Future network transformation 5G cloud architectures

Marius Iordache

18 June 2018

SliceNet Project

SliceNet: End-to-End Cognitive Network Slicing and Slice Management Framework in Virtualised Multi-Domain, Multi-Tenant 5G Networks

Design, prototype and demonstrate an innovative, verticals-oriented, QoE-driven 5G network slicing framework focusing on cognitive network management and control for end-to-end slicing operation and slice-based/enabled services across multiple operator domains in SDN/NFV-enabled 5G networks

SliceNet Consortium

SliceNet Main Objectives

1. Achieve an innovative, cognitive, integrated 'one-stop shop' 5G slice management framework for vertical businesses and co-designed by vertical sectors

2. Enable extensible, end-to-end slice FCAPS management across multiple planes and operator domains

3. Establish cognitive, agile QoE management of slices for service assurance of vertical businesses

4. Empower orchestration for cross-plane coordination of management, control, service and data planes to achieve system-level slicing control and slice operation
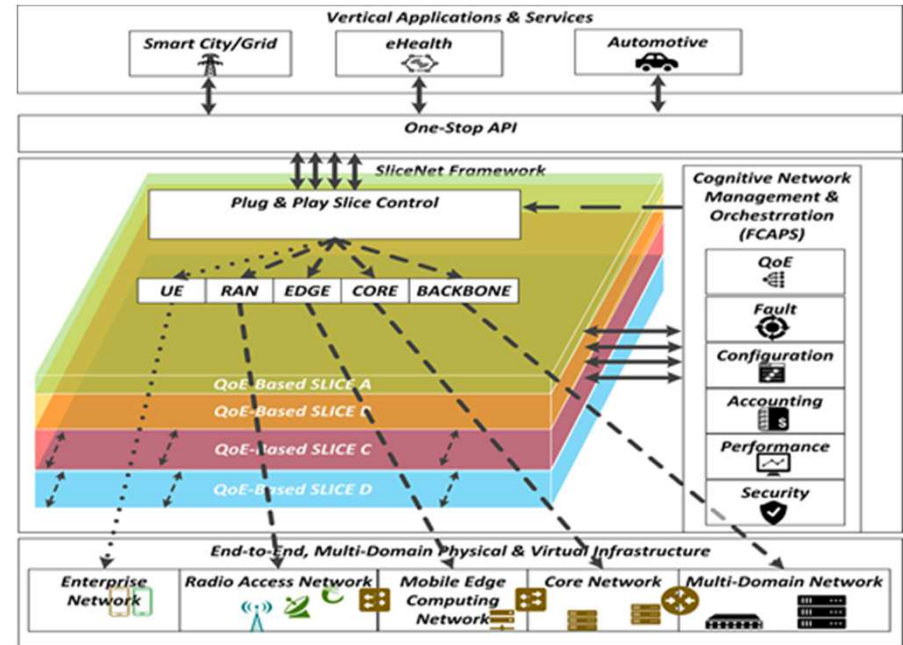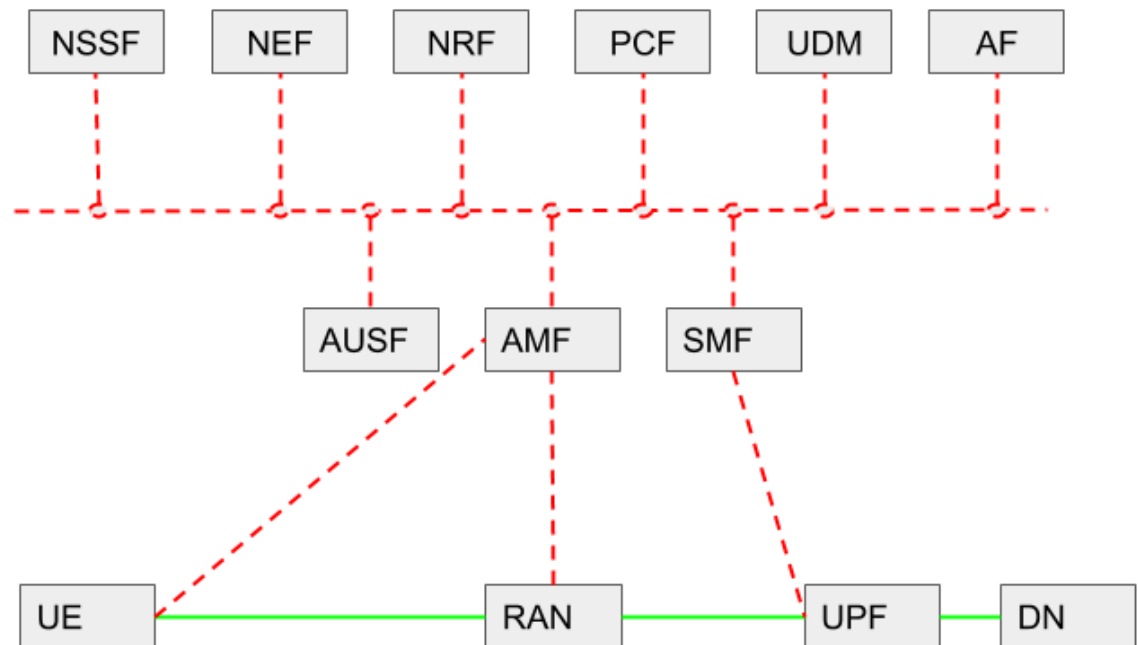
5G Core Network Functions
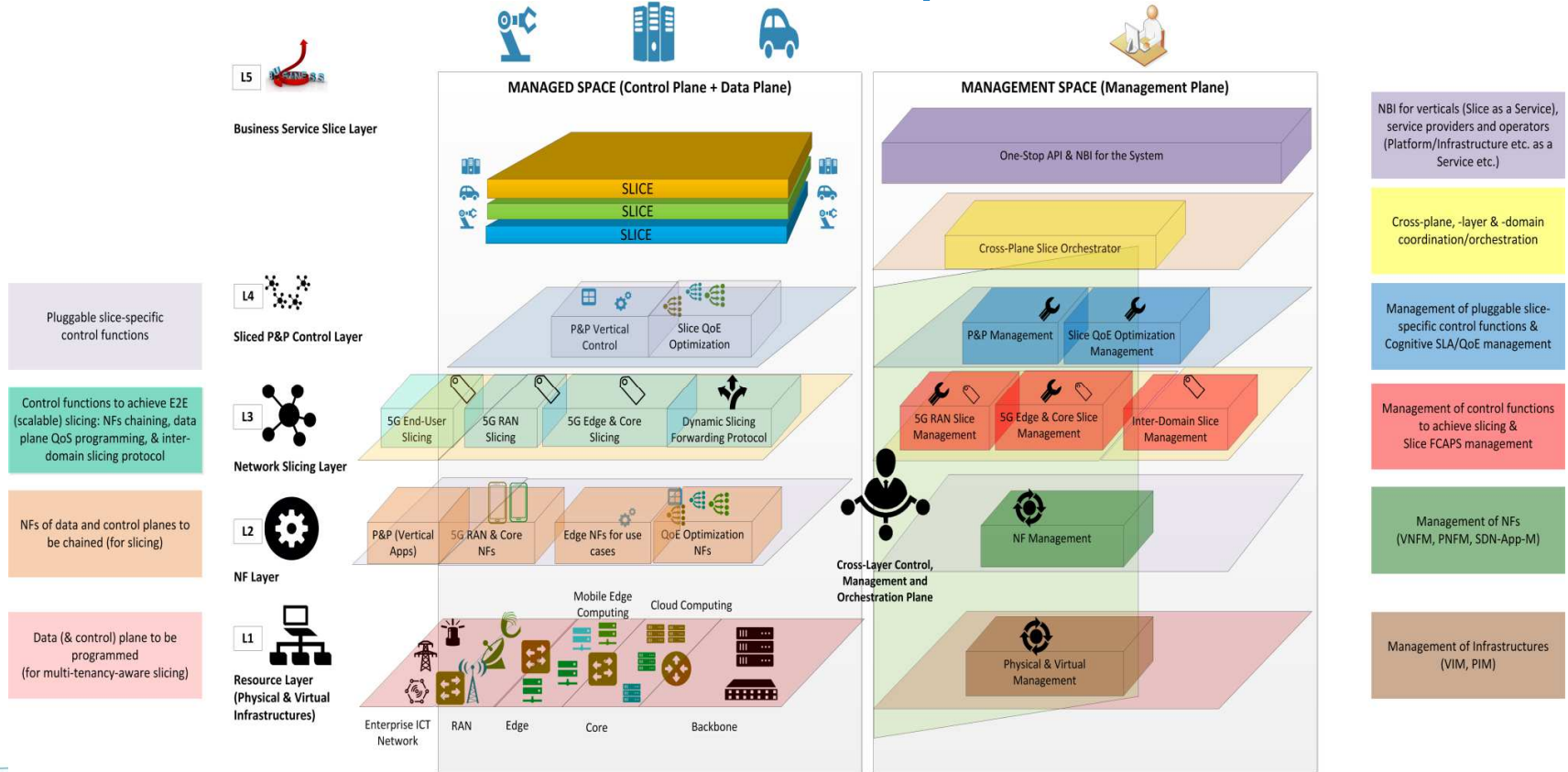
1. Service Based Architecture
   - Management Plane & Control Plane
   - Disassociated through architecture

2. ETSI NFV
   - Dynamic LCM of slices

SliceNet Architectural Layers

MANAGED SPACE (Control Plane + Data Plane)

MANAGEMENT SPACE (Management Plane)

L5 — Business Service Slice Layer

SLICE
SLICE
SLICE

One-Stop API & NBI for the System

NBI for verticals (Slice as a Service), service providers and operators (Platform/Infrastructure etc. as a Service etc.)

L4 — Sliced P&P Control Layer

Pluggable slice-specific control functions

P&P Vertical Control — Slice QoE Optimization

Cross-Plane Slice Orchestrator

P&P Management — Slice QoE Optimization Management

Cross-plane, -layer & -domain coordination/orchestration

Management of pluggable slice-specific control functions & Cognitive SLA/QoE management

L3 — Network Slicing Layer

Control functions to achieve E2E (scalable) slicing: NFs chaining, data plane QoS programming, & inter-domain slicing protocol

5G End-User Slicing — 5G RAN Slicing — 5G Edge & Core Slicing — Dynamic Slicing Forwarding Protocol

5G RAN Slice Management — 5G Edge & Core Slice Management — Inter-Domain Slice Management

Management of control functions to achieve slicing & Slice FCAPS management

L2 — NF Layer

NFs of data and control planes to be chained (for slicing)

P&P (Vertical Apps) — 5G RAN & Core NFs — Edge NFs for use cases — QoE Optimization NFs

NF Management

Management of NFs (VNFM, PNFM, SDN-App-M)

L1 — Resource Layer (Physical & Virtual Infrastructures)

Data (& control) plane to be programmed (for multi-tenancy-aware slicing)

Mobile Edge Computing — Cloud Computing

Enterprise ICT Network — RAN — Edge — Core — Backbone

Cross-Layer Control, Management and Orchestration Plane

Physical & Virtual Management

Management of Infrastructures (VIM, PIM)
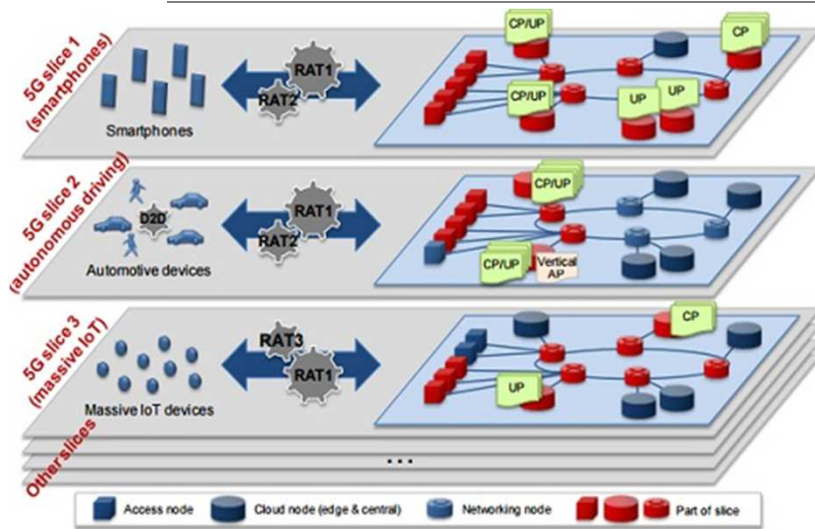
SLICENET

SliceNet Overall Architecture

1. Structured architecture:
   - Management Plane
   - Control Plane
   - Data Plane

2. Layer separation
   - Service Layer
   - Slice Layer
   - Resources Layer

3. Cognition, Automation management and control

4. Vertical friendly architecture
   - P&P Control
   - QoE/SLA Optimization
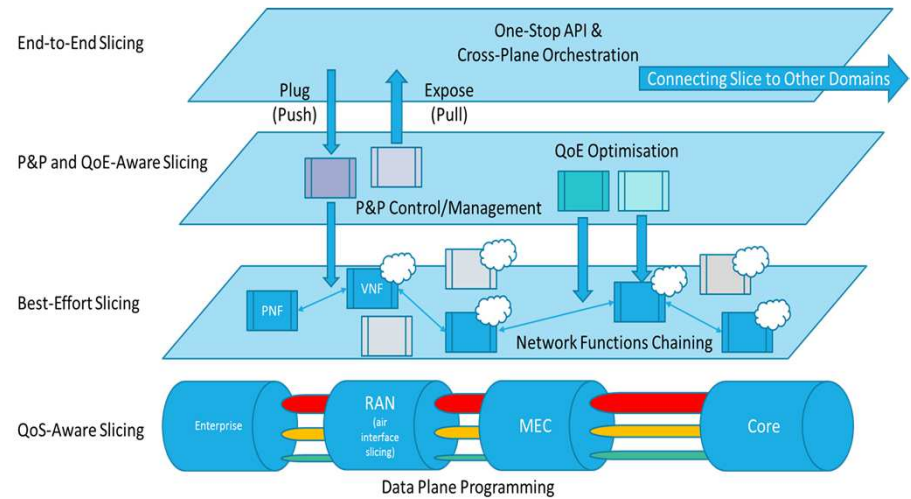   - Network Slicing
   - One-Stop-API for verticals
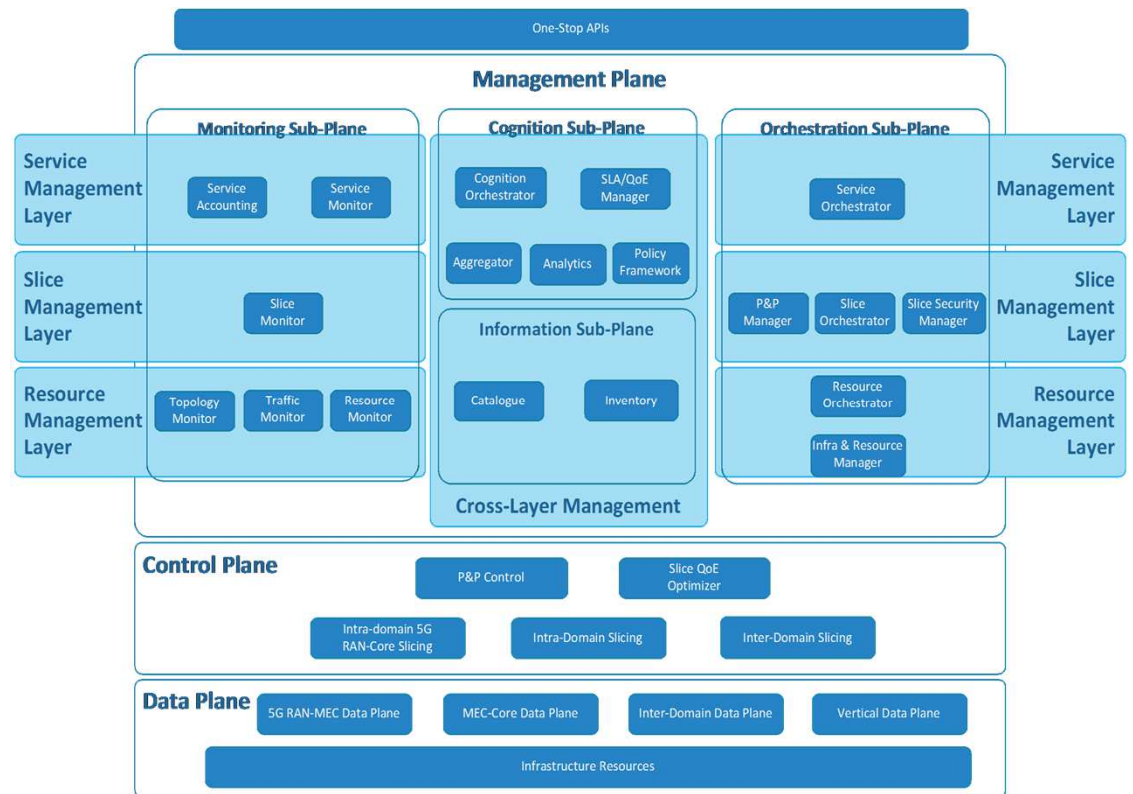
SliceNet network slicing

NGMN

SliceNet

Challenges:
- network slices over same physical infrastructure
- slices types: eMBB; uRLCC; mIoT; FWA; Critical communication
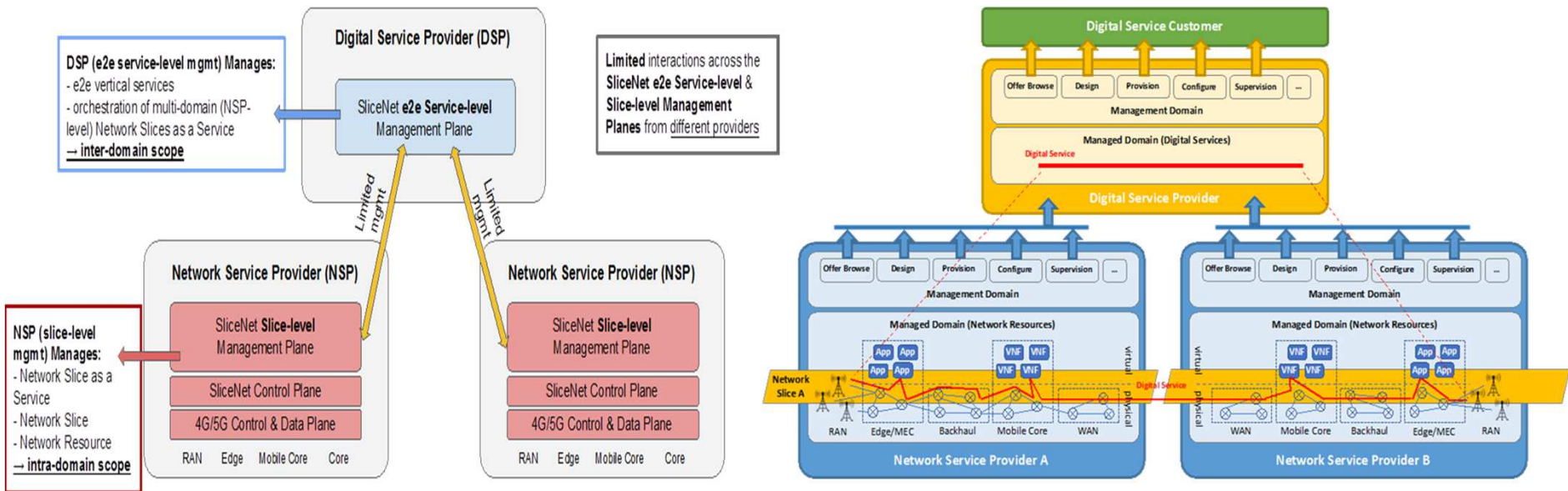- verticals in the loop
- cloud-native telco apps

Approaches:
- Service Based Architecture Components
- 5G ready applications

Management architectures and roles

DSP (e2e service-level mgmt) Manages:
- e2e vertical services
- orchestration of multi-domain (NSP-level) Network Slices as a Service
→ inter-domain scope

Digital Service Provider (DSP)

SliceNet e2e Service-level Management Plane

Limited interactions across the SliceNet e2e Service-level & Slice-level Management Planes from different providers

Limited mgmt

NSP (slice-level mgmt) Manages:
- Network Slice as a Service
- Network Slice
- Network Resource
→ intra-domain scope

Network Service Provider (NSP)

SliceNet Slice-level Management Plane

SliceNet Control Plane

4G/5G Control & Data Plane

RAN Edge Mobile Core Core

Network Service Provider (NSP)

SliceNet Slice-level Management Plane

SliceNet Control Plane

4G/5G Control & Data Plane

RAN Edge Mobile Core Core

Digital Service Customer

Offer Browse Design Provision Configure Supervision ...

Management Domain

Managed Domain (Digital Services)

Digital Service

Digital Service Provider

Offer Browse Design Provision Configure Supervision ...

Management Domain

Managed Domain (Network Resources)

App App VNF VNF App App
App App VNF VNF App App

virtual

physical

Network Slice A

RAN Edge/MEC Backhaul Mobile Core WAN

Network Service Provider A

Offer Browse Design Provision Configure Supervision ...

Management Domain

Managed Domain (Network Resources)

VNF VNF App App
VNF VNF App App

virtual

physical

Digital Service

WAN Mobile Core Backhaul Edge/MEC RAN

Network Service Provider B

SLICENET

SliceNet Management and Managed Spaces

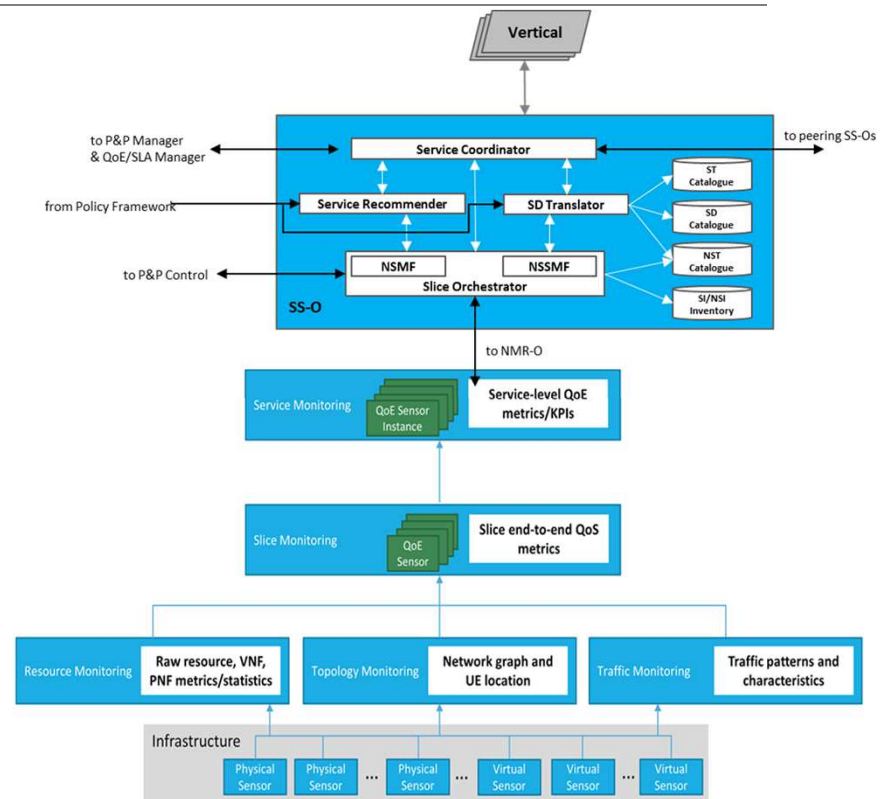| Management Space (Management Plane)	Managed Space (Control Plane and Data Plane)
APIs and NBI for the system NBI for verticals (Slice as a Service, IaaS, PaaS) **Cross-Plane Slice Orchestrator** Cross-plane layer and domain coordination/orchestration **P&P and Slice QoE Optimization Management** The management of specific control functions & cognitive SLA/QoE **5G RAN Slice, Edge & Core, Inter-domain management** Management of control functions including FCAPS management **Management of NFs** VNFM, PNFM, SDN-app **Management of Infrastructure** VIM,PIM	**Business Service Layer** **Plug & Play Vertical Control & Slice QoE Optimization** L4, Slice specific control Functions **Slicing – End User; RAN; Edge & Core, Dynamic** L3 Control functions to achieve E2E slicing: chaining, QoS programming, inter-domain slicing **Vertical Apps, 5G RAN and Core NFs, QoE optimization** L2 NF layer, chaining NF (control plane) **Enterprise, MEC, Core, Cloud computing** L1 Resources Layer, programmability RAN, Edge, Core, Backbone **Cross-Layer Control, Management and Orchestration Plane**

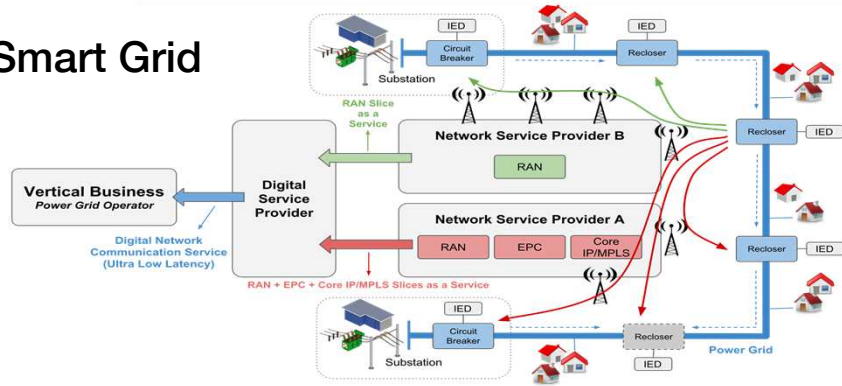# SliceNet key elements
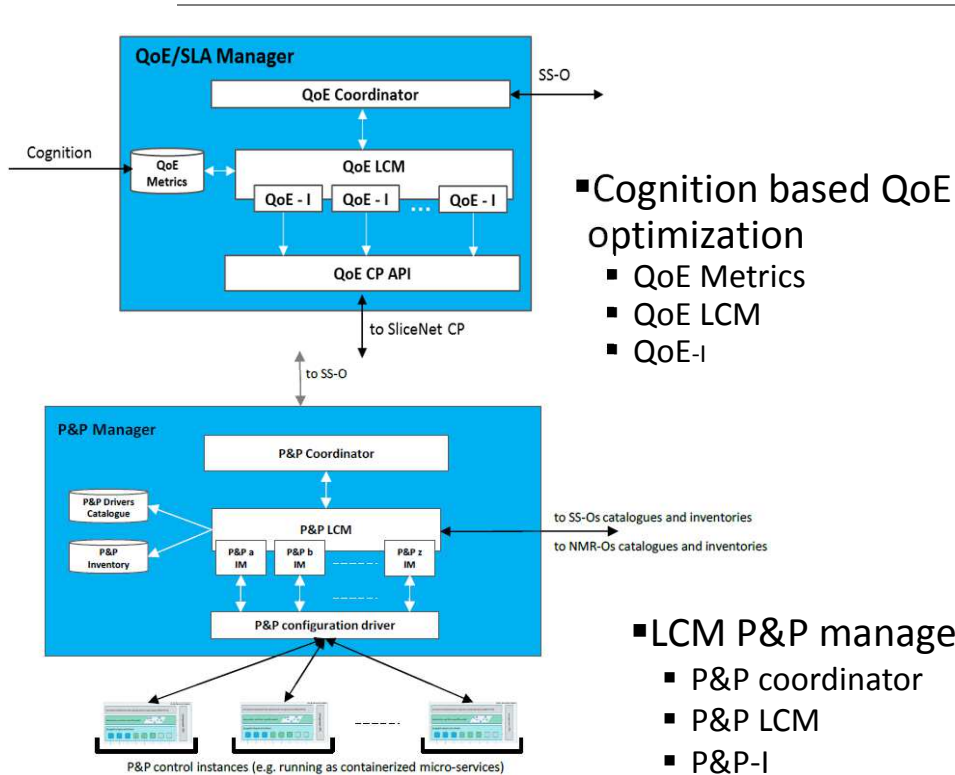
- Cognition based QoE optimization
  - QoE Metrics
  - QoE LCM
  - QoE-I

- LCM P&P manager
  - P&P coordinator
  - P&P LCM
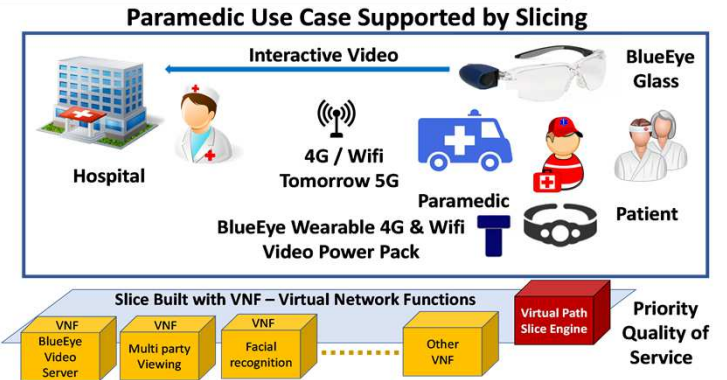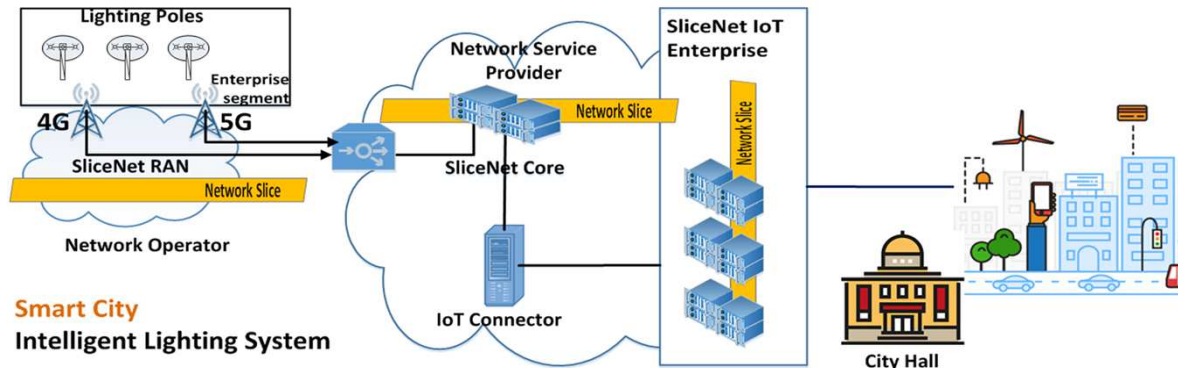 - P&P-I

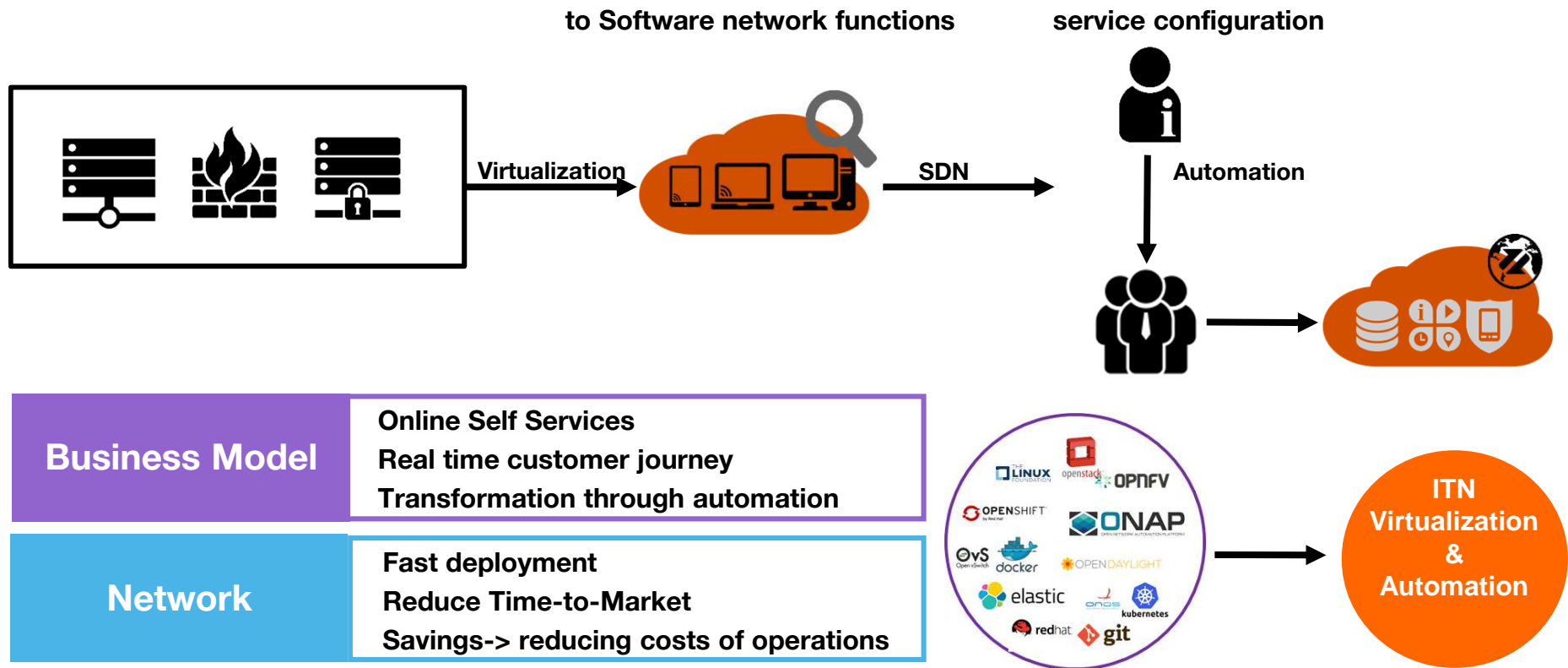# SliceNet Use Cases

Smart Grid

e-Health

Smart City

Telco transformation

to Software network functions

service configuration

Virtualization

SDN

Automation

Business Model	Online Self Services
	Real time customer journey
	Transformation through automation

Network	Fast deployment
	Reduce Time-to-Market
	Savings-> reducing costs of operations

THE LINUX FOUNDATION
openstack
OPNFV
OPENSHIFT by Red Hat
ONAP
OvS Open vSwitch
docker
OPENDAYLIGHT
elastic
onos
kubernetes
redhat
git

**ITN
Virtualization
&
Automation**

Telco cloud-native transformation

3GPP SBA for 5G systems

Virtualization & Softwarization & Cloudification
> SDN/NFV, physical box to functions and protocols to APIs

Telco E2E development paradigm to DevOps

Microservices & containerization adoption

Should follow the start-up approach for adopting cloud-native transformation
> to preserve competitiveness
>
> to innovate

Orange RO R&D Activities

4.5G MultiPath TCP

Thank you