



NETWORK SLICING

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An Operator Led Consortium



5G

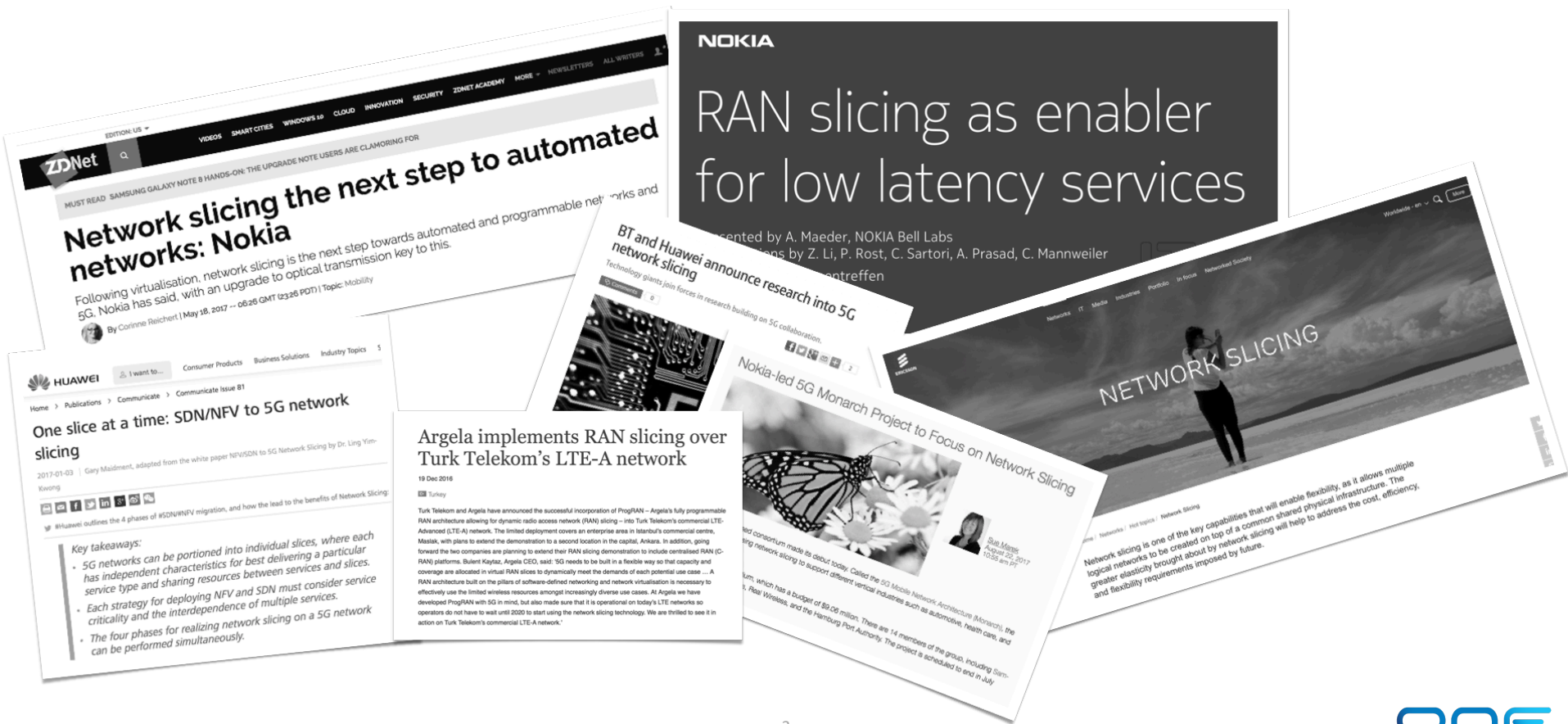
- 5G is not just about making the throughput larger than LTE

- It is also about offering user experiences and inclusion of **vertical sectors** that haven't been included in 4G so far.

These use-cases will need new types of **connectivity services** that are **highly scalable** and **programmable** in terms of speed, capacity, security, reliability, availability, latency and impact on battery life.

- 5G systems will be built to meet a range of performance targets, so that different services with widely differing demands can be deployed on a single infrastructure.

Network Slicing

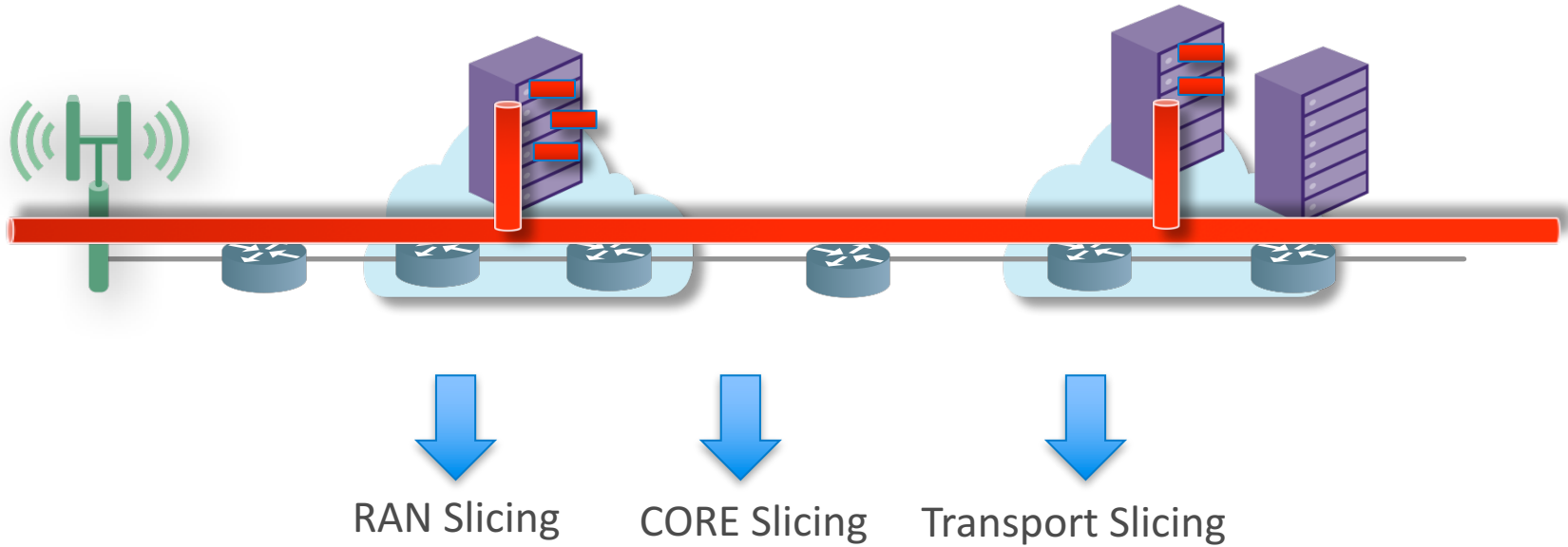


What is Network Slicing?

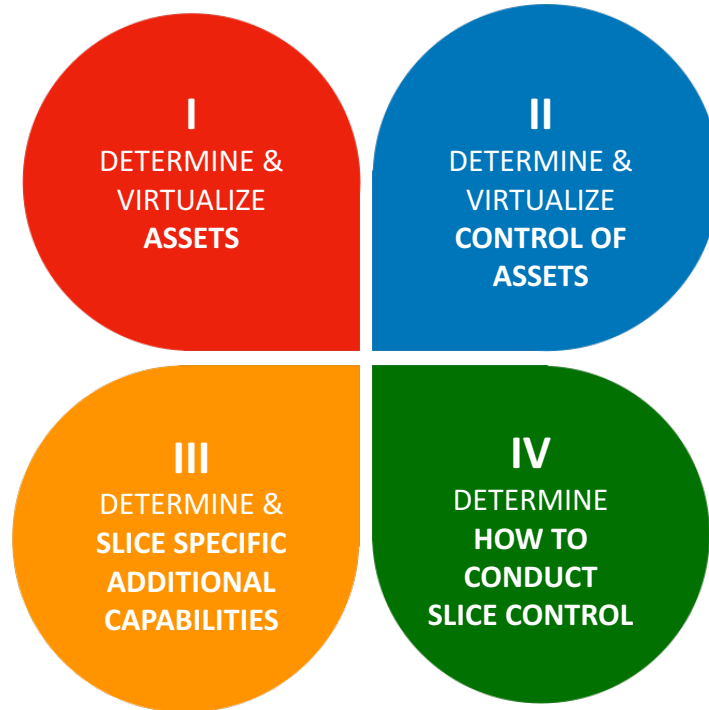


Network slicing is a mechanism to create and dynamically manage functionally-discrete, virtualized networks over a common infrastructure.

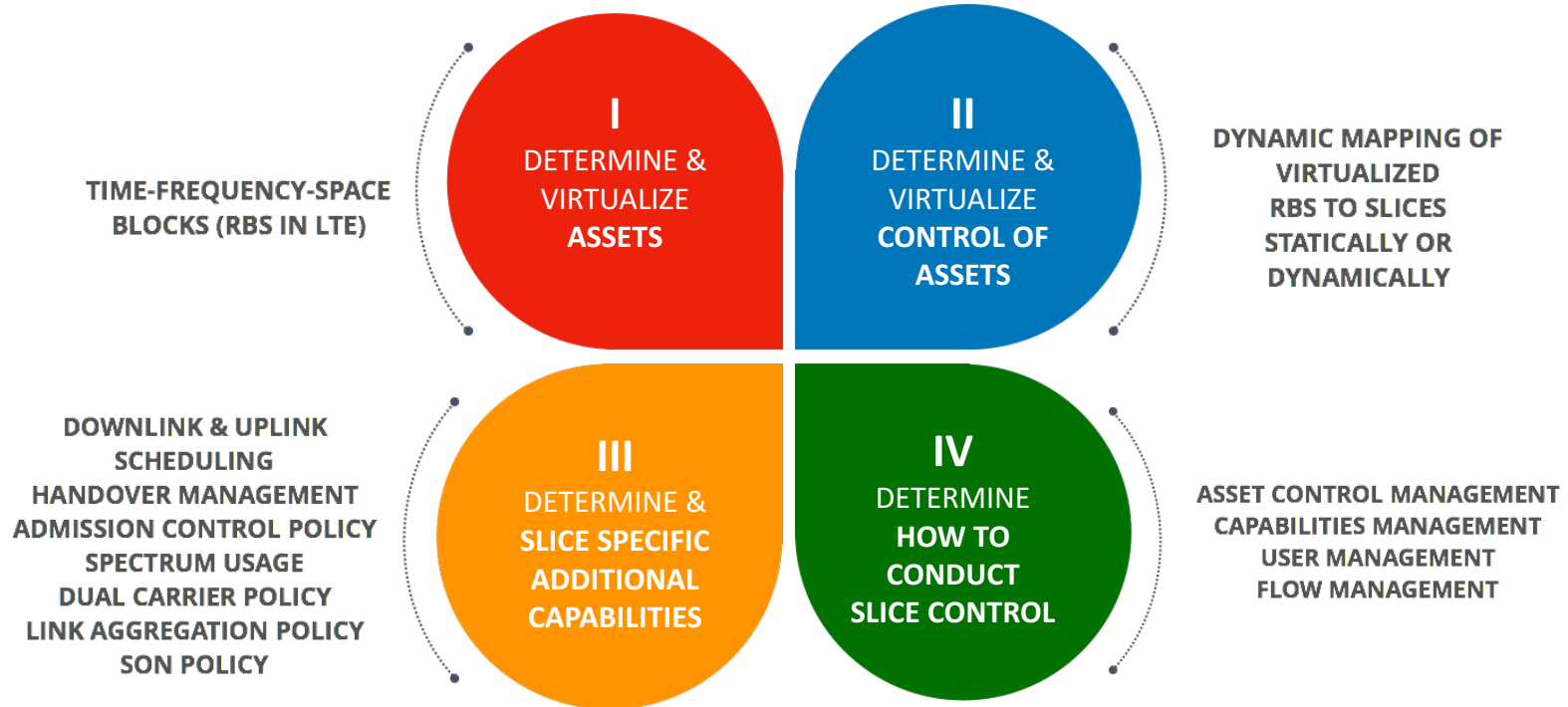
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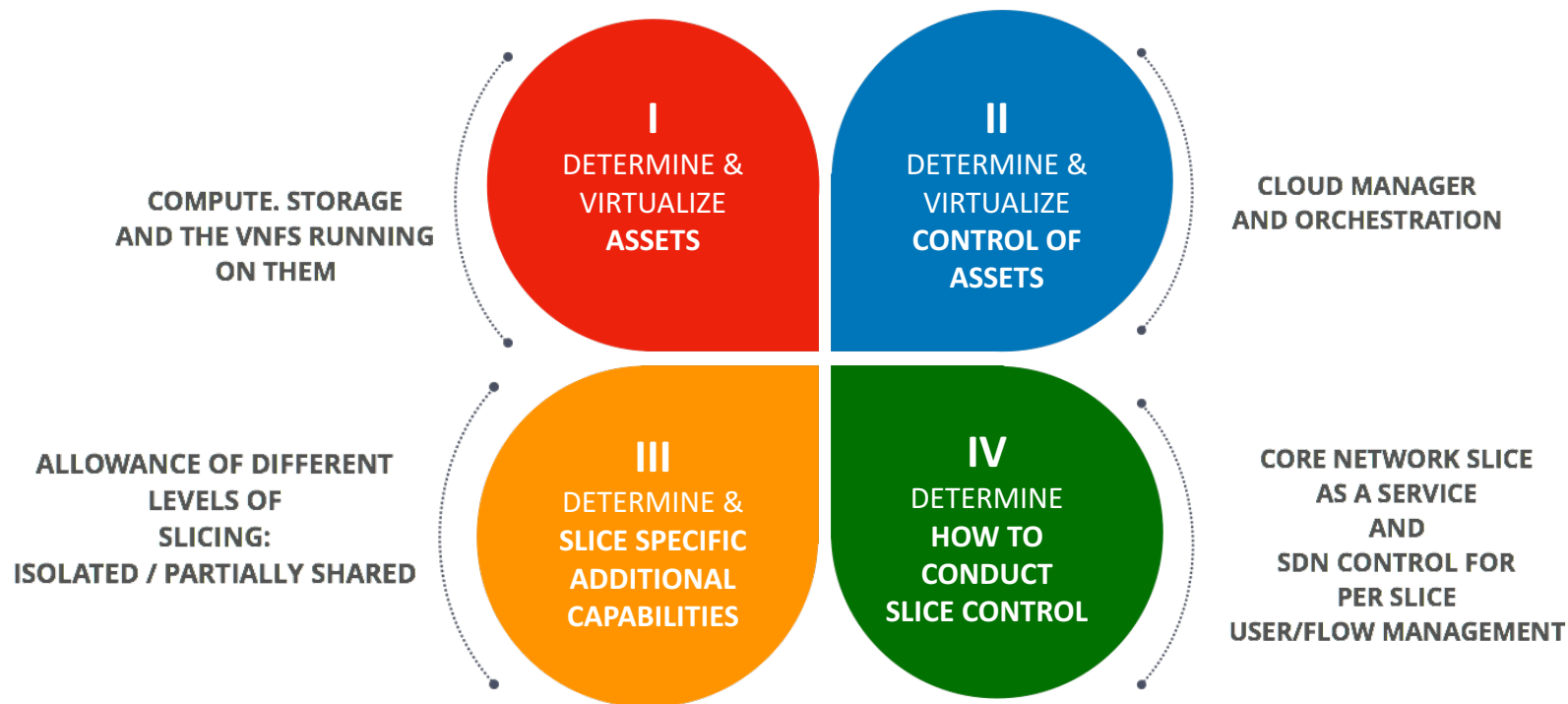
How to Slice?



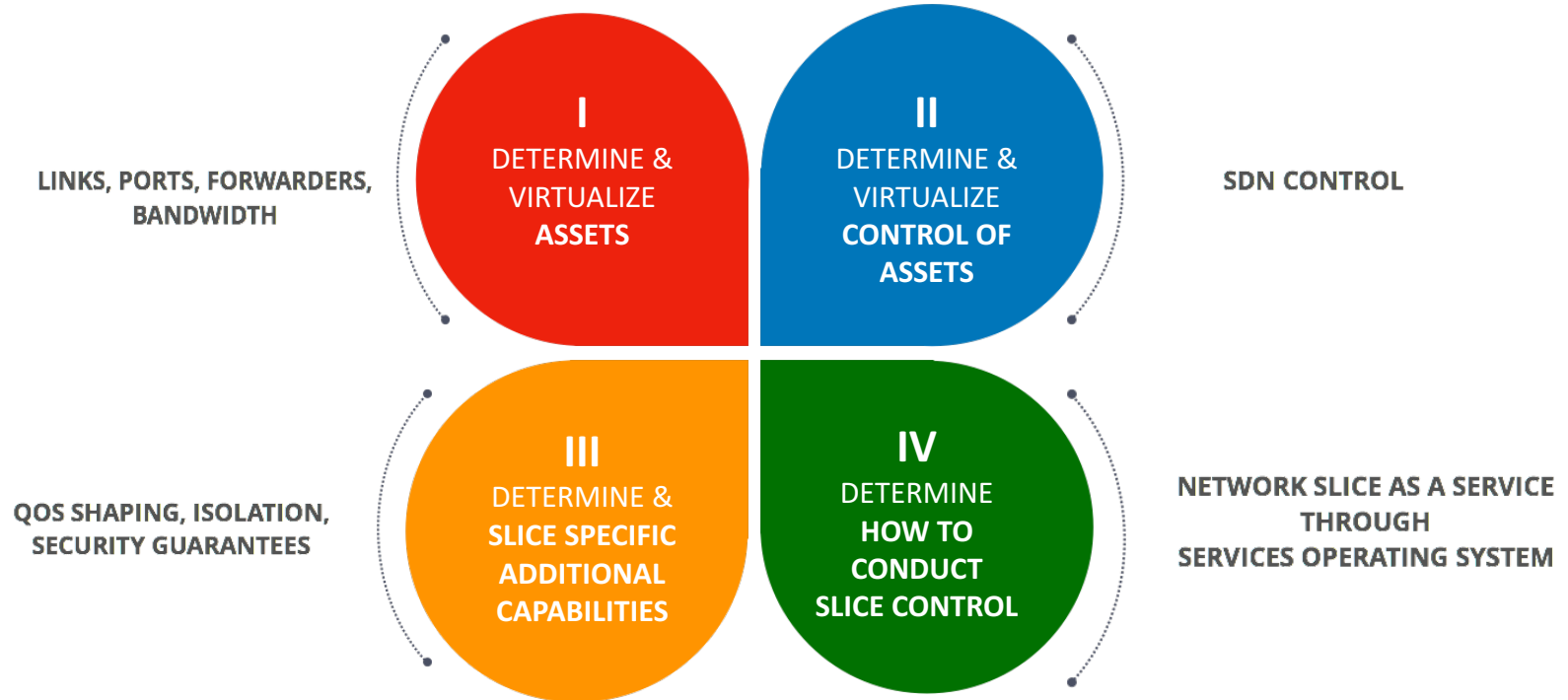
RAN Slicing



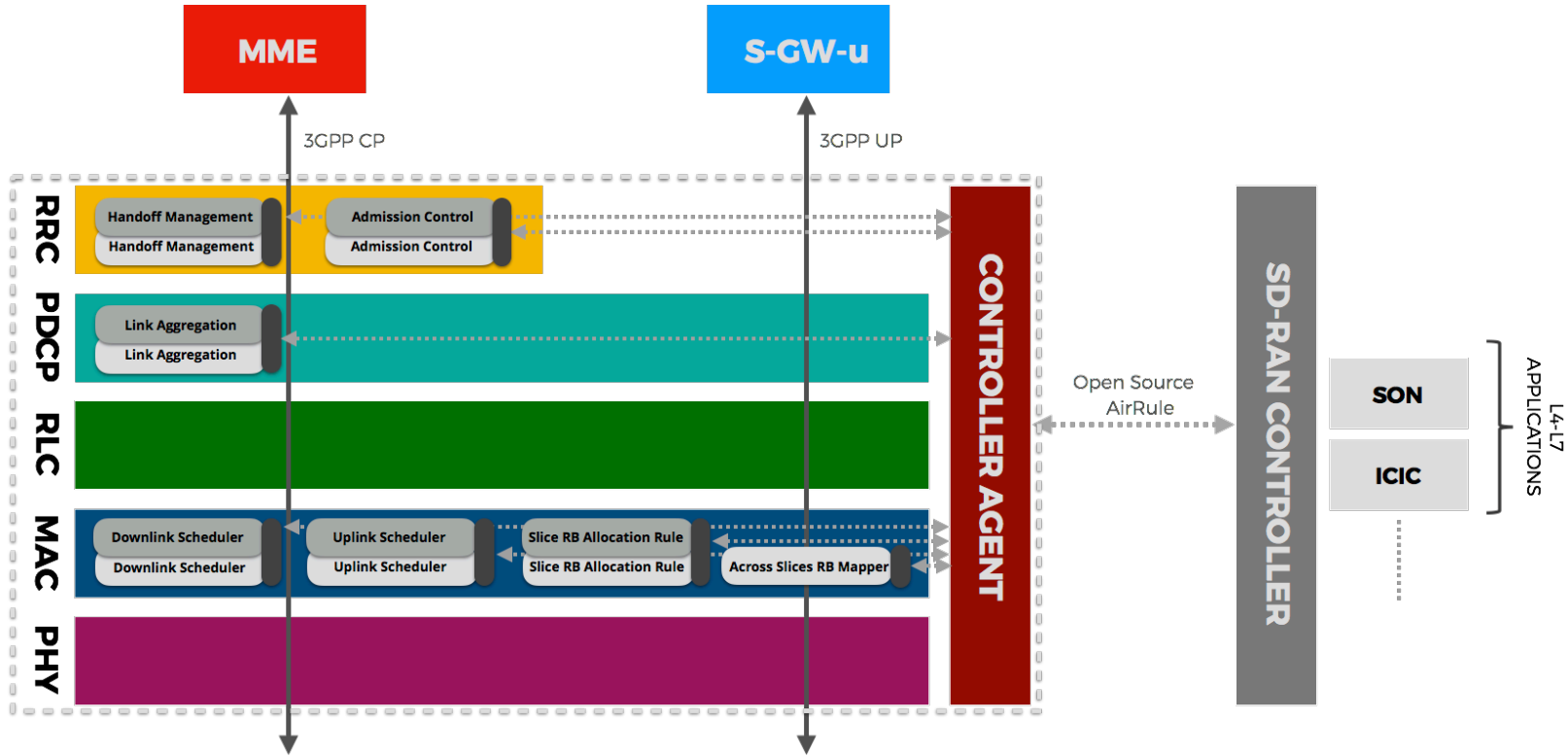
CORE Slicing



Transport Slicing



RAN Slicing: ProgRAN Architecture

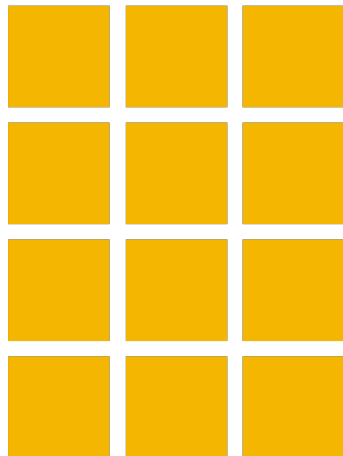


Assignment of Resource Blocks to RAN Slices

1

Static

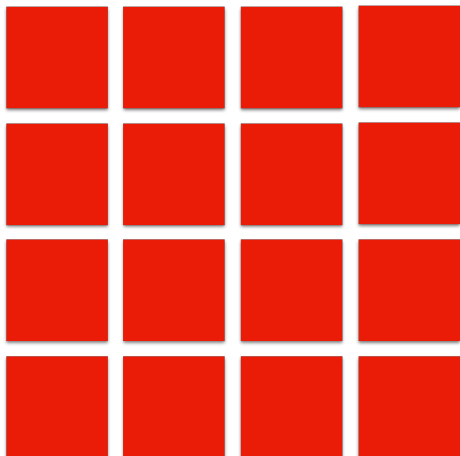
%RB Allocation



2

Dynamic
Per Slice

%RB Allocation,
Backup Slice ID



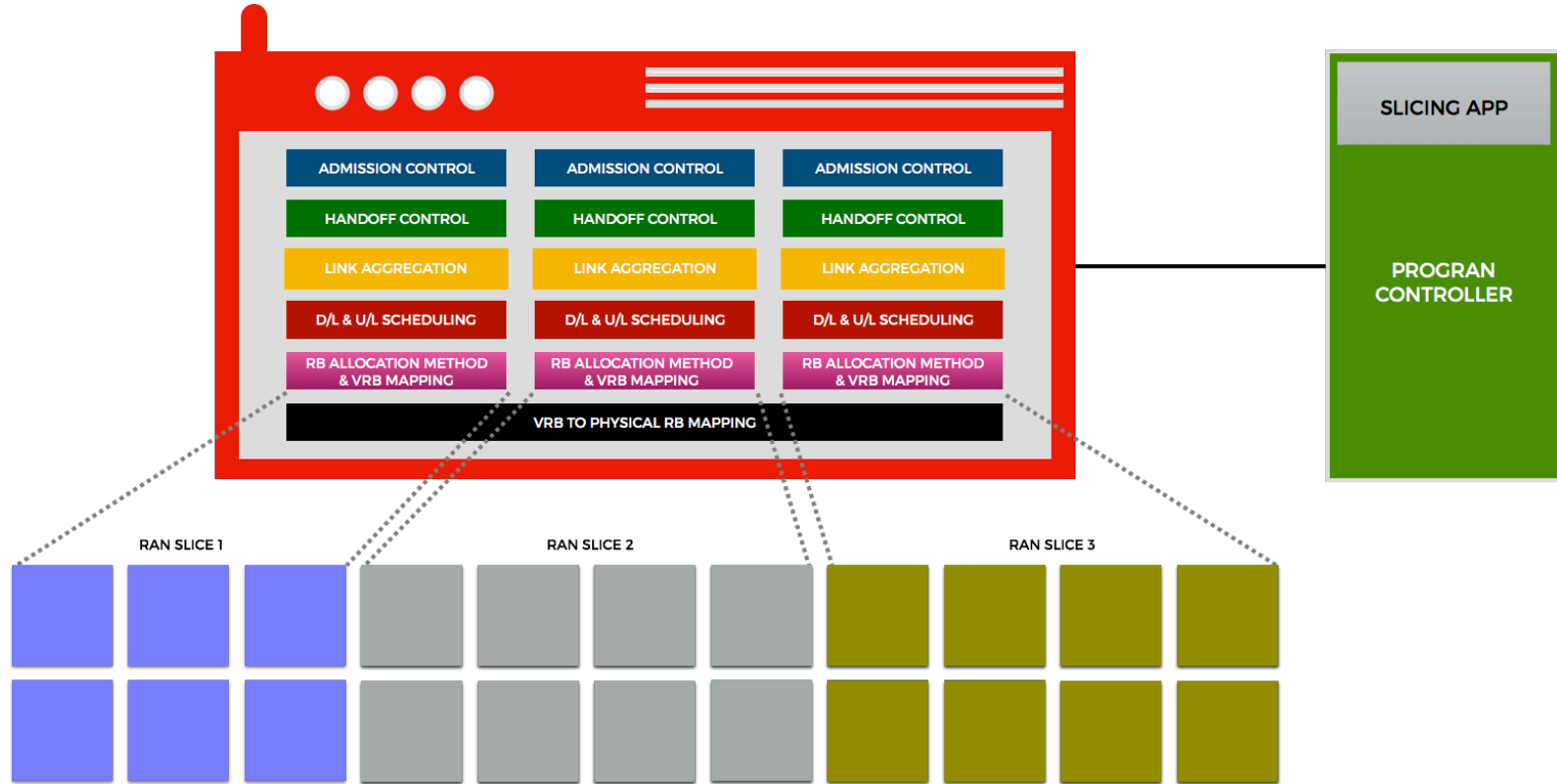
3

Dynamic
Per Active UE

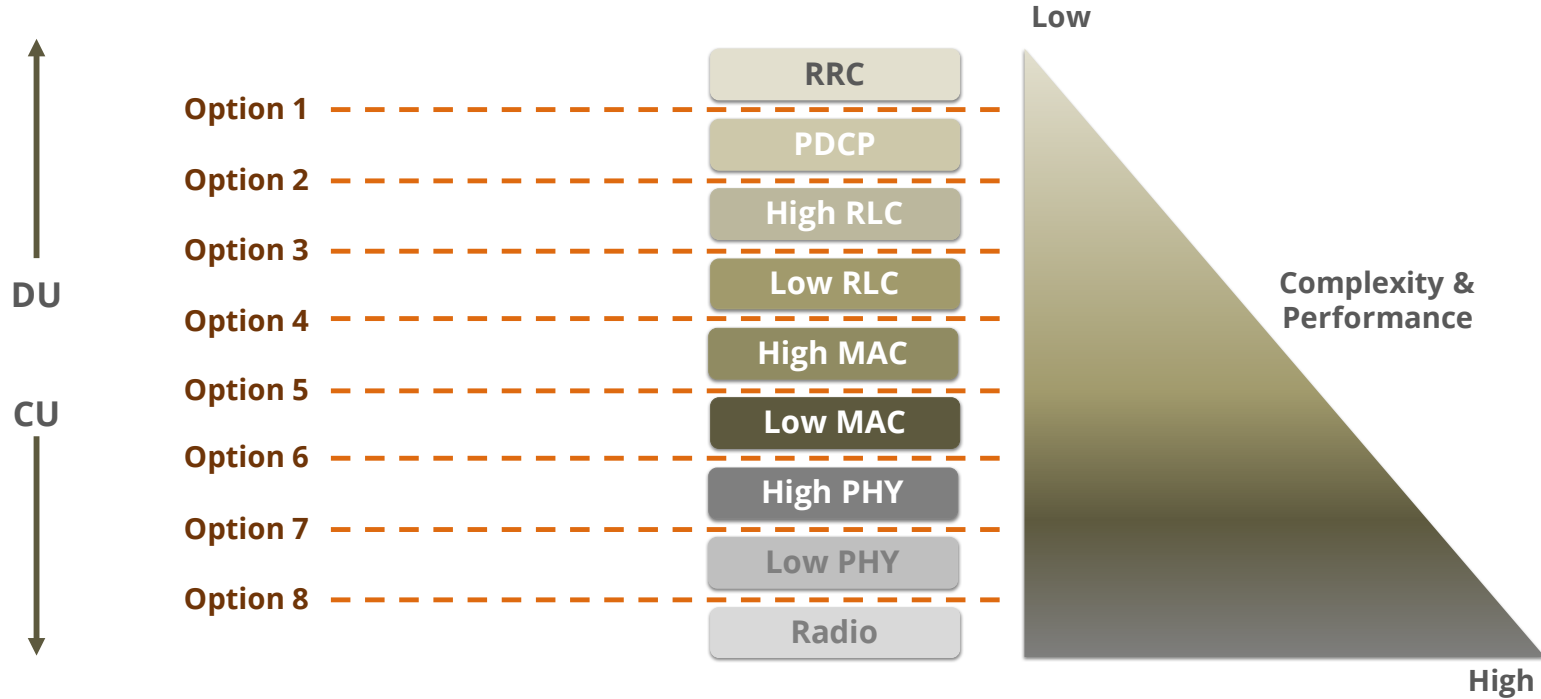
Max %RB Allocation,
Per UE %RB Allocation
Backup Slice ID



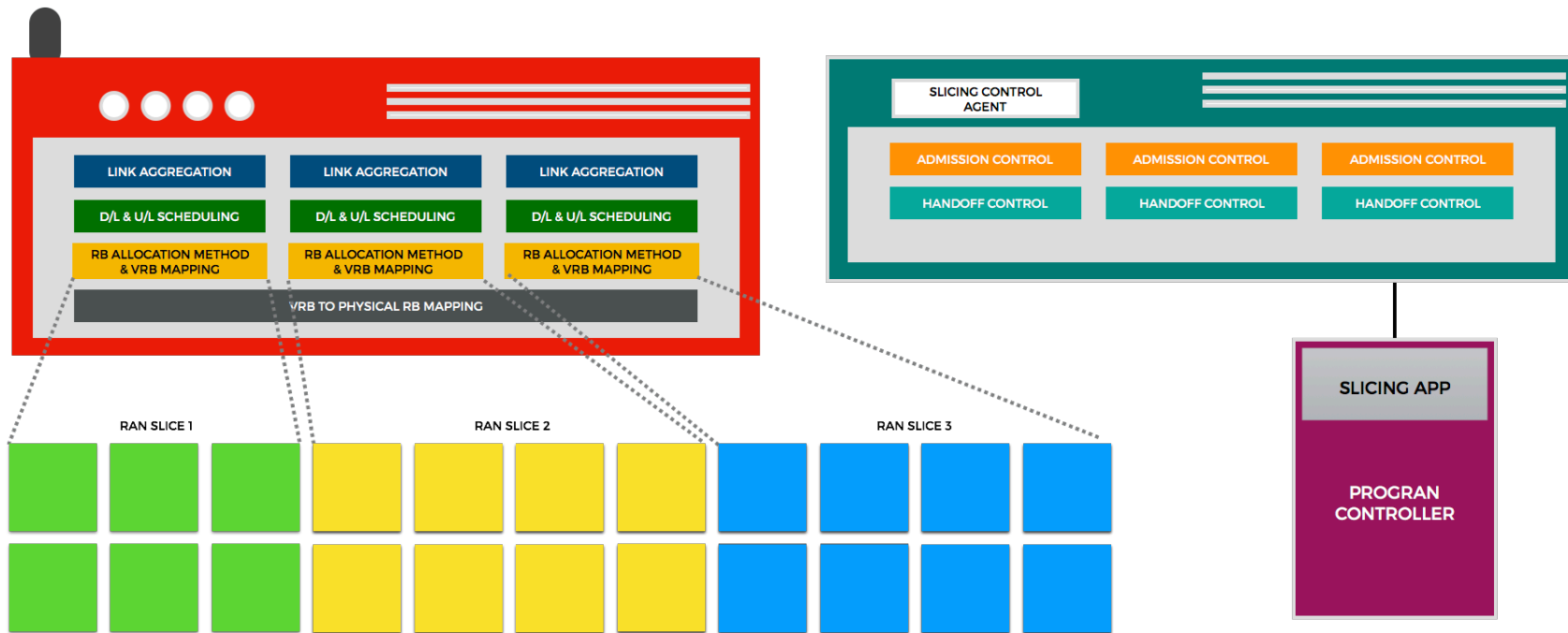
ProgRAN Operation



RAN Disaggregation

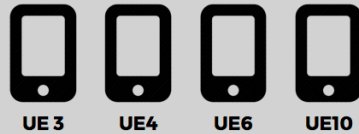
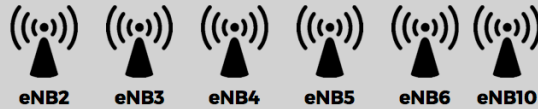


C-RAN ProgRAN Operation



RAN Slicing Profile

P1



Valid From / Until

Time based and/or event-triggered

Slice Specific Network Functions:

Multi-RAT Management:

Link Aggregation: Band 3 LTE and Wi-Fi for D/L
Band 3 LTE for U/L



Scheduling: UL: RR, DL: PF

Handoff Control: Slow Triggered

Admission Control: All flow types for all UEs

SON MLB Parameter: Regular



Assigned Resources:

Downlink



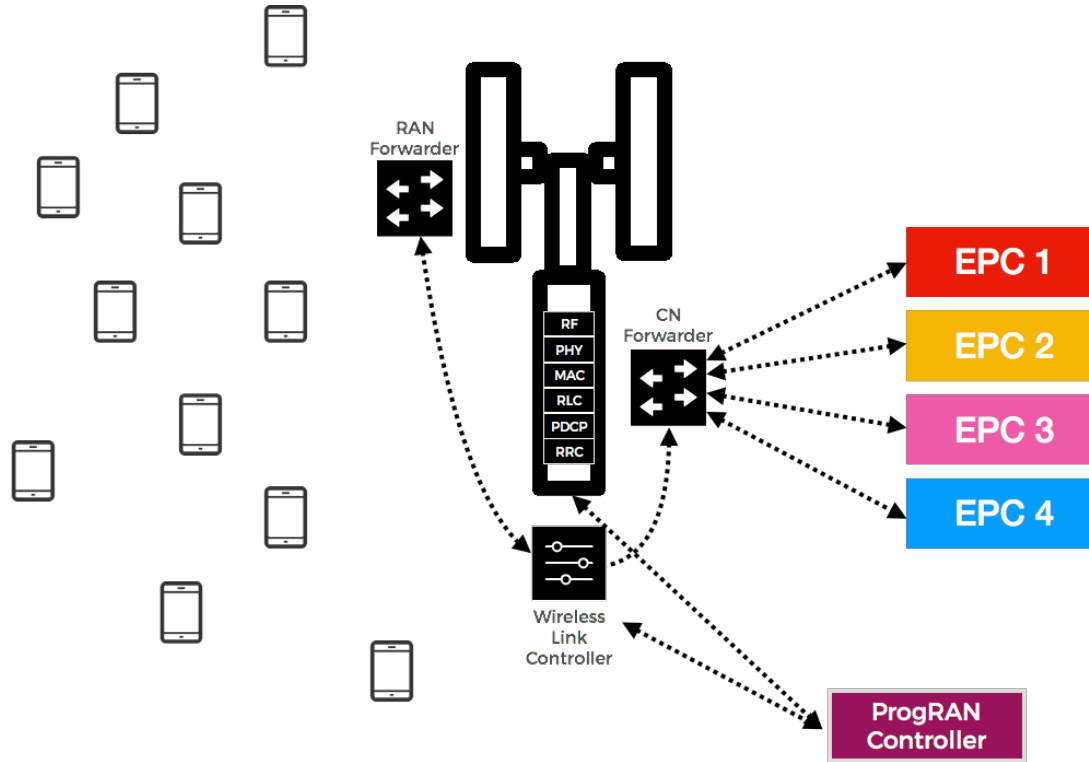
Uplink



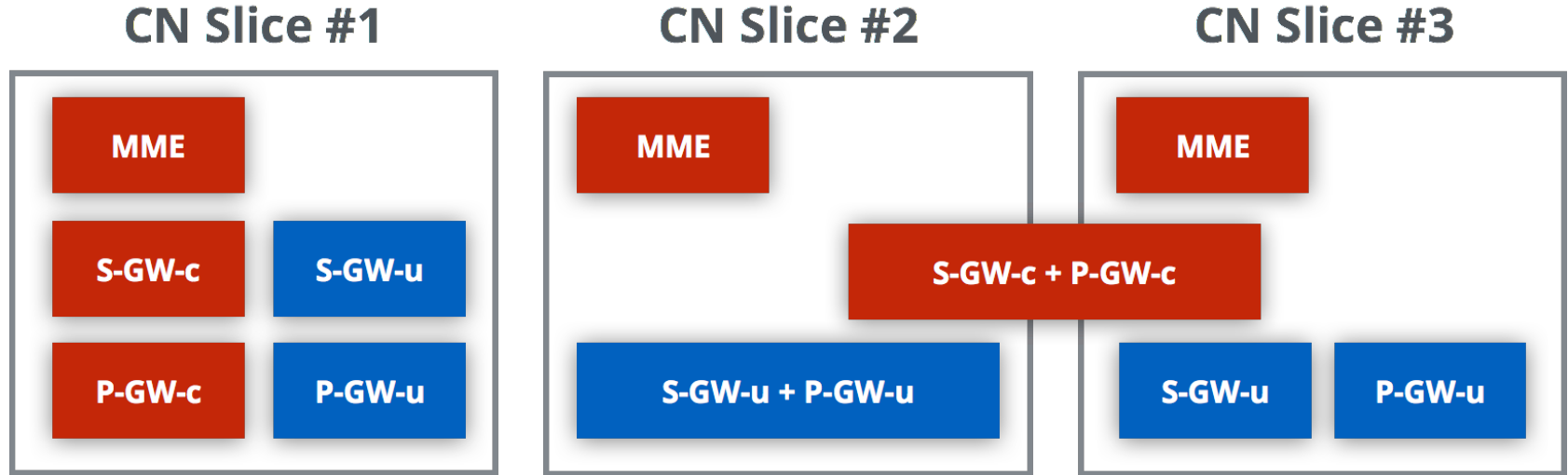
Resource Assignment Strategy: Option 3 - Dynamic - PER UE

Proportional to the Number of Active Slice UEs with a maximum allocation defined above

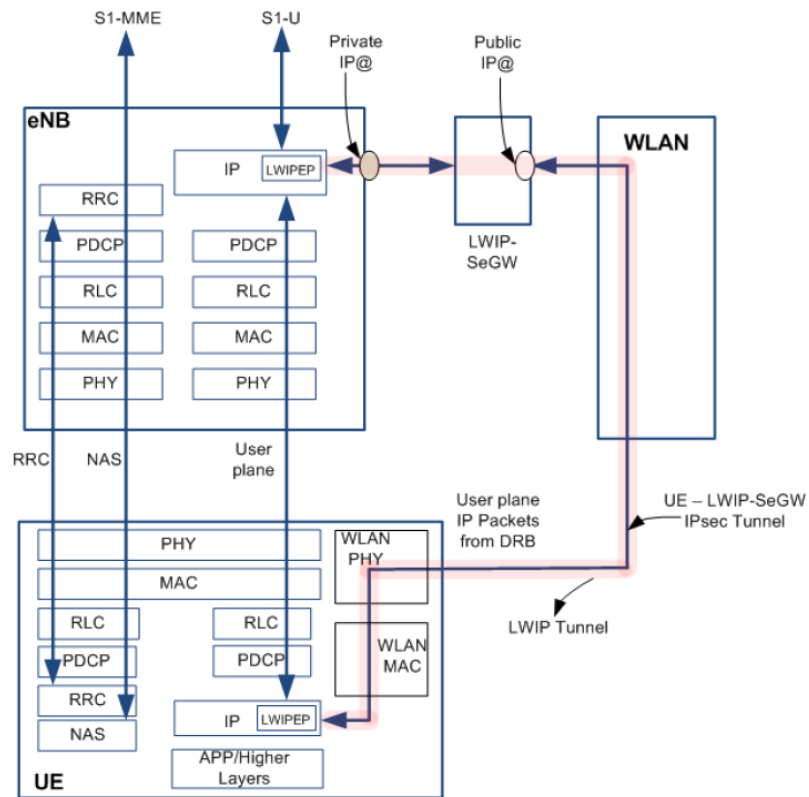
RAN Anchored Core Network Slicing



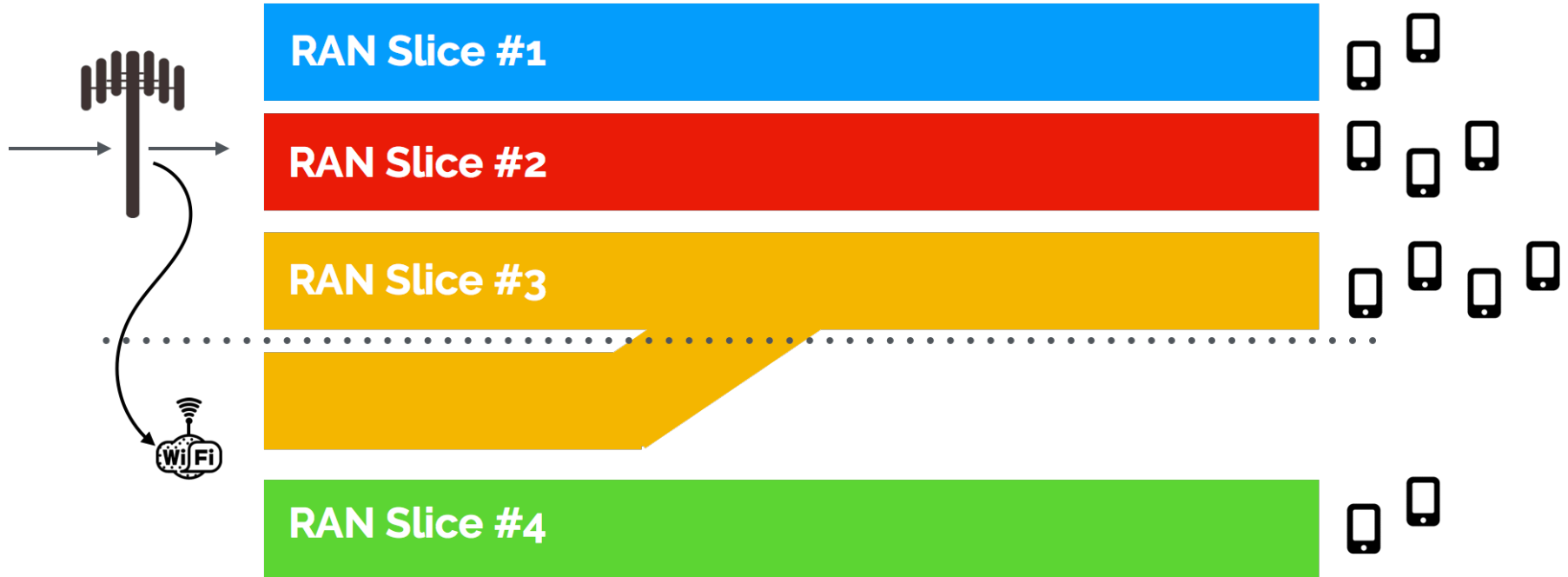
Core Network Slicing



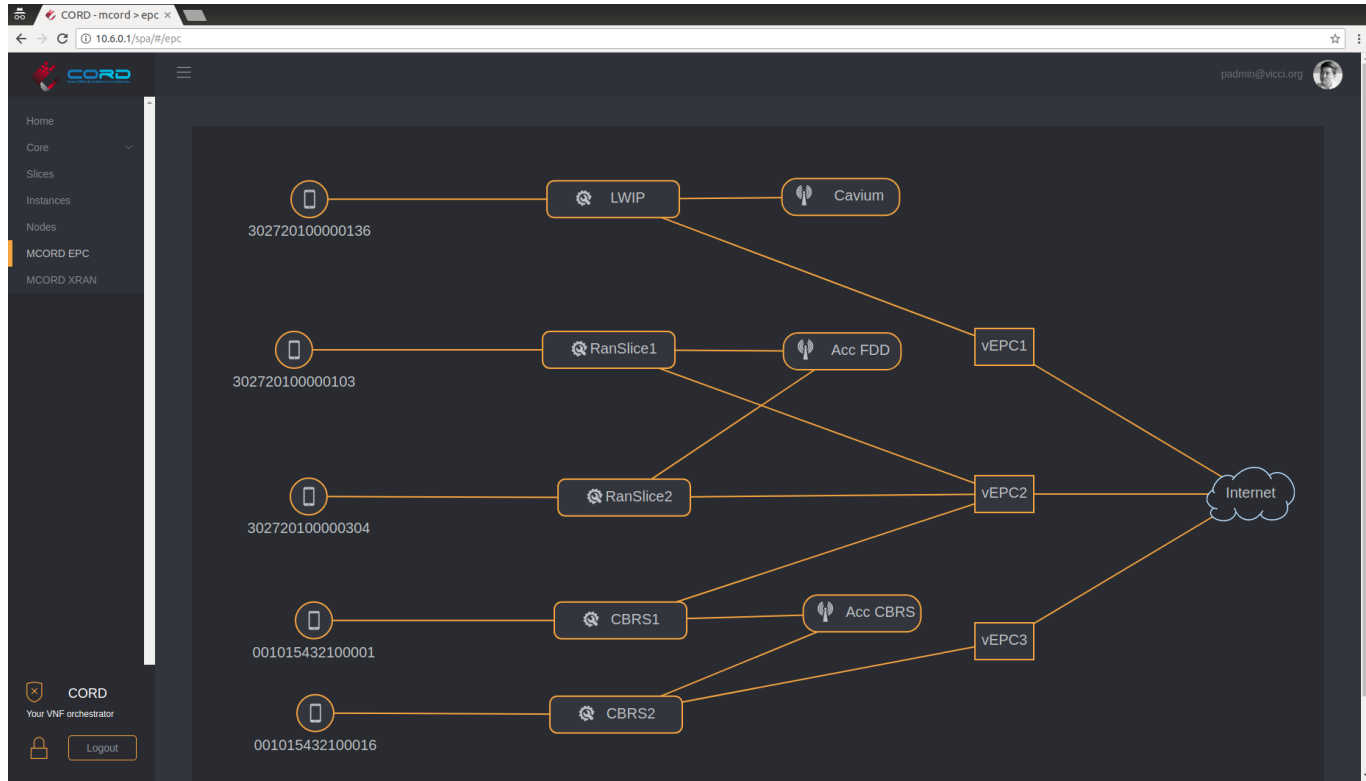
LWIP Link Aggregation



Link Aggregation and Network Slicing



XOS Orchestration of Network Slicing





PRIVATE LTE WITH M-CORD

Private LTE



- Private LTE is an independent LTE offering to provide specific performance and/or control for an enterprise, organization, vertical sector, etc., and/or to establish coverage where public networks don't reach.

When?



UNIQUE REQUIREMENTS

Specific design, operational, and performance requirements that cannot be met by the SP



QoS

Not enabled, or available options not fit for purpose



ALLOCATION RETENTION

No pre-emptive dropping of lower-priority users according to SP policies



CONTROL

Need for enterprise control of one or more of the following: coverage, capacity, capability, subscription, resource utilization, traffic handling



TRUST

Lack of faith in ability to meet service levels - zero tolerance for breach.



COVERAGE

Inadequate breadth or depth of coverage

How?



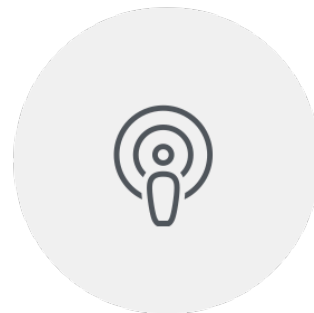
VIRTUALIZATION

Enables personalization of Private LTE offerings optimized for each customer, allows for introduction of future capabilities in software, enables lower CAPEX and OPEX



SD-RAN

Enables the programmability of the RAN - allowing for the enterprise to decide how to allocate wireless resources across its different user groups



SPECTRUM FLEXIBILITY

Allows for use-case specific selection of spectrum: dedicated spectrum, CBRS band or unlicensed band, enables the capability of network sharing across multiple SPs via a Neutral Host architecture

Solution Requirements



SOLUTION SHOULD LEVERAGE
OPEN SOURCE SOFTWARE
AND COMMODITY HARDWARE



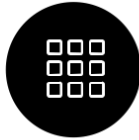
RAN MAY BE ENTERPRISE
CONTROLLED



RAN SHOULD SUPPORT
CBRS AND/OR UNLICENSED
BANDS



PROGRAMMABLE ENTERPRISE
CONNECTIVITY TO MULTIPLE
SERVICE PROVIDER
NETWORKS MAY BE
NECESSARY



RAN SHOULD BE
PROGRAMMATICALLY
SLICEABLE



SERVICE PROVIDERS WILL
PROVIDE CORE CONNECTIVITY
SERVICE



ENTERPRISE AND SERVICE
PROVIDER CLOUDS SHOULD
BE ISOLATED FROM ONE
ANOTHER



RAN MAY BE NEUTRAL HOST



PROGRAMMATIC, HIERARCHICAL
SERVICE ORCHESTRATION IS
NECESSARY ACROSS
ENTERPRISE AND SERVICE
PROVIDER EDGE CLOUDS

Architectural Enablers

MULTIPLE PRIVATE CLOUDS

- Each participating SP has its private cloud. These clouds do not have any access components.
- The enterprise has its own private cloud. Included in this cloud is the Neutral Host RAN.

HIERARCHICAL ORCHESTRATION

- Each participating SP has its own XOS for EPC configuration
- The enterprise has its own XOS for RAN as well as local enterprise services configuration
- The Private LTE has its own XOS for stitching services for an end-to-end service

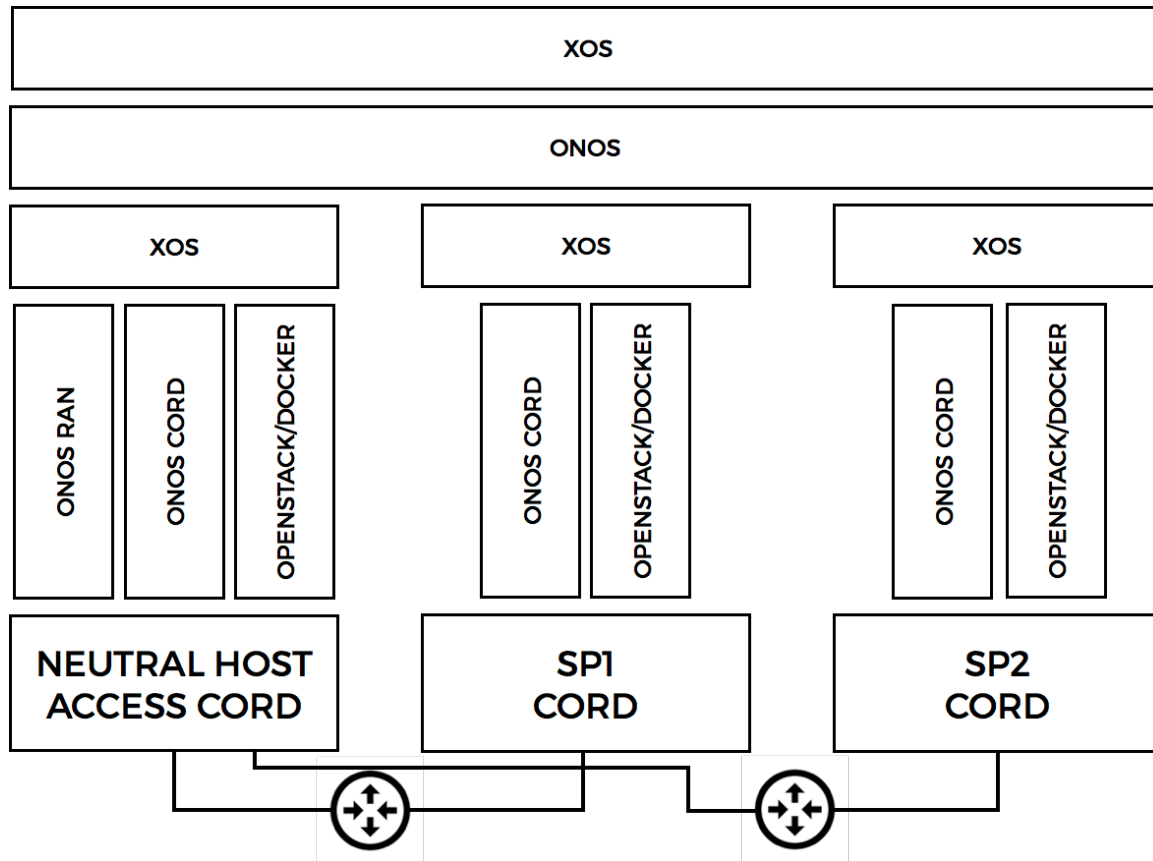
ISOLATION OF CLOUDS

- The services from each private cloud has ingress and egress public IPs
- Each private cloud has a vRouter service providing configurable NAT capability.
- The service maps within a cloud are not disclosed to the other clouds
- Each private cloud can dynamically configure the service maps

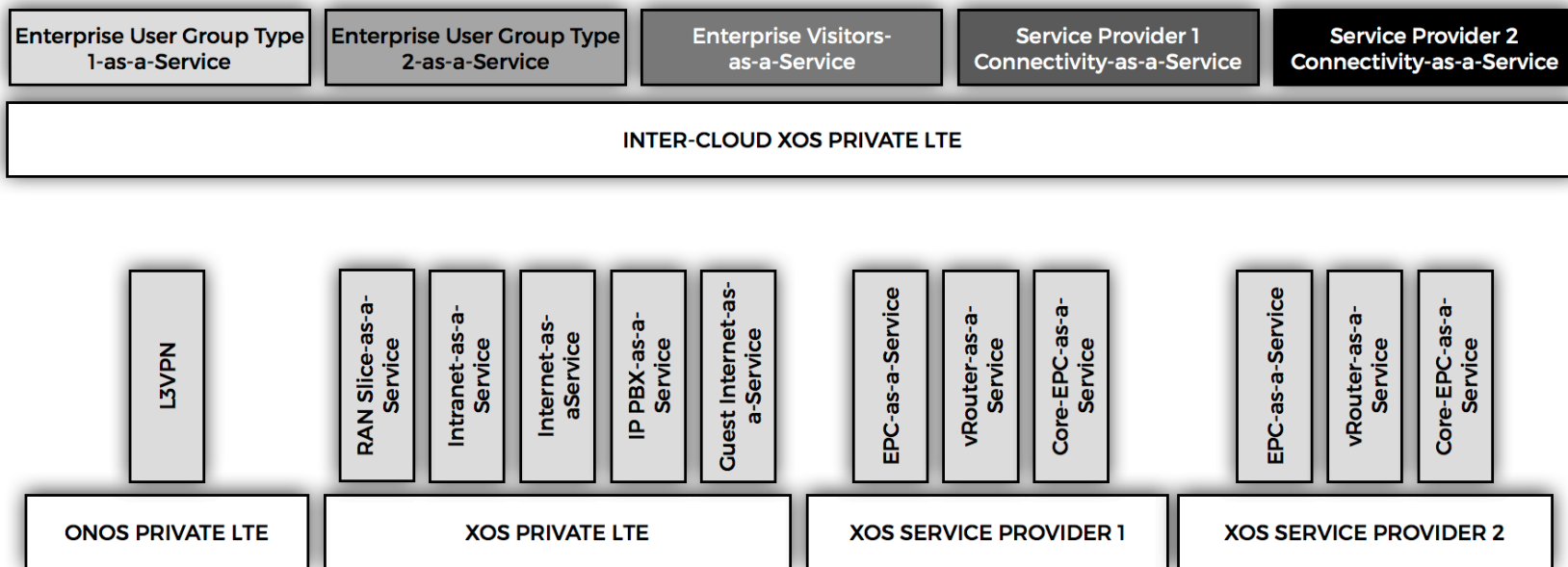
PRIVATE LTE XOS

- This XOS enables ONOS E to use L3VPN to programmatically stitch private clouds allowing the configuration of E2E Service descriptions,

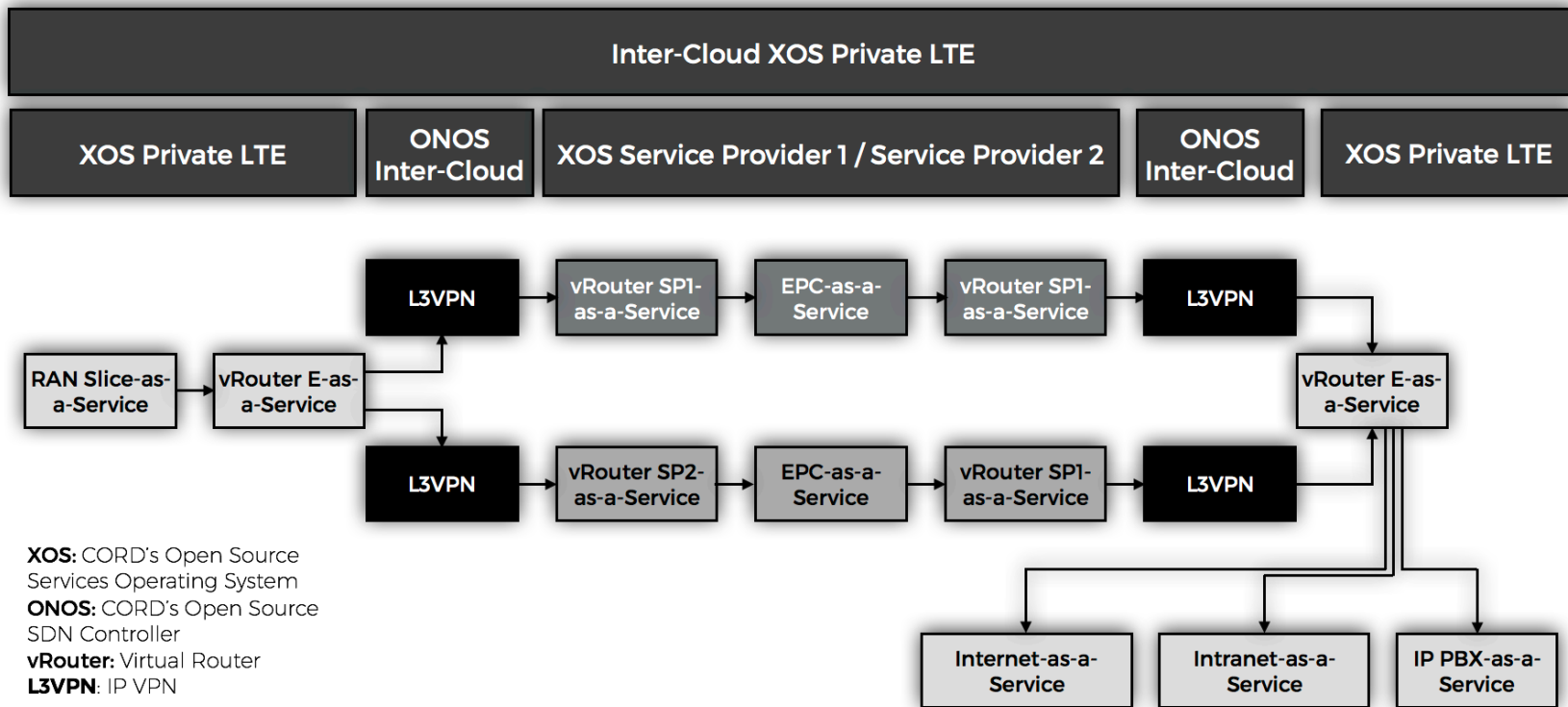
Architectural Overview



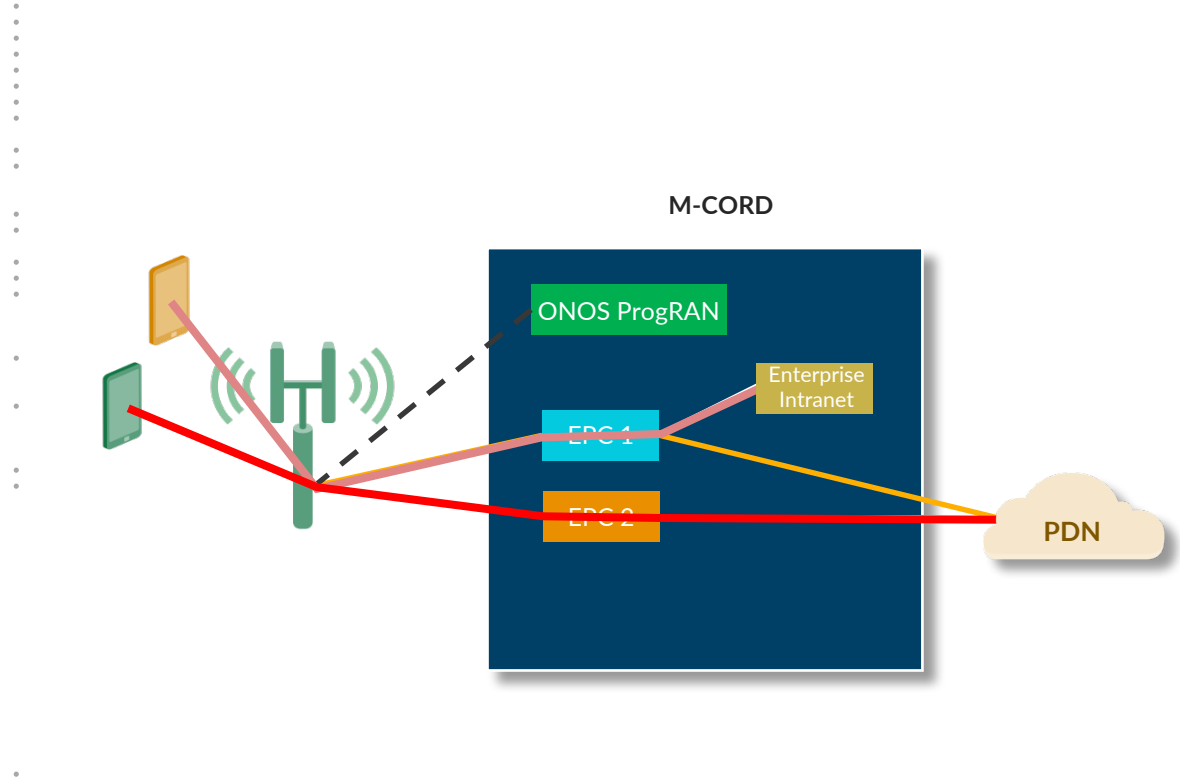
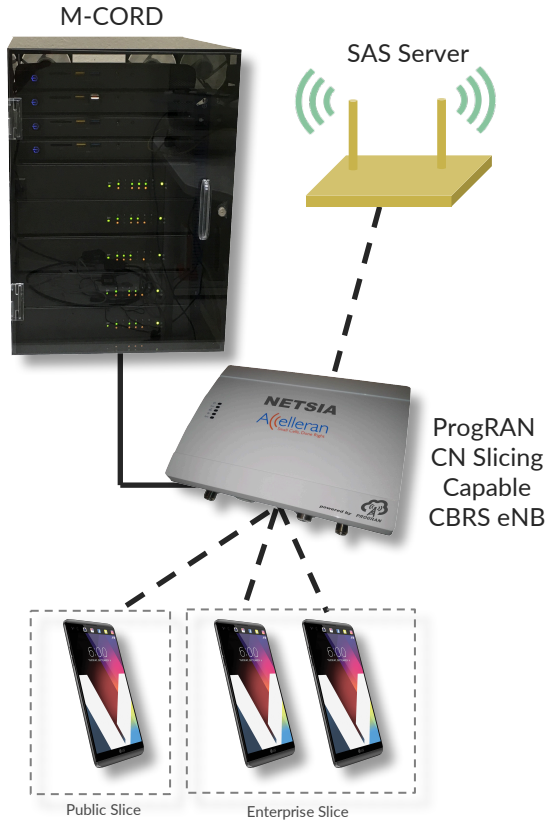
Hierarchical Service Orchestration



Sample Service Configuration



MWCA Demo





THANK YOU

