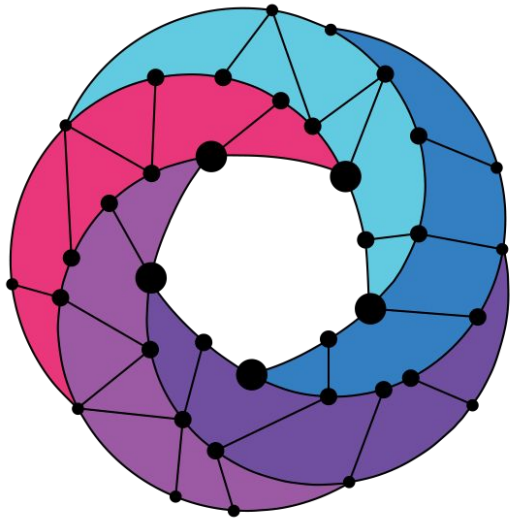

Open Source
MANO

# OSM #13 Hackfest

## Magma - A Free Wireless Core Network



ETSI

# Agenda

1. Magma
2. Private Mobile Networks
3. OSM

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# Magma

A Free Wireless Mobile Core Network



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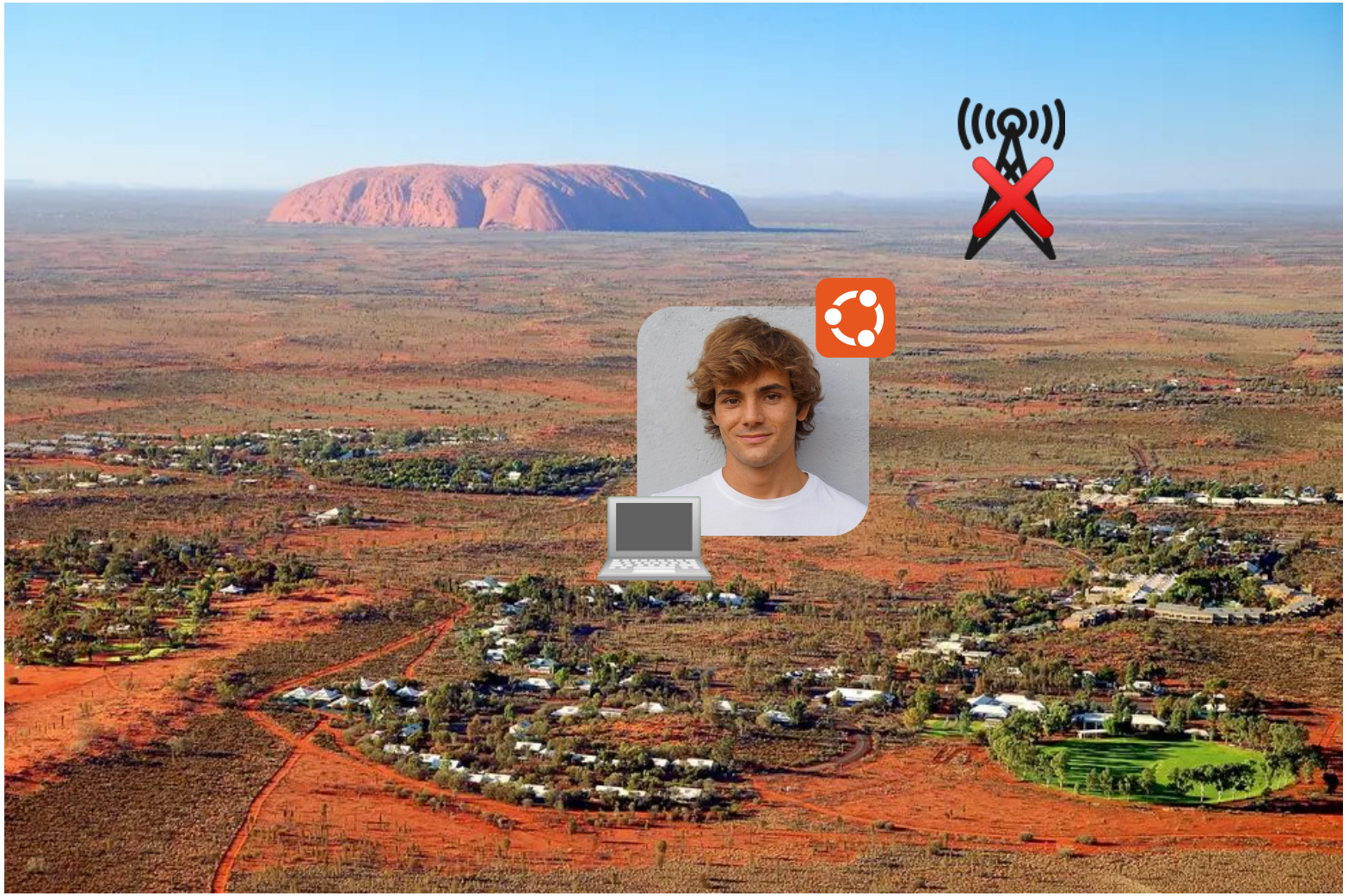
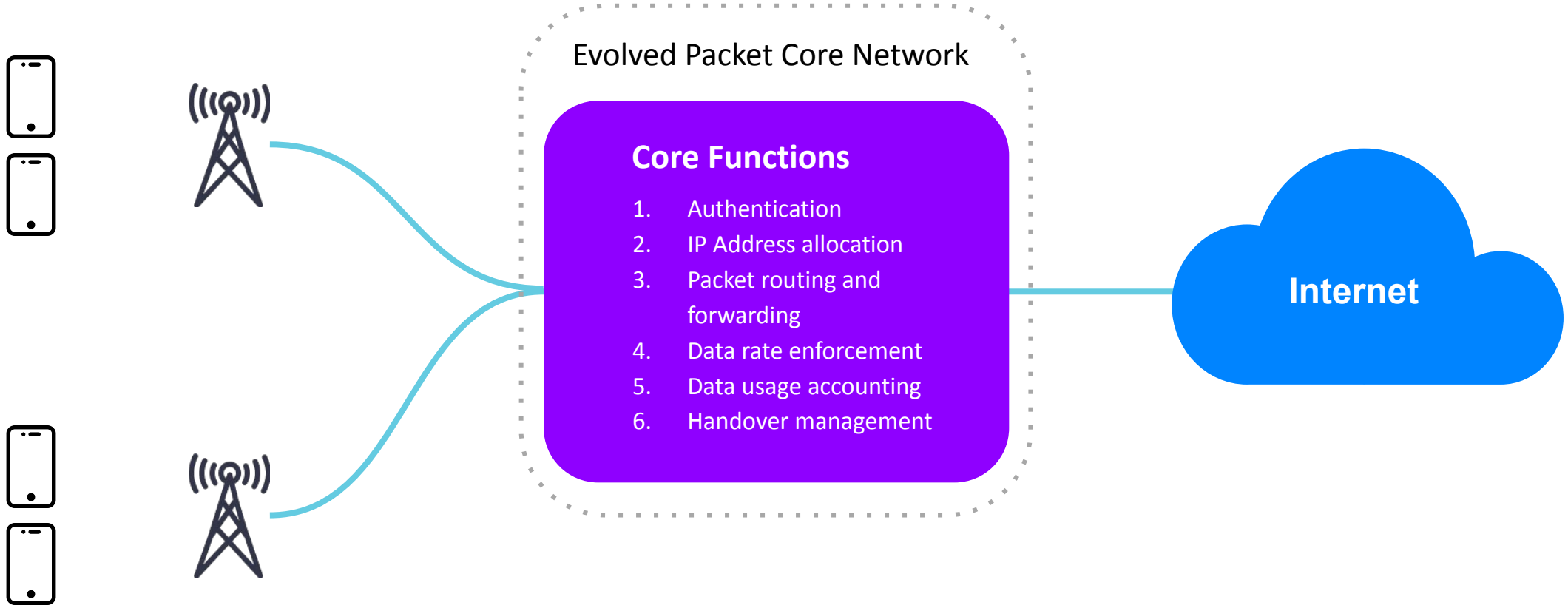
# Internet in Remote Communities



I want to be a remote developer from my remote village, but there's no internet connection.

Why don't ISPs extend their networks to this remote locations?

# What's a Core Network?



# What's the problem with Packet Cores?

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1. 💰 Vendors charge a lot of money for its Packet Core.
2. 🔒 Vendors lock you in to buy their expensive equipment.

**Why isn't a good idea using a cheaper vendor for the remote location?**

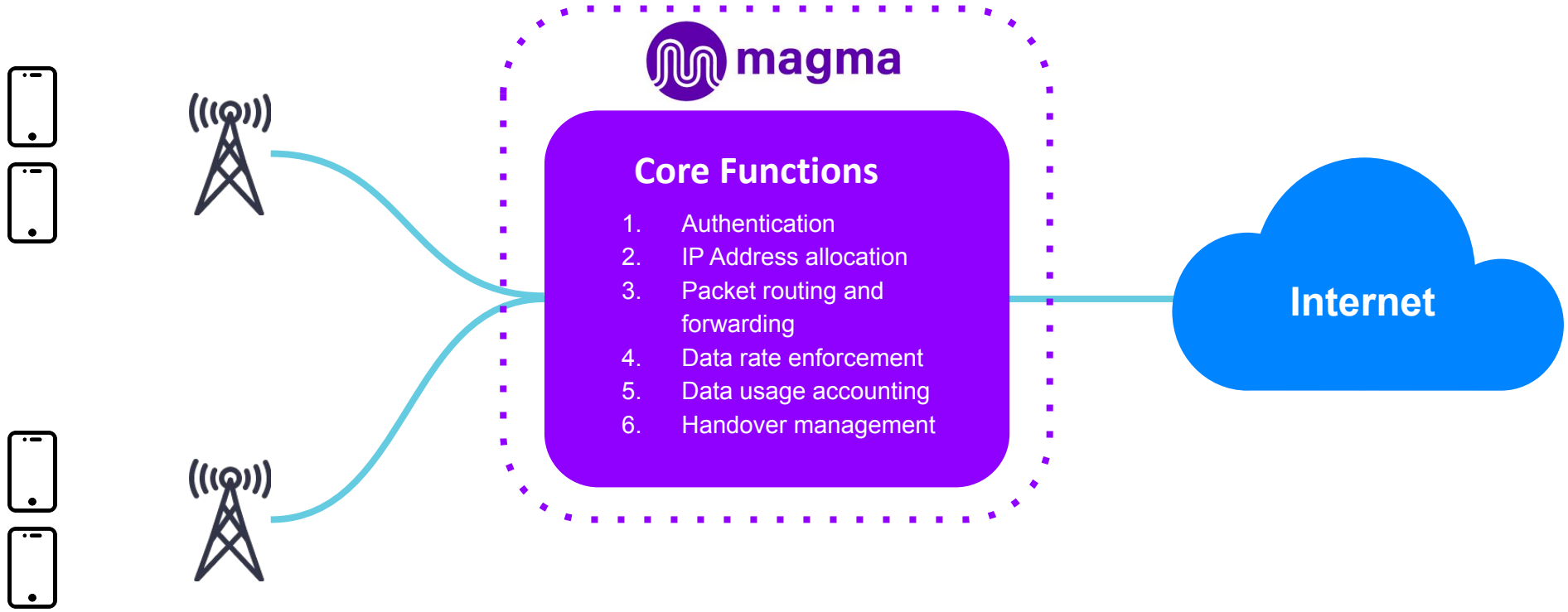
1. Pay for a second Packet Core.
2. Train your existing employees to use the new Packet Core, or even hire additional ones.
3. The Network Management system increases in complexity.
4. If you want to introduce a new feature, you'll have to wait for both vendors to support that feature.

# Serving Remote Communities is Expensive


*"The CRTC has established the Broadband Fund to help provide all Canadians with access to broadband Internet and mobile wireless services. During its first five years of operation, the Fund will award up to $750 million to projects that help achieve this goal."*

# Then, What is Magma?

Magma is an EPC (Evolved Packet Core) that runs on K8s



# Magma runs on

Open Source MANO

Generic Hardware

+


Cloud

(Public or Private)

**No need for expensive vendor dedicated hardware**

# How does Magma solve the problem?

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### Easy to deploy

Get up and running quickly with Magma-embedded hardware and qualified partners who can help you implement Magma.

### No licensing fees

Magma is open-source and has no licensing fees. Switching to Magma could save you 70% on your CAPEX and OPEX.

### Vendor-agnostic

Magma interoperates with a broad range of equipment helping you avoid vendor lock-in and enjoy enhanced flexibility.

### Rich developer support

Magma is backed by a robust developer community, ensuring cutting-edge features, quality assurance, and free upgrades.

### Open APIs

Integrate with your existing BSS/OSS or a new bread of management platforms using simple to use yet robust and open APIs.

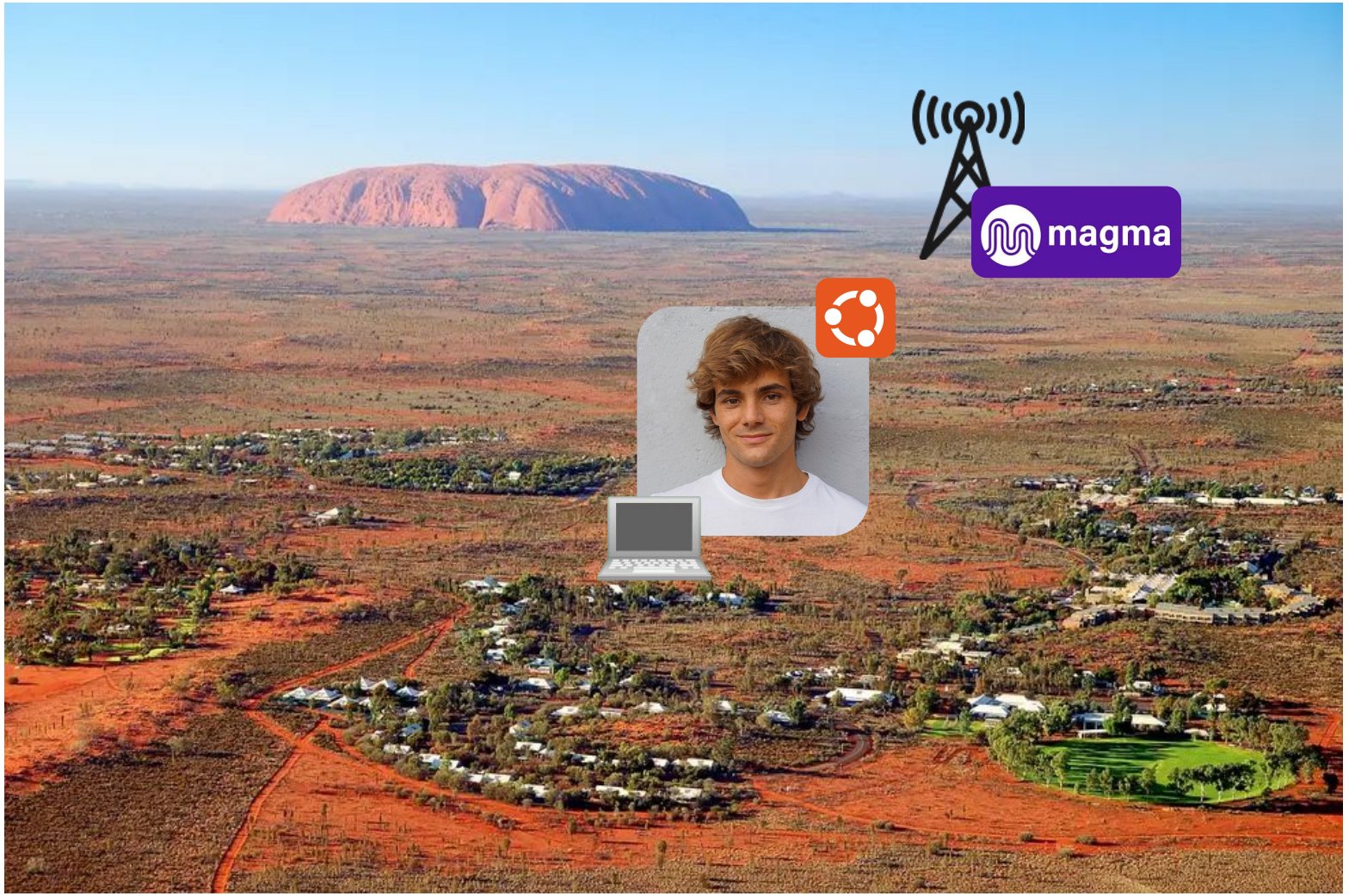
### 3GPP compliant

Compliant converged packet core that supports 4G (S1U, S1-MME), 5G NSA, 5G SA (N1, N2, N3), and integration with third party HSS, OCS and PCRF.

### Local breakout

Skip unnecessary backhaul traffic and deliver user traffic to the internet at the most efficient and cost effective location.

# Internet in Remote Communities




Now MNOs have cheap way to extend their networks to remote locations.

And Javier can work from its remote village to find the peace he wants.

# Magma a free open-source, flexible, and extendable mobile Packet Core network.

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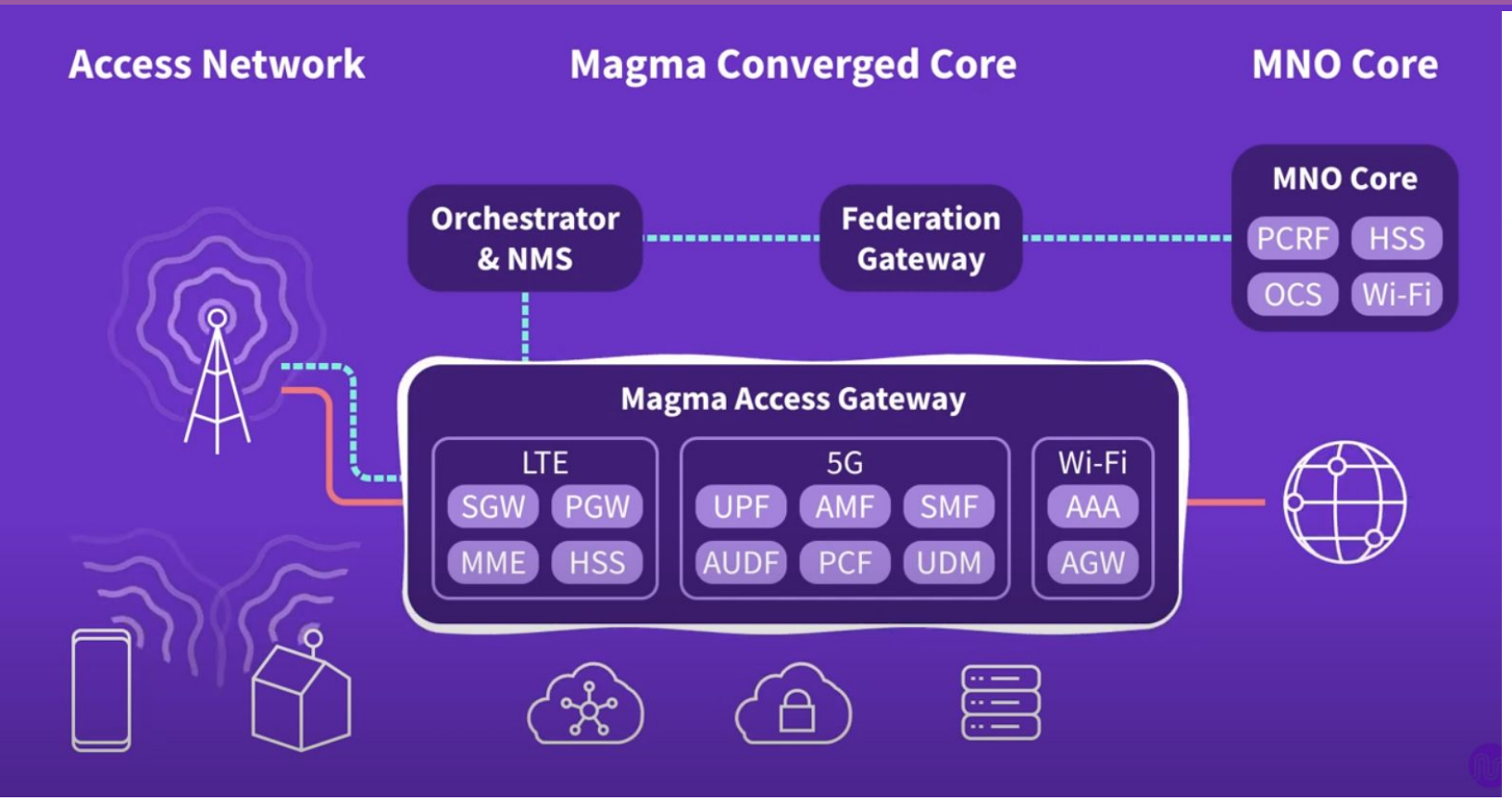



Magma Core Foundation Member - Premier

arm facebook QUALCOMM Red Hat

Magma Core Foundation Member - General

ØCHAIN Aarna Networks ADSACOM CANONICAL

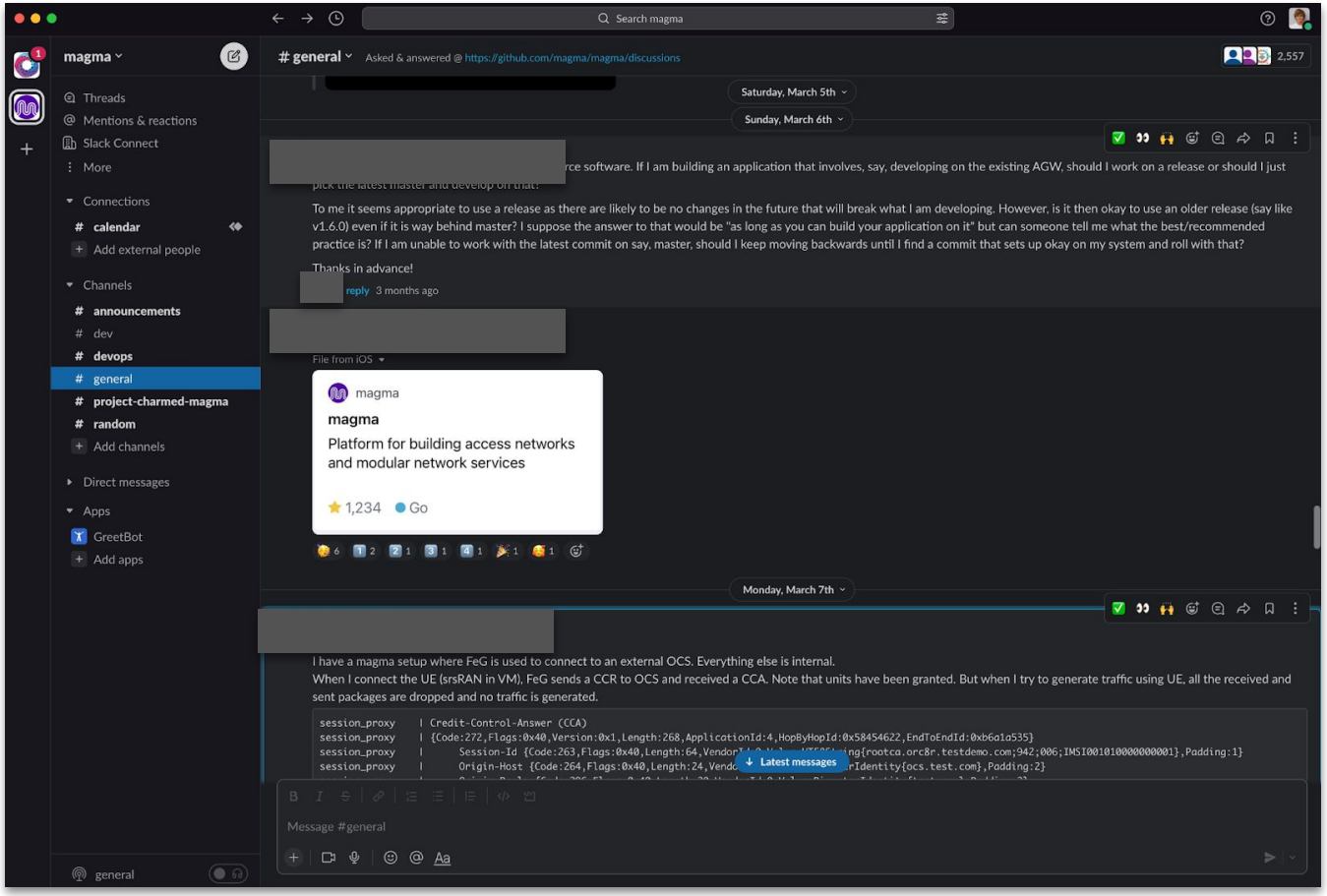
CONNECT 5G helium HIGHWAY 9 NETWORKS PLATFORM9

RADTONICS SEMPRE SHOELACEWIRELESS TEAL

wavelabs whitestack

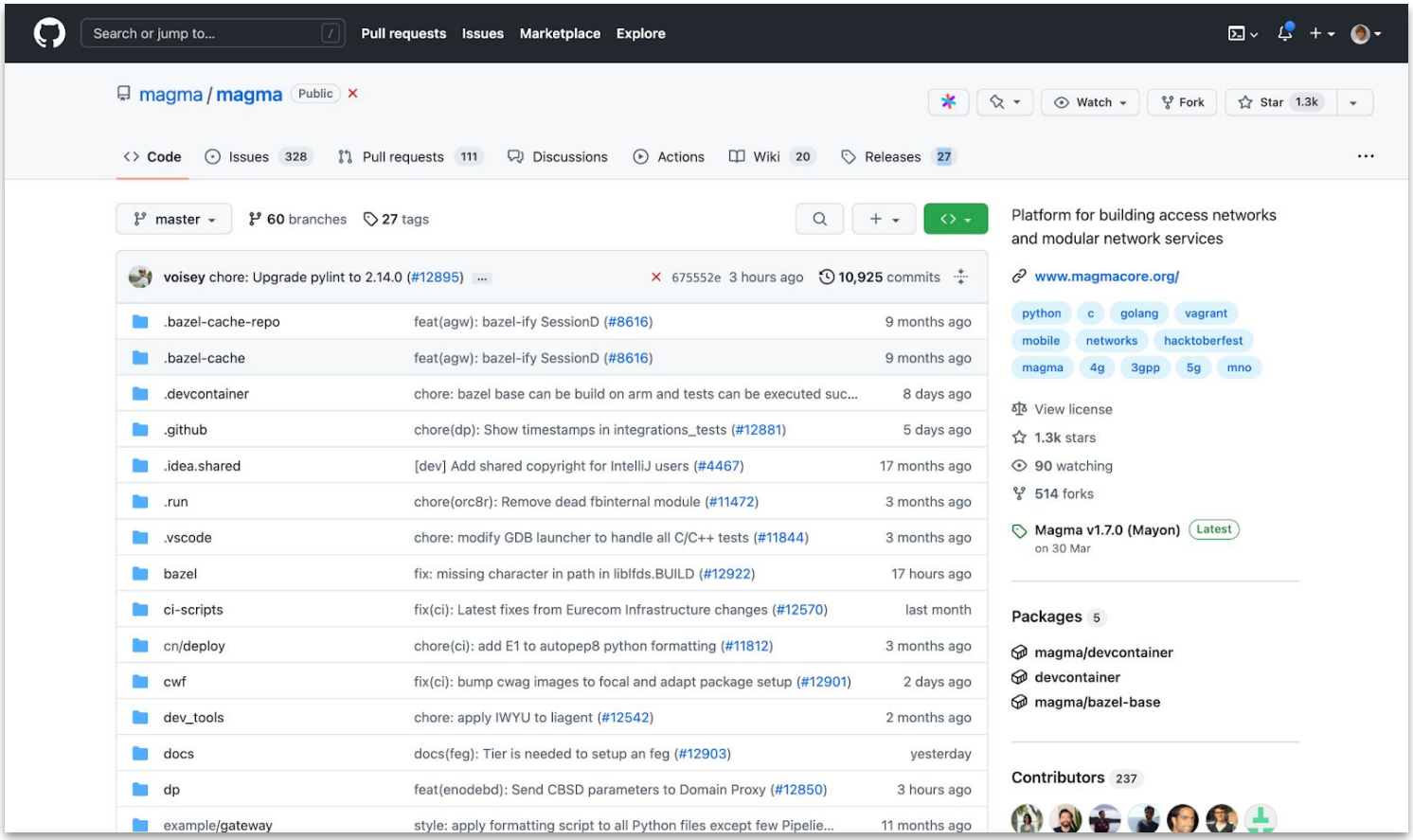
**Learn more on [www.magmacore.org](http://www.magmacore.org)**

# Magma's Slack Community




https://magmacore.slack.com/

# I want to contribute




https://github.com/magma/magma

# Magma's Mission

*Connect the world to a faster network by enabling service providers to build cost-effective, extensible and career grade networks*

# Components Overview

Open Source MANO

## Access Gateway

- Contains core network elements
- In an LTE network:
  - Evolved Packet Core (EPC)
  - Connectivity with EnodeB's

## Orchestrator

- Cloud service
- Allows user to configure and monitor the wireless network
- Allows management of multiple Access Gateways
- Web UI

## Federation Gateway

- Cloud service
- Integration with Mobile Network Operator

# Infrastructure Requirements

Open Source MANO

## Access Gateway

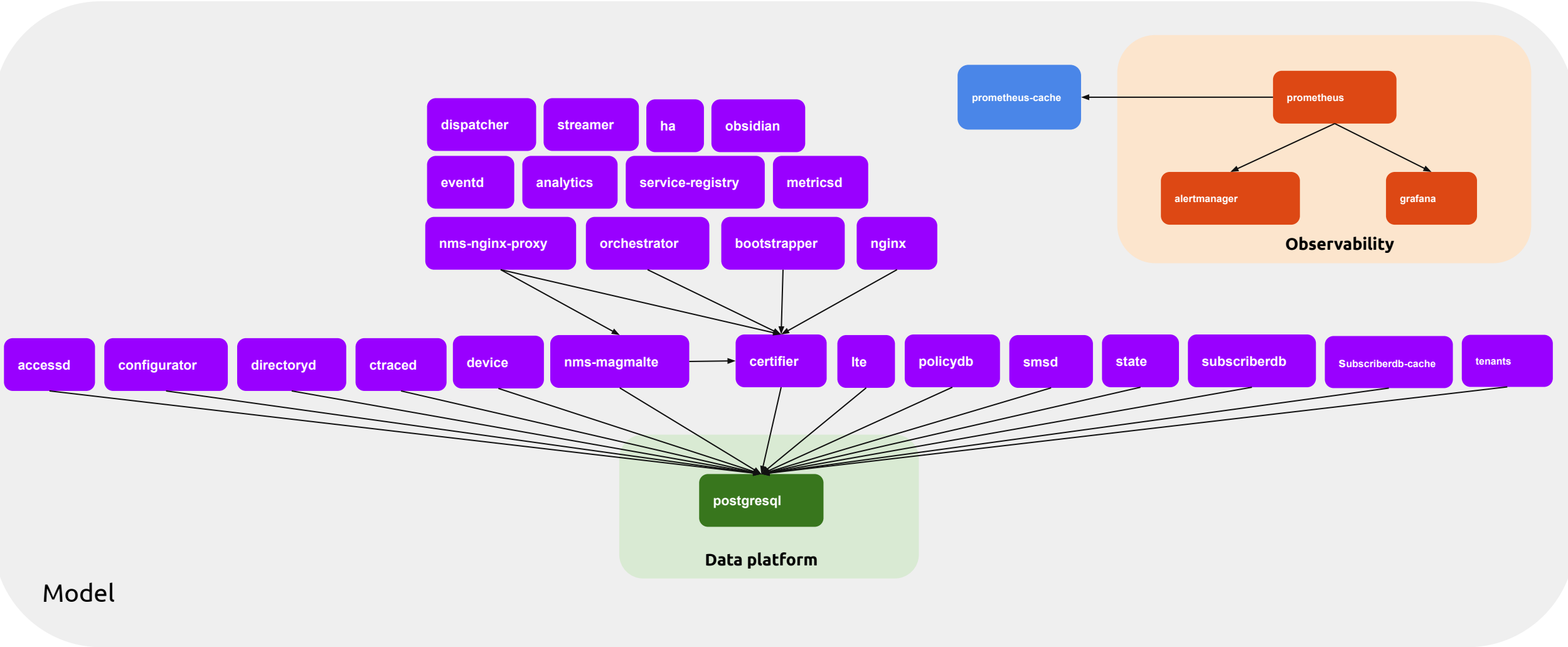
- Ubuntu
  - 20.04
  - snap
- Minimum Requirements
  - Memory: 4GB
  - CPU: x86-64 dual-core processor
  - Storage: 32 GB
  - Network: 2 Interfaces

## Orchestrator

- Kubernetes
  - Microk8s
  - Charmed Kubernetes
  - **AWS - EKS**
  - GCP - GKE
  - Azure - AKS
- Minimum Requirements
  - Nodes: 3
  - Memory: 8 GB
  - CPU: 2 vCPU
  - Storage: 100 GB

```
:~$ juju deploy magma-orc8r
```

Open Source MANO




Model

# :~$ snap install magma-access-gateway

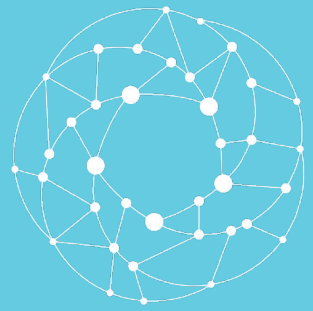
Open Source MANO

## Access Gateway

- Install: *magma-access-gateway.install*
- Configure: *magma-access-gateway.configure*
  - Automatic or manual networking configuration
  - Dynamic or static addressing
  - Custom DNS support
  - IPv6 support
  - Flexible interfaces selection
- Post-Install: *magma-access-gateway.post-install*
- Variety of configuration options:

## Available services

- dnsd
- policydb
- envoy_controller
- pipelined
- smsd
- mobilityd
- eventd
- magmad
- Sessiond
- enodebd
- directoryd
- state
- mme
- ctraced
- td-agent-bit
- subscriberdb
- health
- redis
- control_proxy
- monitord



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# Private Mobile Networks



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# What are private networks & drivers

A dedicated cellular network

Industry and digital transformation

IoT, Industry 4.0 applications, mission critical requirements, smart city initiatives, etc.

Enterprises with use cases requiring:

- Low latency
- High bandwidth
- QoS
- Reliability
- Security & Data Privacy
- Enhanced Capacity & Coverage
- Reliability
- Autonomy, security and control

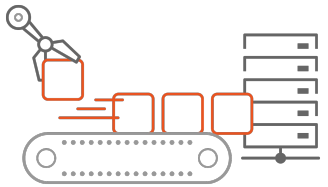
Transportation & Logistics

Automotive

Retail

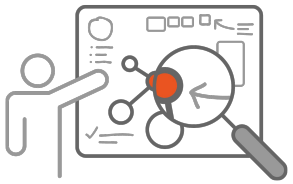
Agriculture

Open Source MANO

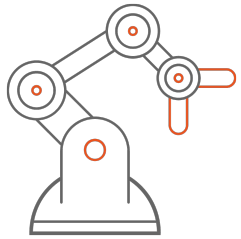


Industrial

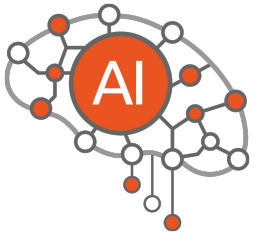
Energy & Utilities



Education and Offices



Robotics




Applied AI

Healthcare

Telco

Gaming

Data centers

Smart cities
Smart homes
Smart buildings

# Is 5G making potatoes grow in shape of a box ?

# Port logistics with a private mobile network

# Autonomous vehicles

# Immersive experiences - AR/VR

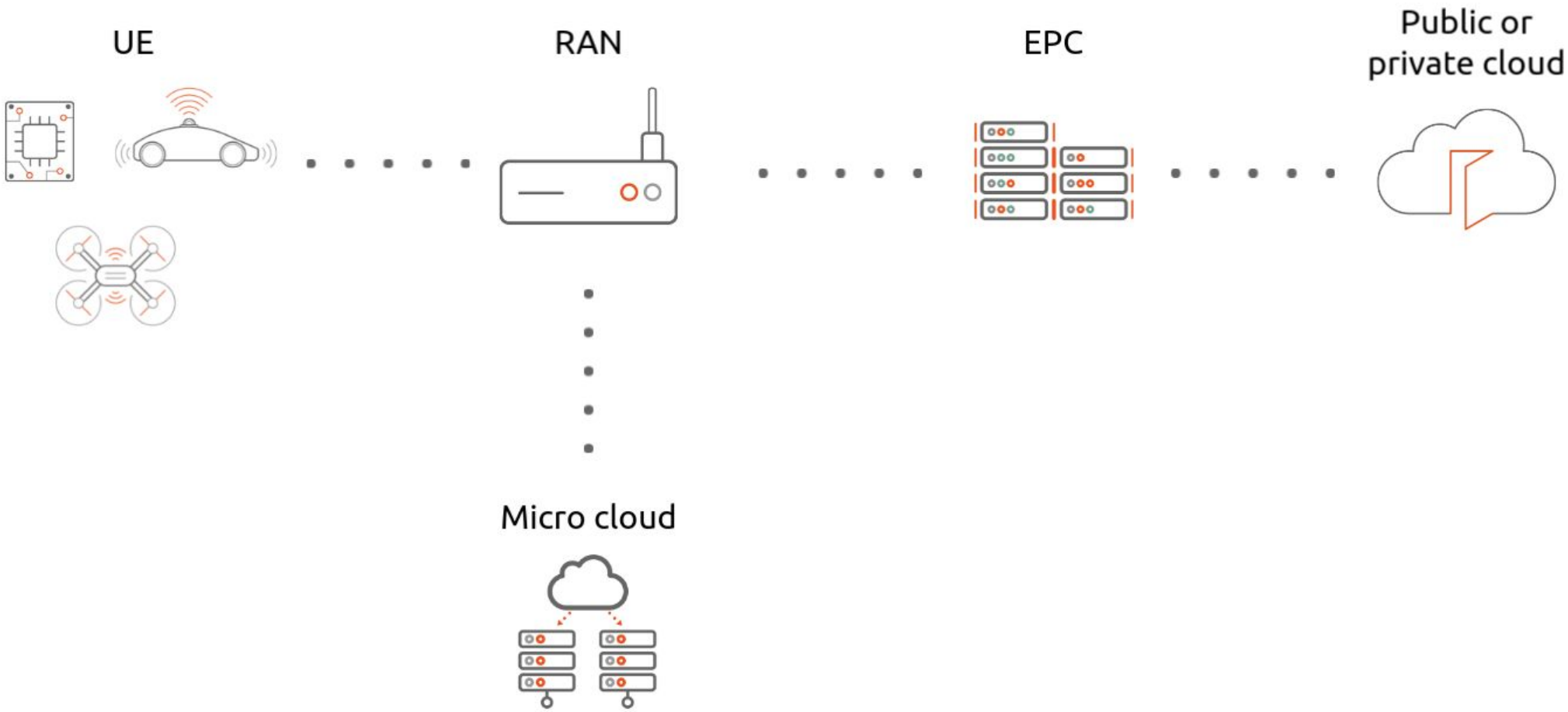
Training

Medicine

Manufacturing

Gaming

# Open Source projects - example small setup



# Open RAN choice - platform

Open Source MANO

SRS RAN

intel®


NVIDIA®

# My own experimentation

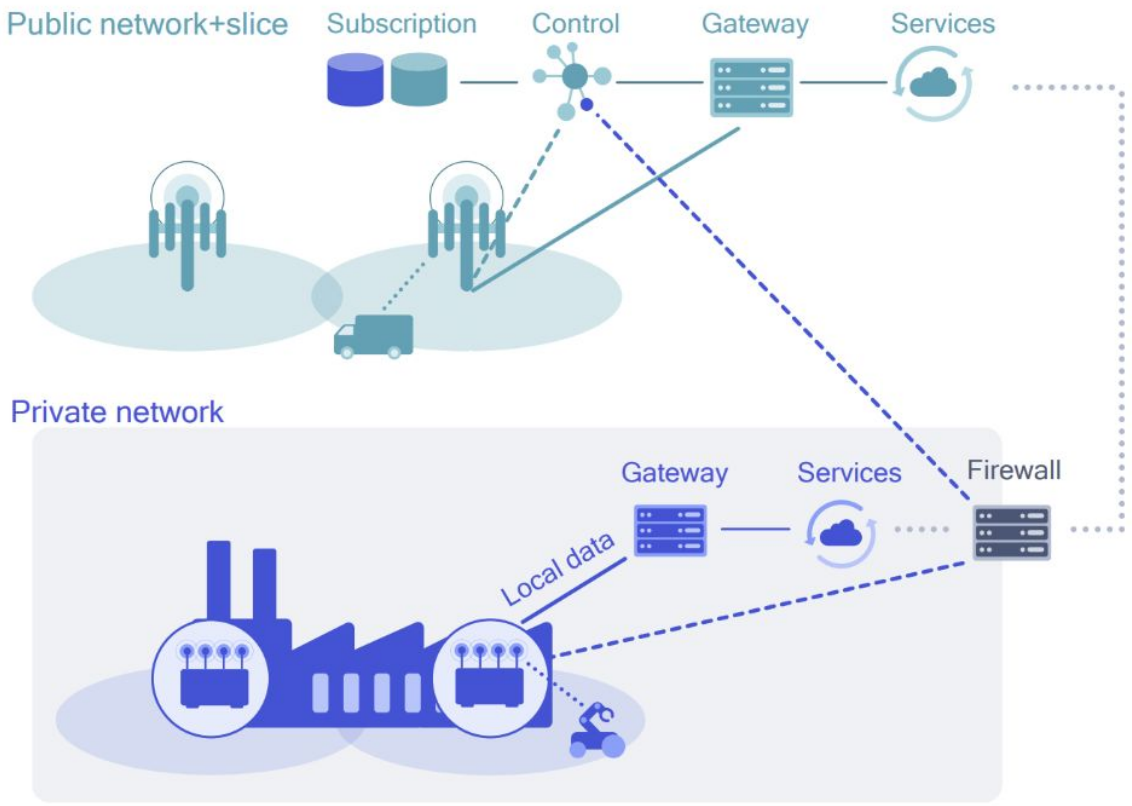
https://github.com/Nuand/bladeRF

https://www.intel.com/content/www/us/en/products/details/nuc.html

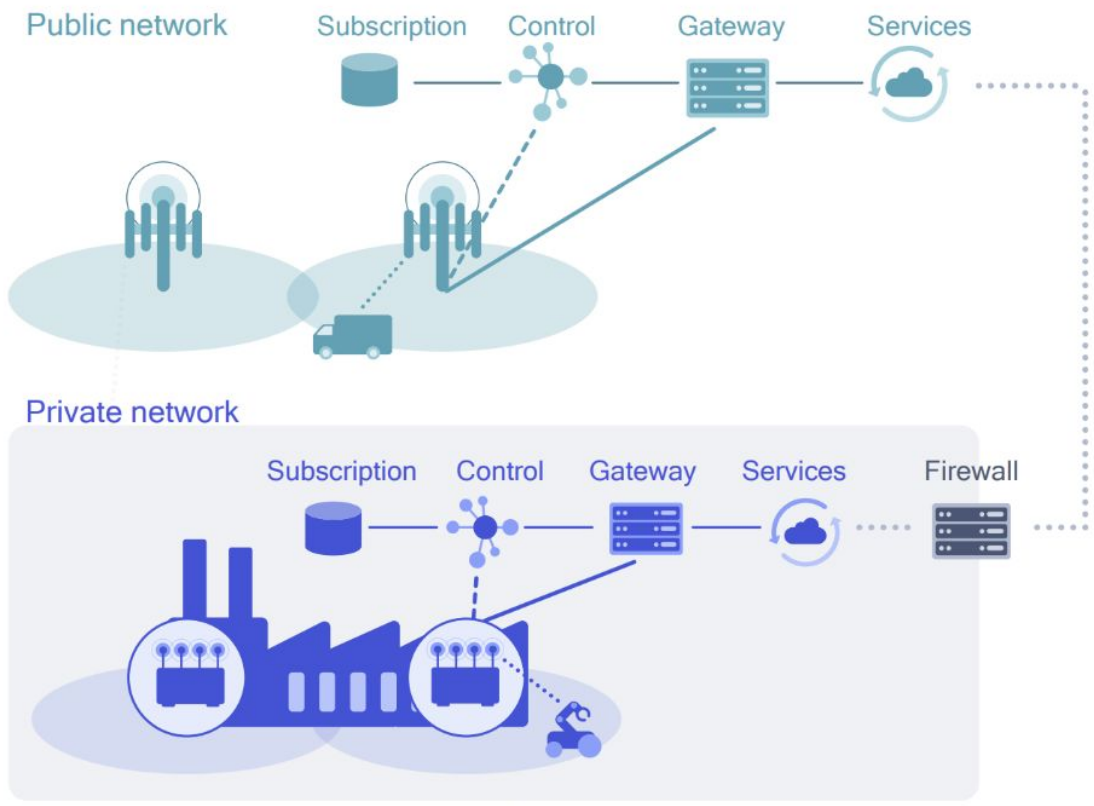

https://www.waveshare.com/sim8200ea-m2-5g-hat.htm

# Potential Private Network Models

## Integrated private network




## Independent private network[1]




1) Mobility between private and public networks can still be supported via dual subscriptions

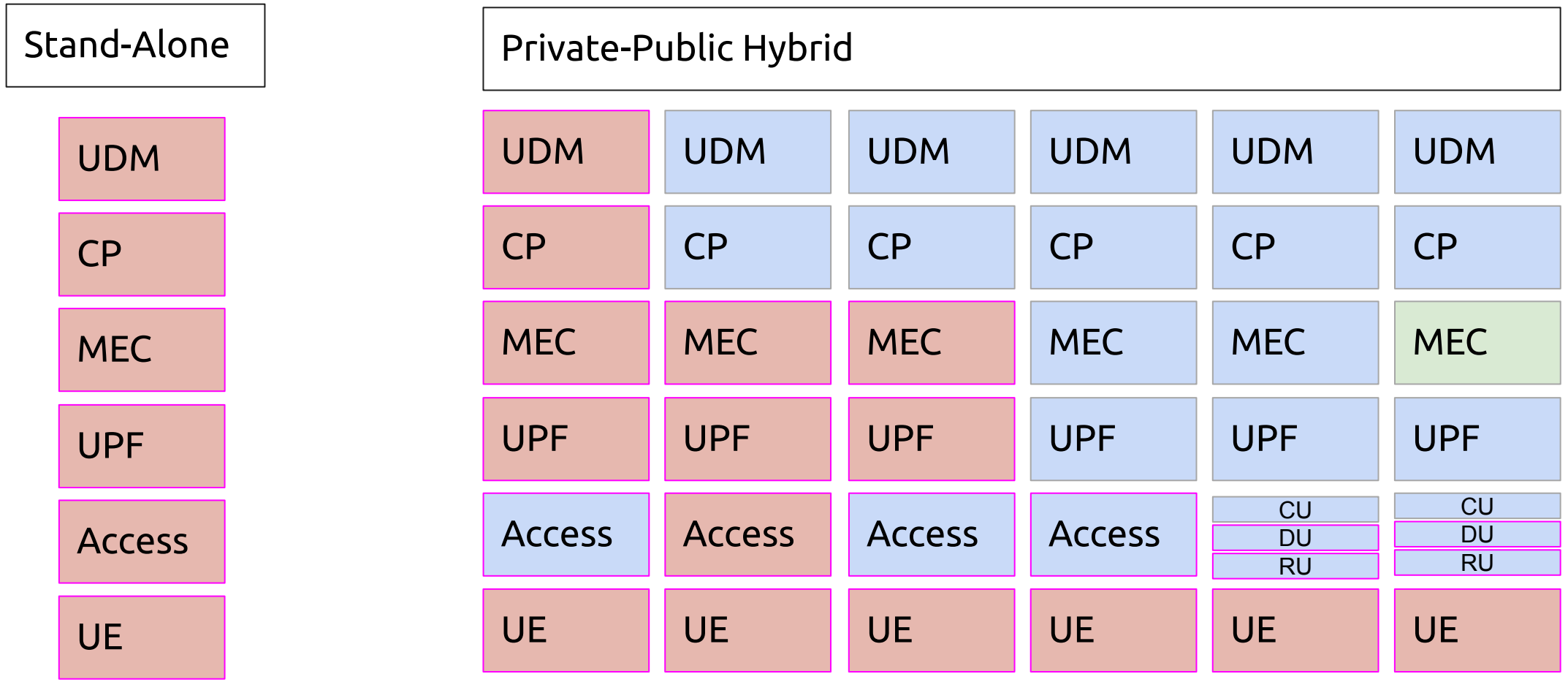
Source: Qualcomm

# Key Decisions & Variables

**Location and Ownership of private cellular network assets are key variables in both solution design and business models.**

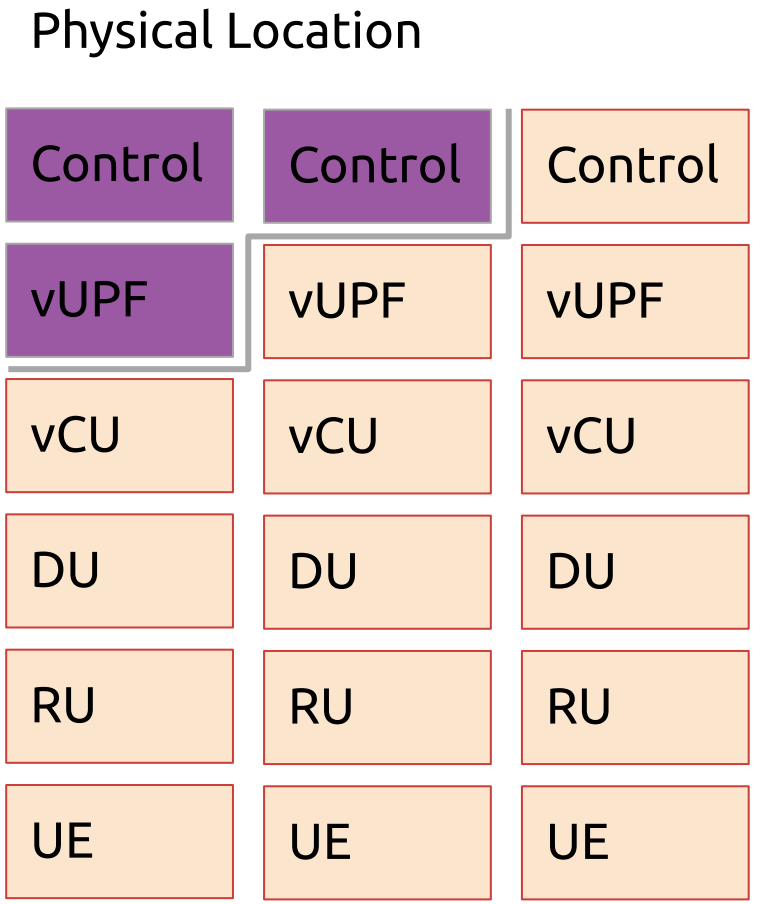
- On prem vs off-prem asset placement
- Shared vs dedicated assets
- Owned assets vs Public assets
- Own spectrum vs CSP spectrum

# Shared vs. Dedicated




CSP Edge | On prem | Shared | Dedicated / Separate from PLMN | Non 3GPP

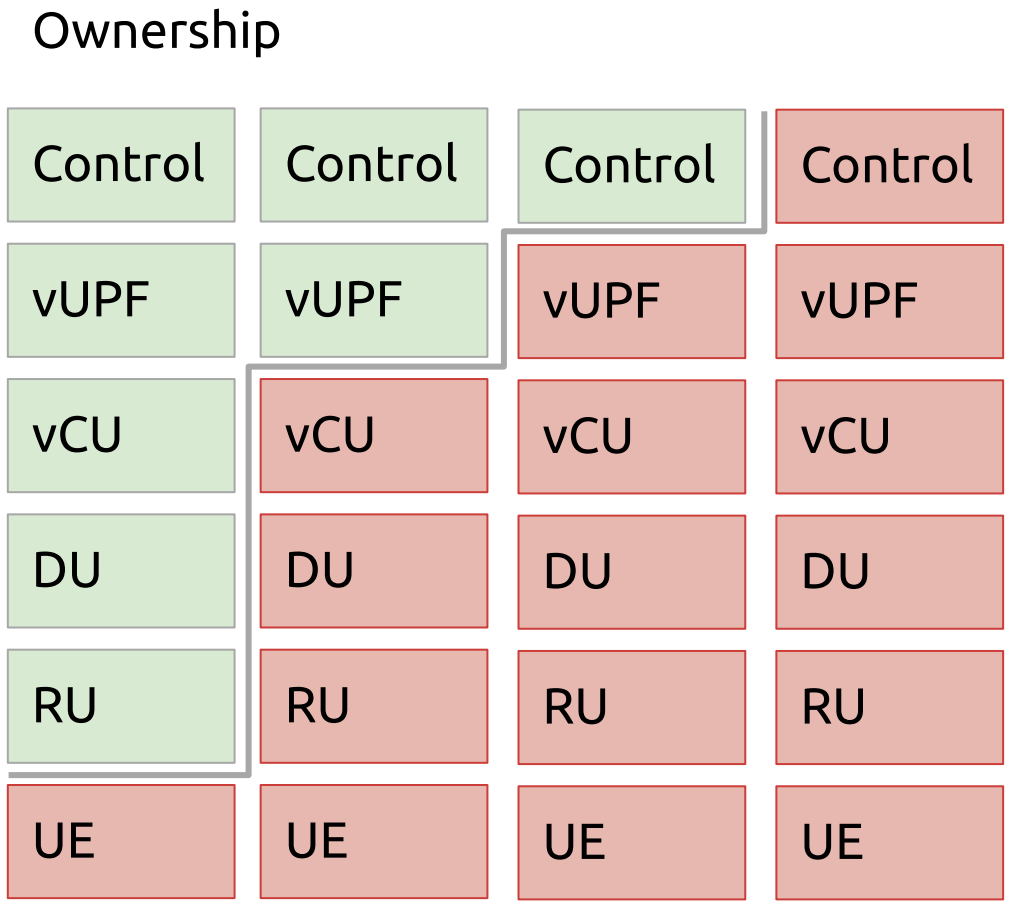
# On Prem vs. Off Prem




Off prem (CSP or Public Cloud)

On prem

# Asset Ownership



# Which RAT ?

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| Technology | 5G - mmWave | 5G - Sub-6GHz | 4G LTE |
|---|---|---|---|
| Speed | ★★★ 1.8 Gbit/s | ★★ 50 - 400Mb/s | ★ 35 - 50Mb/s |
| Range | ★ | ★★ | ★★★ |
| Environment | Dense, urban areas, or specific targeted spots | Suburban and rural areas | Widely applied globally |
| Scale | ★ Only private network deployments now | ★★ Supported by limited devices | ★★★ Supported by most mobile devices |
| Positioning Accuracy | Less than 1 meter | 20 meters | 50 meters |

# Is spectrum a problem ?

Open Source MANO

**USA**
- 3.5 GHz CBRS, exclusive & shared licenses, deployments in 2H19
- 37 - 37.6 GHz shared spectrum/local licenses, under evaluation

**Germany**
- 3.7 - 3.8 GHz
- 24.25 - 27.5 GHz, local licenses, under consultation
- Local licenses. Assignment complete; available 2H 2019

**U.K.**
- 3.8 - 4.2 GHz
- 24.25 - 26.5 GHz, local licenses, applications open since end of 2019
- Local licenses (50 meters square); regulator database; decision formalized; applications invited from end 2019

**Sweden**
- 3.72 - 3.8 GHz, in consultations

**Finland**
- Sub-licensing of 3.4 - 3.8 GHz
- Local permission via operator lease; assignment complete

**Netherland**
- 3.5 GHz for local industrial use; 3.7 - 3.8 GHz (in consultations); 2.3 - 2.4 GHz (licensed shared access online booking system)
- 3.5 GHz for local industrial use; however users may need to move to 3.7 - 3.8 GHz, if allocated; 2.3 GHz approved for PMSE

**France**
- 2.6 GHz, regulator database & approval. Up to 40 MHz approved for Professional Mobile Radio

**Czech Republic**
- 3.4 - 3.44 GHz for private networks

**Brazil**
- 3.7 - 3.8 GHz, under consideration
- 27.5 - 27.9 GHz, allocation completed

**Chile**
- 3.75 - 3.8 GHz, allocation completed at end of 2019

**Australia**
- 24.25 - 27.5 GHz and 27.5 - 29.5 for final consultation in 1H20

**New Zealand**
- Licenses in 2575 - 2620 MHz may be assigned for localized use

**Malaysia**
- 26.5 - 28.1 GHz will be assigned for the deployment of local/private networks

**Singapore**
- Each operator will be allowed to acquire 800 MHz of 26/28 GHz spectrum to deploy local networks

**Hong Kong**
- 24.25 - 28.35 (400 MHz), local licenses; regulator approval. Approved; available 3Q19

**Japan**
- Phase 1: 2,575 - 2,595 MHz (NSA anchor) and 28.2 - 28.3 GHz; local licenses, legislated in December 2019
- Phase 2: 1888.5 - 1916.6 MHz (NSA anchor), 4.6 - 4.9 GHz (4.6 - 4.8 GHz indoor only, 4.8 - 4.9 GHz outdoor possible) & 28.3 - 29.1 GHz (150 MHz outdoor use; total 250 MHz range 28.2 - 28.45 MHz); local license. Consultation 3Q20, legislation 4Q20. Uplink heavy TDD config. using semi-sync is allowed in sub-6 & 28 GHz

Source: Qualcomm

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# Intro to OSM

Link to session slides here



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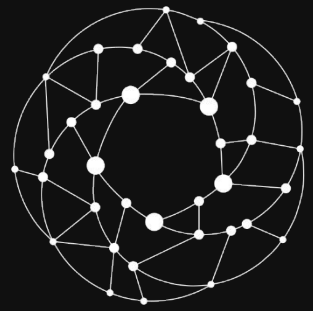

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# Hackfest tasks



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# Hackfest tasks

A) on-board Magma ORC with OSM
B) on-board Magma AGW with OSM
C) on-board SRS-LTE simulators for gnb and UE
D) connect it all together to see traffic in Magma Orchestrator - OSM day 2 action
E) implementing 2 additional lifecycle actions (disconnect / connect simulators)
F) implementing 2 additional lifecycle actions (connect / disconnect AGW to/from ORC)

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# Logistics

Shared with me > team1

Name ↑

- hackfest_magma-agw-enb_nsd.tar.gz
- hackfest_magma-agw-enb_vnfd.tar.gz
- kube_config
- magma_agw_ns.tar.gz
- magma_agw_pnf.tar.gz
- magma_orc_cnf.tar.gz
- magma_orc_ns.tar.gz
- pdu.yaml
- team1_osm_admin_password
- team1-key
- team1-key.pem

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# Logistics

Dedicated slack channel per team

Ask any questions there or on #hackfests

You can use voice conferencing with Jitsi