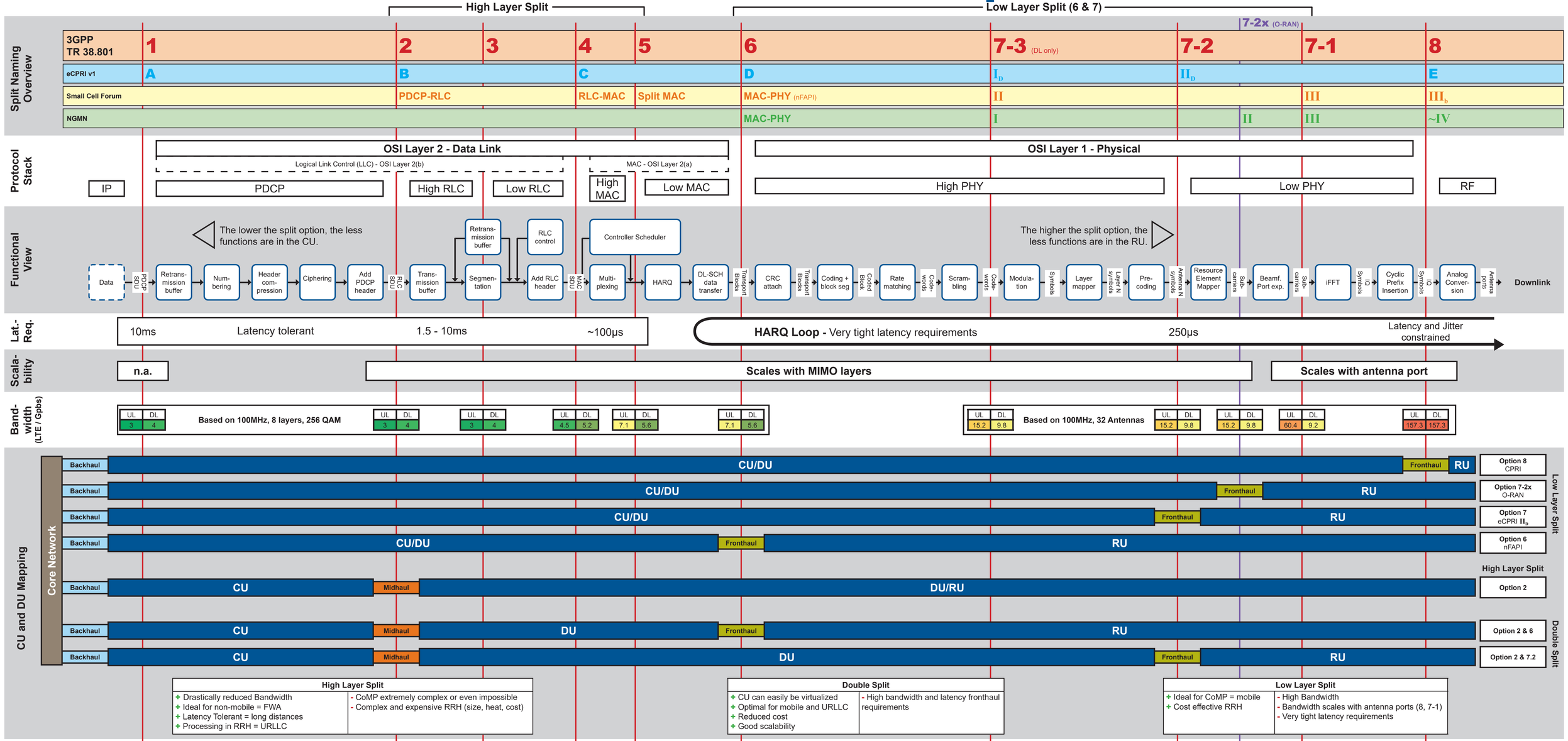
5G Fundamentals : Functional Split Overview



High Layer Split	
+ Drastically reduced Bandwidth	- CoMP extremely complex or even impossible
+ Ideal for non-mobile = FWA	- Complex and expensive RRH (size, heat, cost)
+ Latency Tolerant = long distances	
+ Processing in RRH = URLLC	

Double Split	
+ CU can easily be virtualized	- High bandwidth and latency fronthaul requirements
+ Optimal for mobile and URLLC	
+ Reduced cost	
+ Good scalability	

Low Layer Split	
+ Ideal for CoMP = mobile	- High Bandwidth
+ Cost effective RRH	- Bandwidth scales with antenna ports (8, 7-1)
	- Very tight latency requirements

Split	1	2	3	4	5	6	7-3	7-2	7-2x	7-1	8
Pros	+ Low bandwidth requirements. + Bitrate scales with MIMO layers. + Separate User Plane and centralized RRC/RRM.* + It may in some circumstances provide benefits in handling some edge computing or low latency use cases where the user data needs to be located close to the transmission point.*	+ Fundamentals for achieving a PDCP-RLC split have already been standardized for LTE Dual Connectivity.* + The 2-2 option enables centralization of the PDCP layer.* + Option 2-2 allows a separate UP and a centralized RRC/RRM.*	+ Very Low bandwidth requirements. + Low latency requirements. + More robust under non-ideal transport conditions.* + Possibility of reduced processing and buffer requirements in DU.* + In option 3-2 Rx RLC is placed in the CU, there is no additional transmission delay of PDCP/RLC reestablishment procedures.*	+ Low bandwidth requirements. + Bitrate scales with MIMO layers.	+ Low bandwidth requirements. + Reduced latency requirements if HARQ processing and cell-specific MAC functionalities are performed in DU.* + Efficient interference management across multiple cells and enhanced scheduling technologies such as CoMP, CA, etc.*	+ Bitrate scales with MIMO layers + Significant bandwidth reduction compared to split option 7-3. + Joint Transmission is possible.* + Centralized scheduling is possible.* + Allows resource pooling for layers including and above MAC.*	+ Bitrate scales with MIMO layers + Reduced bandwidth requirements compared to split option 7-1. + Coordinated multi-point schemes are possible if CU/DU are colocated.* + Transmit and receive joint processing is possible.*	+ Bitrate scales with MIMO layers + Reduced bandwidth requirements compared to split option 7-1. + Coordinated multi-point schemes are possible if CU/DU are colocated.* + Transmit and receive joint processing is possible.*	+ Simplified interface + Open interface protocol specifically designed to enable interoperability between RUs and DUs from different vendors. + Bitrate scales with MIMO layers + Reduced bandwidth requirements compared to split option 7-1.	+ The required bitrate is more than half of split option 8. + Coordinated multi-point schemes are possible if CU/DU are colocated.* + Transmit and receive joint processing is possible.*	+ Small and cost effective RU. + Easy to centralize CU/DU enabling coordinated multi-point (CoMP) schemes.* + Majority of processing can be centralized at a BBU hotel or CU-pool.* + RUs can be used for different generations of RAT (GSM, 3G, 4G)
Cons	- Very complex and expensive DU/RU. - It's not clear if this option can support aggregation based on alternative 3C.*	- Coordination of security configurations between different PDCP instances for Option 2-2 required.*	- Split 3-1 is more latency sensitive than 3-2 due to the ARQ in CU and not DU.*	- No benefits for LTE.*	- Complex interface between CU and DU.* - Difficulty in defining scheduling operations over CU and DU.* - Limitations for some CoMP schemes.*	- May require subframe-level timing interactions between MAC layer in CU and PHY layers in DUs.* - Round trip fronthaul delay may affect HARQ timing and scheduling.*	- High bandwidth requirements. - Relatively high latency requirements - Complex timing for RU and CU/DU link.*	- High bandwidth requirements. - Relatively high latency requirements - Complex timing for RU and CU/DU link.*	- High bandwidth requirements. - Relatively high latency requirements.	- Still relatively high bandwidth requirement especially for the uplink. - Bandwidth scales with number of RUs.* - Very latency constrained. - Complex timing for RU and CU/DU link.*	- Highest bandwidth requirements of all functional split options. - Bandwidth scales with number of RUs.* - Very latency and jitter constrained. - Distance between RU and DU/CU limited to ~20km due to latency constraint. - Interoperability between radio equipment vendors not specified
Use Cases	> Best suited for low latency and/or edge computing scenarios.	> Suited for high layer split between CU and DU. Very latency tolerant enabling distances up to 40km.	> Low bitrate and latency insensitive midhaul connections between CU and DU with non-ideal transport conditions.*	> No specific advantage for use cases.	> Ideal for scenarios where distances greater than 20km between DU and CU need to be bridged.	> Ideal for small cell deployments.	> Suited for setup with limited fiber capacity in the fronthaul.	> Current 5G eCPRI radios use this split option.	> Ideally suited for virtualized RAN and virtual DU running on general purpose processing platforms.	> High fiber capacity available between radio and centralized location.	> High fiber capacity available between radio and centralised location. > Real time communication applications. > Possible to integrate in Ethernet based networks using Radio over Ethernet.

* 3GPP TR 38.801 V14.0.0 (2017-03): „Study on new radio access technology: Radio access architecture and interfaces."