

# Open RAN & Ericsson



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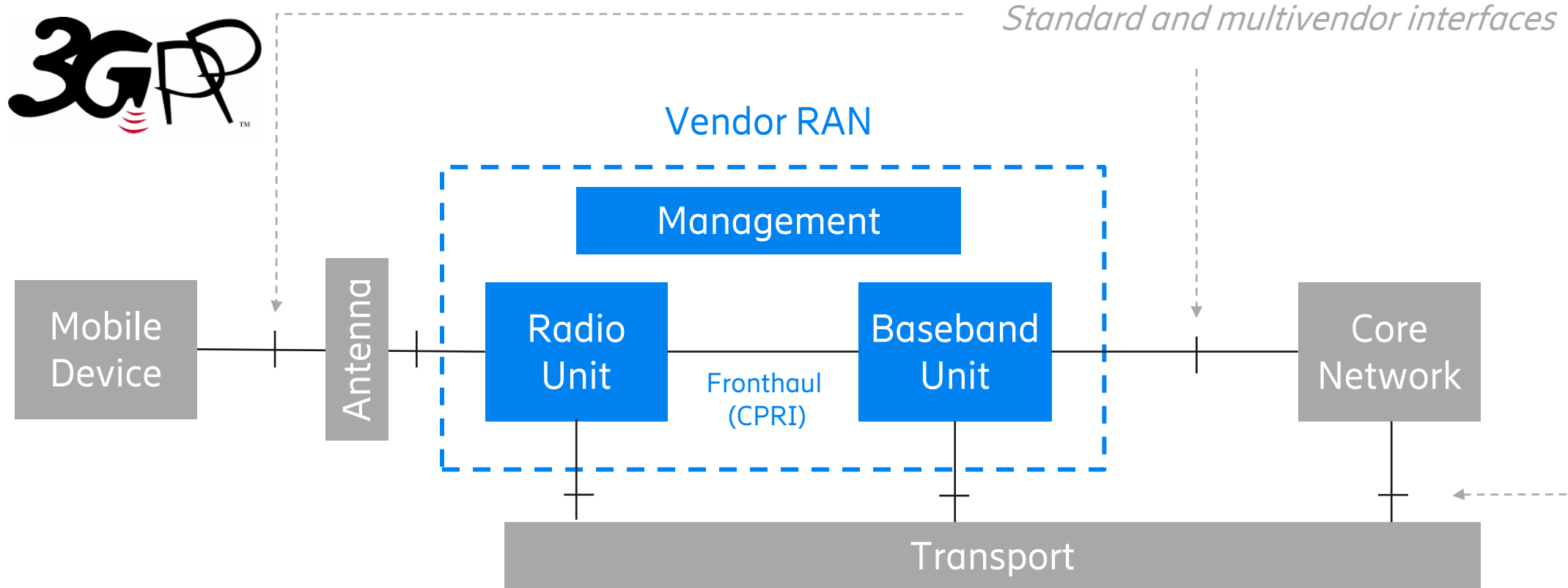


# Agenda




1. Today's RAN & 3GPP
2. Open RAN & 3GPP
3. Open RAN & Ericsson
4. Fronthaul & Lower-Layer Split
5. Higher-Layer Split
6. Virtualization & generic HW

# RAN today




Proprietary RAN HW & SW - internal RAN interfaces from same vendor  
Standard and multivendor interfaces with mobile device and core network


# 3GPP – Key end-user benefits




Affordability



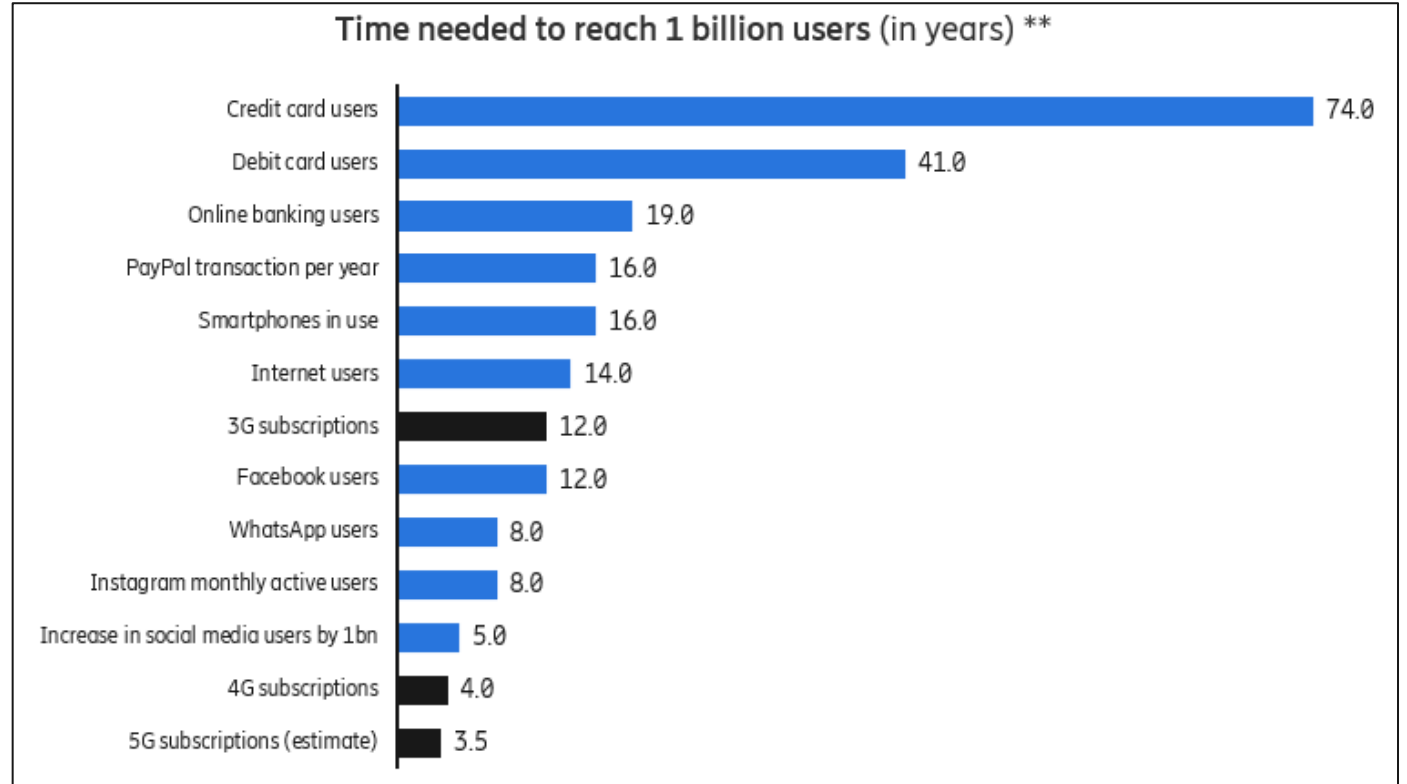
Fast time to market



Mobile broadband



Unparalleled global diffusion



4G and 5G have been very successful 3GPP innovations  
Success is based on open standards and multi-vendor networks

# Key elements of Open RAN

Open RAN is not a standard but an industrial concept

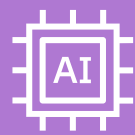


## Key elements of Open RAN



HW & SW  
virtualization

RAN application as VNFs (virtual RAN)  
White-label HW (Digital and Radio)



Intelligence  
and automation

Open Management & Orchestration  
Use external AI/ML capabilities



Open internal  
RAN interfaces

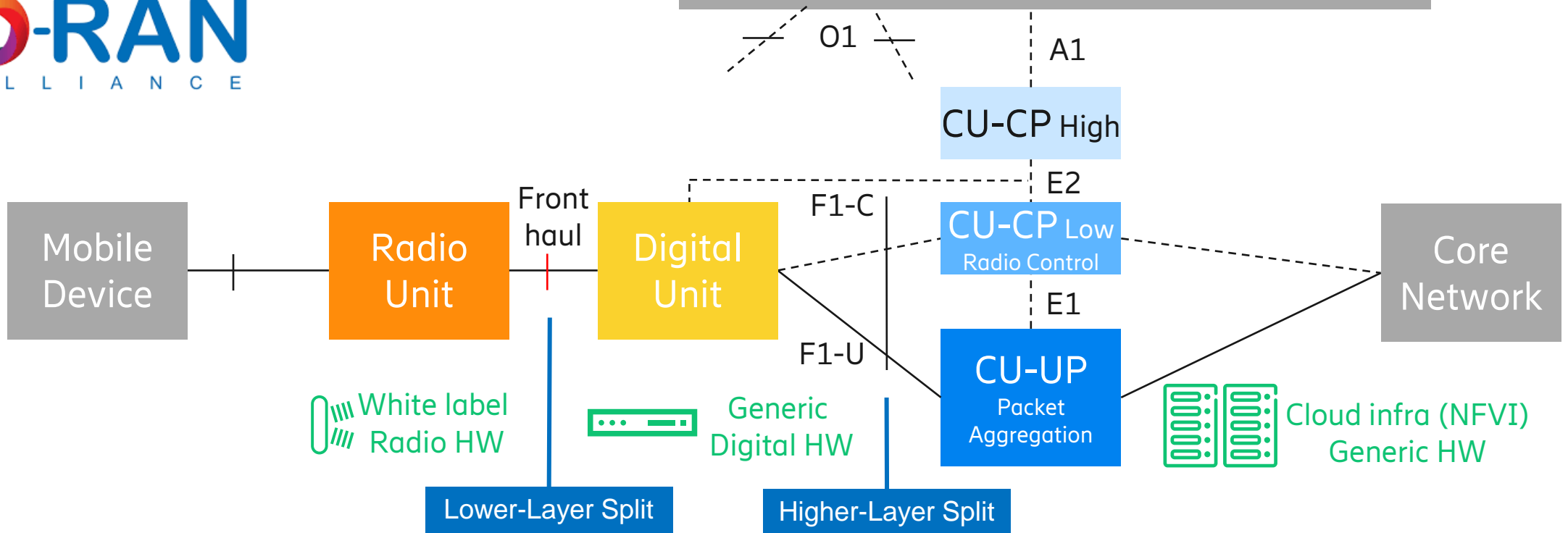
Higher-layer split  
Lower-layer split (Open Fronthaul)

O-RAN Alliance specifications build on 3GPP standards, as an approach to realize Open RAN concepts  
The current main-stream pilot approach to realize Open RAN concepts consist of proprietary solutions

# Open RAN ambition



Open Management and Orchestration

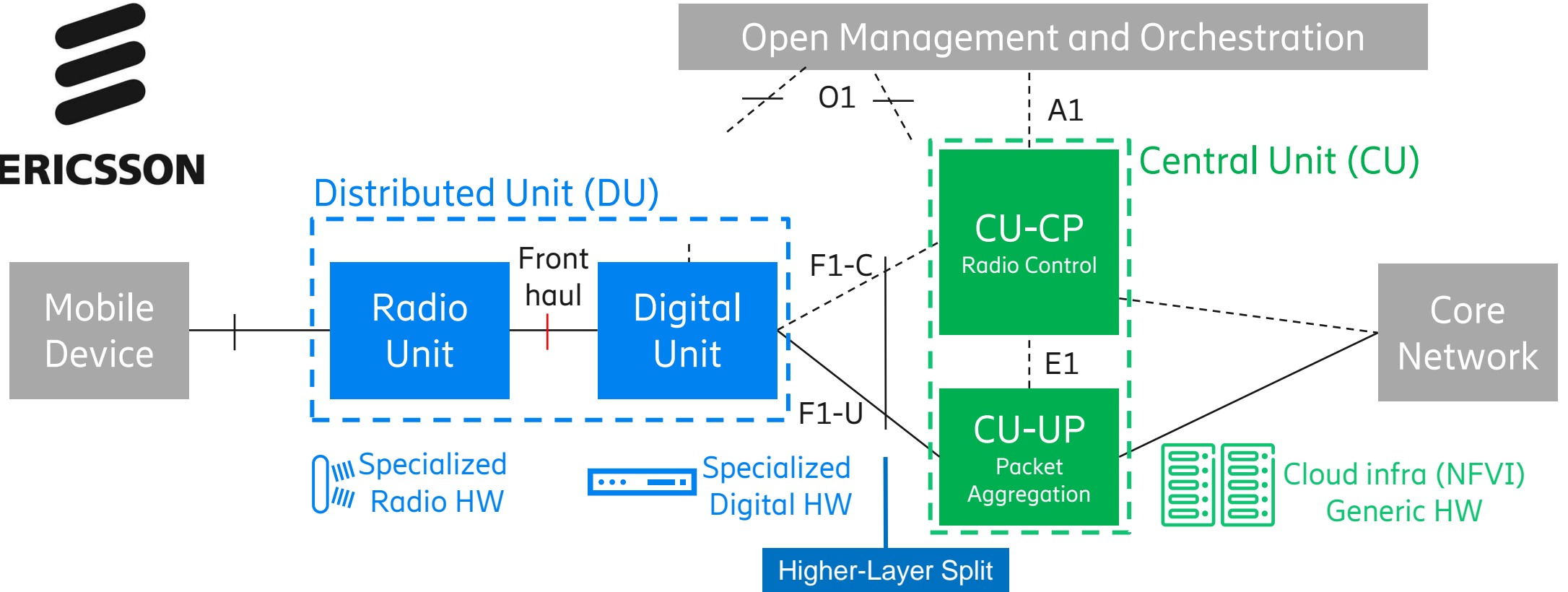


White label HW (RU and DU)

All interfaces are open, further stack fragmentation (E2)

Use Open Source SW

# Open RAN ambition

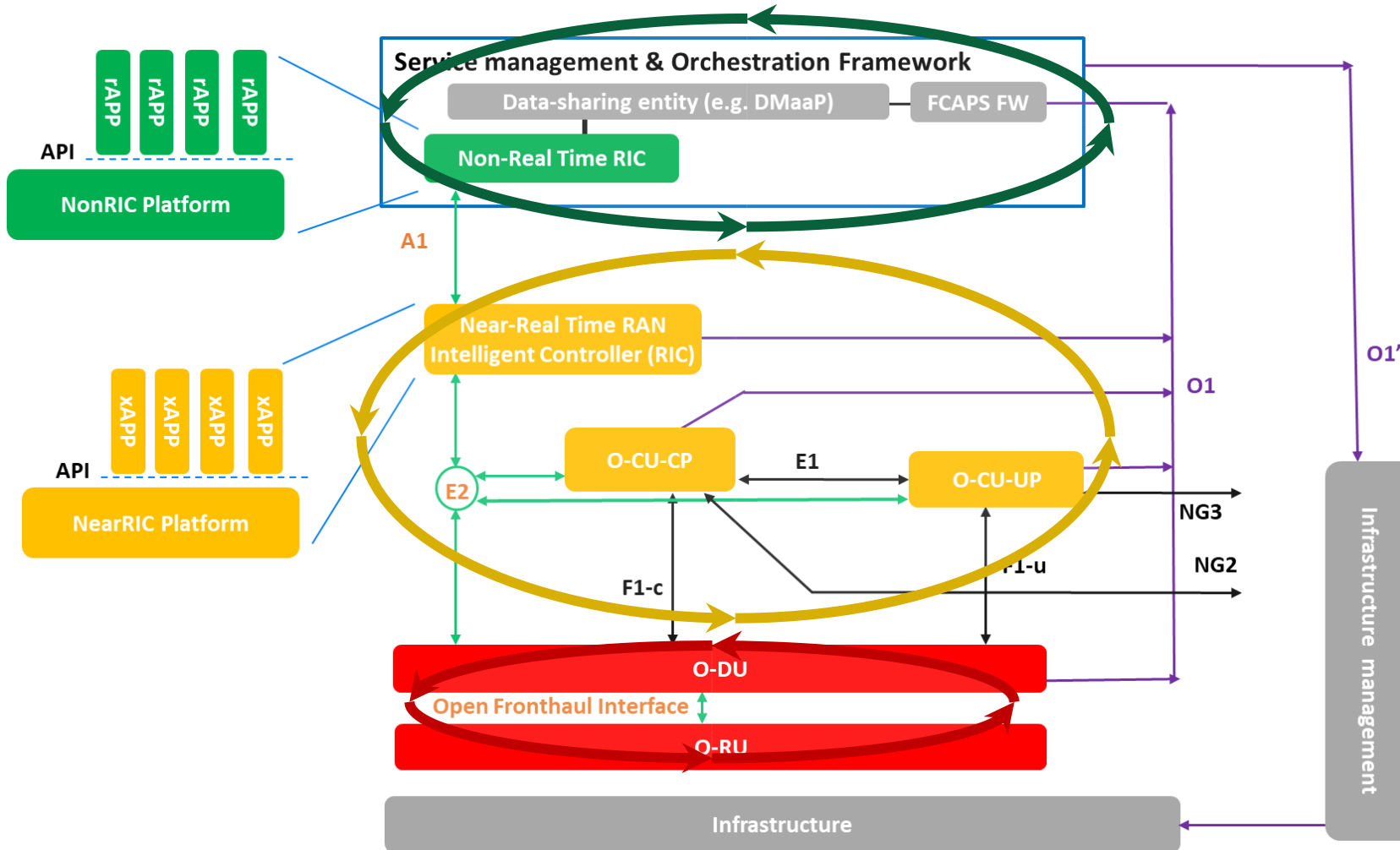


RU/DU remain specialized - CU on generic HW, CU SW as VNF

F1, E1 interfaces multi-vendor - O1, A1 management interfaces open

Ericsson & O-RAN: participation in 5 Work Groups, support for 8 of the 10 interfaces

# RAN control loops



## A1-O1 loop

**Seconds and up**  
Orchestration, programmability, optimization, analytics, automated management, SON,

## E1-F1 loop

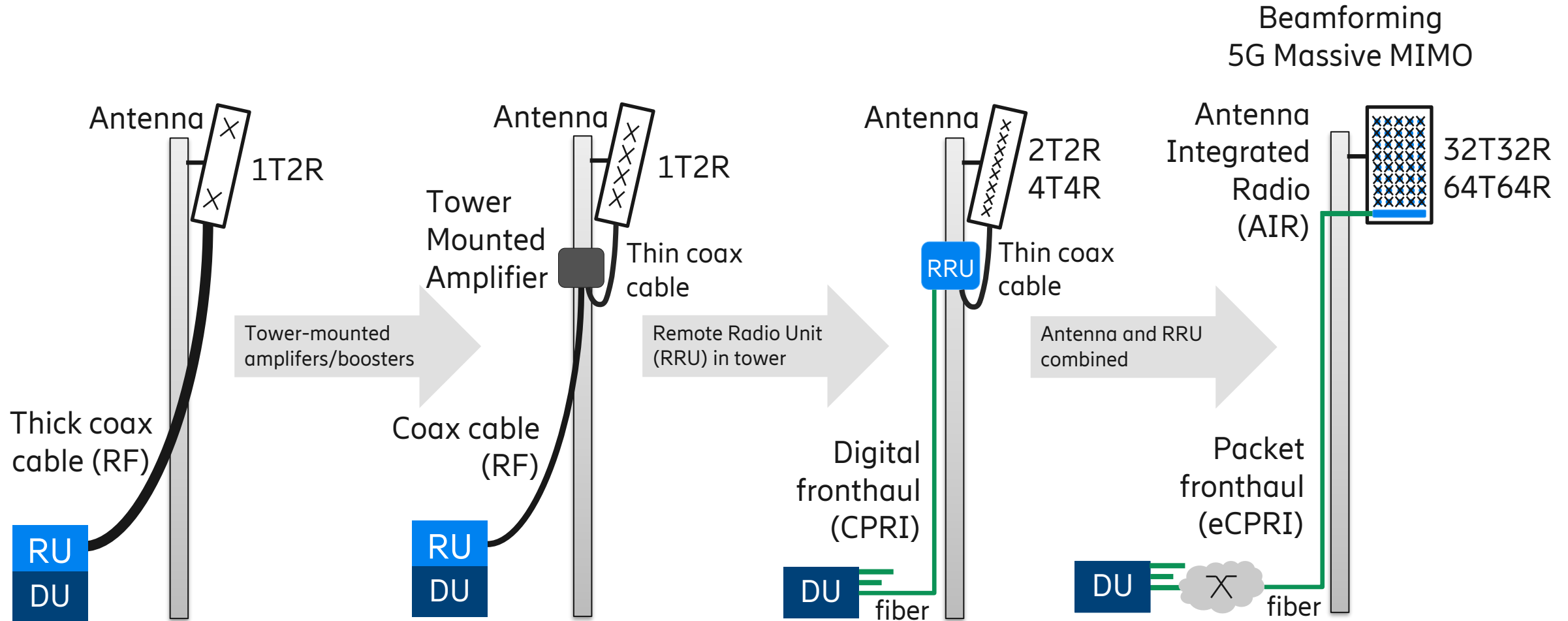
**50 ms – 200 ms**  
Handover decisions, QoS, dual connectivity control, spectrum load balancing...

## DU-RU loop

**50 μs – 10 ms**  
Beamforming, scheduling, CoMP, fast spectrum management..



# Evolution to fronthaul



5G radio innovation requires advanced fronthaul

# Lower-layer split options

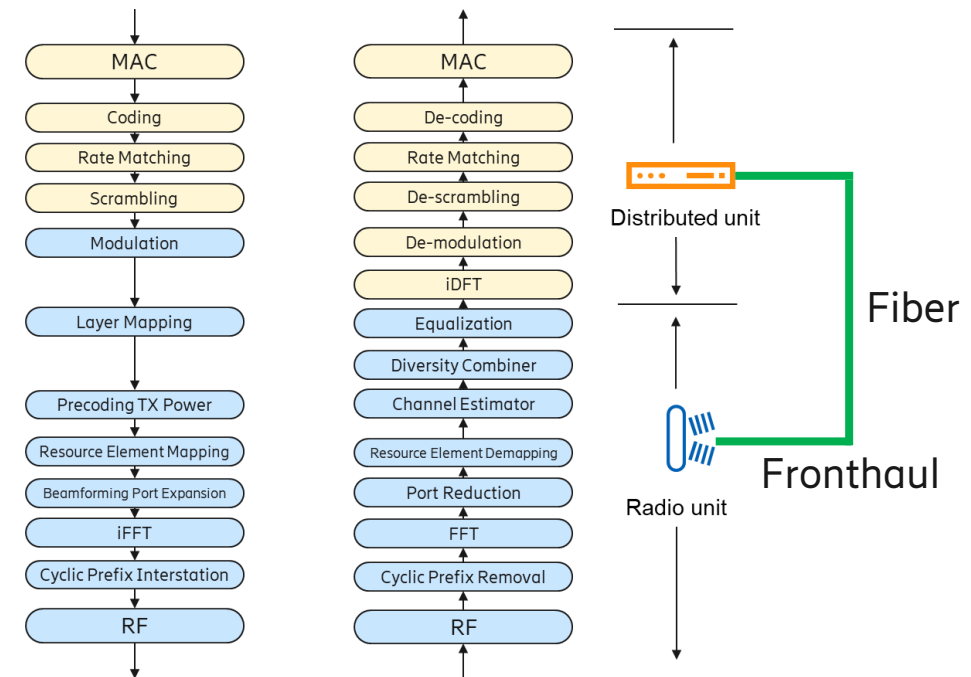
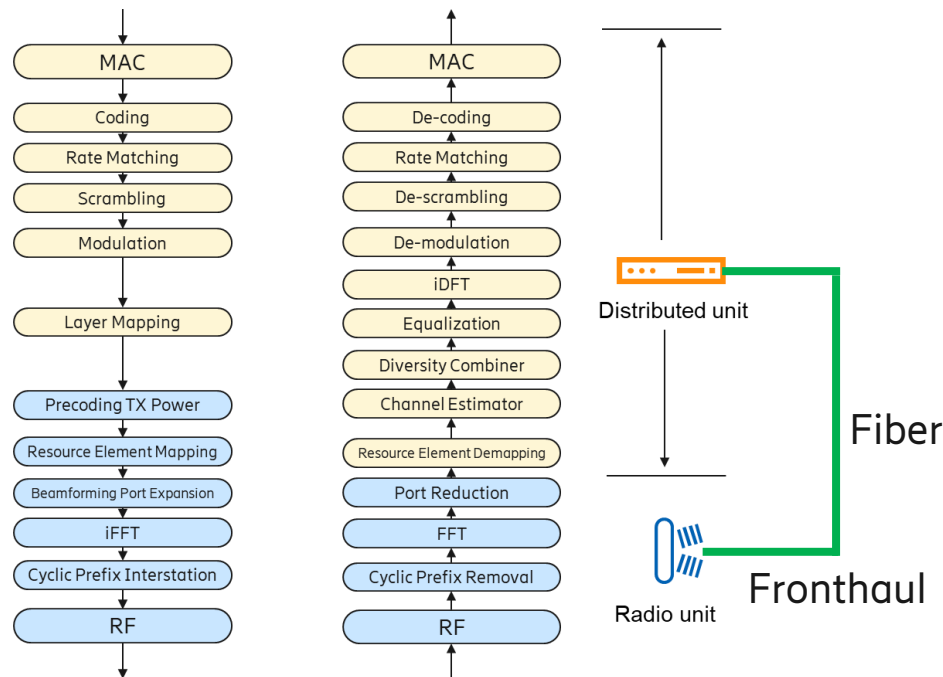


## O-RAN LLS architecture option:

- More functions in the distributed unit.
- Limits the complexity of the radio unit.
- Reduced radio performance with M-MIMO.

## Ericsson LLS architecture option:

- More functions in the radio unit.
- Custom silicon for higher radio complexity: low power consumption and weight, high computation power.
- Optimal radio performance with M-MIMO.

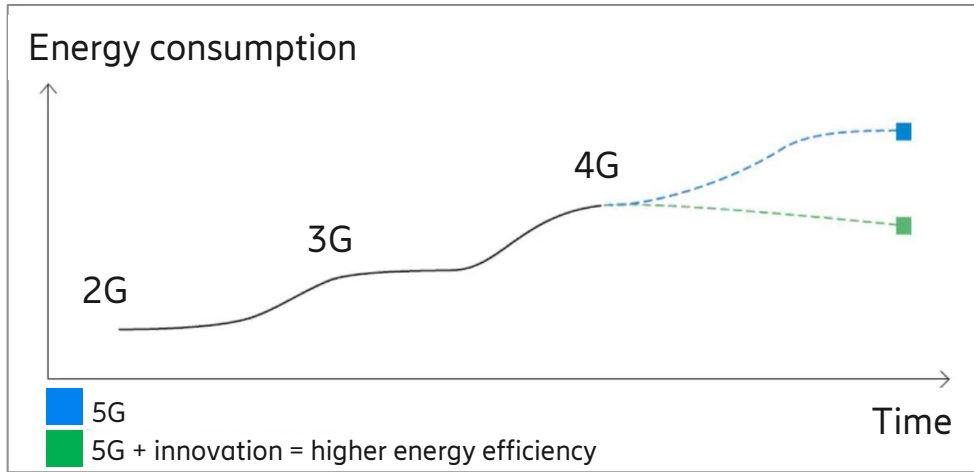


Position of lower-layer split is a key design choice

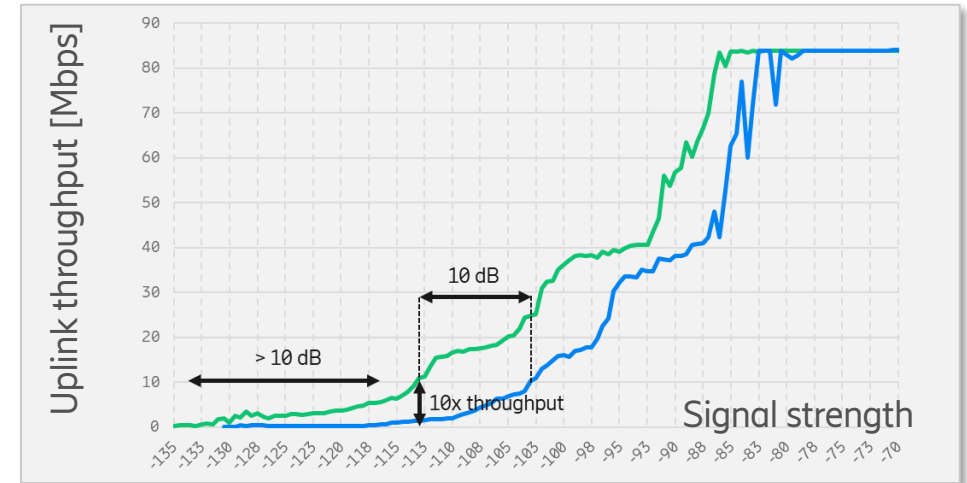
# Benefits of Ericsson LLS - examples



**Breaking the energy curve:** switch off TX for sleep mode @ 0.1 ms



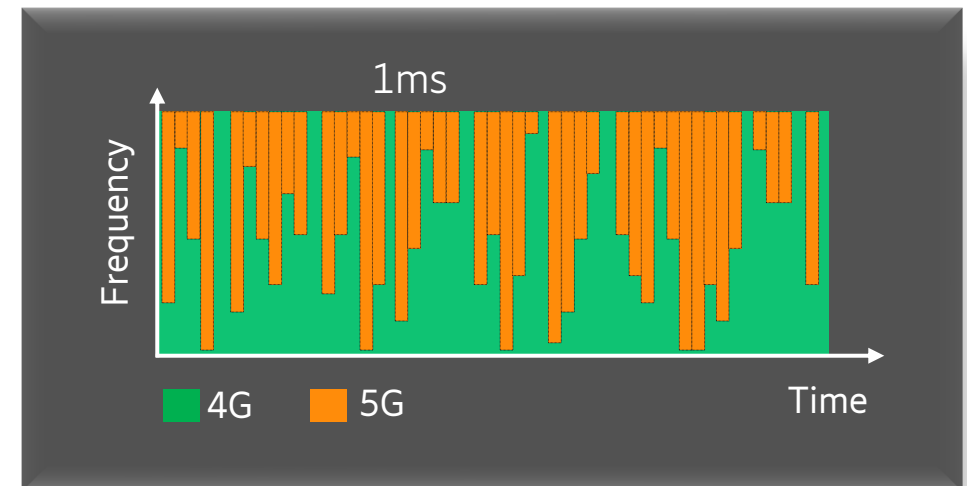
**Superior performance:** 10x cell edge speed, +10 dB range



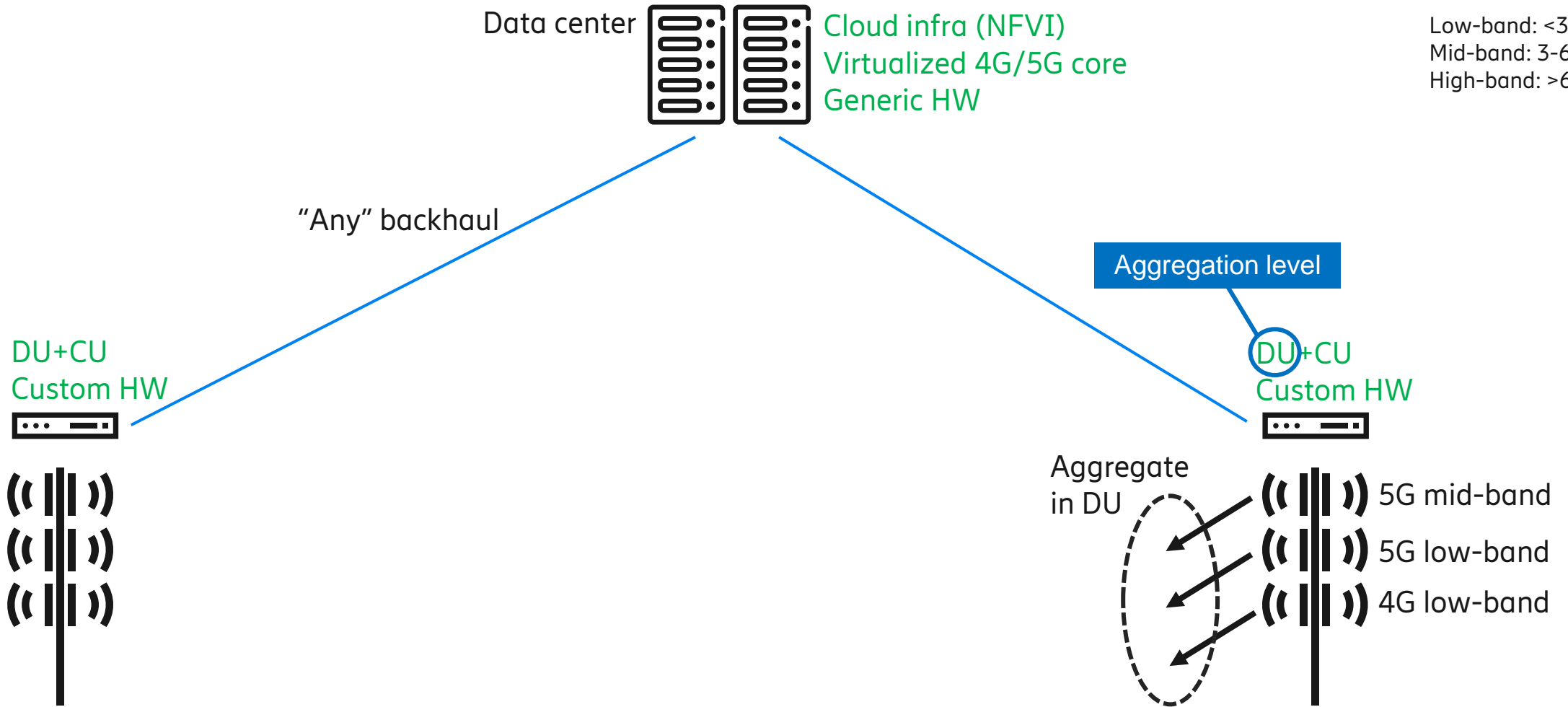
**Security:** DU-RU authentication/encryption, signed SW, secure boot



**Advanced functionality:** 4G/5G spectrum sharing @ 1 ms

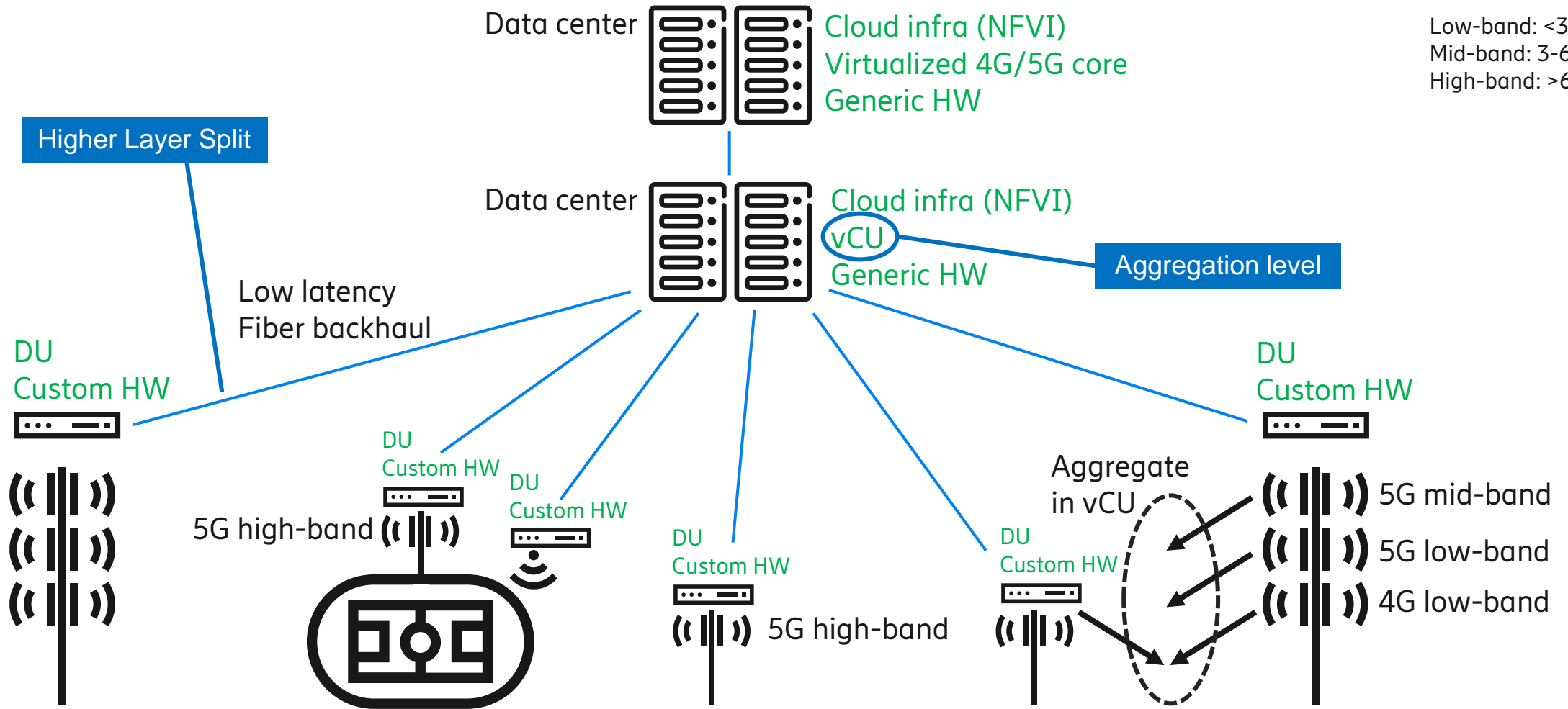


# Typical European network topology



Uniform site grid: efficient aggregation in DU

# vCU first RAN element on generic HW



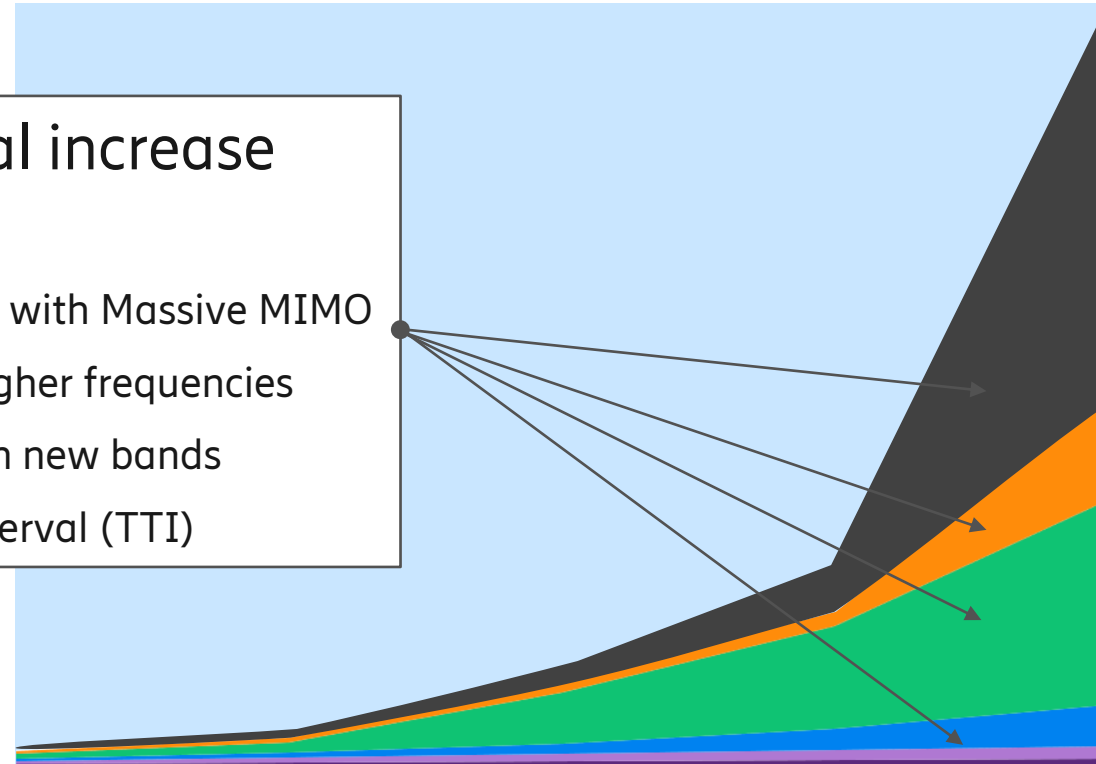
Different site grids: higher-layer split for aggregation in vCU on generic HW

# High processing needs in 5G DU



## 5G drives exponential increase in processing needs

- # Antenna branches growing with Massive MIMO
- More carrier bandwidth at higher frequencies
- Wider spectrum allocations in new bands
- Shorter transmission time interval (TTI)

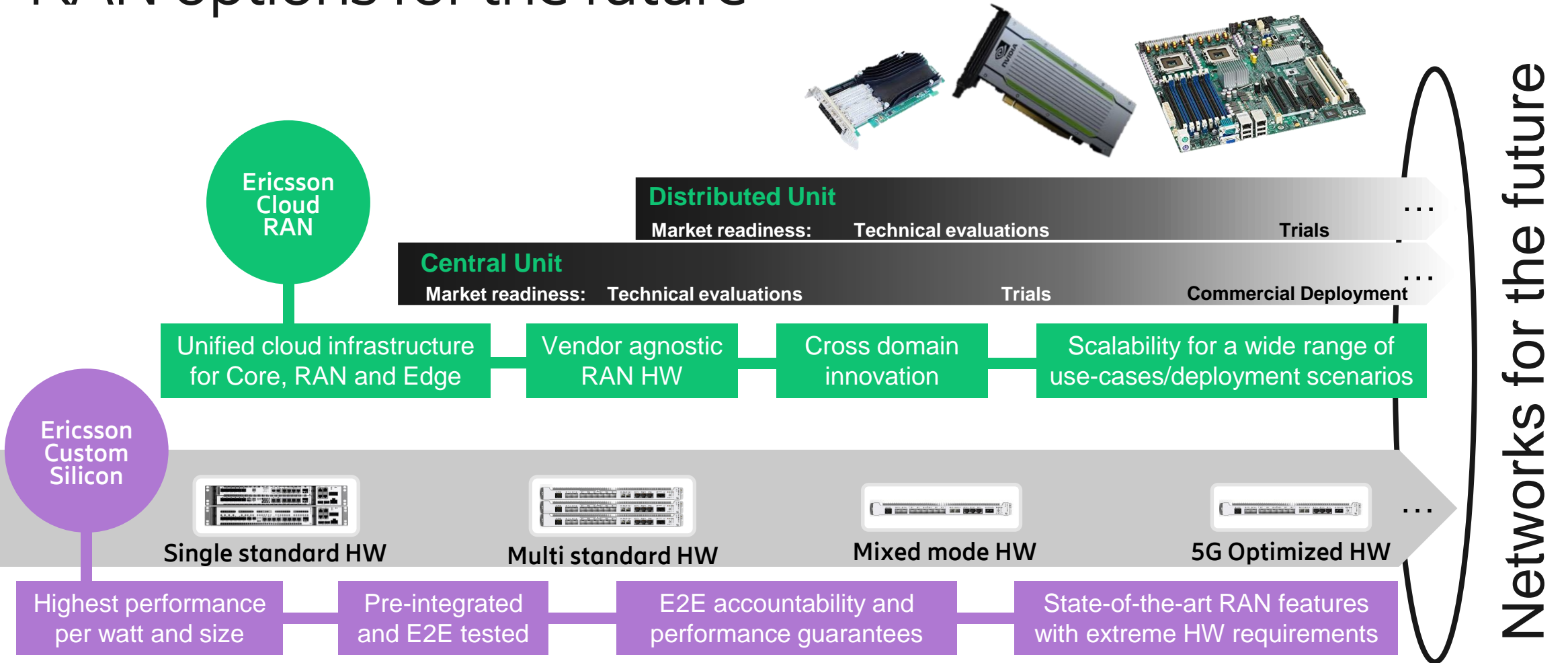


- Digital front-end processing
- Beamforming processing
- Layer 1 processing
- Layer 2 processing
- Packet processing function
- Radio control function

Carrier bandwidth	20 MHz	20 MHz	100 MHz	100 MHz	100 MHz
Antenna branches	2T2R	4T4R	4T4R	8T8R	64T64R
Transmission Time Interval (TTI)	1 ms	1 ms	0.5 ms	0.5 ms	0.5 ms

**5G DU will remain on specialized HW for several years**

# RAN options for the future



**DU+CU on specialized HW as main-stream, vCU first on generic HW, vDU at later stage**

