LoRaWAN® Roaming

Alper Yegin, Actility
LoRa Alliance AMM, Berlin 2019

LoRaWAN®

Creating Valuable IoT Connections
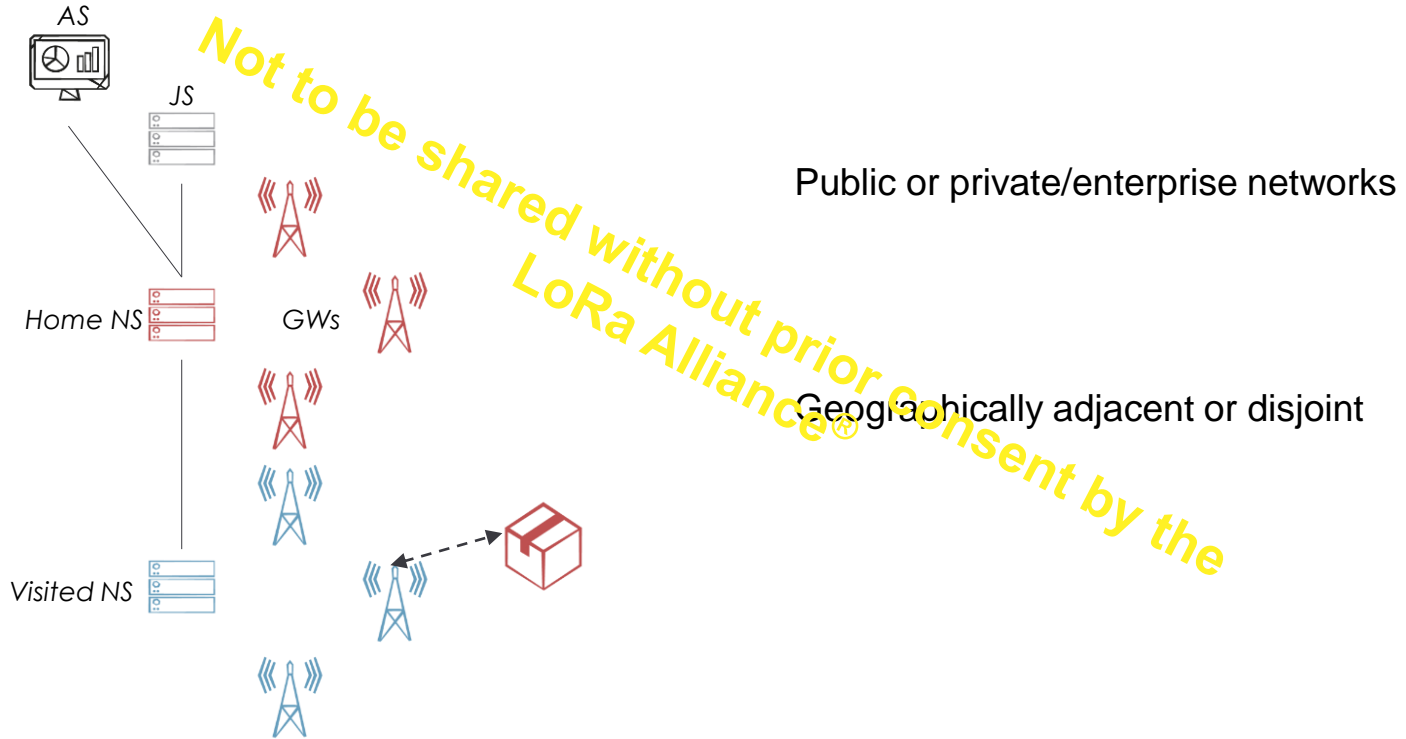
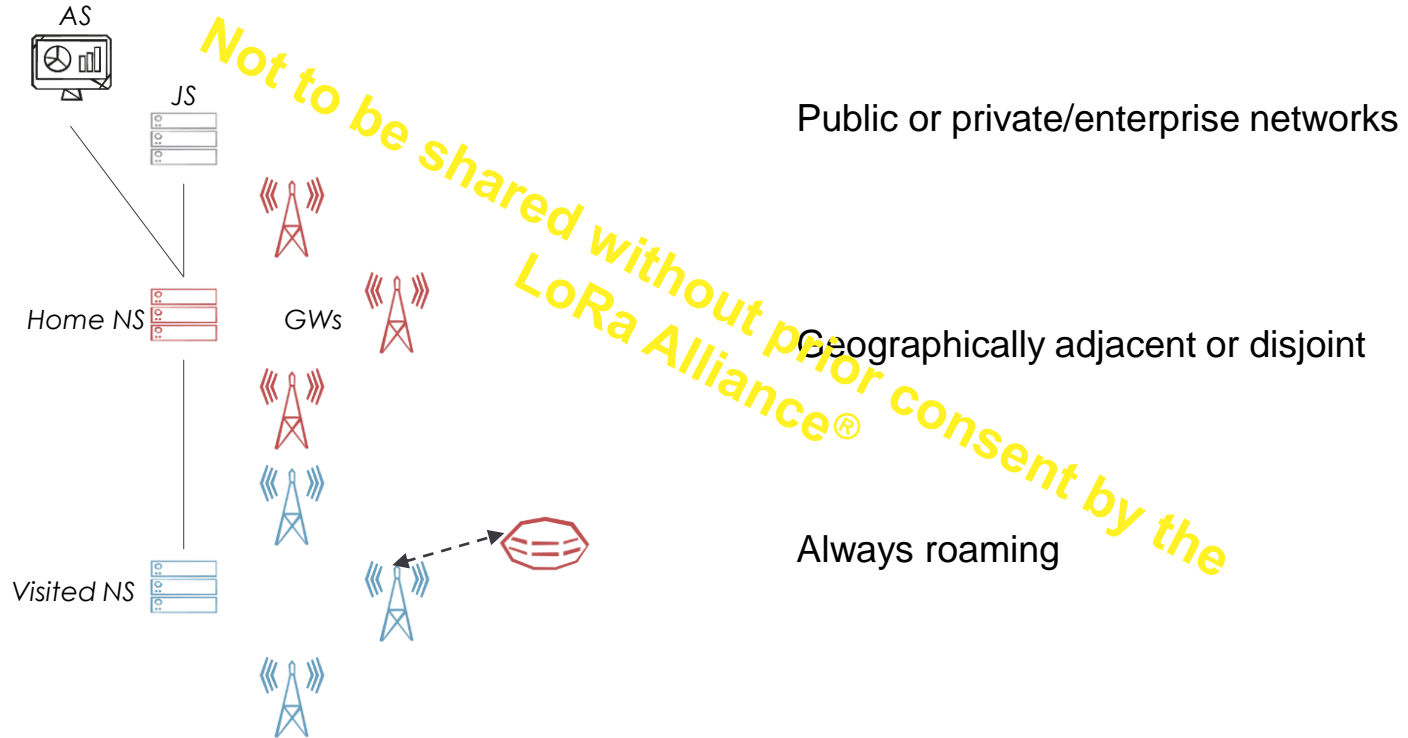Coverage extension

Running core without radio network

Coverage densification

AS

JS

Home NS

GWs

Visited NS

Public or private/enterprise networks

Geographically adjacent or disjoint

AS: Application Server
JS: Join Server
NS: Network Server
GW: Gateway

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AS

JS

Home NS

GWs

Visited NS

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Public or private/enterprise networks

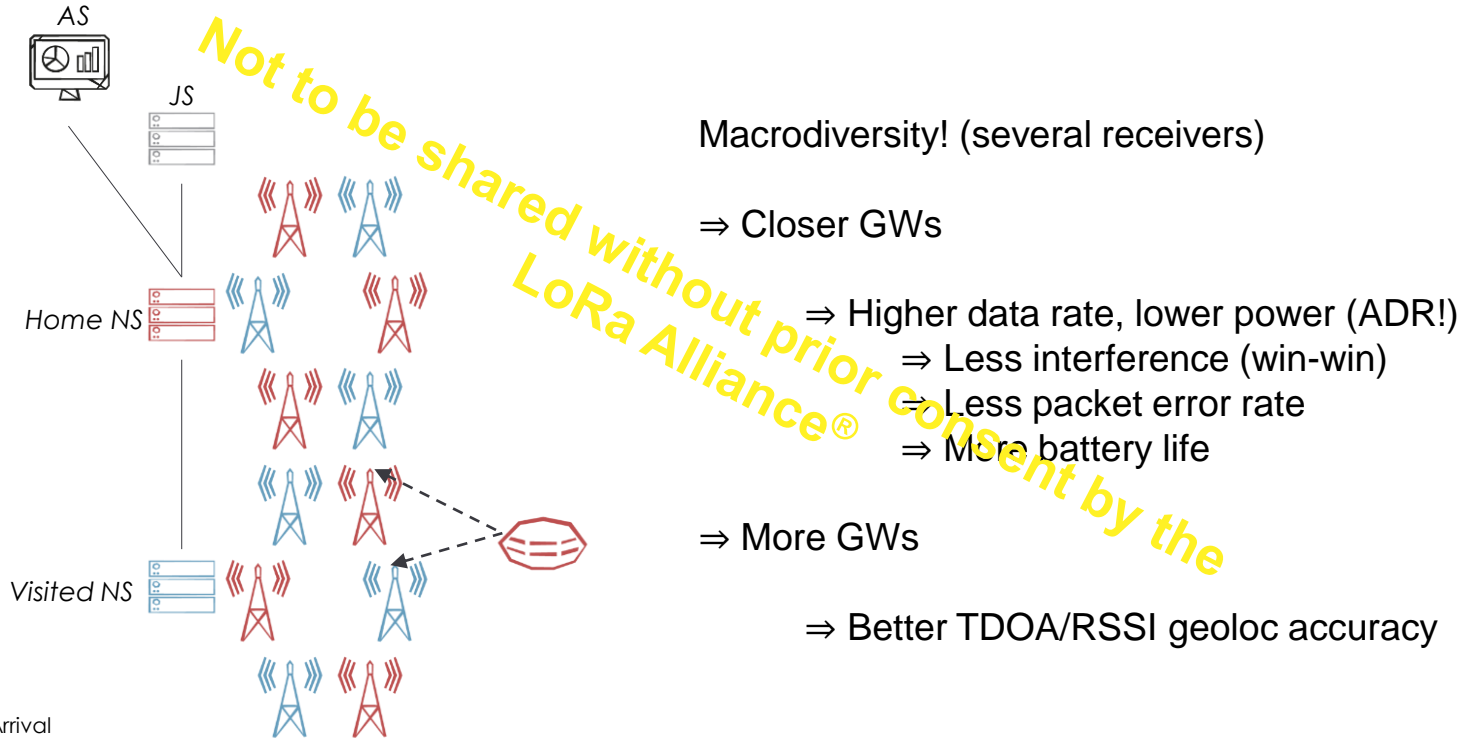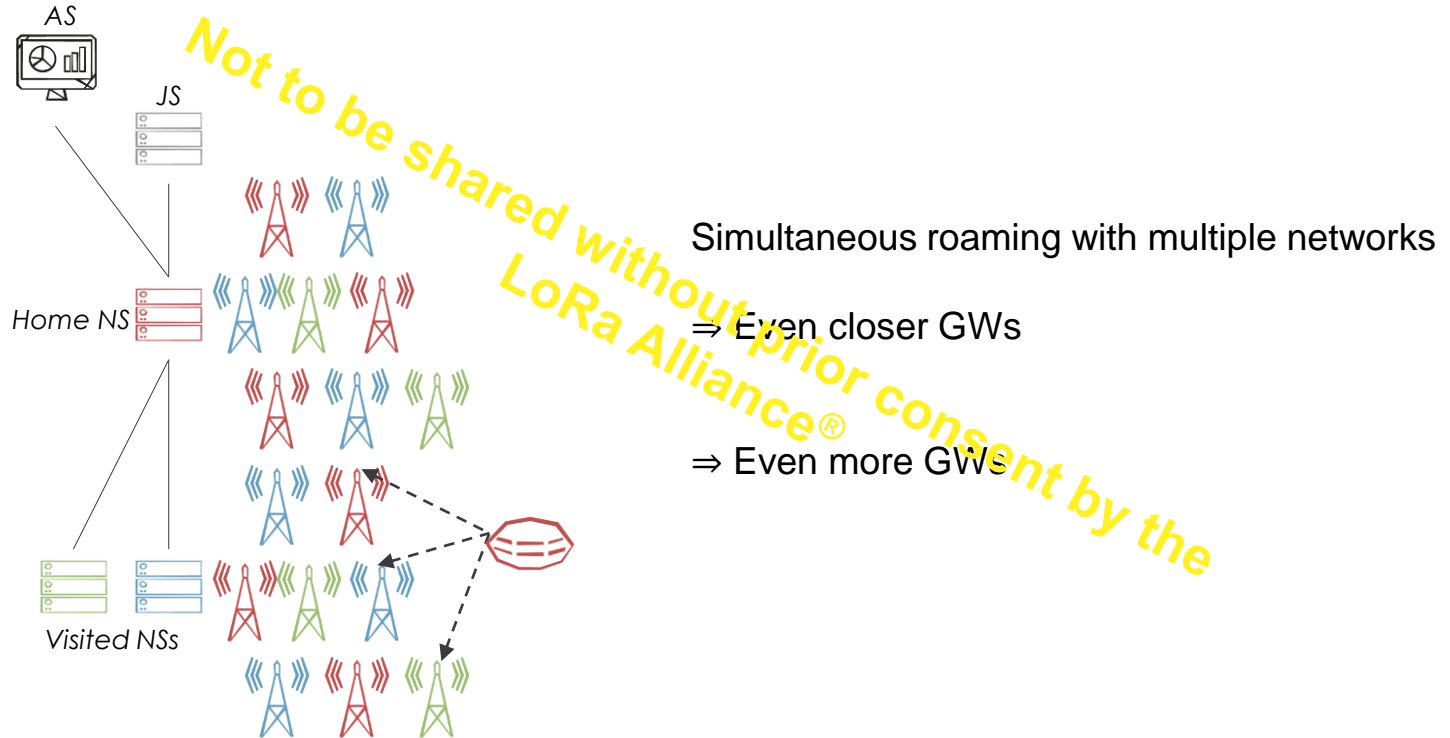Geographically adjacent or disjoint

Always roaming

AS

JS

Home NS

Visited NS
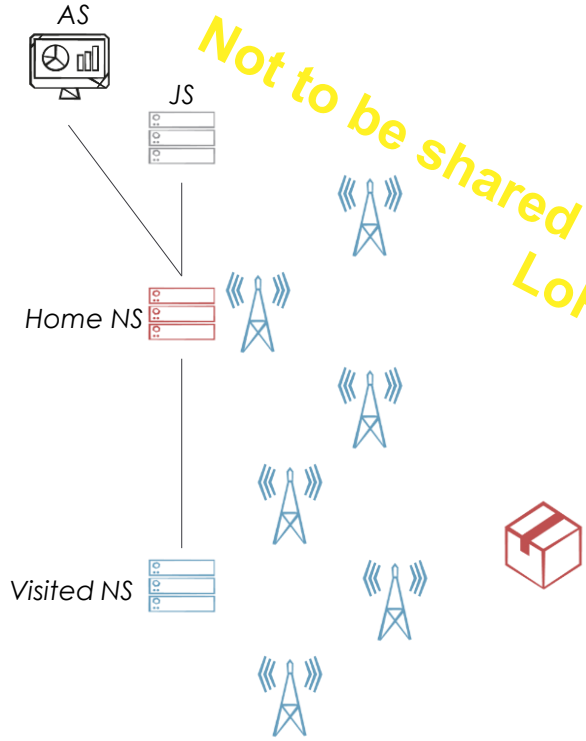
Enterprise networks can choose to have their own core network w/o building the radio networks

= Feasible with LoRaWAN® due to low cost infra

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Macrodiversity! (several receivers)

⇒ Closer GWs

⇒ Higher data rate, lower power (ADR!)
   ⇒ Less interference (win-win)
   ⇒ Less packet error rate
   ⇒ More battery life

⇒ More GWs

⇒ Better TDOA/RSSI geoloc accuracy

AS

JS

Home NS

Visited NS

ADR: Adaptive Data Rate
TDOA: Time Difference of Arrival
RSSI: Received Signal Strength Indicator

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AS

JS

Home NS

Visited NSs

Simultaneous roaming with multiple networks

⇒ Even closer GWs

⇒ Even more GWs

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LoRaWAN

LoRa Alliance
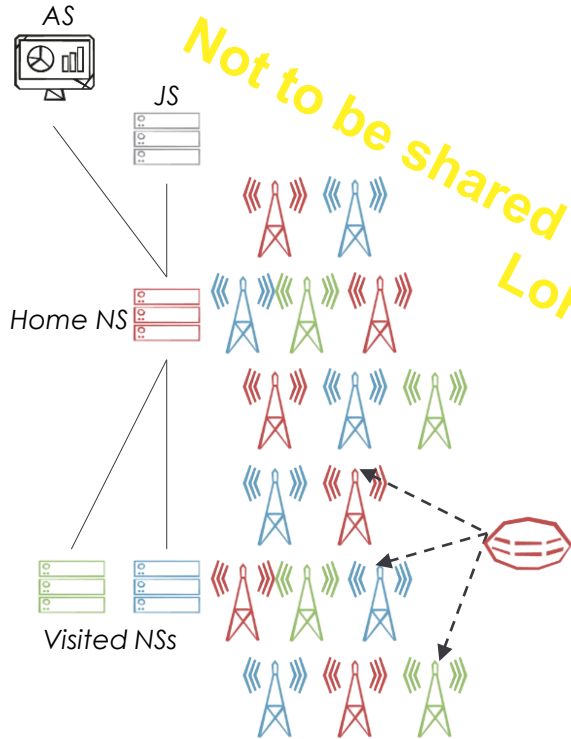
Macrodiversity! (several receivers)

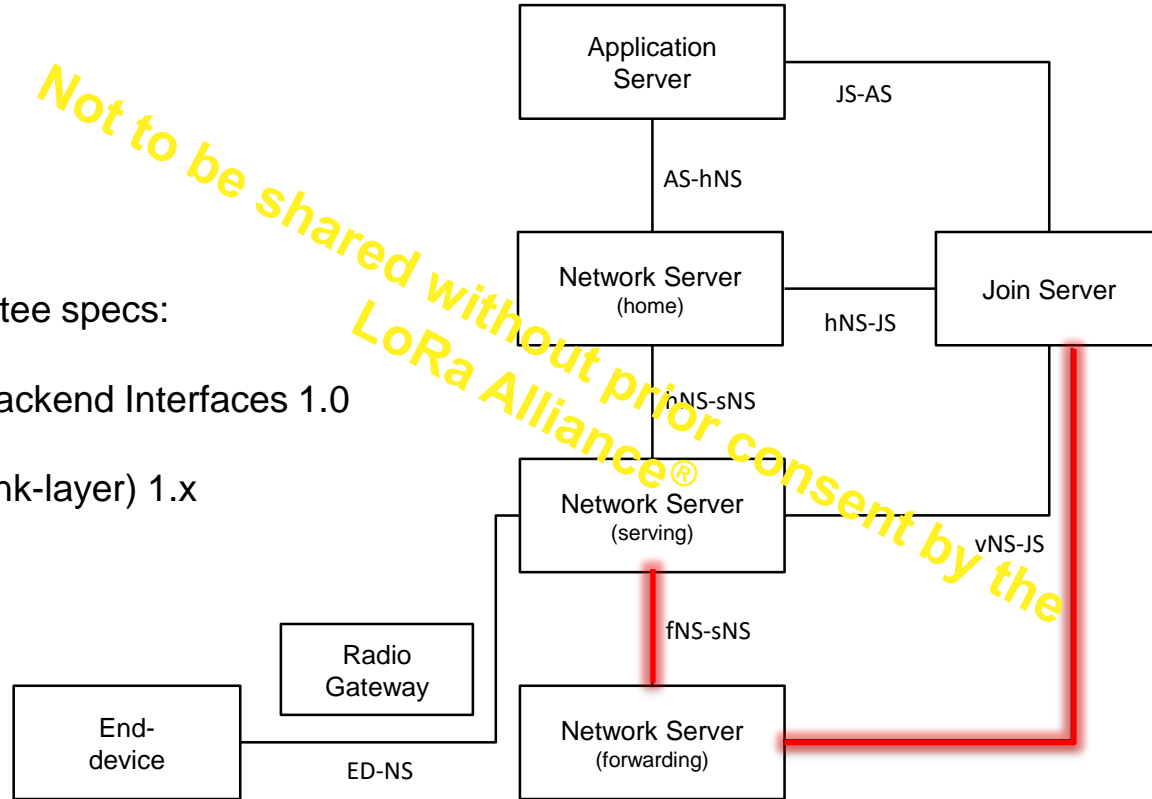Device at home and roaming with multiple networks at the same time

*Very **unique** mode of roaming:*
- *Not available to NB-IoT, Wi-SUN (tech limitation)*
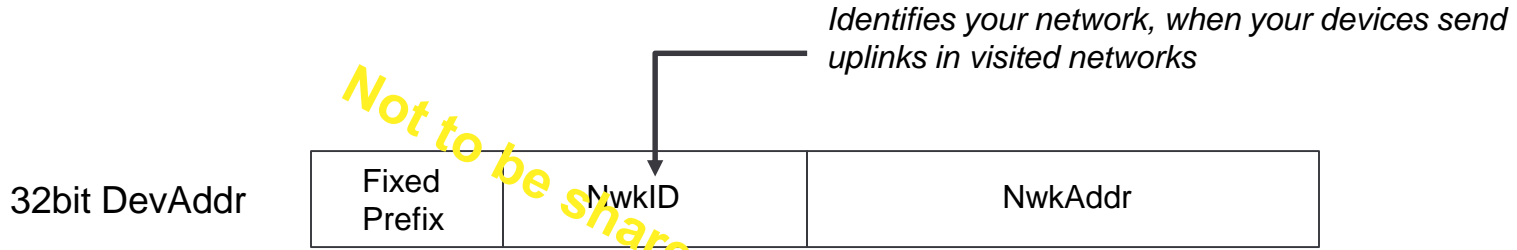- *Not available to SigFox (business model limitation)*

Technical Committee specs:

- LoRaWAN® Backend Interfaces 1.0

- LoRaWAN (Link-layer) 1.x

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```
                        ┌──────────────┐
                        │ Application  │─────────── JS-AS ──────┐
                        │   Server     │                        │
                        └──────┬───────┘                        │
                               │                                │
                             AS-hNS                             │
                               │                                │
                        ┌──────┴───────┐        hNS-JS    ┌──────┴───────┐
                        │Network Server│─────────────────│ Join Server  │
                        │   (home)     │                 │              │
                        └──────┬───────┘                 └──────┬───────┘
                             hNS-sNS                            │
                        ┌──────┴───────┐                        │
               ┌────────│Network Server│──────── vNS-JS ────────┘
               │        │  (serving)   │
               │        └──────┬───────┘
               │             fNS-sNS
     ┌─────────┴──┐   ┌─────────┴──────┐
     │  Radio     │   │ Network Server │
     │  Gateway   │   │  (forwarding)  │
     └─────────┬──┘   └────────────────┘
     ┌─────────┴──┐
     │    End-    │─── ED-NS
     │  device    │
     └────────────┘
```

Application Server

JS-AS

AS-hNS

Network Server (home) — Join Server

hNS-JS

hNS-sNS

Network Server (serving)

vNS-JS

fNS-sNS

Radio Gateway

End-device

ED-NS

Network Server (forwarding)

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Identifies your network, when your devices send uplinks in visited networks

32bit DevAddr

Fixed Prefix	NwkID	NwkAddr

NwkID is a scarce resource (limited # of bits)

NwkID generated from NetID

NetIDs assigned to LoRa Alliance™ members

Sponsors

Contributors

NetID Type	NwkAddr Size
0	25bit
3	17bit
6	10bit

Adopters/Institutionals

LoRaWAN

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Identifies your network, when your devices send uplinks in visited networks

DevAddr

Fixed Prefix	NwkID	NwkAddr

Join-request

JoinEUI/AppEUI	DevEUI	DevNonce

Identifies Join Server, that helps visited network discover the home of an activating device
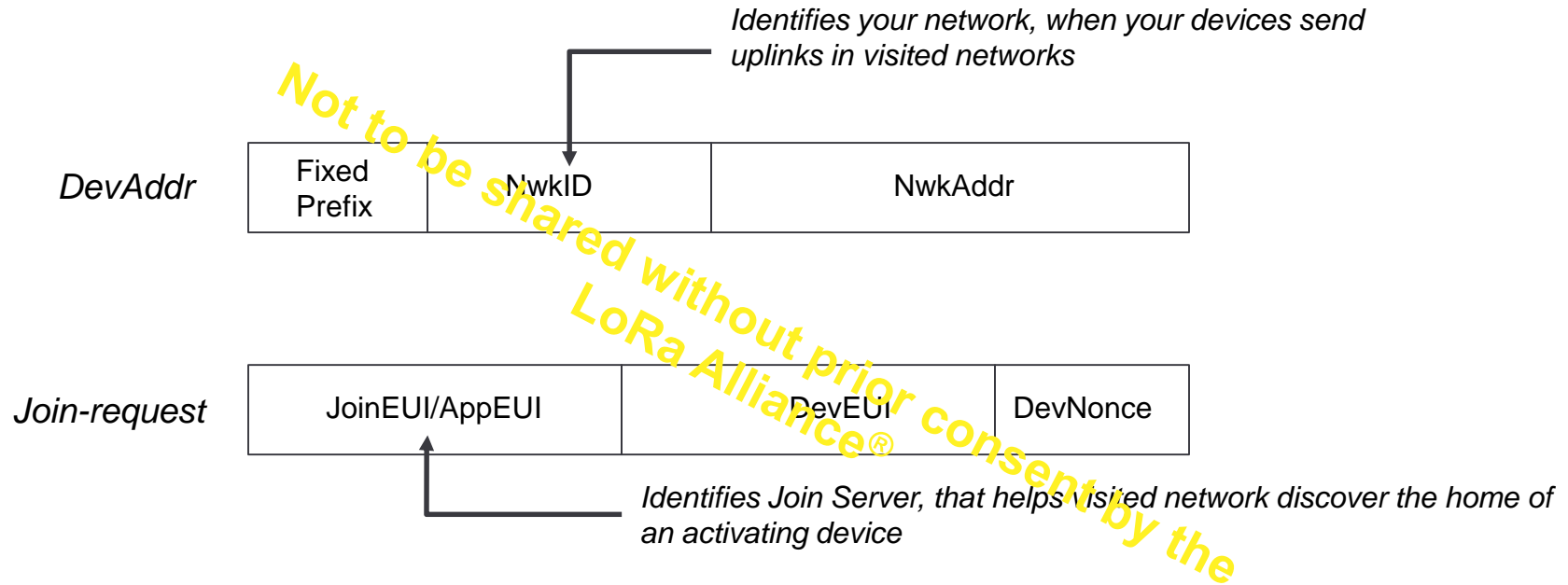
Random DevAddr or JoinEUI/AppEUI ⇒ Device loses home while roaming

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Your network

Public Networks
Private Networks

roaming

roaming

roaming

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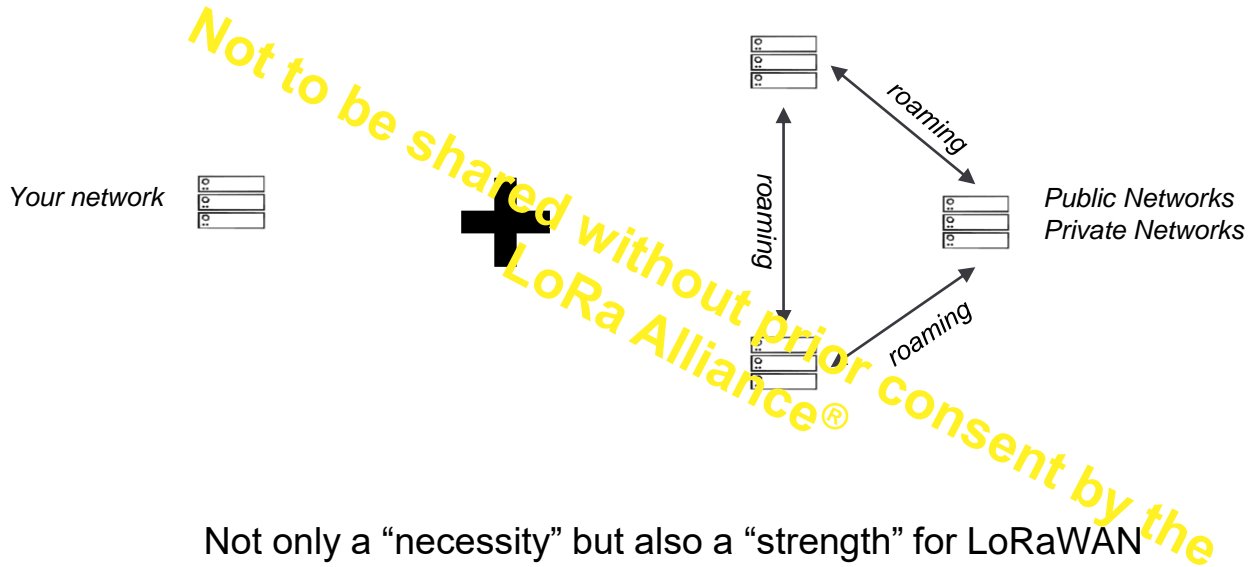
Not only a "necessity" but also a "strength" for LoRaWAN

Treat collaboration/roaming as "default" choice

Your network   *Roaming peer's network*

On your NS,   **On the JS(s) you are using,**
configure Peer's: **configure Peer's:**

NetID(s)
Channel plan
fNS URL
sNS URL
NS IP address(es)
HTTP auth credentials
JS URL(s)
JS IP address(es)
JS HTTP auth credentials
And roaming policy
(roam-in, roam-out,
stateful/stateless)

NetID(s)
fNS URL
NS IP address(es)
HTTP auth credentials

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Configuration and management does not scale
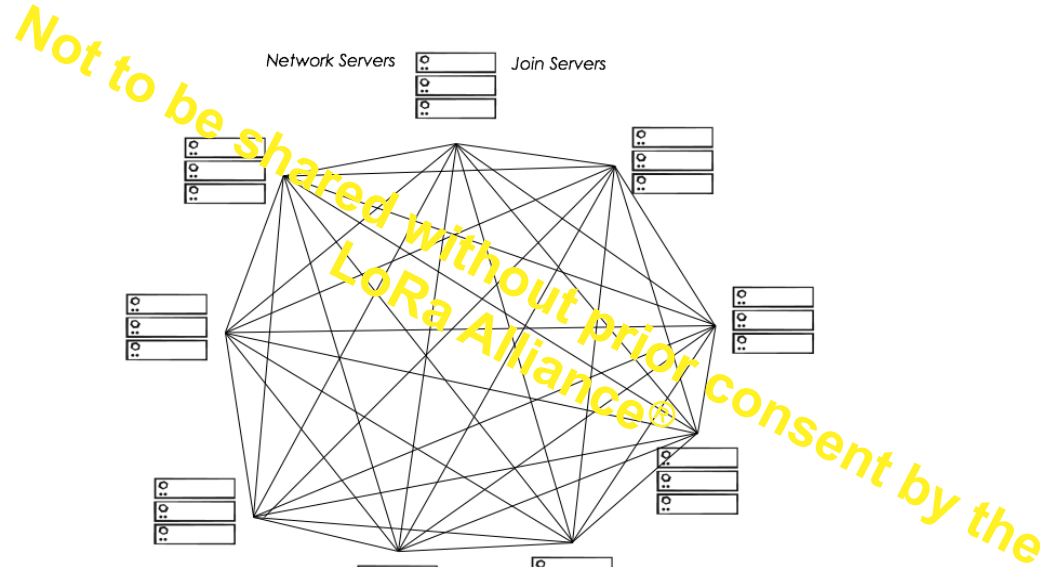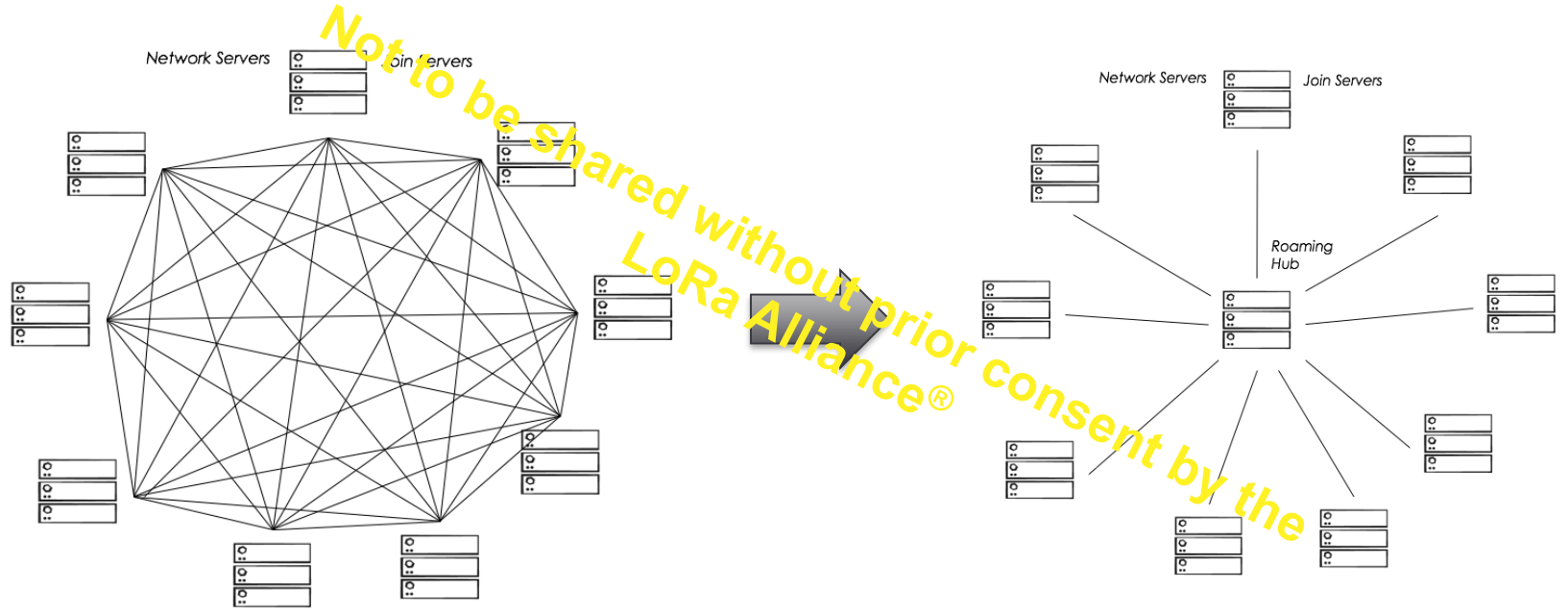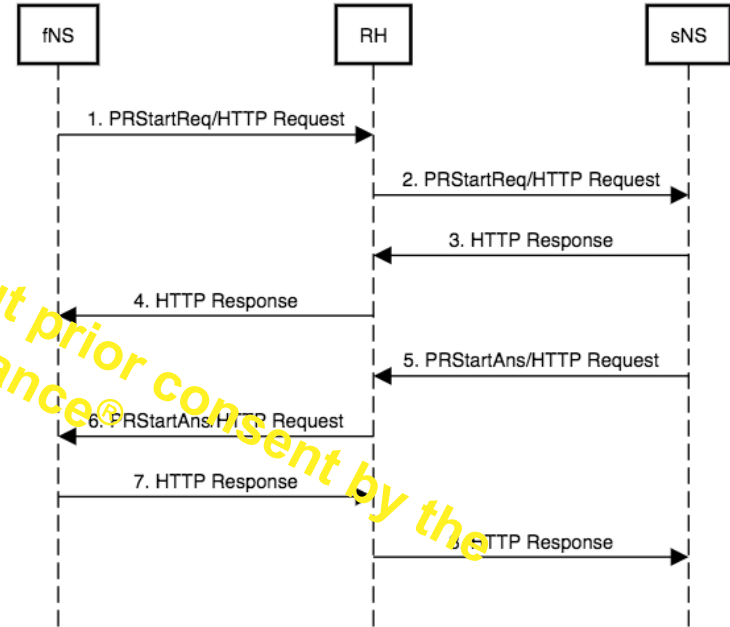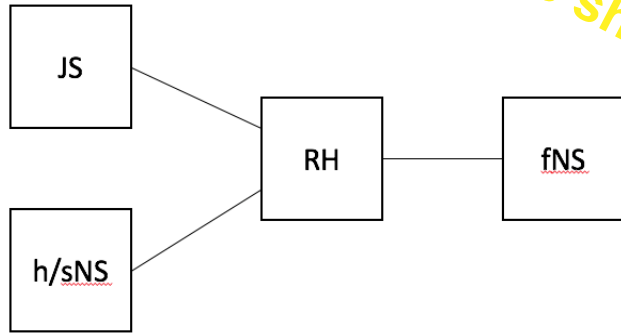
JS: Join Server
fNS: Forwarding Network Server
sNS: Serving Network Server
RH: Roaming Hub

ThingPark Exchange

- Accounting
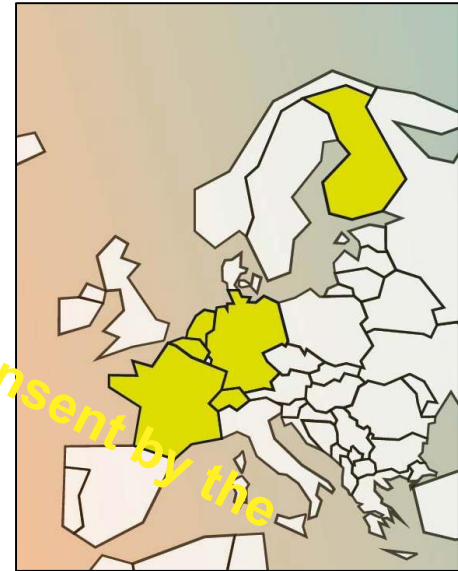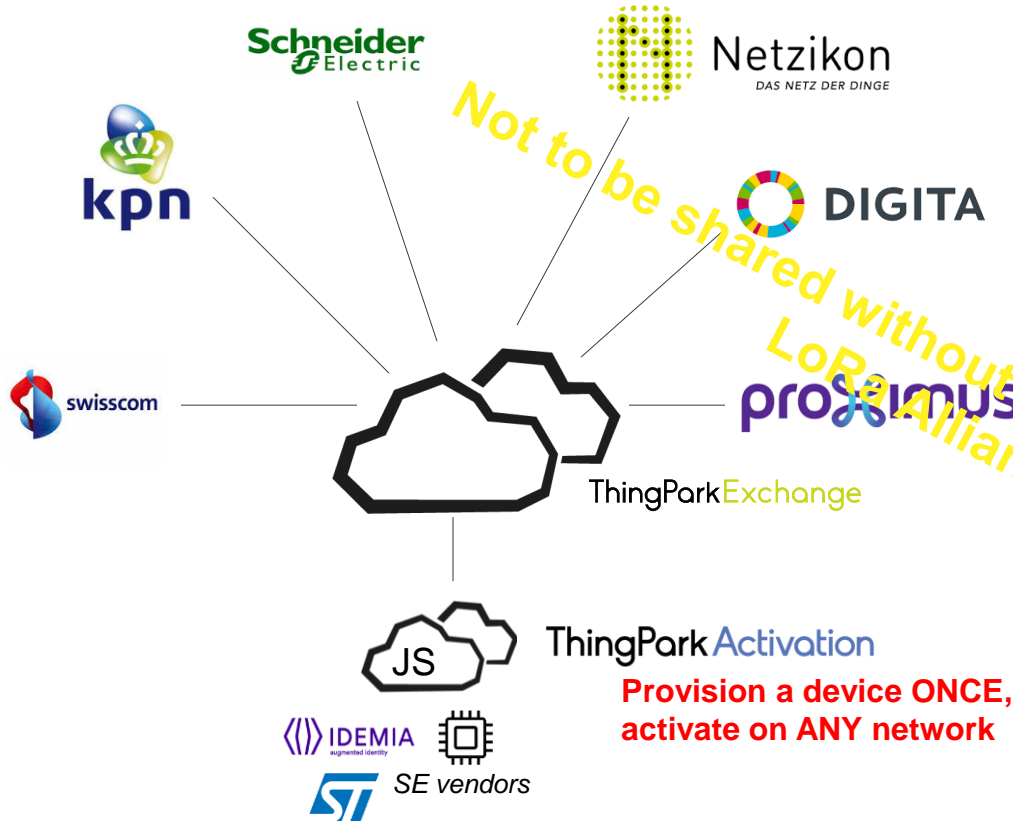- Policy control
- Message forwarder

Public Networks
Private Networks

Network Servers
Join Servers

ThingParkExchange

Actility Platforms
Non-Actility Platforms
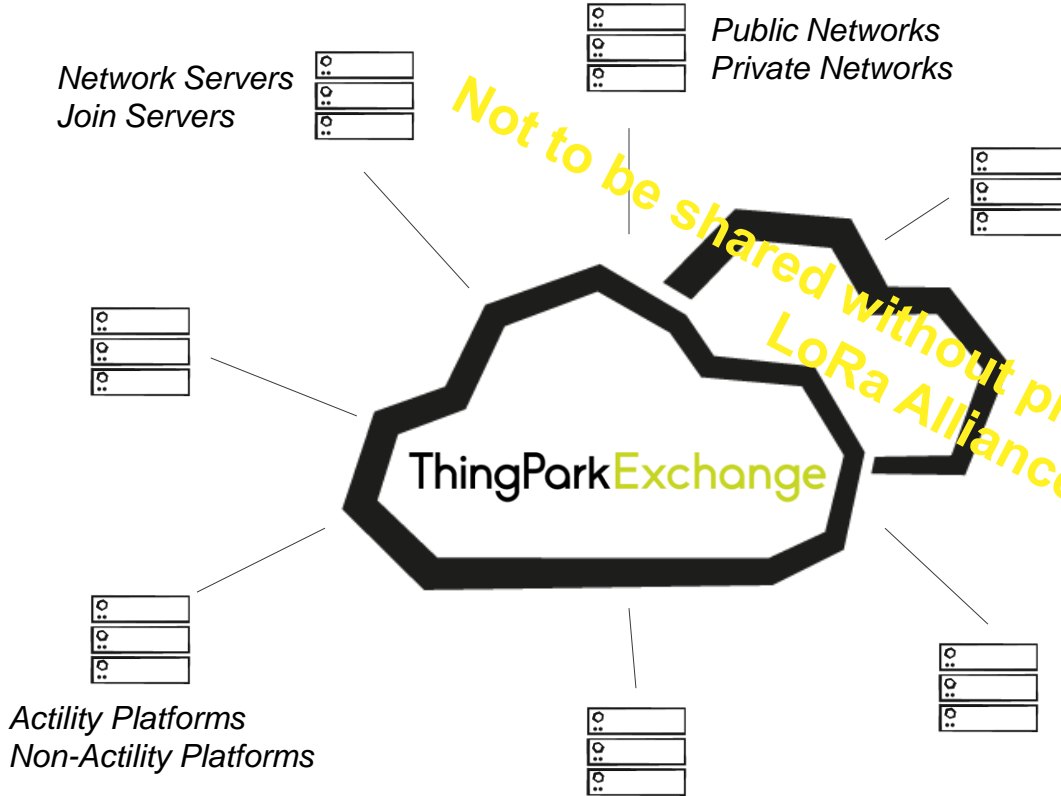
- Easy and scalable interconnections
  - Lower cost: **Interconnect your network ONCE, reach ANY network**
  - Faster network onboarding
  - Reaching a larger peering pool
    - Any size, any vendor, any geography
- Centralized and extensible policy control
- Security shield against NS/JS peering nodes
- Extensible business/peering models
- Unified and live visibility (web UI, UDRs, logs)

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LoRaWAN

Actility
Connecting with intelligence

+ Levikom, Enforta (ERTH), …

Provision a device ONCE, activate on ANY network
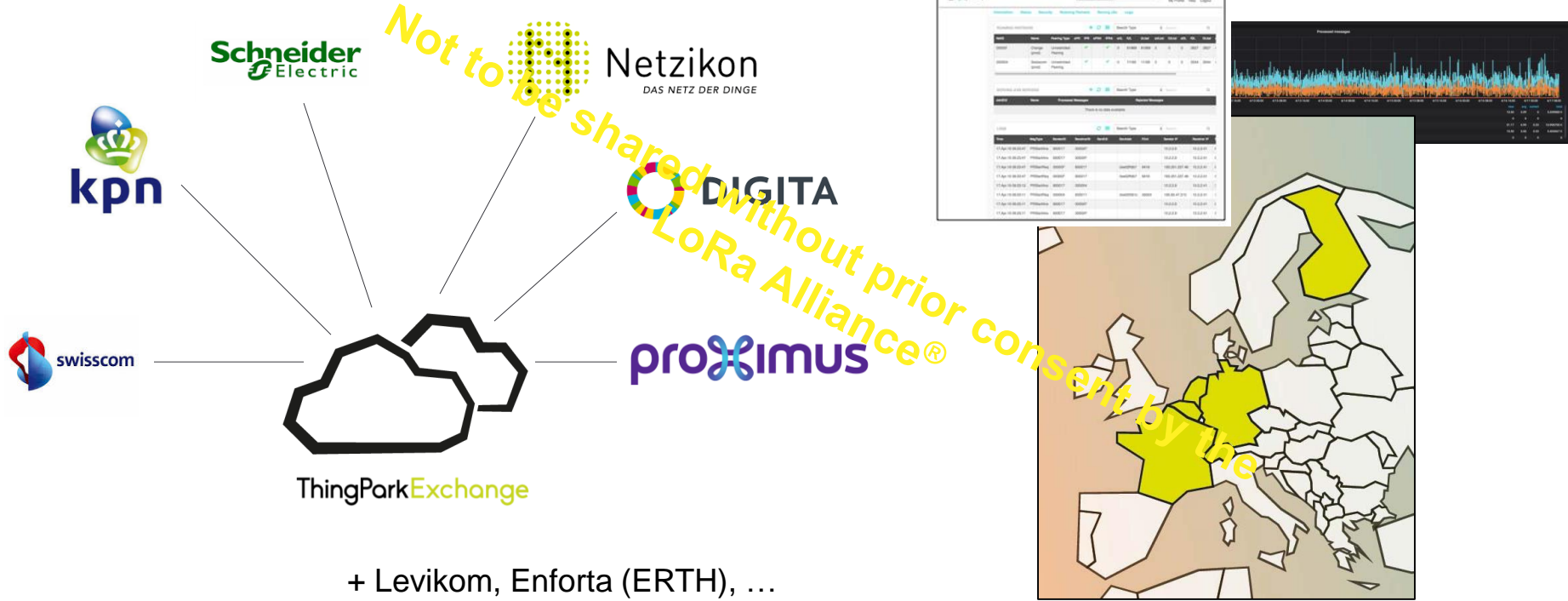
Roaming standard available

Implemented

Deployed

Welcome to join!