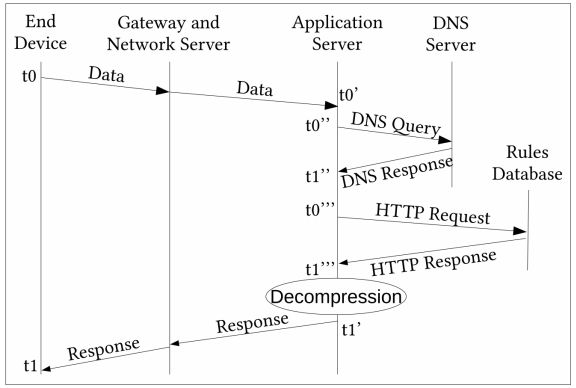
Experiment Methodology



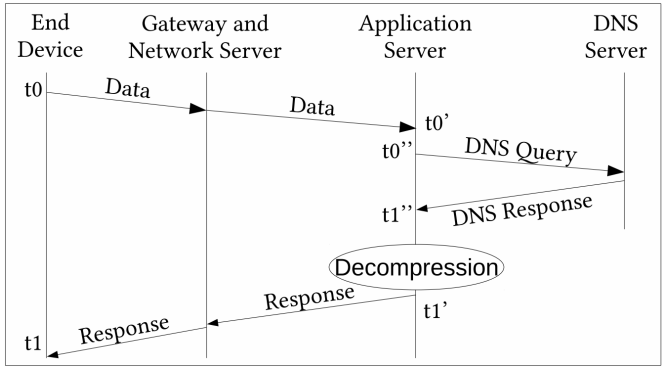
1st Experiment



2nd Experiment

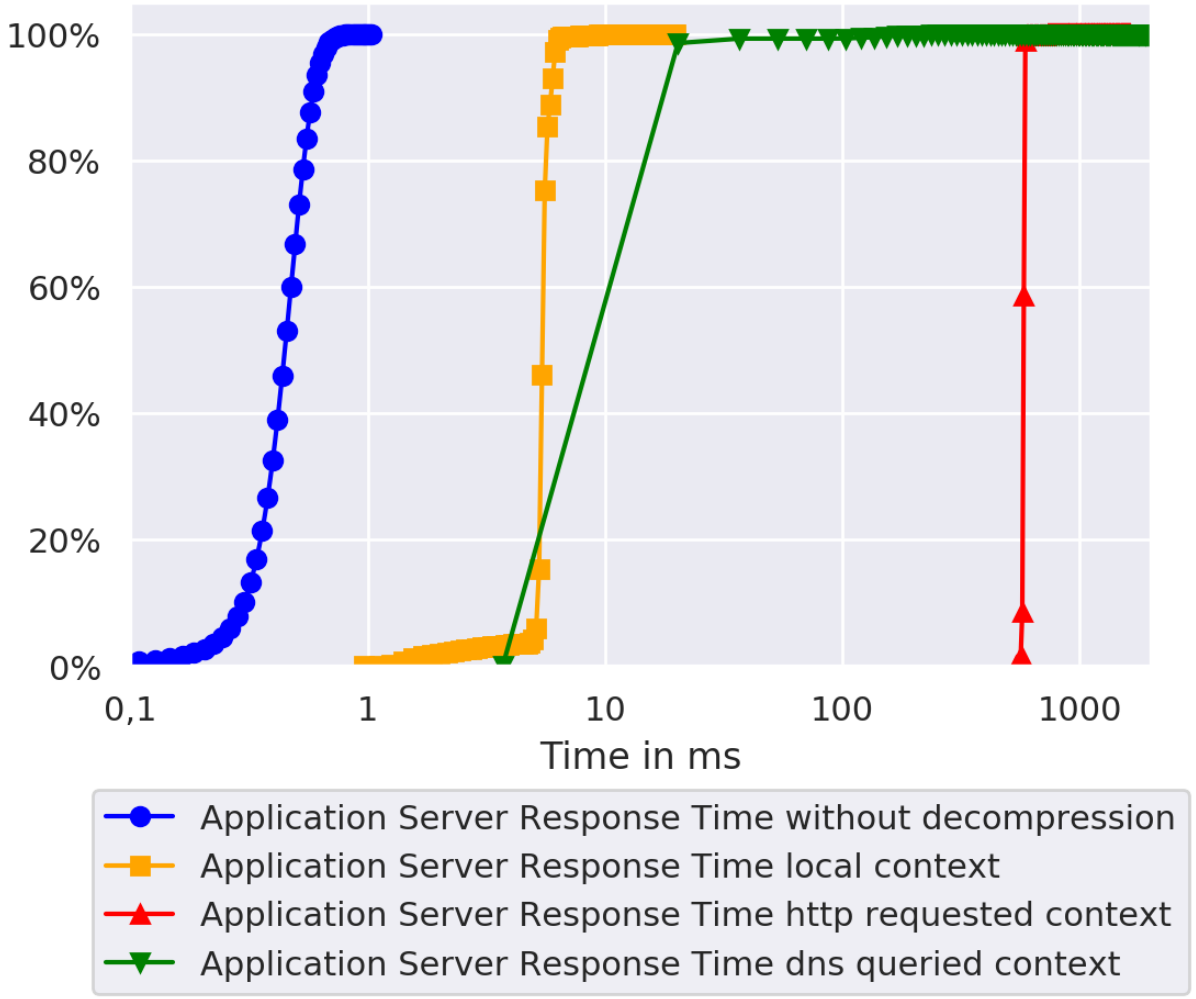


3rd Experiment



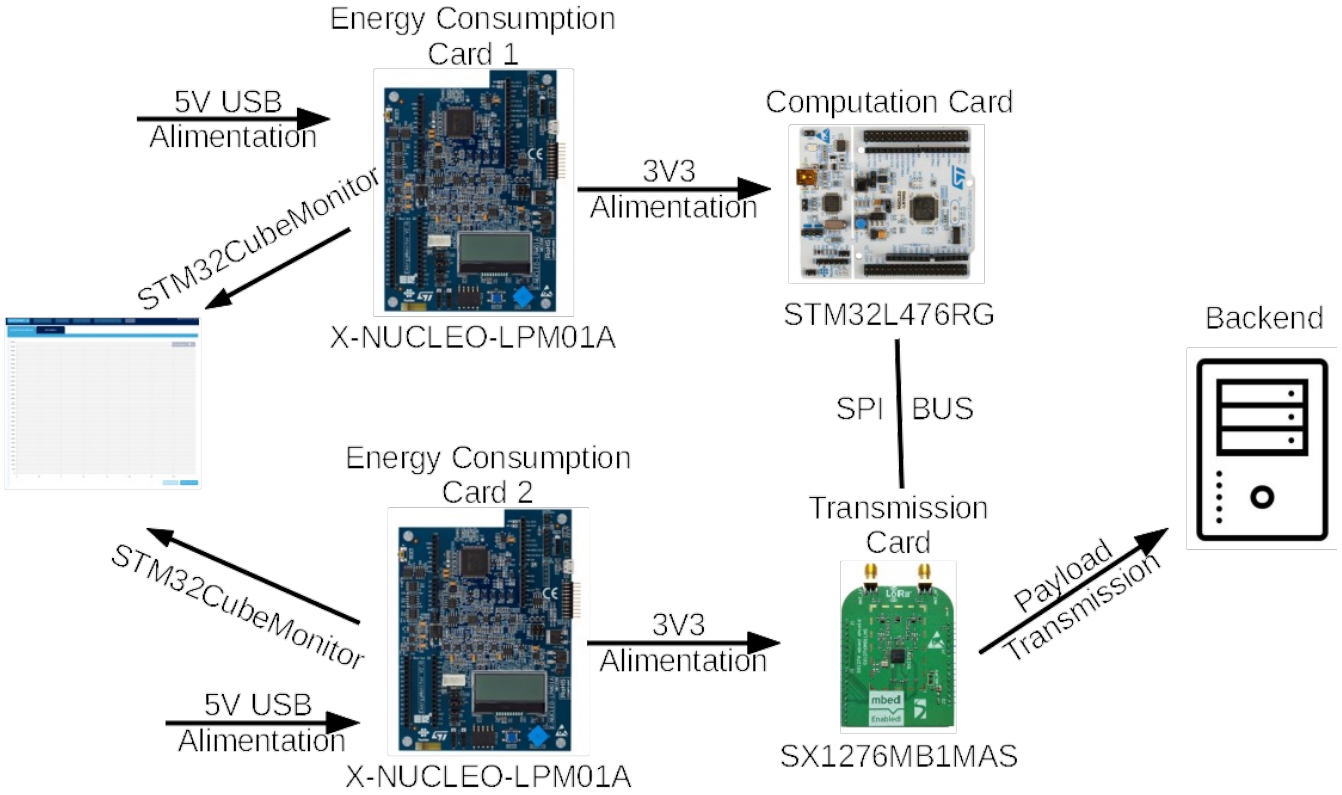
4th Experiment

Results

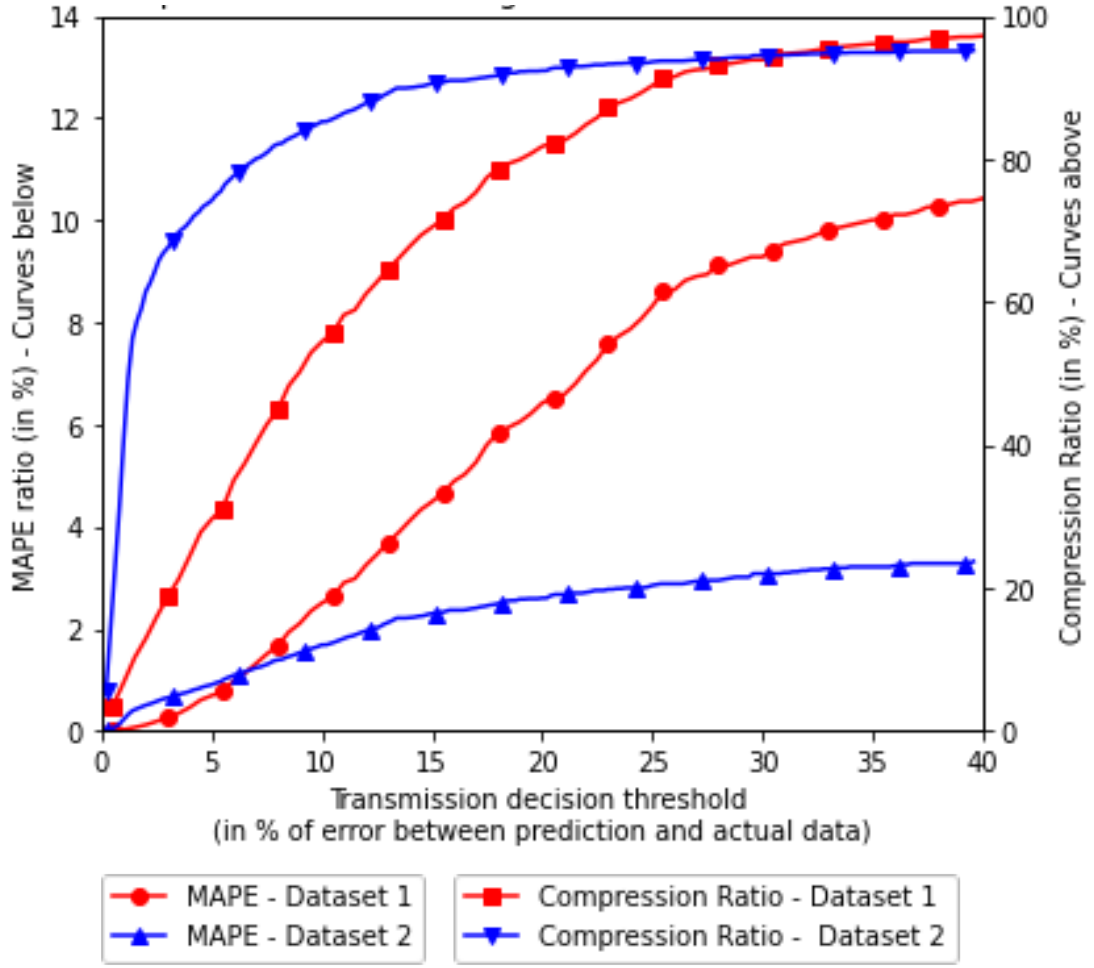

100%
80%
60%
40%
20%
0%
0,1
1
10
100
1000
Time in ms
Application Server Response Time without decompression
Application Server Response Time local context
Application Server Response Time http requested context
Application Server Response Time dns queried context

Compression – Payload Compression

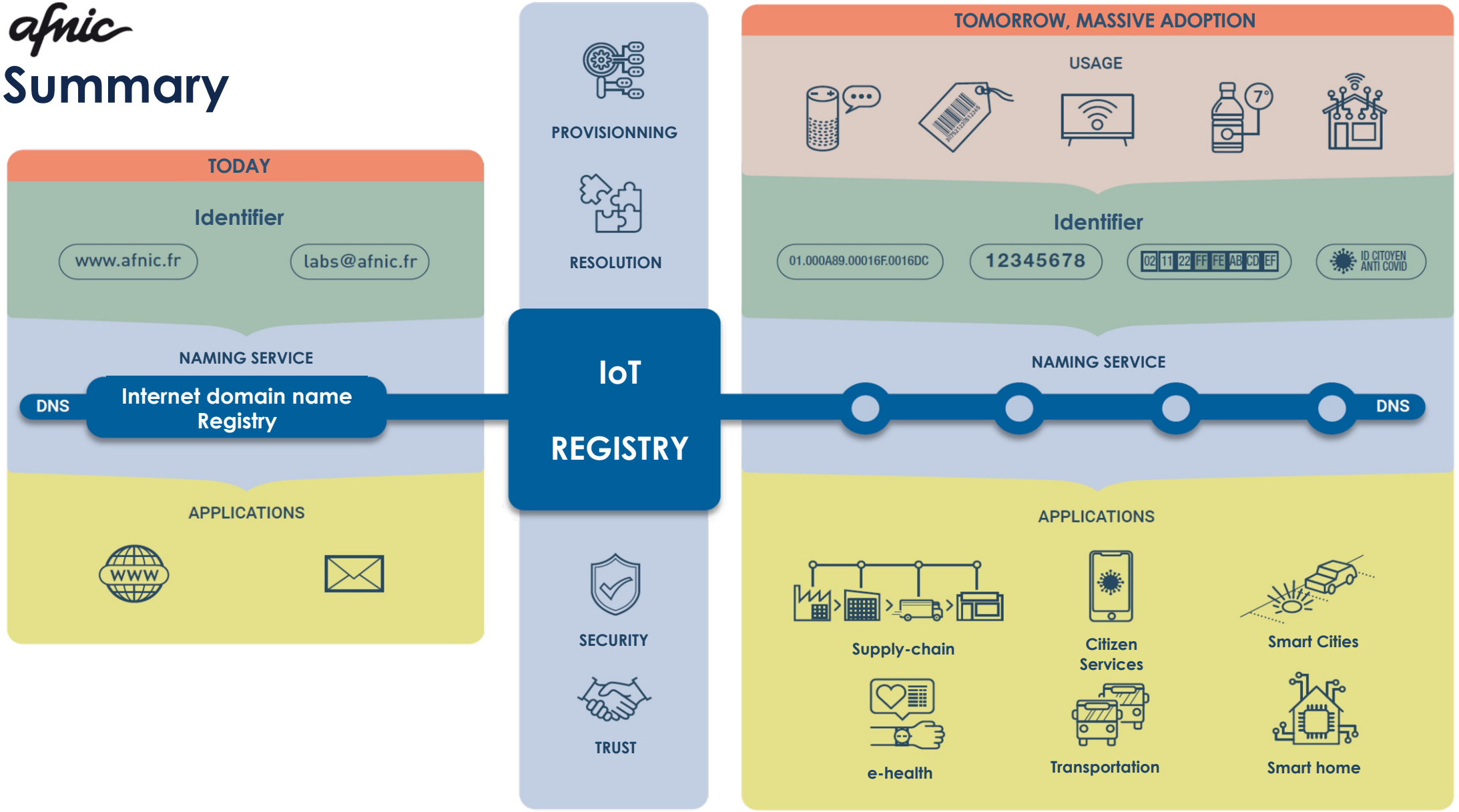
Experimental Setup



Results


MAPE ratio (in %) - Curves below
Compression Ratio (in %) - Curves above
Transmission decision threshold
(in % of error between prediction and actual data)
MAPE - Dataset 1
MAPE - Dataset 2
Compression Ratio - Dataset 1
Compression Ratio - Dataset 2

Summary


TODAY
Identifier
www.afnic.fr
labs@afnic.fr
NAMING SERVICE
DNS
Internet domain name Registry
APPLICATIONS
WWW
PROVISIONNING
RESOLUTION
IoT
REGISTRY
SECURITY
TRUST
TOMORROW, MASSIVE ADOPTION
USAGE
Identifier
01.000A89.00016F.0016DC
12345678
02 11 22 FF FE AB CD EF
ID CITOYEN ANTI COVID
NAMING SERVICE
DNS
APPLICATIONS
Supply-chain
Citizen Services
Smart Cities
e-health
Transportation
Smart home

Afnic's Vision

DONE

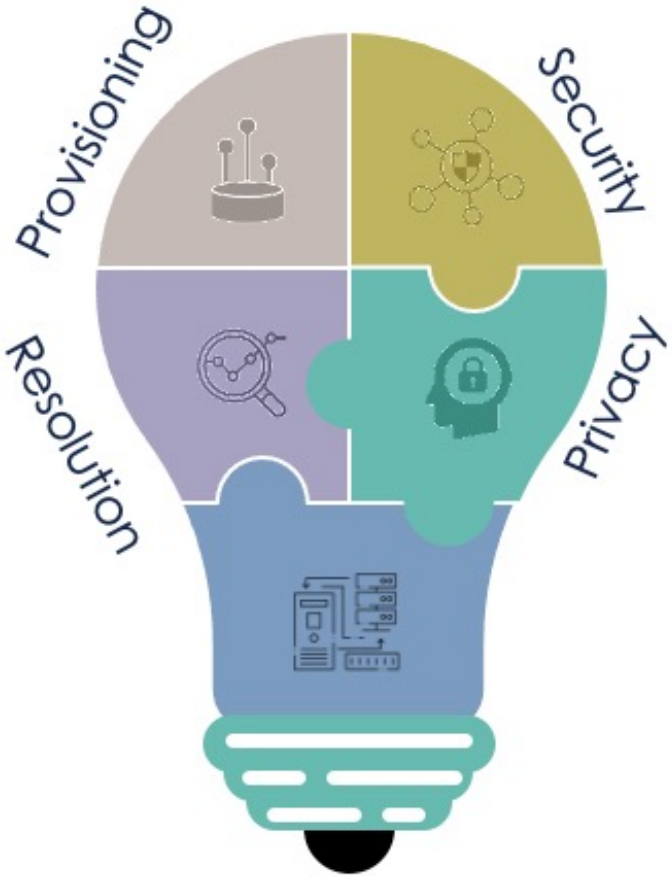
WINGS

Widening interoperability for networking Global supply Chains

DONE

LoRa Alliance

DNS Service



ONGOING

DINS*

DNS Naming and Services for Secure Seamless IoT

ONGOING

PIVOT*

Privacy-Integrated design and Validation in the constrained IoT