# Moving UPF functionalities at the edge for private 5G networks
## www.sma-rty.com

# Who are we

## Passionate team with AI, 5G and embedded computing skills

**8+**
core engineers with PhDs

**2**
R&D centers in Europe

**2**
Scientific Advisors

**8+**
Industrial & academic partnerships

**∞**
Willingness to accept new challenges

**AI**

**Luca, PhD, CEO**
Heterogeneous hardware architecture and computer vision algorithms

*Sant'Anna*
Scuola Universitaria Superiore Pisa

**Kamel, PhD, R&D engineer**
Deep Learning and Artificial Intelligence

*UCA*
UNIVERSITÉ Clermont Auvergne

**Federico, PhD, R&D engineer**
Parallel computing optimizations for embedded systems

*Sant'Anna*
Scuola Universitaria Superiore Pisa

**François, Scientific advisor**
Expert in smart camera and embedded vision
Professor UCA

*UCA*
UNIVERSITÉ Clermont Auvergne

# Where are we

**Clermont Ferrand**

Sma-RTy SAS

Institut Pascal
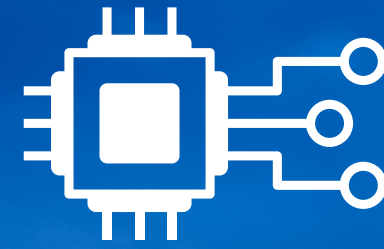4 Avenue Blaise Pascal
63178 Aubière France



**Milano**

Sma-RTy Italia SRL

Via dell'Artigianato 2, Carugate
20061 Italia

**Vision**

Interconnected services from different vendors

5G communication infrastructure

Digital Twin applications

# 5G NPN development trend

**5G**

**1.7B**

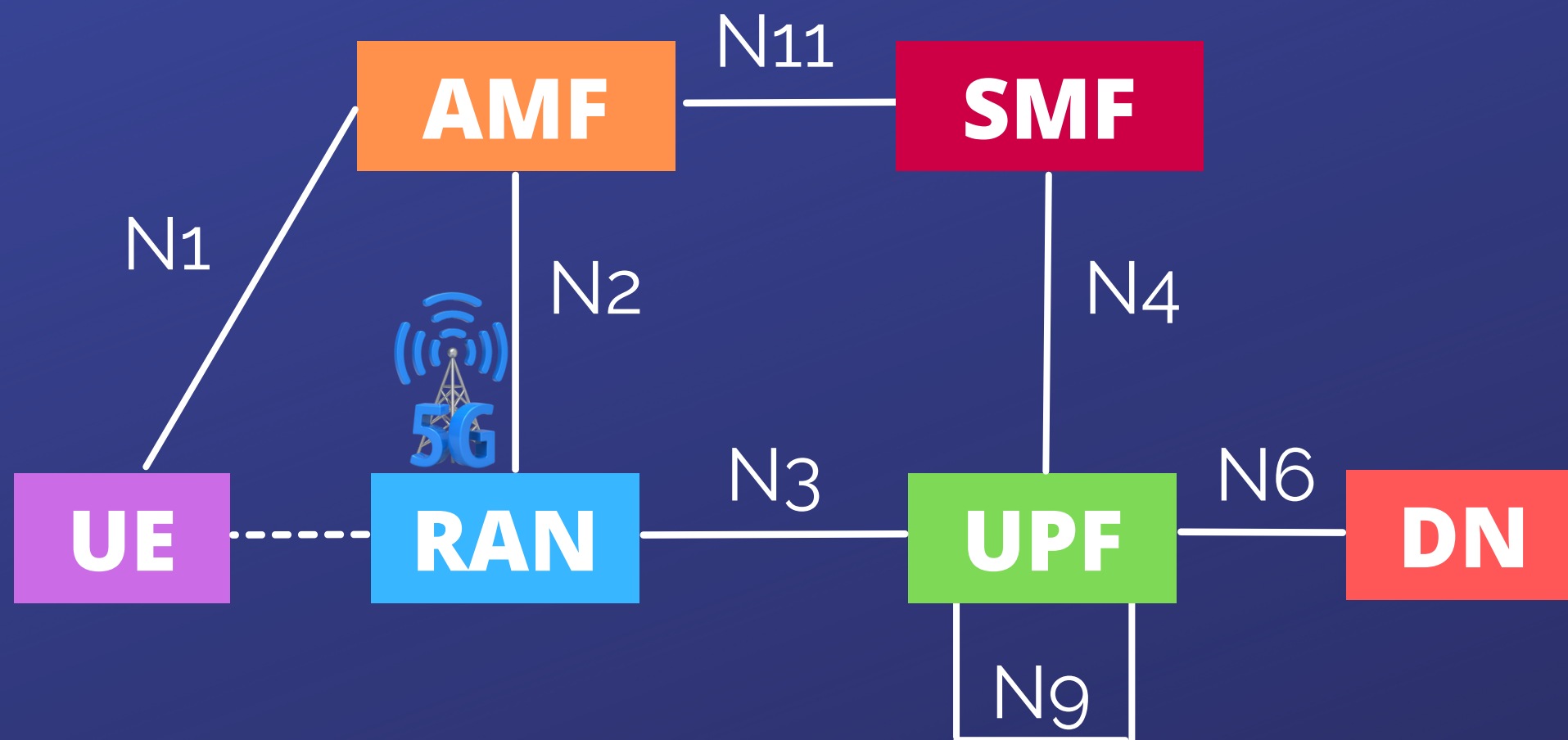5G Mobile devices in 2025, accounting for 20% of total connections

**69%**

of mobile operators consider that the B2B market plays a crucial role for 5G profitability

UPF is the key to expand the B2B market in the 5G era.

# UPF definition



- User Plane Function (UPF) is a basic NF (Network Function) in the 5GC architecture defined by 3GPP
- As a user-plane NF, UPF is controlled and managed by SMF in 5G network,
- It performs service flow identification (DPI), packet processing, and charging in accordance with various policies delivered by SMF.

# Typical UPF scenarios

Large bandwidth
- Video applications, drone live broadcast, HD video monitoring, AR/VR, and machine vision, require UPF to provide large bandwidth.

Low latency
- Industrial control, Internet of Vehicles (IoV), rail transit, smart grid, and other applications, require UPF to provide micro-second ultra-low latency forwarding capability.

High reliability
- Remote surgery, precision manufacturing, and other applications with special requirements for reliability,require UPF to provide multi-level reliability assurance such as dual connectivity and dual tunnels.

5G

# SLA requirements for UPF

To meet differentiated SLA requirements for latency, bandwidth and reliability, UPF needs to be deployed at different positions

| Location | Performance Throughput | E2E Latency | Function Set |
|---|---|---|---|
| Central UPF | >200 Gbps | >50 ms | Full function set |
| Regional UPF | 100~200 Gbps | >30 ms | Full function set |
| Edge UPF | <100 Gbps | <15 ms | Edge offloading Customized function enhancement |

# UPF edge deployment



5GC

Regional UPF — UPF → Internet
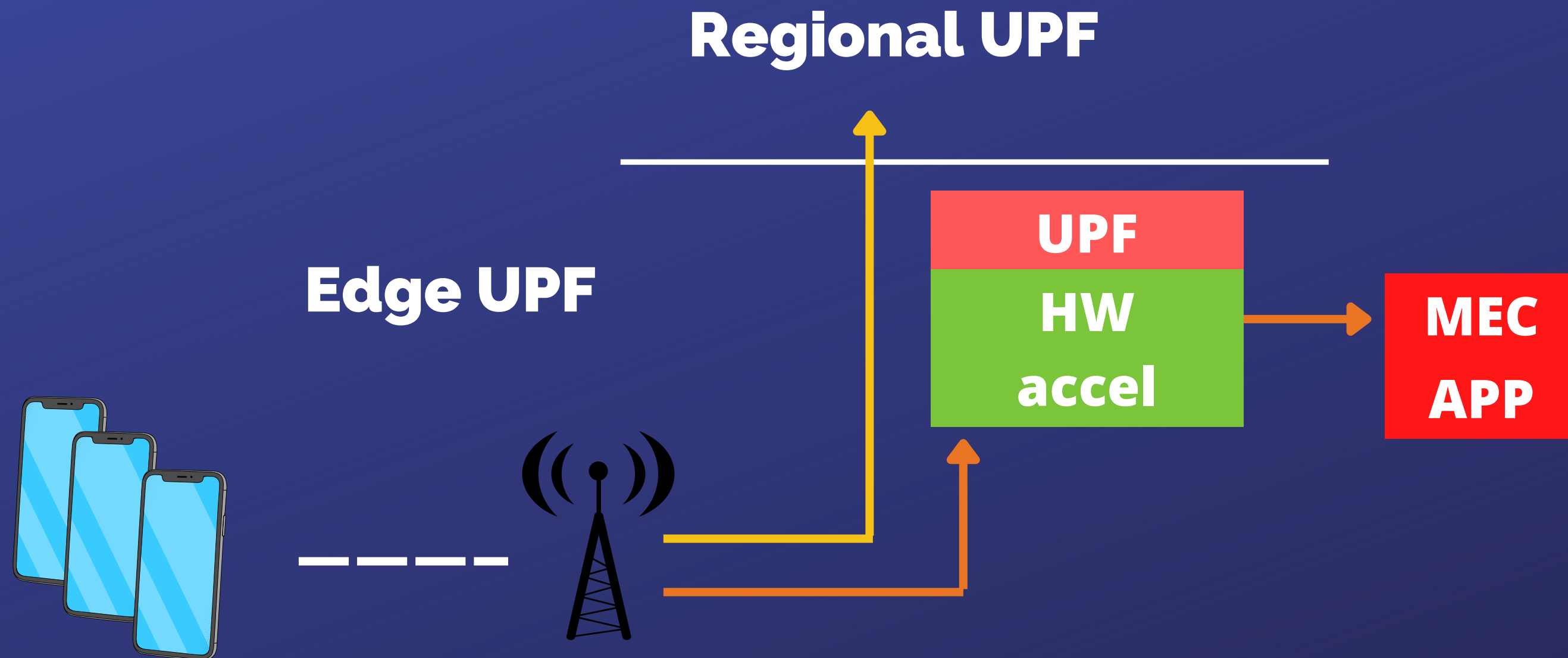
Edge UPF — UPF → MEC APP
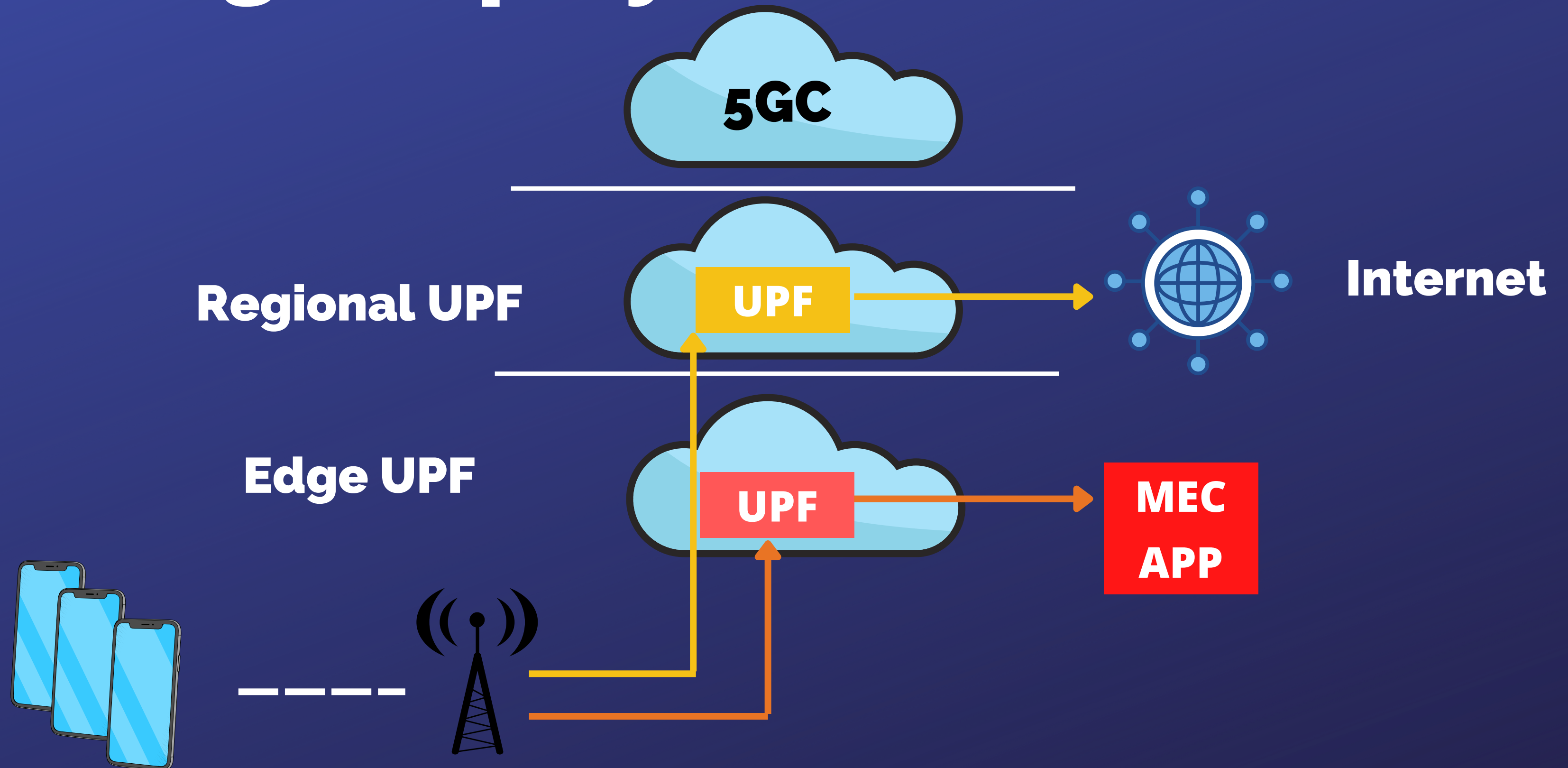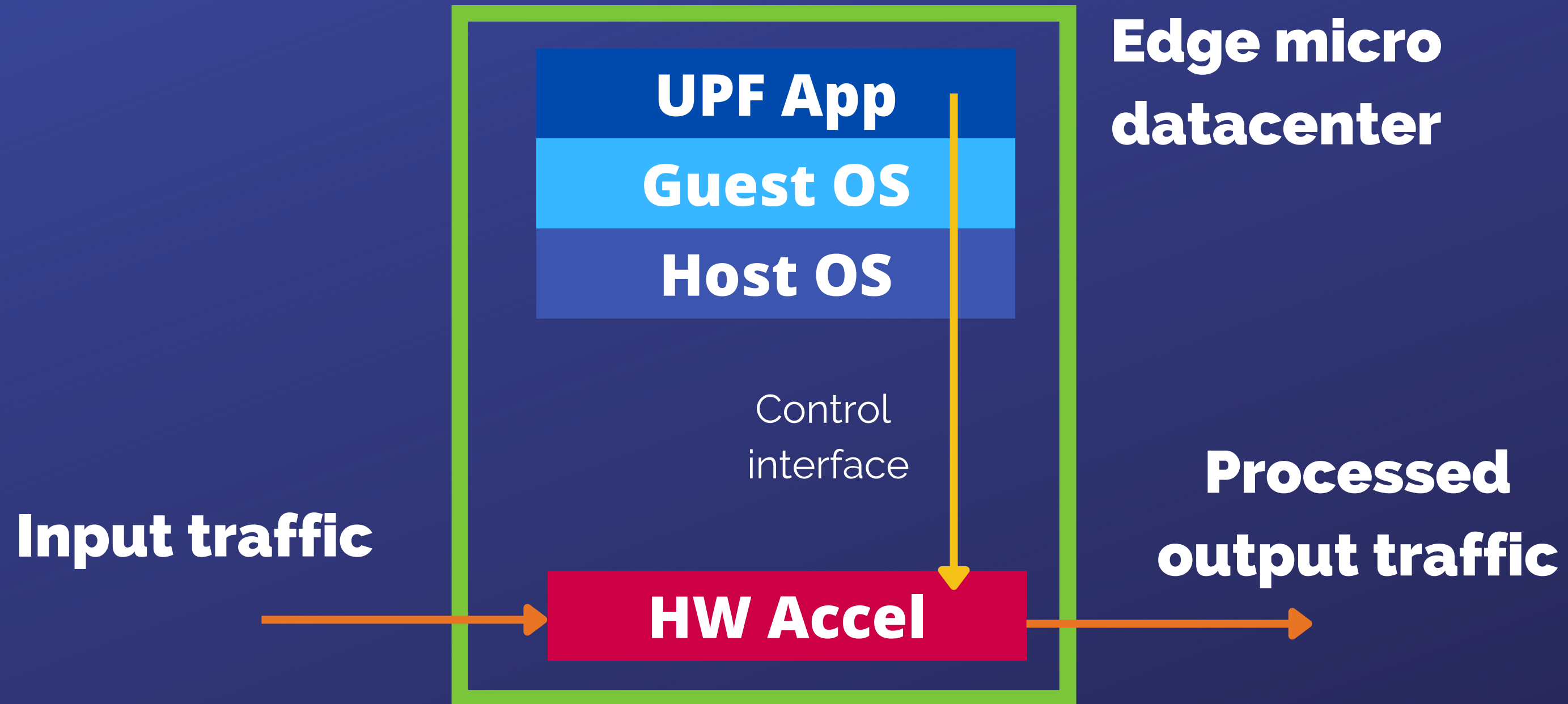
# UPF edge deployment benefits

- Directly process high-bandwidth services at the edge, saves the bandwidth consumption of the backbone network.
- Latency-sensitive services need to be deployed at the edge of a network to be close to users.
- Some industry applications have high data confidentiality and need to be restricted to specific edge areas. It needs to reduce the risk of network data leakage and protect user data security and privacy.
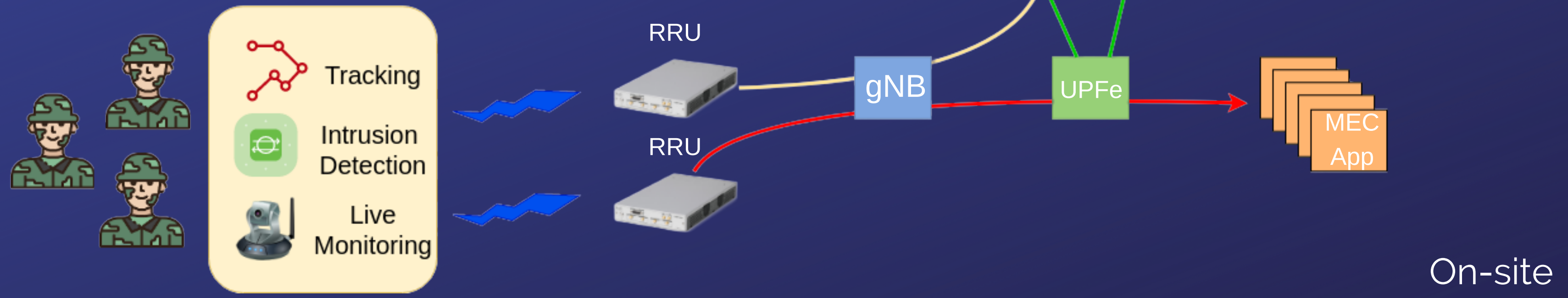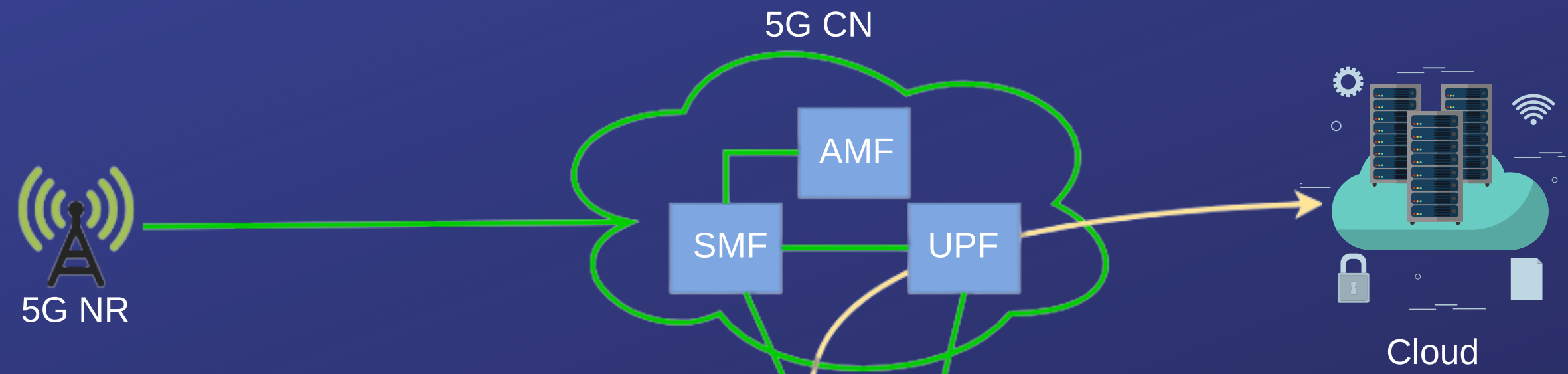
# UPF HW acceleration

Regional UPF

Edge UPF

UPF

UPF HW accel

MEC APP

# UPF HW acceleration

UPF App

Guest OS

Host OS

Edge micro datacenter

Control interface

Input traffic

Processed output traffic

HW Accel

# Sma-RTy application

Remote

5G CN

AMF

SMF    UPF

Cloud

5G NR

RRU

Tracking

Intrusion Detection

Live Monitoring

gNB    UPFe

MEC App

RRU

On-site

# Sma-RTy/OAI integration

- OAI UE, OAI gNB, and CN are already deployed in our facilities
- We are currently working on the OAI code to understand:
  - Already implemented functionalities
  - Useful functionalities that miss for Sma-RTy application
- As next step, we foresee to test and improve the system stability

# Conclusion

- UPF is an important network function (NF) of the 5G Core Network, UPF processes and routes data traffic.
- 5G private network can benefit from using an edge UPF deployments for different slices
- Sma-RTy 5G private network has been presented with a focus on the exploitation of edge UPF
- Next steps consider the implementation of the presented architecture in OAI framework

# Thanks for your attention

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