



SliceNet Webinar

“ System Integration and Demonstration ”

GEORGIOS TSIOURIS, OTE

DATE: 5 MAY 2020

TIME: 11:00 CET

slicenet.eu



Introduction: Webinar Purpose, Presenter

- ❑ SliceNet System integration, validation and demonstrating the features of the Framework by using three diverse use case demonstrators

- ❑ Presenter:

- ❑ Georgios Tsiouris, Technology Labs & Testing, OTE



Agenda

- Introduction
- Requirements & Challenges
- Technical approach for System Integration
- SliceNet Framework Validation
- Use Case Demonstrations
- Questions

Project Aim & Objectives

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

Objective 1: 'One-stop shop' 5G slice management framework for vertical businesses

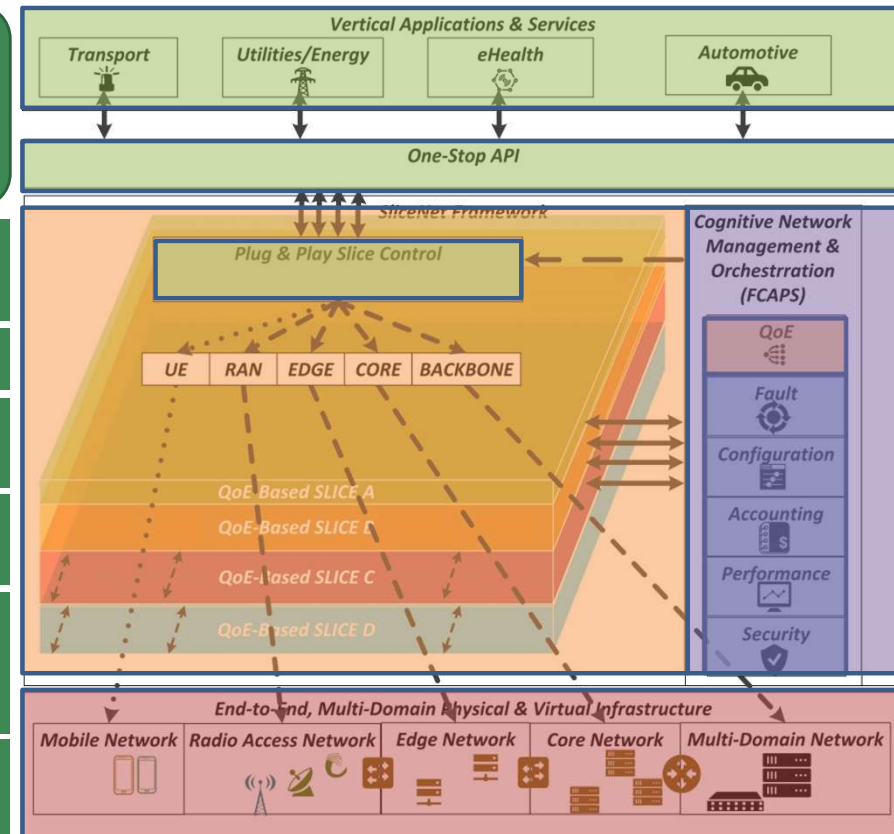
Objective 2: End-to-end slice FCAPS management across planes and domains

Objective 3: Cognitive, agile QoE management of slices for service assurance of vertical businesses

Objective 4: Slicing-friendly infrastructure, provisioning and control of user-definable slices

Objective 5: Orchestration for cross-plane coordination of management, control, service and data planes to achieve system-level slicing control and slice operation

Objective 6: Demonstration of slice-based/enabled, diverse 5G use cases for verticals



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Requirements and challenges

- ❑ Integrate the SliceNet Framework
 - ❑ Bring together a diverse number of partners with different technology backgrounds
 - ❑ Deliver the SliceNet Framework to the Use Cases
- ❑ Demonstrate the key features of the Framework
- ❑ Build an integration environment
 - ❑ Independent of languages and tools used



Agenda

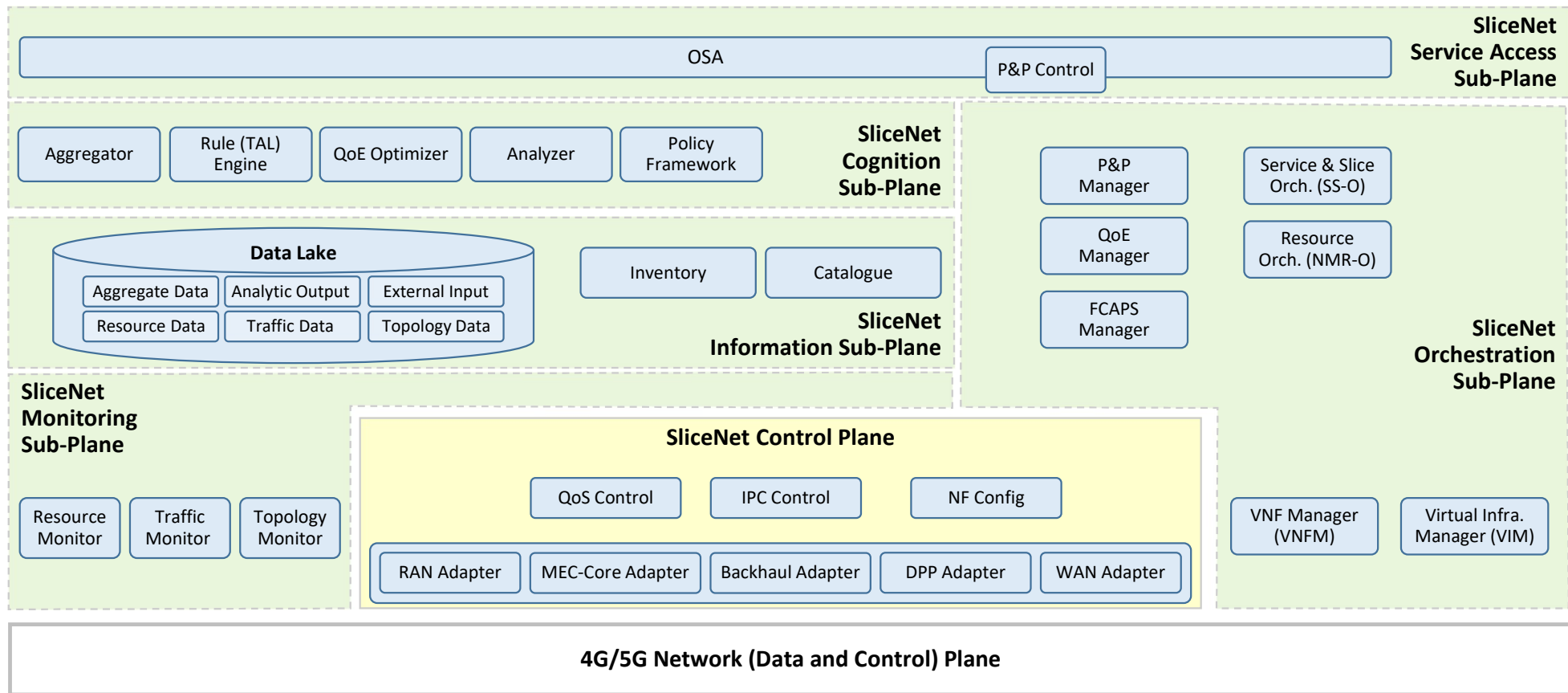
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Integration Roadmap

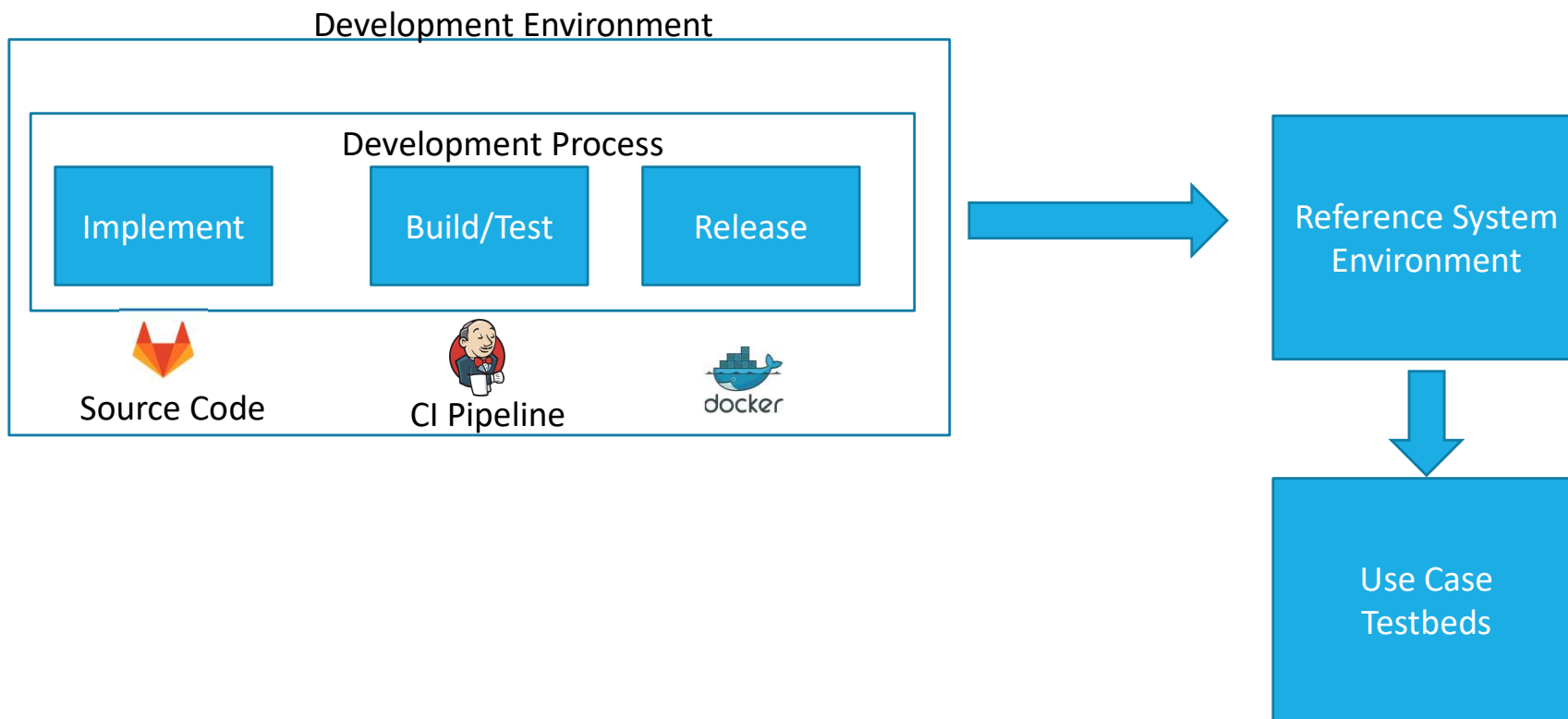
- ❑ The Integration was divided in three Iterations
 - ❑ Iteration I M18
 - ❑ Iteration II M24
 - ❑ Iteration III M33
- ❑ Integration followed a hybrid approach
 - ❑ Mostly bottom-up
 - ❑ Integration also happened in islets at different sub-planes
 - ❑ More versatile

SliceNet System Architecture

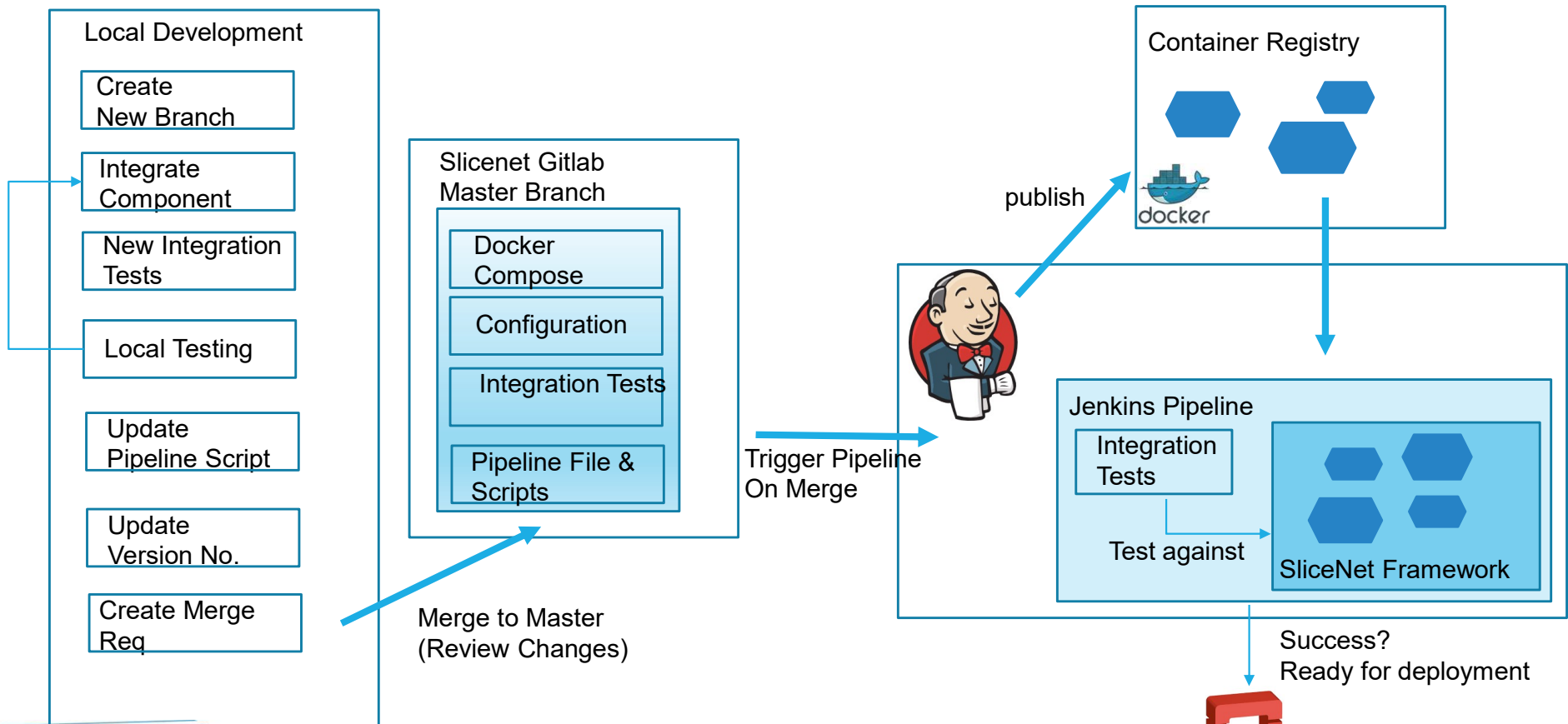
Overall



Development Environment



SliceNet platform development Process



Gitlab for source code management/container registry

- Gitlab.com/slicenet
 - Initial Gitlab for SliceNet
 - SliceNet group public
 - Publish SliceNet software to the community
 - Linked to our webpage
- Gitlab.slicenet.oteresearch.gr
 - Private Gitlab instance accessible through vpn
 - Used as a container registry for the testing environment and for the use case testbeds
 - Used to store jenkinsfiles for the Jenkins CI/CD pipeline
- Gitlab.eurecom.fr
 - The Gitlab instance of EURECOM used for OAI and mosaic5g software
 - Is part of the separate CI/CD environment of EURECOM
 - Used to publish SliceNet software to the community
 - Linked to the webpage



CI/CD Pipeline based on Jenkins

- ❑ Jenkins is used for the CI/CD pipeline
- ❑ Jenkins (not containerized) uses a local docker server to run development and testing tools within the Jenkins pipeline
- ❑ The developers have the flexibility to choose their preferred tools, versions and compilers without creating interdependencies between components
- ❑ The preferred method for the Jenkins CI/CD is the declarative pipeline which follows a Groovy like syntax

Lessons Learned

- Common CI/CD platform was not used to its full potential
 - Everyone has to learn it
 - Hard to adopt
 - Partners come from different backgrounds
- Common testing platform
 - Has to have all features for testing
 - Had to test all ML models
- Lessons Learned
 - Each partner use their own CI/CD env and use common container registry
 - Automate the software deployment from the container registry to the testing system
 - Consider using the most featured Use Case for testing

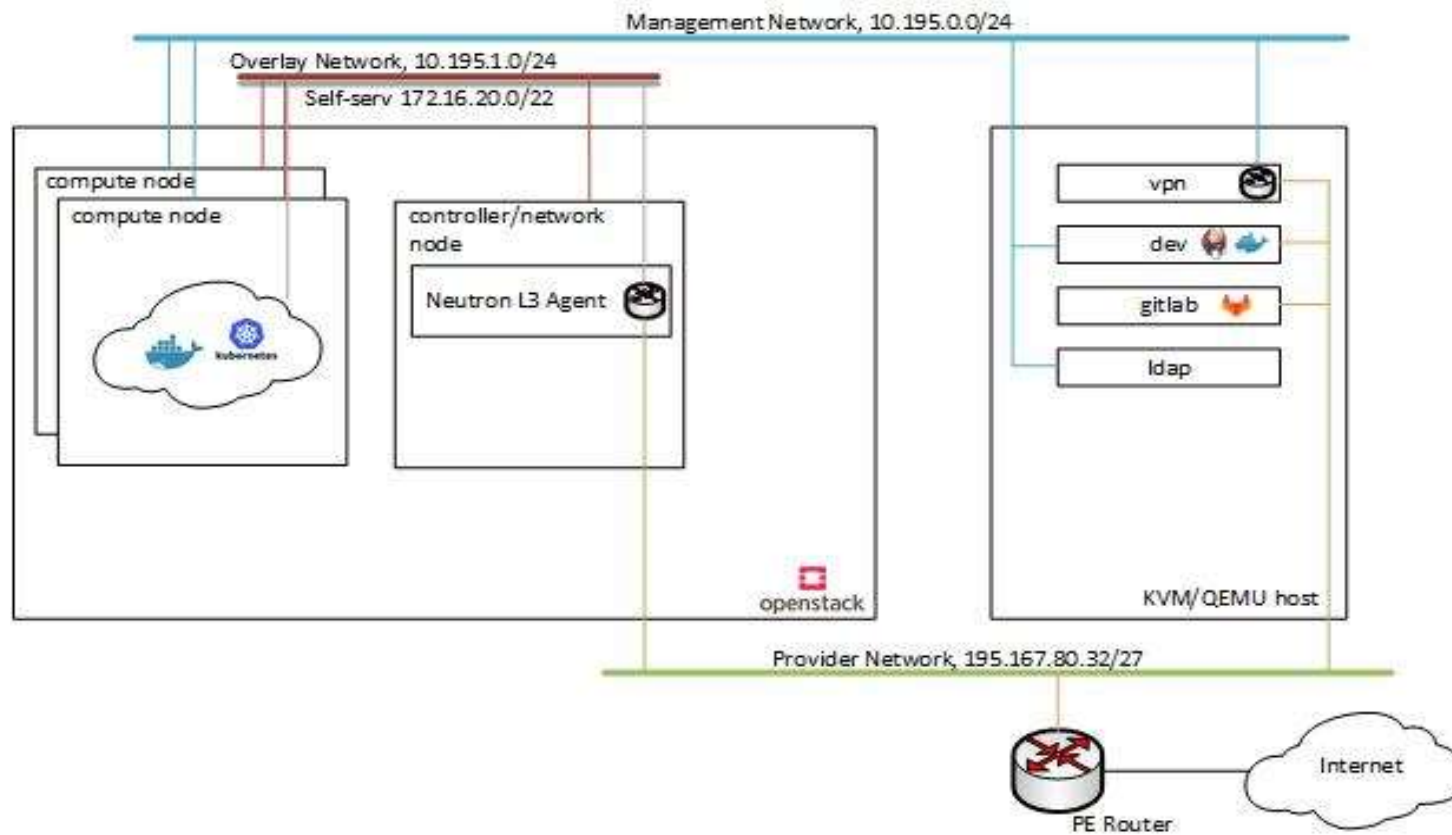
Questions ?



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Development, Integration and Validation Environment



Functional Framework Workflows

❑ Preparation Phase

- ❑ Network Service Provider (NSP) Network Slice Design, Onboard and Offer
- ❑ Digital Service Provider (DSP) E2E-Slice Design, Onboard and Offer

❑ Subscription Phase

- ❑ Service Slice subscription from the Verticals
- ❑ E2E Slice Resource Orchestration/Interactions between DSP & NSP for E2E slice provision
- ❑ E2E Slice Decommissioning

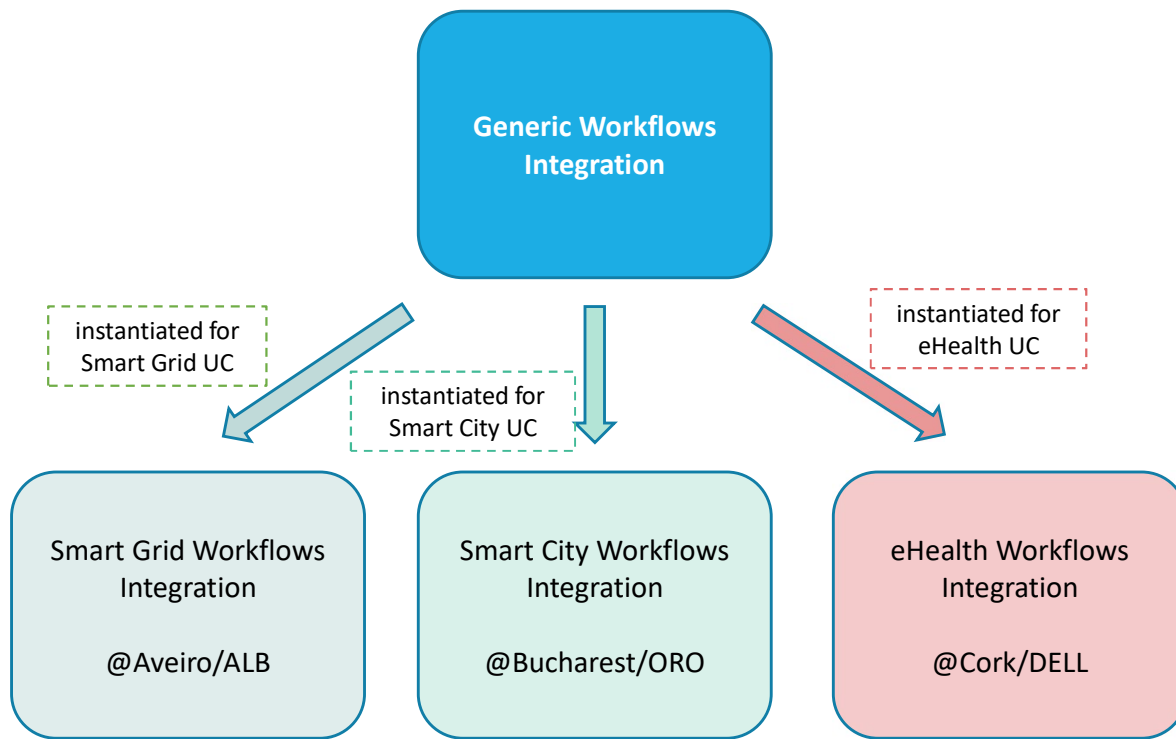
❑ Monitoring (@Run-Time) Phase

- ❑ NSP, Network Slice Monitoring
- ❑ DSP, E2E Service/Slice Monitoring
- ❑ Vertical, E2E Service/Slice Monitoring
- ❑ Vertical, E2E Service/Slice QoE Feedback

❑ Cognition (@Run-Time) Phase

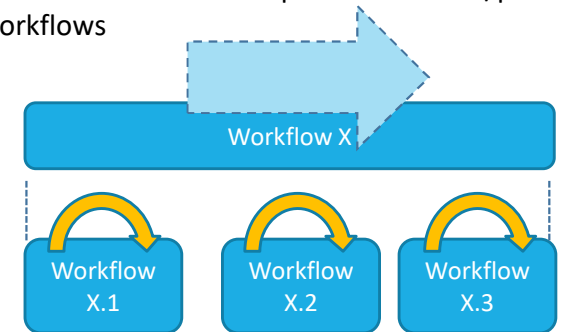
- ❑ AI/ML models algorithm training
- ❑ AI/ML models deployment
- ❑ Real-time prediction/recommendation
- ❑ E2E Slice & NSs Optimization

Use-Cases Integration Approach



Approach:

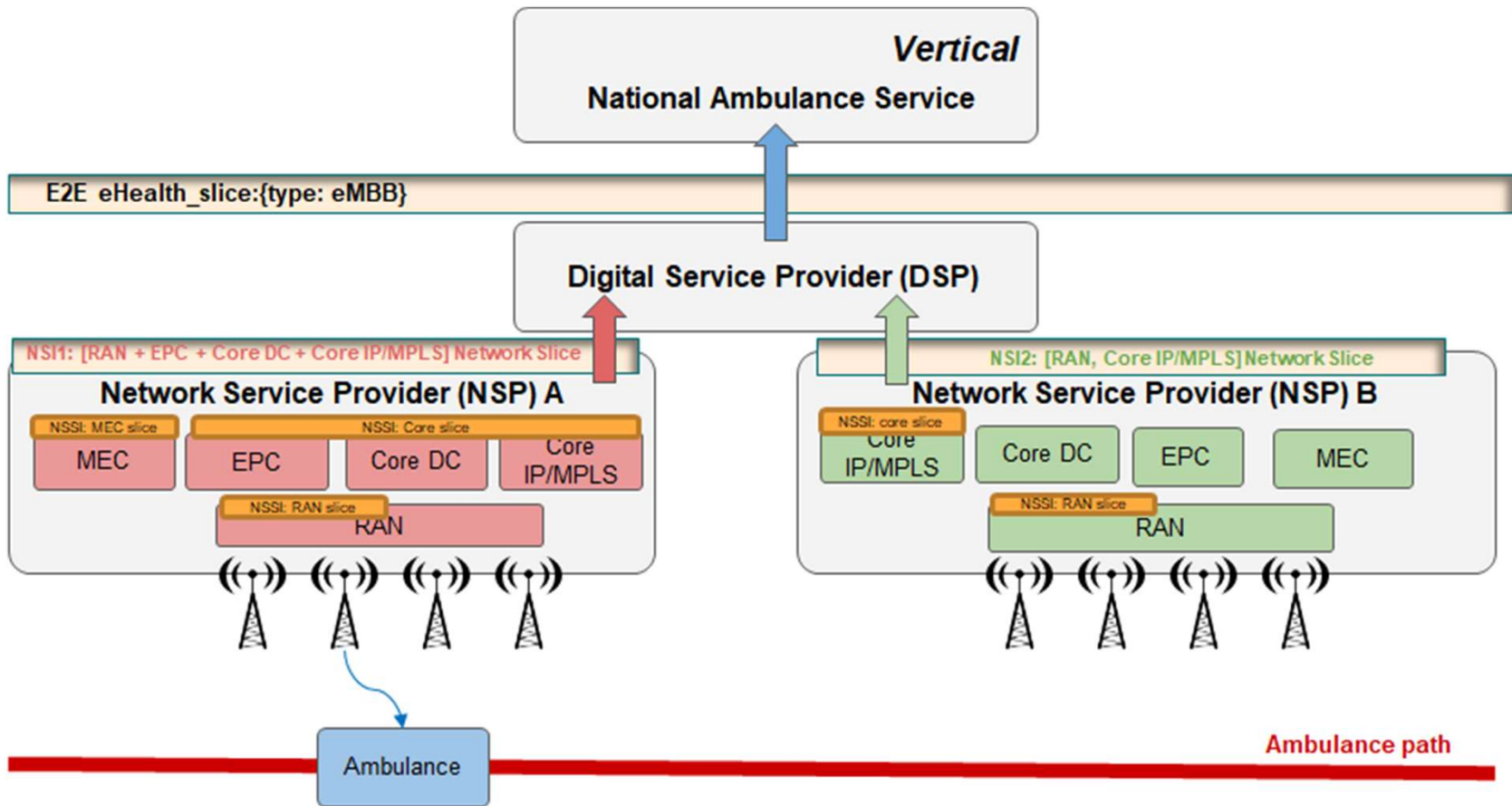
1. Workflows are decomposed in smaller/partial workflows



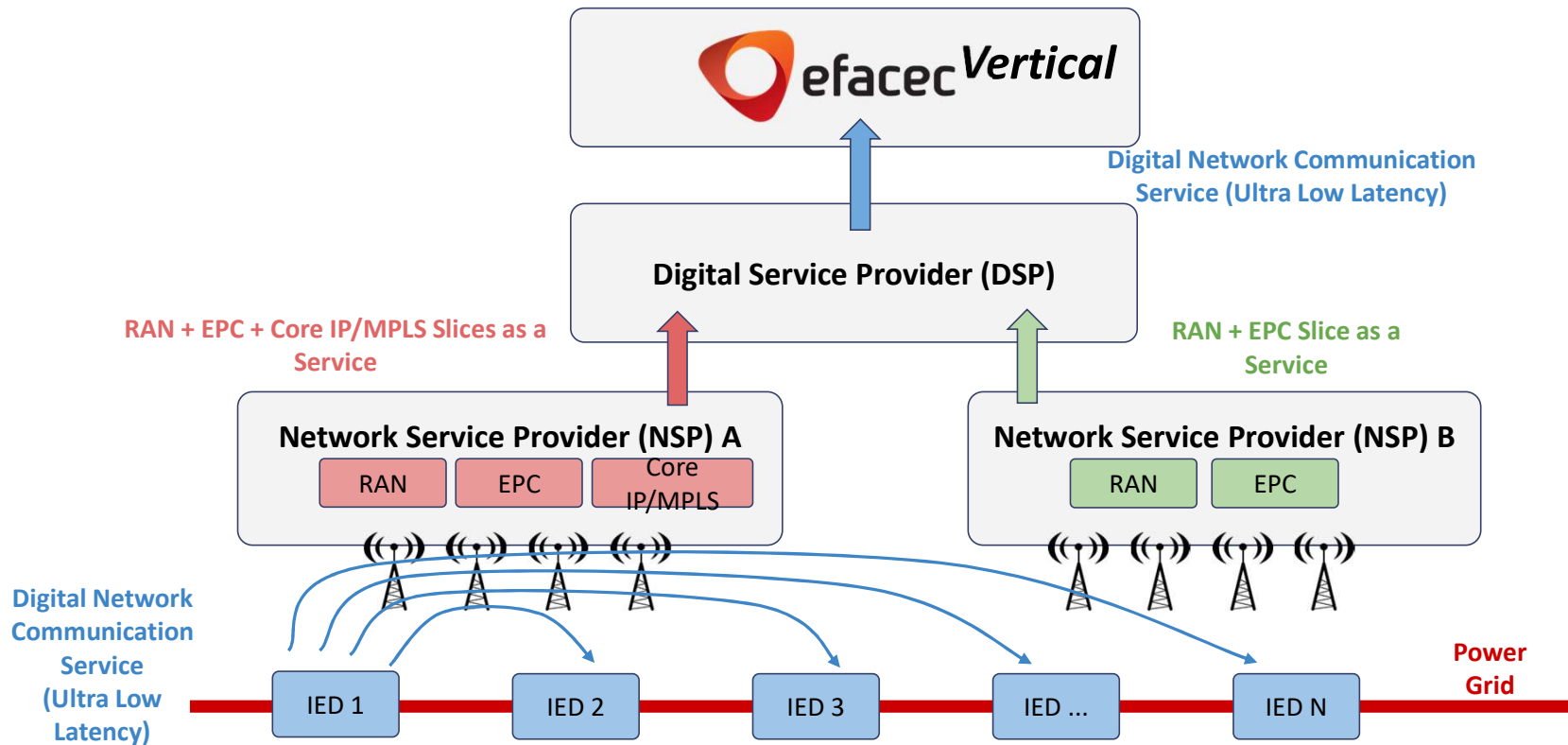
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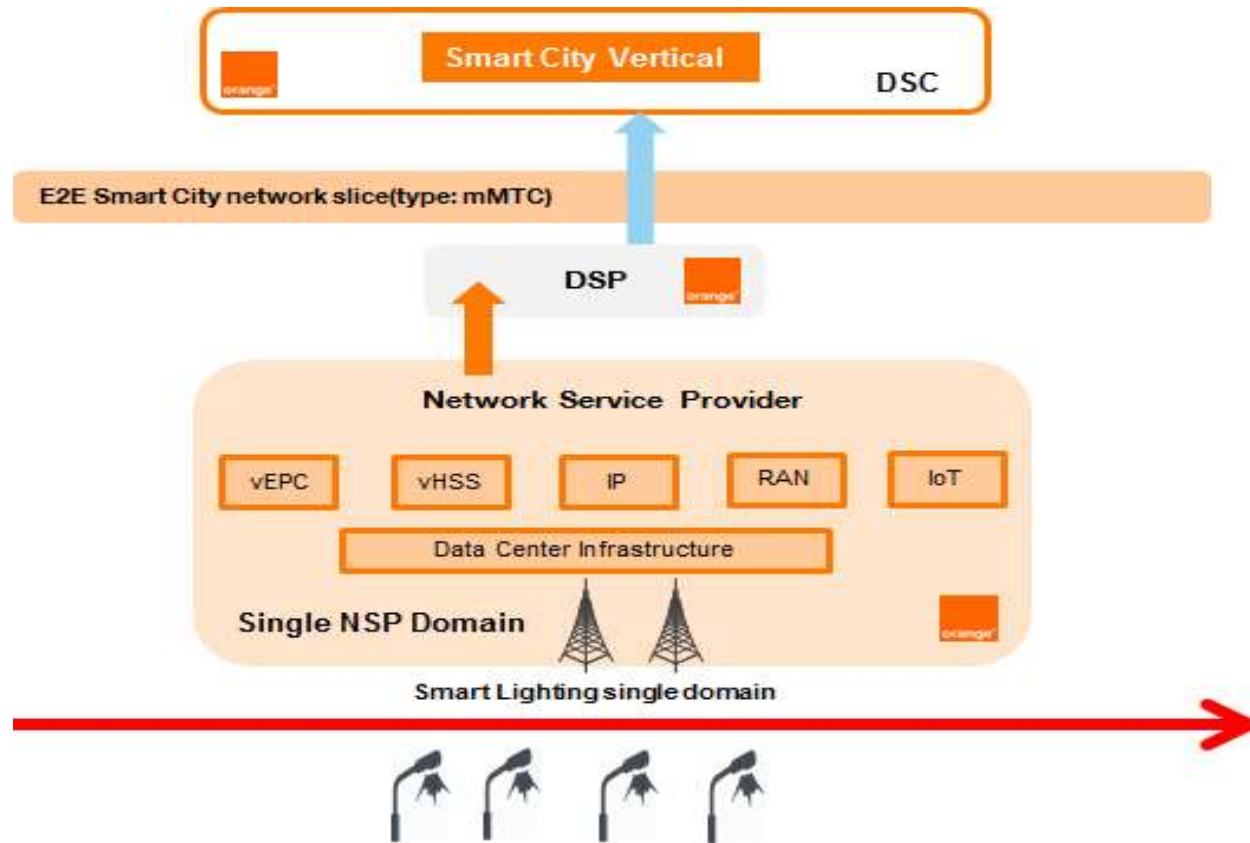
eHealth Use Case



Smart Grid Use Case



Smart City Use Case



Demo features mapped to project objectives

Features	Objectives	Smart Grid	eHealth	Smart City
P&P and OSA	Achieve an innovative, cognitive, integrated 'one-stop shop' 5G slice management framework for vertical businesses and co-designed by vertical sectors	x	x	x
FCAPS	Enable extensible, end-to-end slice FCAPS management across multiple planes and operator domains	x	x	x
QoE management	Establish cognitive, agile QoE management of slices for service assurance of vertical businesses		x	x
Cognition		x	x	x
MEC	Enable slicing-friendly infrastructure and coordinated, true provisioning and control of user-definable slices		x	
multi-domain		x	x	
Orchestration/ slice creation	Empower orchestration for cross-plane coordination of management, control, service and data planes to achieve system-level slicing control and slice operation	x	x	x
Vertical integration	Demonstrate the efficiency and support of the SliceNet framework in delivering slice-based/enabled, diverse 5G use cases for verticals, leverage Phase 1 projects' results, and contribute key integration results to the Phase 2 demonstration process	x	x	x

Prototypes (1)

Component	Licence	Source Code
OpenAirInterface (OAI)	OAI Public License V1.1	https://gitlab.eurecom.fr/oai/openairinterface5g
FlexRAN	Apache 2.0	https://gitlab.eurecom.fr/flexran/flexran-rtc
LL-MEC	Apache 2.0	https://gitlab.eurecom.fr/mosaic5g/ll-mec
Generic RAN Adapter	Apache 2.0	https://gitlab.eurecom.fr/mosaic5g/store/tree/feature-adapter-slicenet
Generic MEC/Core Adapter	Apache 2.0	https://gitlab.eurecom.fr/mosaic5g/store/tree/feature-adapter-slicenet
One Stop API (OSA)	TBA	https://gitlab.com/slicenet/osa
WAN Adapter	TBA	TBA
CPSR	Copyright © Ericsson AB 2019. All rights reserved	n/a
QoS Control Service	Copyright © Ericsson AB 2019. All rights reserved	n/a
IPC Control Service	Copyright © Ericsson AB 2019. All rights reserved	n/a
NF-CONFIG	TBA	https://gitlab.com/slicenet/wp4/-/tree/develop/NF-CONFIG
BKH Adapter	Copyright © Ericsson AB 2019. All rights reserved	n/a
FMM	Copyright © Ericsson AB 2019. All rights reserved	n/a
FCAPS-Manager	TBA	TBA

Prototypes (2)

Component	Licence	Source Code
BCKHL DPP Adapter	Apache 2.0	https://gitlab.com/slicenet/cp-bkhl-dpp-a
P&P Manager	Apache 2.0	https://gitlab.com/slicenet/plug-and-play-manager
RAN NS Prediction Model	n/a	n/a
Slice and Service Orchestrator (SSO)	Apache 2.0	TBA
Network Domain and Resource Orchestrator (NMR-O)	Apache 2.0	https://gitlab.com/slicenet/nmro https://gitlab.com/slicenet/nmro-driver
QoE Optimiser Plug-in	Apache 2.0	https://gitlab.com/slicenet/qoe-plugin
QoE Optimiser	Apache 2.0	https://gitlab.com/slicenet/qoe-optimizer
Plug&Play Control (core and plugins)	Apache 2.0	https://gitlab.com/slicenet/plug-and-play-control
UE control plugin	Apache 2.0	https://gitlab.com/slicenet/plug-and-play-control
QoS Plugin	TBA	https://gitlab.com/slicenet/qoe-plugin
Flow Control Agent (FCA)	Apache 2.0	https://gitlab.com/slicenet/fca
DP UWS API (DPWA)	Apache 2.0	https://gitlab.com/slicenet/fca

https://gitlab.com/slicenet

slicenet - GitLab

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GitLab Projects Groups Snippets Help

Search or jump to... Sign In / Register

S slicenet

Group overview

Details

Activity

Issues 0

Merge Requests 0

Members

slicenet > Details

S slicenet Group ID: 3178610

Subgroups and projects Shared projects Archived projects Search by name Last created

Subgroup/Project	Stars	Created
NMRO-Driver (UPC)	0	4 months ago
NMR-O (UPC)	0	4 months ago
wp6-fcaps	0	10 months ago
Plug and Play Control (NXW)	0	10 months ago
Plug and Play Manager (NXW)	0	10 months ago
QoE REST Client (UPC)	0	10 months ago
QoE Plugin (UPC)	0	10 months ago
QoE Optimizer (UPC)	0	10 months ago

Thank You!

Website: <https://slicenet.eu/>

Email: contact@slicenet.eu

Further information: <https://slicenet.eu/publications/>

SliceNet Open source contributions:
<https://slicenet.eu/software-contributions/>



Questions ?



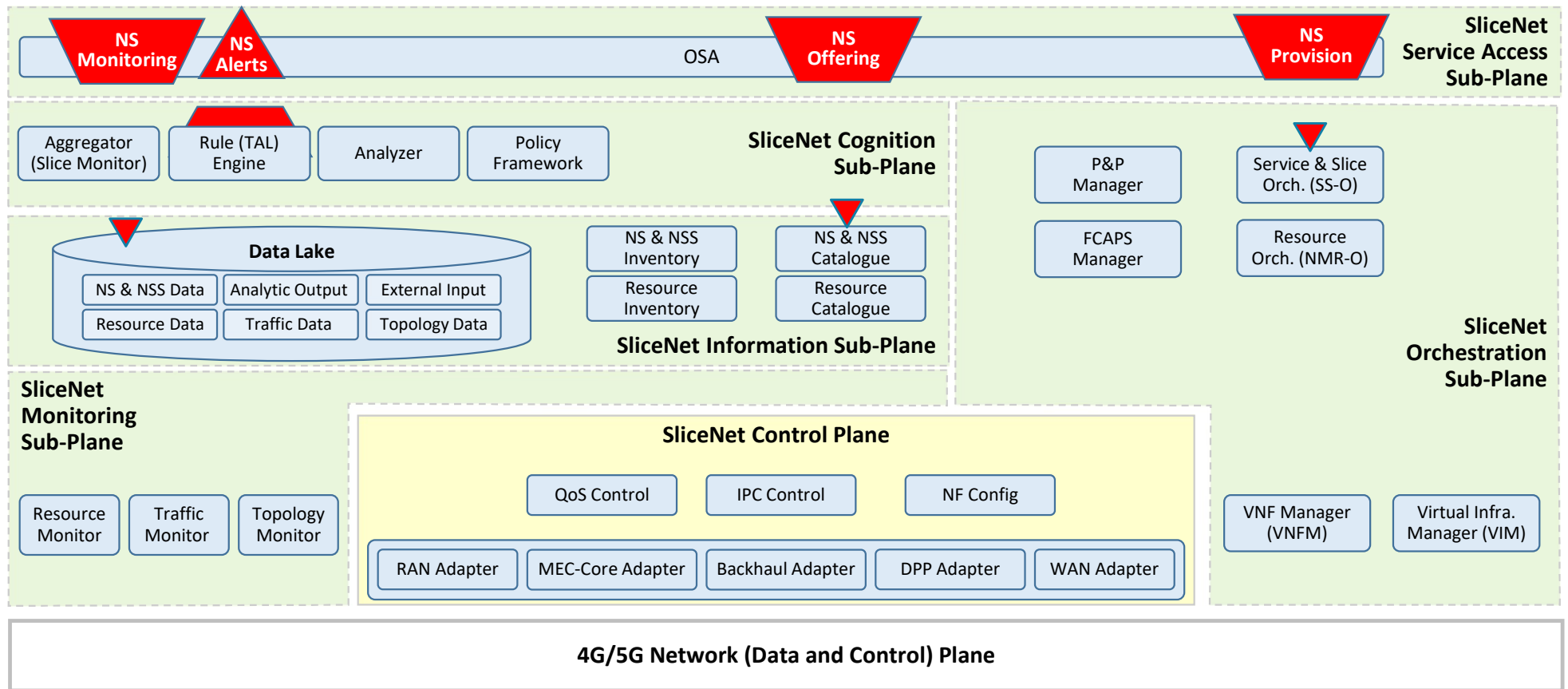
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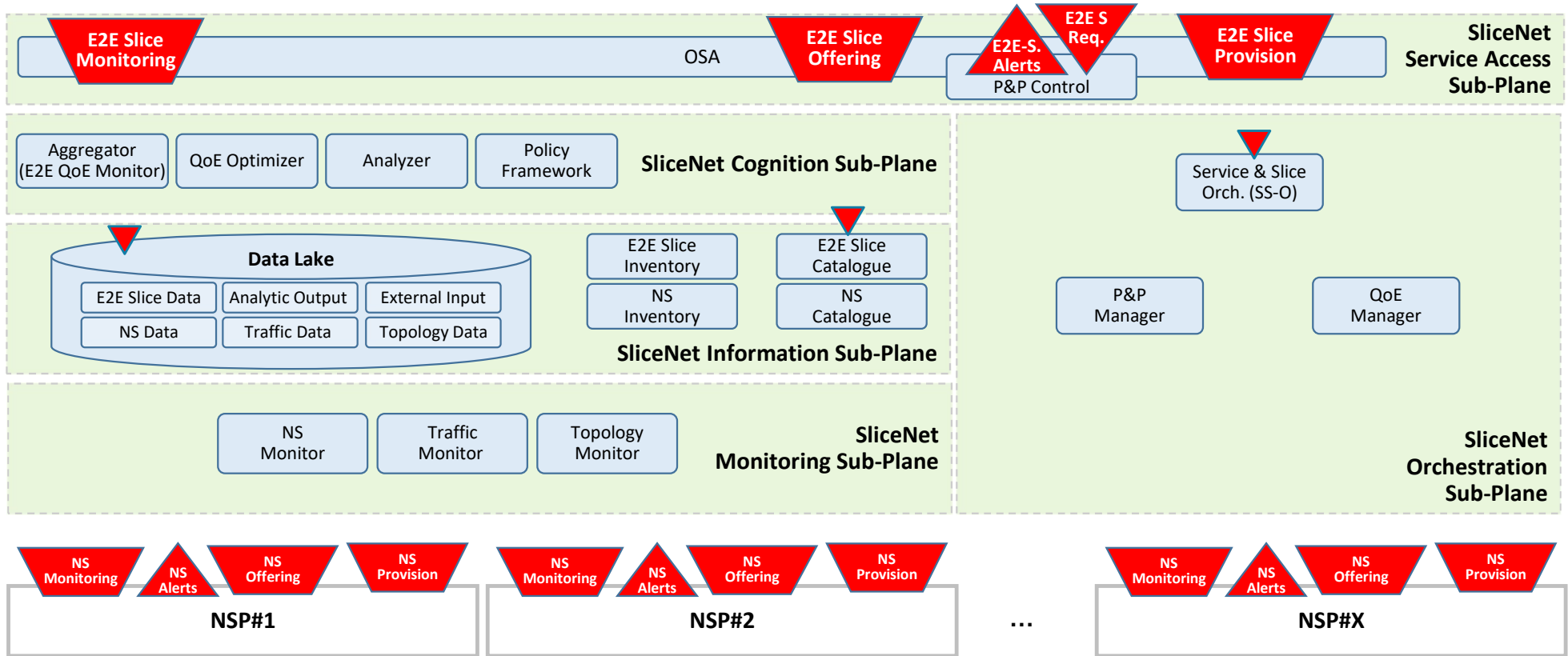
SliceNet System Architecture

NSP



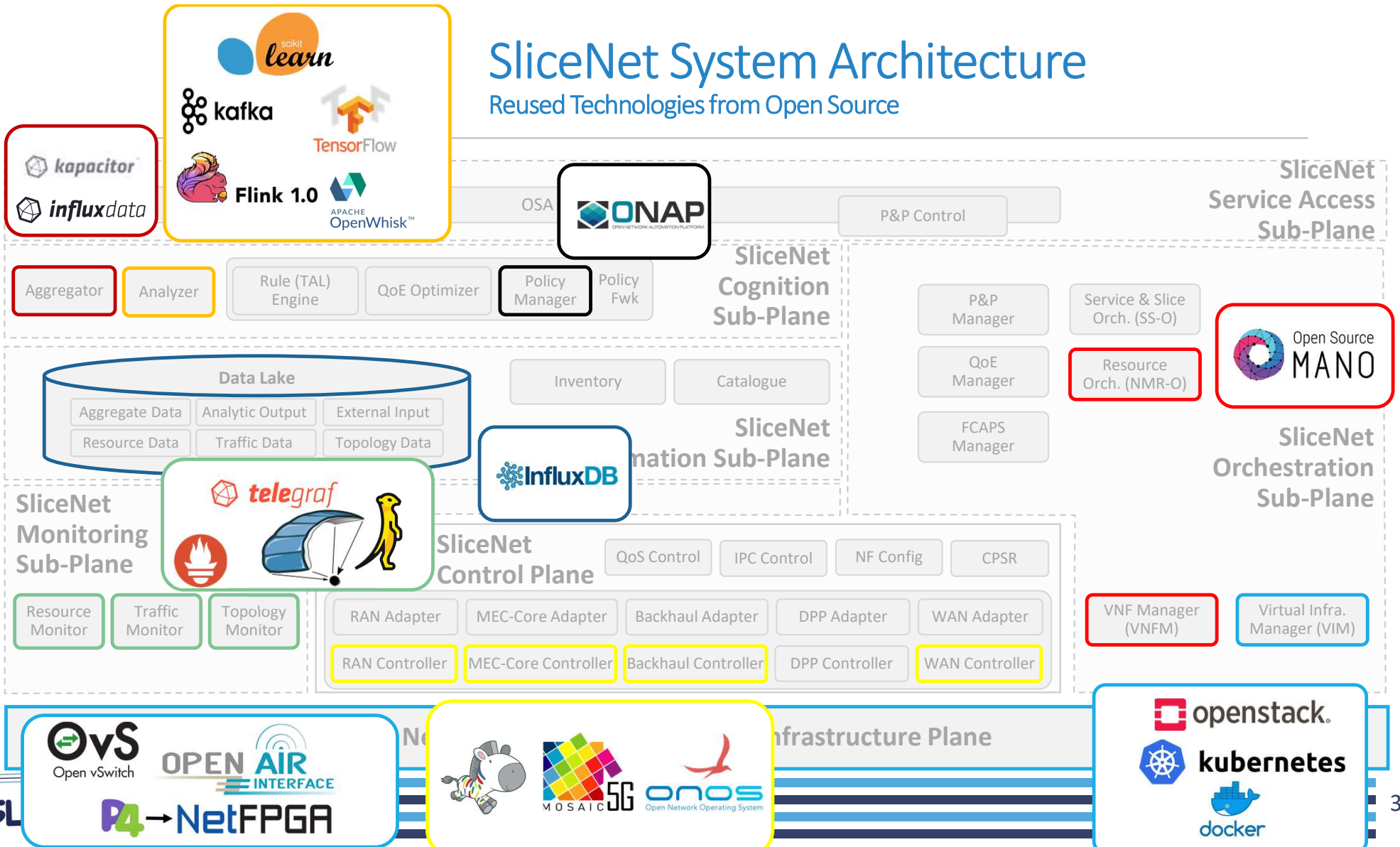
SliceNet System Architecture

DSP



SliceNet System Architecture

Reused Technologies from Open Source



Smart Grid demo scenes

Features	
P&P and OSA	<ul style="list-style-type: none"> • Service subscription, vertical feedback support in OSA, and E2E service monitoring through P&P
FCAPS	NS monitoring ; E2E NS monitoring
QoE management	<ul style="list-style-type: none"> • N/A
Cognition	<ul style="list-style-type: none"> • Network fault prediction and mitigation
MEC	<ul style="list-style-type: none"> • N/A
multi-domain	multi-domain Orchestration, multi-domain FCAPS, multi-domain slicing
Orchestration/ slice creation	Slice creation, multi-domain Orchestration, Integration among orchestration sub-plane, cognition sub-plane and FCAPS
Vertical integration	<ul style="list-style-type: none"> • IED deployment and remote management • Power system protection coordination • Synchrophasor-based differential protection

eHealth demo scenes

Features	
P&P and OSA	<ul style="list-style-type: none">• Service subscription, vertical feedback support in OSA, and E2E service monitoring through P&P
FCAPS	<ul style="list-style-type: none">• E2E service monitoring through P&P
QoE management	<ul style="list-style-type: none">• E2E Performance & Configuration Management based on Vertical Feedback• E2E Fault & Configuration Management
Cognition	<ul style="list-style-type: none">• Anomaly prediction based on Vertical Feedback
MEC	<ul style="list-style-type: none">• Traffic redirection in "E2E Fault & Configuration Management" scenario
multi-domain	<ul style="list-style-type: none">• multi-domain Orchestration, multi-domain FCAPS, multi-domain slicing, multi-domain handover
Orchestration/ slice creation	Slice creation, multi-domain Orchestration, Integration among orchestration sub-plane, cognition sub-plane and FCAPS
Vertical integration	<ul style="list-style-type: none">• Reliable communication between the ambulance and Telestroke assessment servers and hospitals.

Smart City demo scenes

Features	
P&P and OSA	<ul style="list-style-type: none">• Service subscription, vertical feedback support in OSA, and E2E service monitoring through P&P
FCAPS	NS monitoring ; E2E NS monitoring
QoE management	<ul style="list-style-type: none">• E2E QoE configuration management for IoT application
Cognition	<ul style="list-style-type: none">• Anomaly detection based on based on ML model
MEC	<ul style="list-style-type: none">• NA
multi-domain	<ul style="list-style-type: none">• NA
Orchestration/ slice creation	Slice creation, multi-domain Orchestration, Integration among orchestration sub-plane, cognition sub-plane and FCAPS
Vertical integration	<ul style="list-style-type: none">• Reliable and efficient communication between lighting poles and IoT application

Development, Integration and Validation Environment

- ❑ The testing environment is based on an OpenStack Queens installation with one control/network node and two compute nodes
- ❑ A KVM/QEMU host for all support systems and the development tools used.
- ❑ The decision to keep the development tools and support systems separately was taken in order to have flexibility in rebuilding OpenStack or making major changes without affecting the development environment or access to the systems.

Development, Integration & Demonstration Methodology

