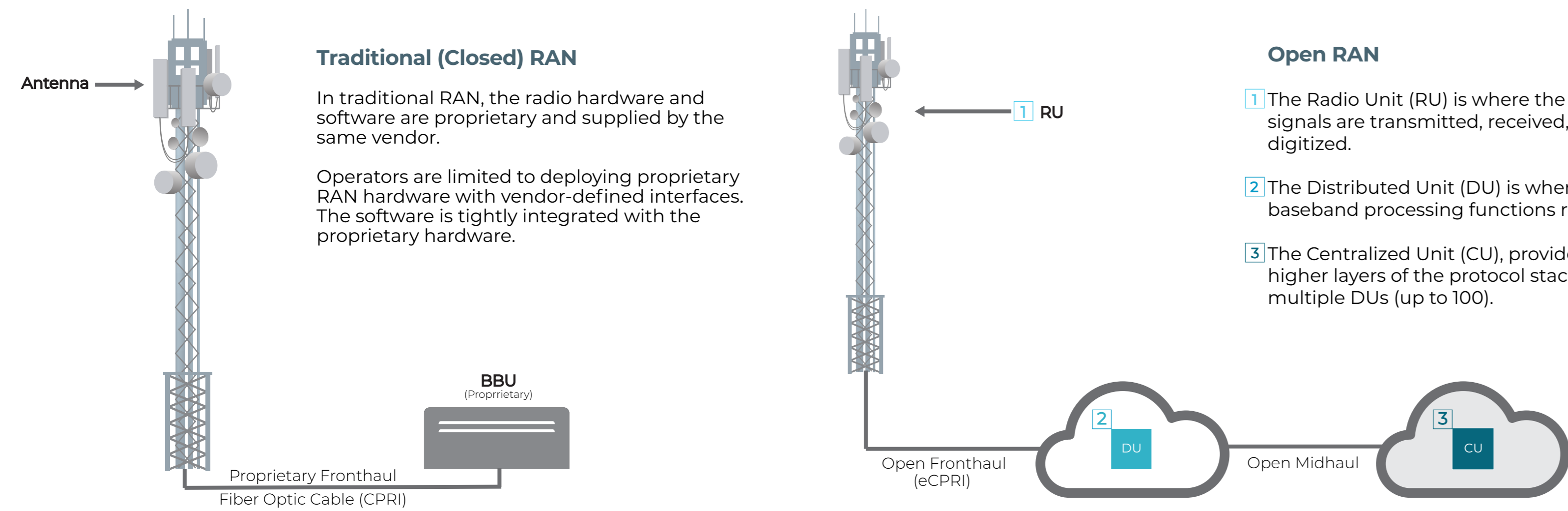


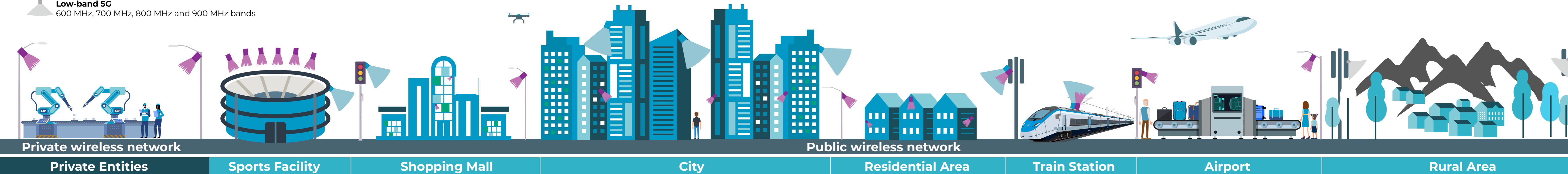
## Transitioning to Open RAN



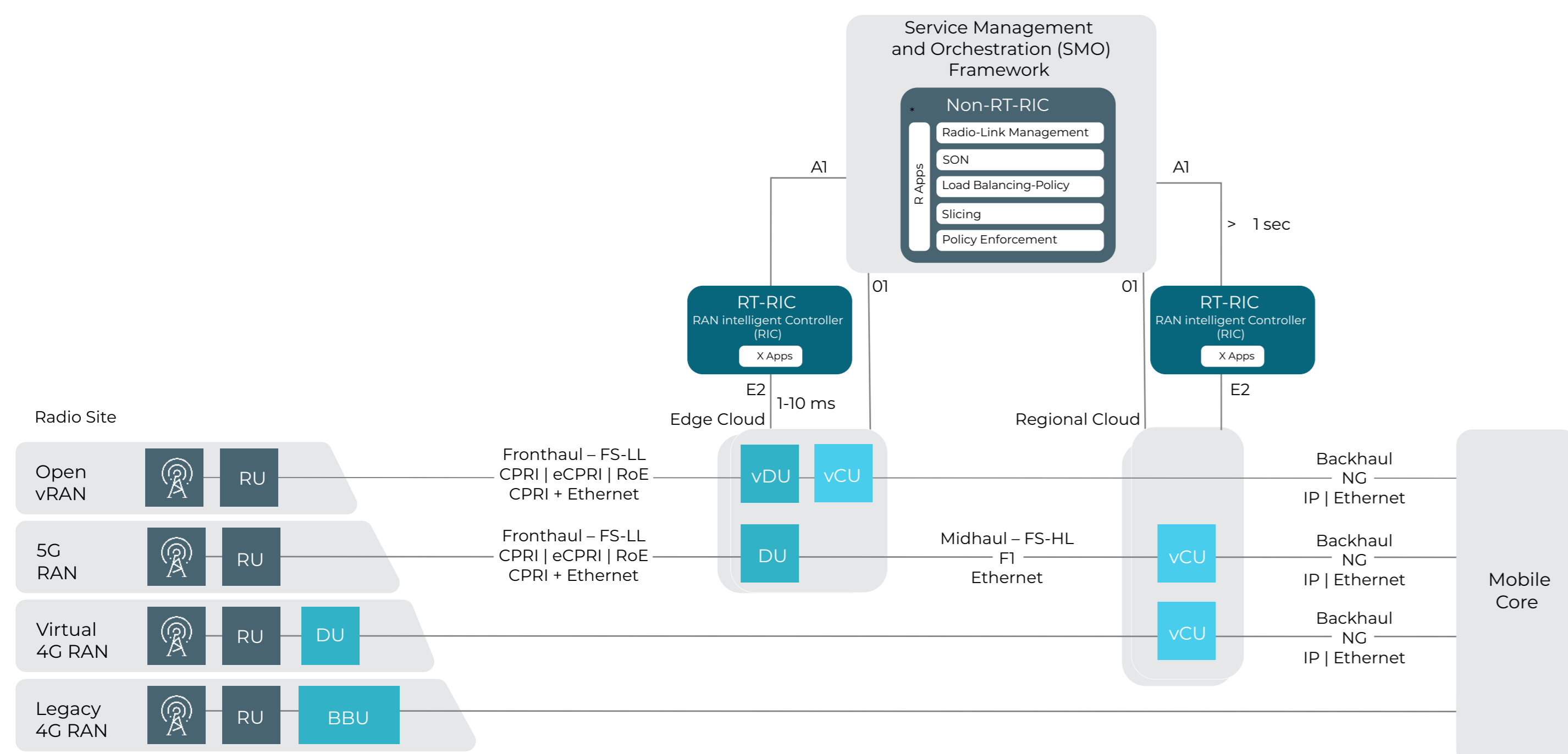
### Legend

- High-band 5G (mmWave)**  
24 GHz, 28 GHz, 37 GHz, 39 GHz and 47 GHz bands.
- Mid-band 5G**  
Sub-6 (1-6) GHz spectrum, ranging from 2.5 GHz, 3.5 GHz and 3.7 GHz to 4.2 GHz bands
- Low-band 5G**  
600 MHz, 700 MHz, 800 MHz and 900 MHz bands

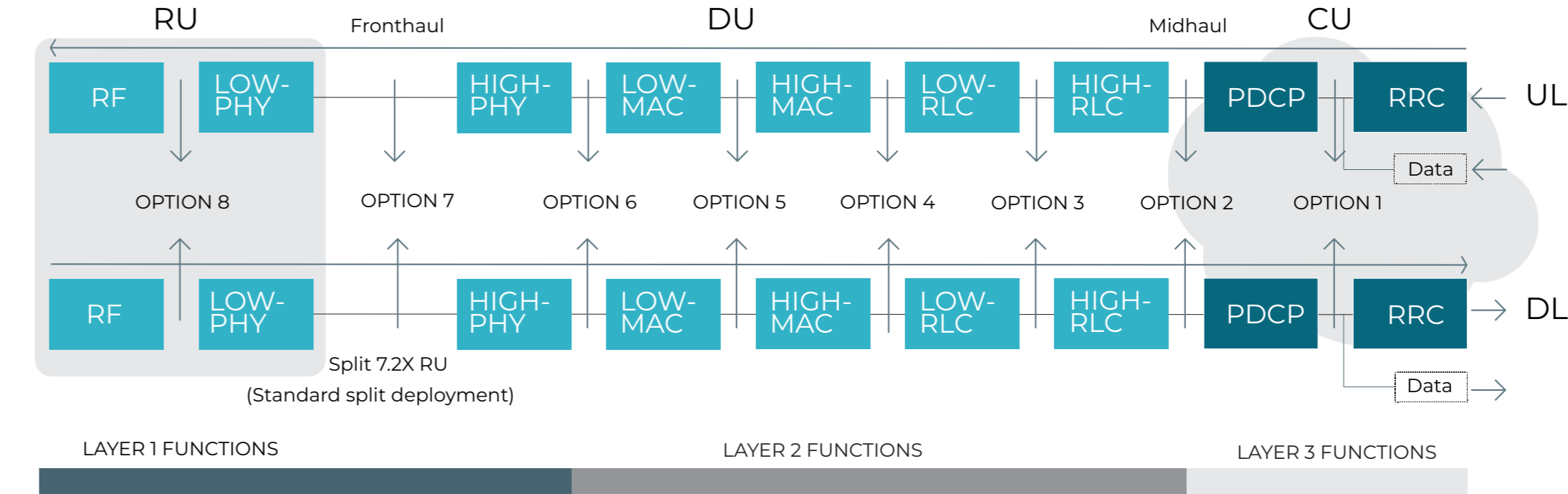
## Delivering 5G with Low, Mid and High Band Spectrum



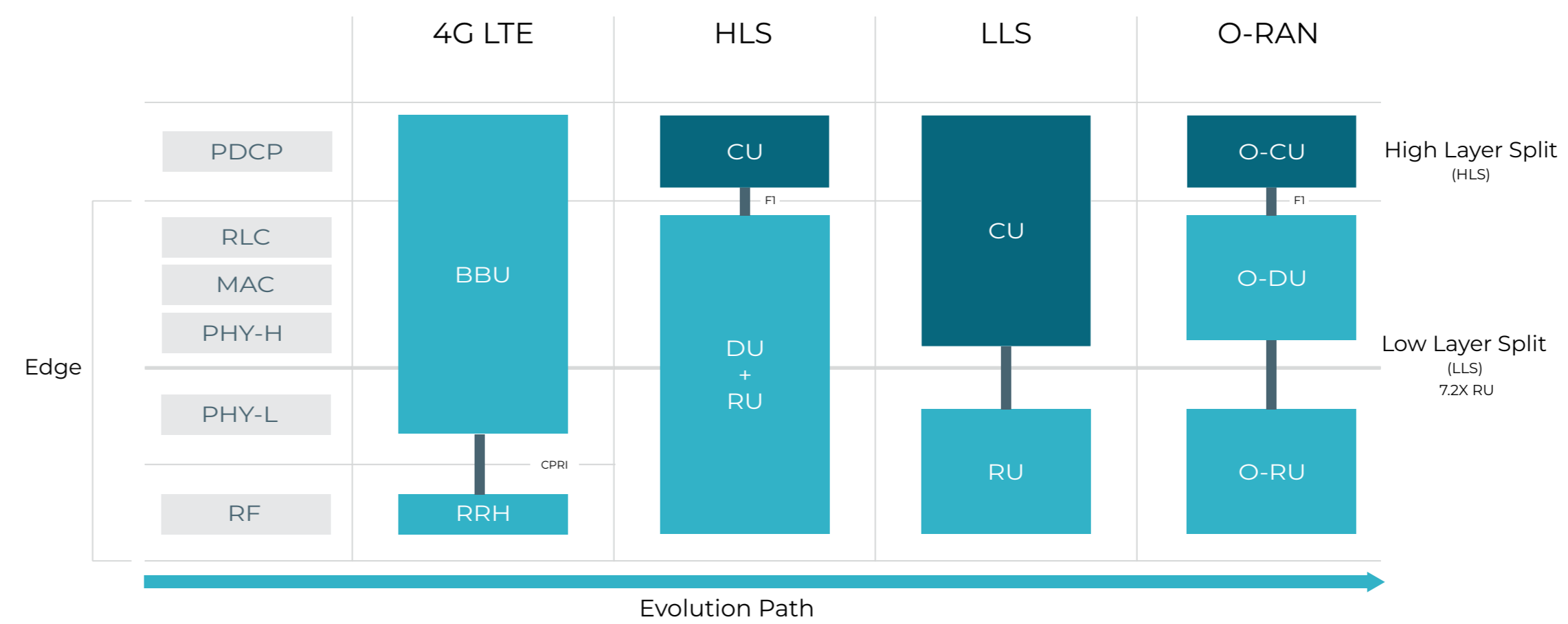
## Transition from 4G to Open RAN



## RAN Functional Split Options for 5G



## Evolution of RAN Component Split from 4G to 5G O-RAN



## 4G vs. 5G RAN Protocols and Specifications

3GPP Specification	4G Advanced	5G New Radio (NR)
Service Data Adaptation Protocol	SDAP: 3GPP TS 36.324	SDAP: 3GPP TS 37.324
Radio Resource Control	RRC: 3GPP TS 36.331	NR-RRC: 3GPP TS 38.331
Packet Data Convergence Protocol	PDCP: 3GPP TS 36.323	NR-PDCP: 3GPP TS 38.323
Radio Link Control	RLC: 3GPP TS 36.322	NR-RLC: 3GPP TS 38.322
Medium Access Control	MAC: 3GPP TS 36.321	NR-MAC: 3GPP TS 38.321
Physical Layer	PHY	NR-PHY
Physical channels and modulation	3GPP TS 36.211	3GPP TS 38.211
Multiplexing and channel coding	3GPP TS 36.212	3GPP TS 38.212
Physical layer procedures	3GPP TS 36.213	3GPP TS 38.213 (control) 3GPP TS 38.214 (data)
Physical layer measurements	3GPP TS 36.214	3GPP TS 38.215
User Equipment (UE) radio transmission and reception	3GPP TS 36.101	3GPP TS 38.101-1: Part 1: Range 1 Standalone 3GPP TS 38.101-2: Part 2: Range 2 Standalone 3GPP TS 38.101-3: Part 3: Range 1 and Range 2 Interworking operation with other radio access technologies 3GPP TS 38.101-4: Part 4: Performance requirements
Base Station (BS) radio transmission and reception	3GPP TS 36.104	3GPP TS 38.104
Requirements for support of radio resource management	3GPP TS 36.133	3GPP TS 38.133
Physical layer: General description	3GPP TS 36.201	3GPP TS 38.201
Services provided by the physical layer	3GPP TS 36.302	3GPP TS 38.202
User Equipment (UE) procedures in idle mode	3GPP TS 36.304	3GPP TS 38.304
Multi-RAT Co-Existence	3GPP TR 37.872: Supplementary uplink (SUL) and LTE-NR co-existence	

## Acronyms

Acronym/Abbreviation	Description
ACLAR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
AMF	Access and Mobility Management Function
AS	Access Stratum
AWGN	Additive White Gaussian Noise
BHR	Backhaul Rate
BM-SC	Broadcast Multicast Service Center
BS	Base Station
BSS	Business Support System
BW	Bandwidth
BWP	Bandwidth Part
CA	Carrier Aggregation
CBRS	Citizens Broadband Radio Service
CC	Component Carrier
CoMP	Coordinated Multipoint
CP	Control Plane
CP-OFDM	Cyclic Prefix-OFDM
CPRI	Common Public Radio Interface
CU	Central Unit
CUPS	Control and User Plane Separation
CW	Continuous Wave
DC	Data Center
DFT-s-OFDM	Discrete Fourier Transform-spread-OFDM
DL	Downlink
DN	Data Network
DU	Distributed Unit
eCPRI	Enhanced Common Public Radio Interface
eMBB	Enhanced Mobile Broadband
EN-DC	E-UTRA-NR Dual Connectivity
EPC	Evolved Packet Core
EPS	Evolved Packet System
FDD	Frequency Division Duplex
FFT	Fast Fourier Transform
FR	Frequency Range
gNB	gNodeB (5G NR Base Station)
HLS	Higher Layer Split
LDPC	Low Density Parity Check
LLS	Lower Layer Split
MAC	Medium Access Control
MBMS	Multimedia Broadcast Multicast Service
MBMS-GW	MBMS Gateway
MIMO	Multiple-Input Multiple-Output
MME	Mobility Management Entity
mMTC	Massive Machine Type Communication
mmWave	Millimeter-wave
MN	Master Node
NAS	Non-Access Stratum
NB-IoT	Narrow Band Internet of Things

## Protocol Stack by Band Distribution

