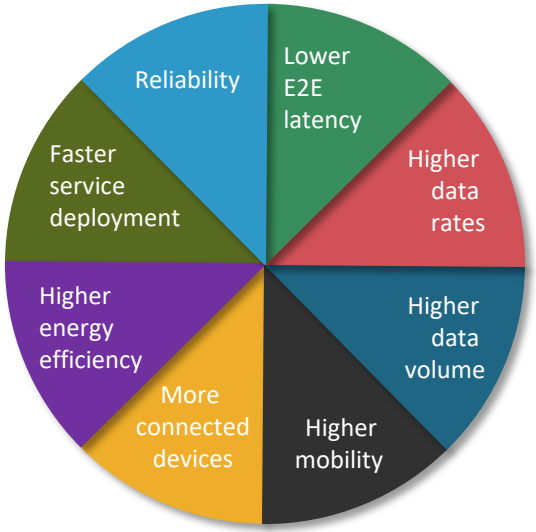
MULTI-ACCESS EDGE CLOUD

ENABLING TELCO TRANSFORMATION & 5G

OĞUZ SUNAY
CHIEF ARCHITECT FOR MOBILE NETWORKING
OPEN NETWORKING FOUNDATION

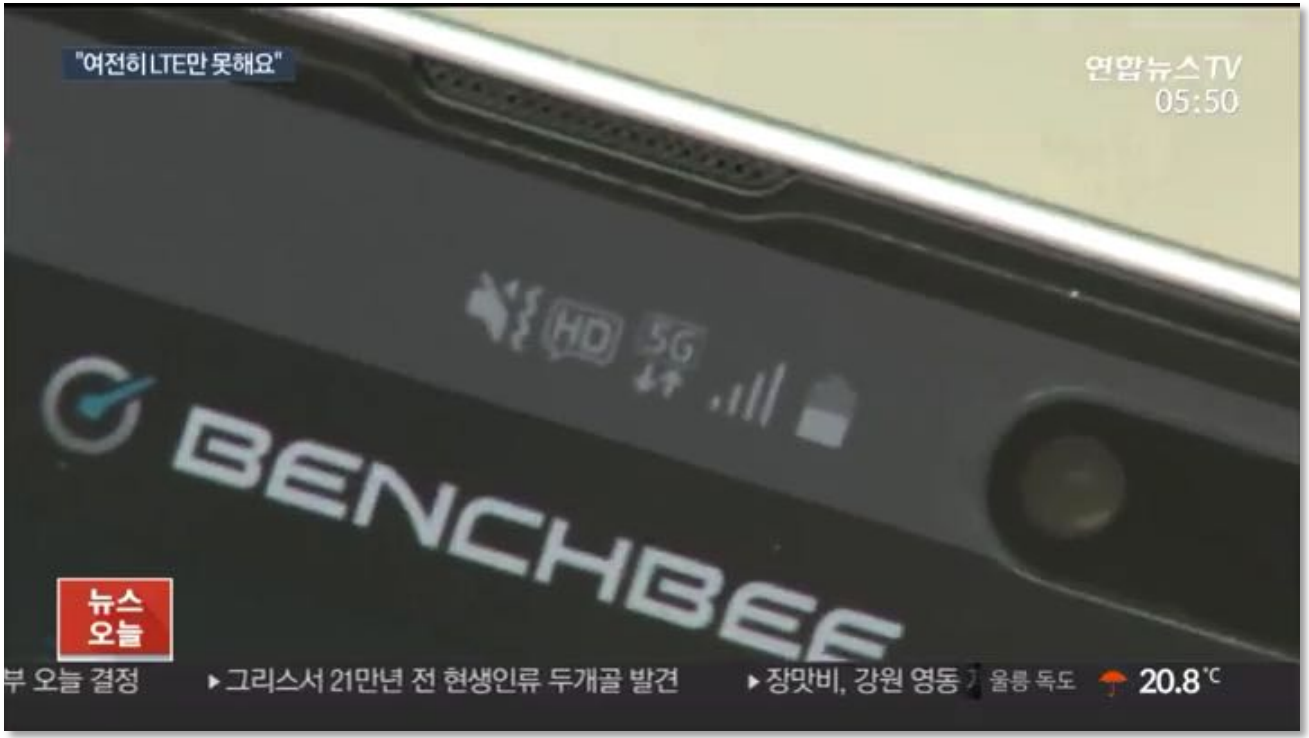
5G IS HERE

5G PROMISES


Reliability
Lower E2E latency
Faster service deployment
Higher data rates
Higher energy efficiency
Higher data volume
More connected devices
Higher mobility

INITIAL SOUTH KOREA EXPERIENCE

77% of Global 5G PHY Deployments are in South Korea



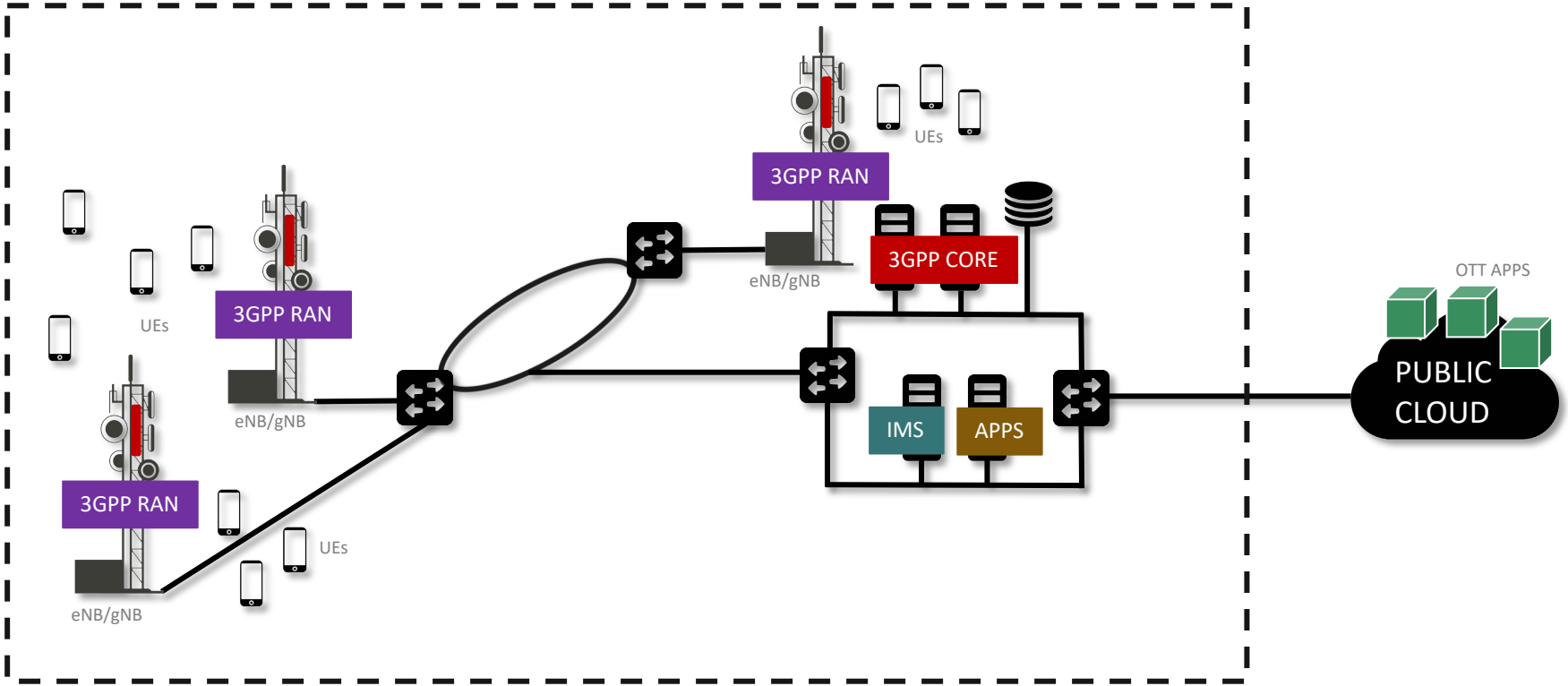
July 17, 2019

5G IS **DIFFERENT**

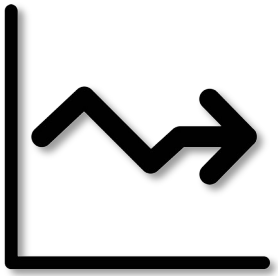
IT IS MAINLY AN ENABLER FOR **TELCO TRANSFORMATION**

TELCO TRANSFORMATION & THE EDGE

CELLULAR NETWORKS TODAY



WHY WE NEED TRANSFORMATION



WORLWIDE MOBILE SUBSCRIPTIONS

CAGR: 2%

2017: 7.8B

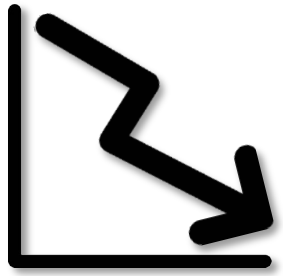
2023: 8.8B

WORLWIDE TOTAL MONTHLY MOBILE DATA TRAFFIC

CAGR: 38%

2017: 15EB

2023: 105EB



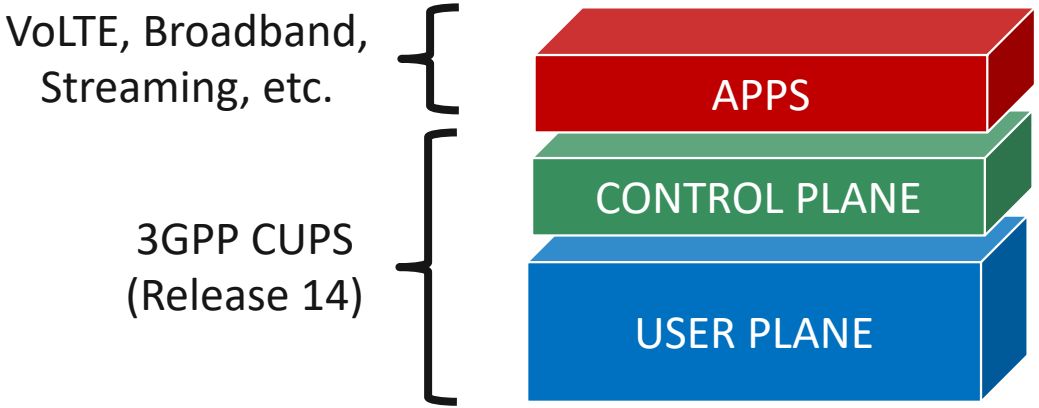
ANNUAL REVENUE PER USER

LTE	*5G*
CAGR: -11%	*CAGR: -16% (5G)*
2017: $20	2020: $50
2023: $10	2023: $30

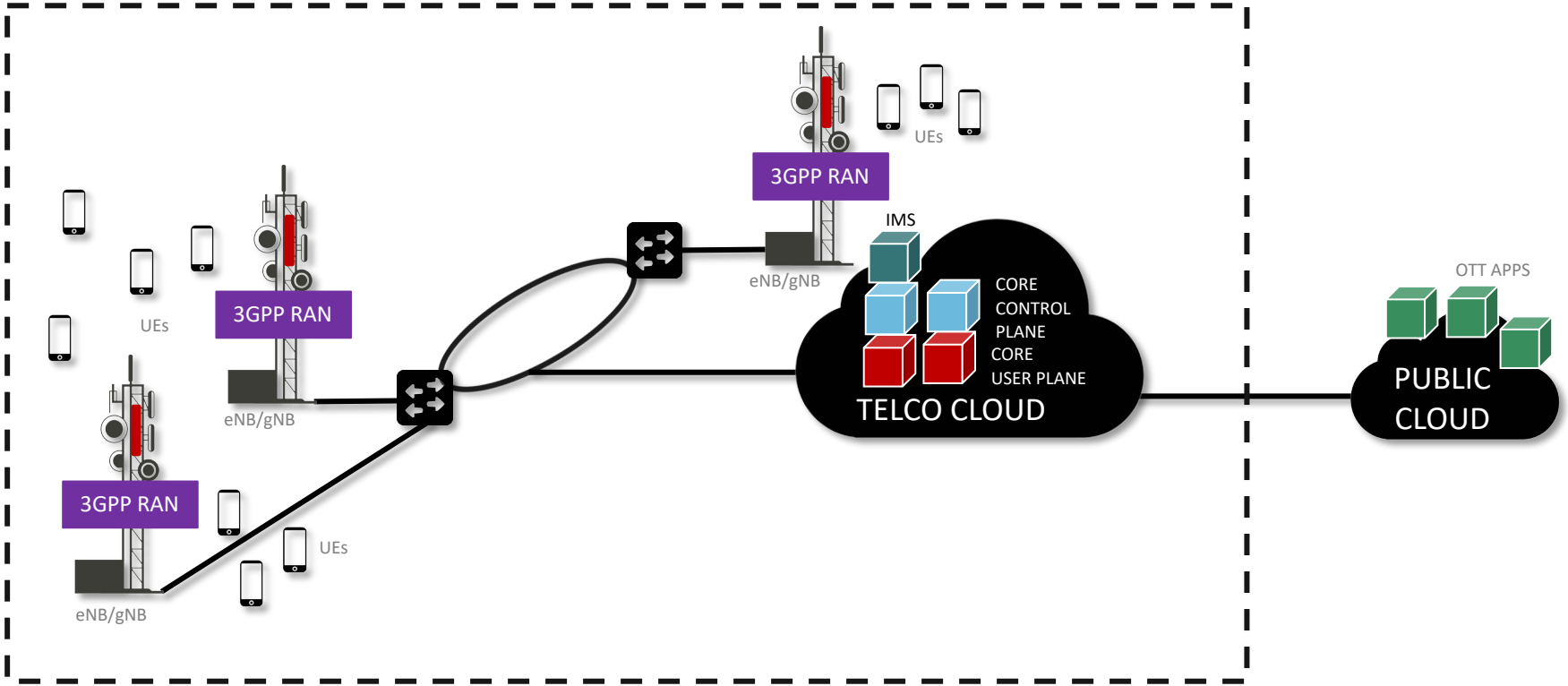
**Ericsson, 2019*

**Strategy Analytics, 2018*

HORIZONTAL DISAGGREGATION

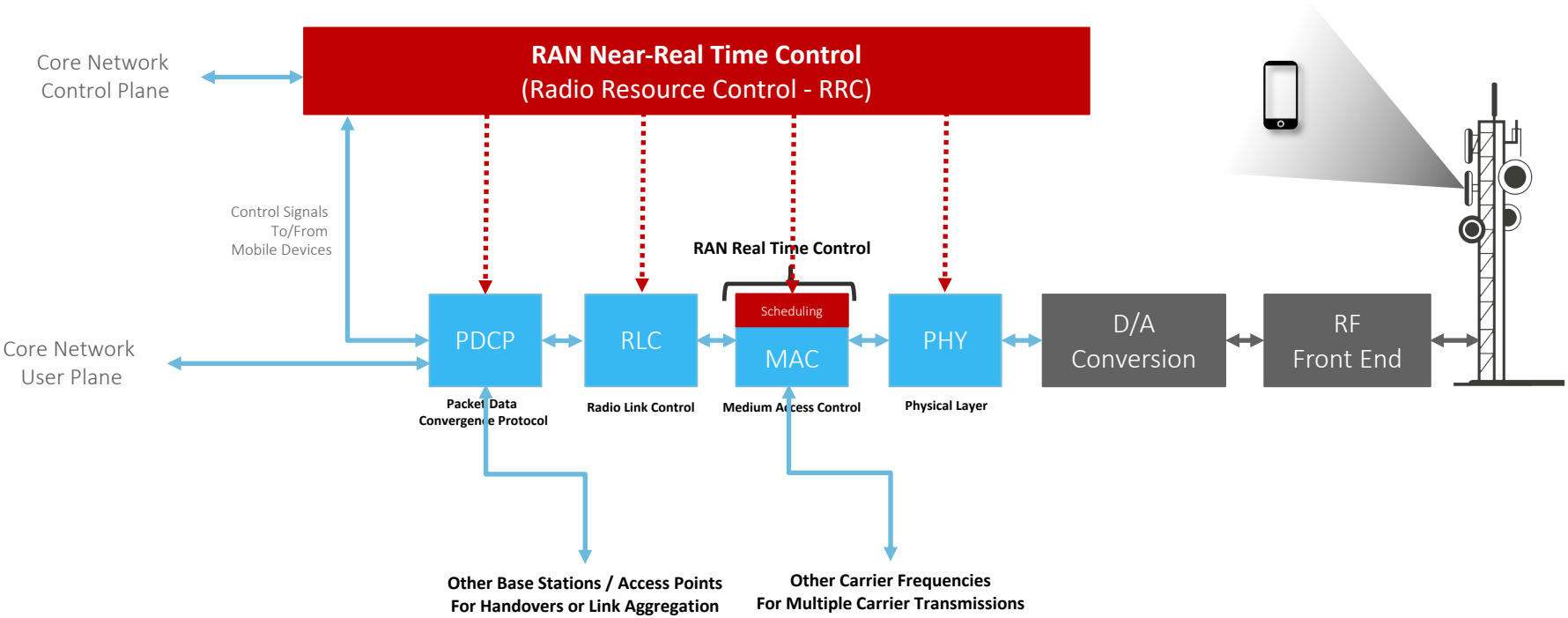


VIRTUALIZATION



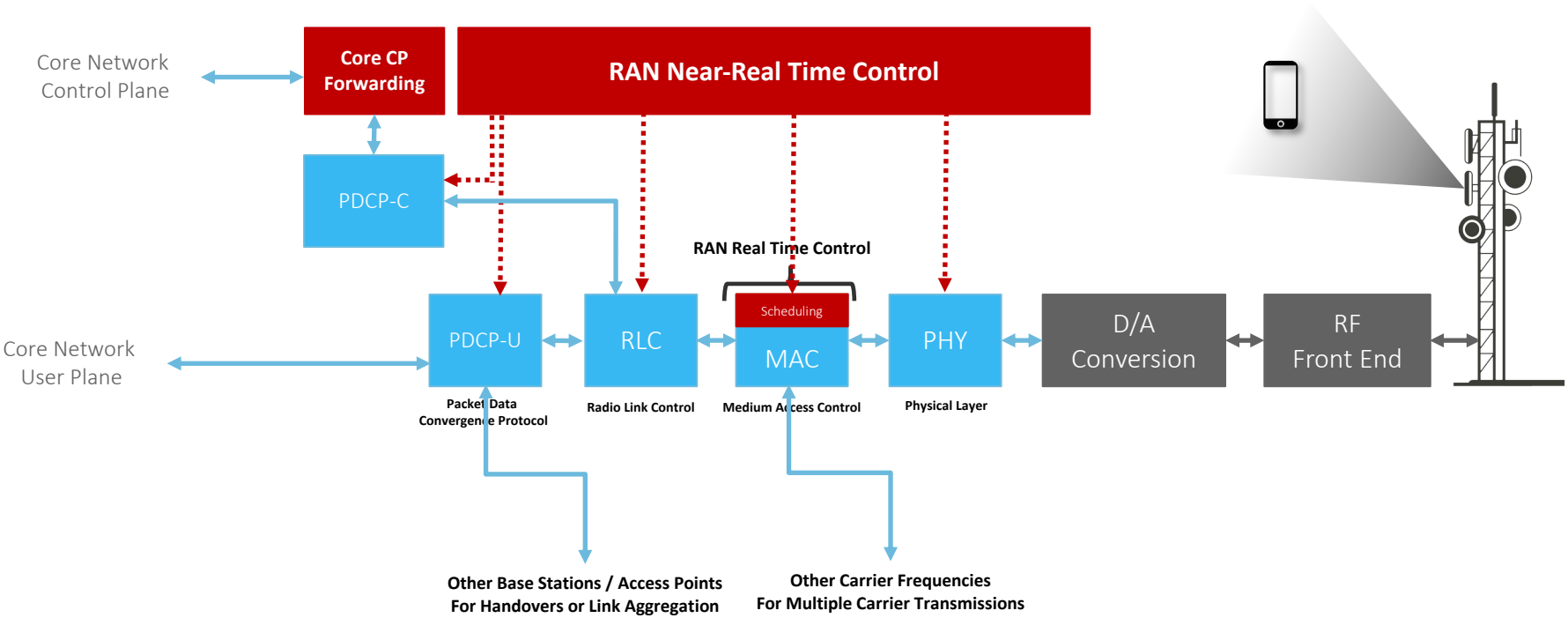
HOW ABOUT THE RAN?

Functional Disaggregation

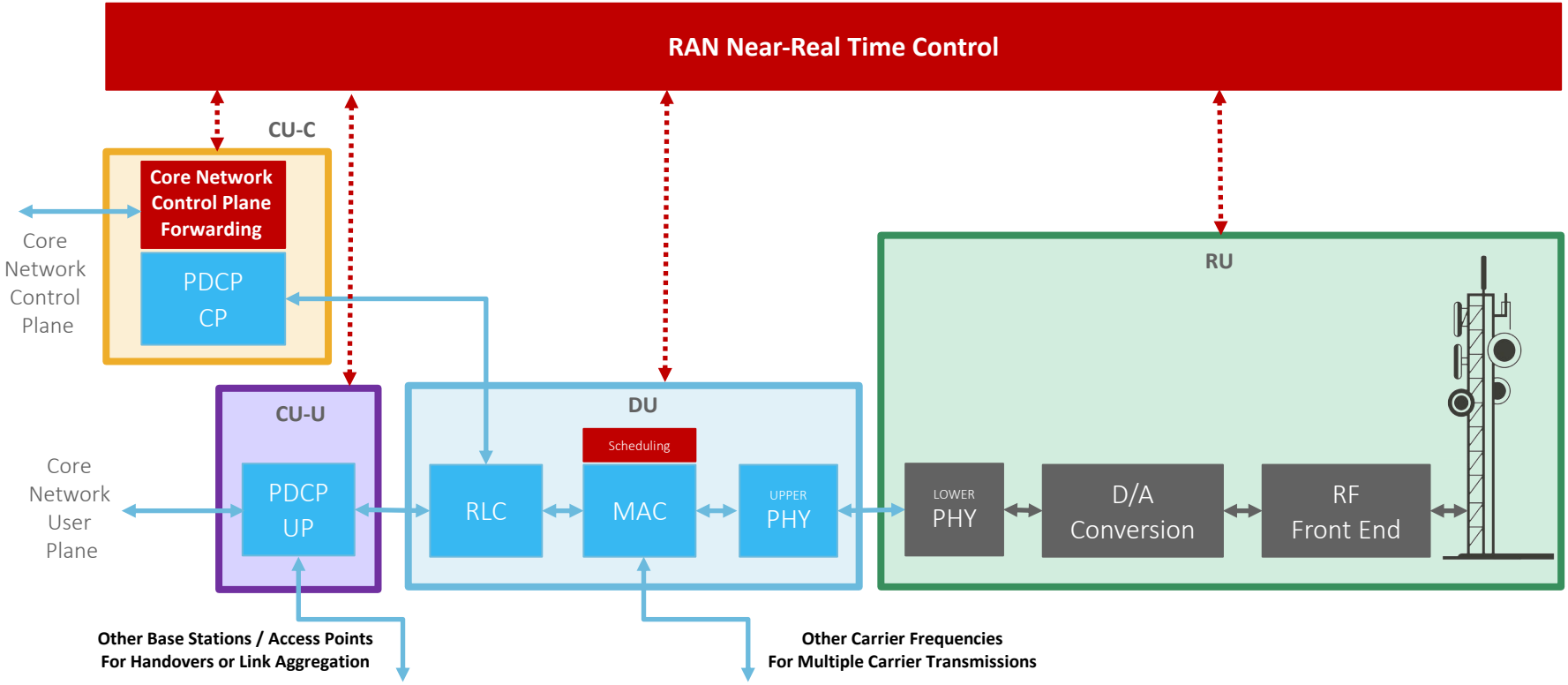


HOW ABOUT THE RAN?

Functional Disaggregation



HOW ABOUT THE RAN?



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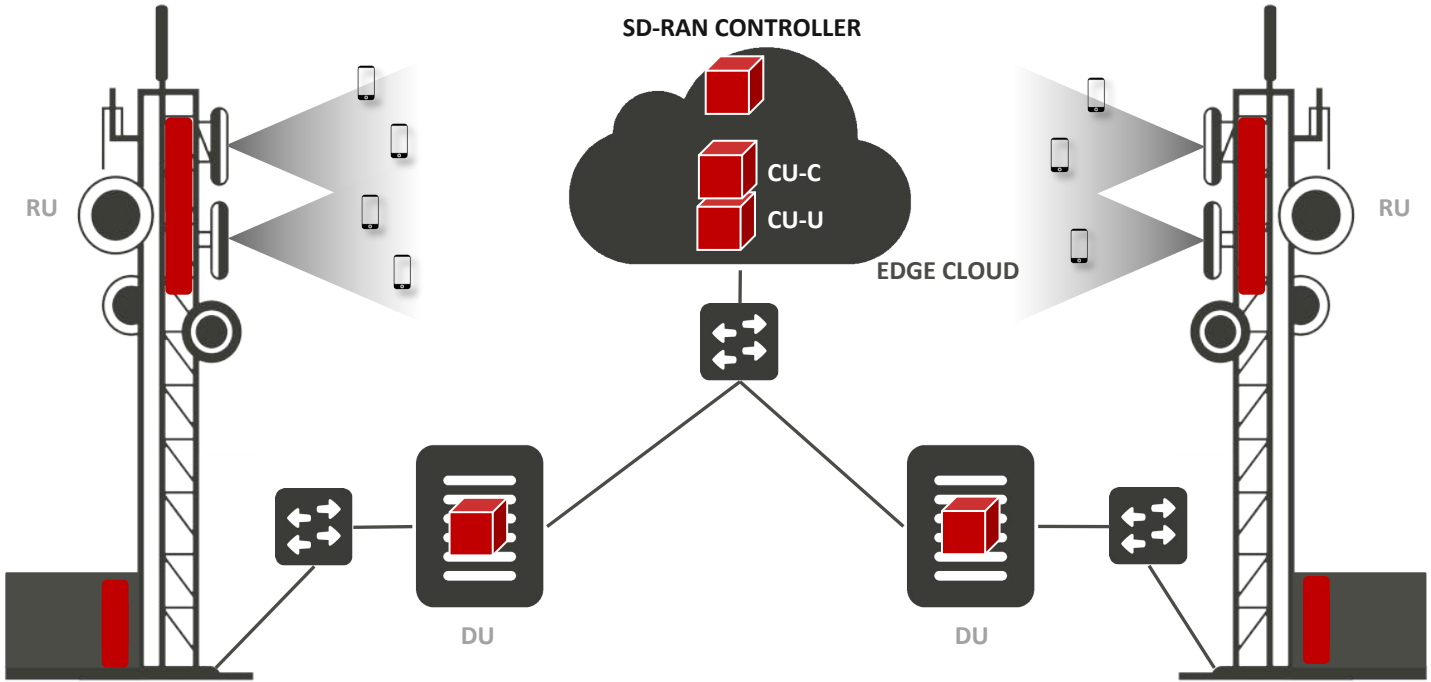
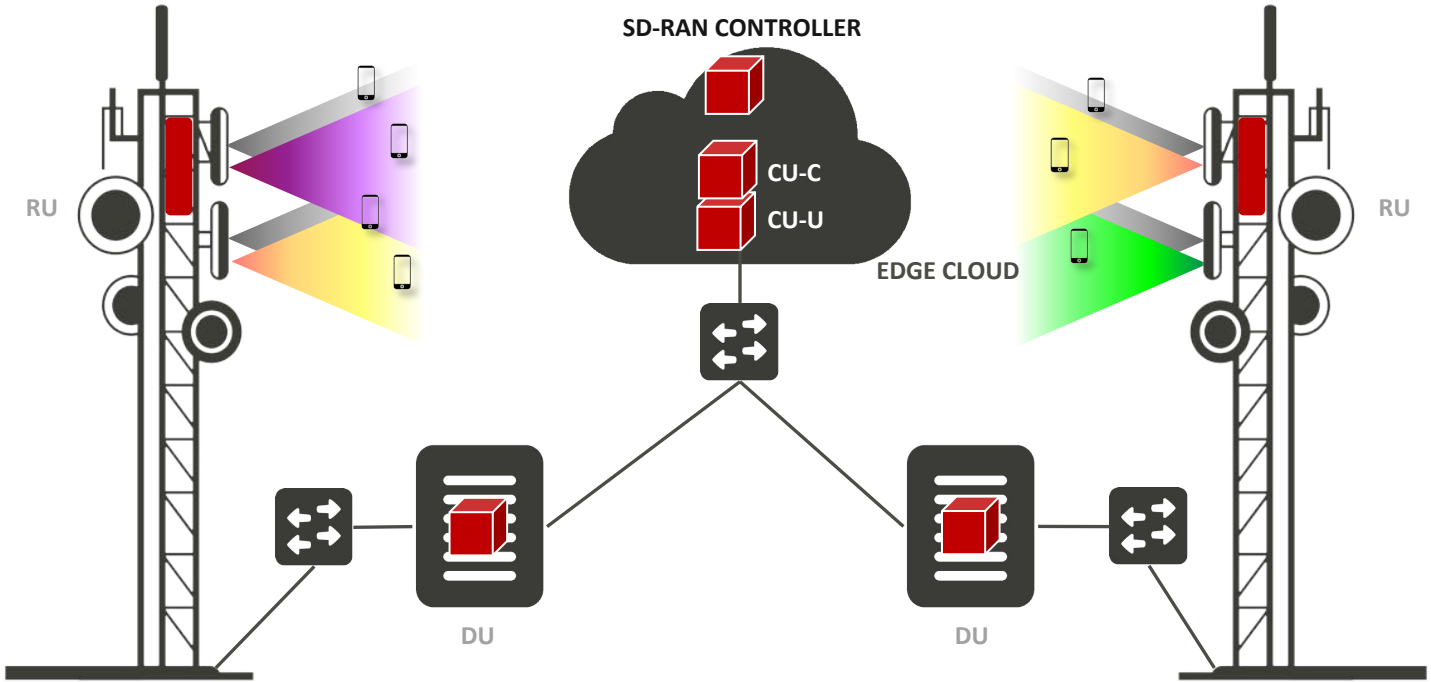


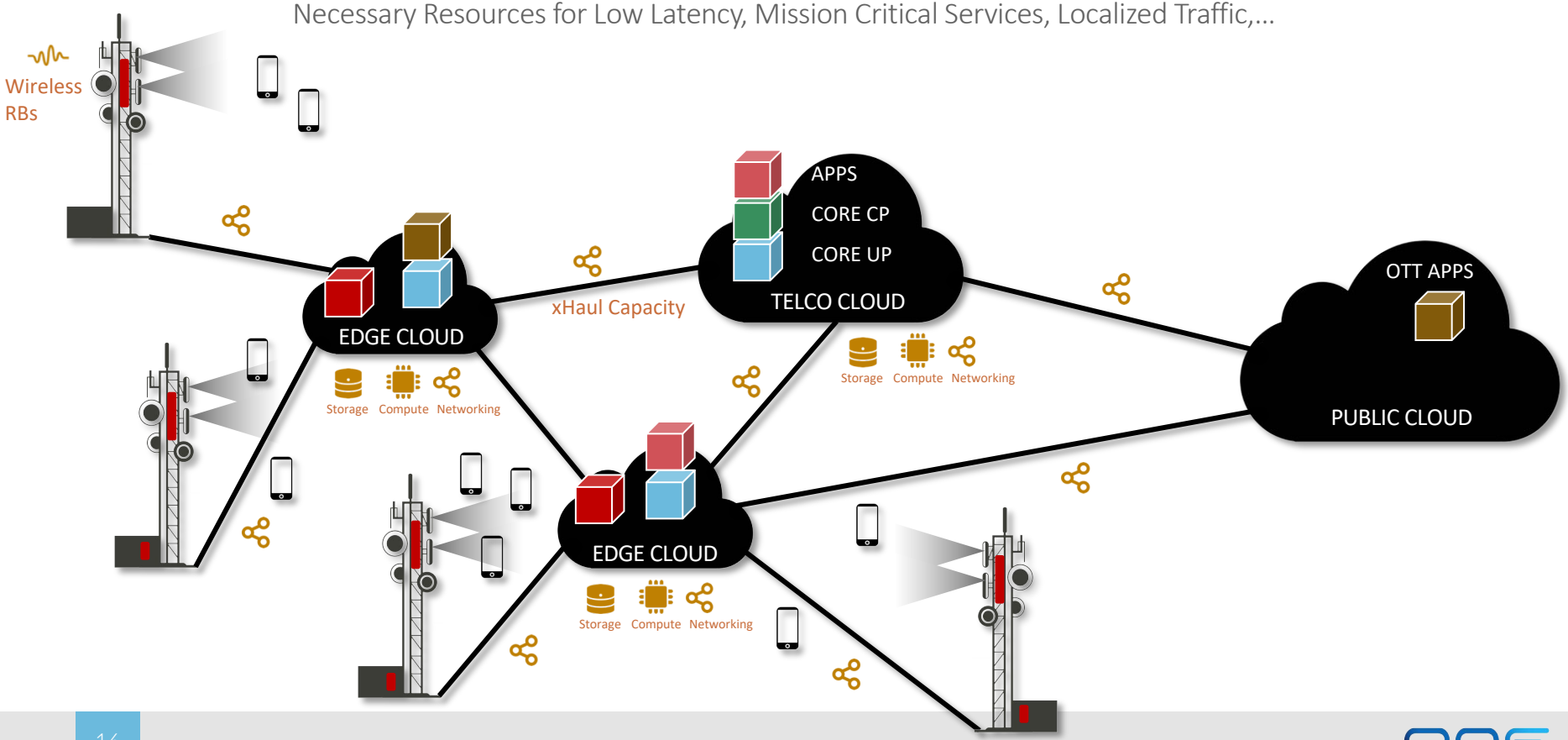
HOW ABOUT THE RAN?

Virtualization of the Spectrum Resource



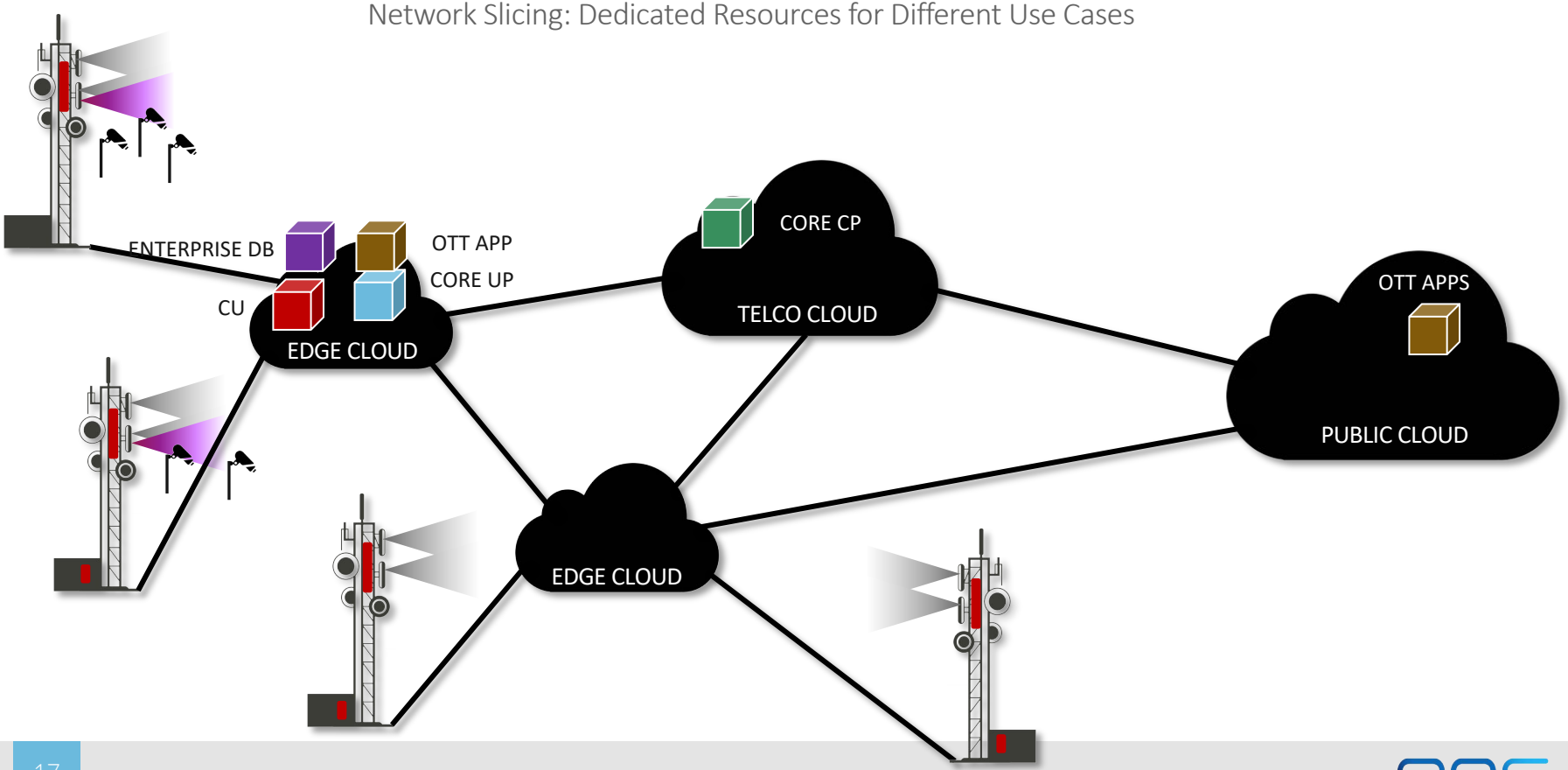
NEW BUSINESS VERTICALS

Necessary Resources for Low Latency, Mission Critical Services, Localized Traffic,…



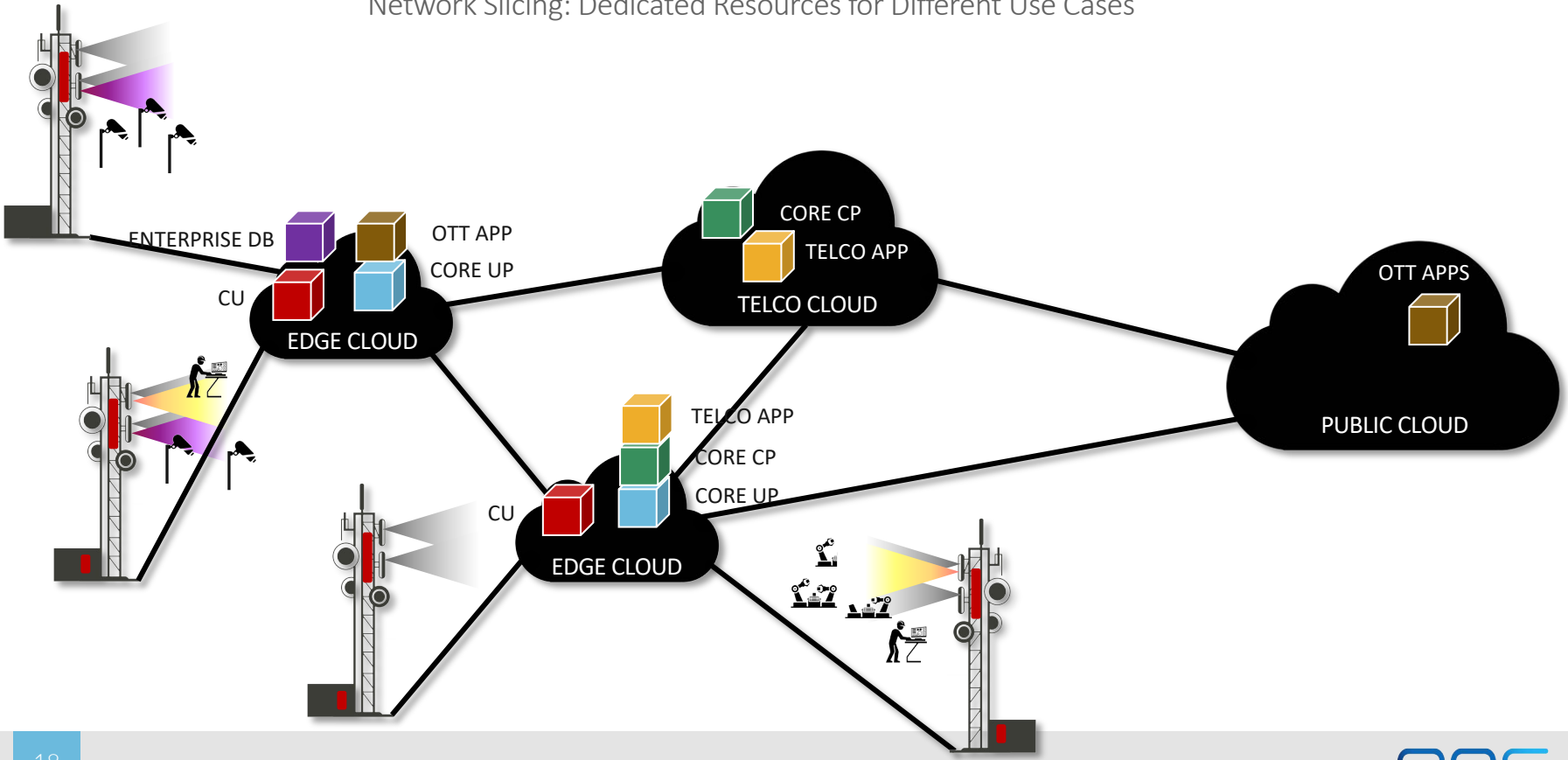
NEW BUSINESS VERTICALS

Network Slicing: Dedicated Resources for Different Use Cases

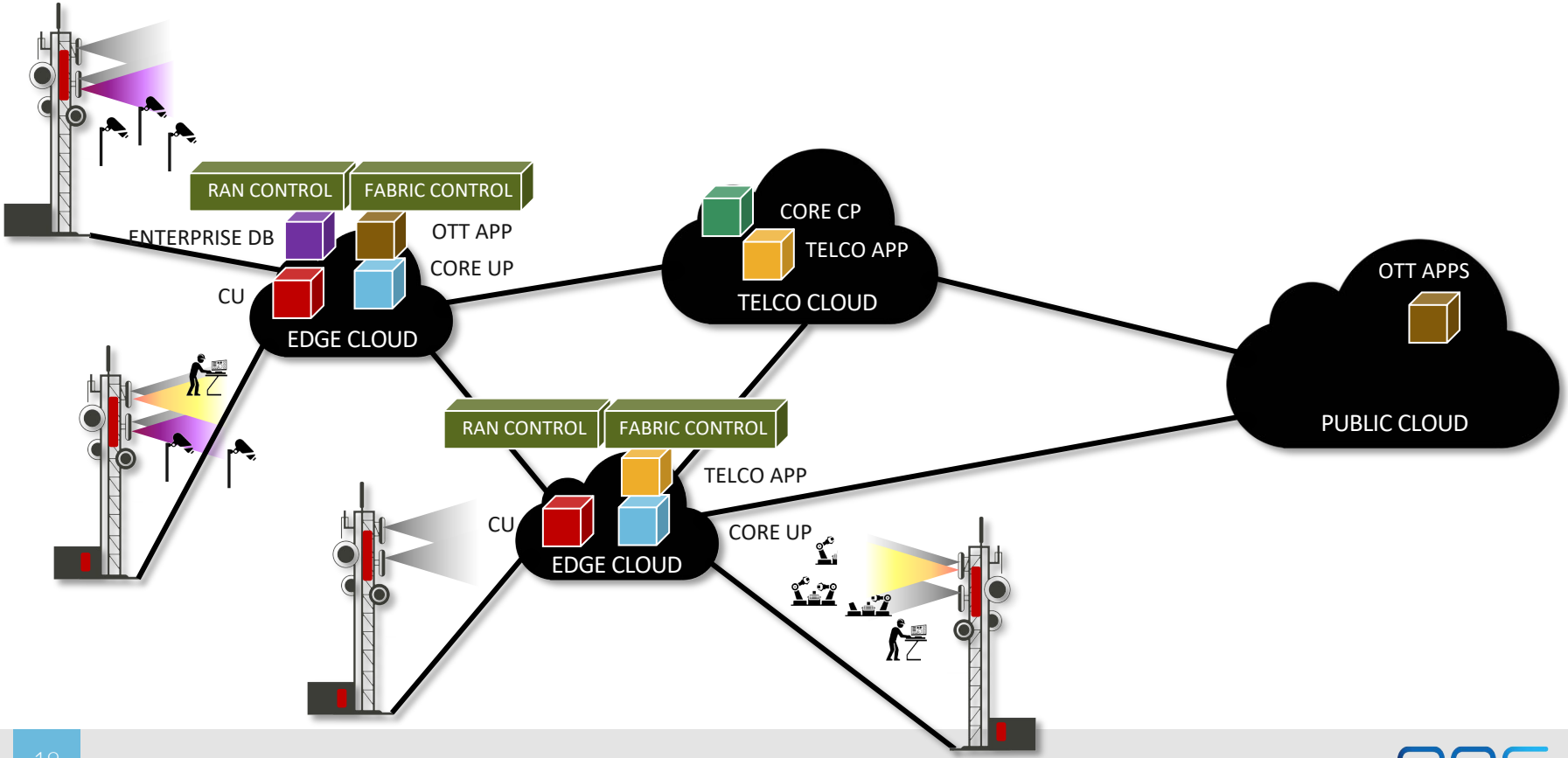


NEW BUSINESS VERTICALS

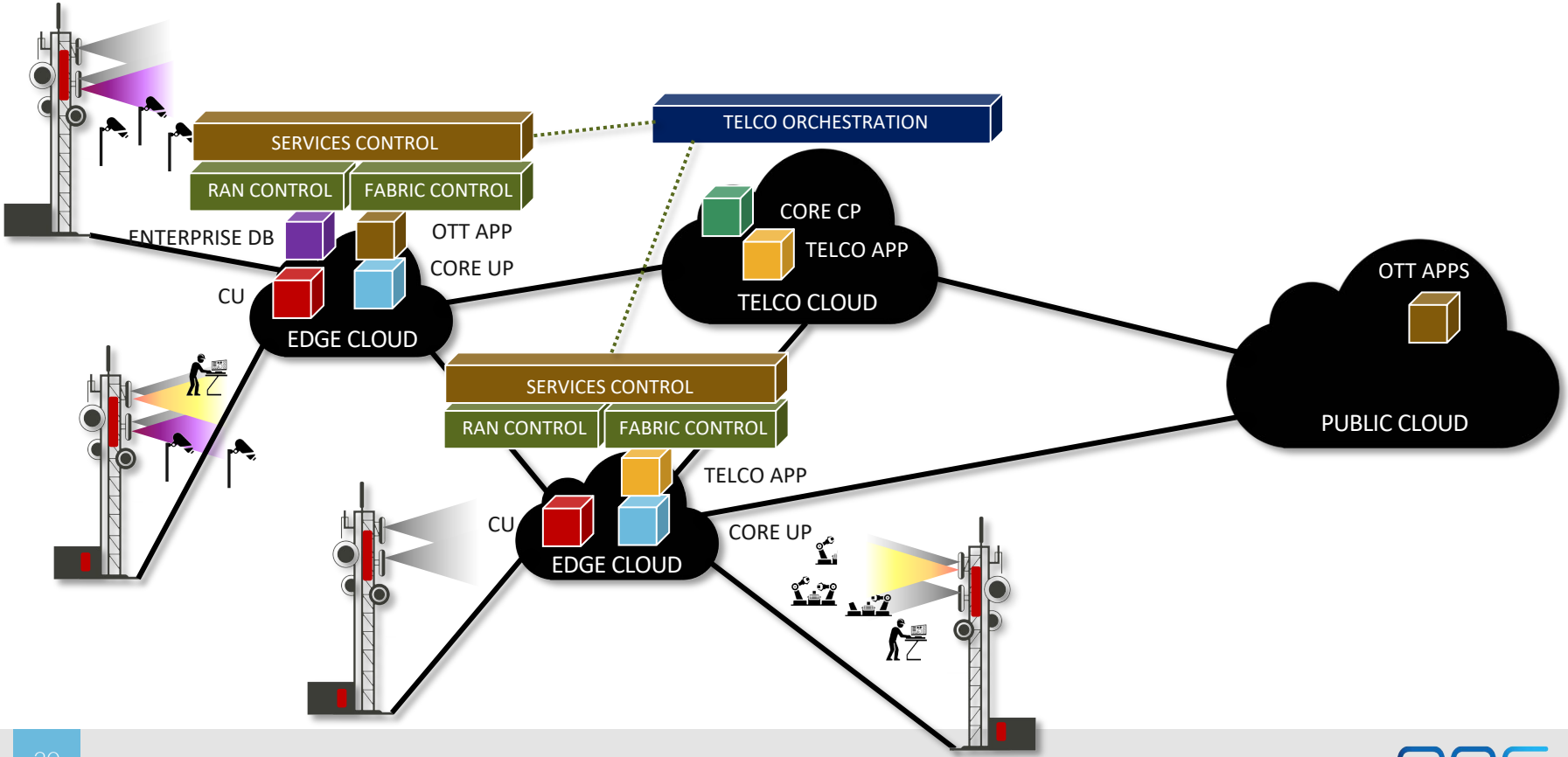
Network Slicing: Dedicated Resources for Different Use Cases



SOFTWARE-DEFINED CONTROL



AUTOMATION & ORCHESTRATION

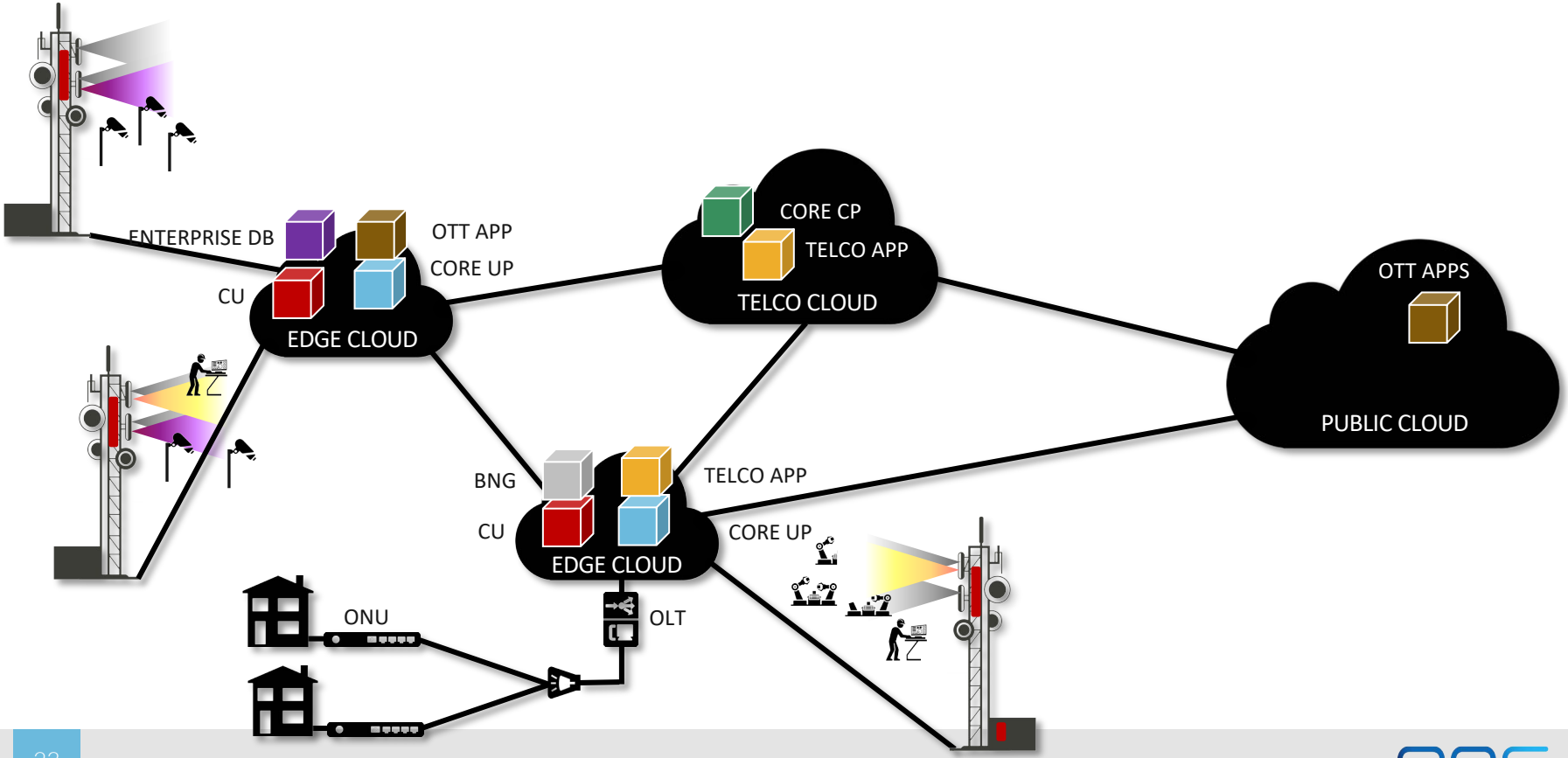


TELECOM OPERATORS USE **ADDITIONAL ACCESS TECHNOLOGIES** TO PROVIDE CONNECTIVITY FOR THEIR SUBSCRIBERS

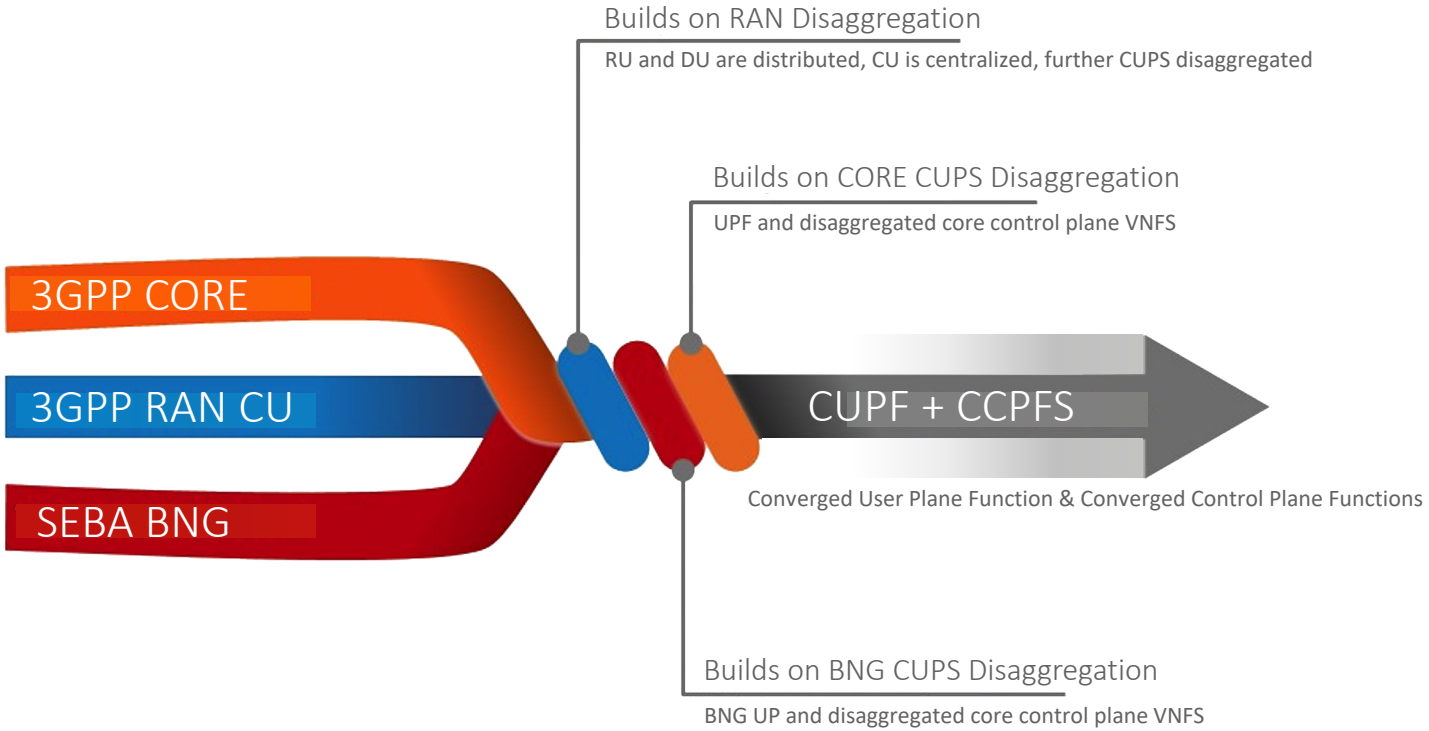
COMAC

CONVERGENCE/CO-EXISTENCE AT THE EDGE

CELLULAR AND BROADBAND ACCESS



COMAC


Builds on RAN Disaggregation
RU and DU are distributed, CU is centralized, further CUPS disaggregated
Builds on CORE CUPS Disaggregation
UPF and disaggregated core control plane VNFS
3GPP CORE
3GPP RAN CU
SEBA BNG
CUPF + CCPFS
Converged User Plane Function & Converged Control Plane Functions
Builds on BNG CUPS Disaggregation
BNG UP and disaggregated core control plane VNFS

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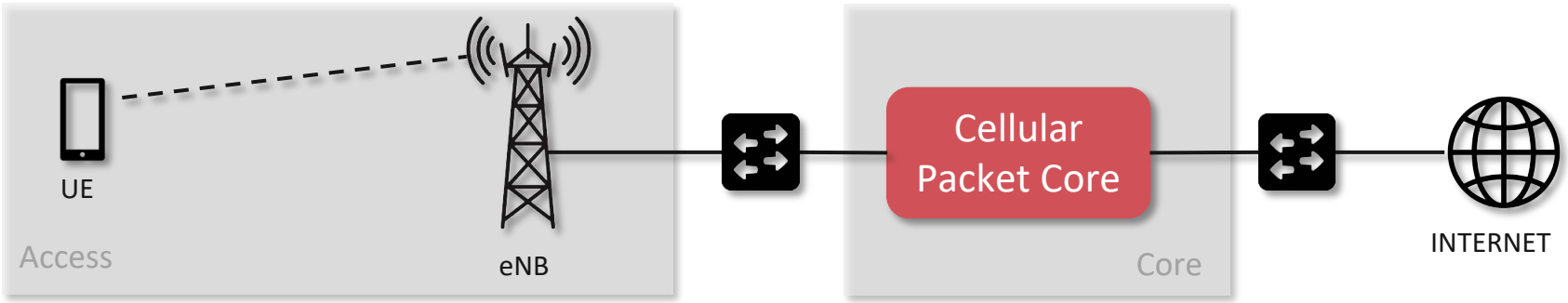
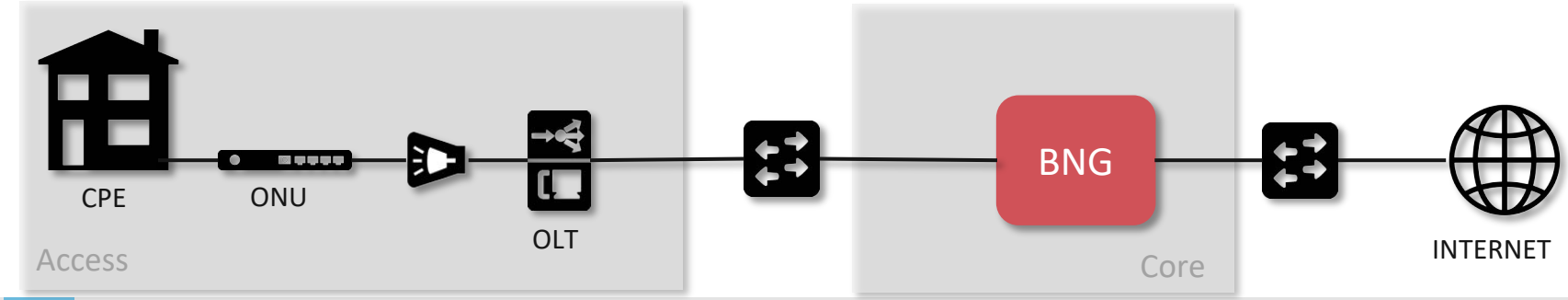
Supporting Operators

COMAC

Describing Access and Core



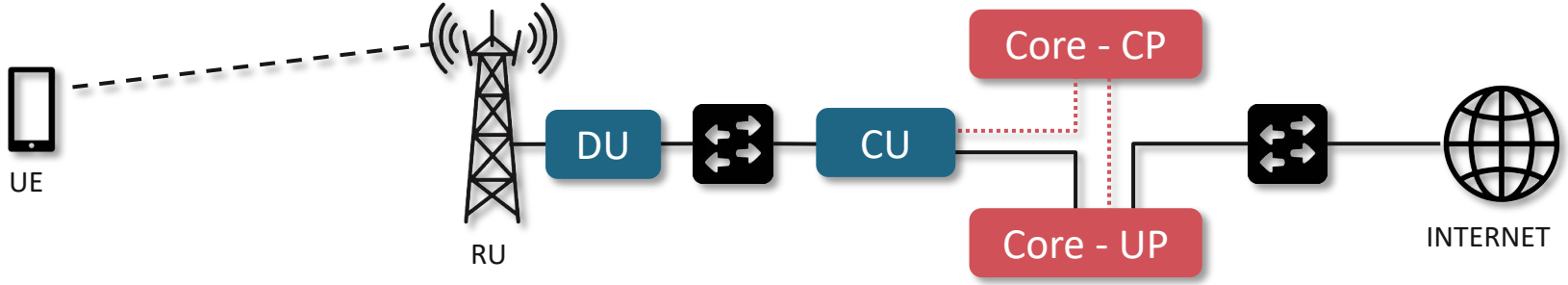
Cellular Network



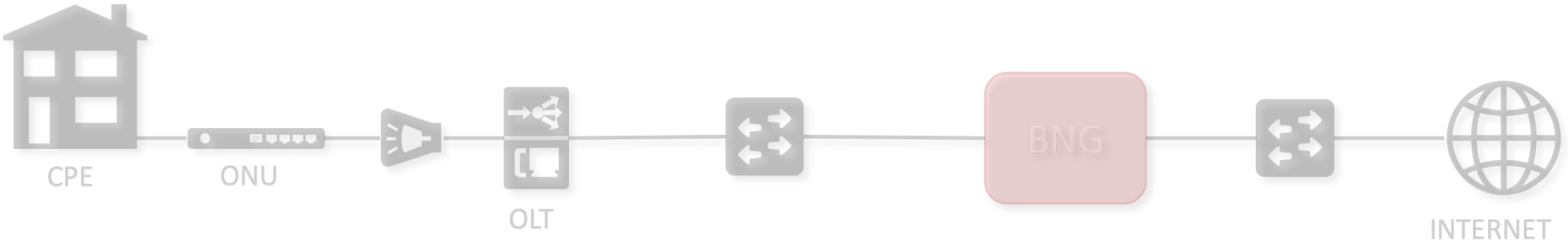
Broadband Network

COMAC

Disaggregate First



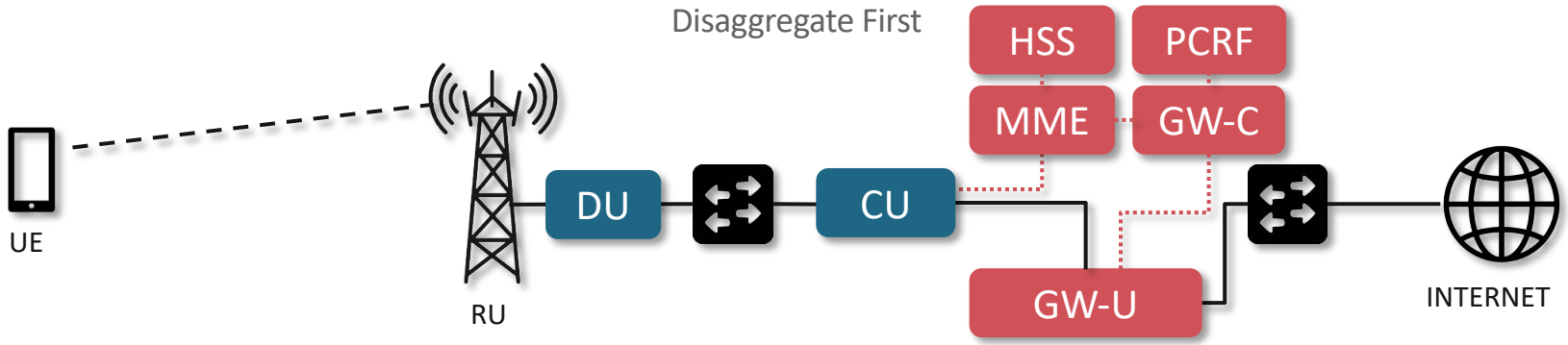
Cellular Network



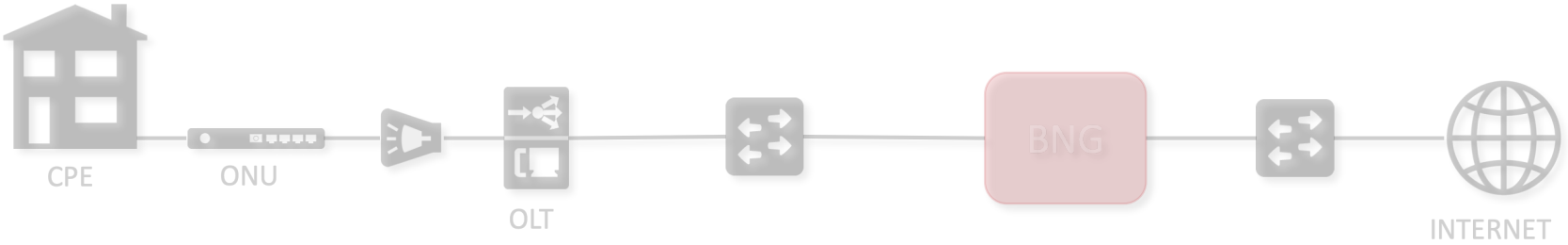
Broadband Network

COMAC

Disaggregate First



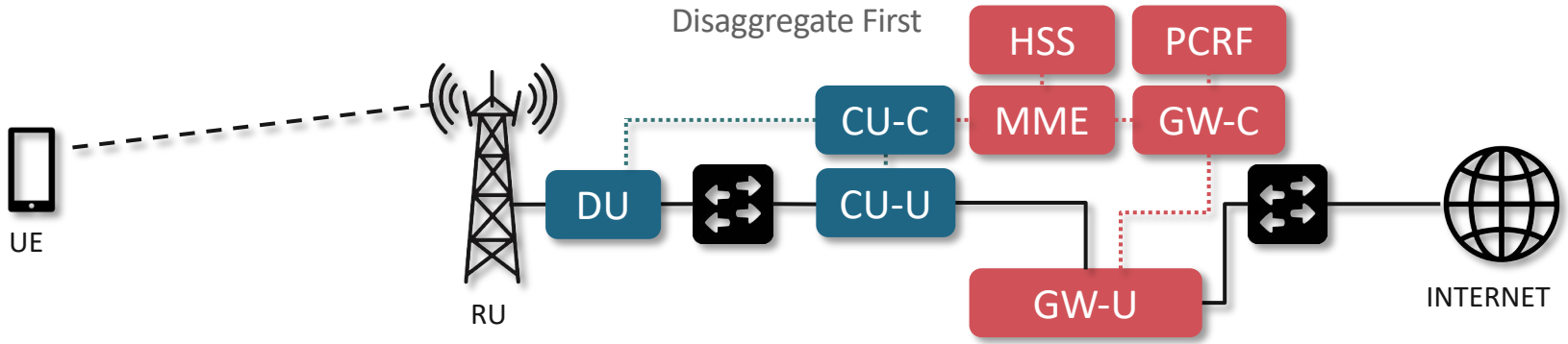
Cellular Network



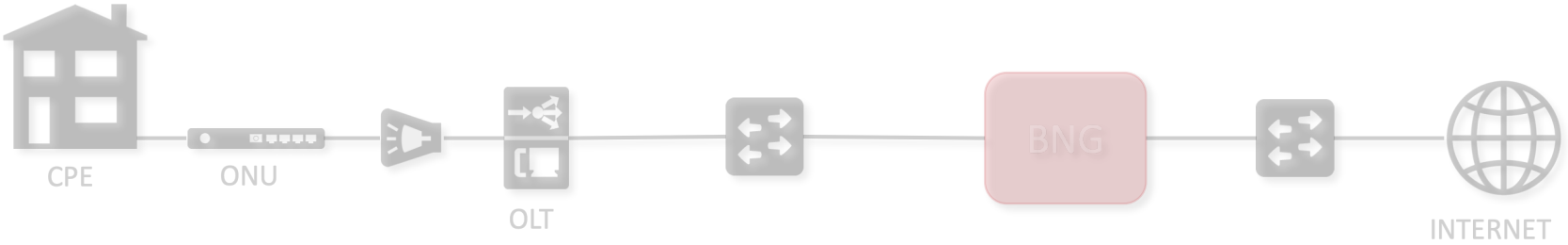
Broadband Network

COMAC

Disaggregate First



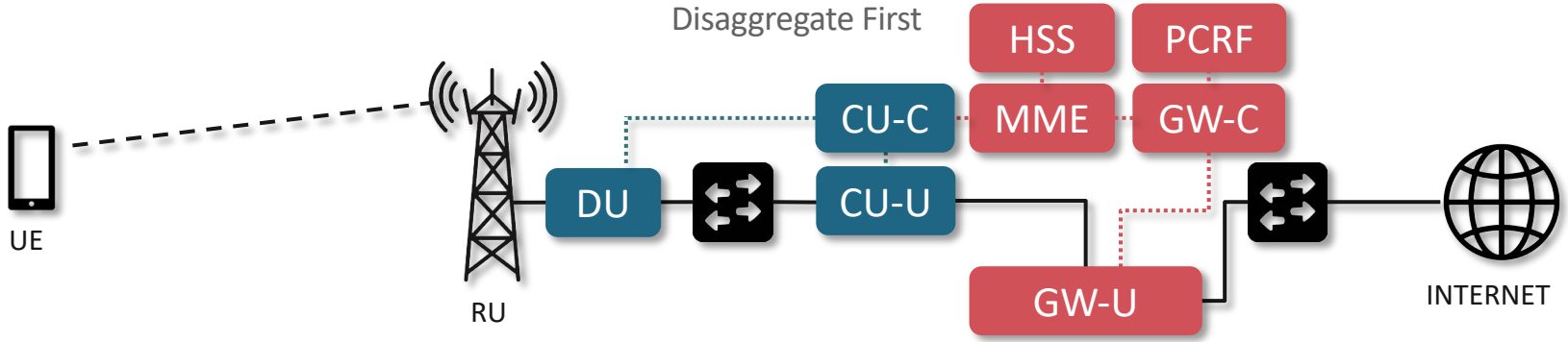
Cellular Network



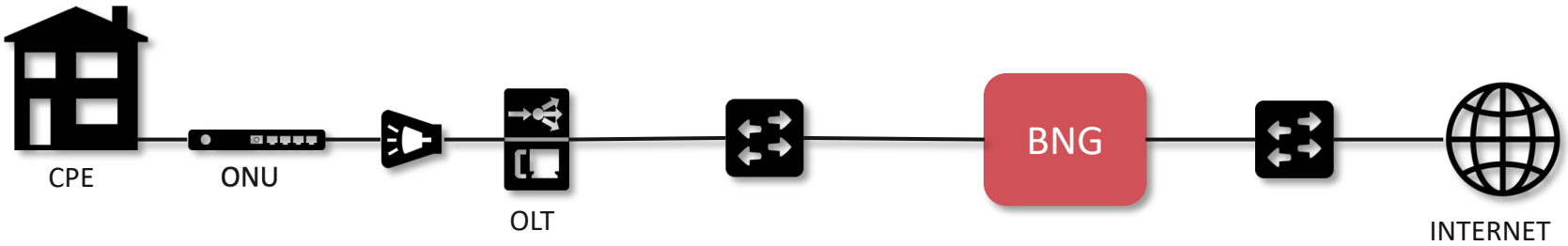
Broadband Network

COMAC

Disaggregate First



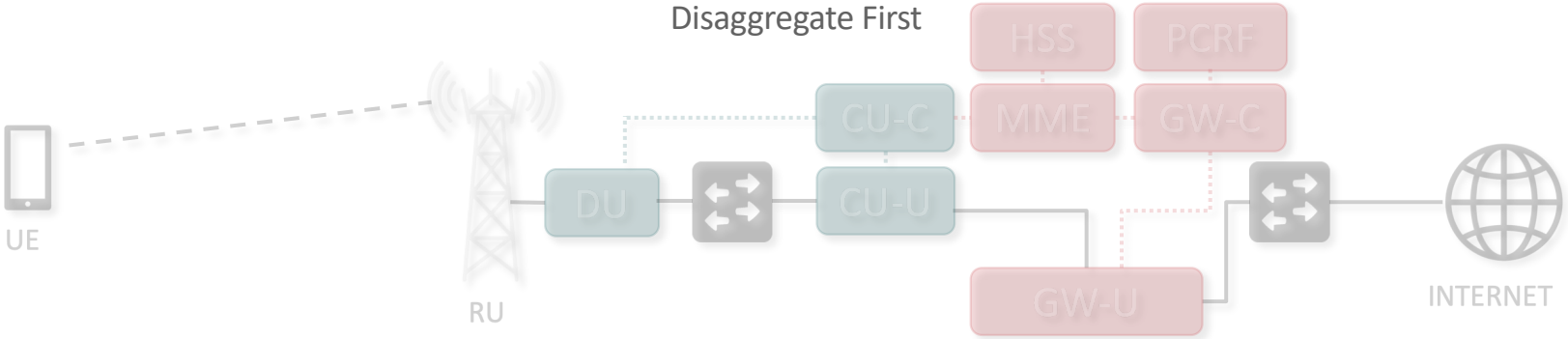
Cellular Network

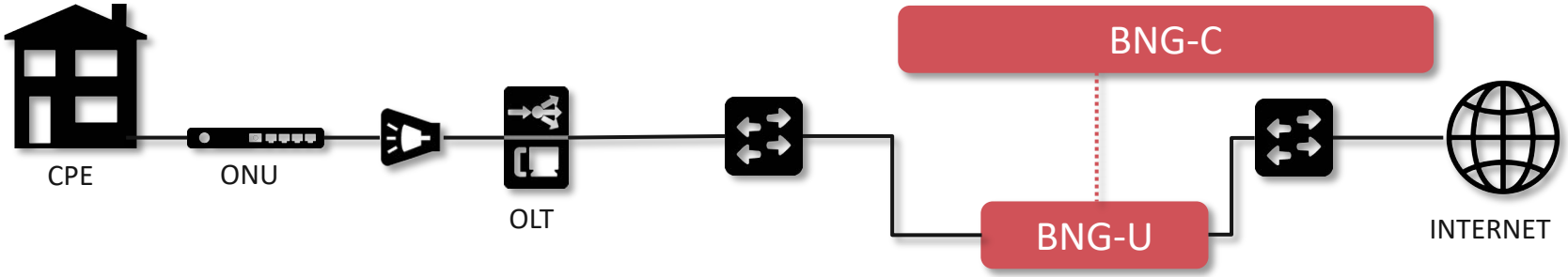


Broadband Network

COMAC

Disaggregate First

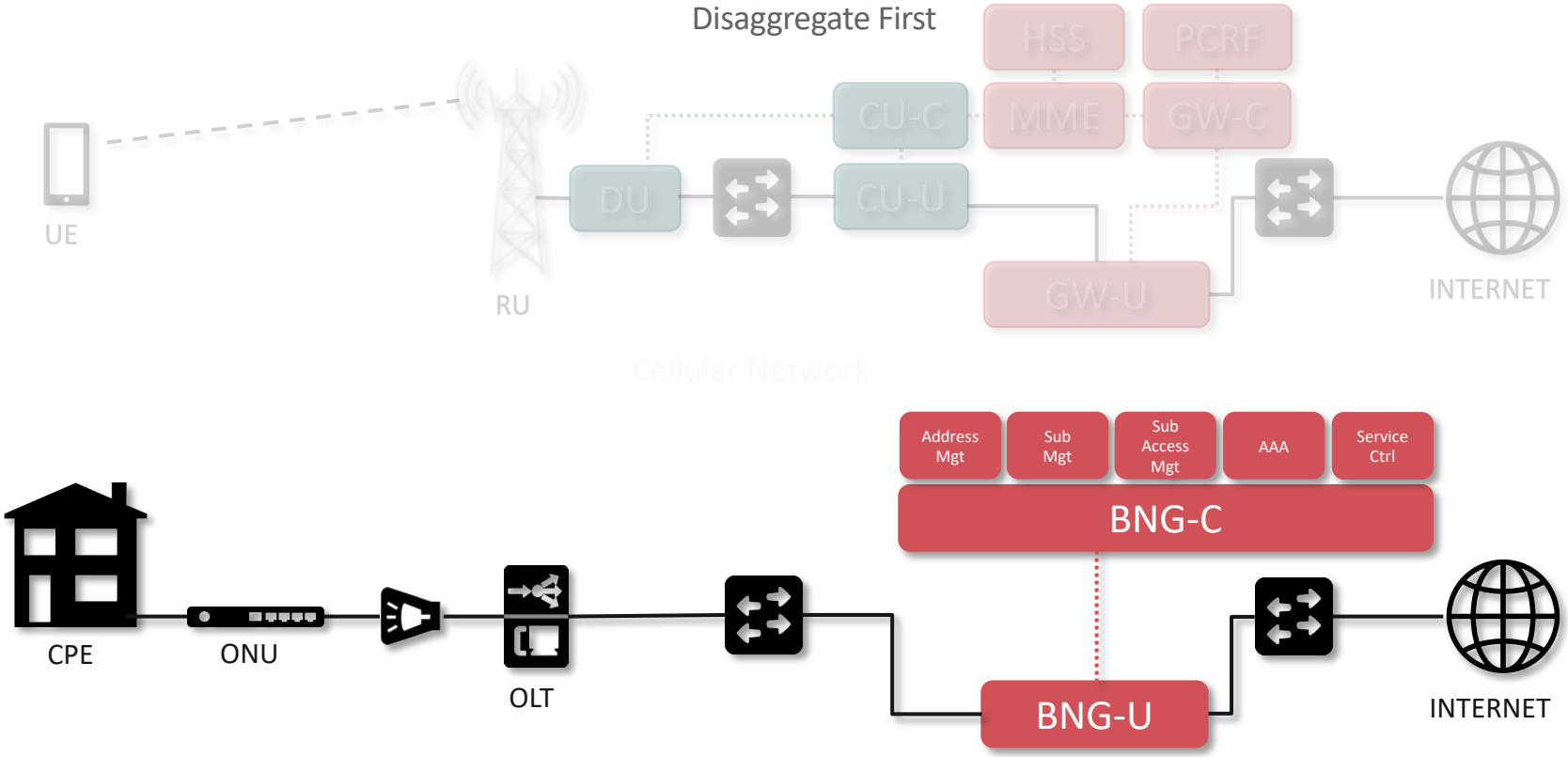




Broadband Network

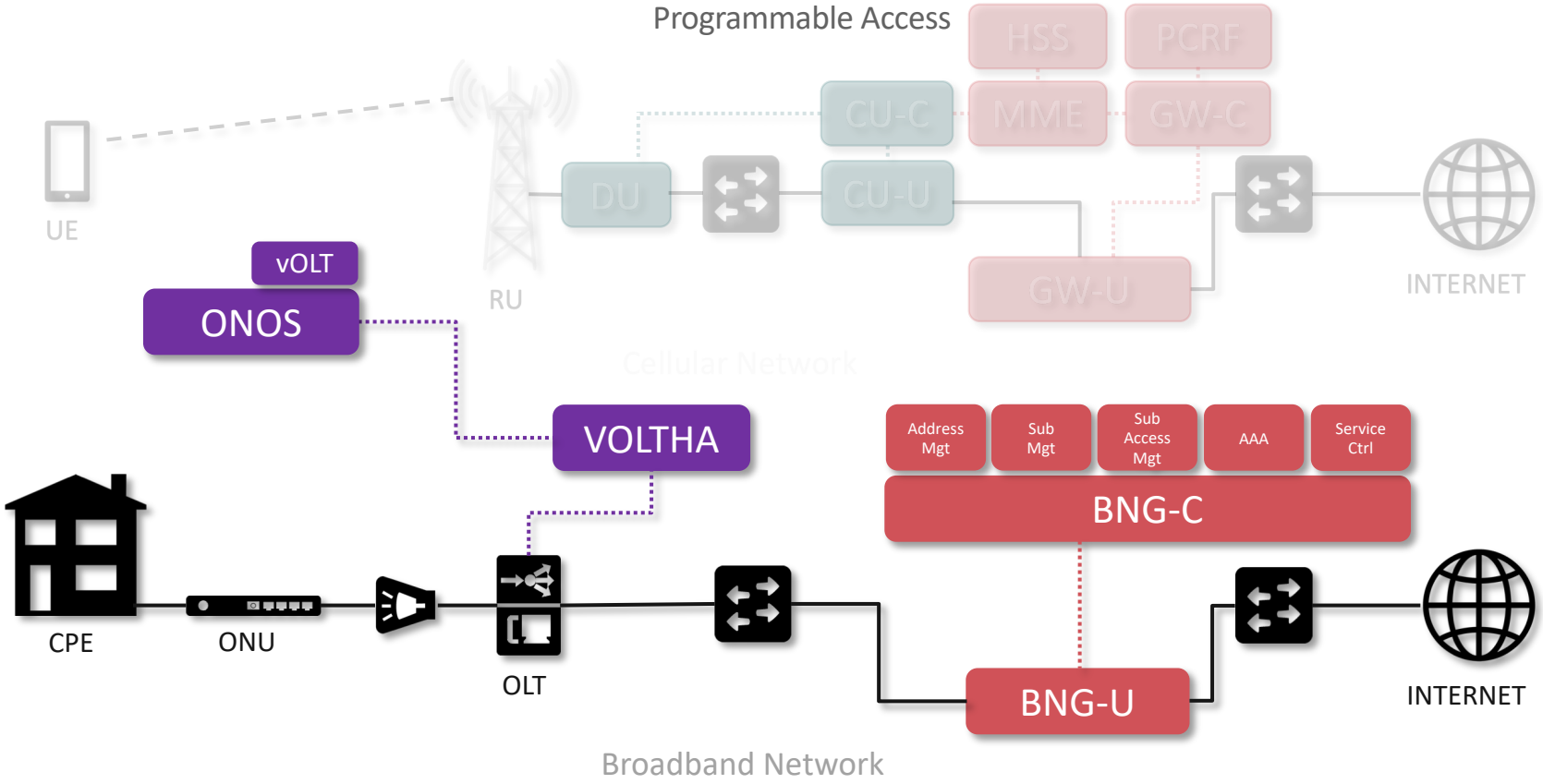
COMAC

Disaggregate First



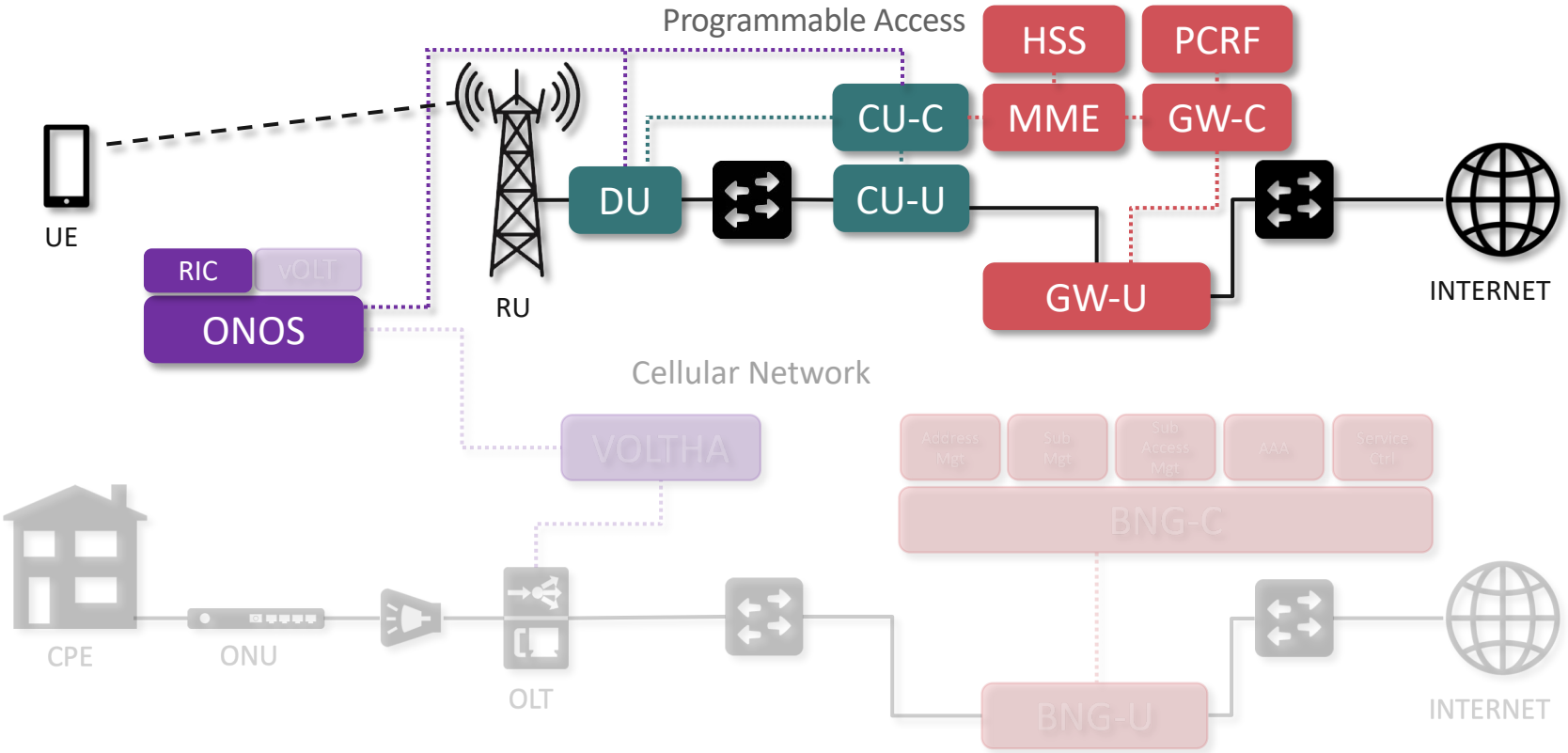
COMAC

Programmable Access

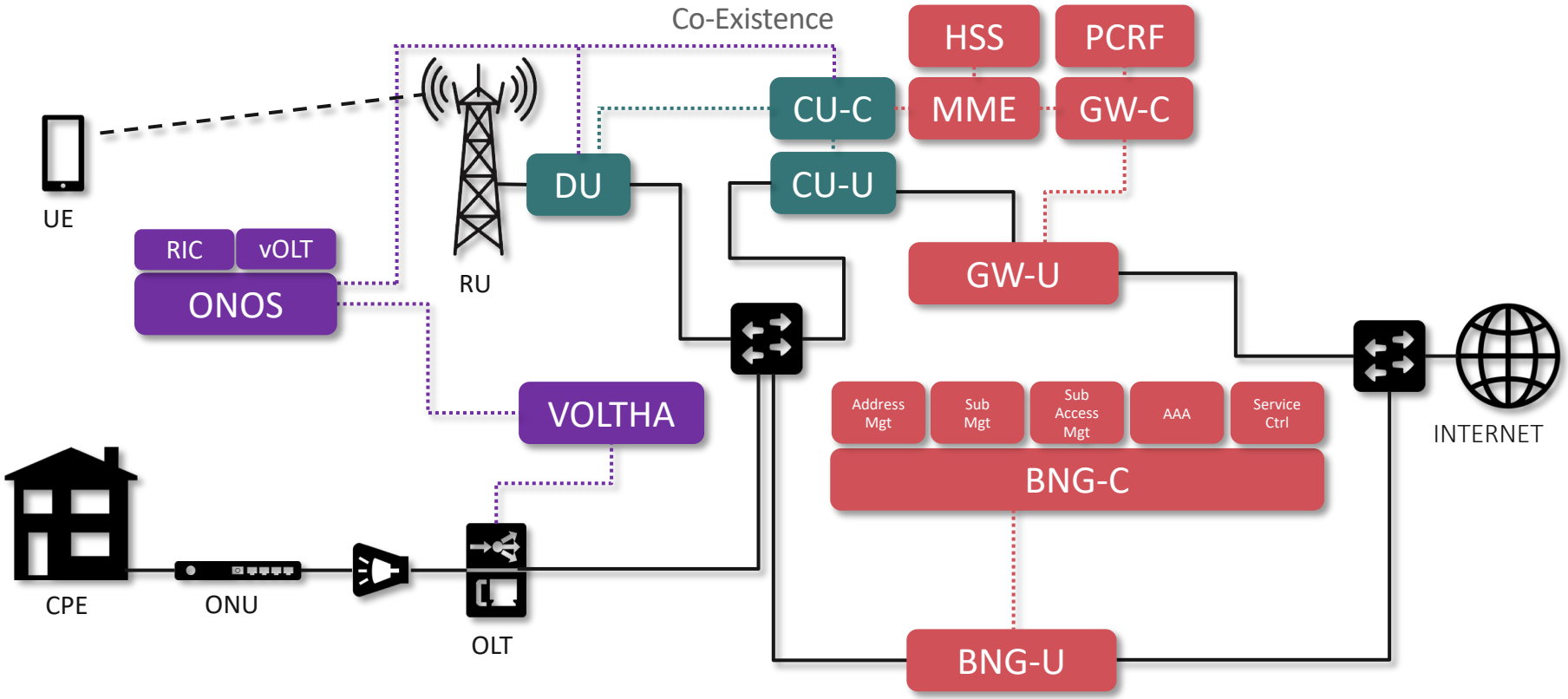


Broadband Network

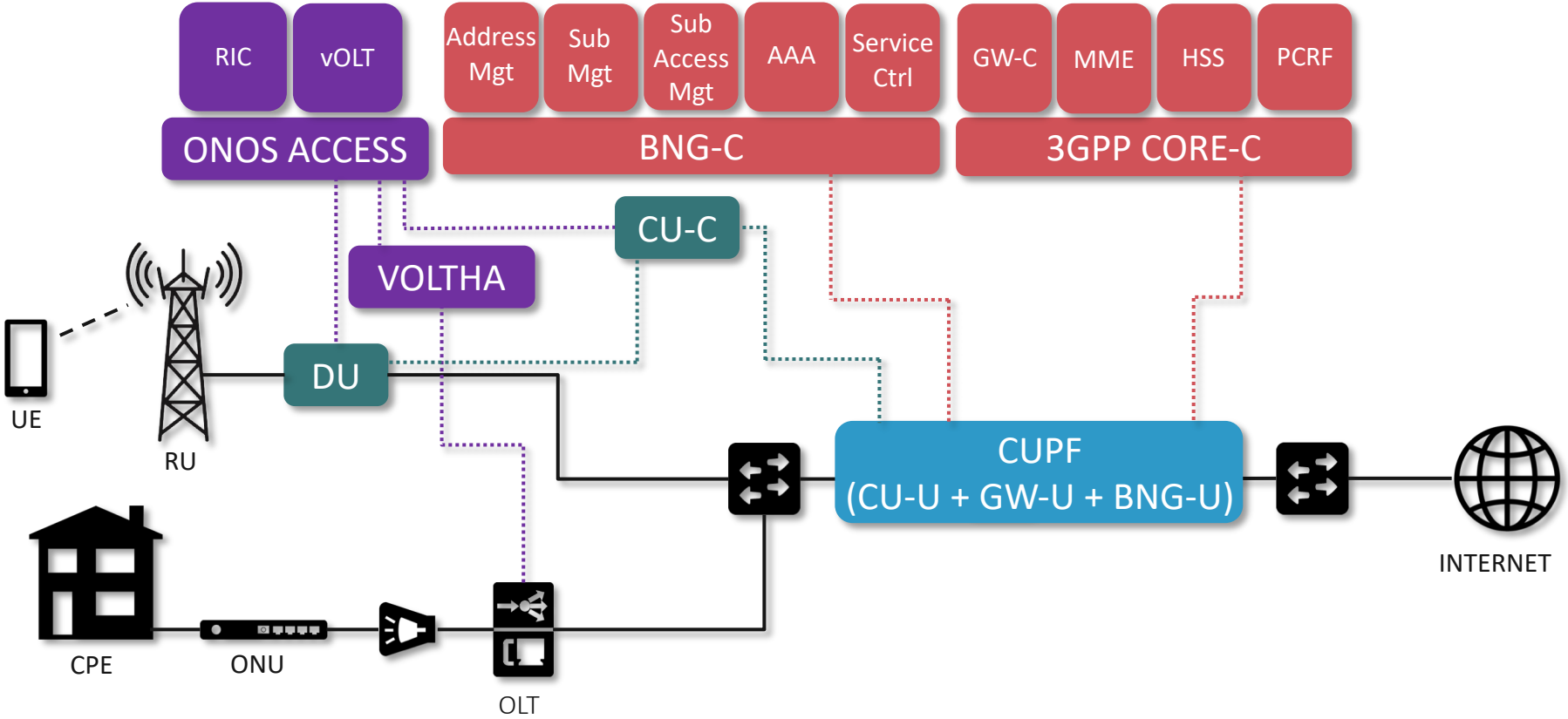
COMAC


Programmable Access
HSS
PCRF
CU-C
MME
GW-C
UE
DU
CU-U
RIC
vOLT
ONOS
RU
GW-U
INTERNET
Cellular Network
VOLTHA
Address Mgt
Sub Mgt
Sub Access Mgt
AAA
Service Ctrl
BNG-C
CPE
ONU
OLT
BNG-U
INTERNET
Broadband Network

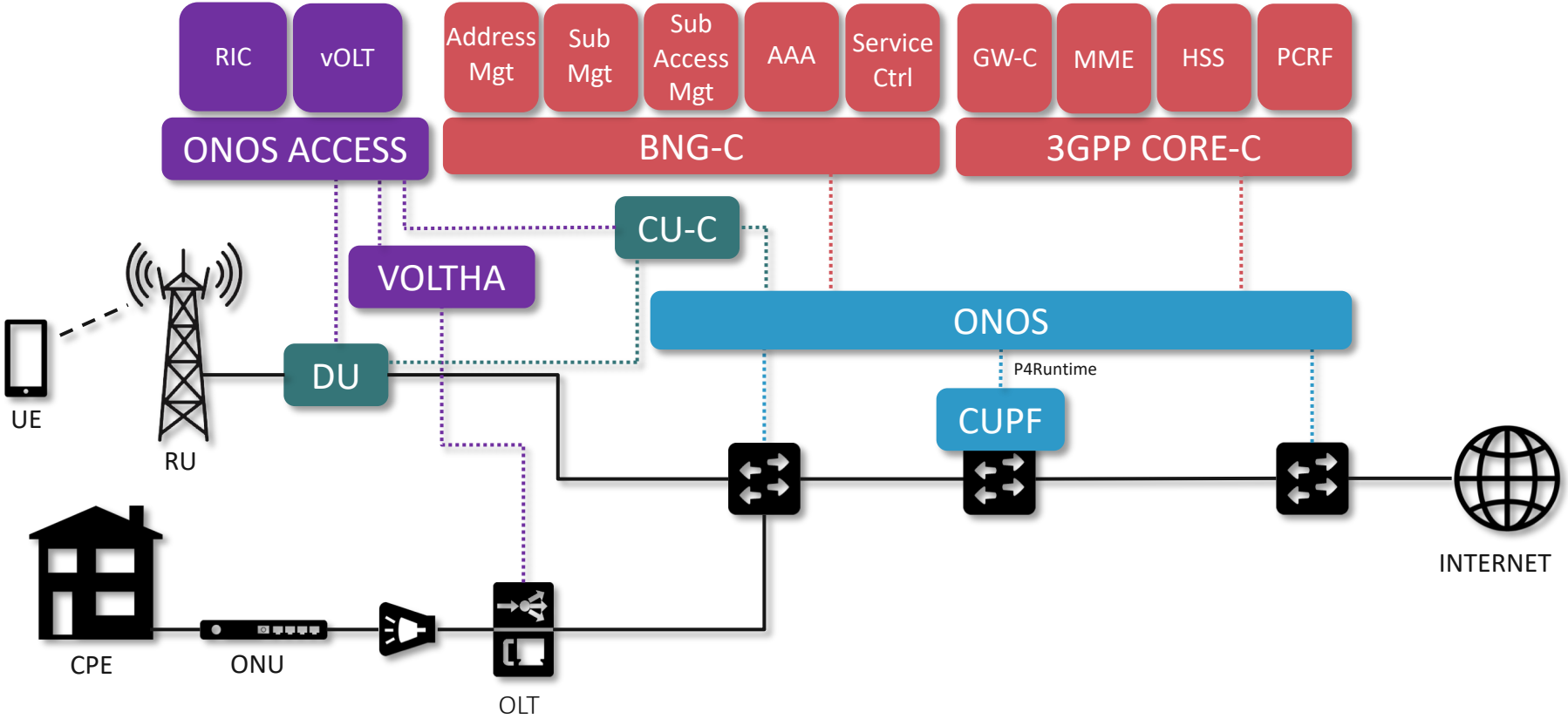
COMAC


Co-Existence
HSS
PCRF
CU-C
MME
GW-C
DU
CU-U
UE
RIC
vOLT
ONOS
RU
GW-U
VOLTHA
Address Mgt
Sub Mgt
Sub Access Mgt
AAA
Service Ctrl
INTERNET
BNG-C
CPE
ONU
OLT
BNG-U

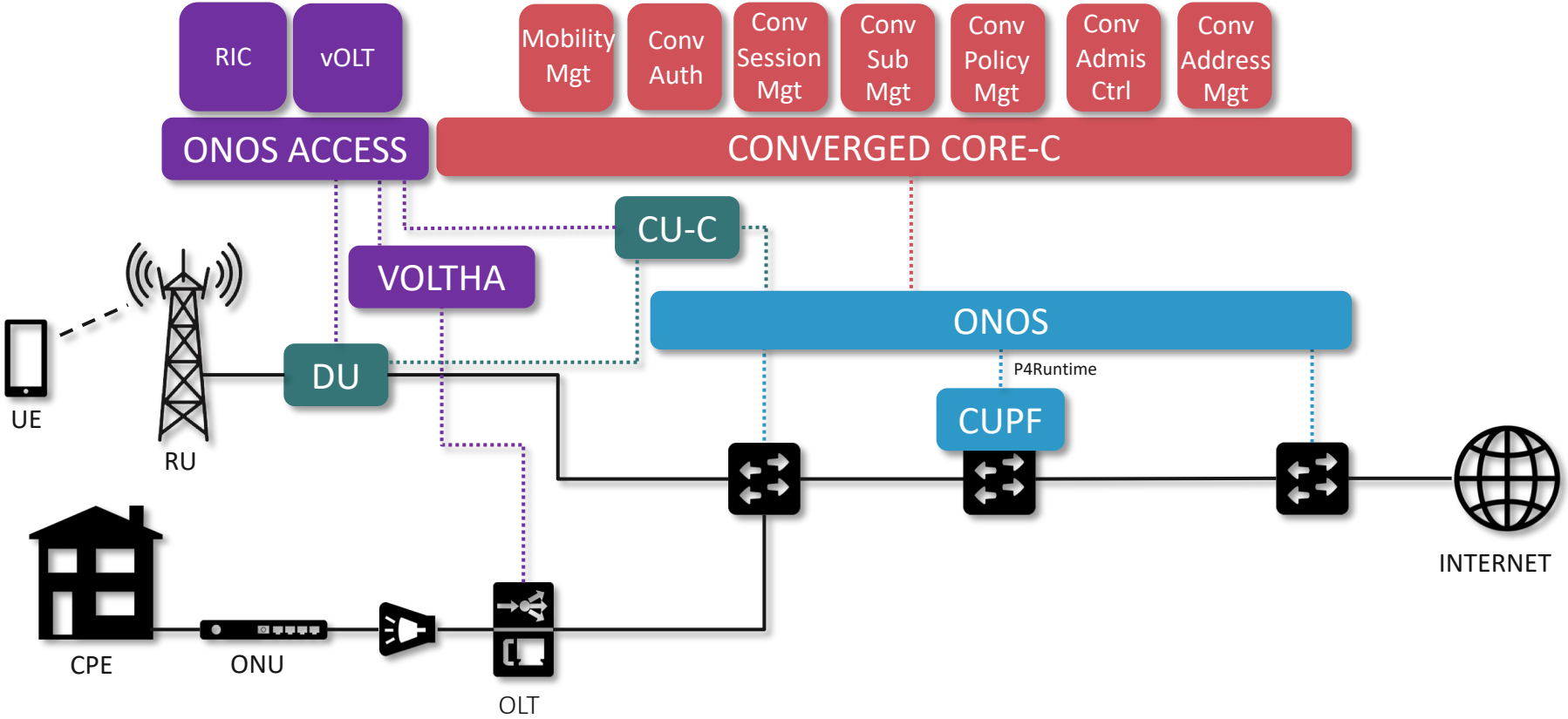
USER PLANE CONVERGENCE



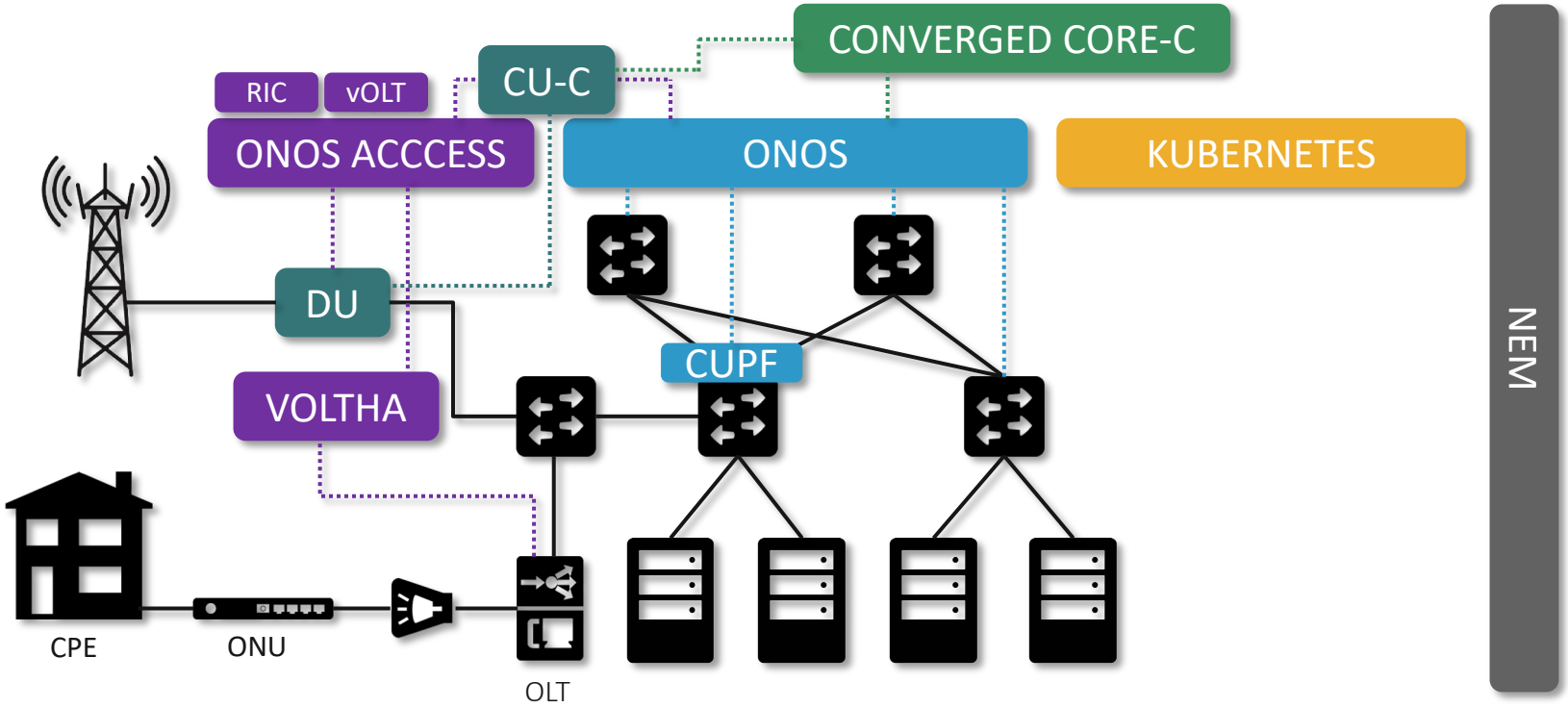
P4-BASED USER PLANE CONVERGENCE



CONTROL PLANE CONVERGENCE



COMAC EDGE

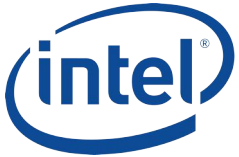

CONVERGED CORE-C
RIC
vOLT
CU-C
ONOS ACCCESS
ONOS
KUBERNETES
NEM
DU
CUPF
VOLTHA
CPE
ONU
OLT

OMEC

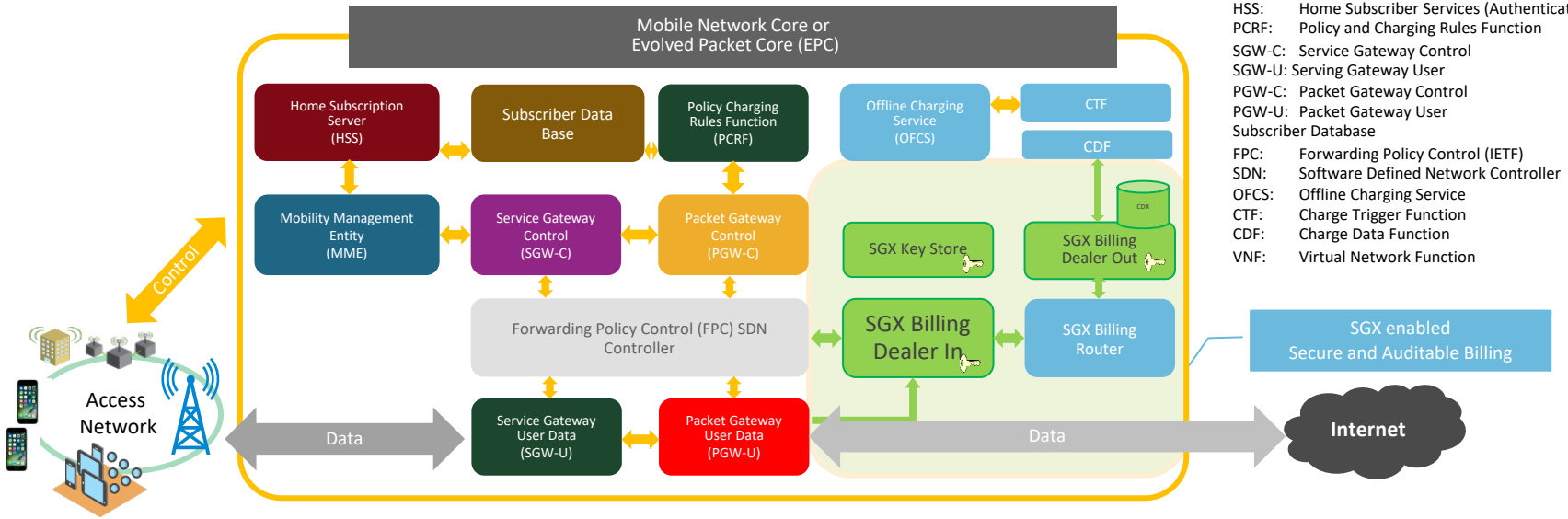
OPEN SOURCE MOBILE CORE

OMEC

Ecosystem



OMEC COMPONENTS



MME: Mobility Management Engine (Control)
HSS: Home Subscriber Services (Authentication)
PCRF: Policy and Charging Rules Function
SGW-C: Service Gateway Control
SGW-U: Serving Gateway User
PGW-C: Packet Gateway Control
PGW-U: Packet Gateway User
Subscriber Database
FPC: Forwarding Policy Control (IETF)
SDN: Software Defined Network Controller
OFCS: Offline Charging Service
CTF: Charge Trigger Function
CDF: Charge Data Function
VNF: Virtual Network Function

Includes fully secured, scalable and auditable Intel Secure Guard Extensions (SGX) based integrated billing record processing.

RELEASE CODE OVERVIEW

- The open source code provides an end-to-end comprehensive 3GPP core infrastructure:
  - Fully secured distributed Xeon E3 based **SGX enabled billing system**, automated, real time billing data collection and storage.
  - **SGX based secured, auditable mutual attestation**. Guaranteed confidentiality and integrity of Charge Data Records (CDRs)
  - 1x Frame of Capacity= 13+ VNFs **handling 250K Flows**, **1000TPS, 2MPPS** == ~100 CPU Cores, 256GB, 1TB HDD, 8x 10GbE
  - Cross platform deployment orchestration, provisioning and network configuration tools ready- **KVM, AWS, Docker, K8, etc**.

COMPONENTS

13 VNFs

- Mobility Management Entity (MME)
- Home Subscription Server (HSS)
- Database (DB)
- Serving Gateway Control (SGW-C)
- Serving Gateway User Plane (SGW-U)
- Packet Gateway Control (PGW-C)
- Packet Gateway User Plane (PGW-U)
- Charge Data Function (CDF)
- Charge Trigger Function (CTF)
- Intel® Secure Guard Extensions CDR Dealers-In (SGX-DLR-IN)
- Intel® SGX Dealer-Out (SGX-DLR-OUT)
- Intel® SGX Key-store (SGX-KMS)
- CDR-ROUTER

2019 PLANS

- Necessary code enhancements & hardening for field trials towards production network deployments:
  - Sprint: IoT Use Case
  - DT: Fixed Mobile Substitution Use Case
- Relevant Enhancements:
  - MME hardening
  - User Level Packet Copying for LI
  - Support of multiple APNs
  - Sx interface
  - Further logging, statistics and CLI support

COMAC CO-EXISTENCE DEMO AT MWC 2019

MWC 2019 DEMO FEATURES

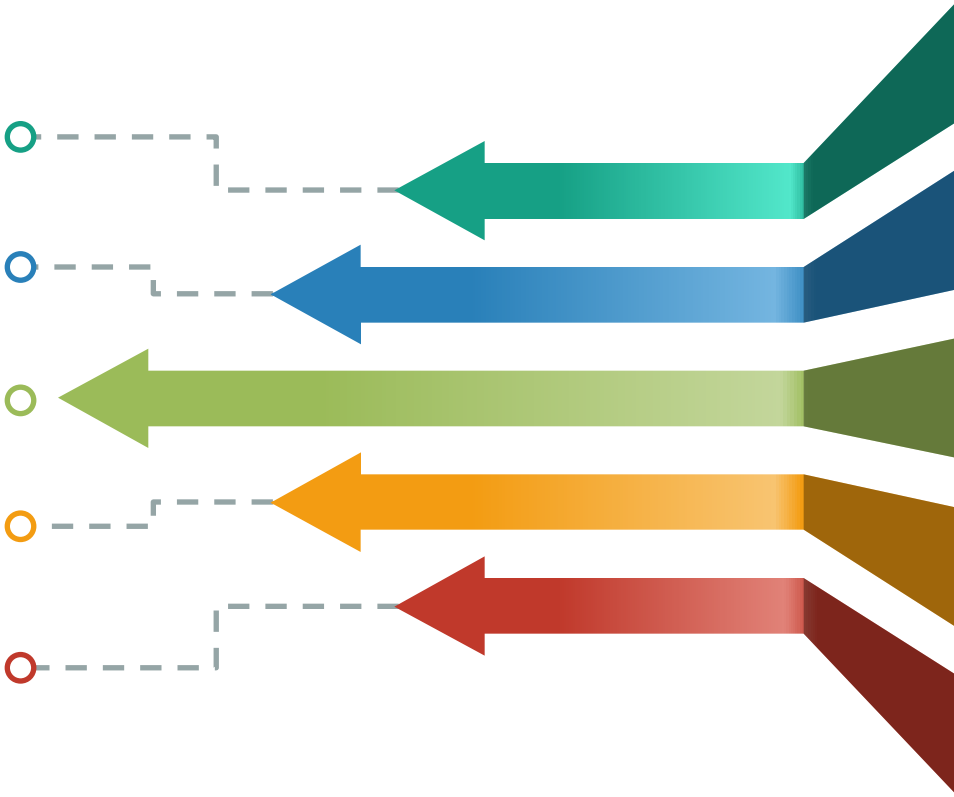
COMAC-Ready Platform: Multi-Access Support with SDN-Programmable Access

Multi-Cloud Connectivity Supporting Distributed Mobile Core Service Core

OMEC: Production grade, open source, CUPS compliant 3GPP core with SR-IOV accelerated user plane

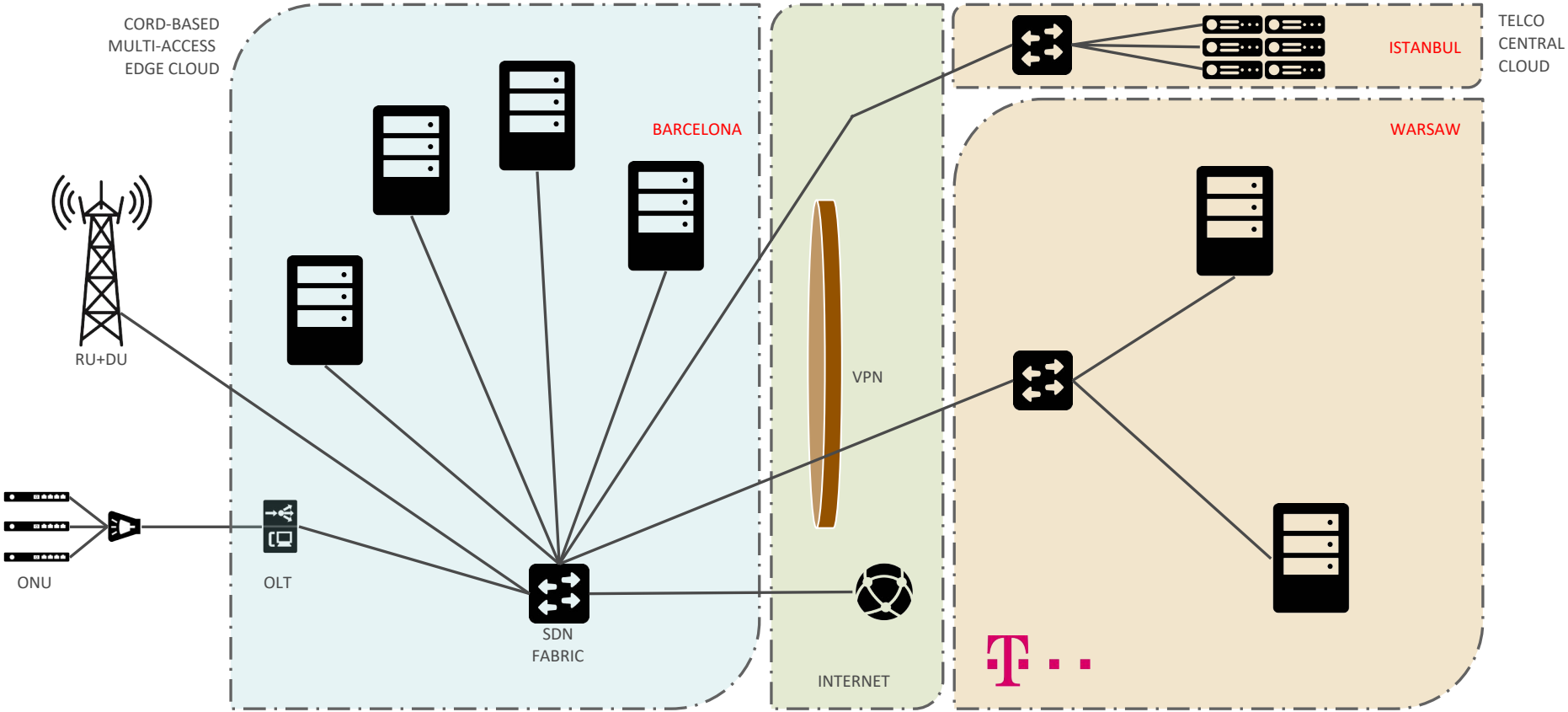
OTT Services Support allowing for multi-cloud distribution of service components

ONAP Integration Allowing for Global Design and Edge Execution of Programmatic RAN Slicing

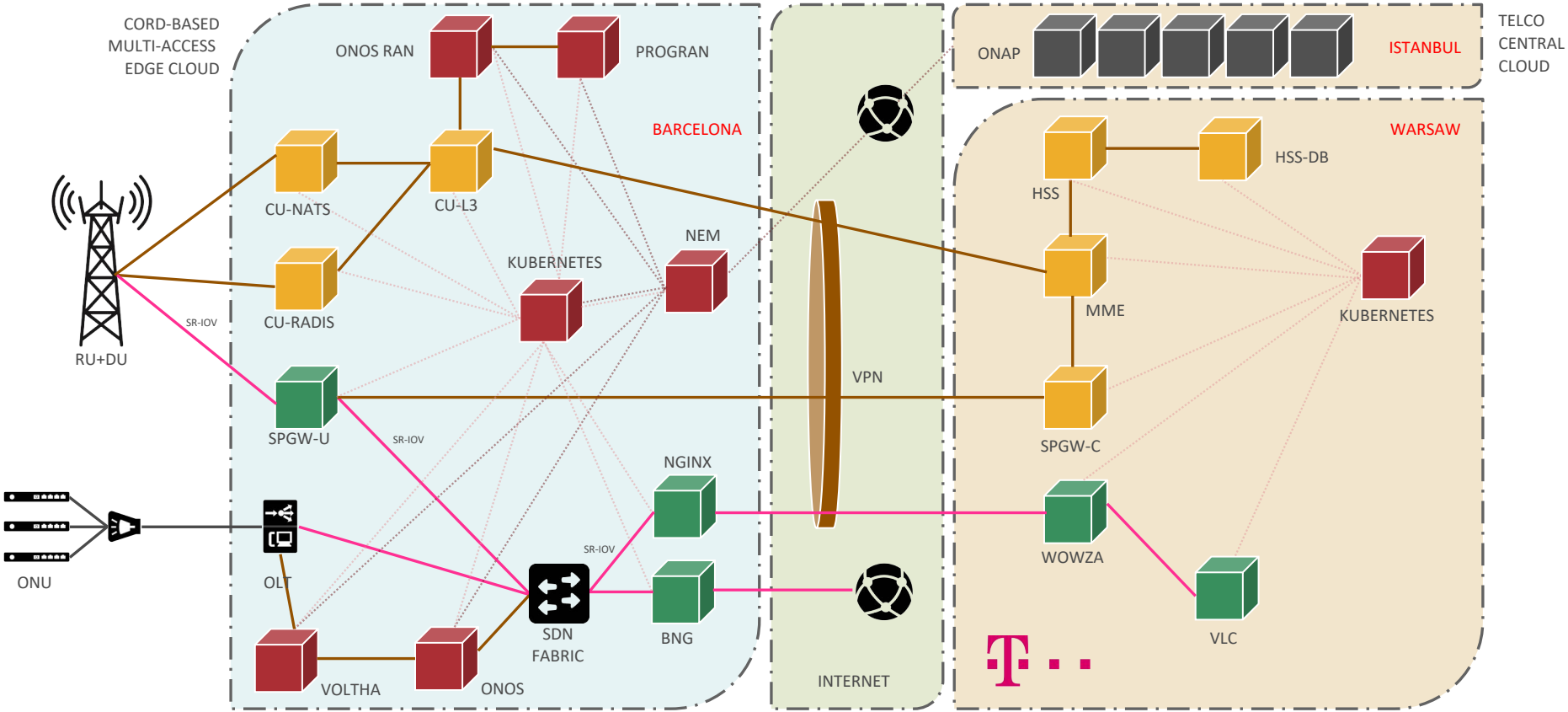


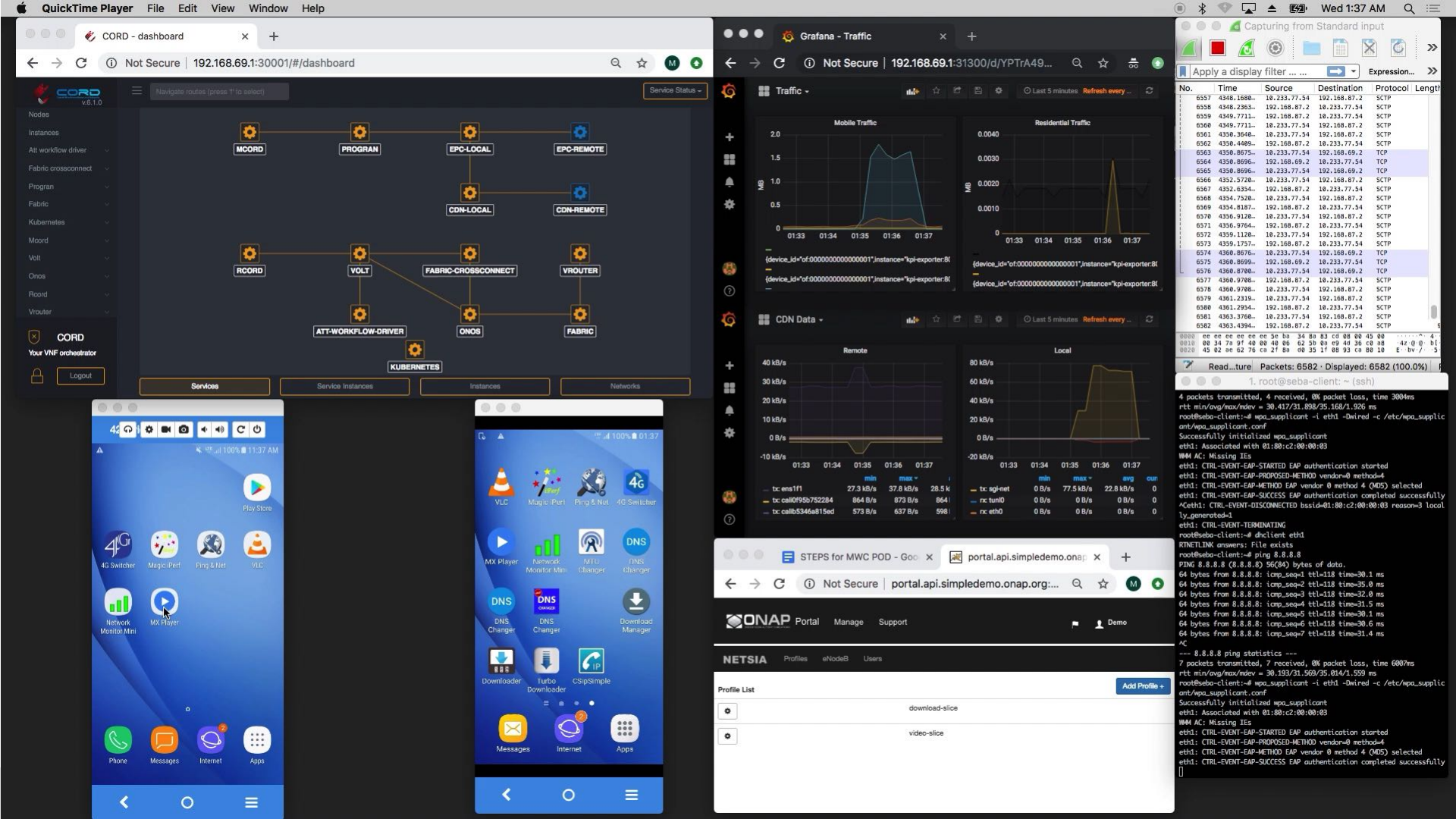
MWC 2019 DEMO PARTICIPANTS & SPONSORS

MWC 2019 DEMO INFRASTRUCTURE



ZERO-TOUCH DEMO SOFTWARE INSTALLATION




QuickTime Player File Edit View Window Help
Wed 1:37 AM
CORD - dashboard
Not Secure 192.168.69.1:30001/#/dashboard
CORD v.6.1.0
Navigate routes (press '/' to select)
Service Status
Nodes
Instances
Att workflow driver
Fabric crossconnect
Program
Fabric
Kubernetes
Mcord
Volt
Onos
Rcord
Vrouter
MCORD
PROGRAN
EPC-LOCAL
EPC-REMOTE
CDN-LOCAL
CDN-REMOTE
RCORD
VOLT
FABRIC-CROSSCONNECT
VROUTER
ATT-WORKFLOW-DRIVER
ONOS
FABRIC
KUBERNETES
CORD
Your VNF orchestrator
Logout
Services
Service Instances
Instances
Networks
Grafana - Traffic
Not Secure 192.168.69.1:31300/d/YPTrA49...
Traffic
Mobile Traffic
Residential Traffic
CDN Data
Remote
Local
Capturing from Standard input
Apply a display filter ... ...
Expression...
No. Time Source Destination Protocol Length
Read...ture Packets: 6582 · Displayed: 6582 (100.0%)
1. root@seba-client: ~ (ssh)
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 30.417/31.898/35.168/1.926 ms
root@seba-client:~# wpa_supplicant -i eth1 -Dwired -c /etc/wpa_supplicant/wpa_supplicant.conf
Successfully initialized wpa_supplicant
eth1: Associated with 01:80:c2:00:00:03
WHM AC: Missing IEs
eth1: CTRL-EVENT-EAP-STARTED EAP authentication started
eth1: CTRL-EVENT-EAP-PROPOSED-METHOD vendor=0 method=4
eth1: CTRL-EVENT-EAP-METHOD EAP vendor 0 method 4 (MD5) selected
eth1: CTRL-EVENT-EAP-SUCCESS EAP authentication completed successfully
^Ceth1: CTRL-EVENT-DISCONNECTED bssid=01:80:c2:00:00:03 reason=3 locally_generated=1
eth1: CTRL-EVENT-TERMINATING
root@seba-client:~# dhclient eth1
RTNETLINK answers: File exists
root@seba-client:~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=118 time=30.1 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=118 time=35.0 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=118 time=32.0 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=118 time=31.5 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=118 time=30.1 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=118 time=30.6 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=118 time=31.4 ms
^C
--- 8.8.8.8 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6007ms
rtt min/avg/max/mdev = 30.193/31.569/35.014/1.559 ms
root@seba-client:~# wpa_supplicant -i eth1 -Dwired -c /etc/wpa_supplicant/wpa_supplicant.conf
Successfully initialized wpa_supplicant
eth1: Associated with 01:80:c2:00:00:03
WHM AC: Missing IEs
eth1: CTRL-EVENT-EAP-STARTED EAP authentication started
eth1: CTRL-EVENT-EAP-PROPOSED-METHOD vendor=0 method=4
eth1: CTRL-EVENT-EAP-METHOD EAP vendor 0 method 4 (MD5) selected
eth1: CTRL-EVENT-EAP-SUCCESS EAP authentication completed successfully
STEPS for MWC POD - Goo
portal.api.simpledemo.onap
Not Secure portal.api.simpledemo.onap.org:...
ONAP Portal Manage Support
Demo
NETSIA Profiles eNodeB Users
Profile List
Add Profile +
download-slice
video-slice

THANK YOU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