Extending Network Slicing to the RAN

Oğuz Sunay, Chief Architect, ONF

Outline

- Cloud-Computing-As-An-Analogy
- Cellular Network Evolution Towards Network Slicing
- Network Slicing – What is it?
- Network Slicing in 3GPP
  - Only focusing on the core
- Where are we with the RAN?
  - SD-RAN driving RAN Slicing?

Evolution to Cloud Computing

VERTICALLY
INTEGRATED

HORIZONTAL
DISAGGREGATION

Open Interface

Mac OS

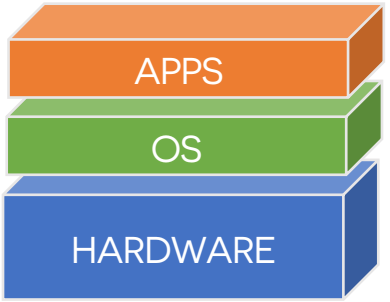
Open Interface

Open Interface

Evolution to Cloud Computing

VERTICALLY
INTEGRATED

HORIZONTAL
DISAGGREGATION



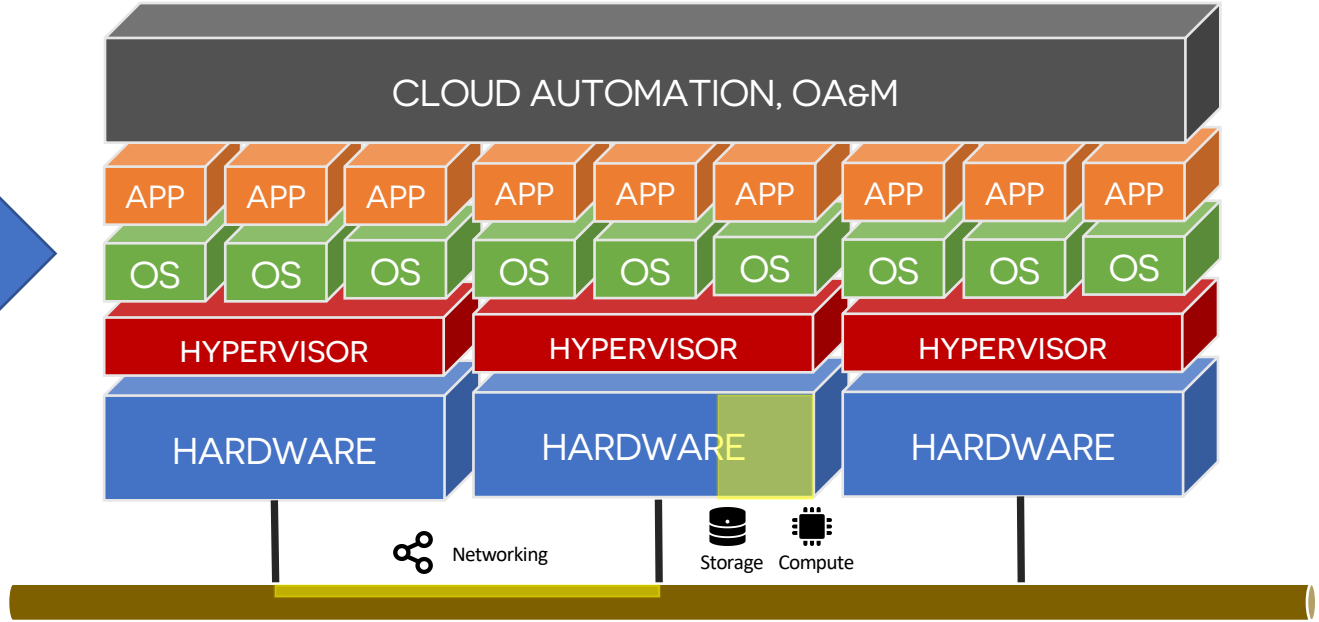
Evolution to Cloud Computing

Evolution to Cloud Computing

Physical Resources

CLOUD

RESOURCES:
SEEMINGLY INFINITE

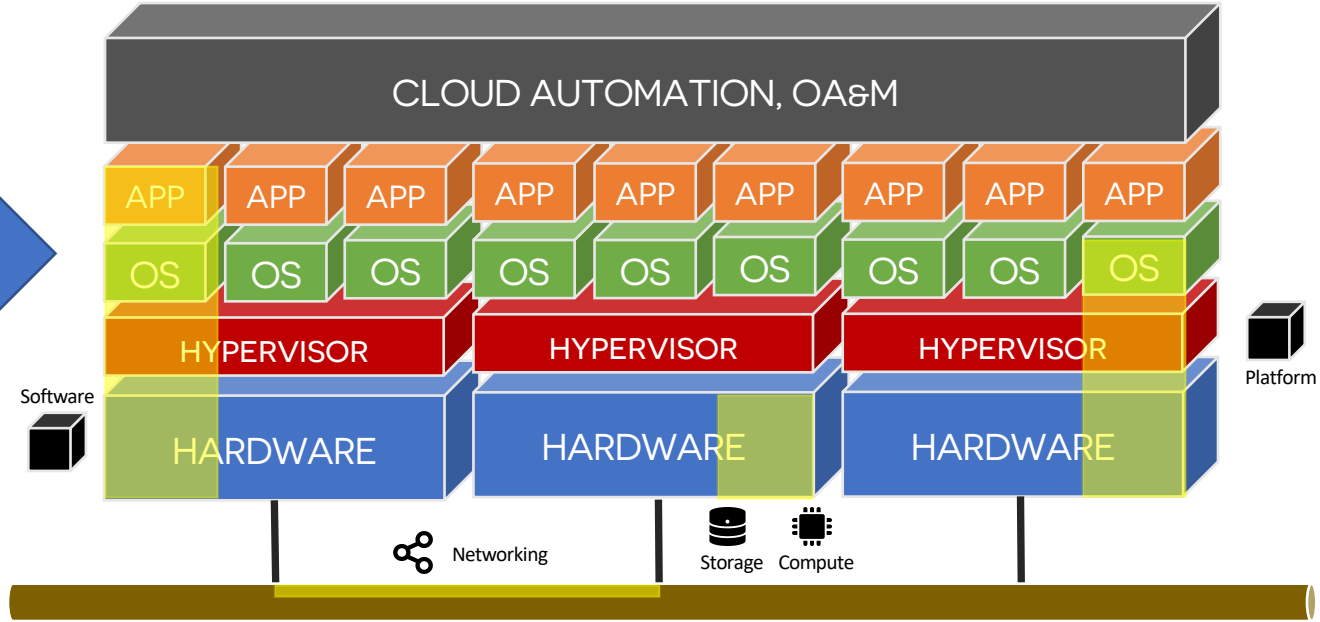


Evolution to Cloud Computing

Services Resources

CLOUD

RESOURCES:
SEEMINGLY INFINITE



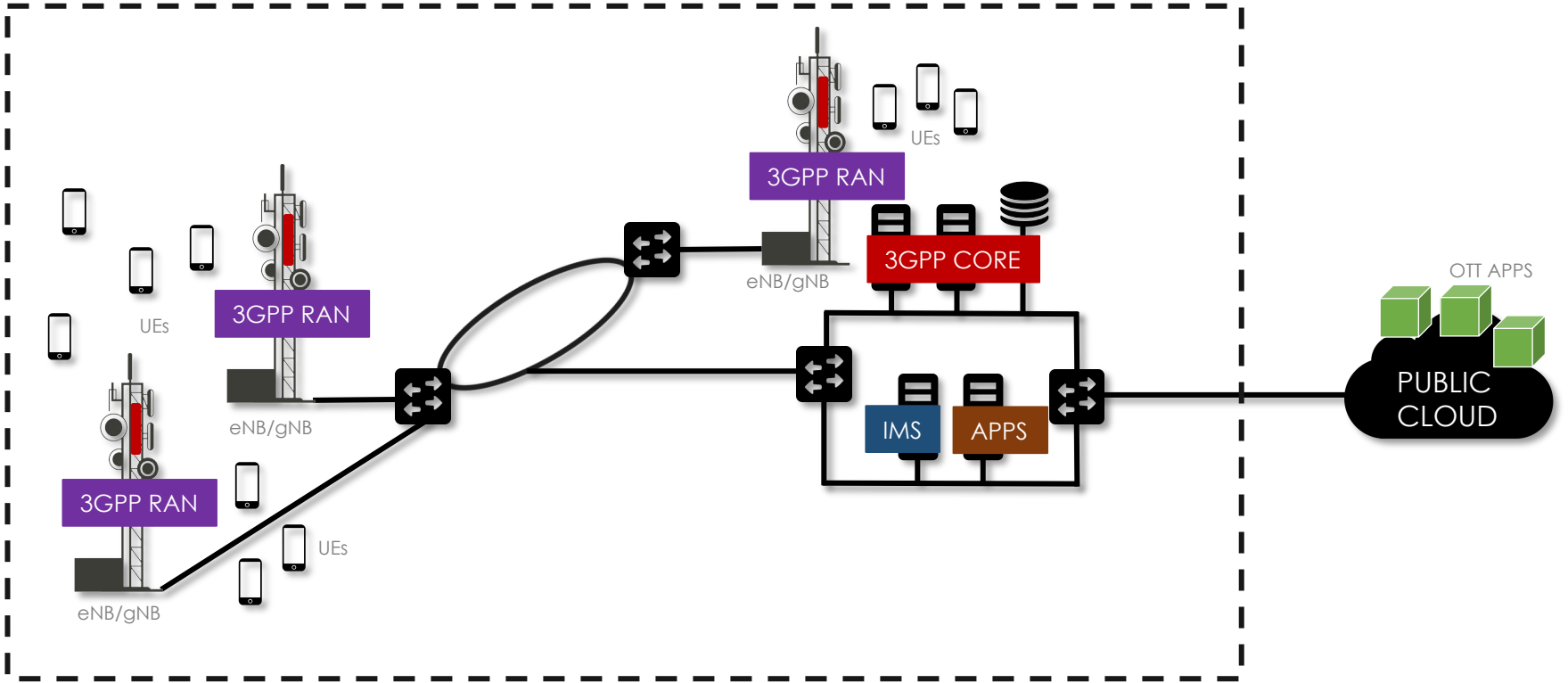
Cloud Computing…

is a style of computing where **scalable** and **elastic** IT-related **capabilities** are provides as-a--service to **external customers** using Internet technologies

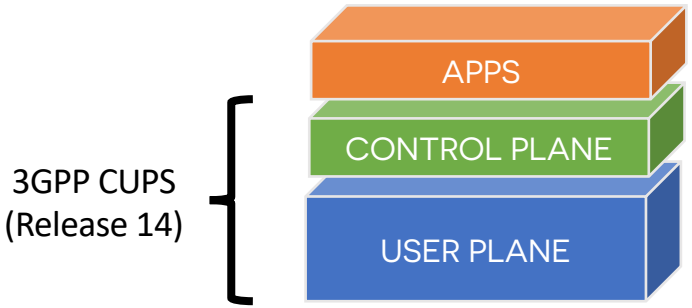
elasticity: ability to grow or shrink infrastructure resources (compute and storage) dynamically as needed to adapt to workload changes in an autonomic manner, maximizing the use of resources

scalability: ability to increase workload size within existing infrastructure (hardware and software) without impacting performance

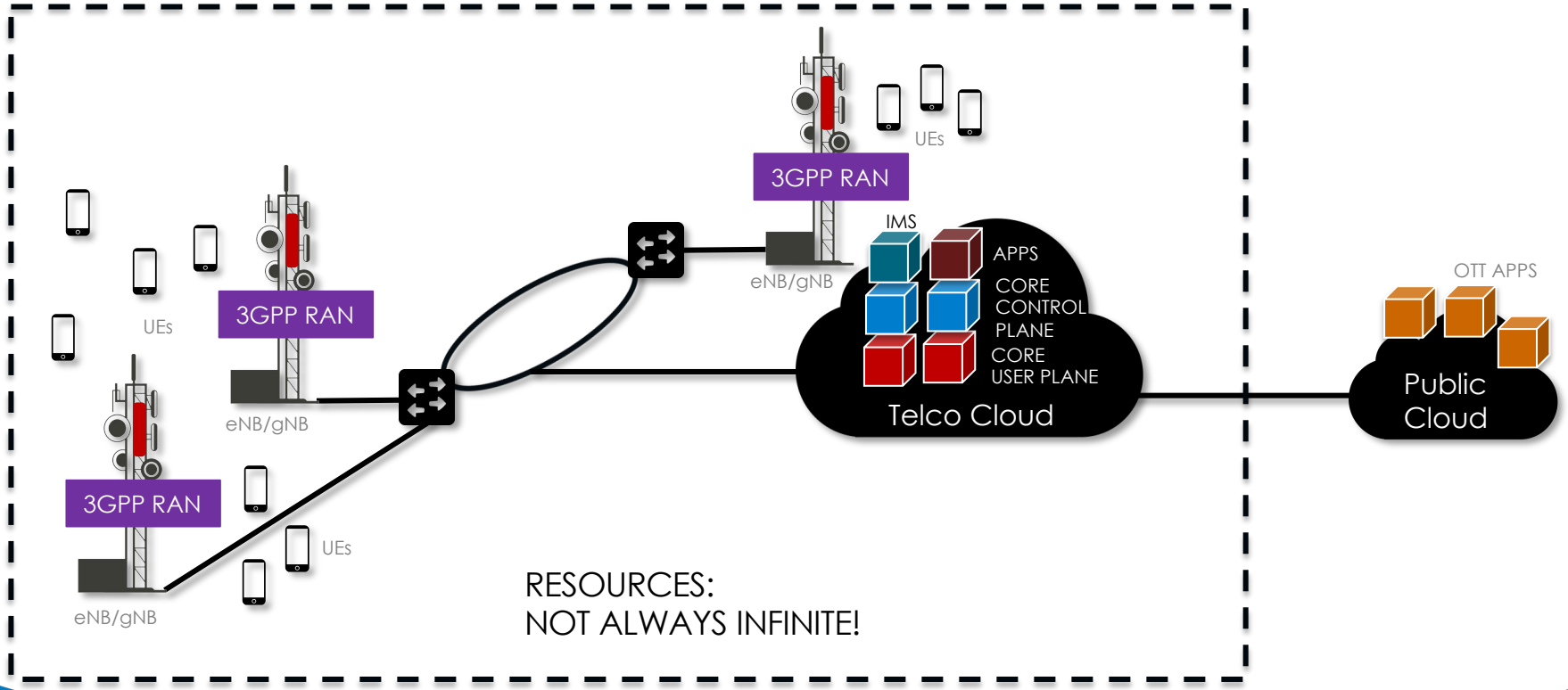
Cellular Networks Today



Horizontal Disaggregation



Virtualization

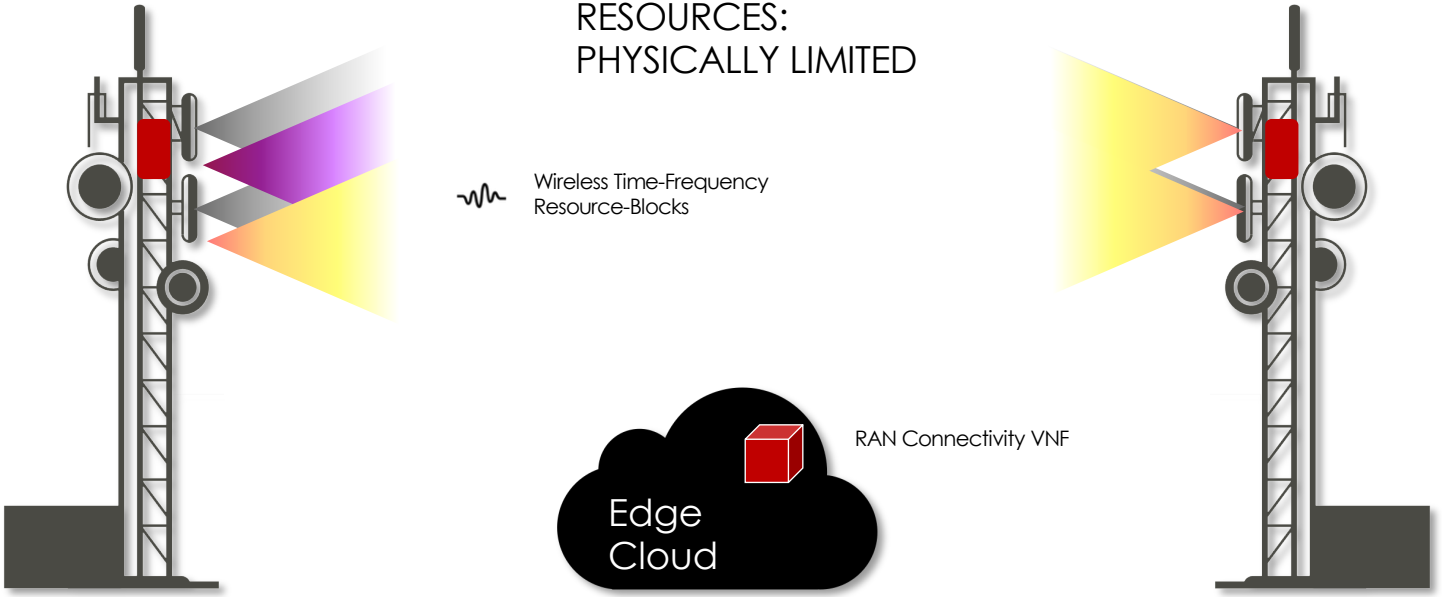


RAN Virtualization

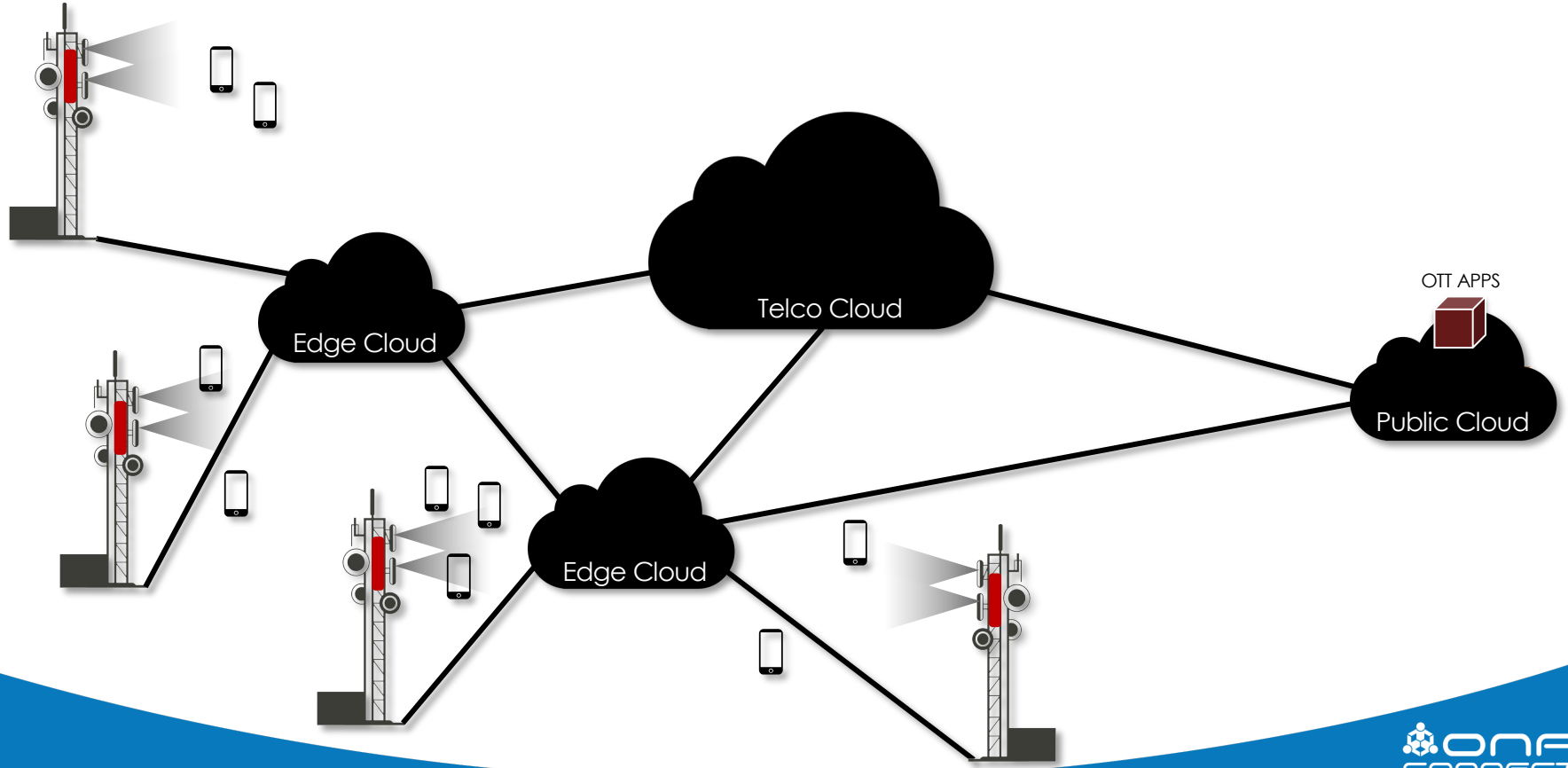
New Resources: Connectivity Service VNFs

RAN Virtualization

New Resources: Time-Frequency Resource Blocks

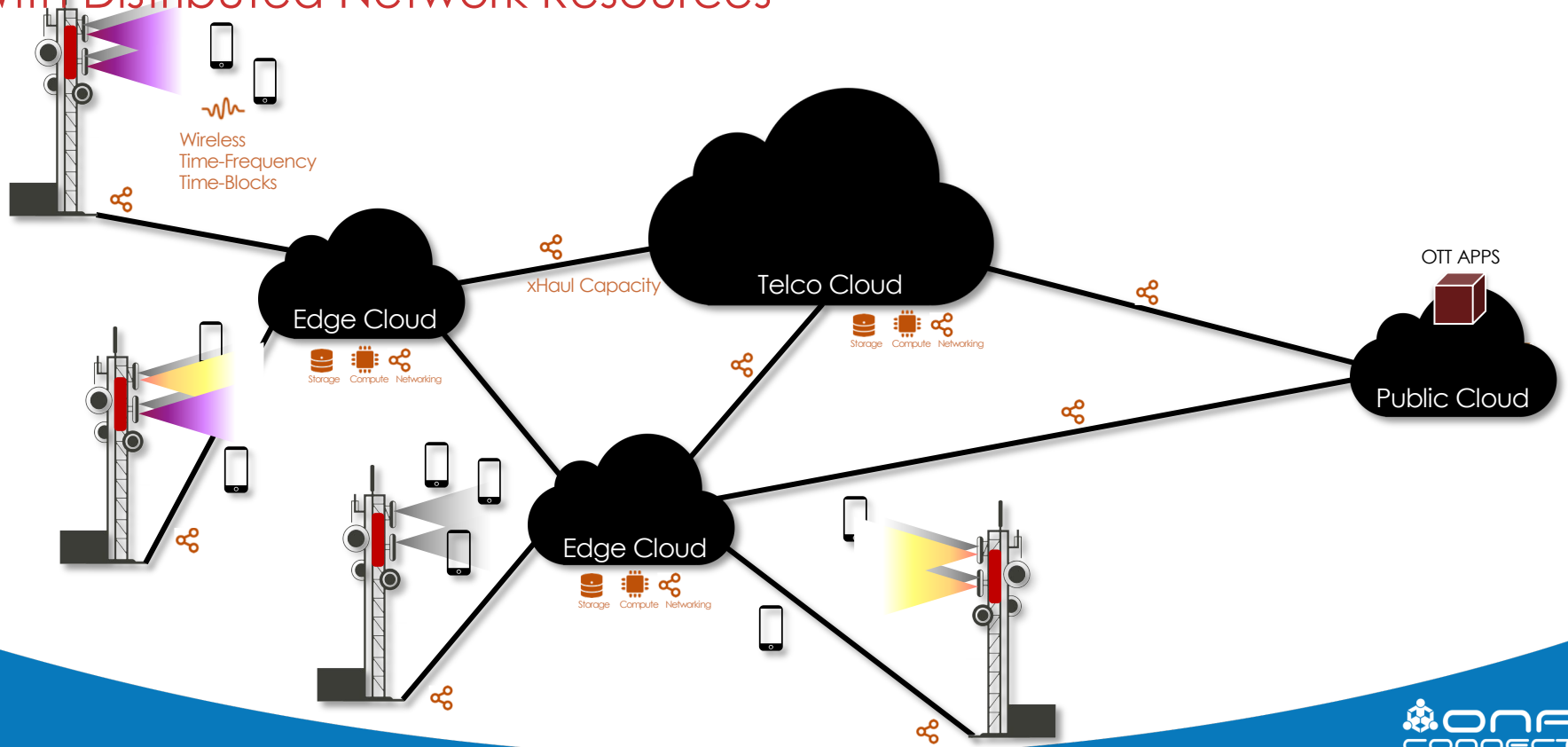


Virtualized Mobile Networks



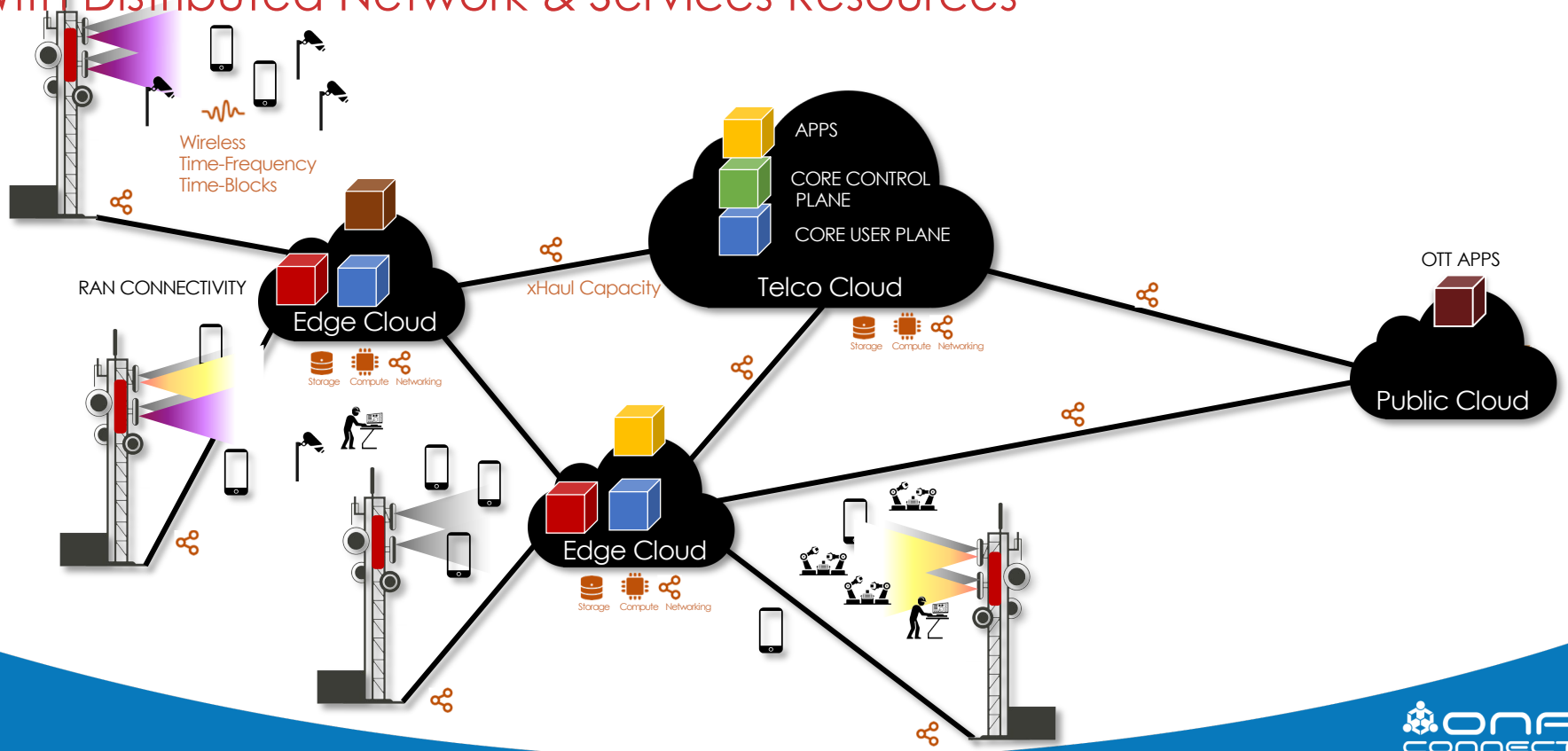
Virtualized Mobile Networks

With Distributed Network Resources



Virtualized Mobile Networks

With Distributed Network & Services Resources



Network Slicing…

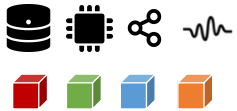
is a mobile networking platform using which elastic and scalable access & connectivity related capabilities are provided as-a-service to customers in a given geography using 3GPP-standardized technologies

elasticity: ability to grow or shrink networking resources (spectrum, compute, storage, xhaul) dynamically as needed to adapt to supported use case changes in an autonomic manner, maximizing the use of resources

scalability: ability to increase allocated networking capacity size within existing network resources (spectrum, hardware and software) without impacting own or other slices' performance

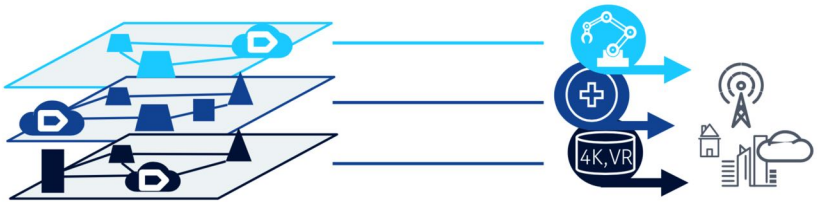
Network Slicing Lifecycle

Slice Request Attributes
Latency
Throughput
Reliability
Mobility
Geography
Security
Analytics
Cost Profile
…



Composable Network & Service Resources

Automated Composition and Life-Cycle Management



Localized, Personalized Delivery

Network Slicing aims to transform a mobile network to
a network cloud with distributed physical and services resources

Network Slicing & 3GPP

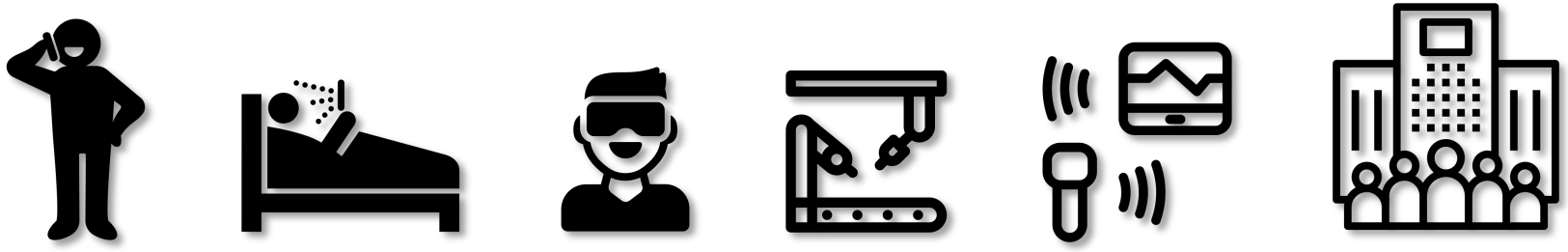
Descriptions

Network Function: A 3GPP adopted or 3GPP defined processing function in a network, which has defined functional behavior and 3GPP defined interfaces.

Network Slice: A logical network that provides specific network capabilities and network characteristics.

Network Slice Instance: A set of Network Function instances and the required resources (e.g. compute, storage and networking resources) which form a deployed Network Slice.

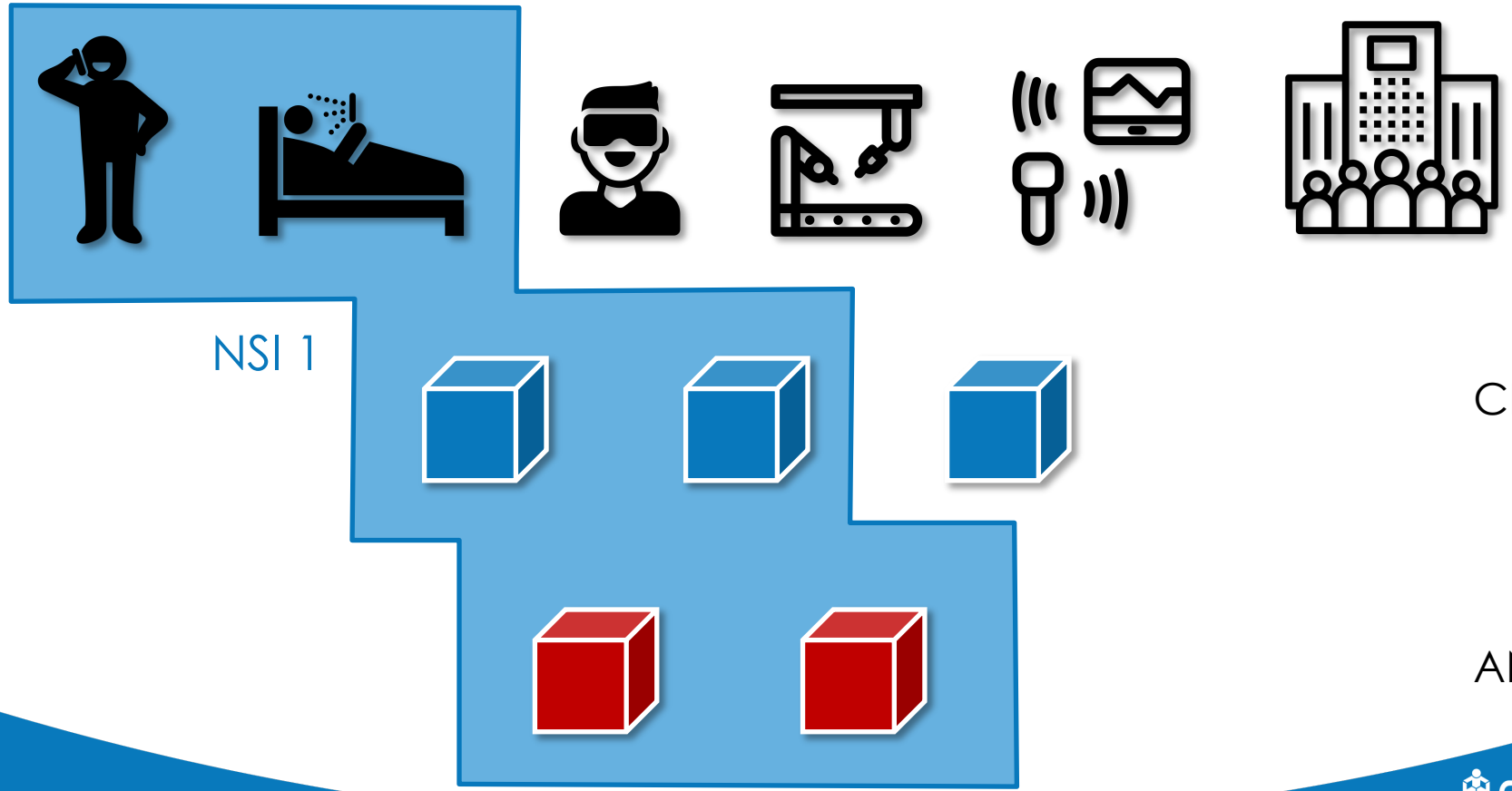
Network Slicing & 3GPP



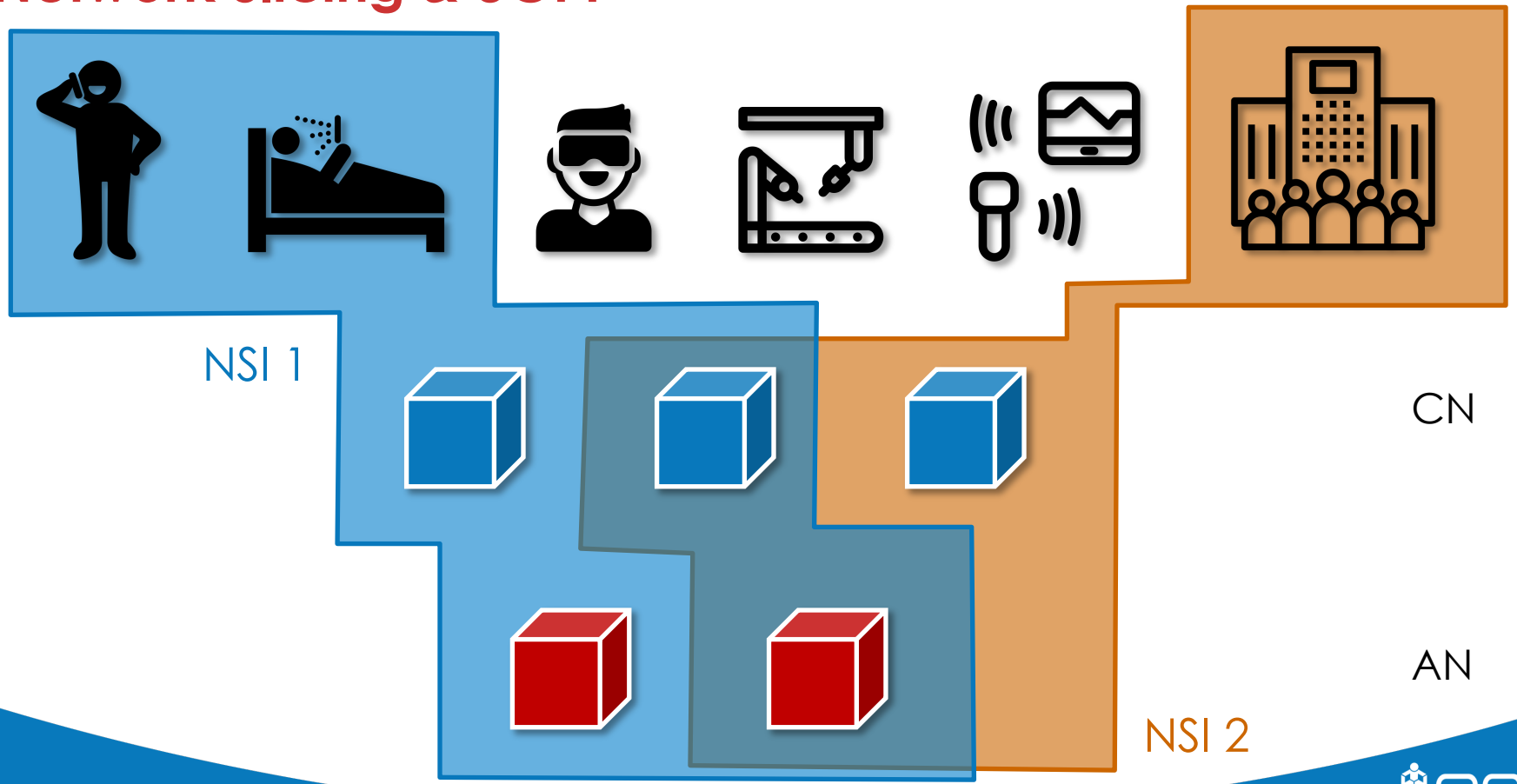
CN

AN

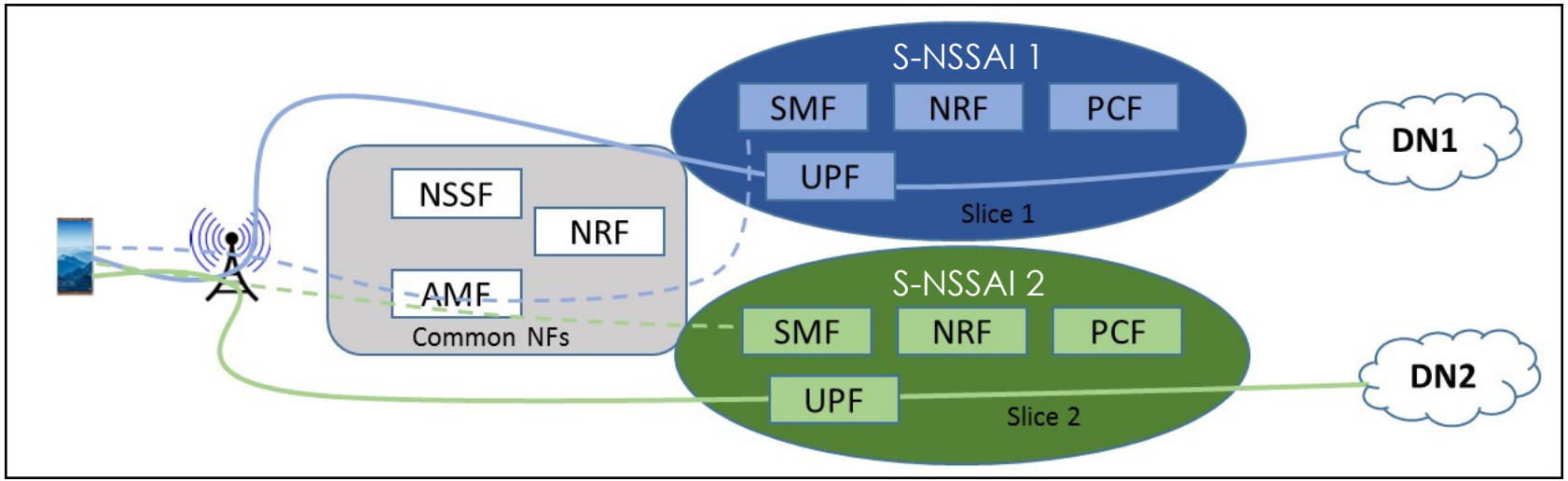
Network Slicing & 3GPP



Network Slicing & 3GPP

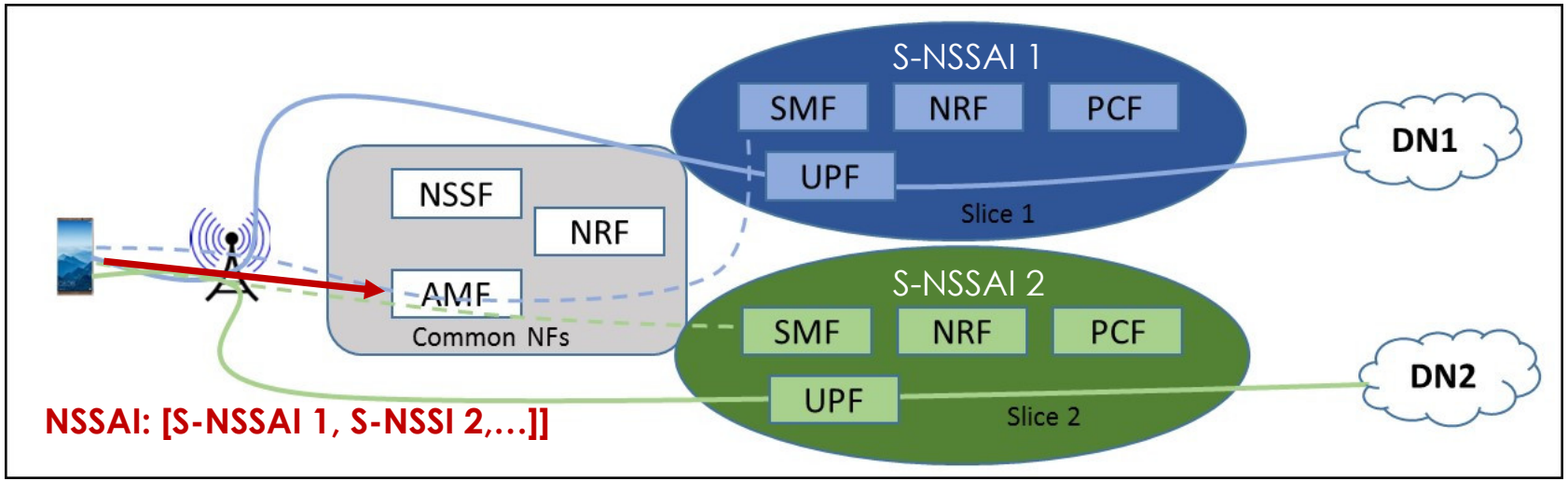


Network Slicing & 3GPP



S-NSSAI: [SST, SD]

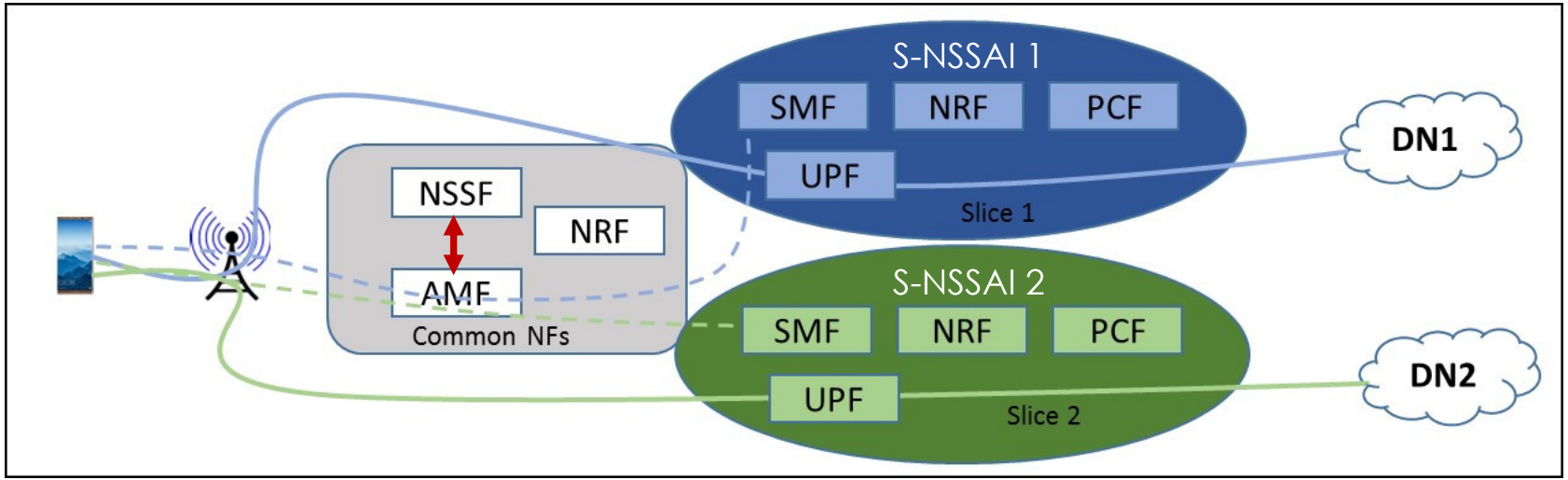
Network Slicing & 3GPP



S-NSSAI: [SST, SD]

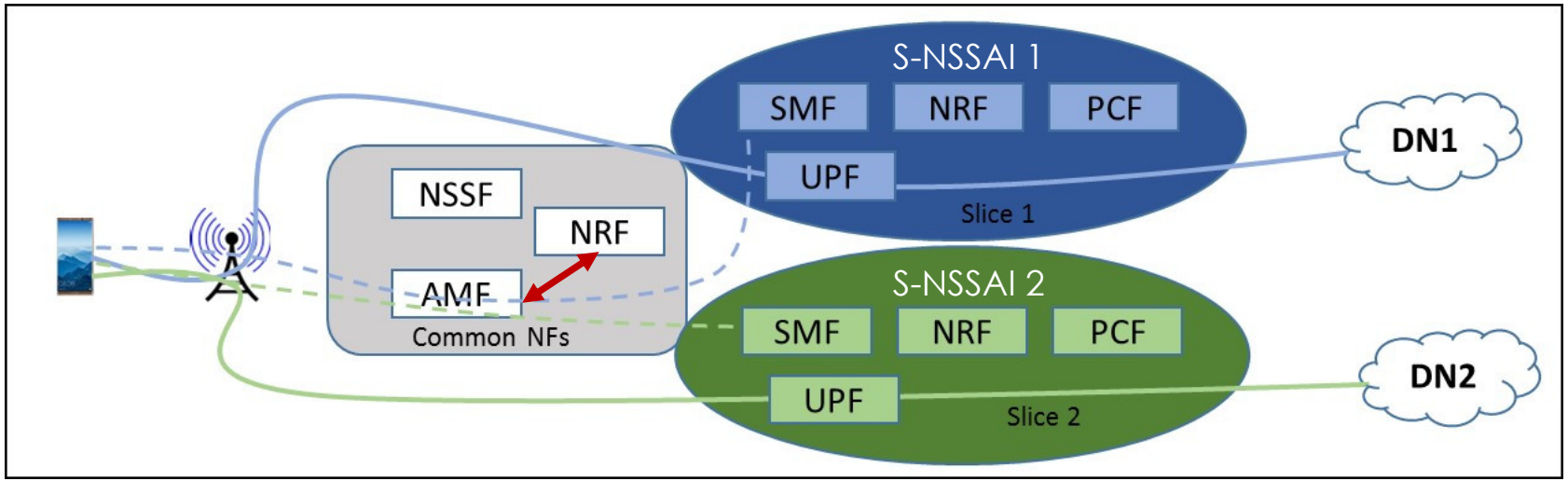
Network Slicing & 3GPP

Q: Which Slice Instance for S-NSSAI 1 and PLMN x?
A: NSI 1



S-NSSAI: [SST, SD]

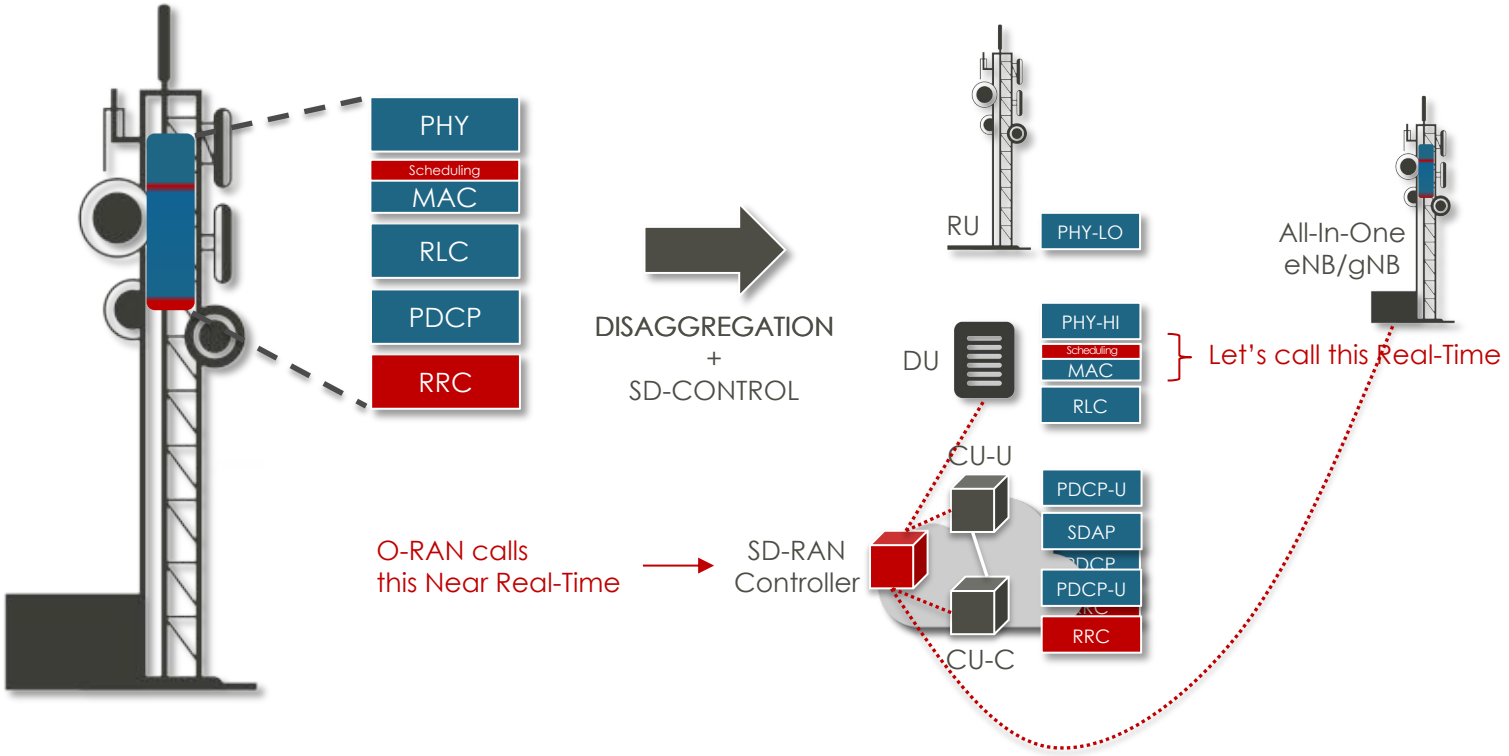
Network Slicing & 3GPP



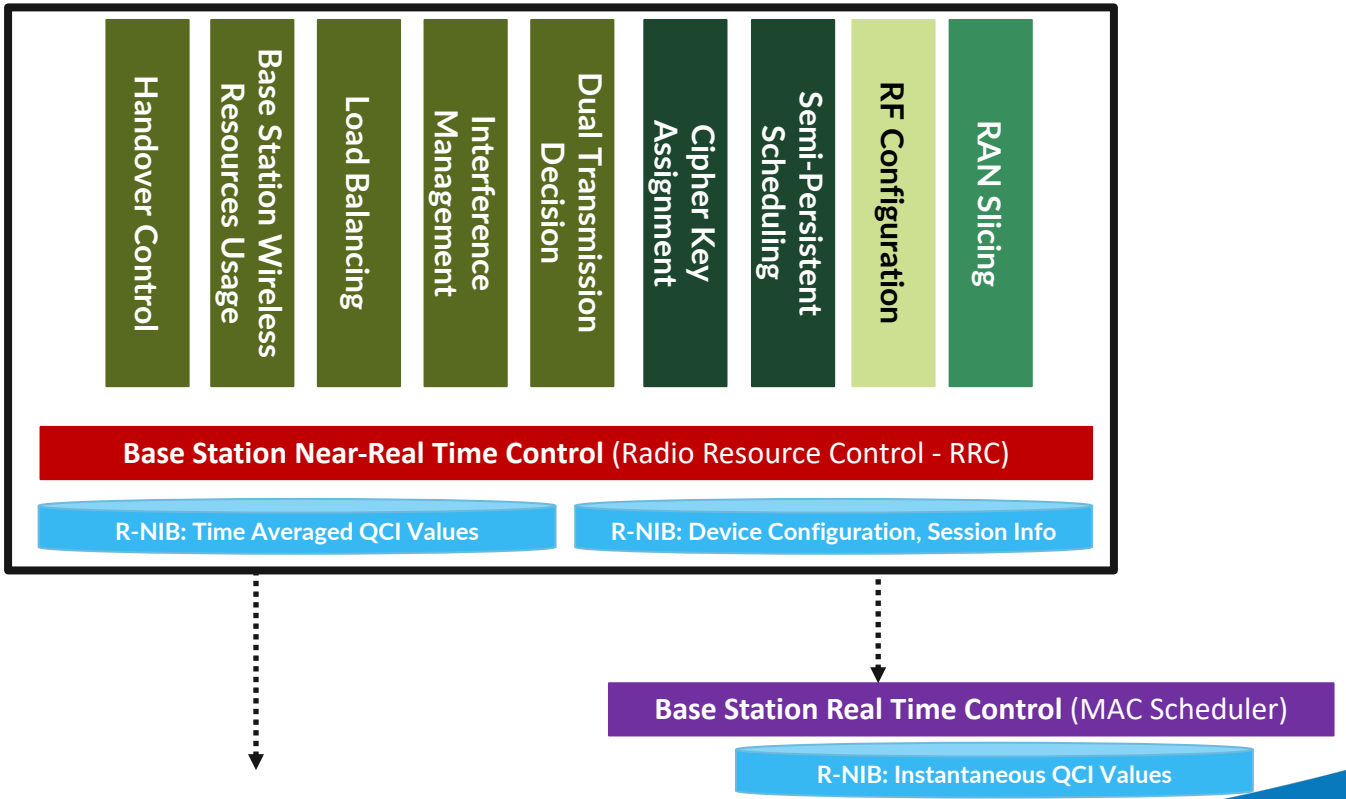
Q: Where are the Slice Instance components for NSI 1?
A: IPs

S-NSSAI: [SST, SD]

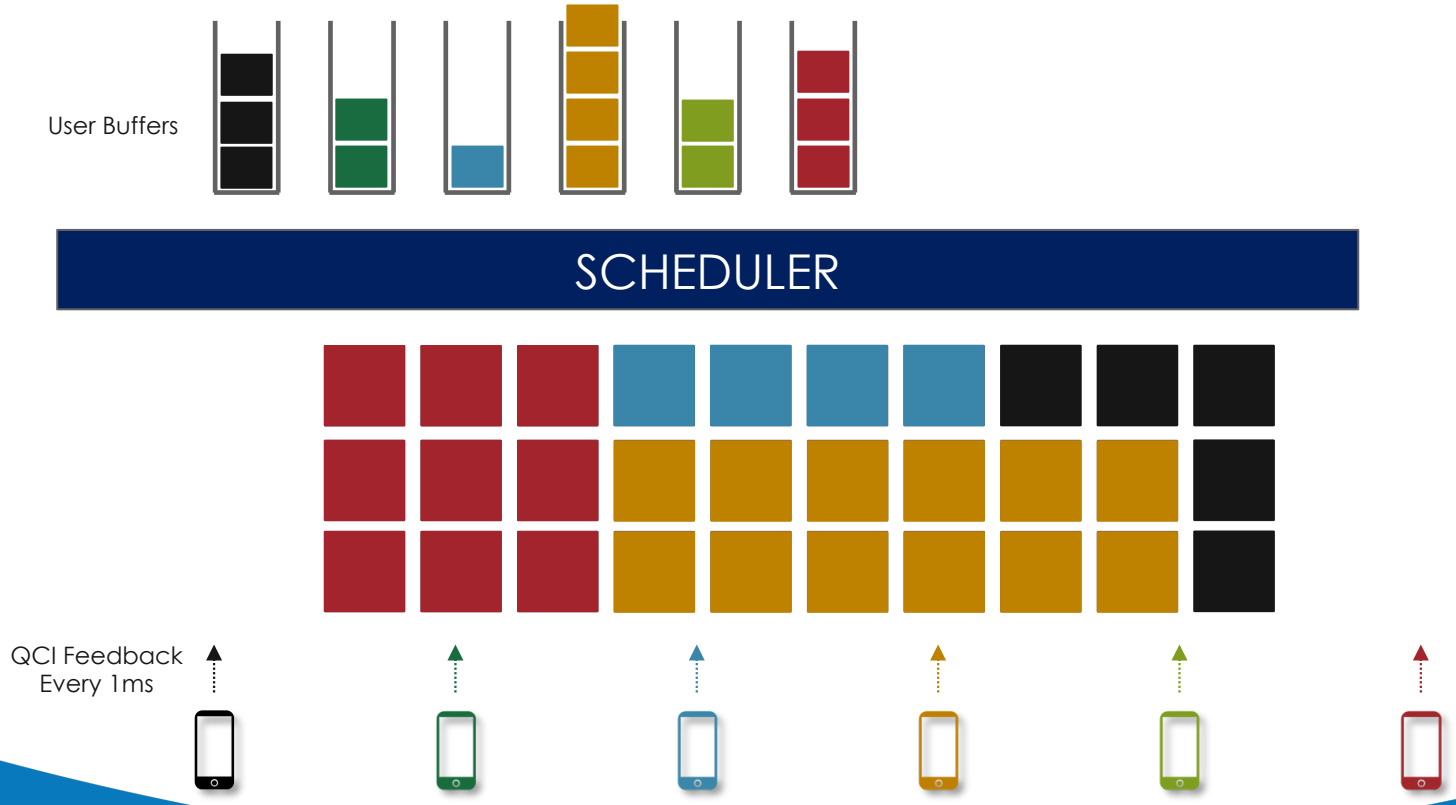
What About the RAN?



RAN Controller



Real-Time Control



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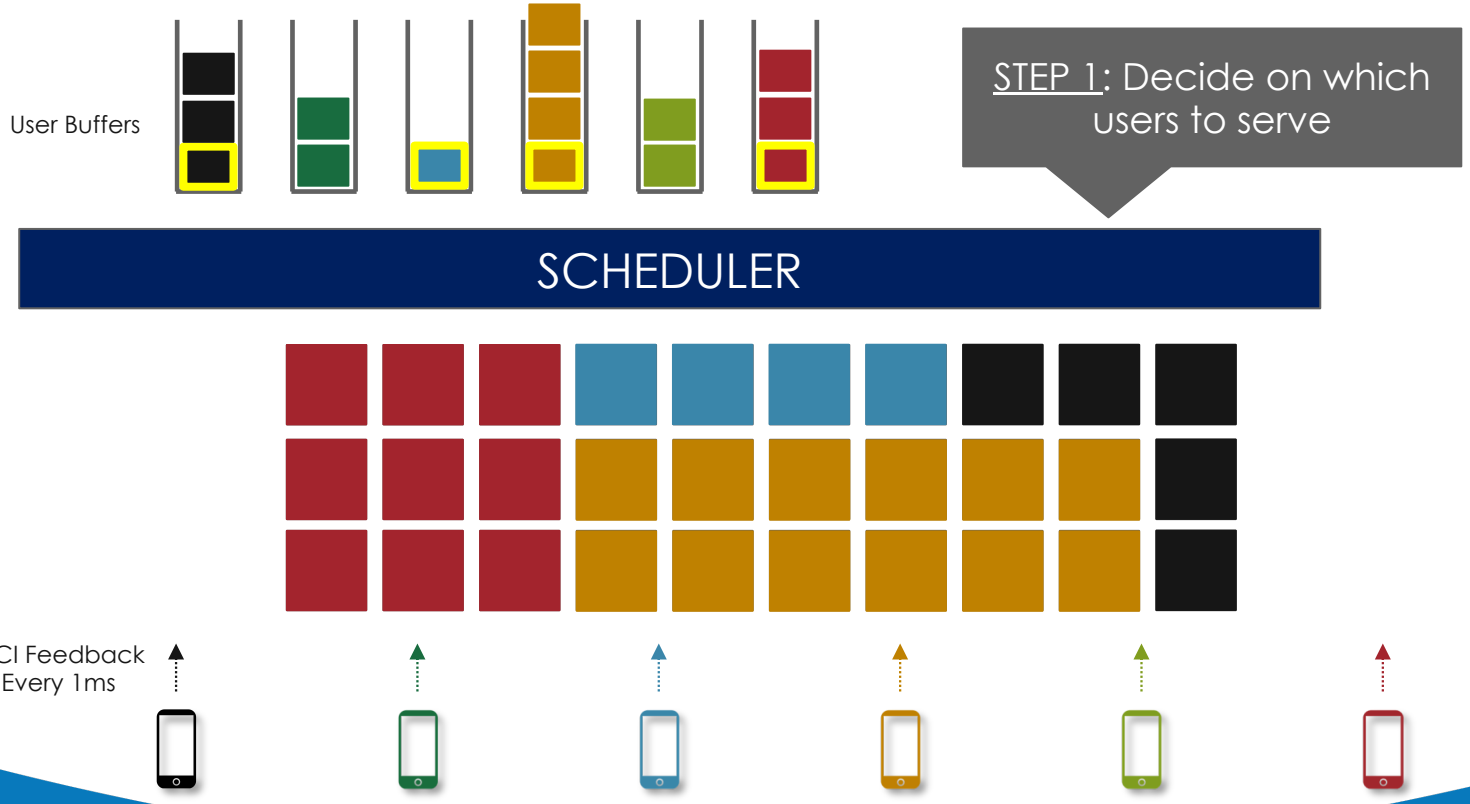

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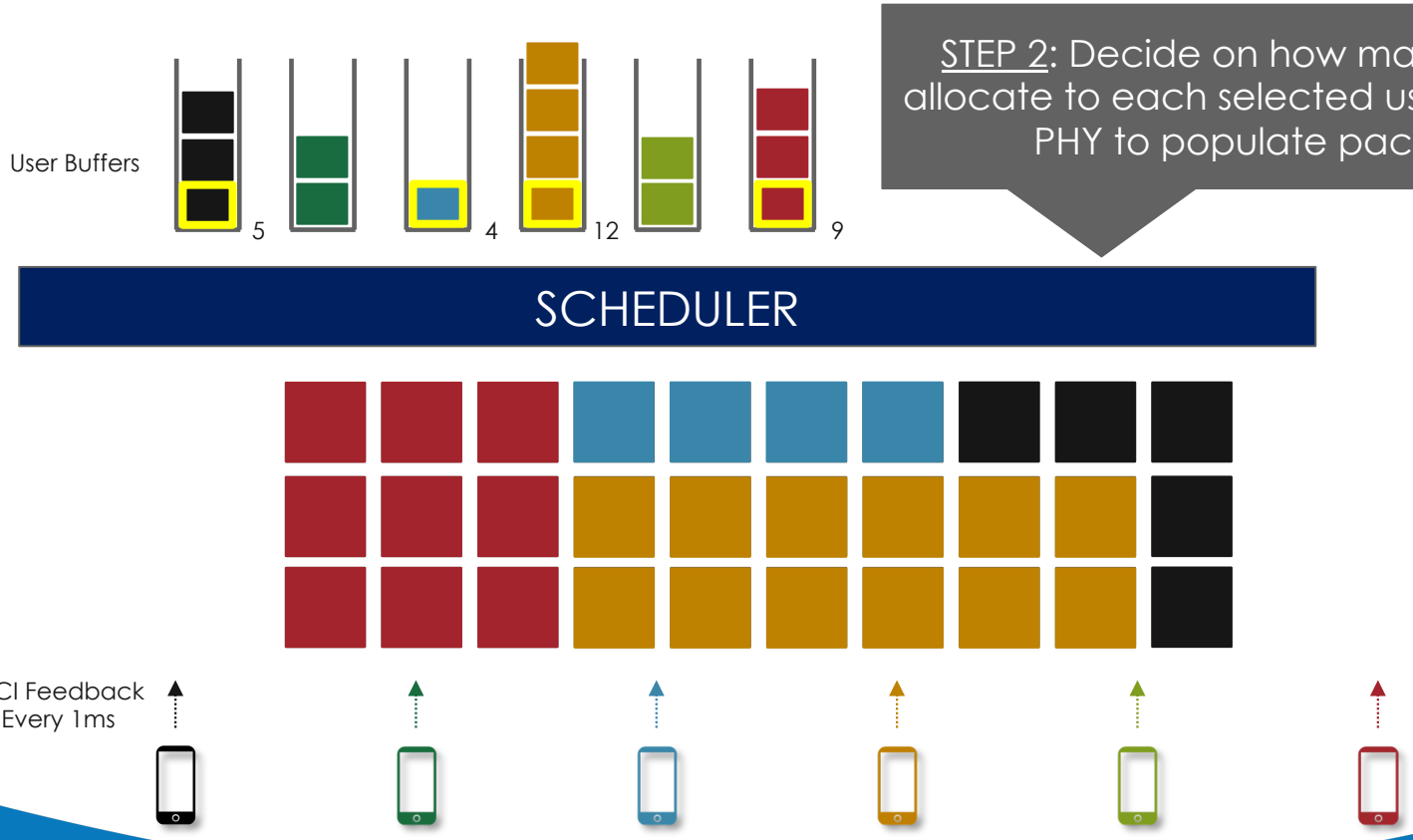

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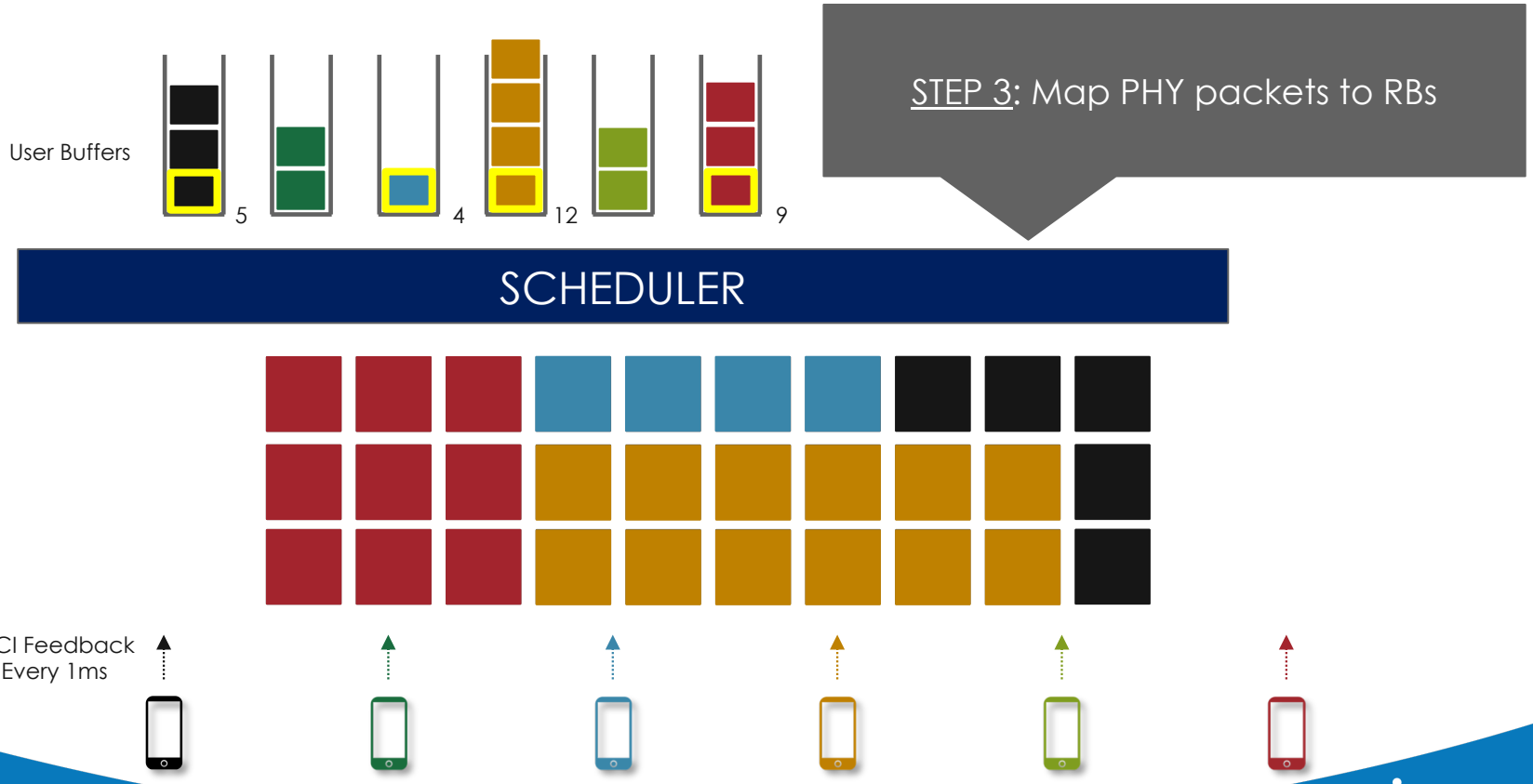
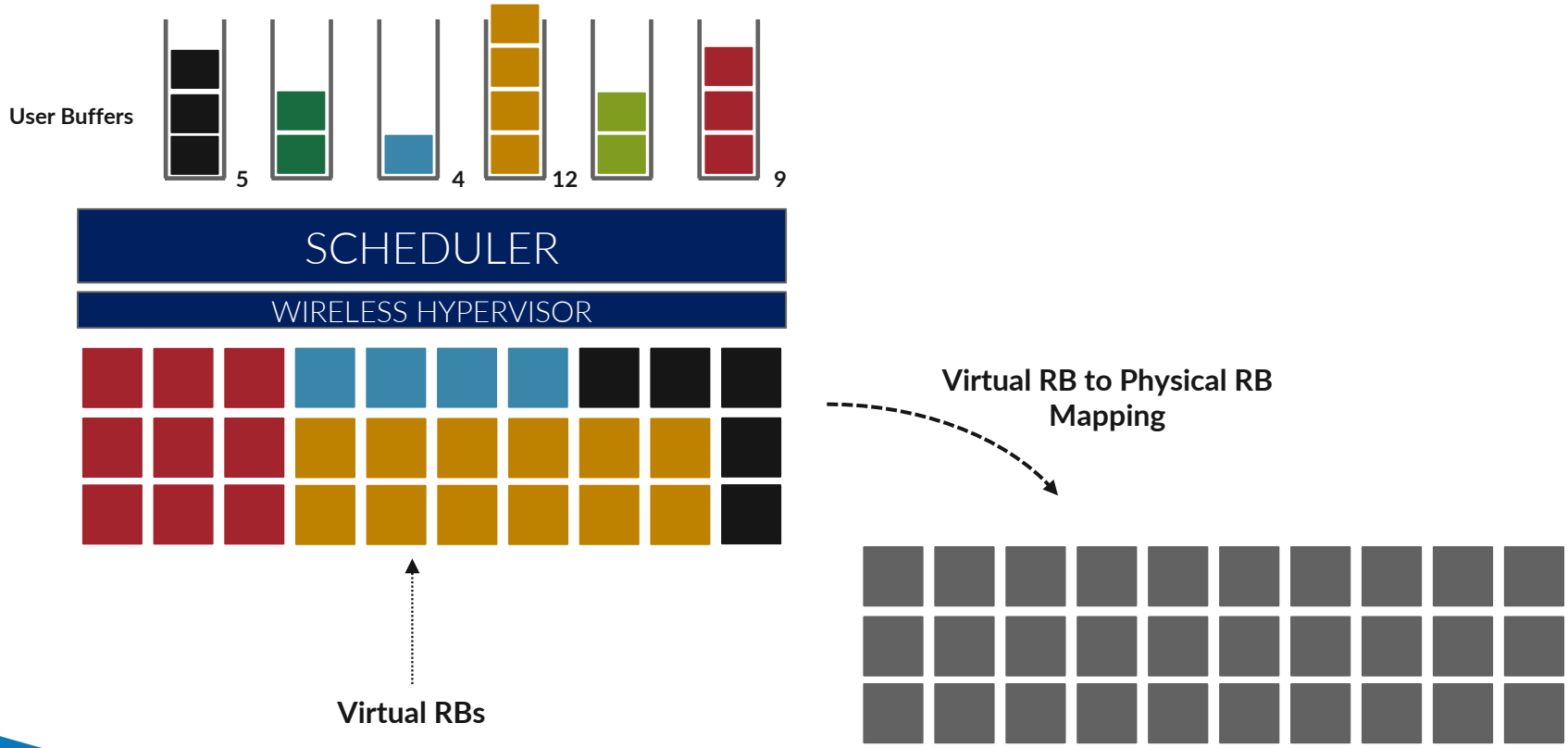
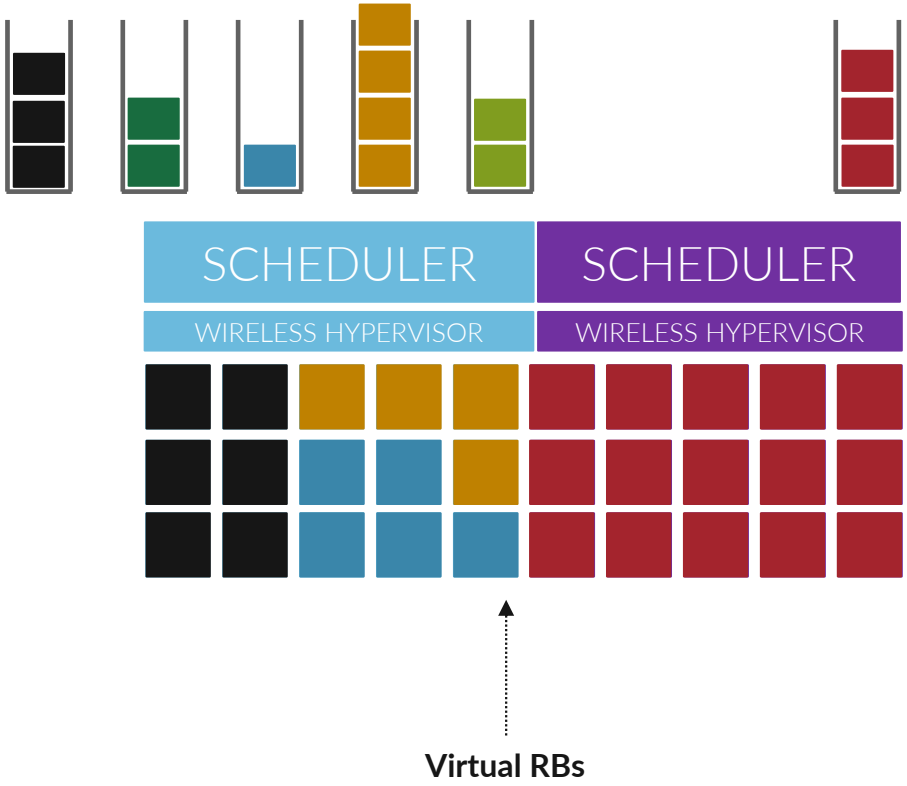


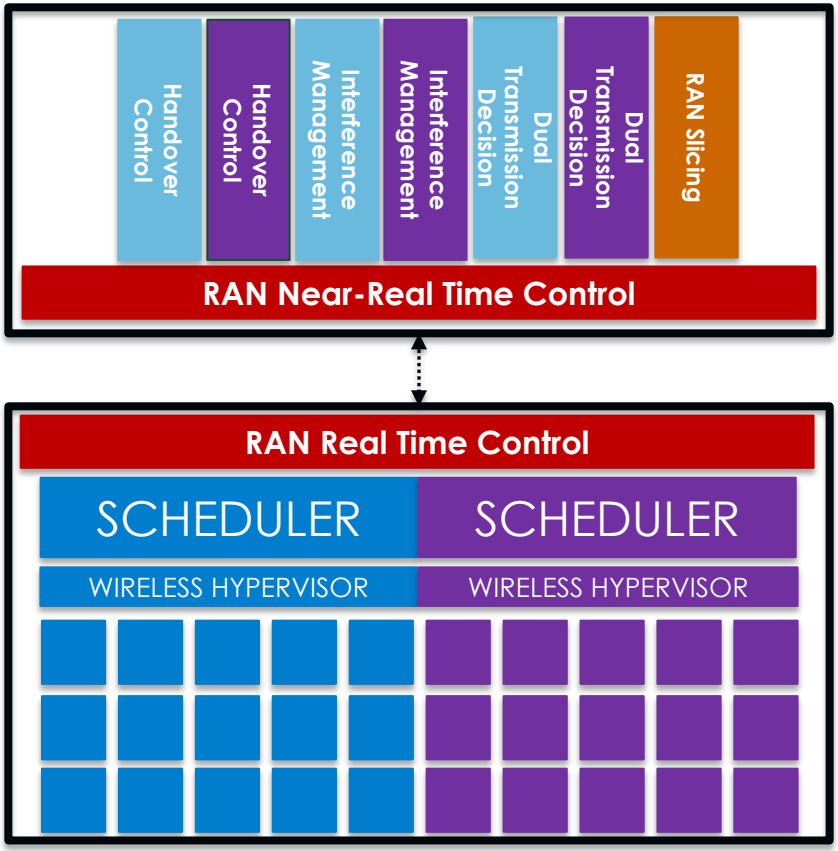
Disaggregate and Virtualize Real-Time Control



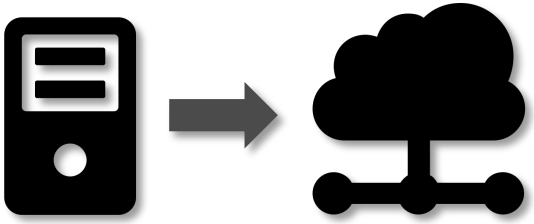
Assign Resources Elastically



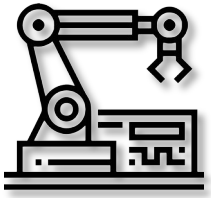
Configure Slices



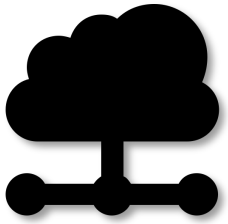
Challenges



Telco Transformation:
Mindset shift from appliance-based thinking to cloud-based thinking



Killer use cases enabling new revenue streams

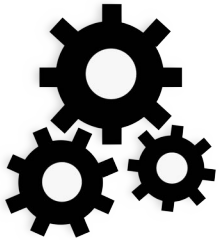


Where is the Edge?

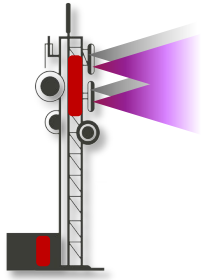
Telco Transformation:
Cloud-Native

Workload Placement

Telco-Transformation:
Multi-Tenancy



Orchestration, Automation, Network Cloud Management



RAN Virtualization and Slicing

Network Slicing and the Edge

With 5G - Edge is where Public Cloud meets the Network Cloud

Network Slicing and the Edge

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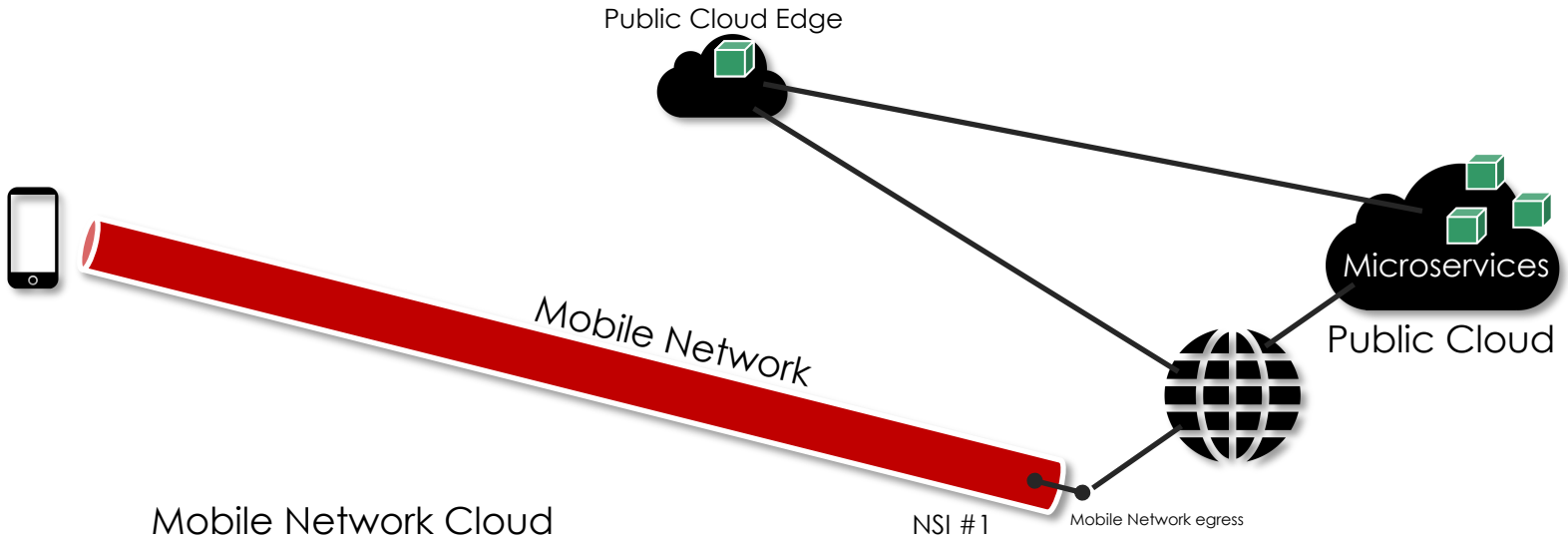

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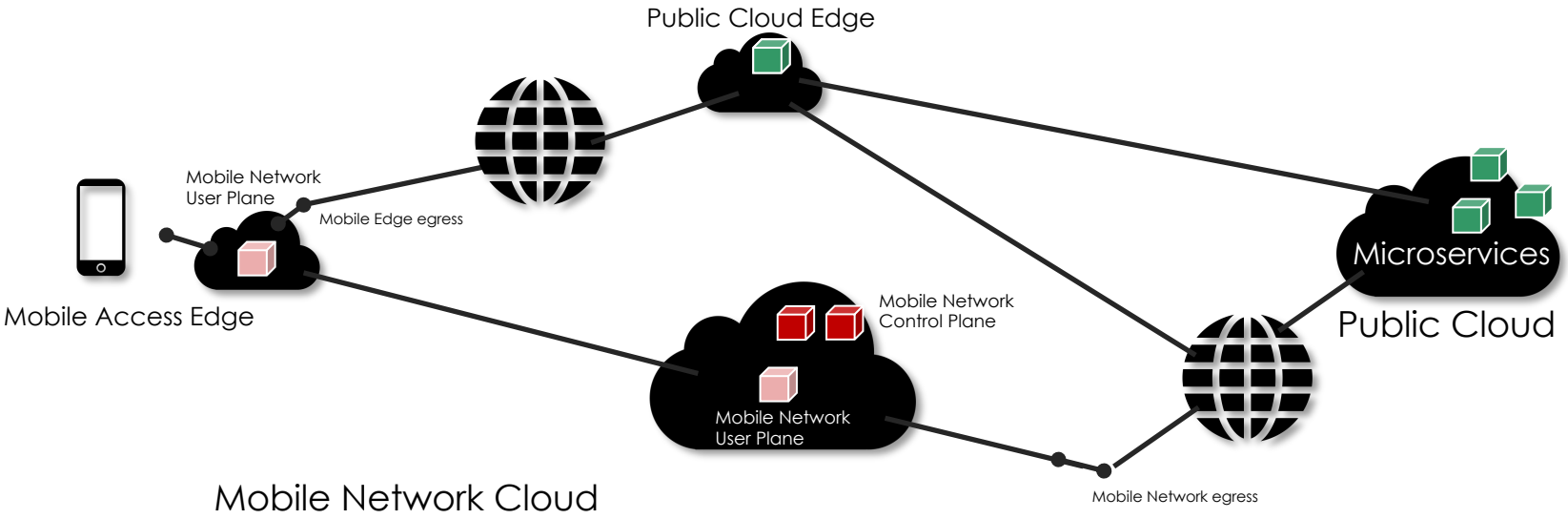

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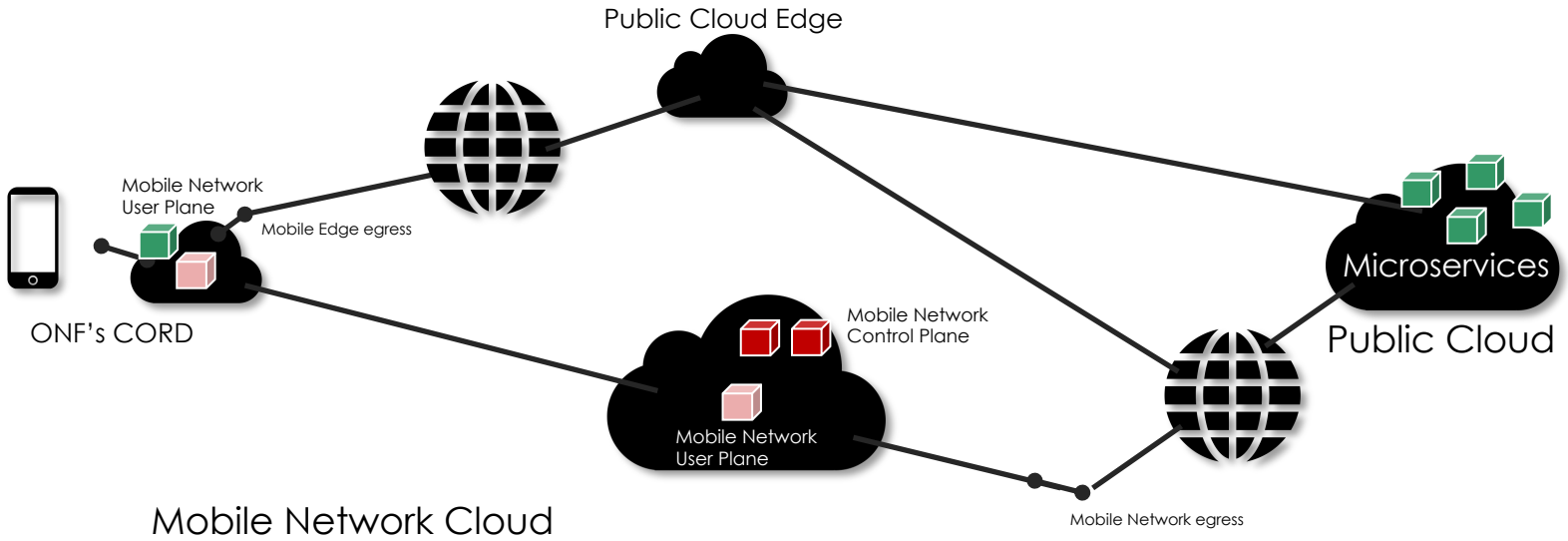

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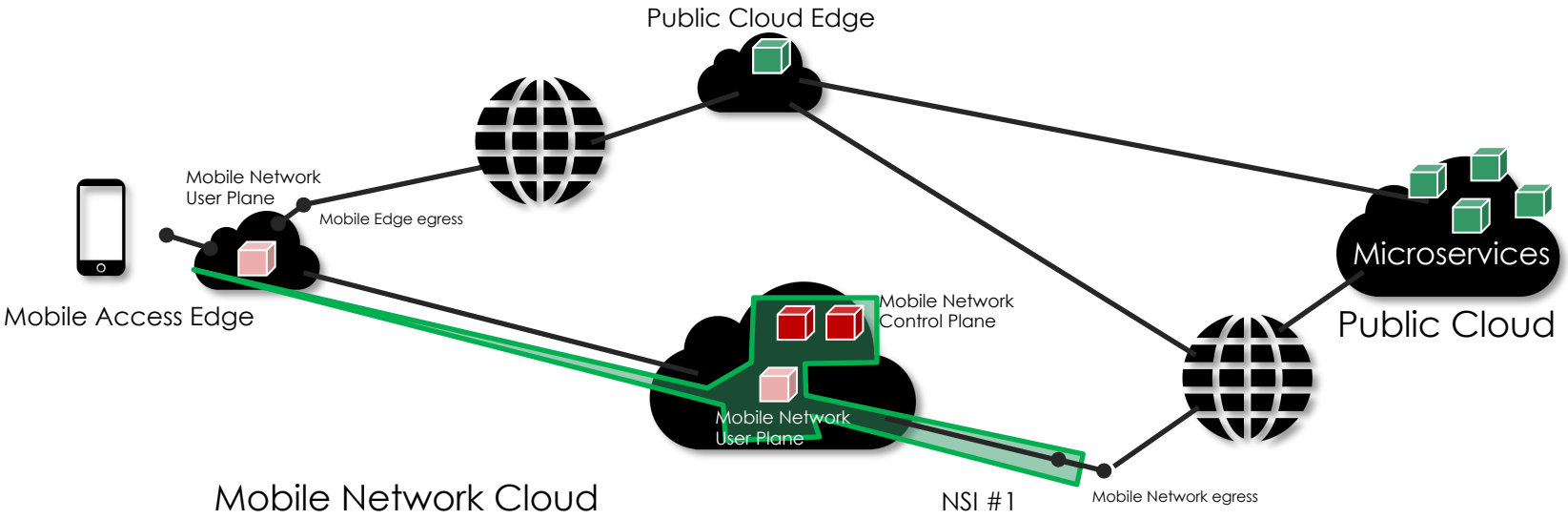

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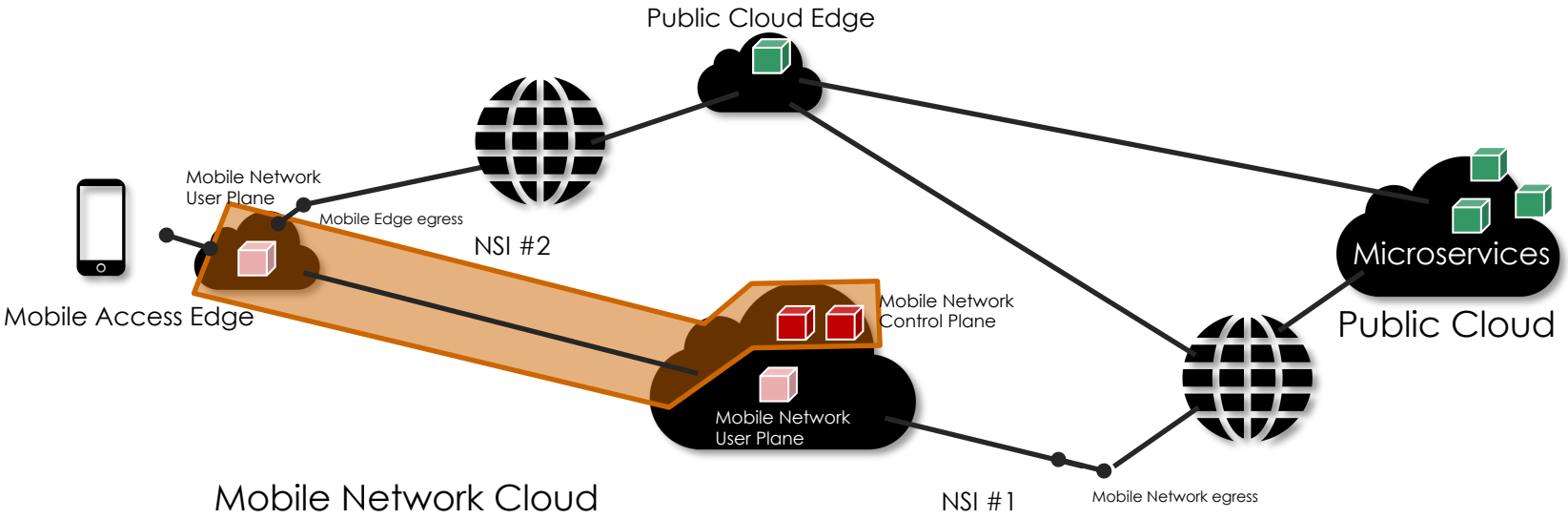
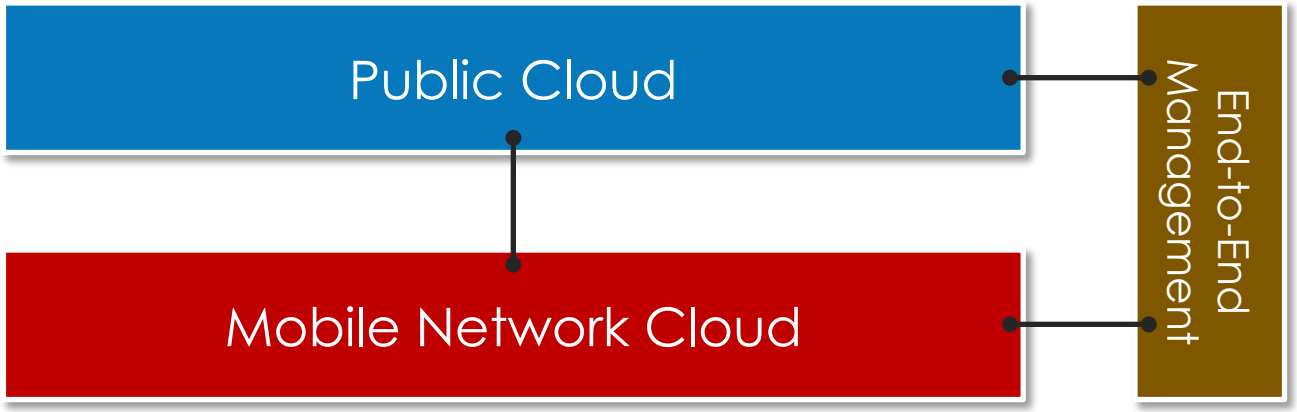


Two Clouds: Let's Talk



THANK YOU

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