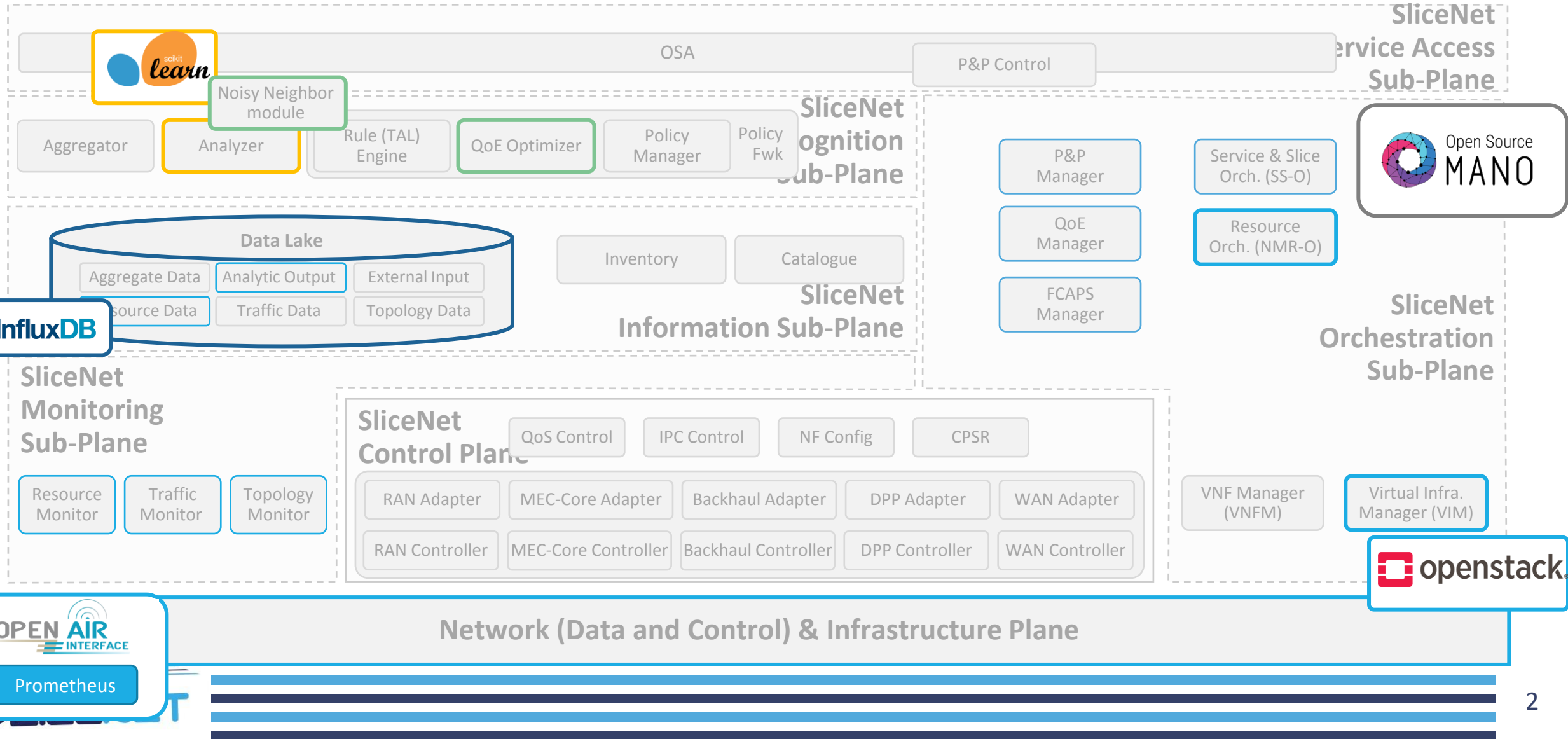# Slicenet 5G Slicing concepts

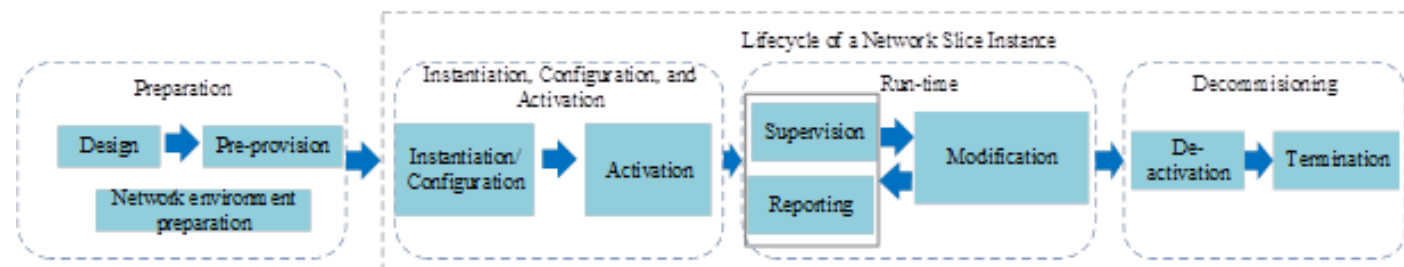**15th of July 2019**

slicenet.eu

Architecture Components

Use case

❑Network slicing definition

  ❑ framework for provisioning flexible, cost-efficient, scalable and tailored services in software-networking based 5G networks

  ❑"Vertical-In-The-Loop" approach

  ❑ network slicing is a paradigm where logical networks/partitions are created, with appropriate isolation, resources and optimized topology to serve a purpose or service category(mMTC; eMBB; URLCC)

❑Technical use-cases requirements

  ❑slice creation,

  ❑slice configuration,

  ❑slice FCAPS management,

  ❑Self-Optimized Network (SON) applied to Slices,

  ❑multi-domain slicing,

  ❑customization of slice management exposure (Plug&Play)

  ❑cognition-based slice management

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Lifecycle of a Network Slice Instance

Preparation — Design → Pre-provision — Network environment preparation

Instantiation, Configuration, and Activation — Instantiation/Configuration → Activation

Run-time — Supervision → Modification ← Reporting

Decommisioning — De-activation → Termination

Slice Instances Roles& Responsabilities

- Create Network Slice Instance with (shared) Network Slice Subnet Instance
- Create end-to-end NSI across multiple network segments
- Network Slice Instance Activation
- NSI FCAPS management
- Configuration management supporting network slice
- Network Slice Instance Change Capacity(OSA or cognitive ordered)
- Slice specific information configuration for CN
- Accounting for Slice Instance
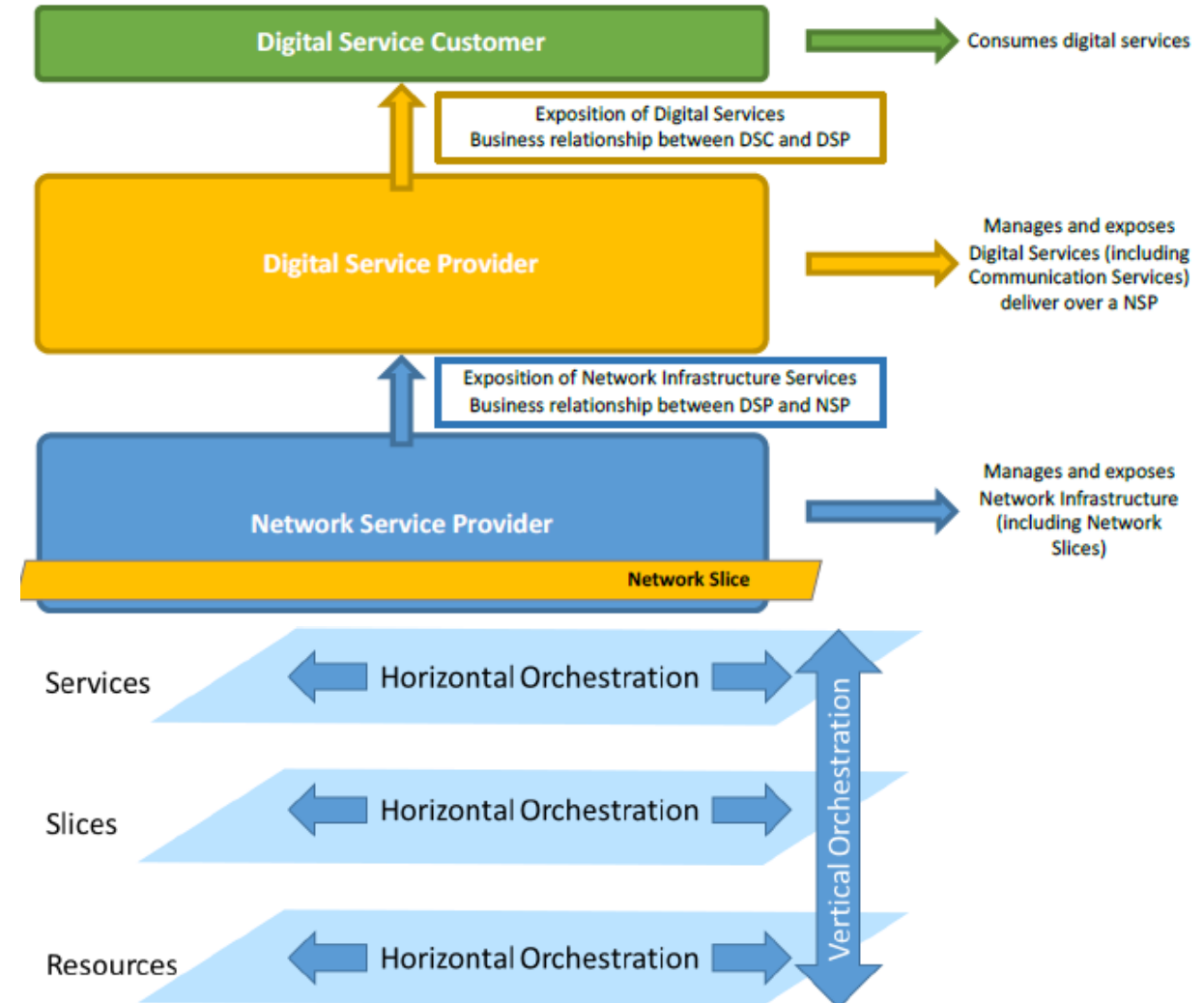
Slicing Information model

- ❑ 3G-PPP Information model diagram
  - ❑ Service-Slice-Network Service-Resources
  - ❑ Service Level
  - ❑ Service Slice-Level
  - ❑ Slice-Resource Level

- ❑ SliceNet Slice Template
  - ❑ Slice Type
  - ❑ Endpoints
  - ❑ Mobility features
  - ❑ Security features
  - ❑ Network performance
  - ❑ Priority levels
  - ❑ P&P features
  - ❑ P&P view: Service Level; Slice Level
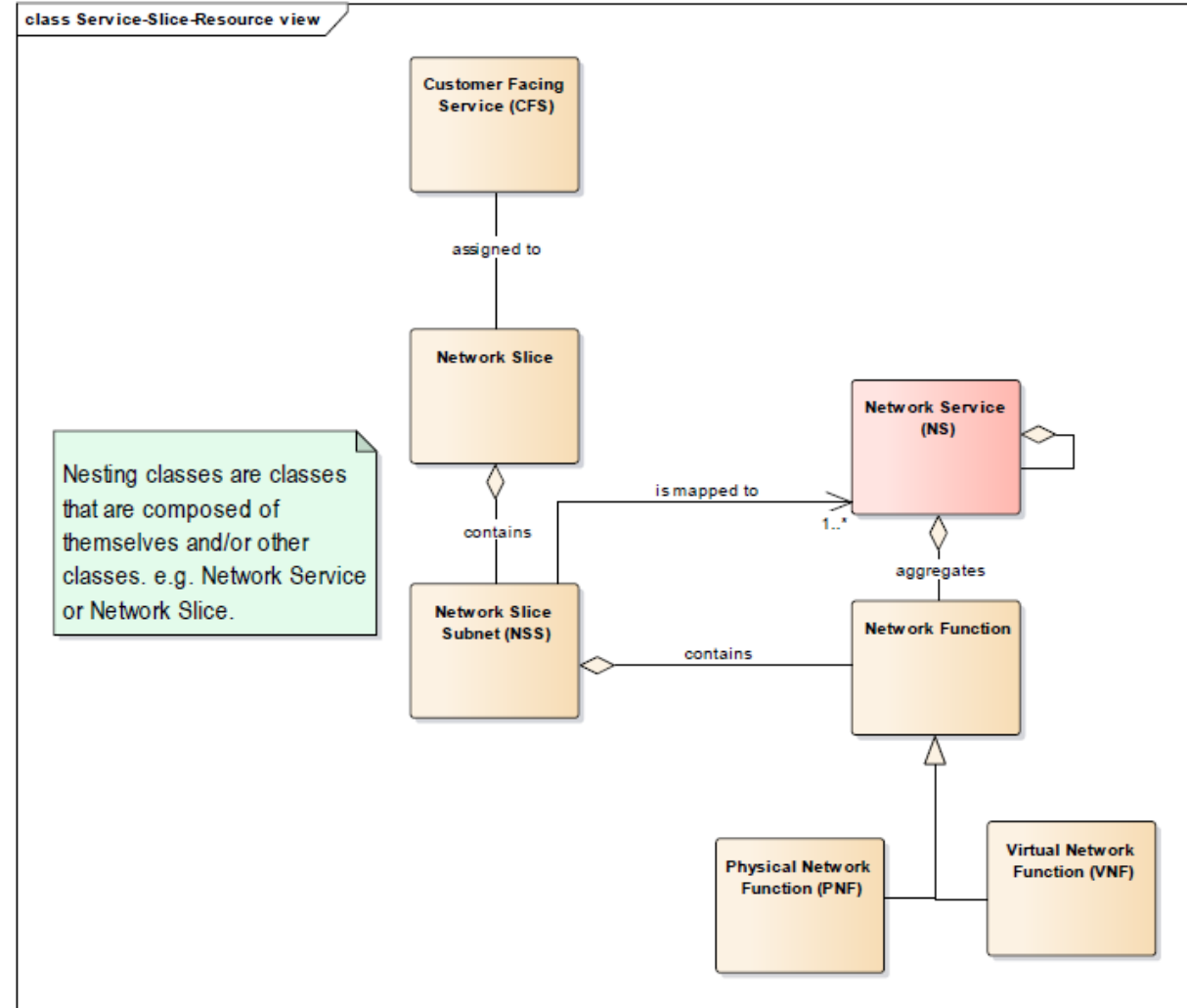
Slicing related concepts

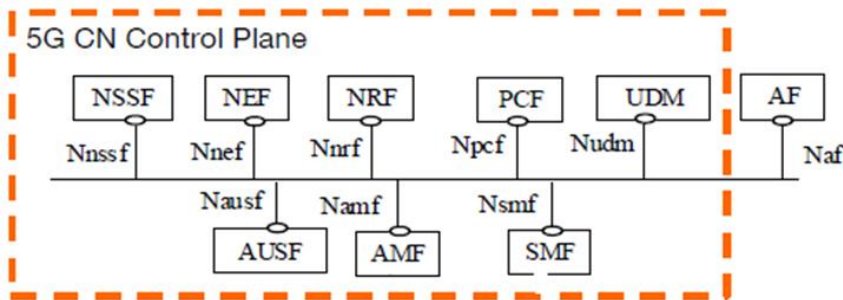| Concept |
|---------|
| URLLC |
| eMBB |
| mMTC |
| Slice Service Type(SST) |
| Customer Facing Service (CFS) |
| Customer Facing Service Instance (CFSI) |
| Customer Facing Service Template (CFST) |

Concept
Network Slice(NS)
Network Slice Template(NST)
Network Slice Instance (NSI)
Network Slice Subnet (NSS)
Network Slice Subnet Instance (NSSI)
Network Slice Subnet Template (NSST)
Network Function (NF)

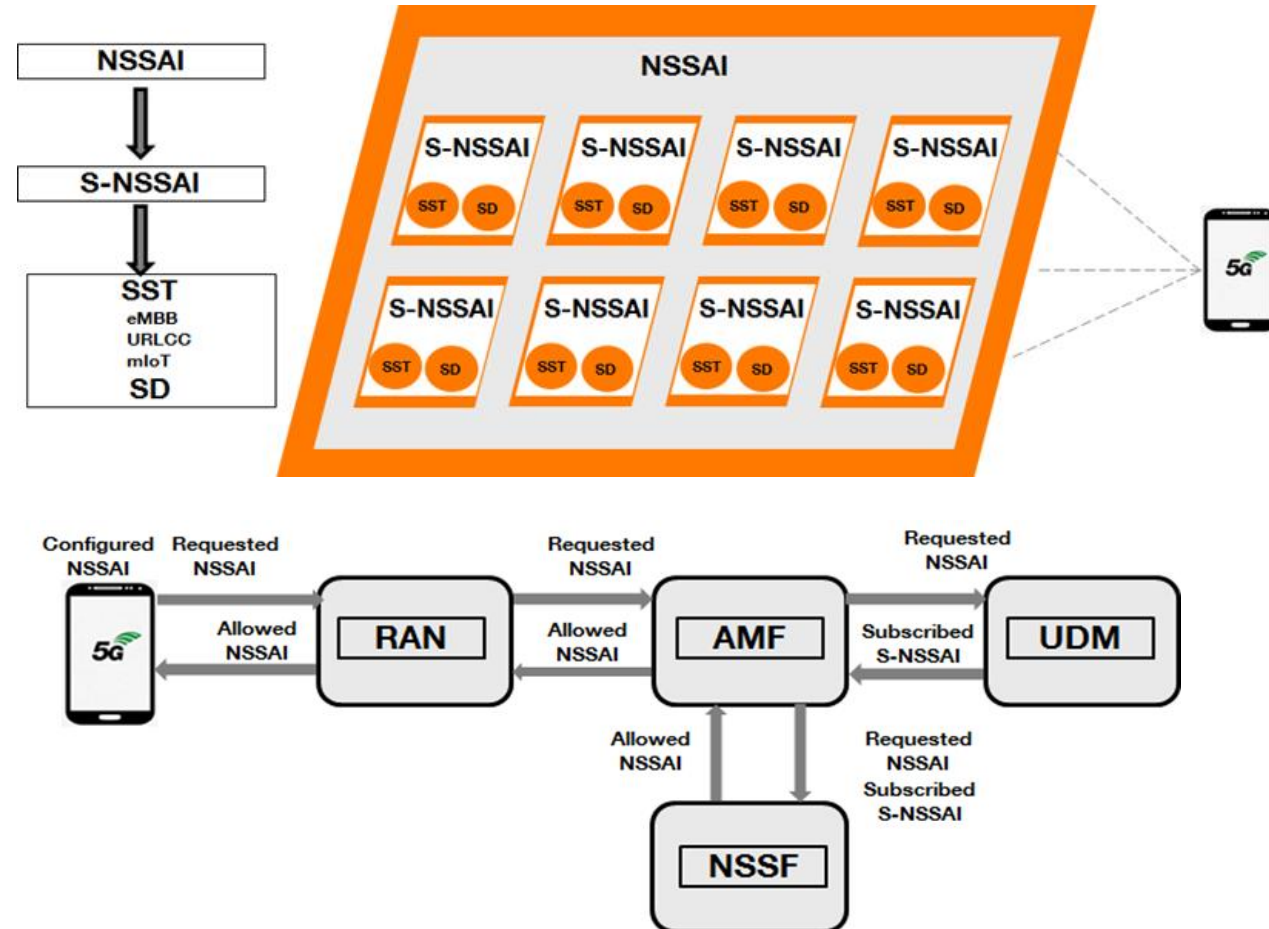❑based on the TMF, 3GPP and ETSI definitions: 3GPP 23.501; 3GPP 28.530; 3GPP 28801

Core Network Slicing

4G LTE

- **Multi-Operator Core Network (MOCN, TS 23.251 [11]):** Multiple operators jointly use eNodeBs and connect them to their (non-shared) core networks

- **Dedicated Core Network (DECOR, TR 23.707 [12]):** The Home Subscriber Server (HSS) contains an additional field "usage type". It is possible to define multiple CNs to be used for certain usages, thus leading to specialized CNs for special needs.

- **Enhanced Dedicated Core Network (eDECOR, TR 23.711 [13]):** This requires UE signaling to route to the correct CN and thus UE interaction is required

- APNs based slicing

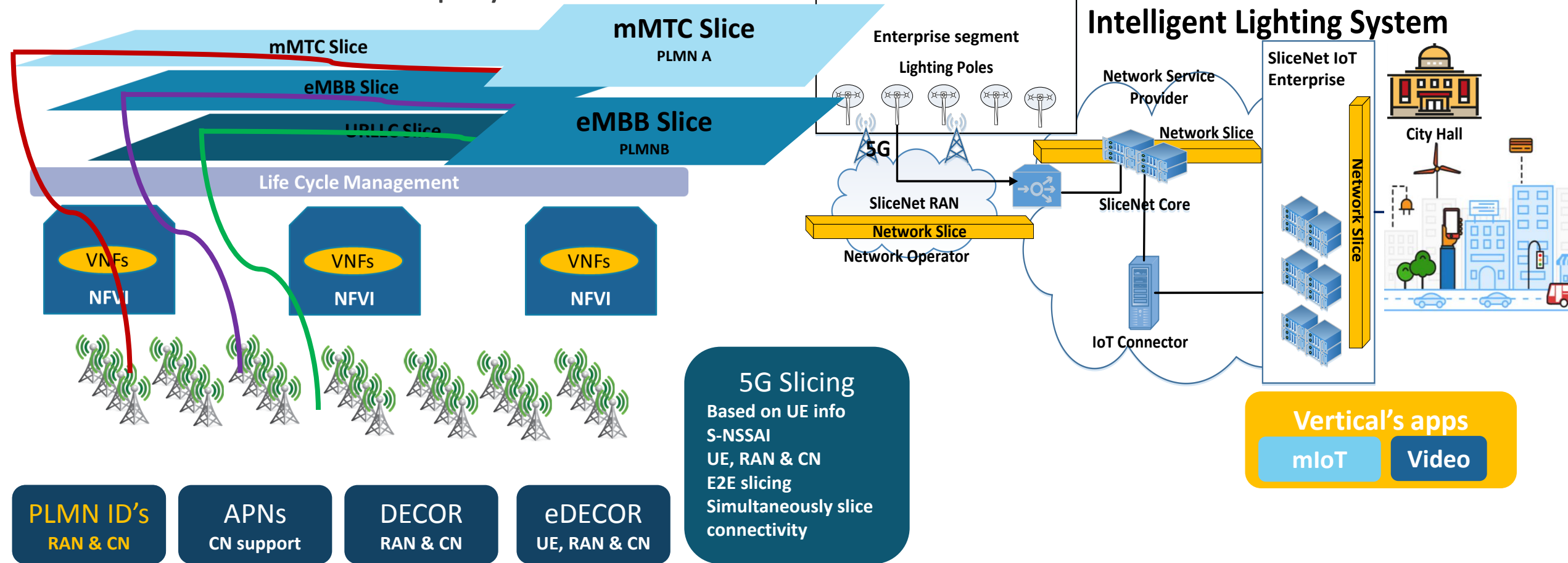- S1-FLEX connect two or more core networks of multiple operators

5G - 3GPP TS 23.501

5G slicing use-case implementation

□ E2E "network slice" deployment

mMTC Slice
PLMN A

mMTC Slice

eMBB Slice

URLLC Slice

eMBB Slice
PLMNB

Life Cycle Management

VNFs
NFVI

VNFs
NFVI

VNFs
NFVI

Smart City

Intelligent Lighting System

Enterprise segment

Lighting Poles

5G

SliceNet RAN

Network Slice

Network Operator

Network Service Provider

Network Slice

SliceNet Core

SliceNet IoT Enterprise

Network Slice

City Hall

IoT Connector

5G Slicing
Based on UE info
S-NSSAI
UE, RAN & CN
E2E slicing
Simultaneously slice connectivity

Vertical's apps

mIoT | Video

PLMN ID's
RAN & CN

APNs
CN support

DECOR
RAN & CN

eDECOR
UE, RAN & CN

Orange IaaS architecture

- Virtualized network Infrastructure(IaaS)

- Openstack model

- Network management resource orchestrator(OSM) integration

- Open RAN and Core deployed(openairinterface)

- Software tools and apps developed by SliceNet:
  - QoE Optimier; P&P; QoE measurements
  - CPSR; Adaptors
  - Policy Framework

- CICD approach, gitlab repository
  - https://gitlab.com/slicenet

- Microservices based components

Use Case Prototyping

Use case deployment scenario

□ Infras...

□ Deplo...r each NF, distri...d storage: 1

b...

□ C plmn_list...

□
□

□ OSM5...

□ FlexR...

```
5071FFB700 DEBUG MME-AP src/mme_app/mme[INFO][APP] - sent new configuration to BS 10001:      Status| Added since las
5071FFB700 DEBUG MME-AP src/mme_app/mme "dl": [                                          |      |            0 |
                                            {
```

```
// Tracking area code, 0x0000 and 0xfffe are reserved values
tracking_area_code = 1;

plmn_list = ( { mcc = 901; mnc = 70; mnc_length = 2; },
              { mcc = 208; mnc = 93; mnc_length = 2; }
            );

tr_s_preference     = "local_mac"
```
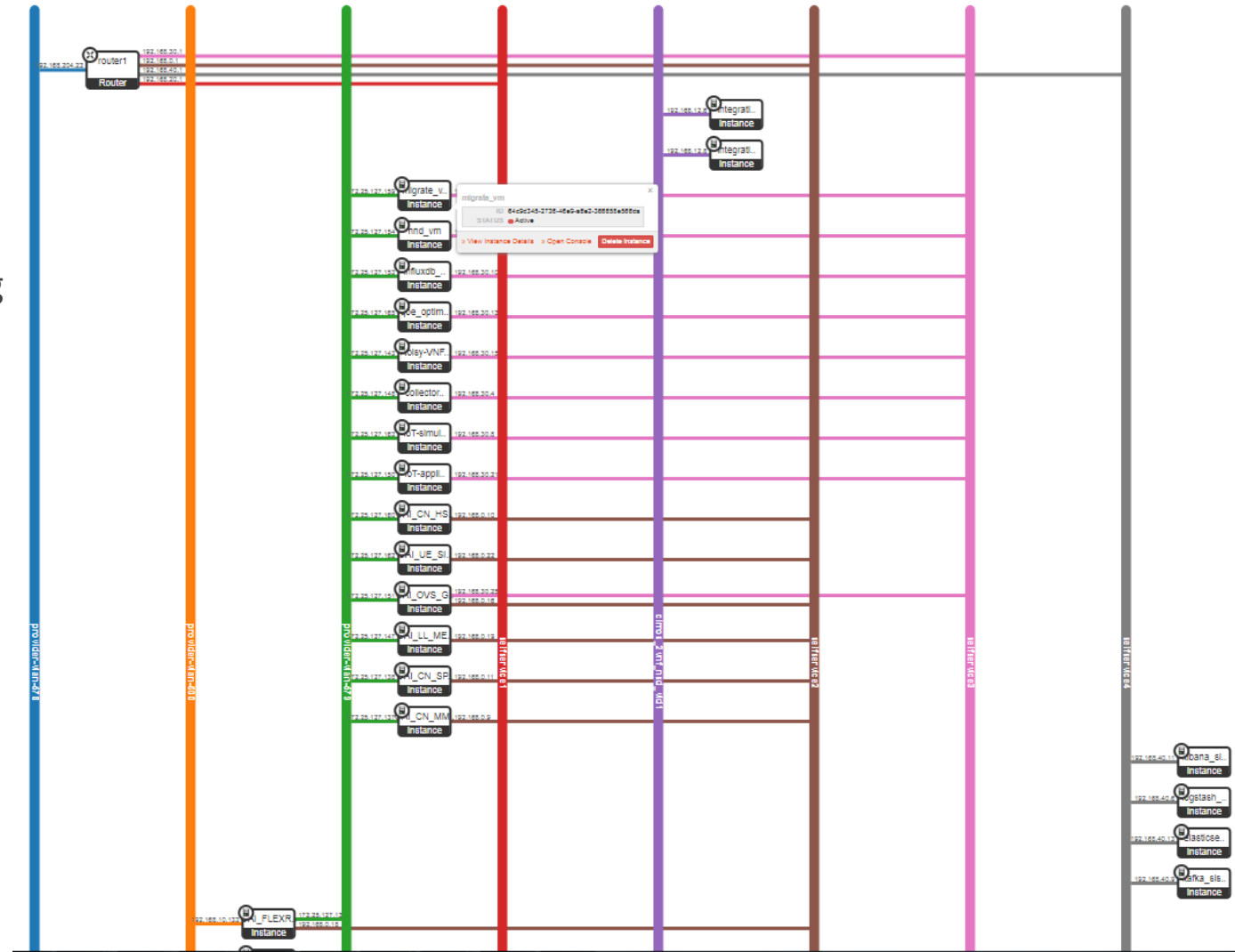
```
/////////// MME parameters:
                              #Address of the oaimme2
mme_ip_address        = ( { ipv4      = "172.25.127.146";
                            ipv6      = "192:168:30::17";
                            active    = "yes";
                            preference = "ipv4";
                            broadcast_plmn_index = [0];
                          },
                          #Address of the oaimme3
                          { ipv4      = "172.25.127.139";
                            ipv6      = "192:168:30::17";
                            active    = "yes";
                            preference = "ipv4";
                            broadcast_plmn_index = [1,0];
                          }
                        );
```
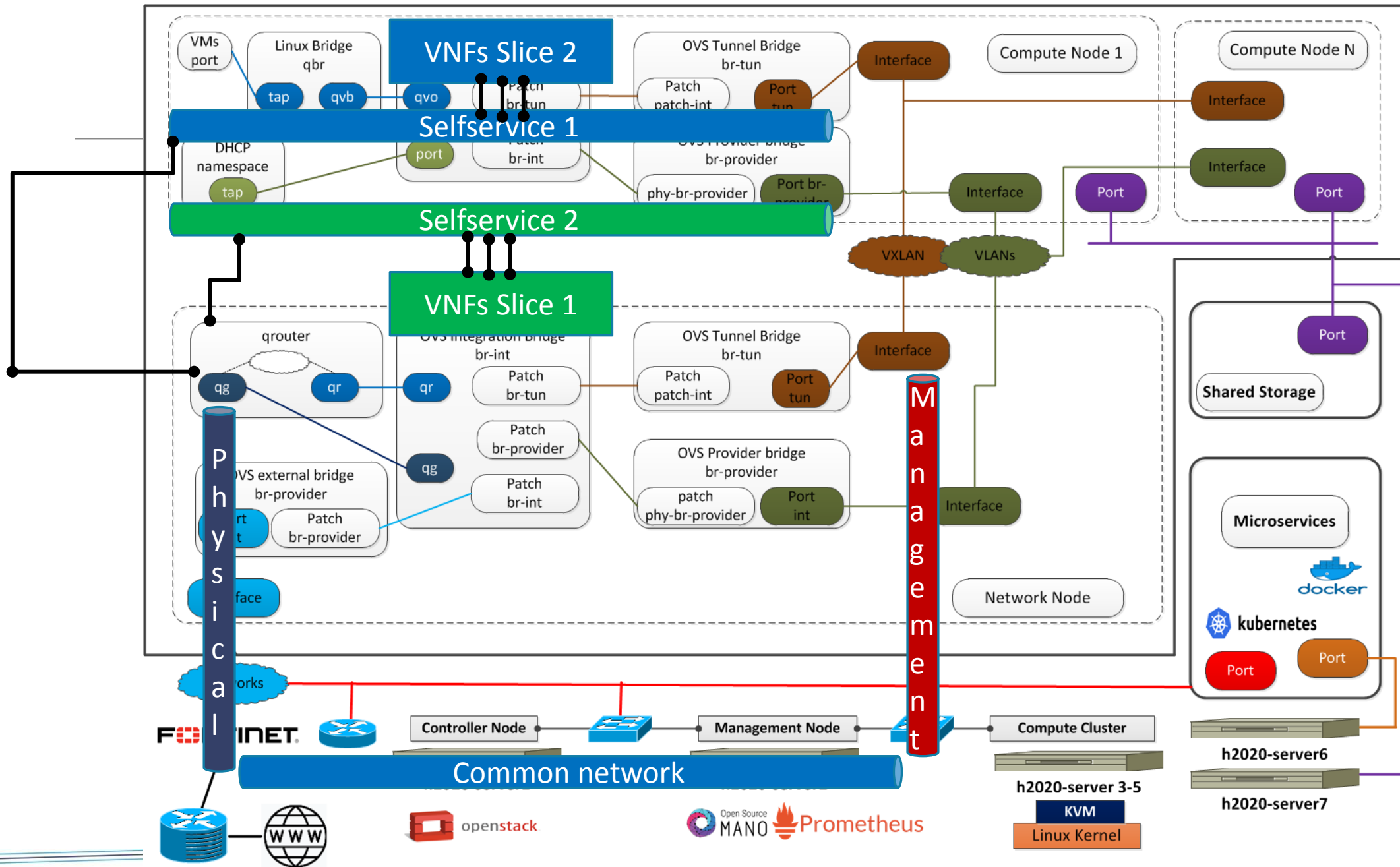
```
                                      "isolation": false,
                                      "maxmcs": 28
[FLEXRAN_AGENT]     [0] update intraslice_share_ac
[FLEXRAN_AGENT]     [0] update interslice_share_ac
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][DL slice 0] update percent
==                [FLEXRAN_AGENT]     [0] Creating DL slice with ID
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][DL slice 3] update label:
                  [FLEXRAN_AGENT]     [0][DL slice 3] update percent
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][DL slice 3] update priority: 0 -> 10
|                 [FLEXRAN_AGENT]     [0][DL slice 3] update position_high: 0 -> 25
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][DL slice 3] update maxmcs: 0 -> 28
|                 [FLEXRAN_AGENT]     [0][DL slice 3] update sorting array
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][DL slice 3] update scheduler: (null) -> schedule_ue_spec
|                 [FLEXRAN_AGENT]     [0][UL slice 0] update percentage: 100 -> 60
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0] Creating UL slice with ID 3, taking default values from UL slice 0
|                 [FLEXRAN_AGENT]     [0][UL slice 3] update label: 0 -> 2
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][UL slice 3] update percentage: 0 -> 40
                  [FLEXRAN_AGENT]     [0][UL slice 3] update first_rb: 0 -> 15
04517FA700 DEBUG M[FLEXRAN_AGENT]     [0][UL slice 3] update maxmcs: 0 -> 20
                  [FLEXRAN_AGENT]     [0][UL slice 3] update scheduler: (null) -> schedule_ulsch_rnti
                  [FLEXRAN_AGENT]     [0] slice configuration: applied 14 changes
```

SLICENET

NSI deployment

- ❑ CP & UP deployed in Openstack

- ❑ NSD contains both CP & DP VNFs

- ❑ Each VNF has specific management interface, within the management plane cfg

- ❑ VXLAN use only for bridge-tune interface, interconnecting VNFs deployed on different compute nodes

- ❑ OVS & DPP

- ❑ Orchestration Components:
  - ❑ NMRO – OSM
  - ❑ Service & Slice – NMRO(NXT) – to be integrated

- ❑ Services Bluprint: SmartCity; eHealth & Smart Grid

- ❑ FCAPS components

Thank you!