Déploiement d'un testbed LoRaWAN métropolitain ouvert

Motivations, architecture et perspectives

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Sommaire

LoRa

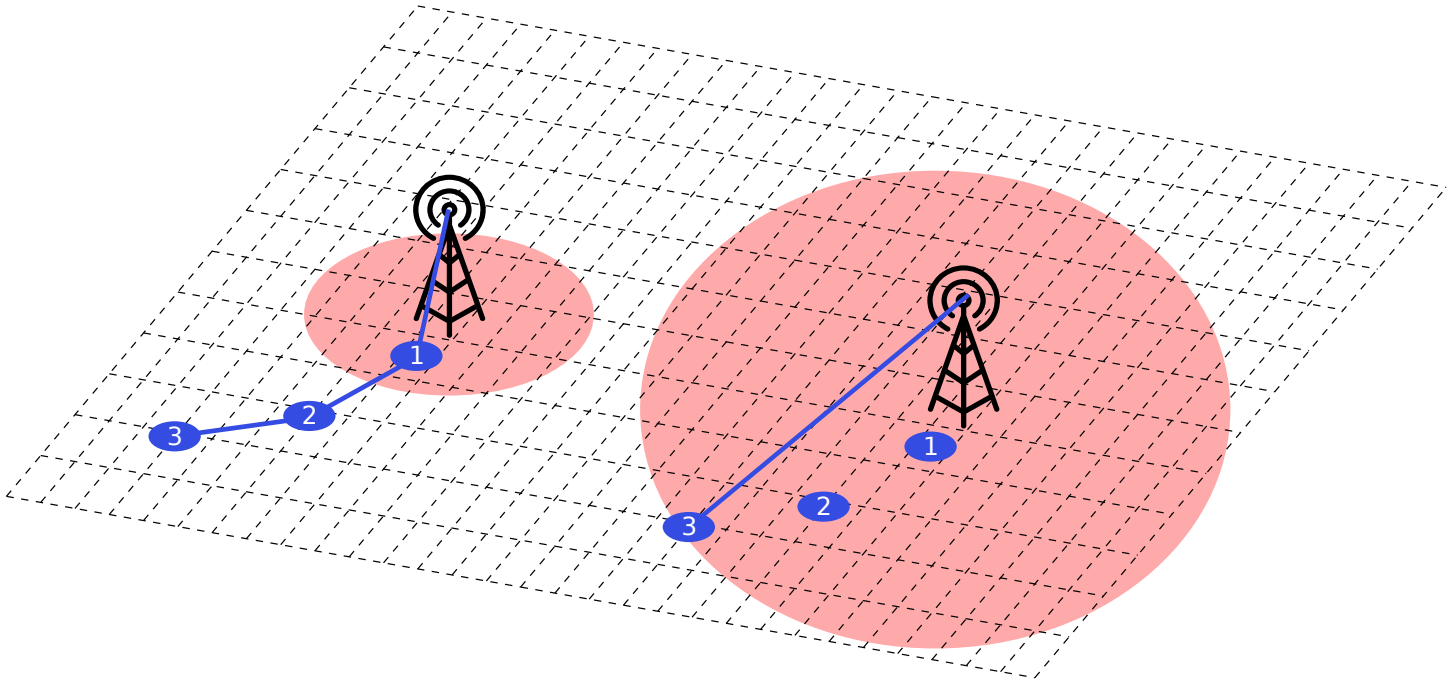
Historique

- Création de la startup toulousaine Sigfox en 2009
- Rachat de la startup grenobloise Cycléo en 2012 par Semtech
- Création de la LoRa Alliance pour promouvoir la technologie
- Création de The Thing Network en 2015

Points clés

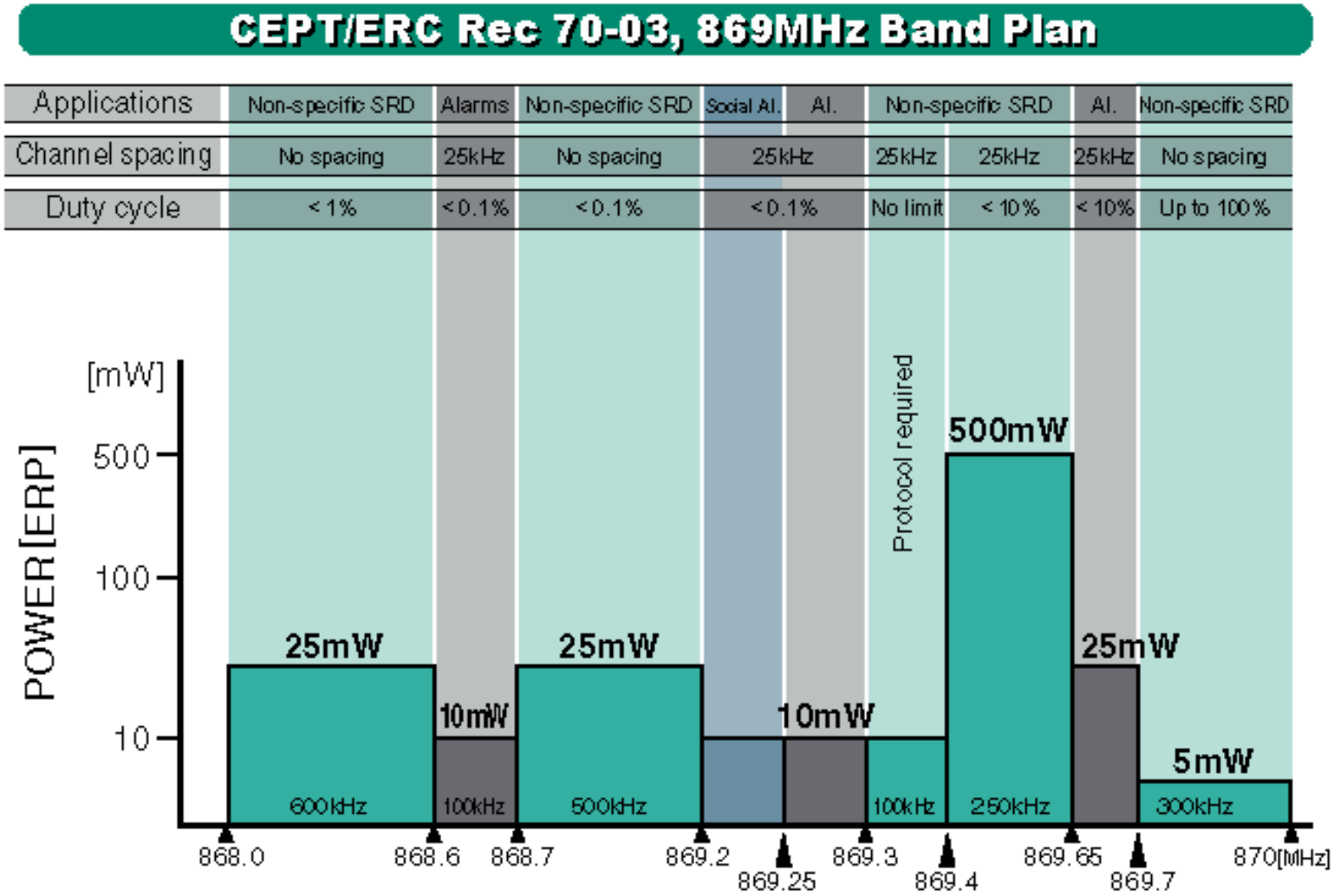
- Messagerie pour les objets à faibles ressources
- Utilisation des bandes ISM
- Portée de plusieurs kilomètres (1km -> 10km)

Du multi-saut au multi-canal



Comparaison entre MAC multi-saut et MAC multi-canal

Bande ISM 868MHz



Application de la législation

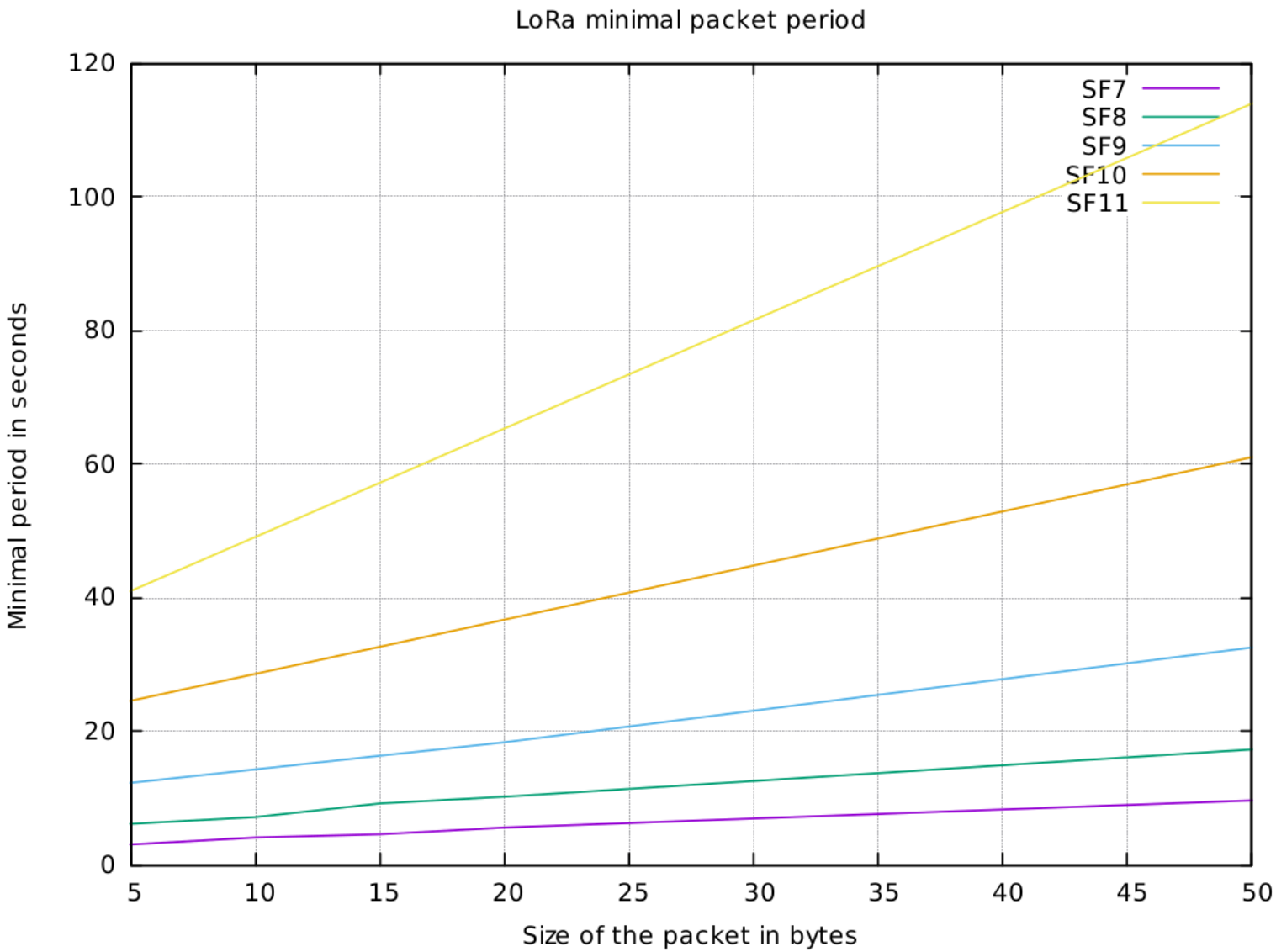
Utilisation du rapport cyclique

- Attente de t x 99 secondes après émission d'une trame de t secondes
- Maximum d'émission de 36 secondes par heure glissante

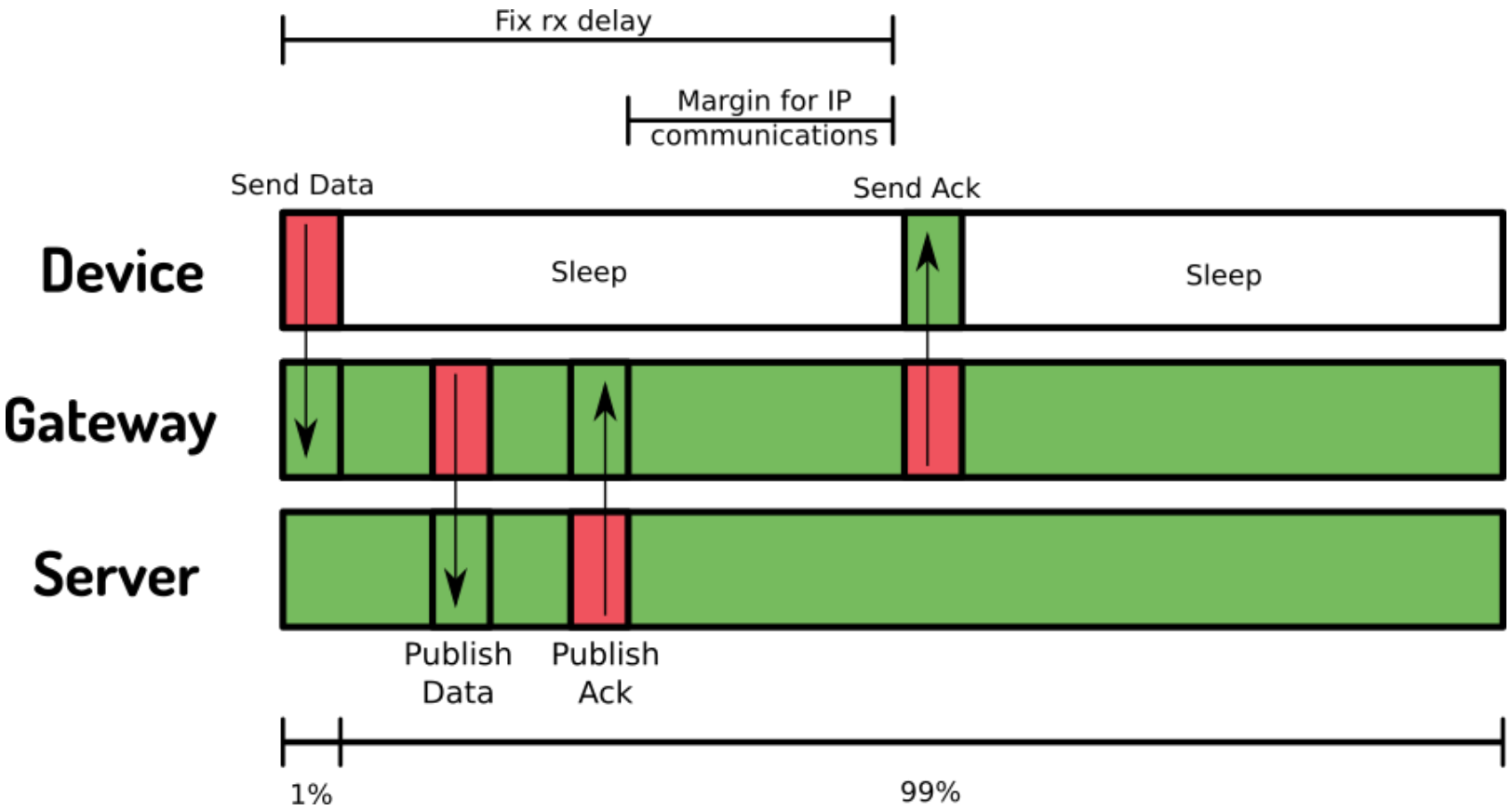
Utilisation du Listen Before Talk

- Écoute du médium avec d'émettre une trame

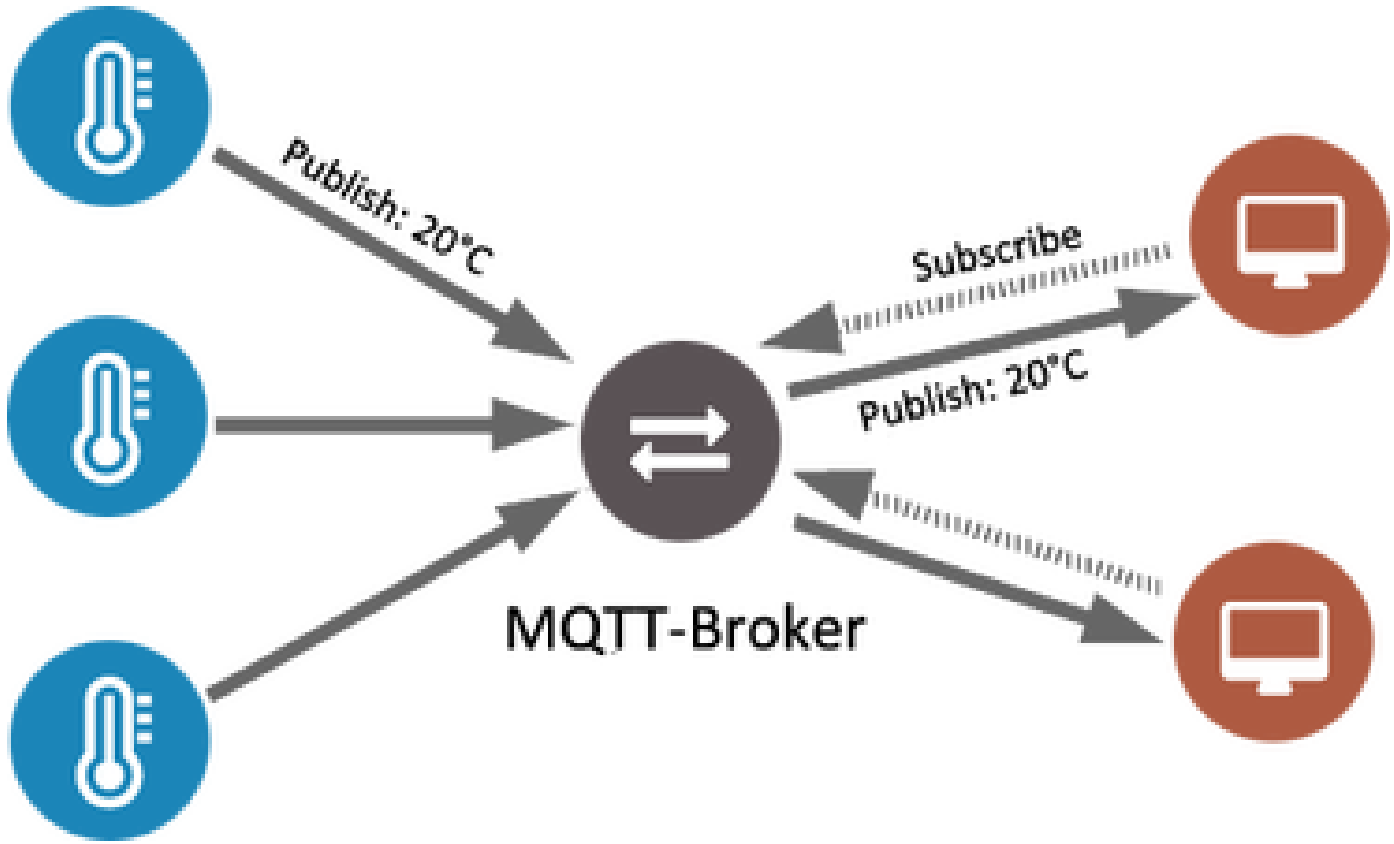
Rapport cyclique



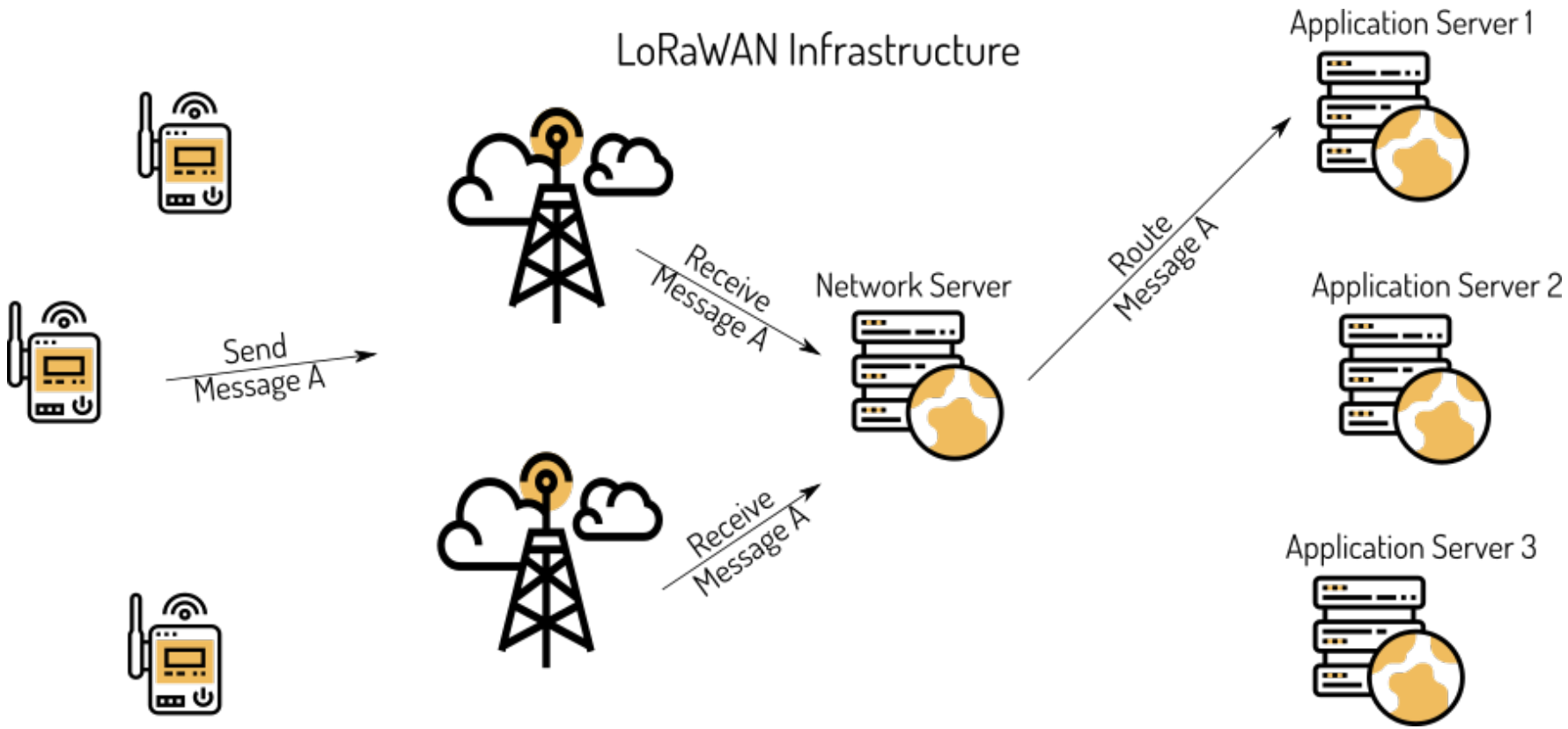
Rapport cyclique LoRa et communication IP



Publish/Subscribe design pattern



LoRaWAN Architecture

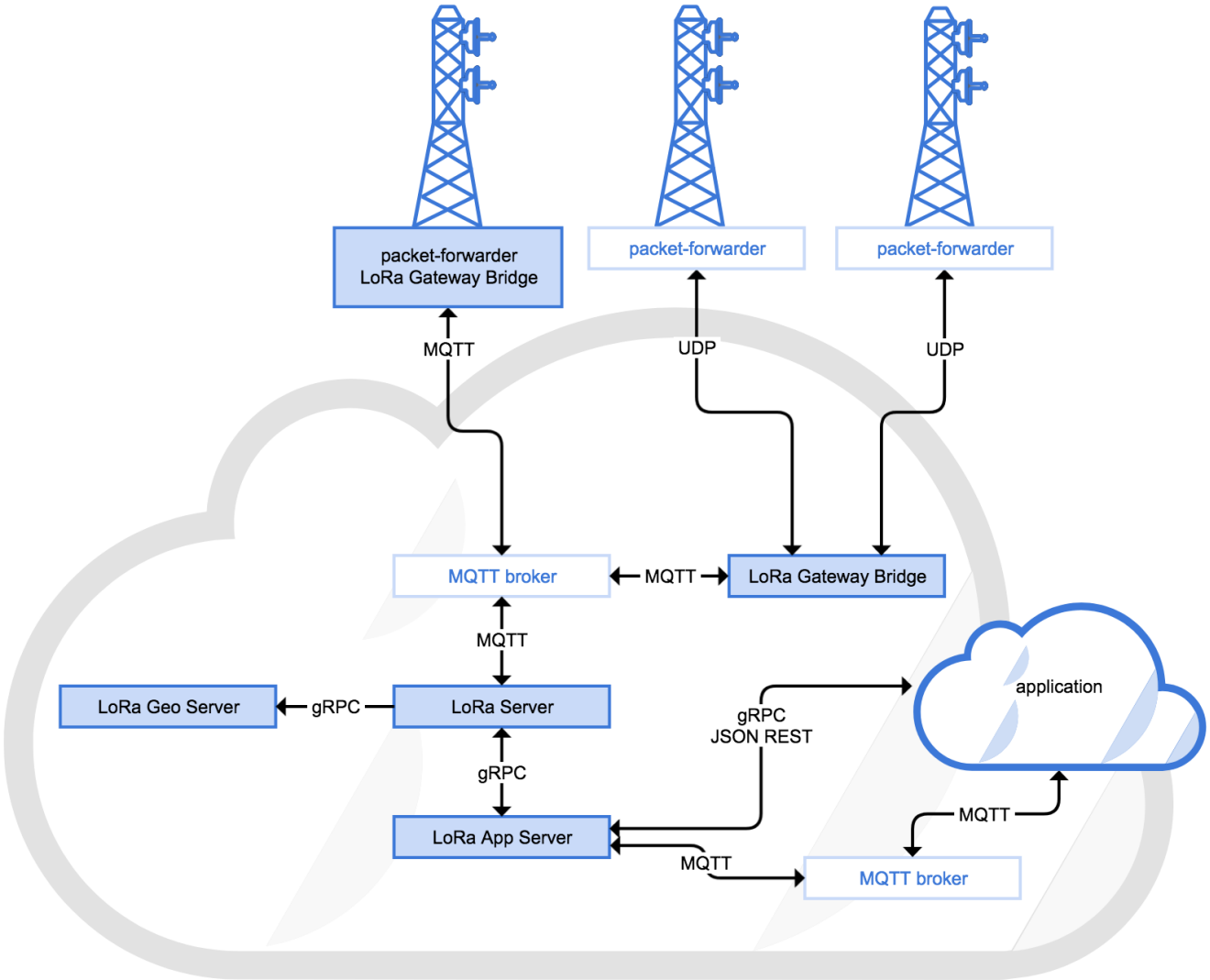


loraserver.io écosystème

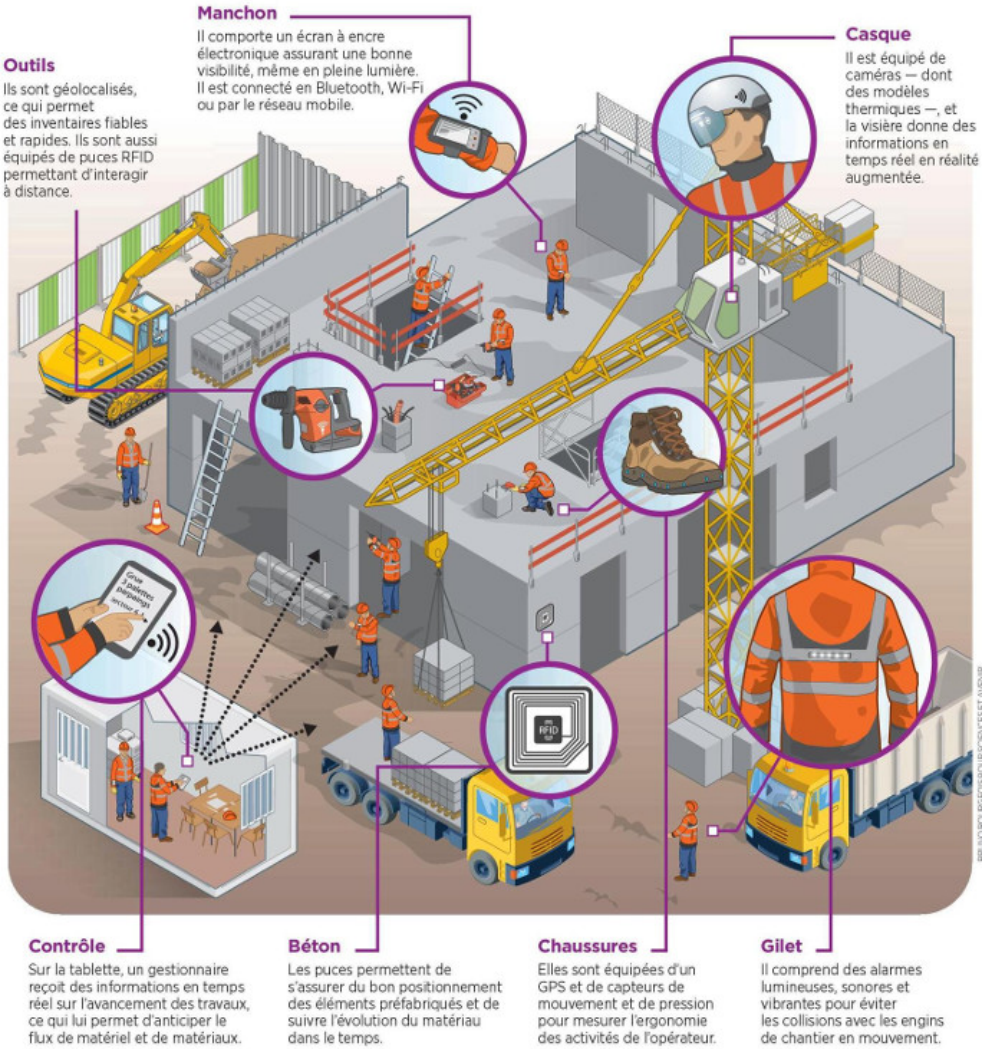
Briques logicielles

- OS pour les gateways
- Traducteur packet forwarder vers MQTT
- Network server
- Application server
- Interface web de management

loraserver.io architecture



Cas d'application : chantier connecté

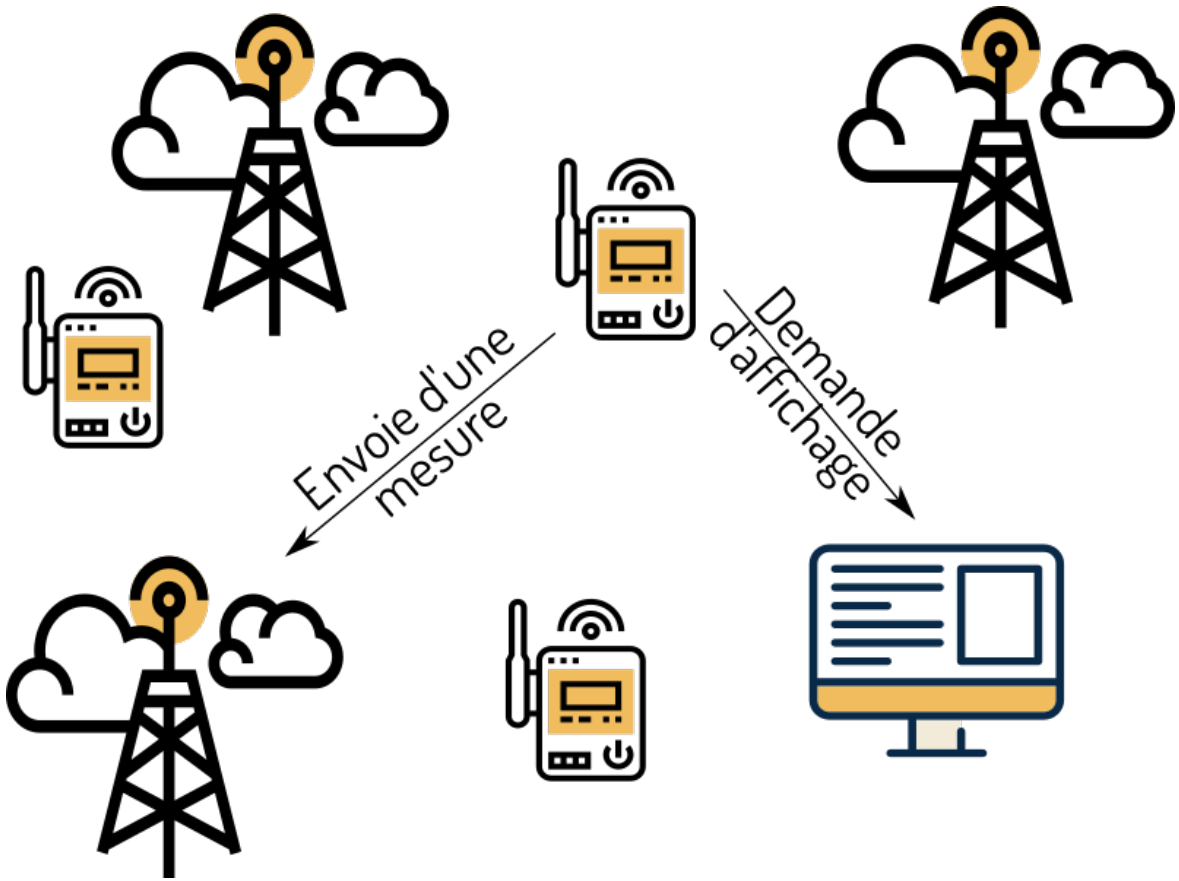


https://com-1.fr/blog/tag/securite/

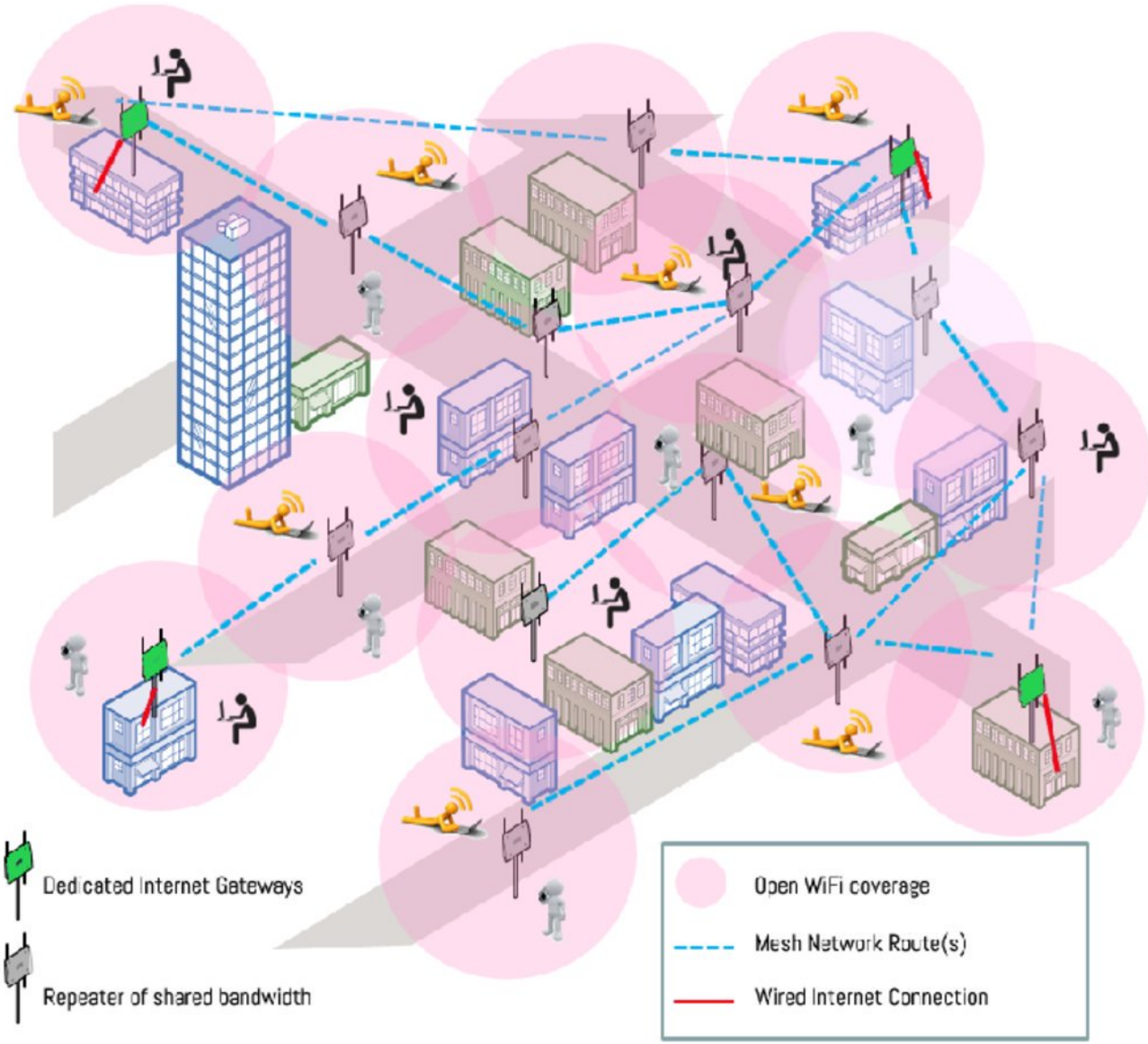
Monitoring des engins de chantiers

```
61444 00 35 | ff ff 91 c8 19 ff f0 ff | Electronic Engine Controller 1                    | 825 rpm
61444 00 35 | ff ff 91 b3 19 ff f0 ff | Electronic Engine Controller 1                    | 822 rpm
61444 00 35 | ff ff 92 b3 19 ff f0 ff | Electronic Engine Controller 1                    | 822 rpm
61443 00 35 | ff 0d 1f ff ff ff ff ff | Electronic Engine Controller 2                    | 12 %
61444 00 35 | ff ff 92 bb 19 ff f0 ff | Electronic Engine Controller 1                    | 823 rpm
61444 00 35 | ff ff 91 bb 19 ff f0 ff | Electronic Engine Controller 1                    | 823 rpm
65241 00 38 | 00 10 03 0f 00 14 00 14 | Auxiliary Input/Output Status 1                   |
61444 00 35 | ff ff 91 c4 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
61444 00 35 | ff ff 91 c7 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
65266 00 38 | 67 00 ff ff ff ff ff ff | Fuel Economy (Liquid)                             | 5.150000 L/h
65174 00 38 | 34 ff ff ff ff ff ff ff | Turbocharger Wastegate                            |
61443 00 35 | ff 0d 1e ff ff ff ff ff | Electronic Engine Controller 2                    | 12 %
65264 00 38 | ff ff ff ff ff ff ff ff | Power Takeoff Information                         |
61444 00 35 | ff ff 91 c7 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
61444 00 35 | ff ff 91 c9 19 ff f0 ff | Electronic Engine Controller 1                    | 825 rpm
61444 00 35 | ff ff 91 bf 19 ff f0 ff | Electronic Engine Controller 1                    | 823 rpm
65247 00 38 | ff bc 19 ff ff ff ff ff | Electronic Engine Controller 3                    |
61444 00 35 | ff ff 91 bf 19 ff f0 ff | Electronic Engine Controller 1                    | 823 rpm
61443 00 35 | ff 0d 1e ff ff ff ff ff | Electronic Engine Controller 2                    | 12 %
61444 00 35 | ff ff 91 b0 19 ff f0 ff | Electronic Engine Controller 1                    | 822 rpm
65241 00 38 | 00 10 03 0f 00 14 00 14 | Auxiliary Input/Output Status 1                   |
61444 00 35 | ff ff 92 b0 19 ff f0 ff | Electronic Engine Controller 1                    | 822 rpm
61444 00 35 | ff ff 92 b9 19 ff f0 ff | Electronic Engine Controller 1                    | 823 rpm
65266 00 38 | 69 00 ff ff ff ff ff ff | Fuel Economy (Liquid)                             | 5.250000 L/h
65174 00 38 | 34 ff ff ff ff ff ff ff | Turbocharger Wastegate                            |
65264 00 38 | ff ff ff ff ff ff ff ff | Power Takeoff Information                         |
61444 00 35 | ff ff 92 c1 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
61443 00 35 | ff 0d 1e ff ff ff ff ff | Electronic Engine Controller 2                    | 12 %
61444 00 35 | ff ff 92 c1 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
61444 00 35 | ff ff 91 c0 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
65271 00 38 | ff ff ff ff 3b 02 3b 02 | Vehicle Electrical Power 1                        |
65262 00 38 | 4b ff 00 ff ff ff ff ff | Engine Temperature 1                              | 35 degres
65253 00 38 | b7 b5 02 00 ff ff ff ff | Engine Hours Revolutions                          | 8879.549805 hours total operations
64968 00 38 | ff ff ff ff ff ff ff ff | Operator Primary Intermediate Speed Control state |
65269 00 38 | c8 ff ff 00 ff ff ff ff | Ambient Conditions                                |
65252 00 38 | ff ff ff fc ff ff ff ff | Shutdown                                          |
61444 00 35 | ff ff 91 c0 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
61444 00 35 | ff ff 91 c3 19 ff f0 ff | Electronic Engine Controller 1                    | 824 rpm
65241 00 38 | 00 10 03 0f 00 14 00 14 | Auxiliary Input/Output Status 1                   |
61443 00 35 | ff 0d 1e ff ff ff ff ff | Electronic Engine Controller 2                    | 12 %
61444 00 35 | ff ff 91 b8 19 ff f0 ff | Electronic Engine Controller 1                    | 823 rpm
```

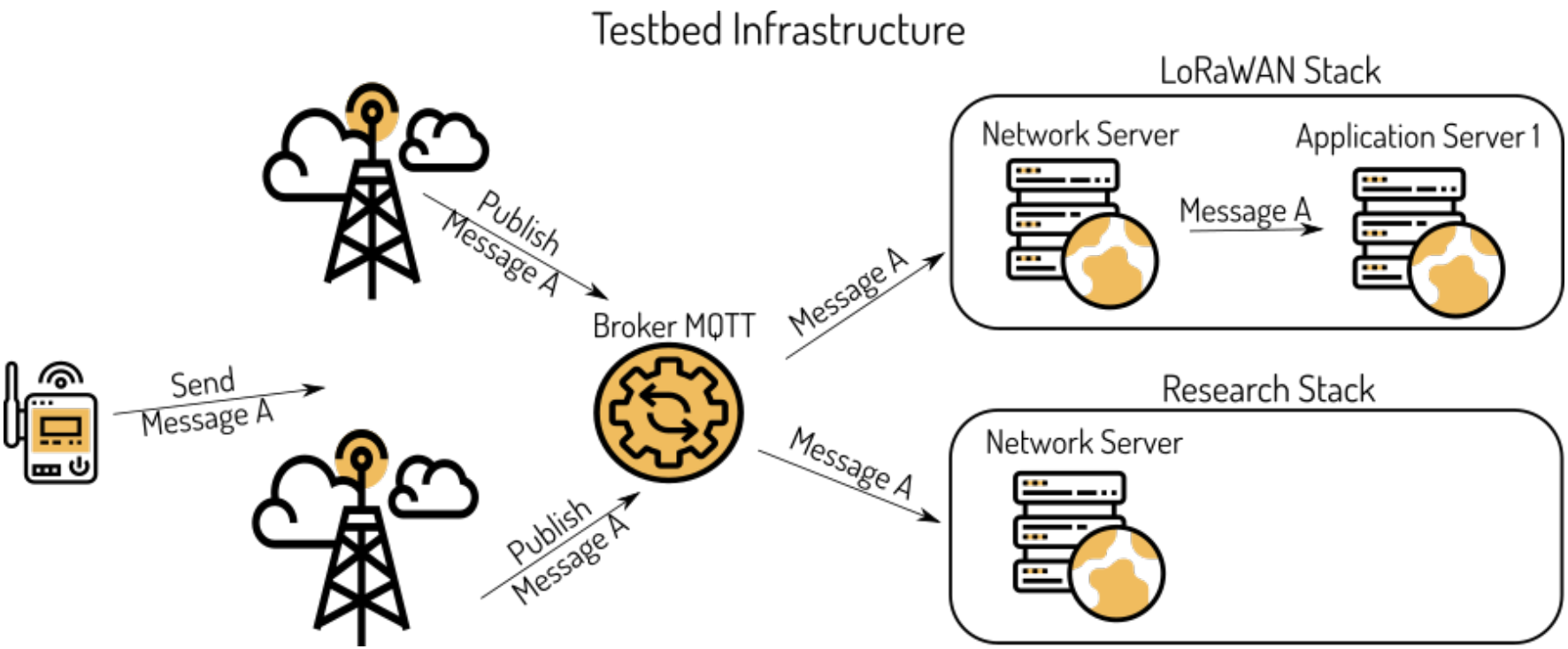
Nécessité de multicast et d'unicast entre objets



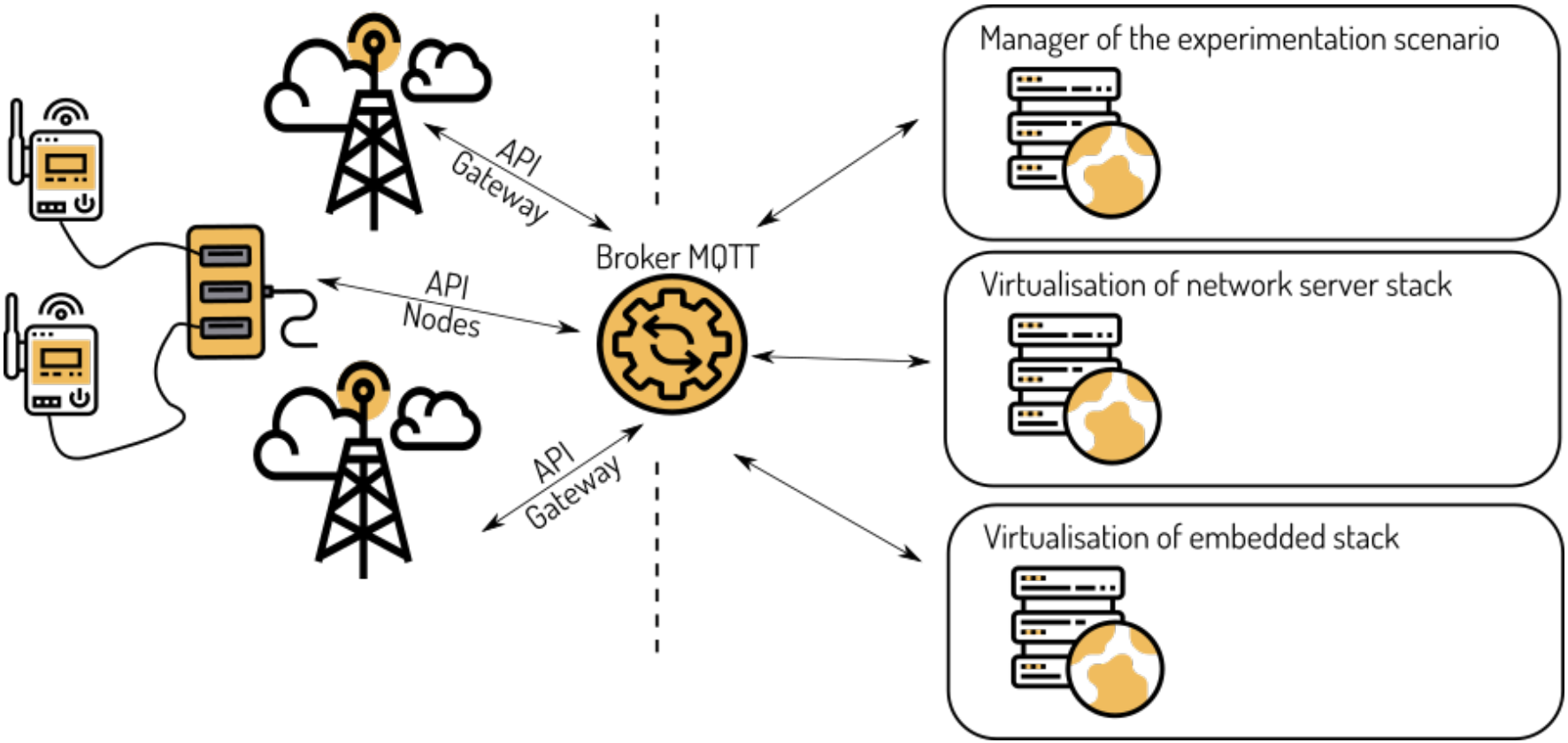
Réseau associatif Tetaneutral.net



Testbed Architecture



Network in the loop



Merci pour votre attention ! Des questions ?

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Contact