M-CORD: Mobile CORD

RAN Split Architecture

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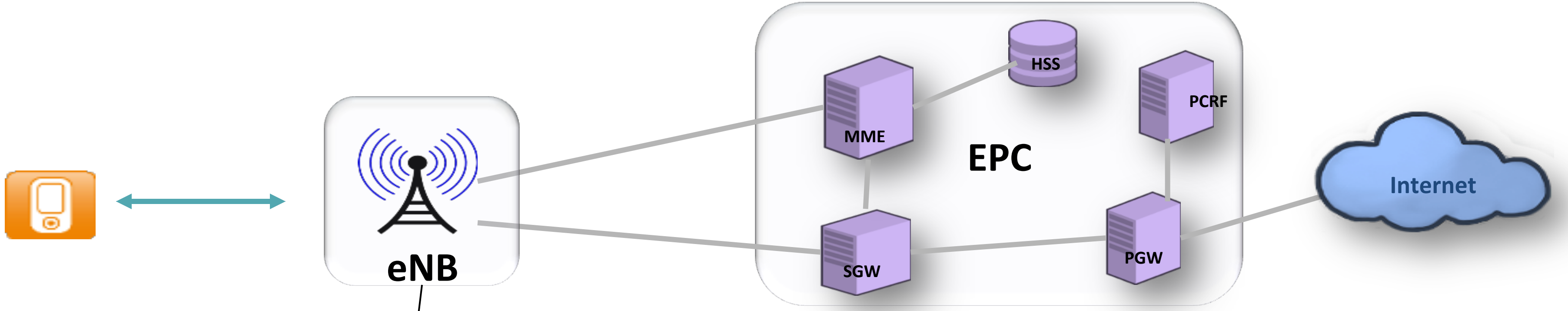
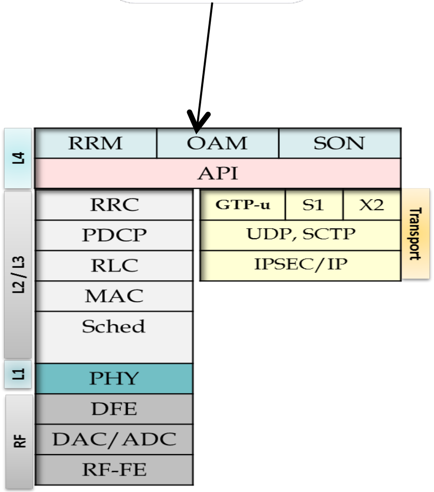
CORD
Central Office Re-architected as a Datacenter

LTE RAN Architecture





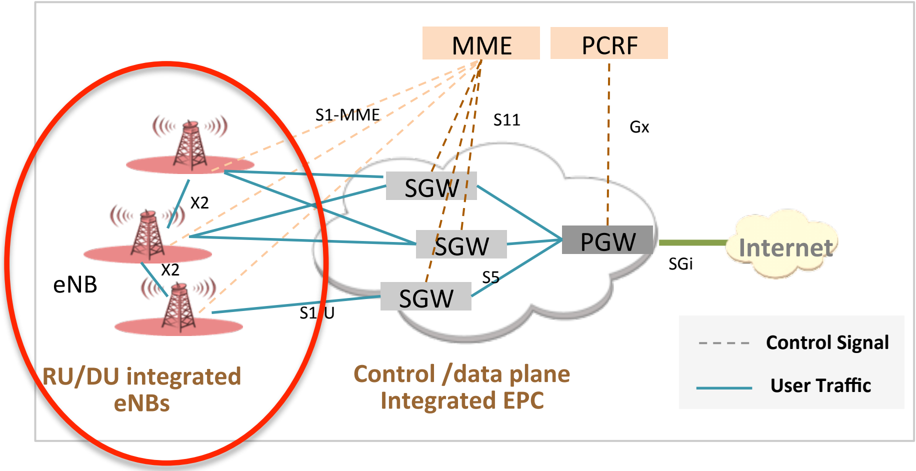
LTE eNB w/ Integrated RRU/BBU

- Flat architecture
- Integrated RRU and BBU
- Distributed L1/L2/L3 in eNB

Difficult to scale performance and capacity for traffic hotspots, HetNets, new services

Disaggregating & virtualizing RAN

Traditional Architecture

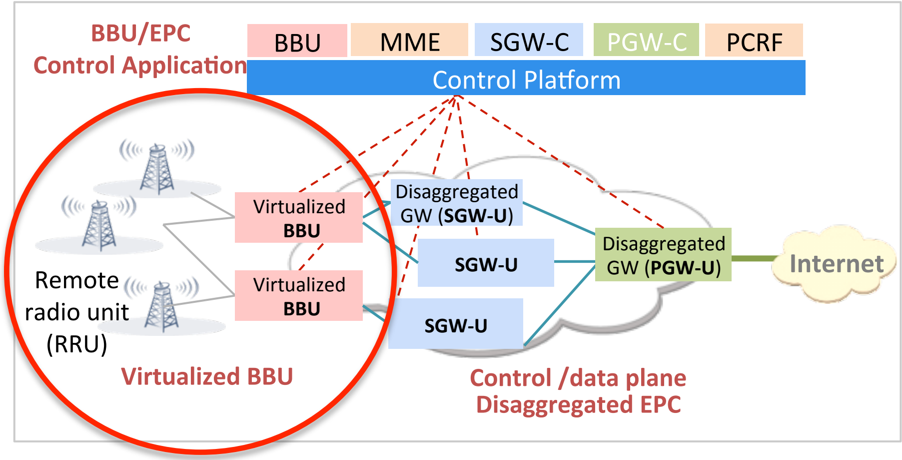


with proprietary boxes & solutions

RU/DU integrated RAN

- Limited Scalability
- Inefficient coordination
- Sub-optimal spectrum usage

Target Architecture

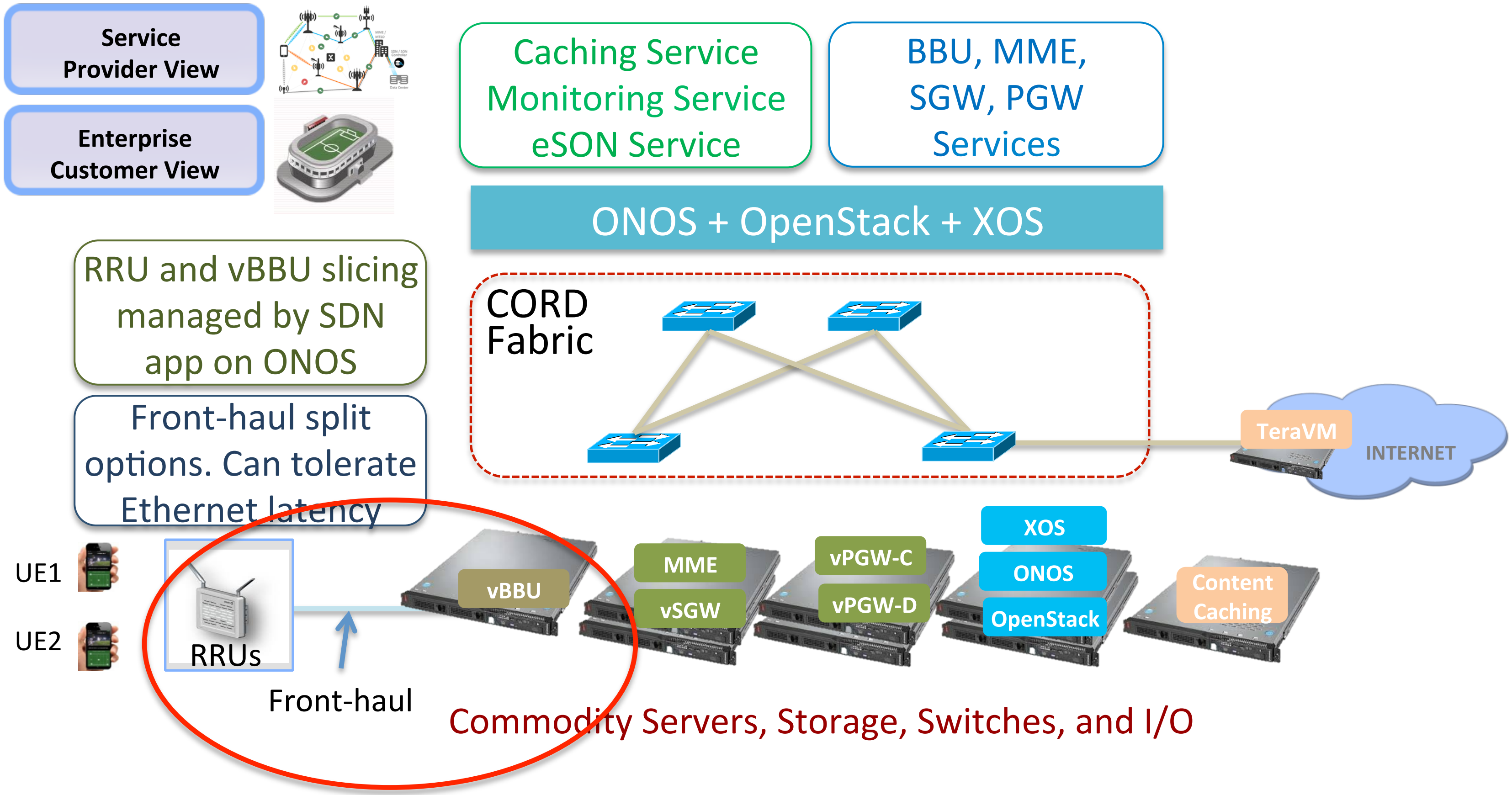


with commodity H/W & open source/open API

Disaggregated & Virtualized RAN

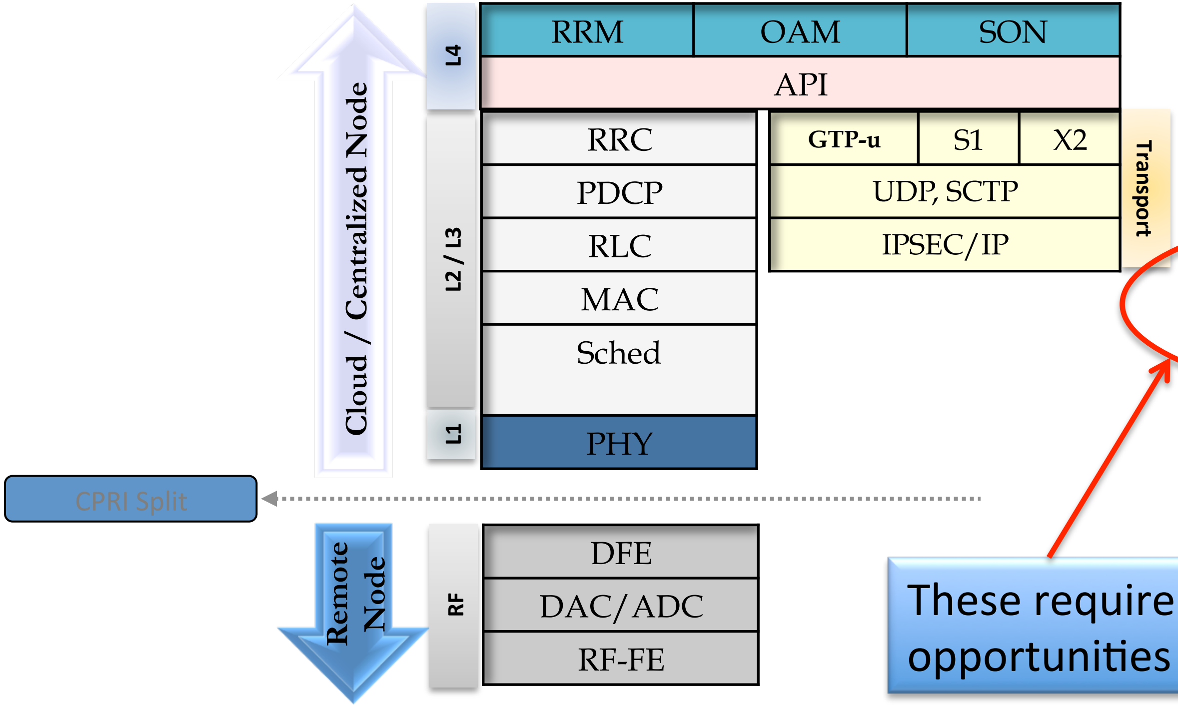
- High Flexibility & Scalability
- Centralized Coordination
- Spectrum usage optimization
- SDN managed slicing

Mobile CORD POC



Conventional C-RAN Topology

- Remote Radio Head providing Digital-Front-End and RF functions
- Centralized node(s) hosting BBU (DU) - PHY, L2/L3 and other applications
- Digitized IQ data and RF management over CPRI (Fronthaul)



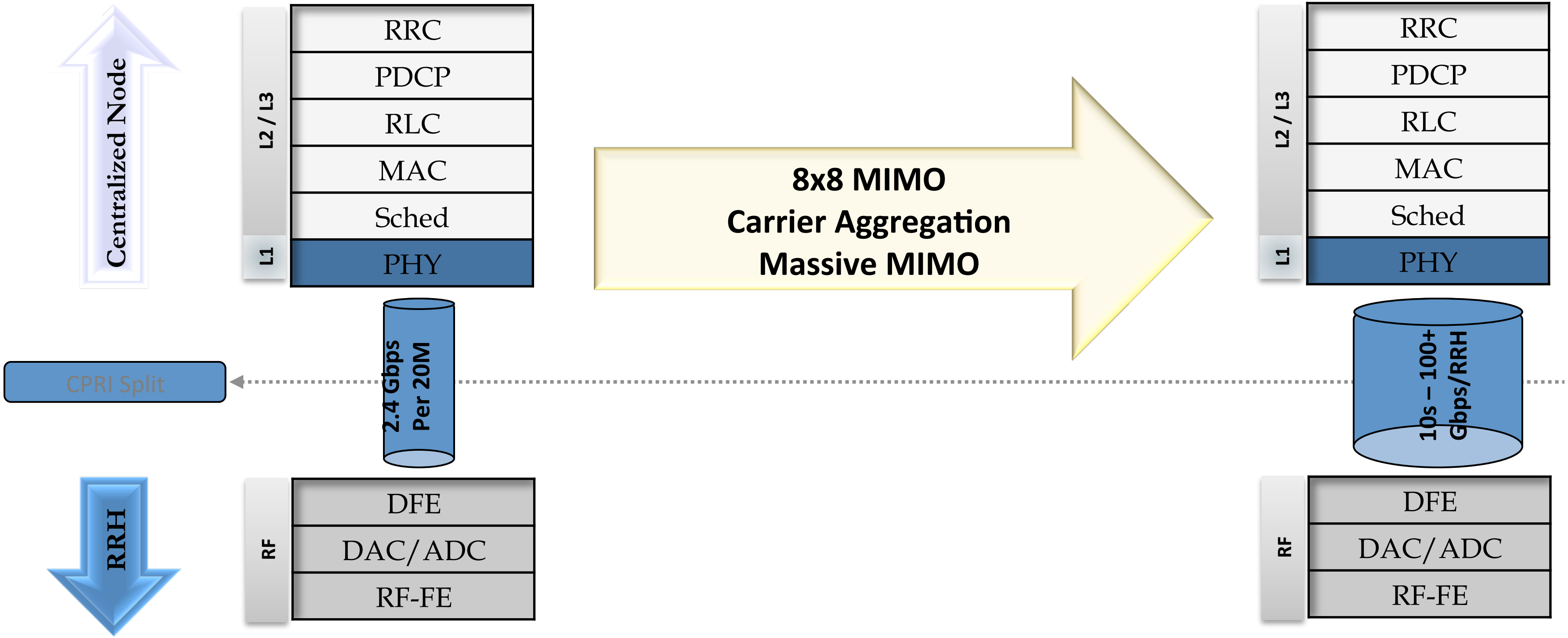
	CPRI Split
Remote Unit Split	RRH
Centralization Gain	MAX
Fronthaul	CPRI / Fiber
Fronthaul BW (1 sector 20 MHz 2T2R)	2.4 / 2.4 Gbps[1]
One-way Latency	< 250 us
CoMP (across RRHs)	Full CoMP

These requirements may limit deployment opportunities

Implications of LTE-A / 5G on C-RAN

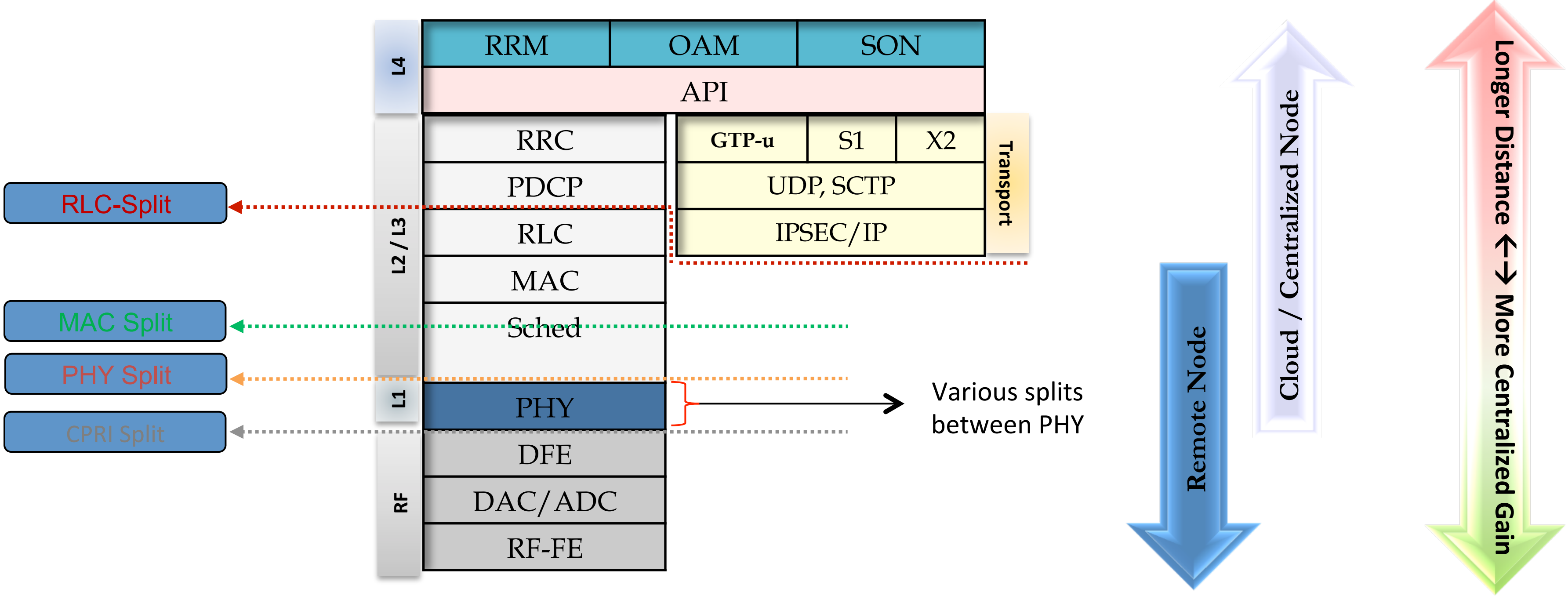
LTE-A and 5G demand much higher bandwidth demand on front-haul

- LTE-A: Higher-order MIMO, Carrier Aggregation
- 5G: Massive MIMO, Higher bandwidth. Bandwidth required jumps from Gbps to 10s to >100 Gbps



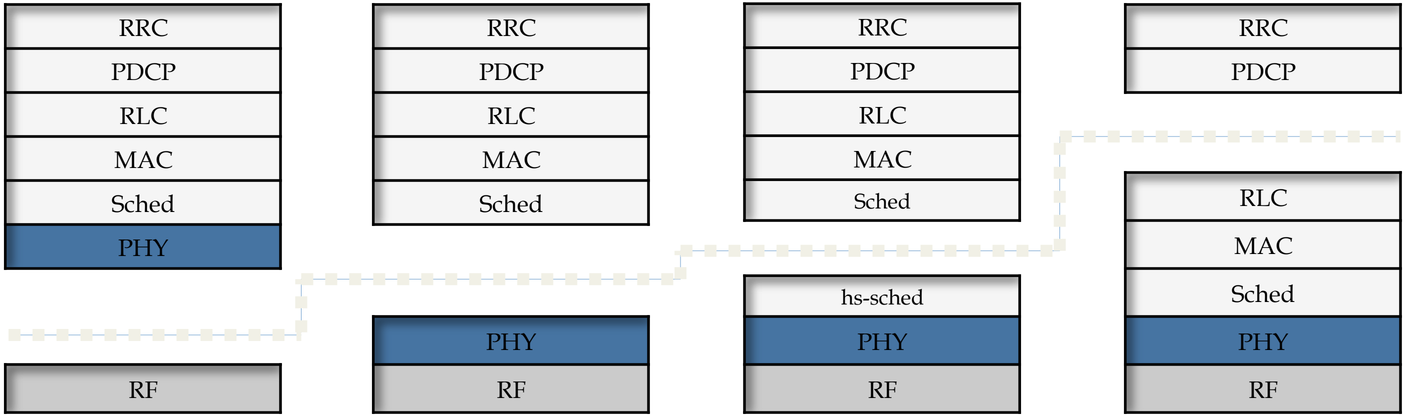
Split Options Maximize Deployment Opportunities

- Various Cloud RAN split architecture to reduce the front-haul requirements
- Each providing different benefits for centralization
- Multiple splits may co-exist in same network



Cloud RAN Split Options
Based on Fronthaul Network

Flexible CRAN Split
- Based on fronthaul
- Based on traffic / network load
- Co-existence of various splits
- Edge clouds incl. distributed (partial) EPC



	CPRI Split	PHY Split	MAC Split	RLC Split
Remote Unit Split	RRH	RF , PHY	RF, PHY, HS-Sched	RF, PHY, MAC, RLC
Centralization Gain	MAX	Scheduler+	Scheduler+	PDCP+
Fronthaul	CPRI / Fiber	Ethernet	Ethernet	Ethernet
Fronthaul BW (1x 20 MHz 2T2R sector)	2.4 / 2.4 Gbps[1]	Similar to S1/X2 Rate OTA: 150/75 Mbps[2]	Similar to S1/X2 Rate OTA: 150/75 Mbps	Similar to S1/X2 Rate OTA: 150/75 Mbps
One-way Latency	< 250 us	< 250 us < 3 ms w/ HARQ susp	0 – 6 ms	Low: 0-10 ms Med-High: 10-30ms
Centralization Gain	Full CoMP, Scheduler, RRM +	Limited CoMP, Scheduler, RRM+	Limited CoMP, Scheduler, RRM+	RRM+

[1]No CPRI compression [2]Ignoring communication overheard for split

Standardization Activities

Small Cell Forum RPH Group on Virtualization

- Small Cell virtualization functional splits and use-cases
  - Various eNB functional splits: PHY, Split MAC, RLC-PDCP, PDCH-RRC
  - Various front-haul latencies
- Network FAPI interface standardization
  - Standardize interface between central and remote processing units