IMPACT OF 5G RAN ARCHITECTURE IN TRANSPORT NETWORKS

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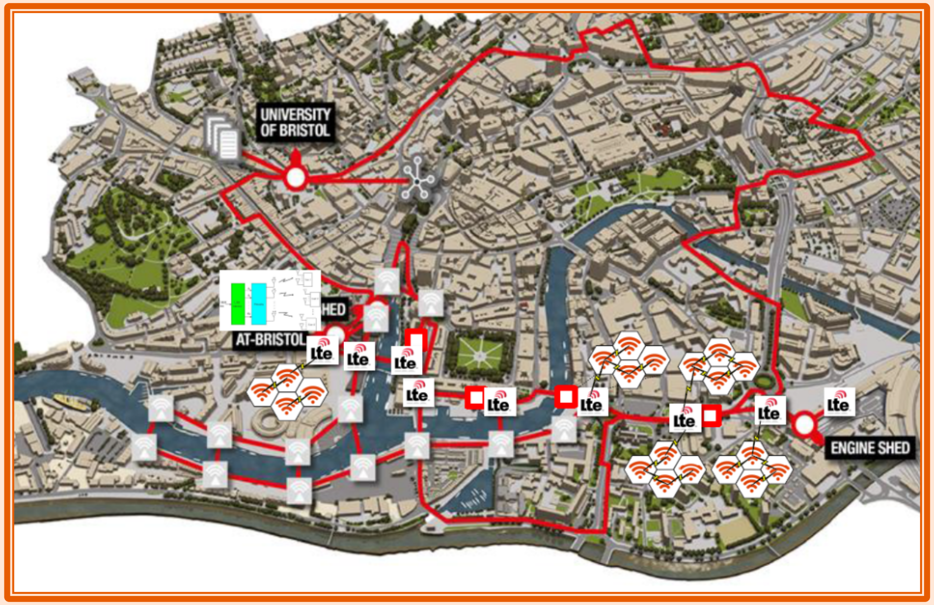
ONDM 2018 – Optical Technologies in the 5G era (Workshop)



Bristol 5G city testbed with 5G-XHaul extensions

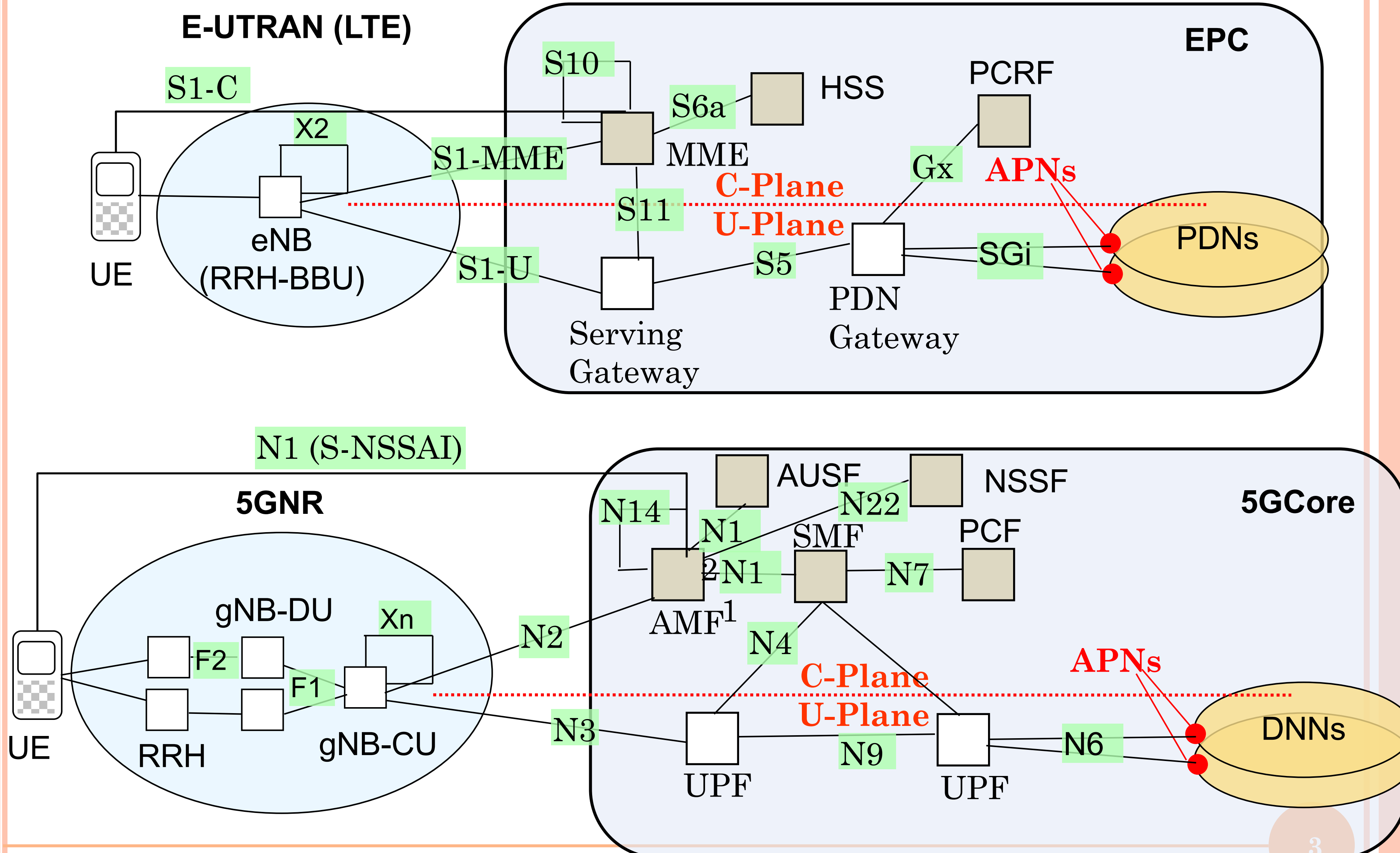
Horizon 2020
European Union funding
for Research & Innovation

5G-XHaul

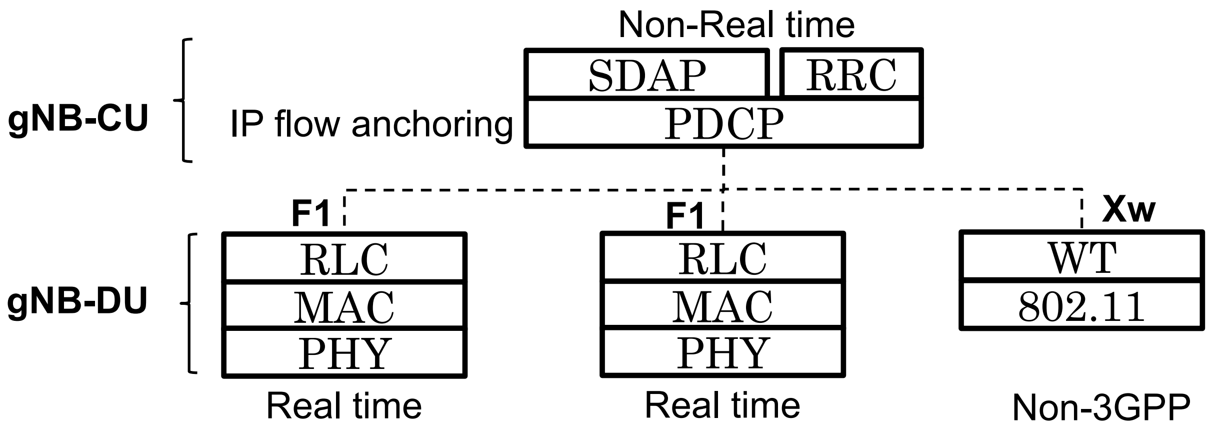
OUTLINE

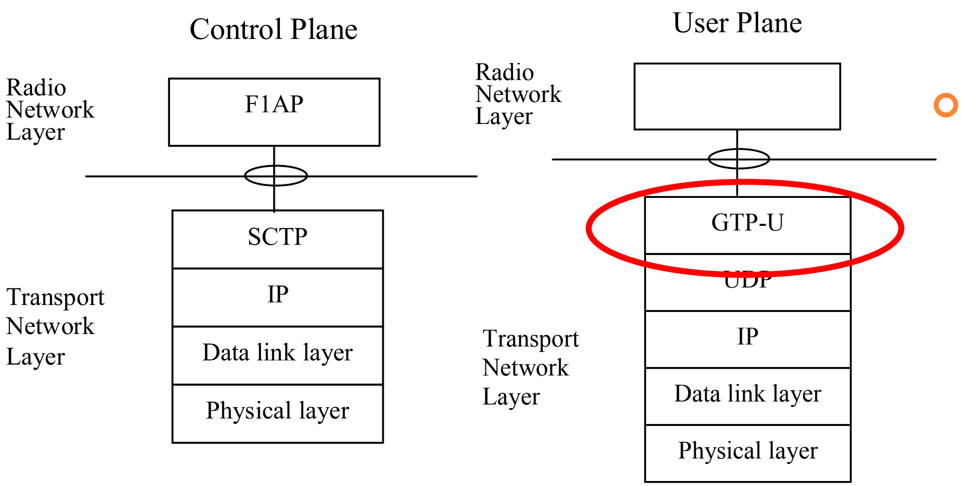
- From 4G to 5G architecture
- The F1 interface and new RRC states
- The F2 interface (3GPP and eCPRI)
- 5G deployment options
- 5GXHAUL/5GPICTURE's view on a converged 5G transport
- Thoughts on transport support for 5G QoS
- Conclusions

From 4G to 5G architecture



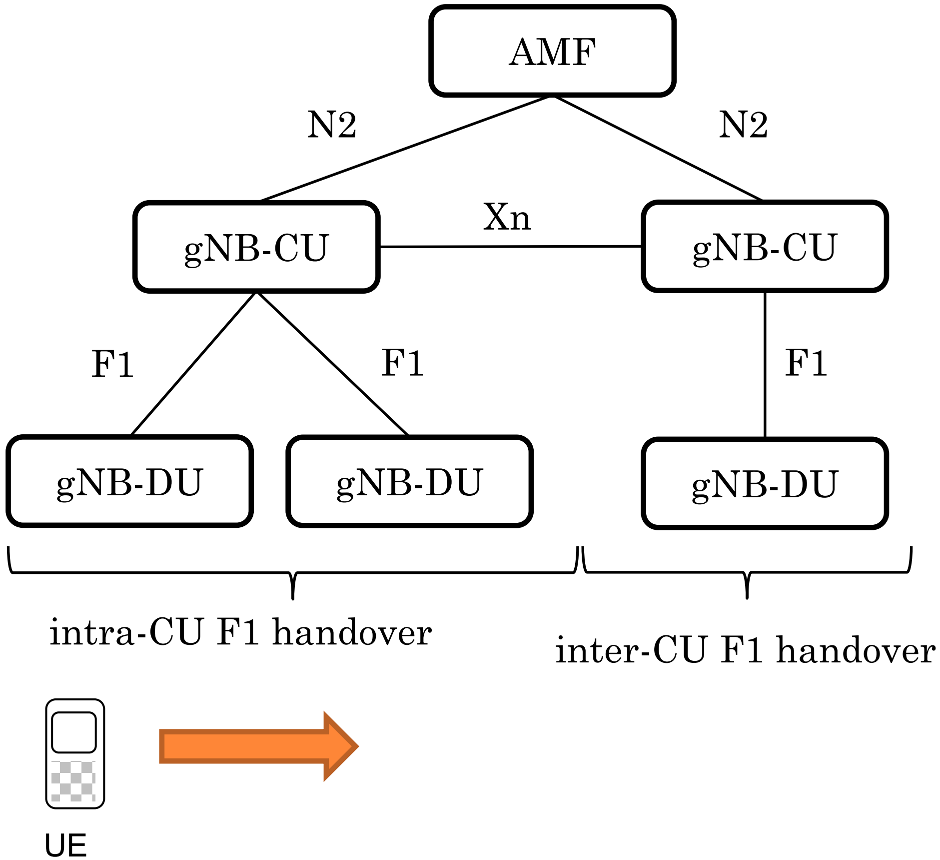
F1 INTERFACE AND NEW RRC STATES

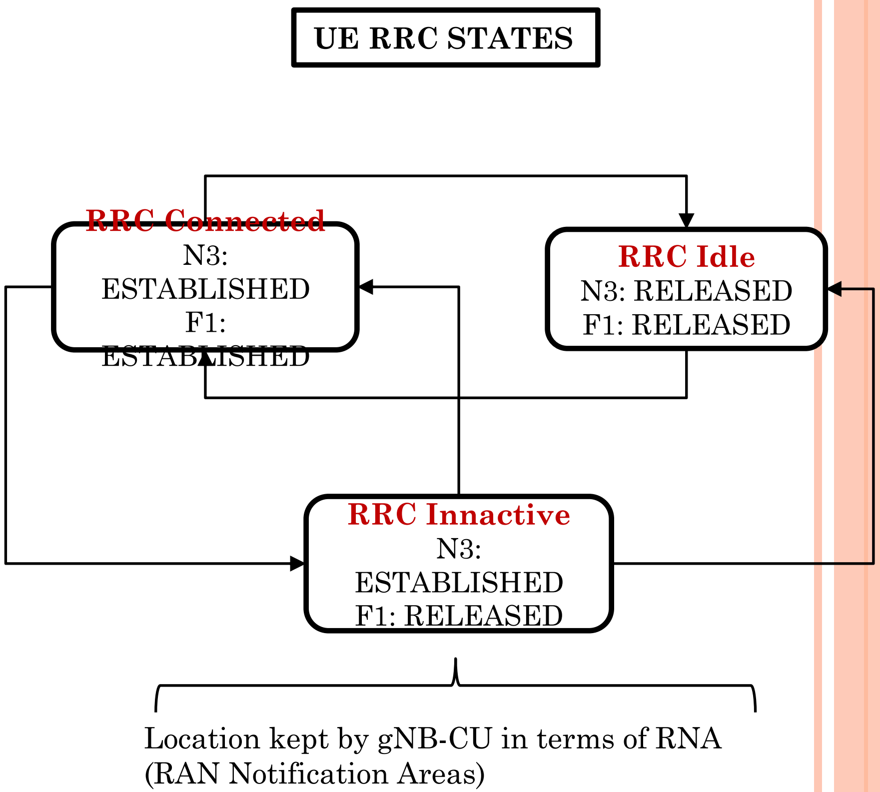




- F1 functions:
  - **Mgmt CU-DU** (discovery, reset, etc)
  - **SIB delivery** from CU to DU
  - **UE context mgmt**: F1 sessions maintained per UE

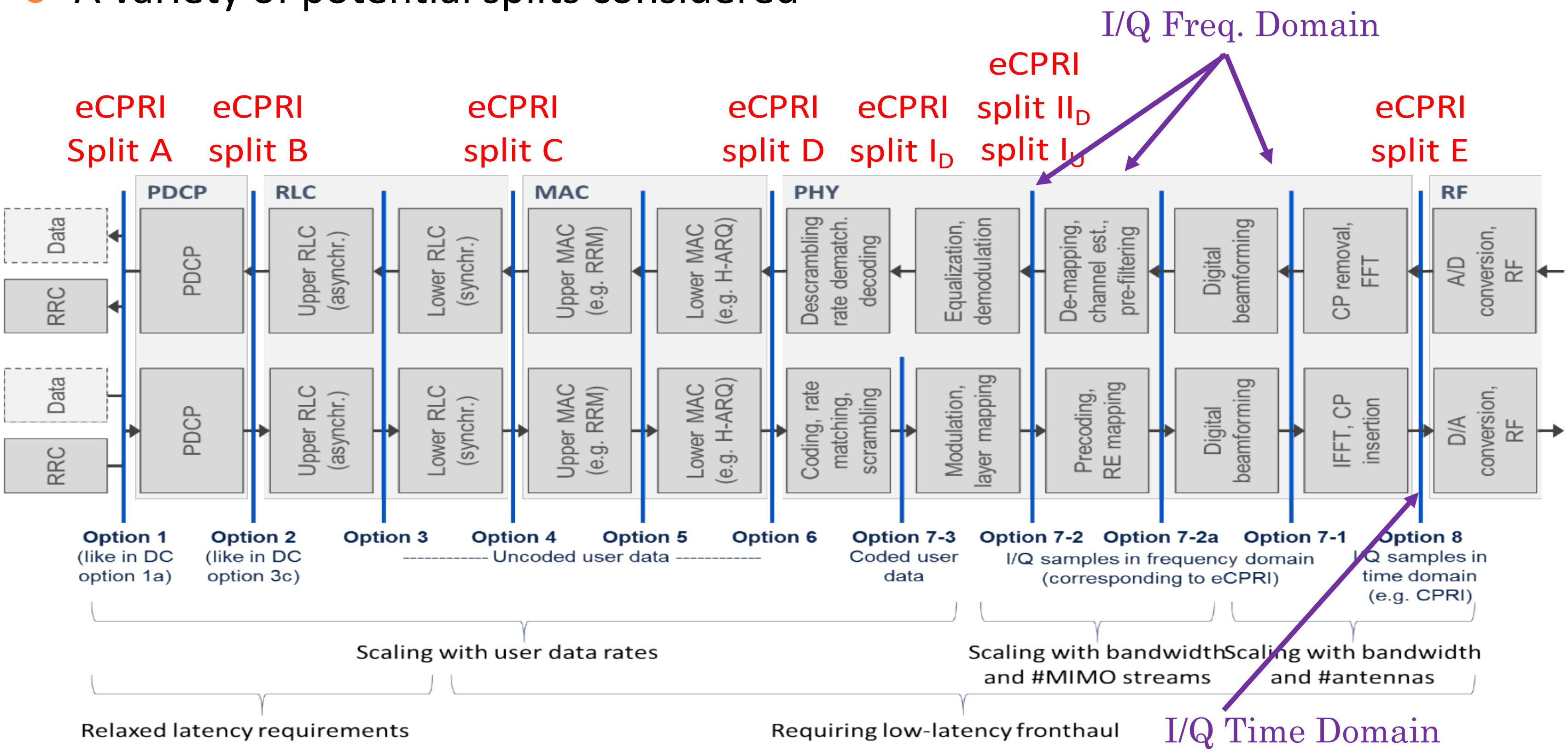
F1 INTERFACE AND NEW RRC STATES





F2 INTERFACE (3GPP AND ECPRI)

- Not much progress inside 3GPP → Work in parallel carried out by eCPRI
- A variety of potential splits considered



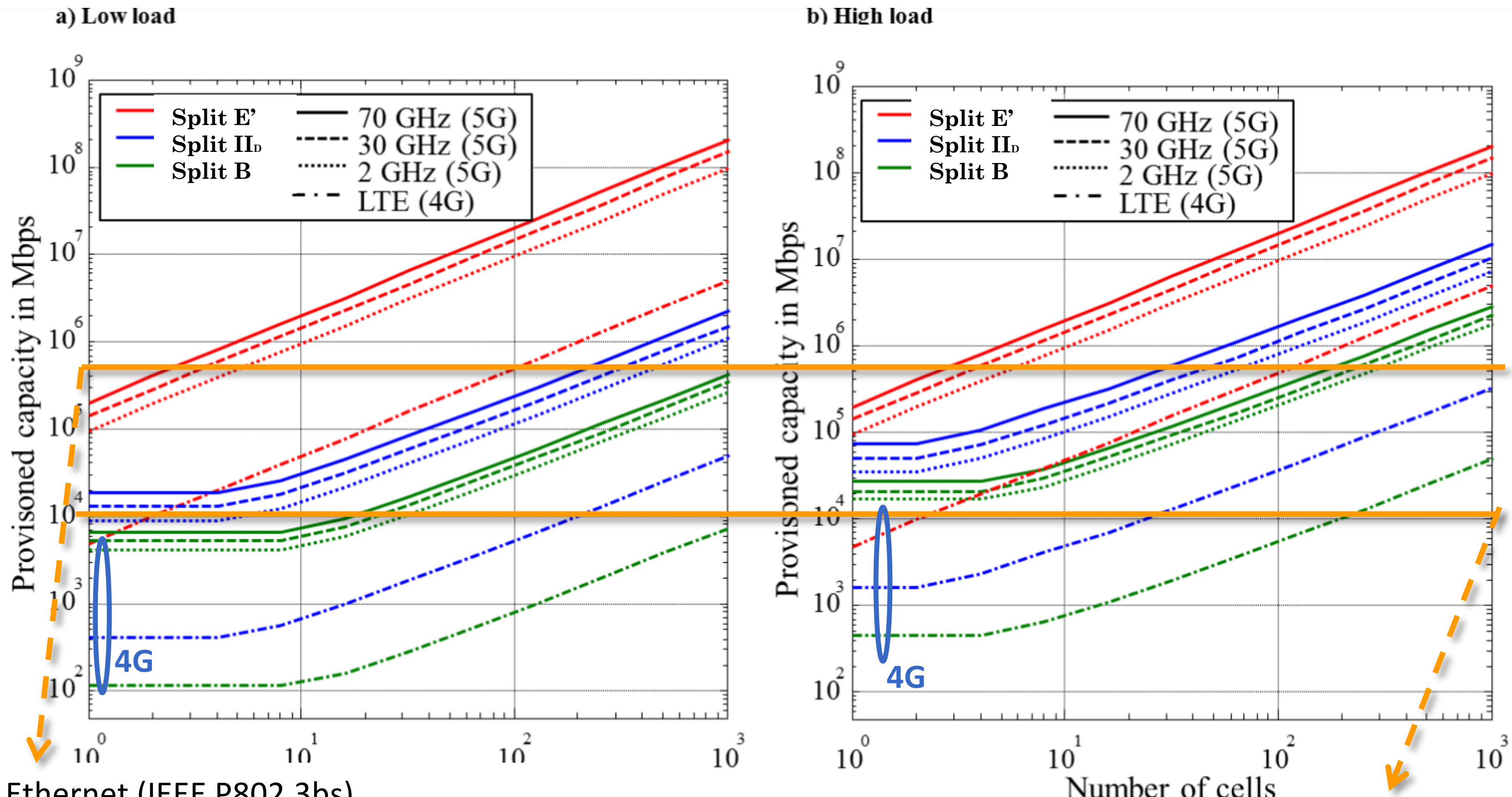
F2 Requirements Summary

- From eCPRI spec
  - 3/1.5 Gbps user throughput
  - 500 PRBs
  - 8/4 DL/UL MIMO layers
  - 64 Antennas
  - Digital BF in eREC
  - 256QAM
  - IQ 30 bits/sample

	Split D		Split I_D		Split II_D		Split E
	User Data [Gbps]	Control [Gbps]	User Data [Gbps]	Control [Gbps]	User Data [Gbps]	Control [Gbps]	User Data [Gbps]
eREC→ eRE	3 (assumption)	<< 1	< 4	< 10	~ 20	< 10	236
	Split D		**Split I_U**				**Split E**
eRE→ eREC	1.5 (assumption)	<< 1	~ 20	< 10			236

5G-XHaul

F2 INTERFACE SCALABILITY [1]



400G Ethernet (IEEE P802.3bs)

→supports all splits/RATs

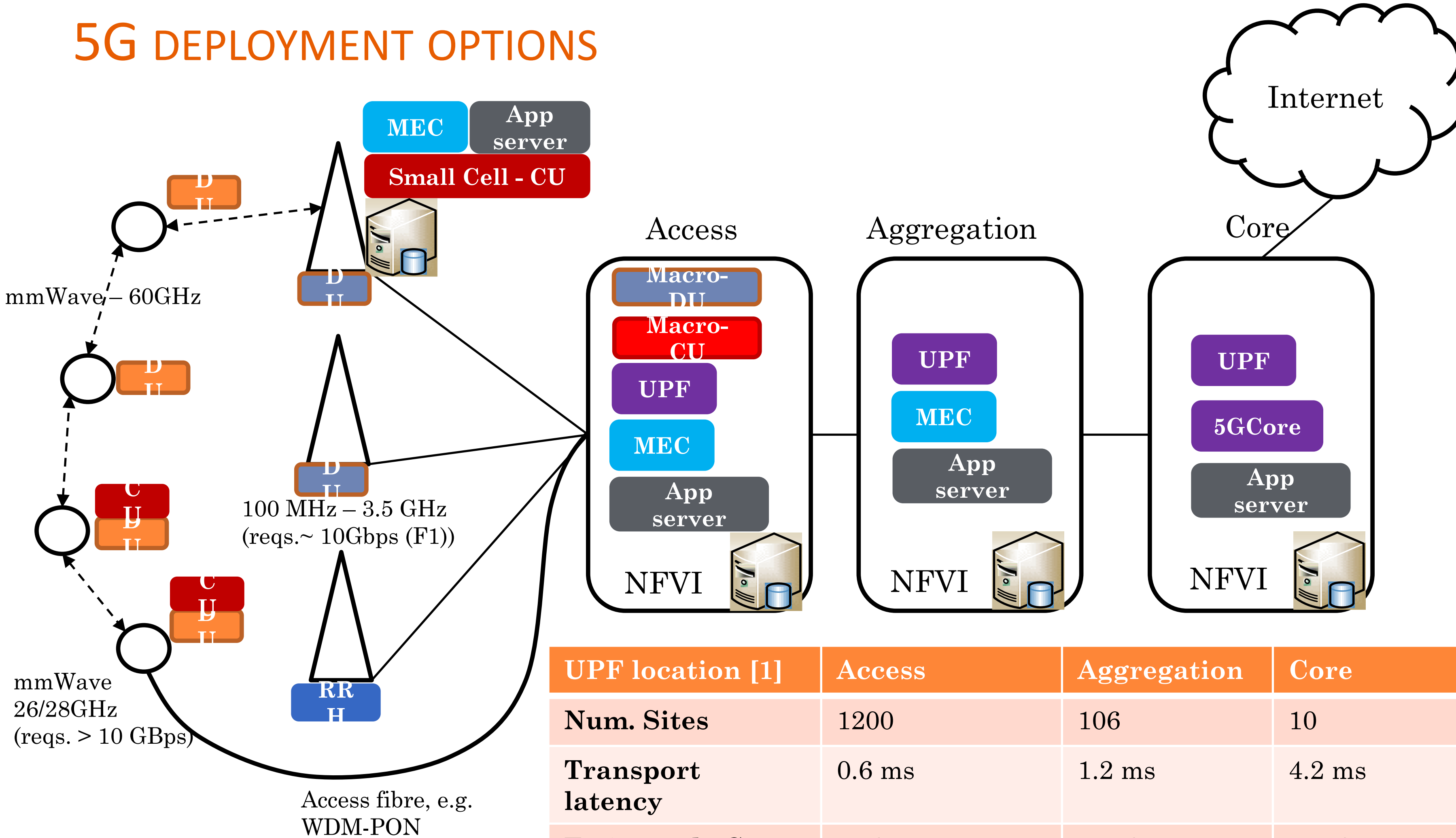
→for 5G split E'/full centralization only a few cells can be aggregated in one link

10G Ethernet, ~CPRI rate 8

→can support only 4G, low load/split C, no support of 5G split E'/full centralization

[1] Bartelt, Jens, et al. "5G transport network requirements for the next generation fronthaul interface." *EURASIP Journal on Wireless Communications and Networking* 2017.1 (2017): 89.

5G DEPLOYMENT OPTIONS

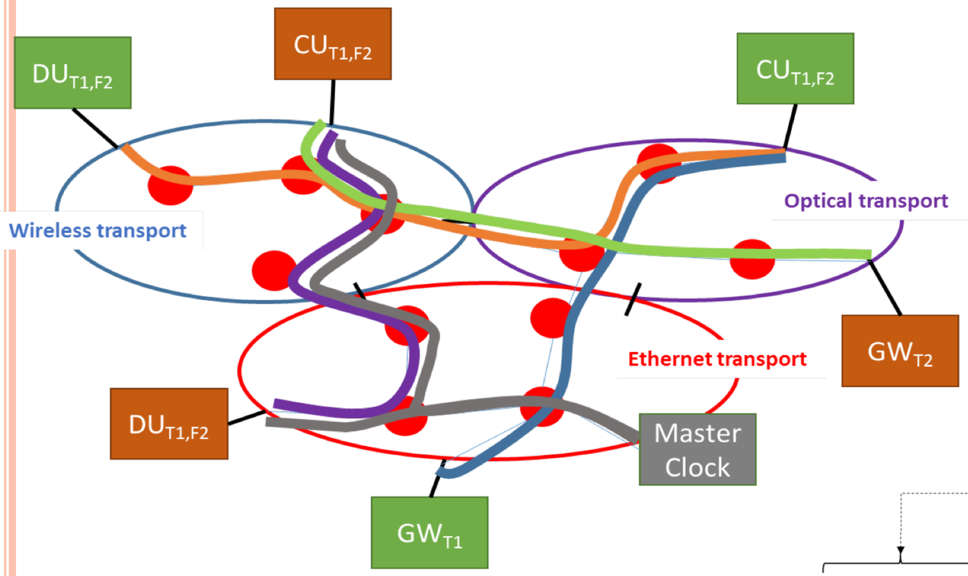


UPF location [1]	Access	Aggregation	Core
Num. Sites	1200	106	10
Transport latency	0.6 ms	1.2 ms	4.2 ms
Estimated 5G latency (*)	9.2/2.2 ms (eMBB/URLLC)	10.4/3.4 ms (eMBB/URLLC)	16.4/9.4 ms (eMBB/URLLC)

(*) 5G-RAN target OWD delays: 4 ms eMBB, 0.5 ms URLLC
[1] Andy Sutton, BT, 5G Network Architecture, available at: https://www.youtube.com/watch?v=aGEAQJ7U1tA

5GXHAUL/5GPICTURE'S VIEW ON A MULTI-TENANT 5G TRANSPORT

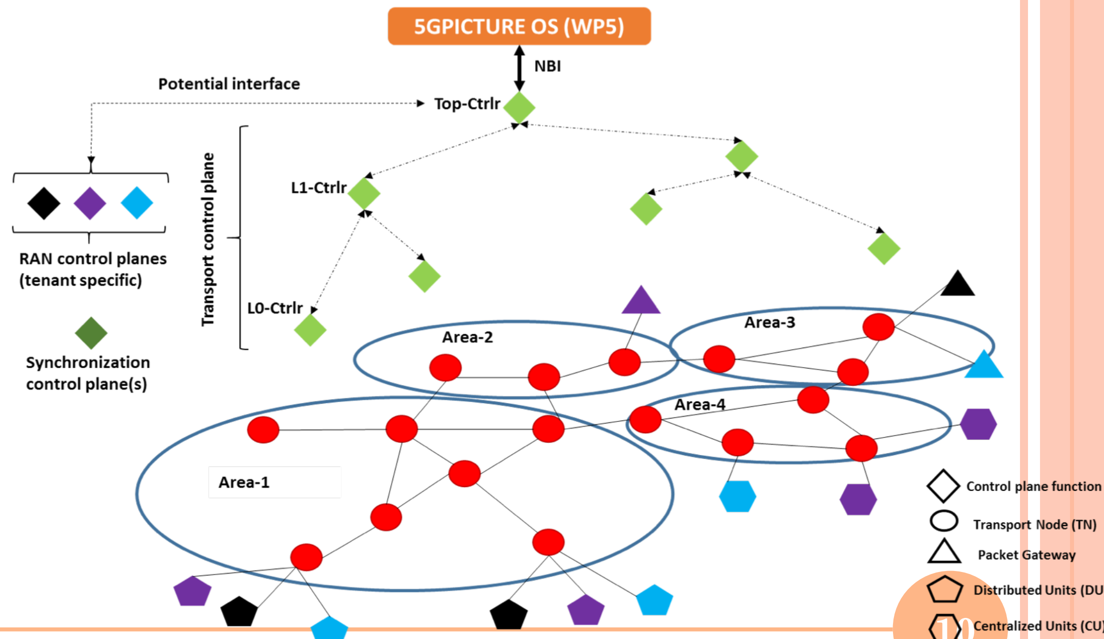
Data Plane



Data plane

- ETN (interface PNF/VNF) – IATNs (stich transport domains)
- Per-tenant state at the edge
- MACinMAC transport (pathID+sliceID)

Control Plane



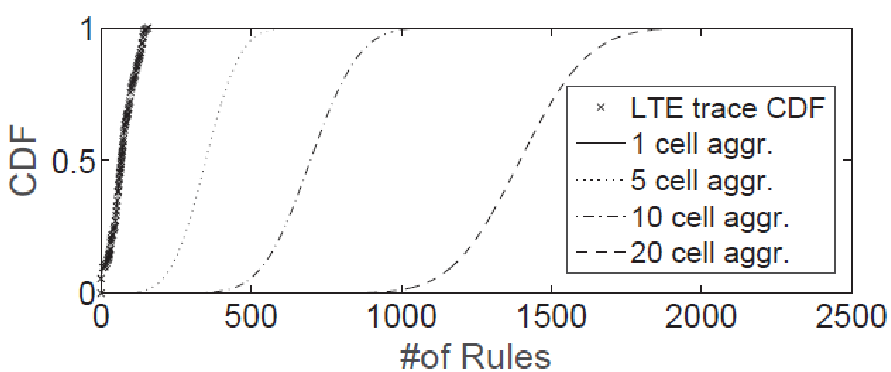
Control plane

- Hierarchical
- L0 – tech domain aware
- L1 – tech domain agnostic
- RAN – Transport interface
- Synch Harmonizer

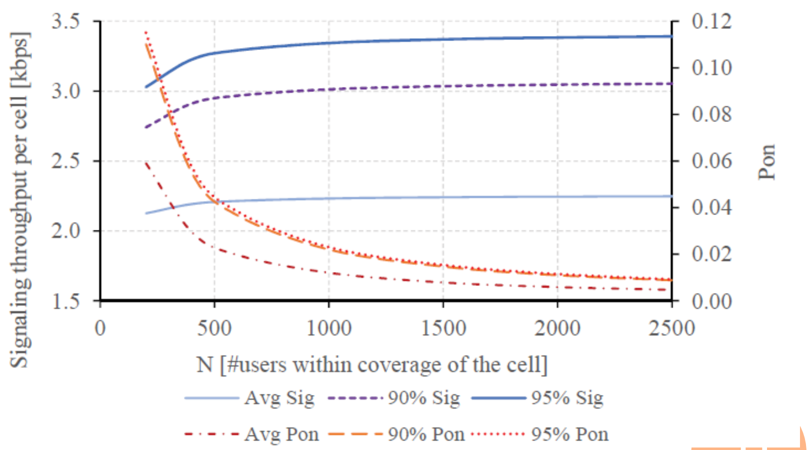
THOUGHTS ON TRANSPORT SUPPORT TO 5G QOS

- F1, N3, Xn, Xw interfaces are all based on GTP
  - GTP TEID identifies per-UE sessions
  - GTP extension header will carry the 5G QoS Flow ID (QFI)
- Can we directly map 5G QoS to transport flows (at least at the edge)?
  - i.e. establish transport flows according to UE's RRC transitions
- Analysis performed based on an operational LTE network in Greece (33 cells)

State maintained at each transport node



Signalling load with transport controller



SUMMARY AND CONCLUSIONS

- 5G RAN base station decomposed into RRH – DU – CU
- "Backhaul-like" F1 interface below PDCP between CU and DU
- Multiplicity of options (functional splits) between DU and RRH
- 5G's flexibility provides built-in support for low latency applications within the network

Thanks for
your attention!

Questions?