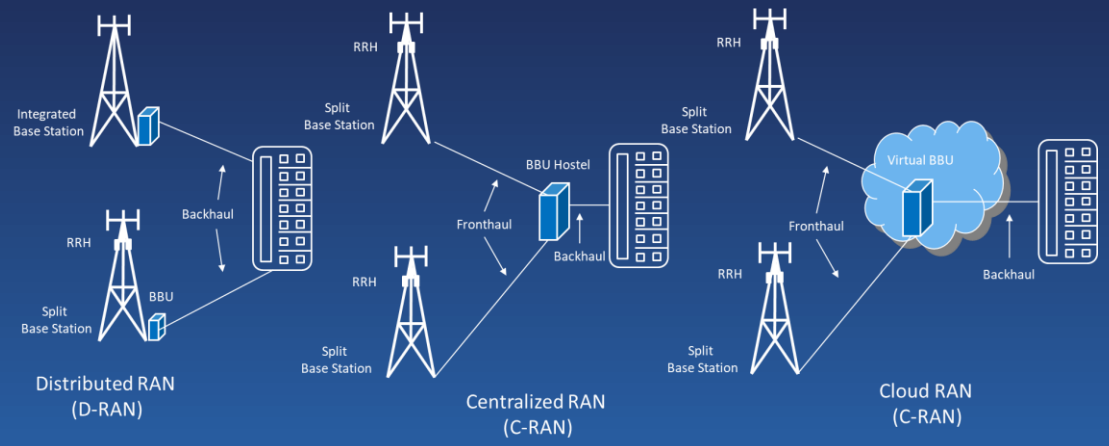


Beginners:

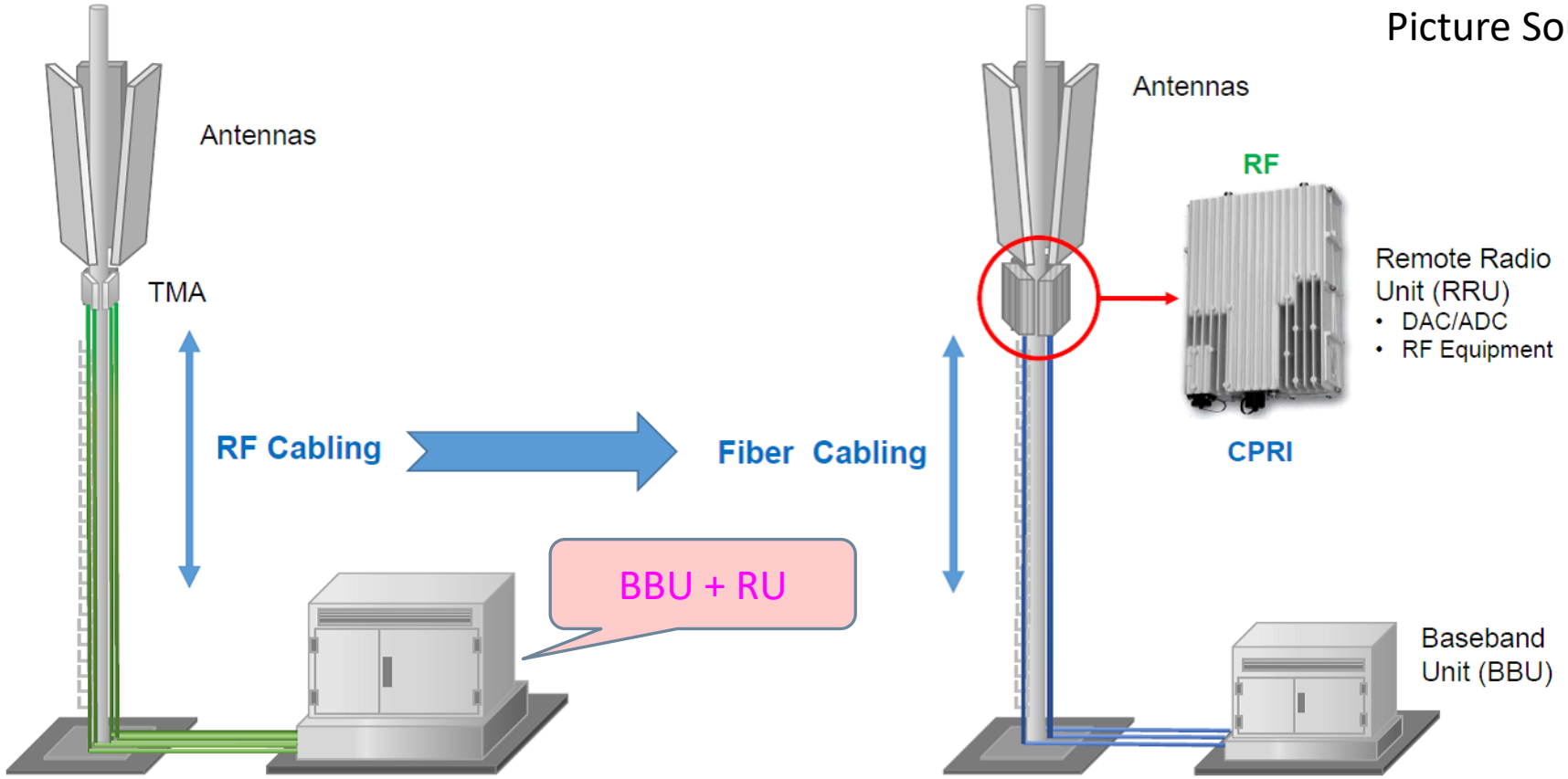
Different Types of RAN Architectures

Distributed, Centralized & Cloud

@3g4gUK

Mobile Towers in Real Life

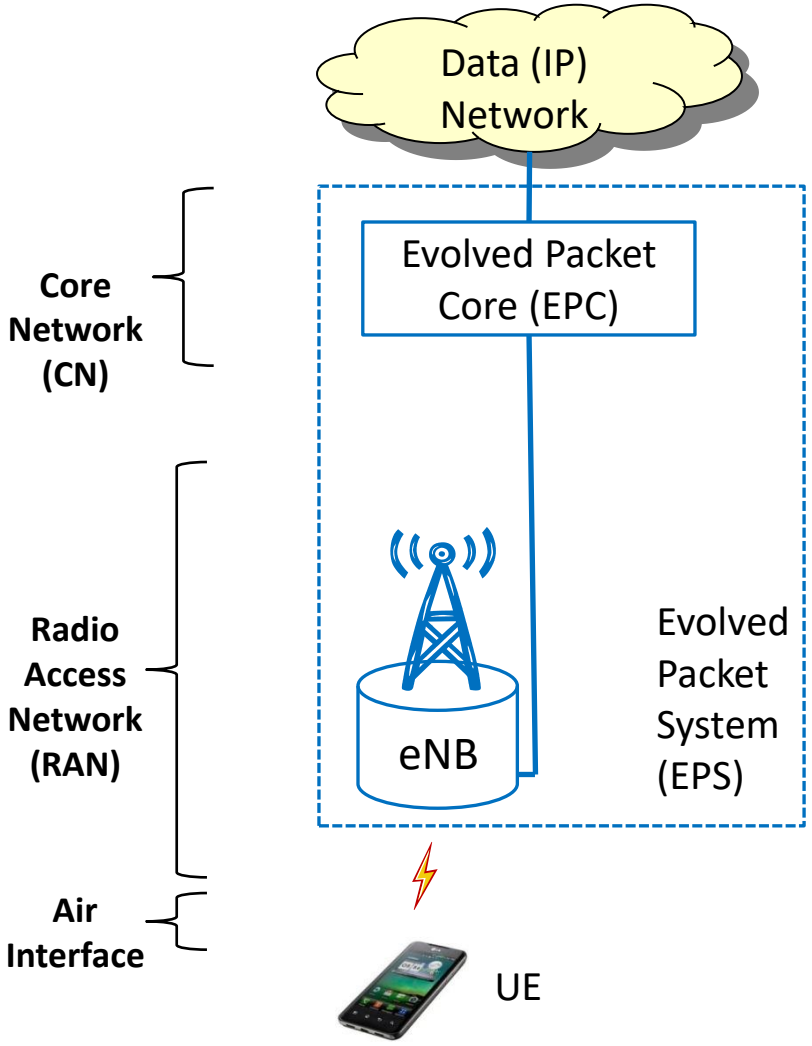
Picture Source: National Instruments



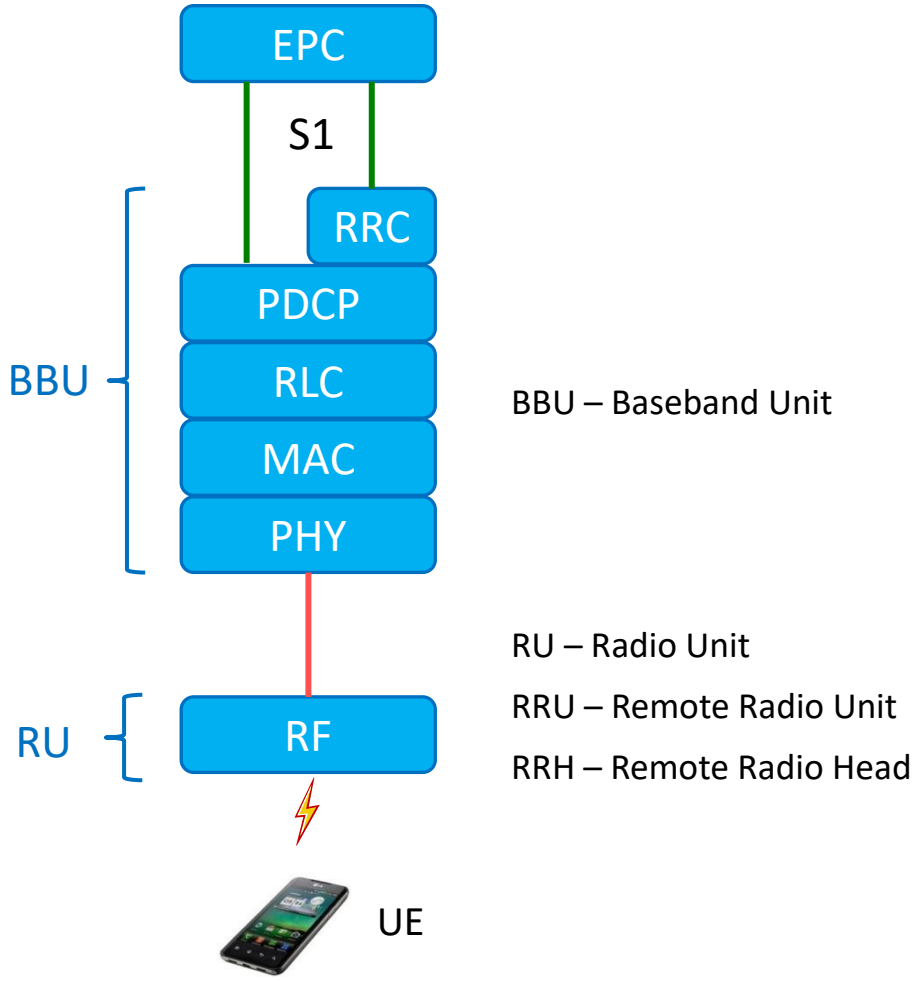
Traditional Base Station
- Signal Processing
- RF Equipment
- Network Access
- Long RF Cables

Contemporary Base Station
- Signal Processing
- Network Access
- Fiber Optic Cables

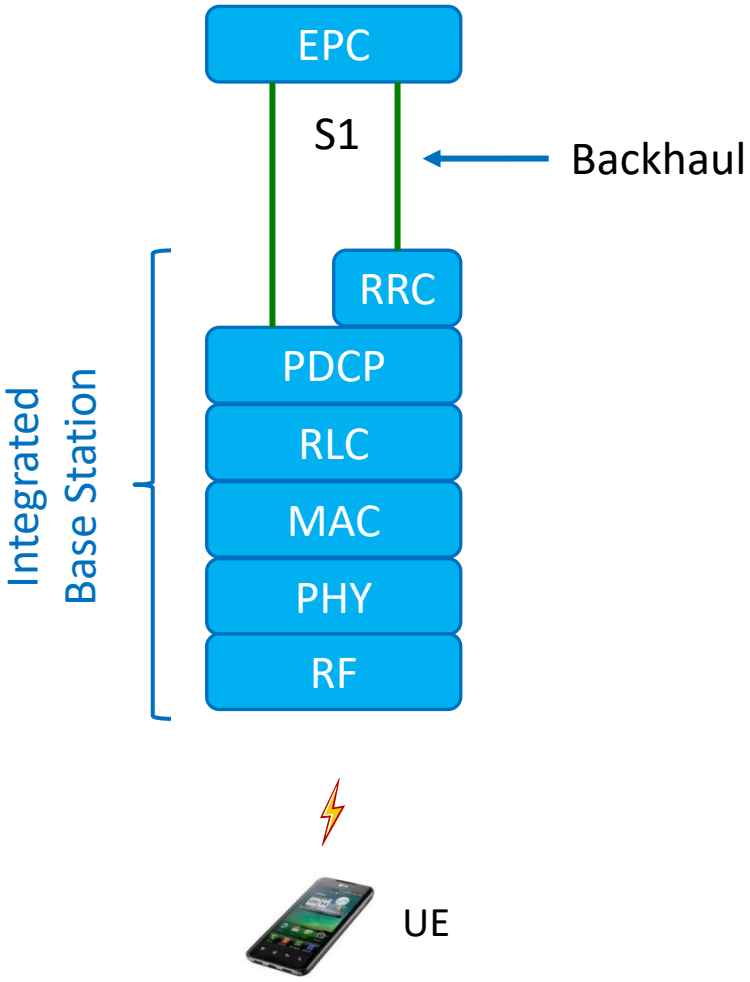
4G Mobile Network Architecture

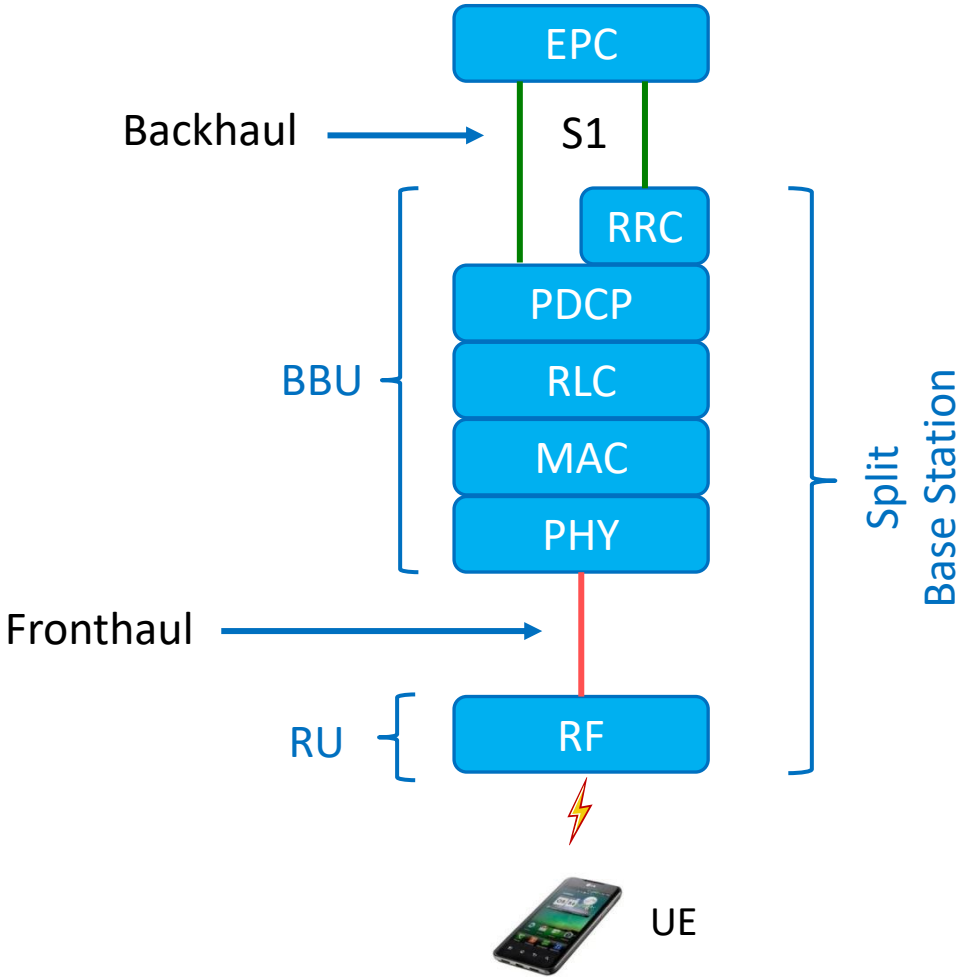


In Practice

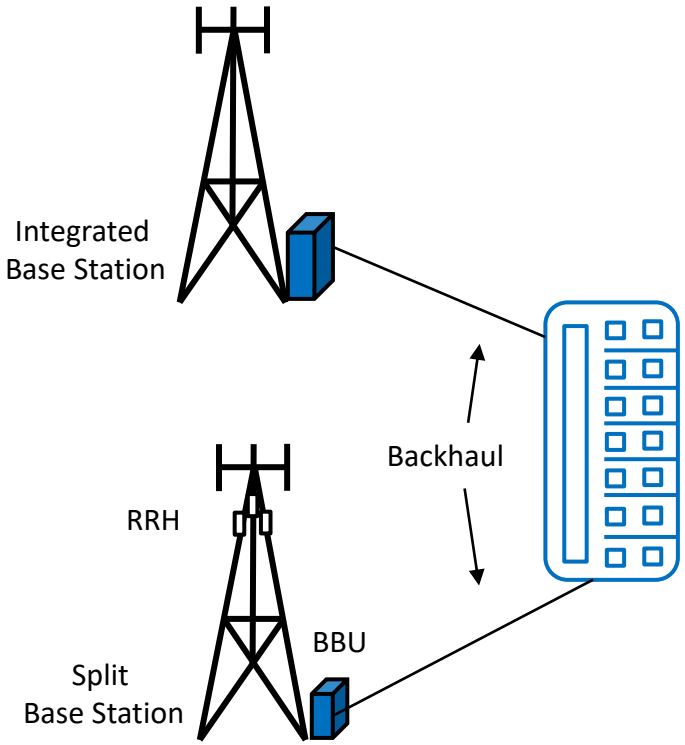


Integrated & Split LTE Base Station

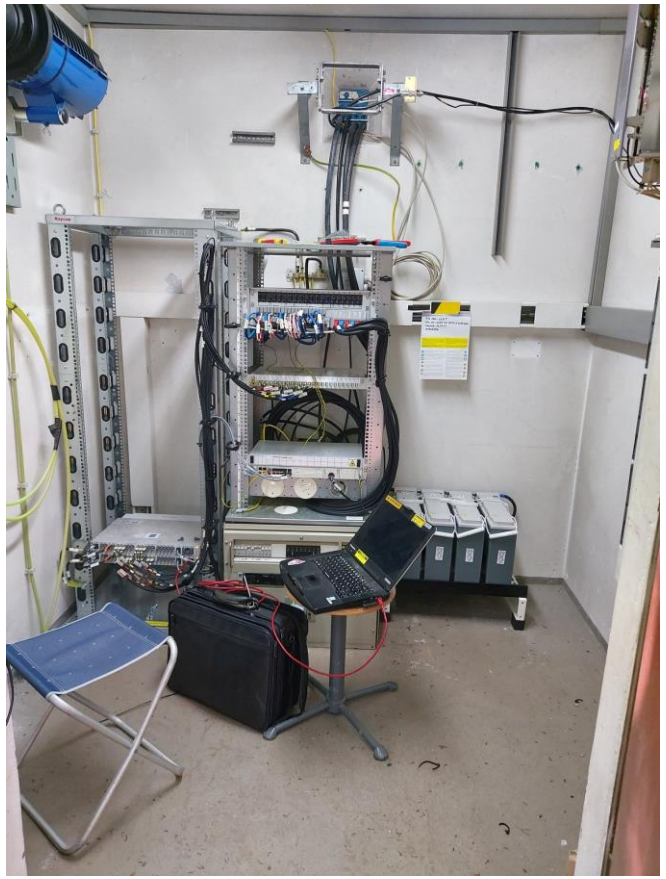




Different Types of Deployment Options

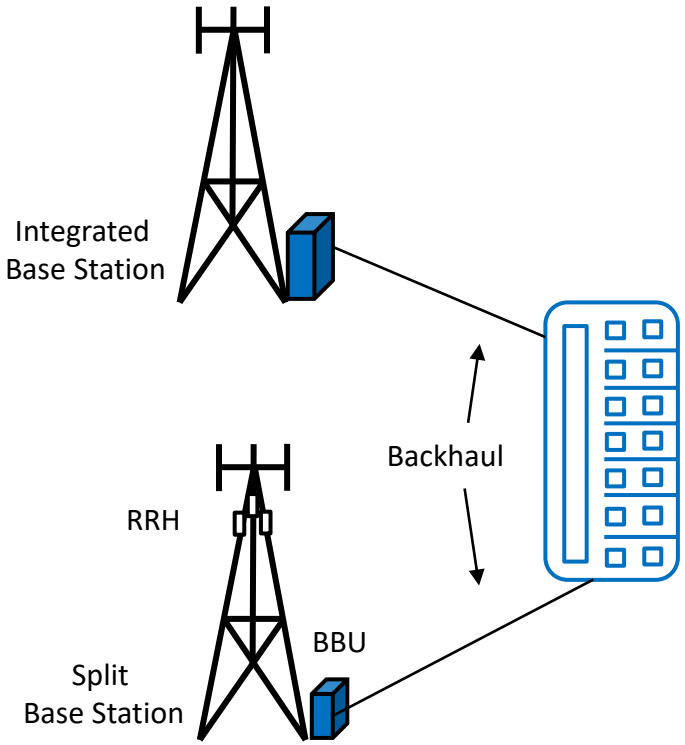


Distributed RAN
(D-RAN)



Rooftop site – picture source: Peter Schmidt (link)

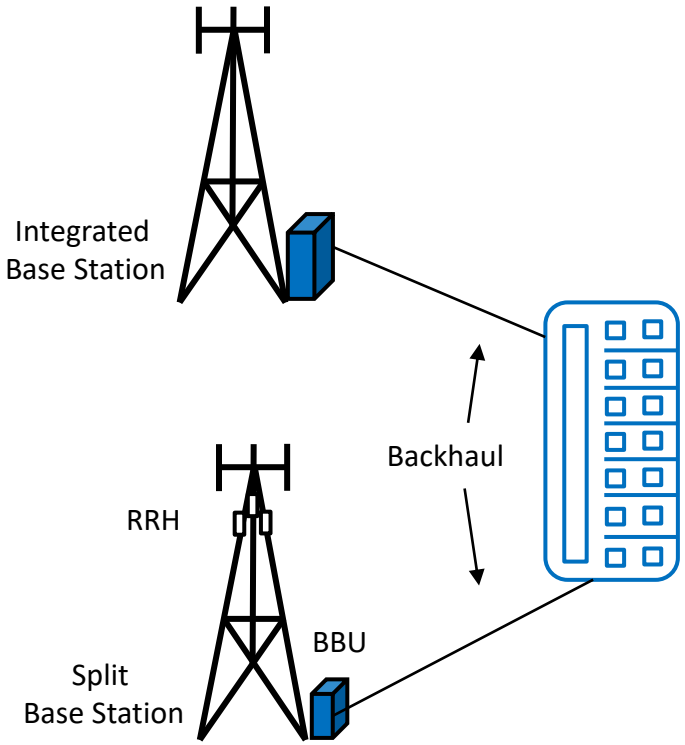
Different Types of Deployment Options



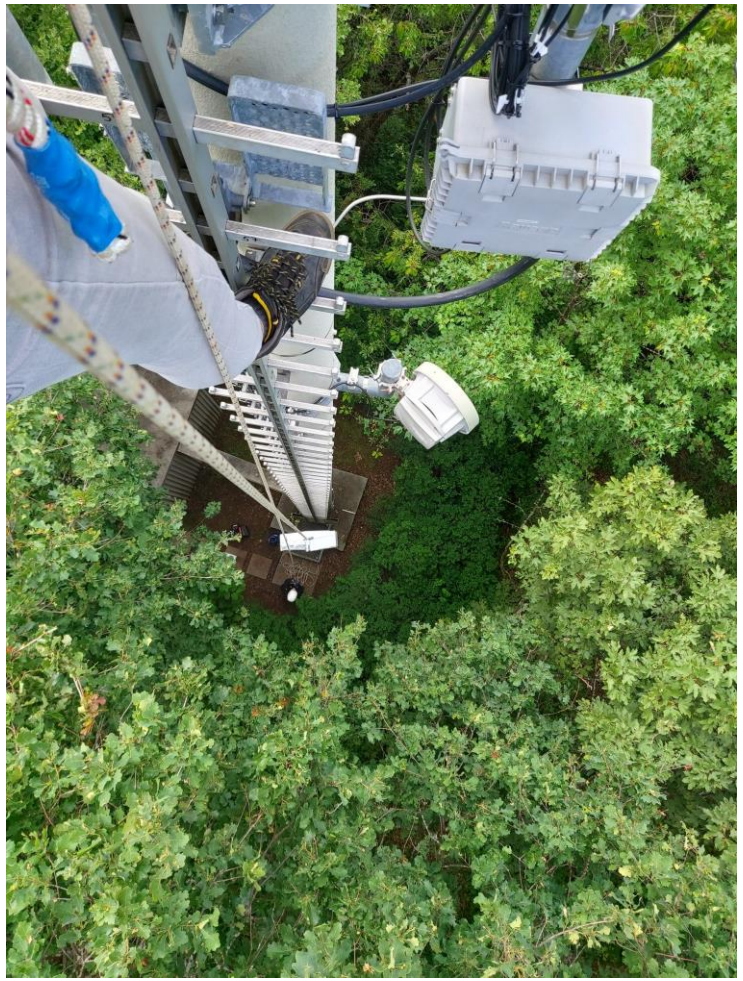
Distributed RAN
(D-RAN)

Temporary mast site – picture source: Peter Schmidt (link)

Different Types of Deployment Options

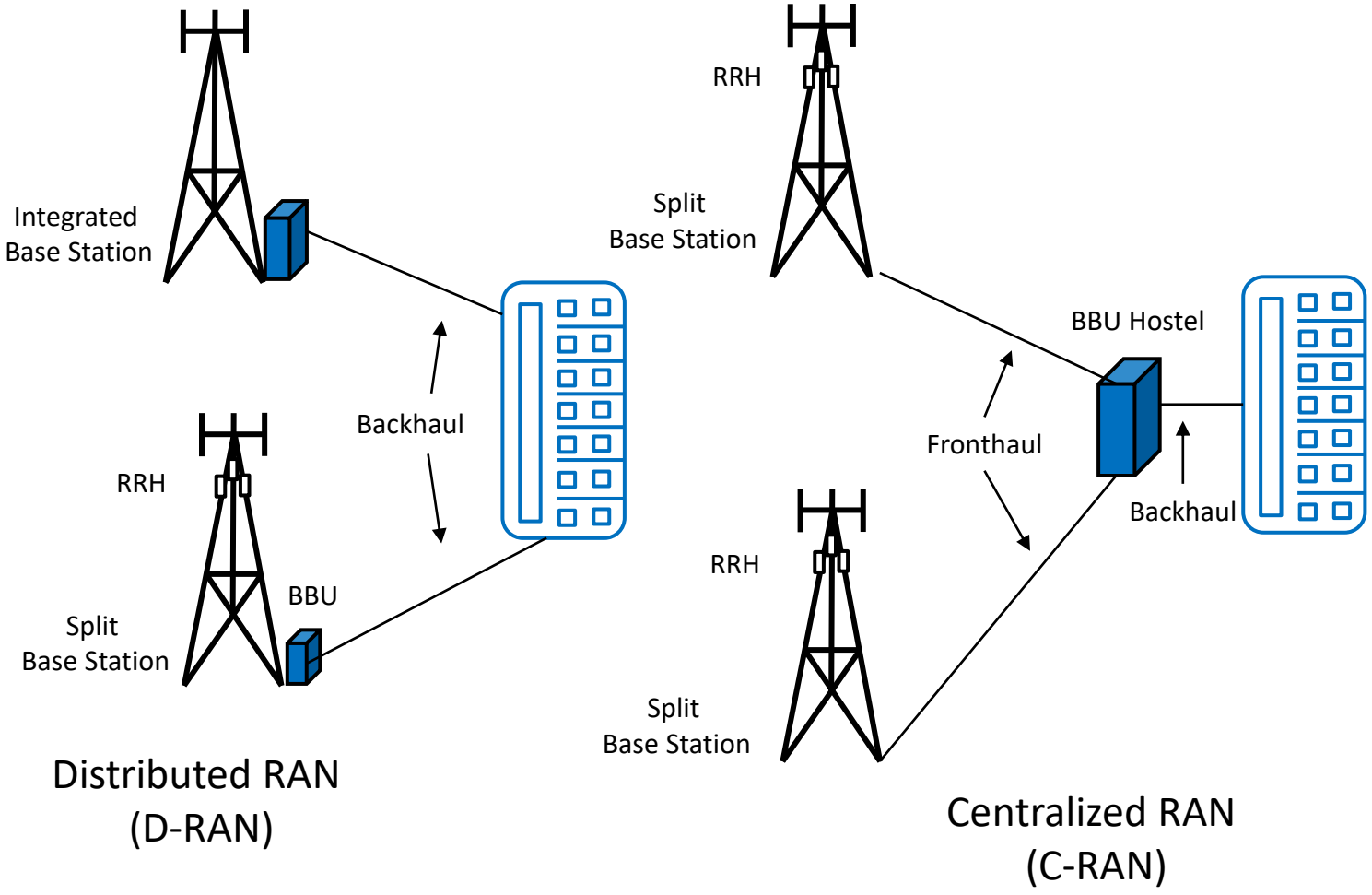


Distributed RAN
(D-RAN)

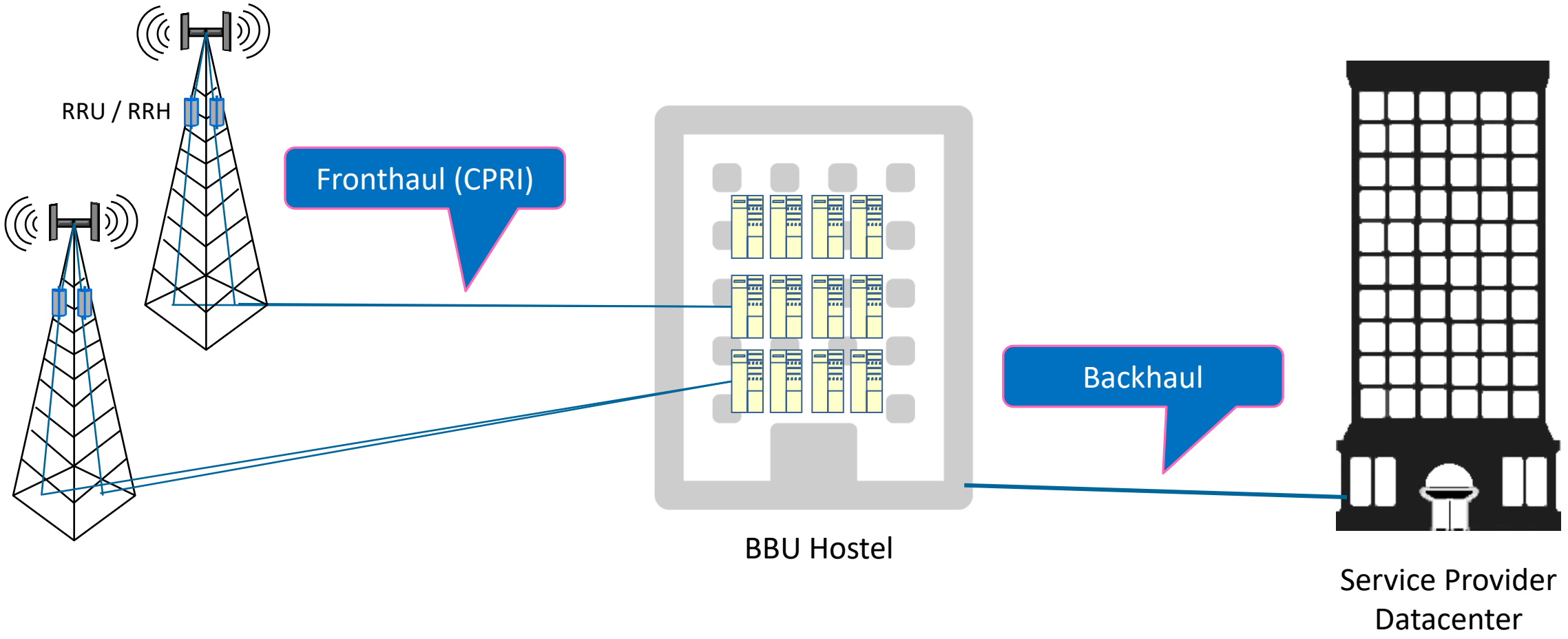


RRH on the tower – picture source: Peter Schmidt (link)

Different Types of Deployment Options

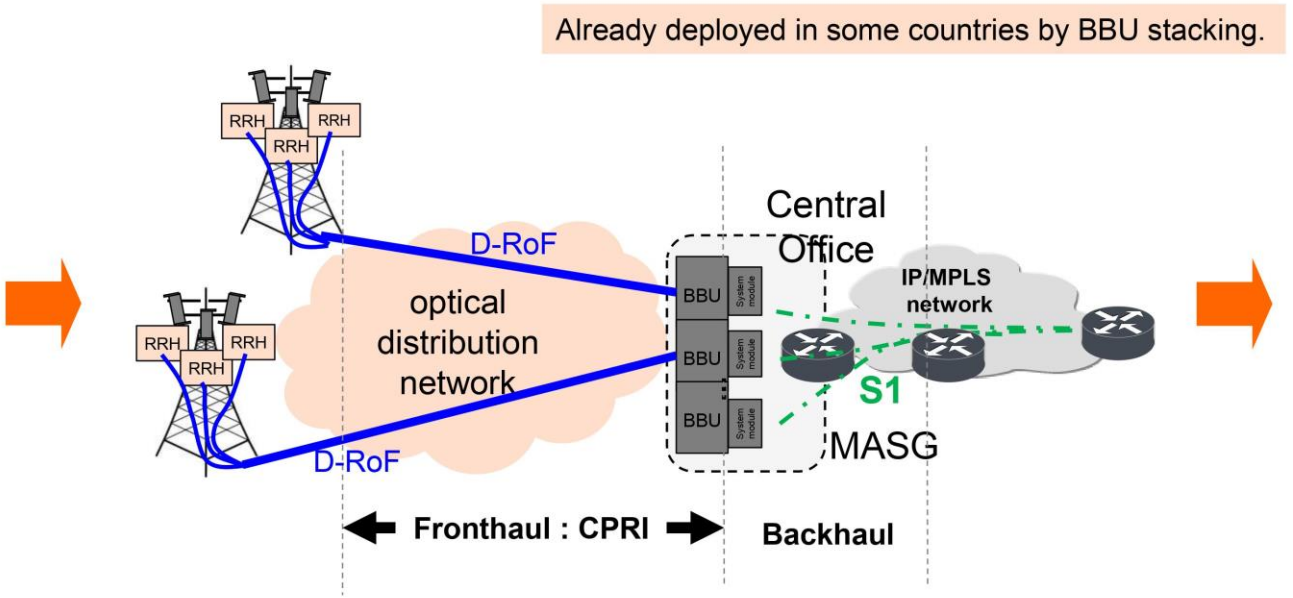


Centralized RAN (C-RAN) / BBU Hostelling

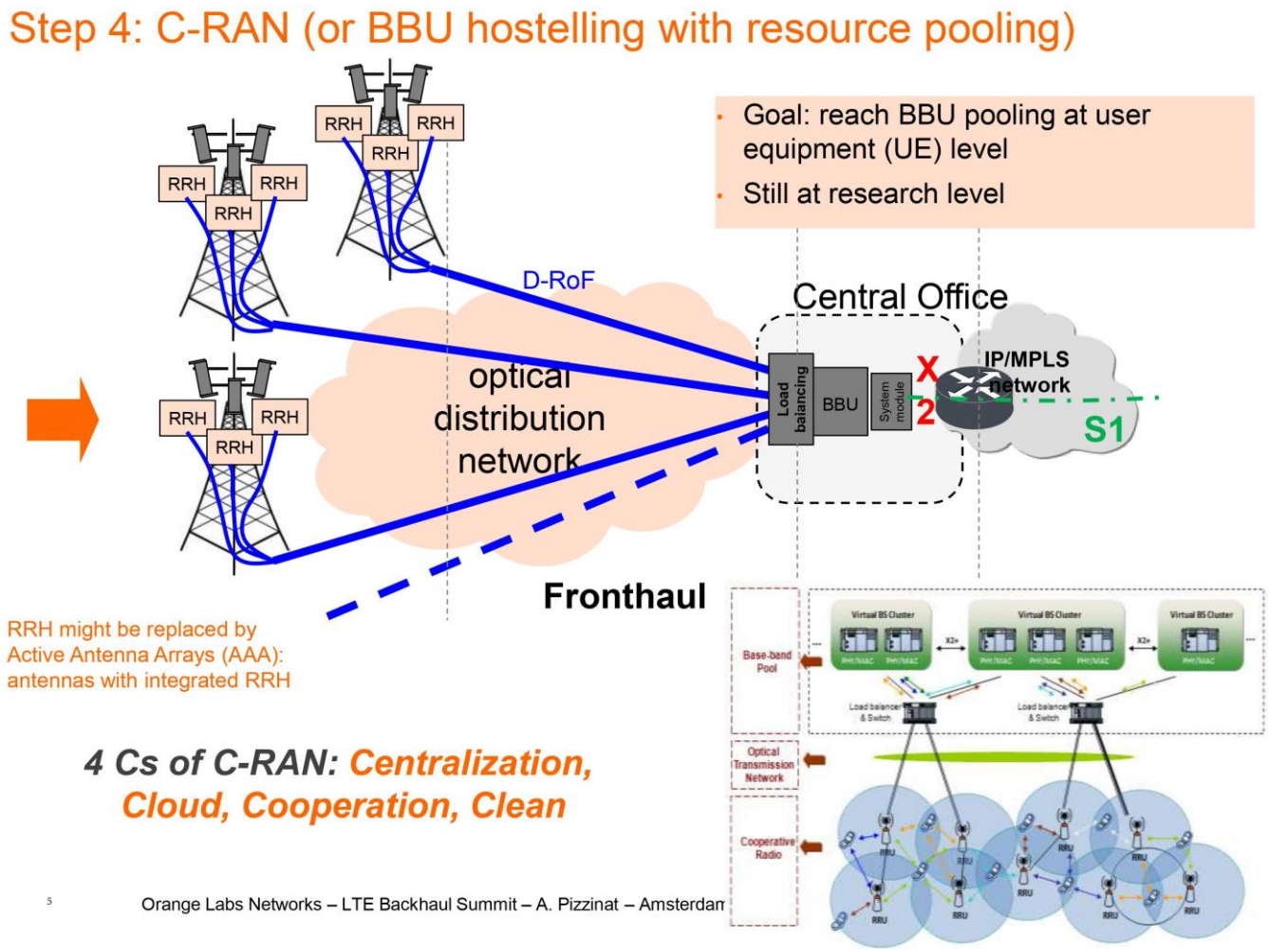


Orange Labs Presentation, June 2013

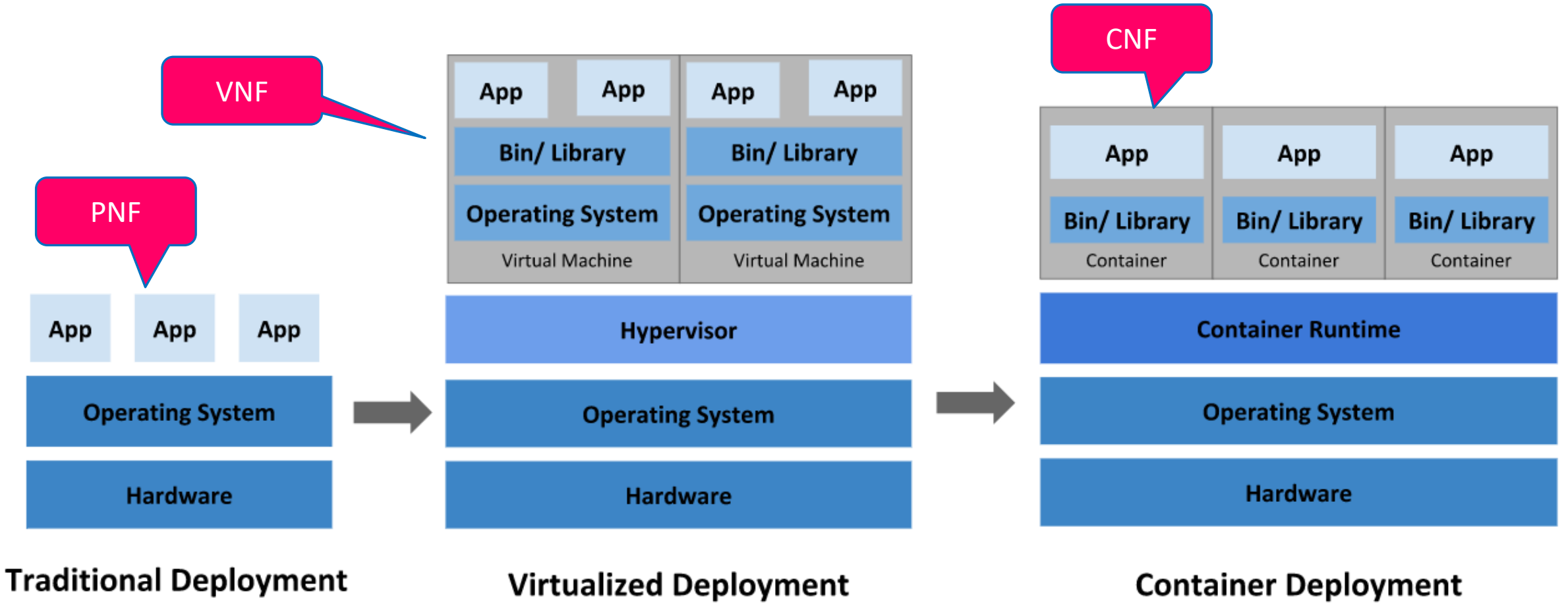
Step 3: BBU hostelling with stacking (or BBU centralisation)



Orange Labs Presentation, June 2013

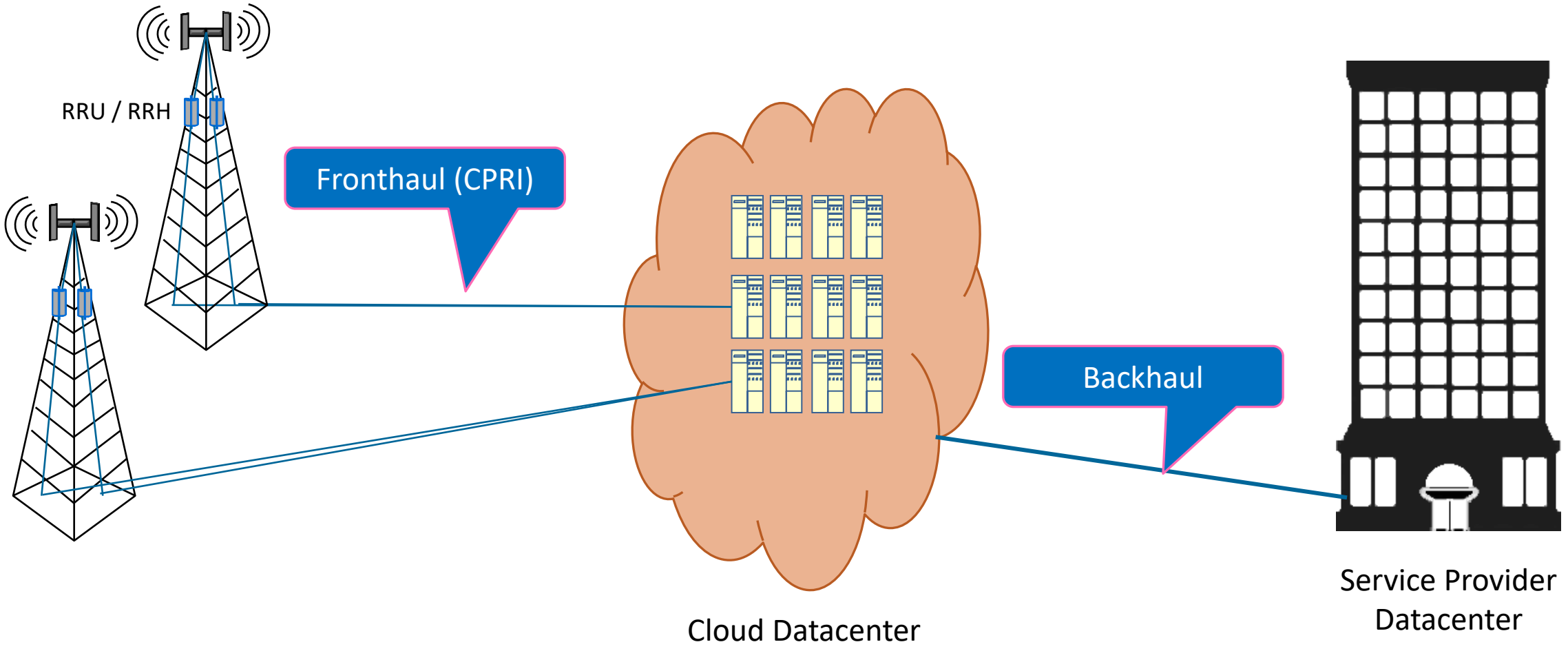


Evolution from Traditional to Virtualized to Containerized Deployment

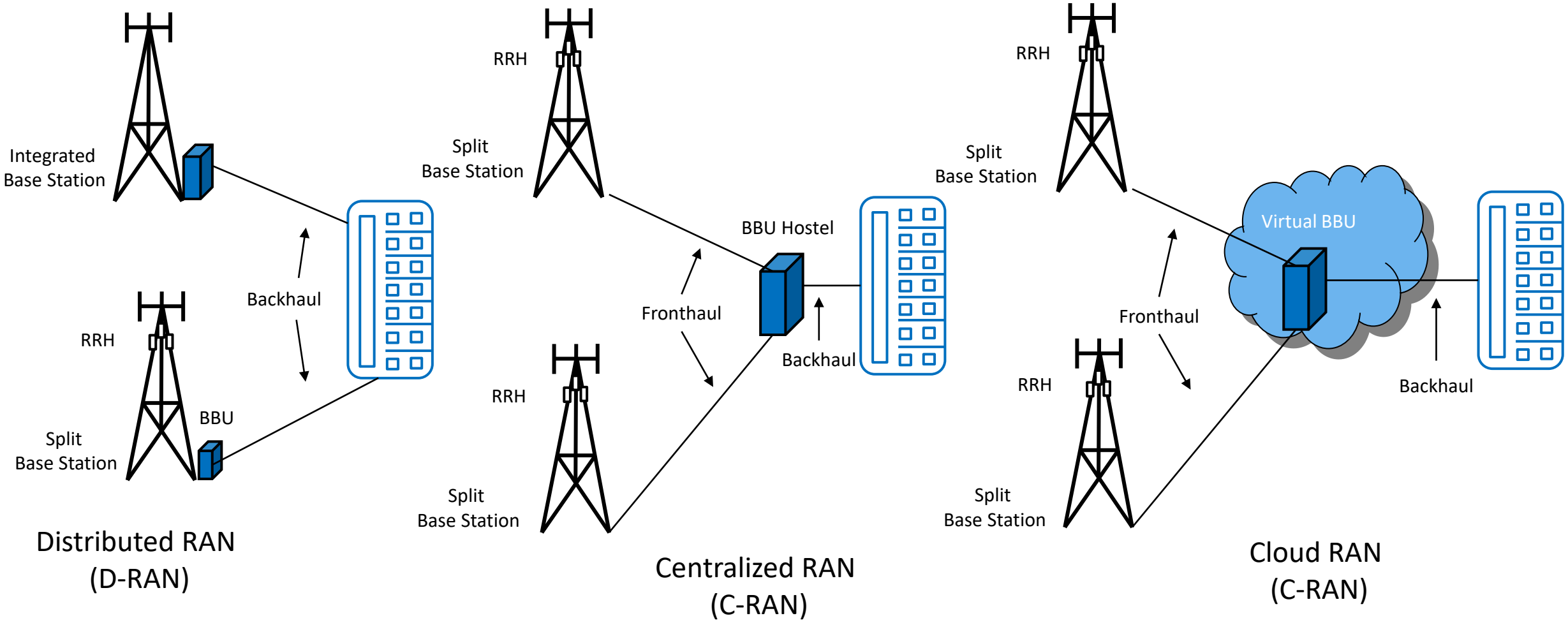


Picture Source: Kubernetes

Cloud RAN (C-RAN)



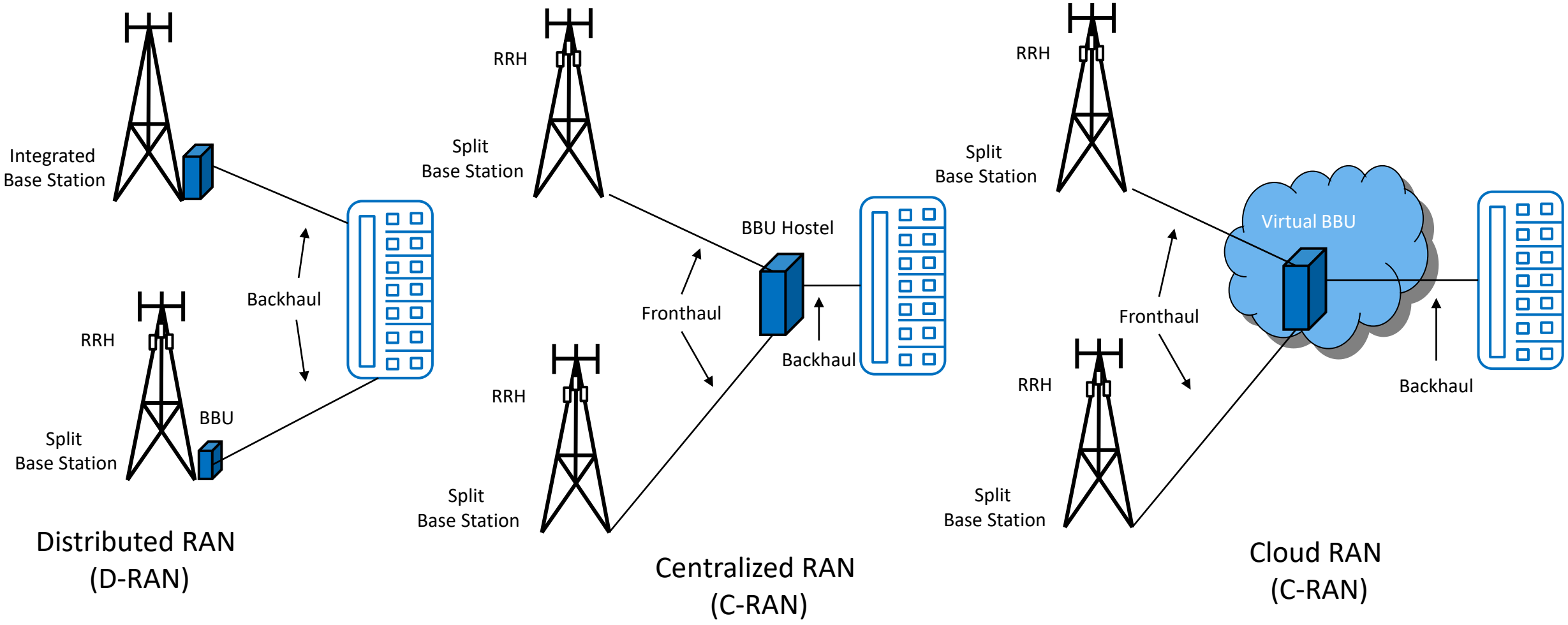
Different Types of Deployment Options



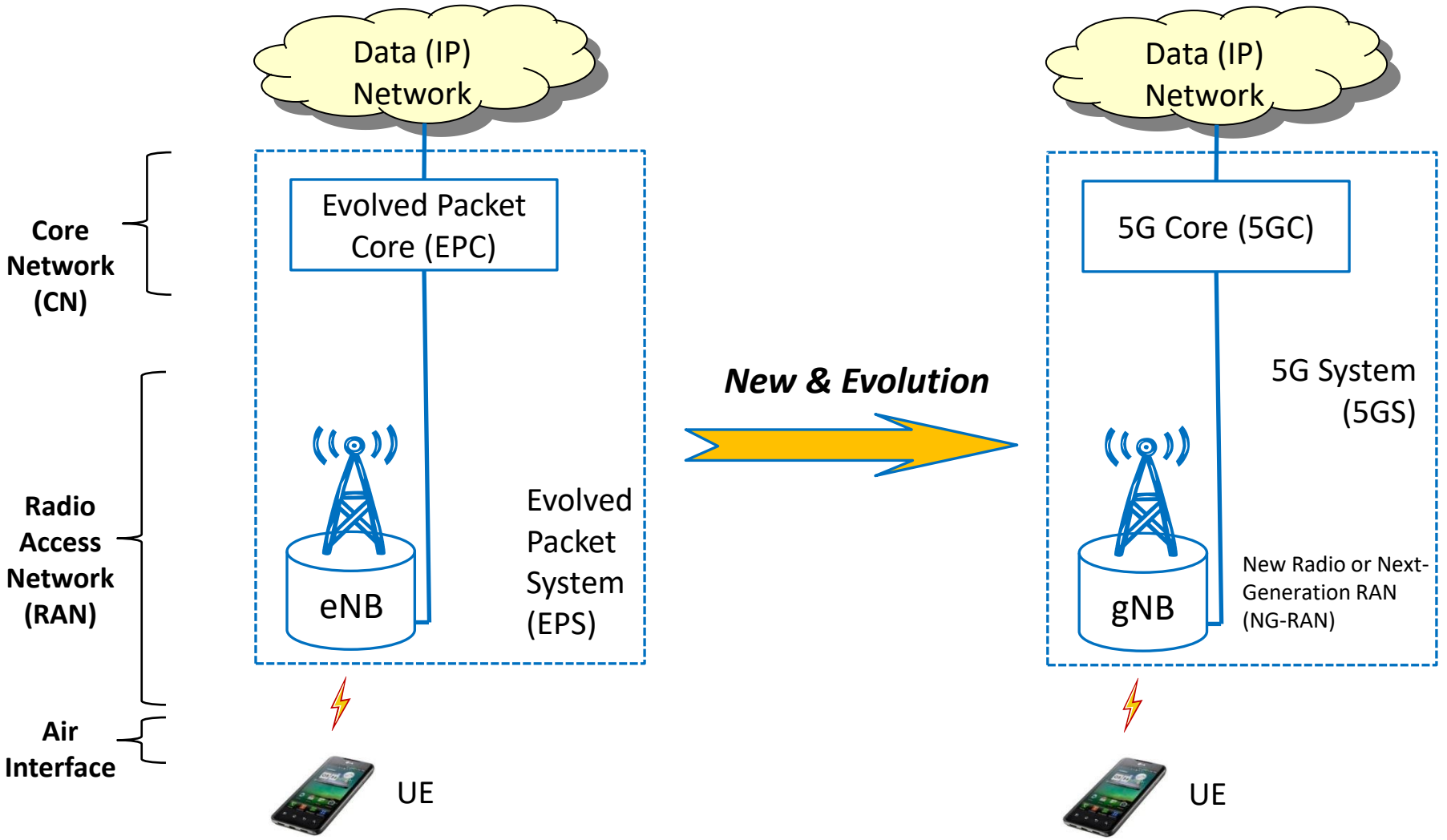
RAN Architecture and Deployment Options

	D-RAN	Centralized-RAN	Cloud-RAN
PNF	Y	Y	N
VNF	Y	Y	N
CNF	Y	Y	Y

Different Types of Deployment Options



5G Mobile Network Architecture

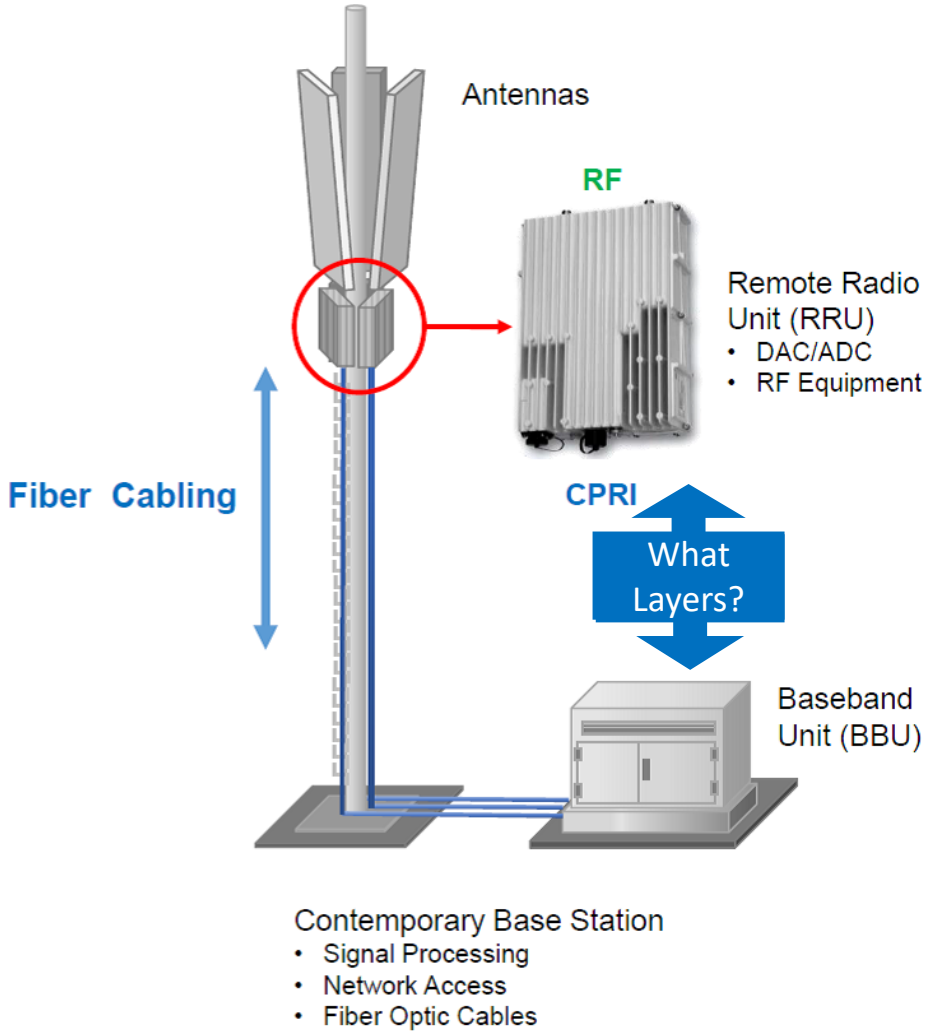


5G System is defined as 3GPP system consisting of 5G Access Network (AN), 5G Core Network and UE. The 5G System provides data connectivity and services.

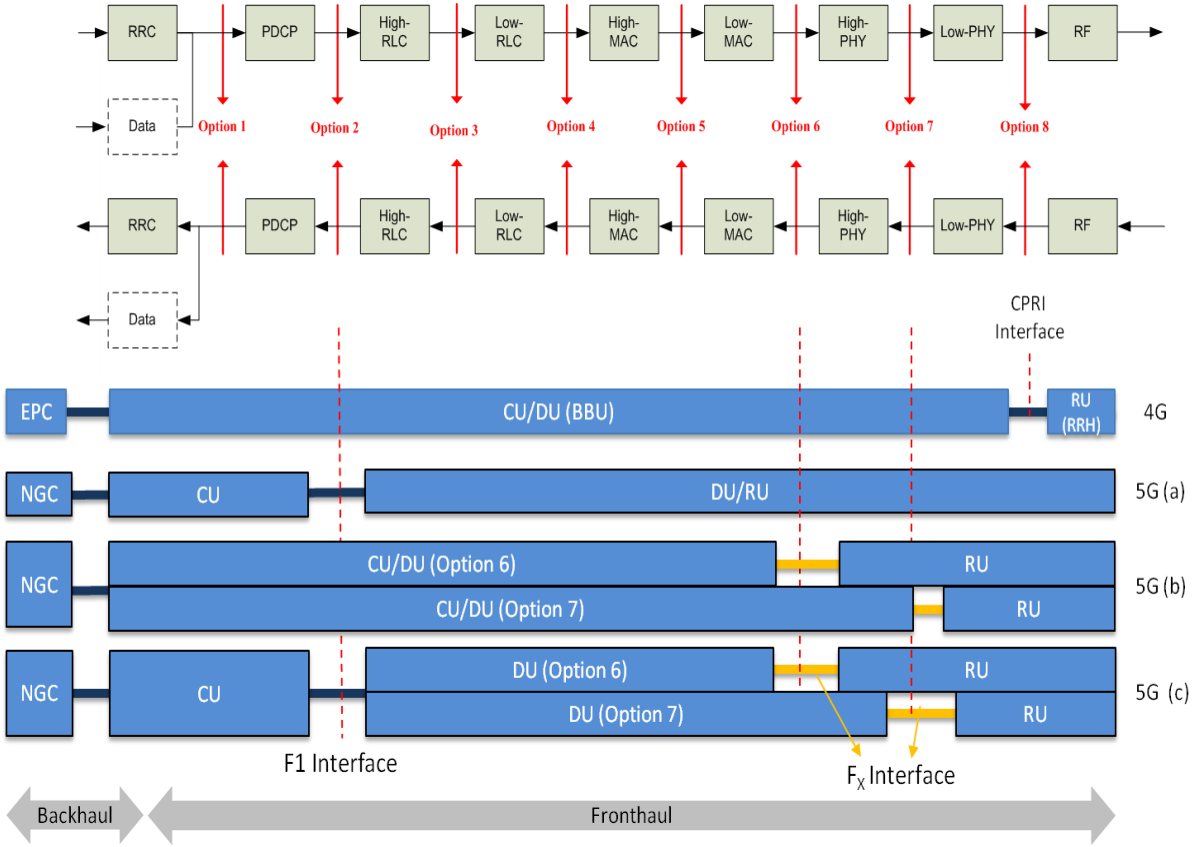
3GPP TS 23.501: System Architecture for the 5G System; Stage 2

3GPP TS 23.502: Procedures for the 5G System; Stage 2

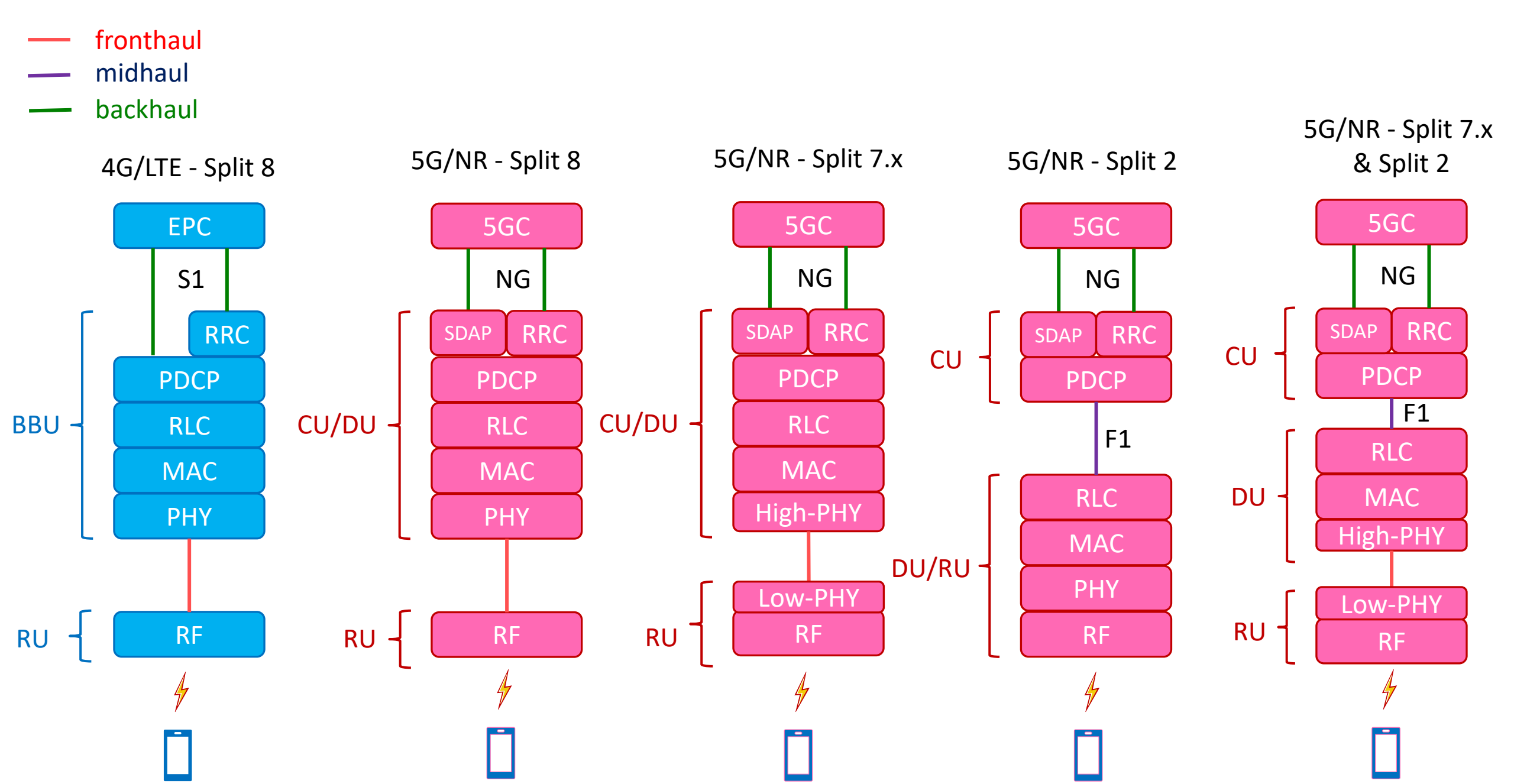
Mobile Towers in Real Life – Layers Split



Contemporary Base Station
- Signal Processing
- Network Access
- Fiber Optic Cables



Small Cells, initially implied an integrated unit with all layers in the same integrated unit. In the USA it generally means small form factor


fronthaul
midhaul
backhaul
4G/LTE - Split 8
EPC
S1
RRC
PDCP
RLC
MAC
PHY
BBU
RU
RF
5G/NR - Split 8
5GC
NG
SDAP
RRC
PDCP
RLC
MAC
PHY
CU/DU
RU
RF
5G/NR - Split 7.x
5GC
NG
SDAP
RRC
PDCP
RLC
MAC
High-PHY
CU/DU
Low-PHY
RU
RF
5G/NR - Split 2
5GC
NG
SDAP
RRC
PDCP
CU
F1
RLC
MAC
PHY
DU/RU
RF
5G/NR - Split 7.x & Split 2
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RLC
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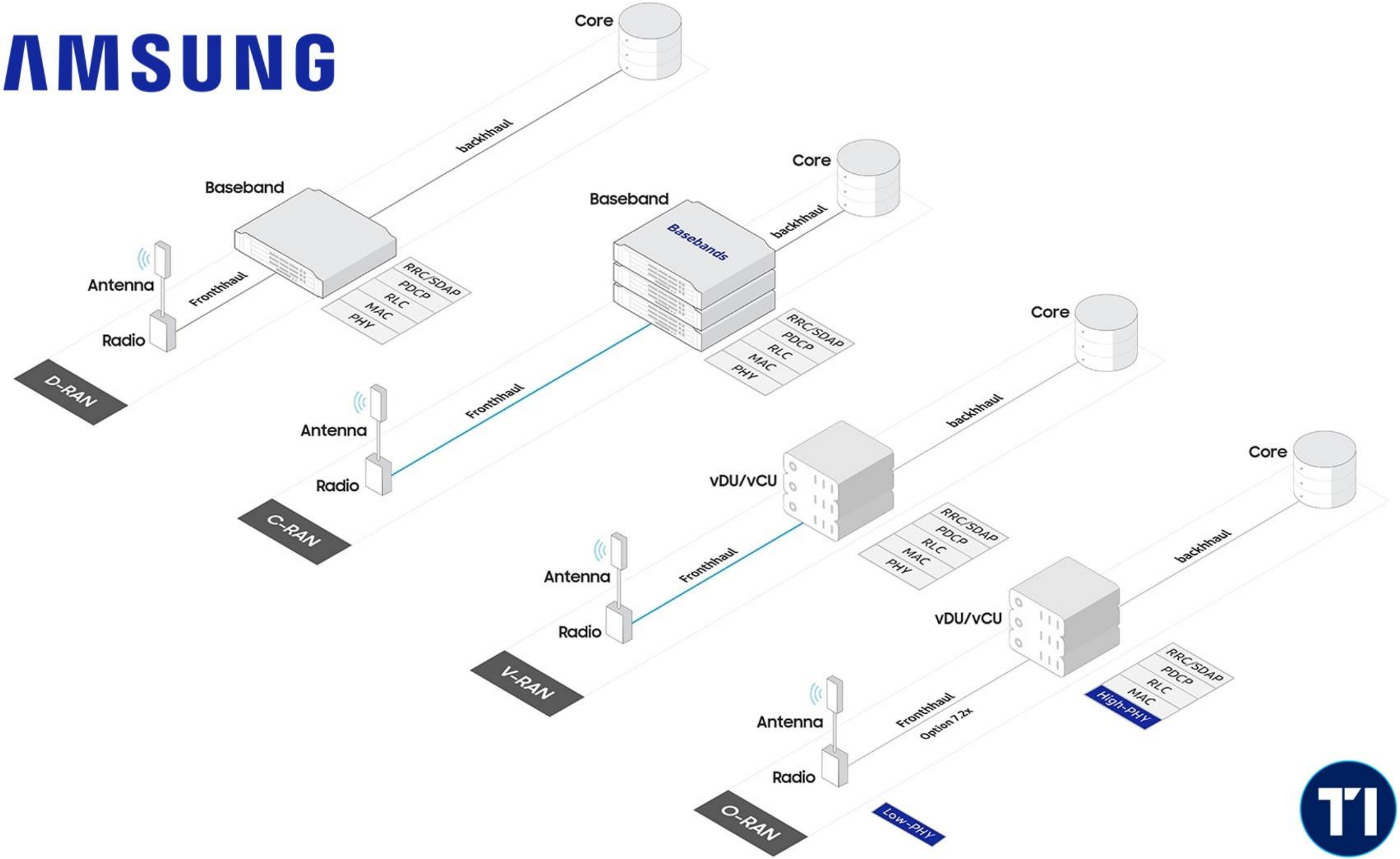
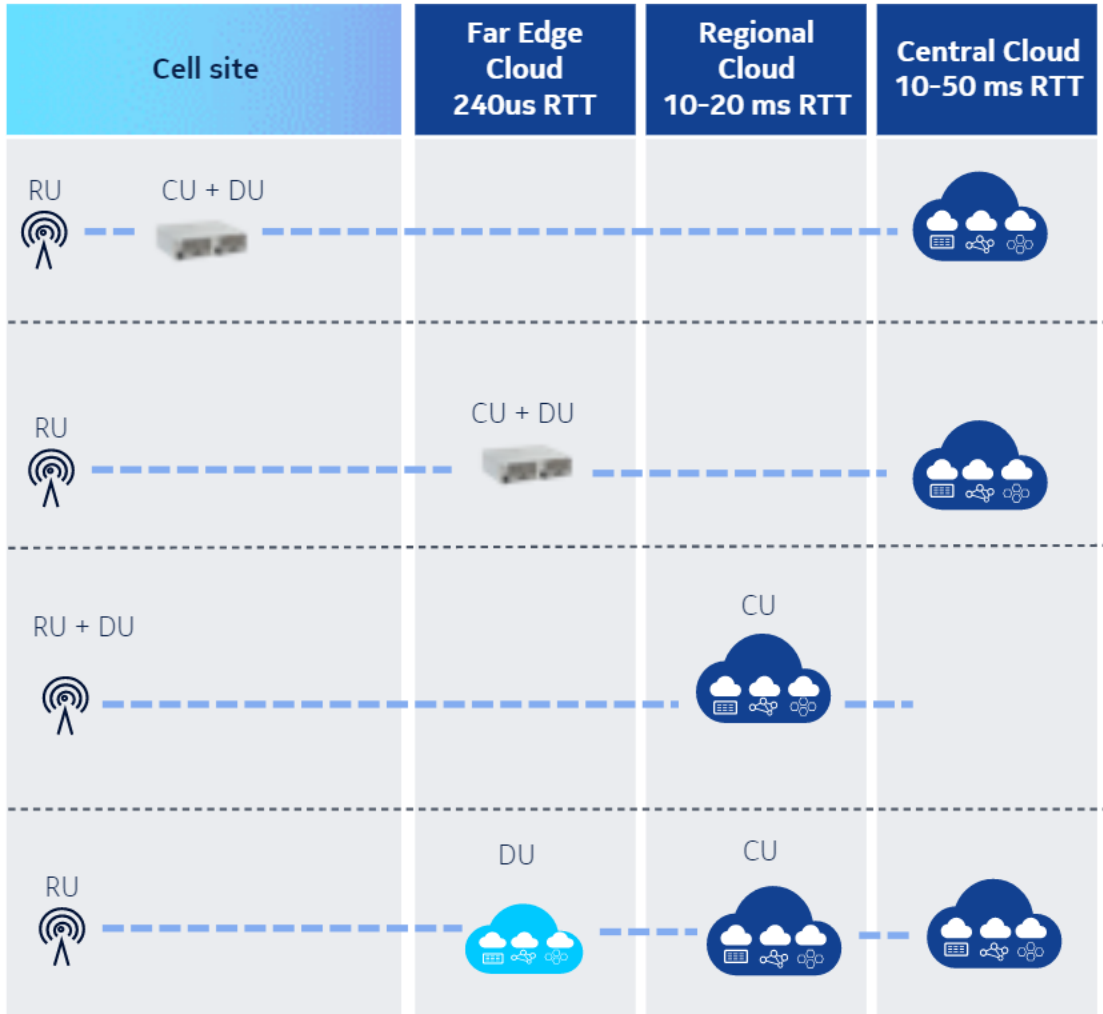
DU
Low-PHY
RU
RF

SAMSUNG


Core
backkhaul
Baseband
Antenna
Fronthaul
Radio
RRC/SDAP
PDCP
RLC
MAC
PHY
D-RAN
Core
Baseband
Basebands
backkhaul
RRC/SDAP
PDCP
RLC
MAC
PHY
Antenna
Fronthaul
Radio
C-RAN
Core
backkhaul
vDU/vCU
RRC/SDAP
PDCP
RLC
MAC
PHY
Antenna
Fronthaul
Radio
V-RAN
Core
backkhaul
vDU/vCU
RRC/SDAP
PDCP
RLC
MAC
High-PHY
Antenna
Fronthaul
Option7.2x
Radio
O-RAN
Low-PHY

3 vRAN disaggregation: different options with fiber availability & latency and pooling gains



Classic Distributed: RU, DU and CU at cell site
- Typical classical, distributed deployment
- Fiber needed at cell site only

Classic Centralized: CU and DU at far edge site
- Fiber needed from cell site to far edge site
- Classical C-RAN or "baseband hotel" configuration
- Baseband pooling benefits

vRAN 1.0: RU and DU co-located or integrated; vCU
- E.g. mmWave RAP (Radio Access Point) case where DU is integrated with RU
- Flexible Ethernet transport from cell site to regional Cloud site
- Baseband pooling benefits

vRAN 2.0: RU, vDU and vCU disaggregated
- Fiber needed from cell site to far edge site
- Baseband pooling benefits

References & Further Reading

- The 3G4G Blog: C-RAN Architecture and Challenges (link)
- Telecoms Infrastructure Blog: Are we going to see more of Cloud RAN (C-RAN) in future? (link)
- The 3G4G Blog - Prof. Andy Sutton: 5G Radio Access Network Architecture Evolution (link)
- Telecoms Infrastructure Blog: Samsung Talks about TCO Optimization to Accelerate 5G Network Evolution (link)
- Nokia webinar: The future of open and virtualized radio access networks (link)
- Samsung: How to optimize total cost of ownership (TCO) to accelerate 5G network evolution – Part One (link)
- The Mobile Network: How Nokia views the open and virtual RAN (link)
- RCR Wireless - C-RAN: Cloud RAN vs. centralized RAN (link)
- Ericsson - Evaluating processing options in RAN: Purpose built and Cloud RAN (link)
- Telecoms Infrastructure Blog: AWS for Public and Private 5G Networks (link)
- Telecoms Infrastructure Blog: Antennas for Small Cells and C-RAN (link)
- Netmanias: Network Architecture Evolution from 4G to 5G (link)
- The 3G4G Blog: 5G RAN Functional Splits (link)

Thank You

To learn more, visit:

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Operator Watch Blog – https://www.operatorwatch.com/

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