

A stylized world map composed of horizontal lines in blue, red, and orange. Four white curved arrows form a circular path around the map, pointing clockwise. The top arrow points from the left to the right, the right arrow points from the top to the bottom, the bottom arrow points from the right to the left, and the left arrow points from the bottom to the top.

OPEN SOURCE NETWORKING DAYS

Bay Area

Opendaylight: Enabling 5G through Cloud Native Telco Architecture

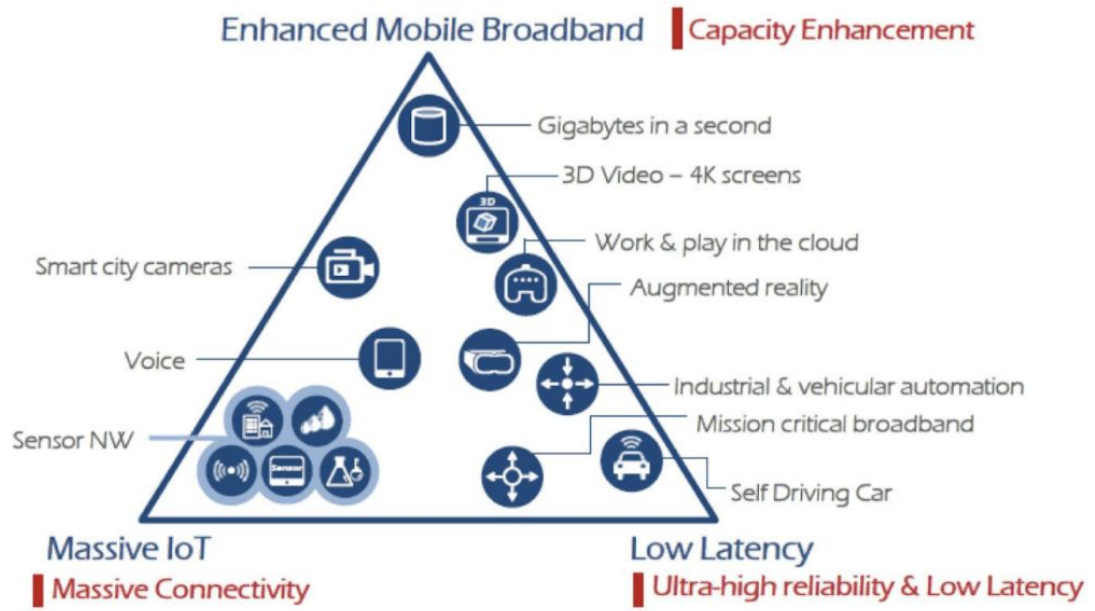
Edgar Lombara
Lumina Networks Inc.

Agenda



- Key drivers for 5G
- 5G and Cloud native
 - Edge Cloud
 - Core Cloud
- Microservices building block
- Container Networking
- Opendaylight and Kubernetes
- COE
- Q&A

Key Drivers for 5G



(Source: ETRI graphic, from ITU-R IMT 2020 requirements)



- 5G architecture adds agility to Telco network to meet the critical requirements of business needs
- Emerging Business needs can vary depending on the type of services they offer
- Below are broader category
 - Ultra Reliable Low Latency Communication - Delay/Jitter sensitive
 - Massive IoT - Reliability sensitive
 - Enhanced Mobile Broadband - Bandwidth sensitive
- The above requirements call for the network to be composable based on the intent
- This calls for the software architecture driving 5G to be cloud-enabled and microservices based

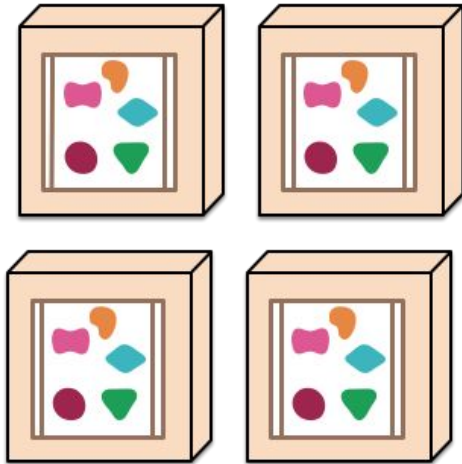
Microservices



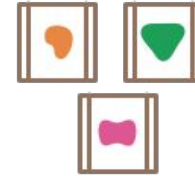
A monolithic application puts all its functionality into a single process...



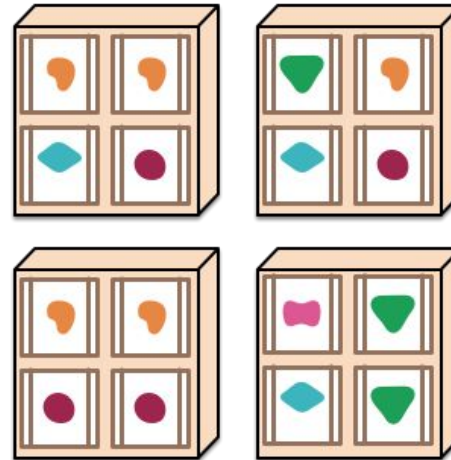
... and scales by replicating the monolith on multiple servers



A microservices architecture puts each element of functionality into a separate service...



... and scales by distributing these services across servers, replicating as needed.



Reference / Image credit : <https://martinfowler.com/articles/microservices.html>

Kubernetes Architecture

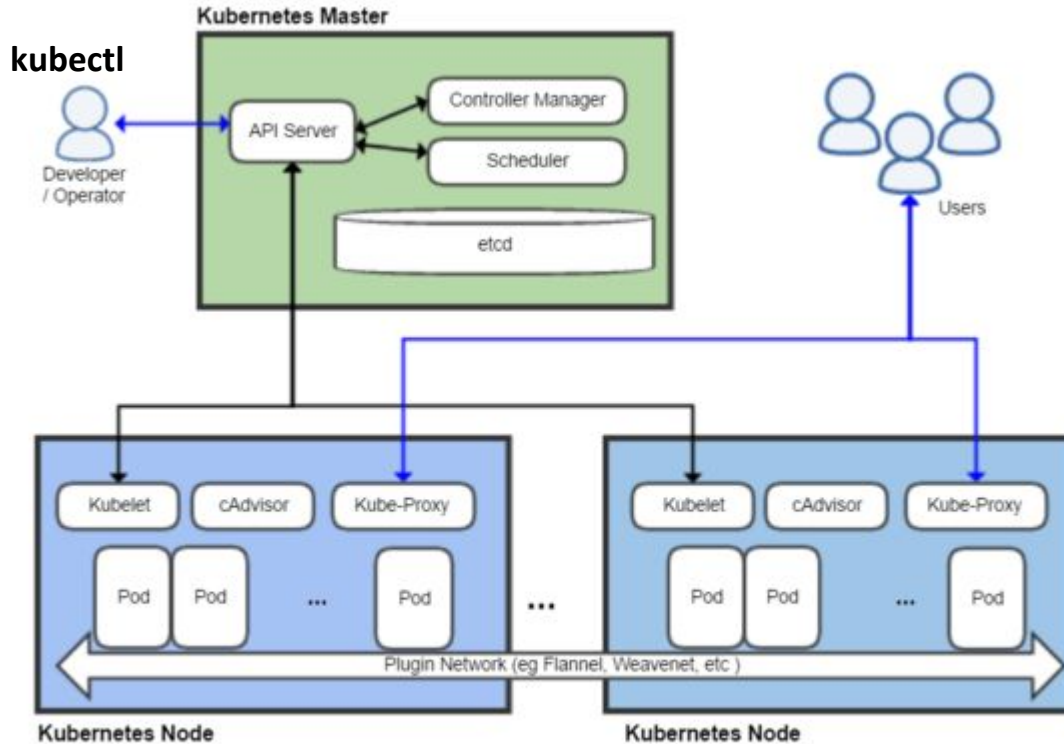


Image credit : <https://en.wikipedia.org/wiki/Kubernetes>

Containers



- Microservices is an architectural guidance for building apps
- Apps can be built as
 - Services on a single OS on a bare-metal [Issues: Services can have conflicting library versions. Dependency management is an issue]
 - Each service in a VM [Issues: Compute utilization unoptimized]
 - Each service in a container
 - Lightweight and isolated execution environment
 - Consistent environment across development, test, staging and production
 - Granular control on workload placement
 - Better options for horizontal scaling
 - Improved resource utilization
- Microservices does not dictate use of containers (Eg. Netflix)
 - But containers are a great way to decompose large applications

Container Networking - Introduction



- Single Host
 - Docker models (Bridge, Host, Container)
 - Linux MACVLAN / IPVLAN
 - Direct attachment to SRIOV
- Multi Host
 - Overlay:
 - L2 - Flannel
 - L3 - Calico
 - Underlay:
 - Data Center Fabric (EVPN)
 - WAN-Services (IP/MPLS/OTN)
 - NextGen data planes(OpenFlow, P4, other)
- IP address management
- Port allocation

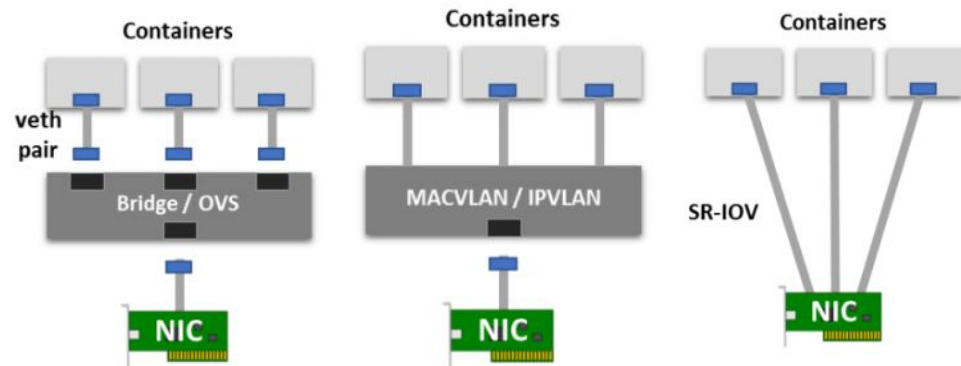
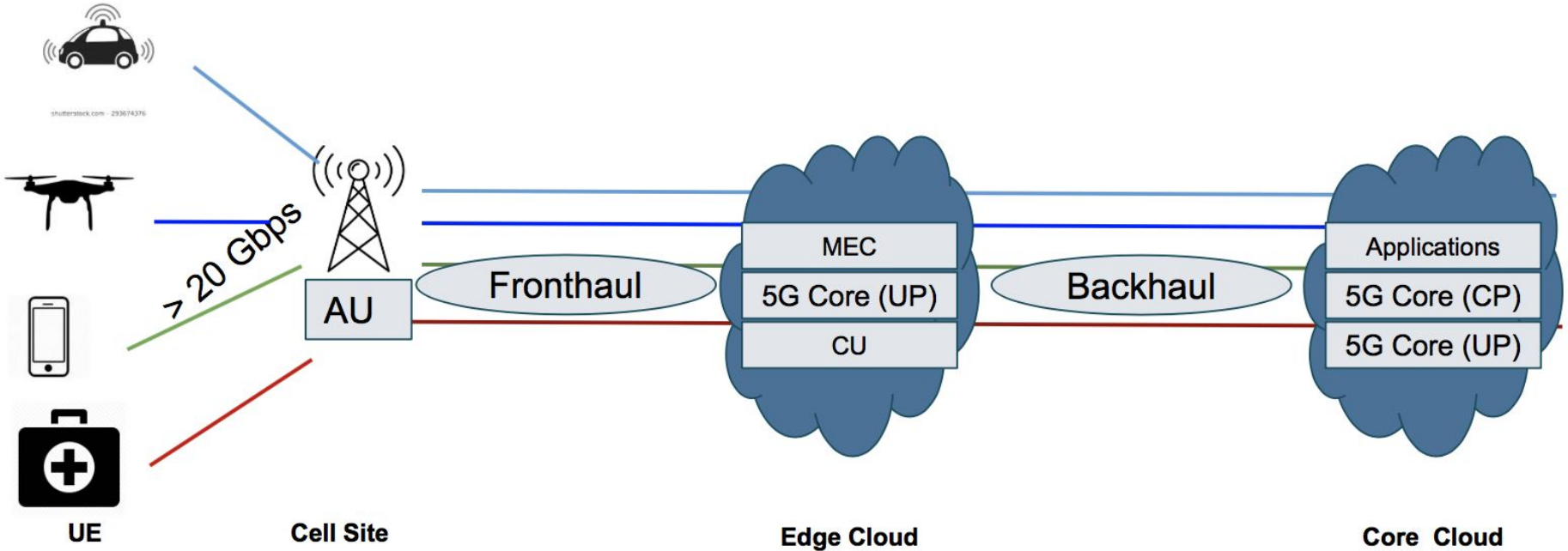


Image credit : <https://thenewstack.io/hackers-guide-kubernetes-networking/>



- 5G components that benefits most of microservices
 - Edge Cloud - Application Mobility
 - Core Cloud - Cloud Native Functions for Network Slicing
 - Orchestration - Lifecycle management

5G Components



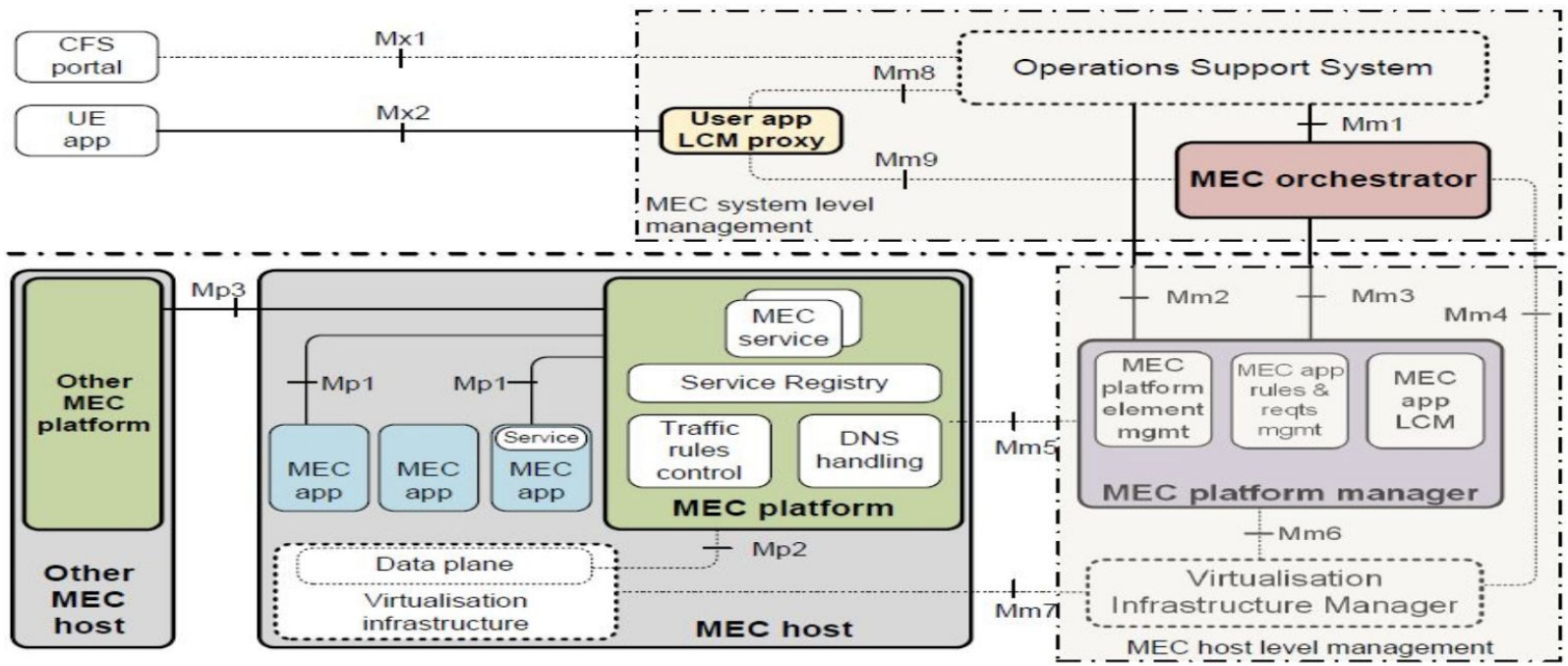
AU - Access Unit
CU - Cloud Unit

CP - Control Plane
UP - User Plane



- Applications Mobility is key for 5G
- Applications placement is an important requirement that allows instantiation of applications on Edge locations meeting the constraint
- Applications (Business logic+network functions) needs to be instantiated on demand to meet the mobility requirements
- Applications needs to be microservice based that would enable them to be instantiated on demand

MEC

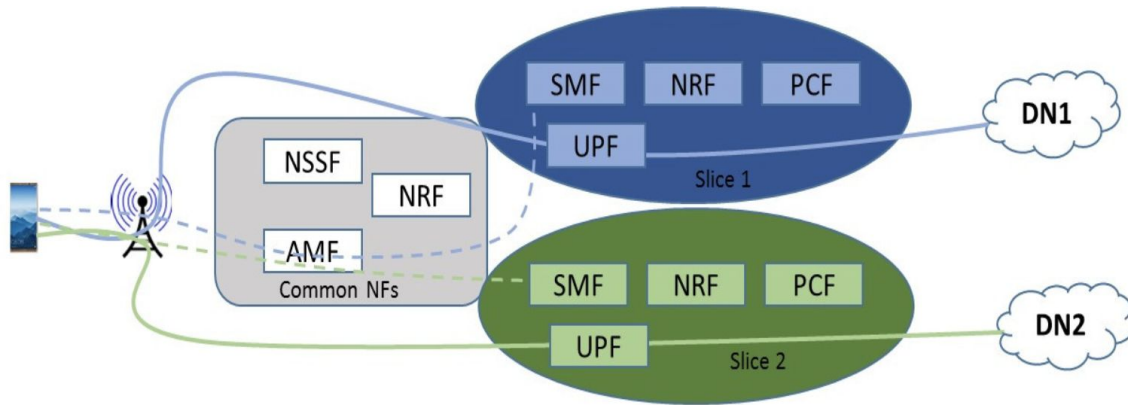


• ETSI MEC

Core Cloud



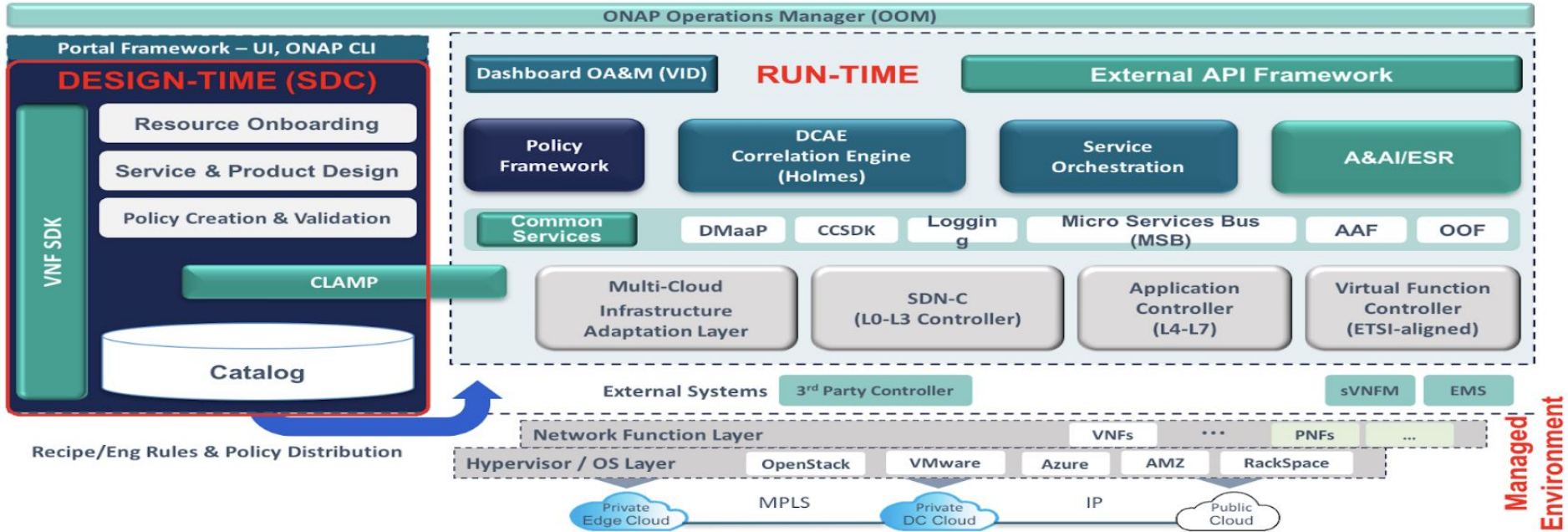
- Network Slicing is a type of Virtual Networking architecture that leverages SDN
- Network flexibility through partitioning of network resources
- Control plane and User plane separate is key to realize
- Instantiation of Network functions per slice is easily realized by microservices based Cloud Native Functions



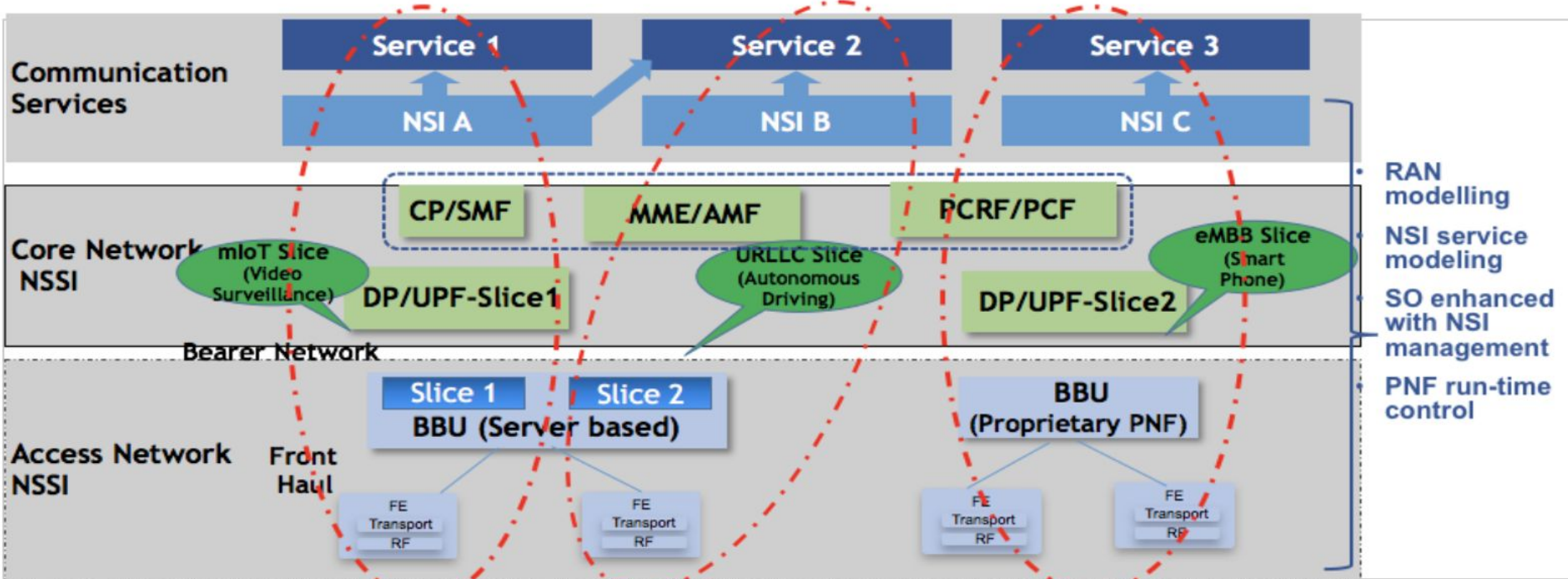


- Composability and Intent based network architecture needs an orchestrator
- 5G Orchestrator has the ability to manage end-to-end management of 5G network with help of network controllers.
- ONAP is becoming the industry recognized 5G Orchestrator
- ONAP leverages microservices architecture extensively

ONAP Architecture



ONAP Slice Manager

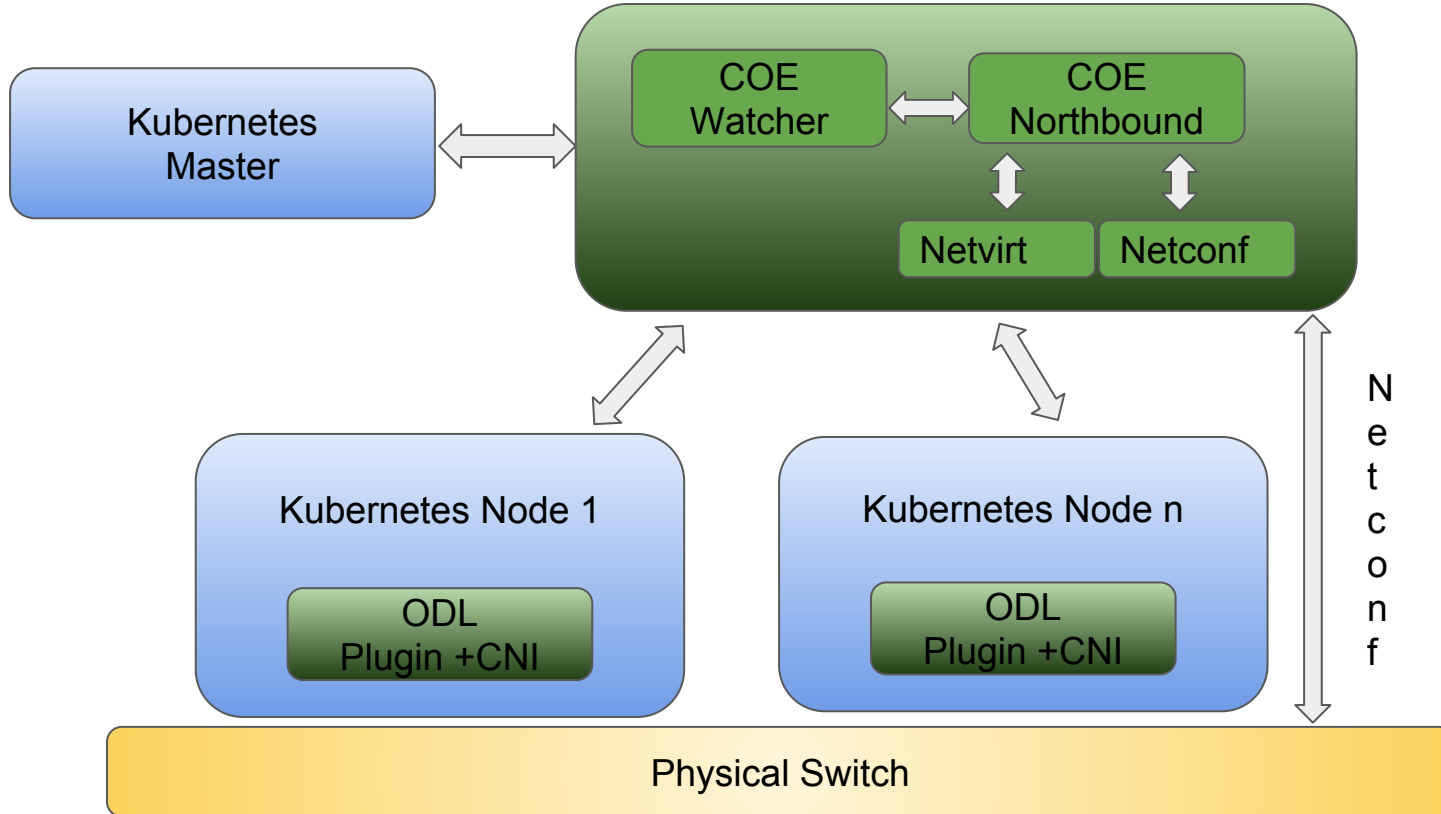


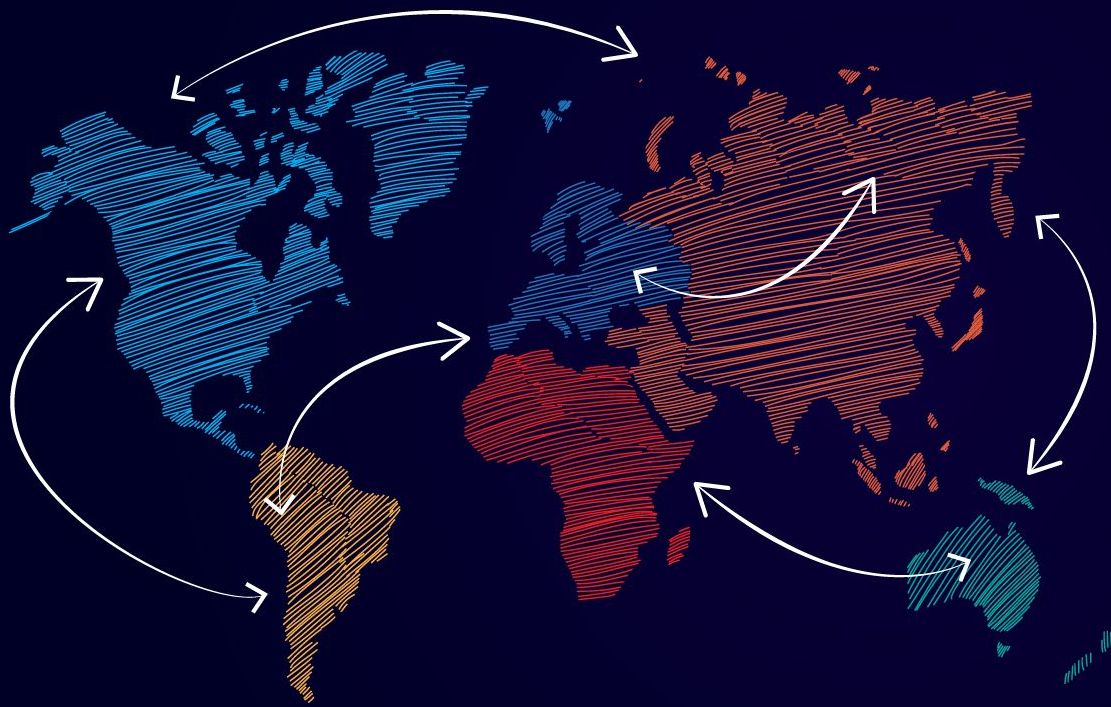
- Support CUPS; 4G/5G VNF/PNF are both fine as demo
- VNF/PNF co-exist; VM/Container/bare metal co-exist
- RRH, Front-haul, Bearer slicing will be consider later



- Opendaylight is the industry recognized SDN controller and it has become the default choice due to its features
- ODL COE can be leveraged to program the Edge cloud and Core cloud network that are built using microservices architecture
- In addition, ODL can be leveraged to program the Network Slices
- ONAP leverages ODL for SDN-C, APPC and SDN-R

Opendaylight COE





Q&A



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