



SliceNet Webinar

“5G Multi-domain Slice Management”

WEBINAR HOST: THUY TRUONG, DELL OCTO RESEARCH OFFICE

DATE: 31 MARCH 2020

TIME: 11:00 CET

slicenet.eu
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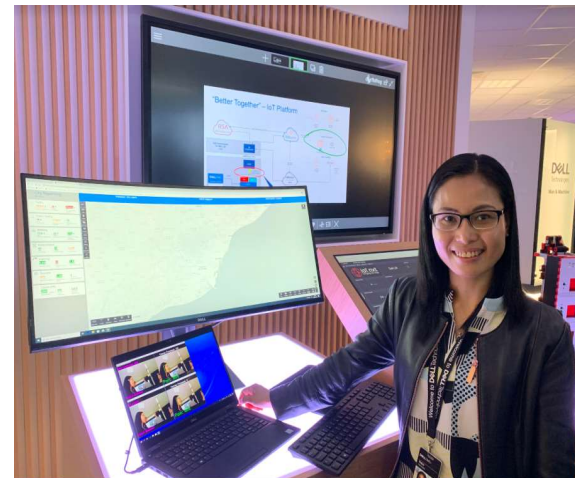
Introduction: Webinar Purpose, Presenter

❖ Webinar Purpose:

- ❖ Disseminations of SliceNet Technical Achievements and Innovations with focus on the **Management Plane**

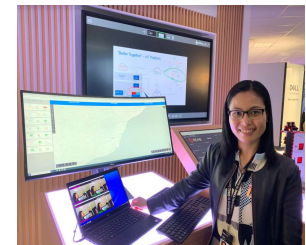
❖ Presenter:

- ❖ Thuy Truong, Dell OCTO Research Office
Dell representative in SliceNet



Webinar Agenda

- ❖ Introduction
- ❖ Requirements & Challenges
- ❖ Technical Approach for Design & Prototyping
- ❖ Technical Achievements
- ❖ Major Innovations
- ❖ Industry Vertical Applications
- ❖ Q&A, References



Thuy Truong
Dell OCTO Research Office

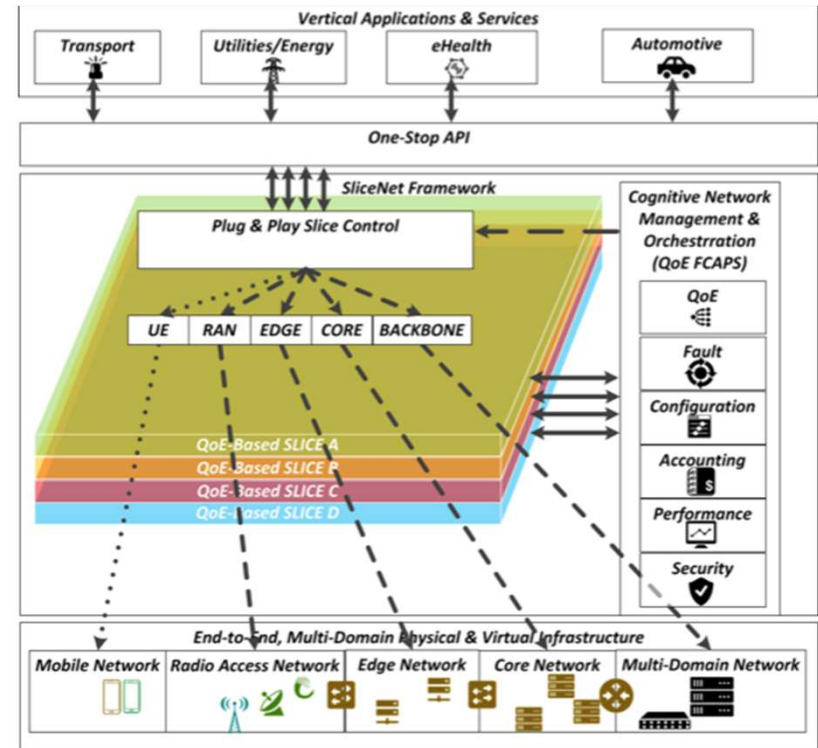
End-to-End Cognitive Network Slicing and Slice Management Framework in Virtualised Multi-Domain, Multi-Tenant 5G Networks

❖ Project Objectives

- Achieve an innovative, cognitive, integrated **'one-stop API'** 5G slice management framework for vertical businesses and co-designed by vertical sectors
- Enable extensible, **E2E slice FCAPS management** across multiple planes and operator domains
- Establish **cognitive, agile QoE management** of slices for service assurance of vertical businesses
- Empower **orchestration** for cross-plane coordination of management, control, service and data planes to achieve system-level slicing control and slice operation

❖ Today Focus

- **Management Plane with P&P and FCAPS Management**



Requirements & Challenges

- ❖ **Data Collection** from **multiple and heterogeneous sources**
- ❖ **Information metrics diversity**
- ❖ **Flexibility** for **adaptation, extensions, scaling** (amount/types of data, number of rules, supported rule operations)
- ❖ **Abstraction** of underlying network technology specific details
- ❖ **Dynamic multi-domain slice management** over SliceNet infrastructure



Technical Approach

❖ P&P Management

- ❖ Design and prototype implementation of the management plane for the plug and play capabilities implemented in control plane, cognition sub-plane and one-stop API

❖ Single-domain FCAPS Management

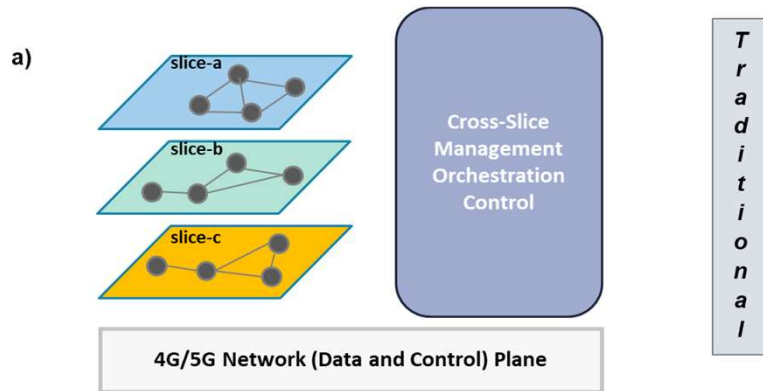
- ❖ Design and prototype implementation of slice FCAPS within the single-domain management framework

❖ Multi-domain FCAPS Management

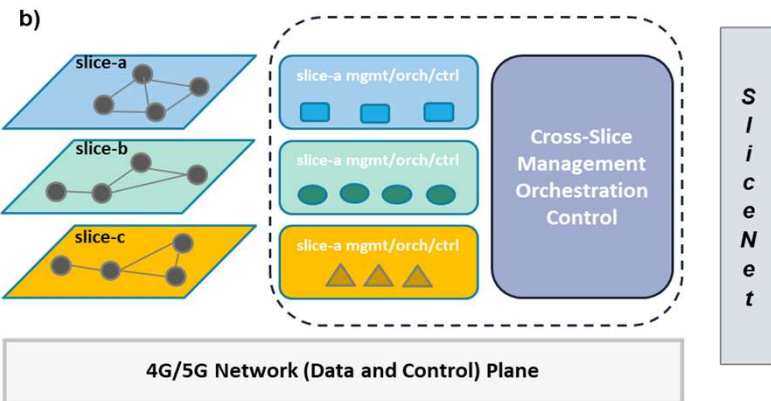
- ❖ Design and prototype implementation of slice FCAPS within the inter-domain management framework



SliceNet vision/P&P approach

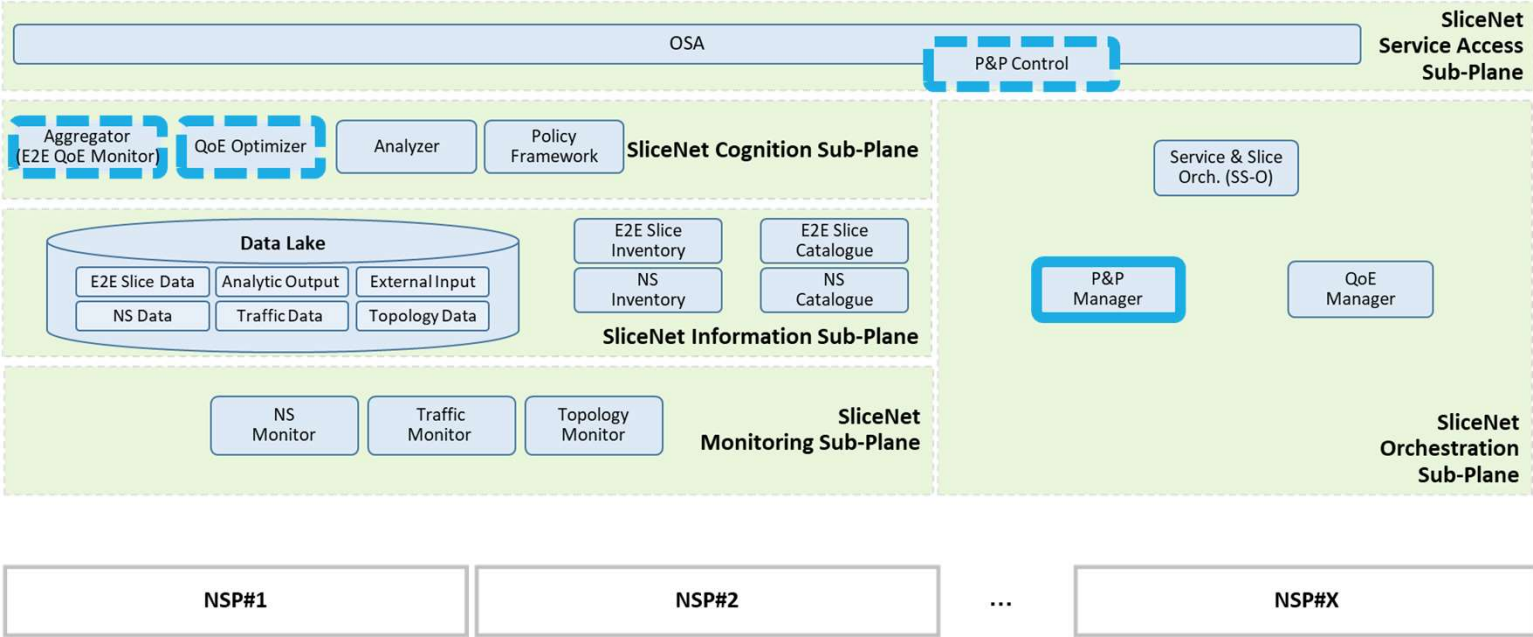


Monolithic/All-in-one framework with one single point of management & orchestration control for multiple slices

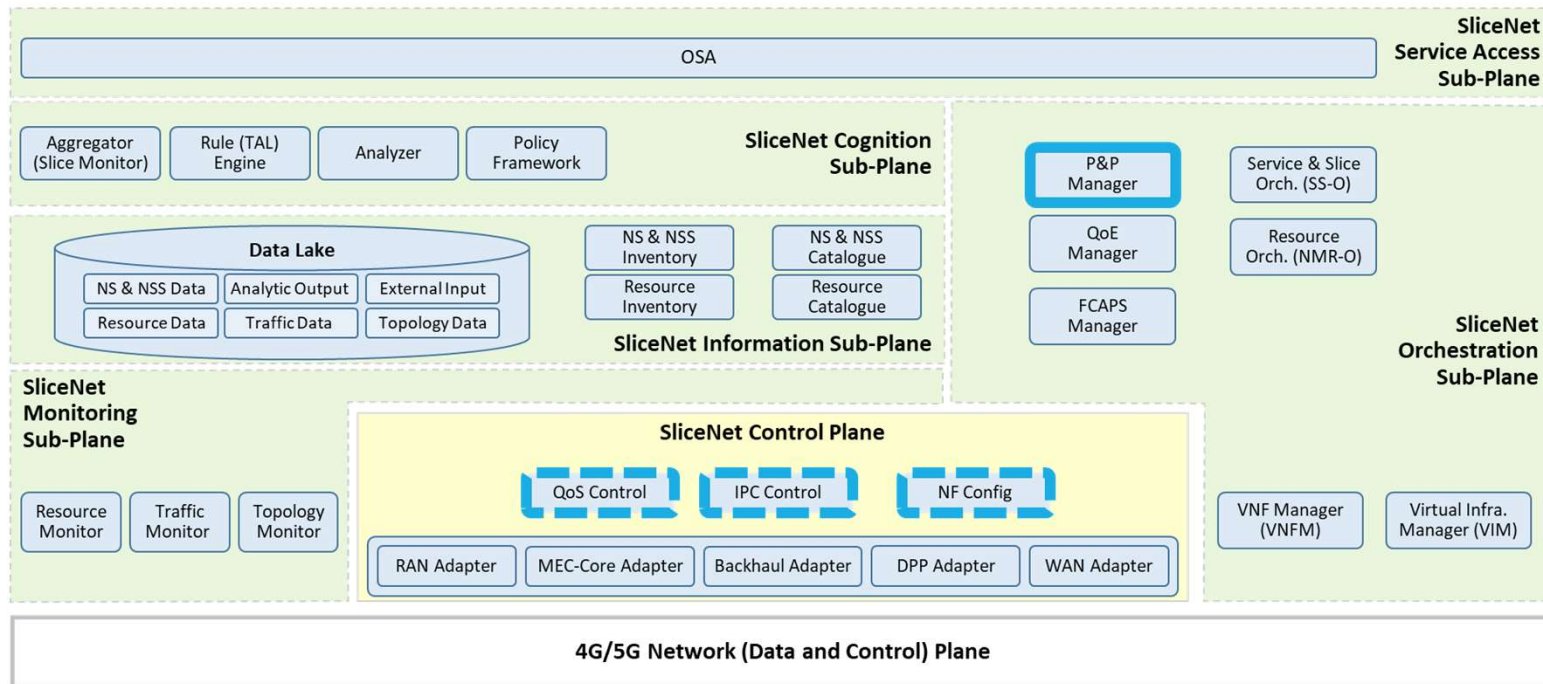


Per-slice and per-service functions that are activated, configured and operated within the management platforms only when needed and with the aim of fulfilling the specific needs of (and agreements with) verticals and customers.

P&P Management – DSP Level



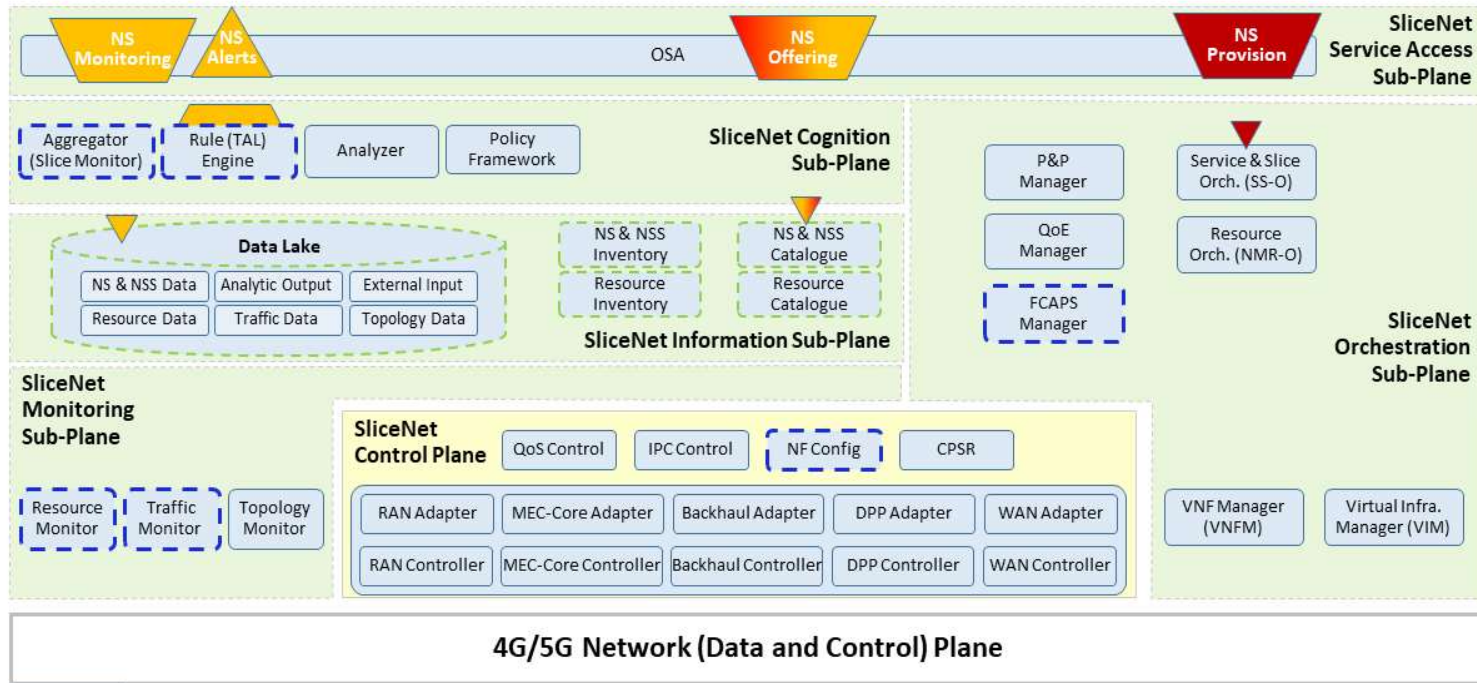
P&P Management – NSP Level



P&P Management

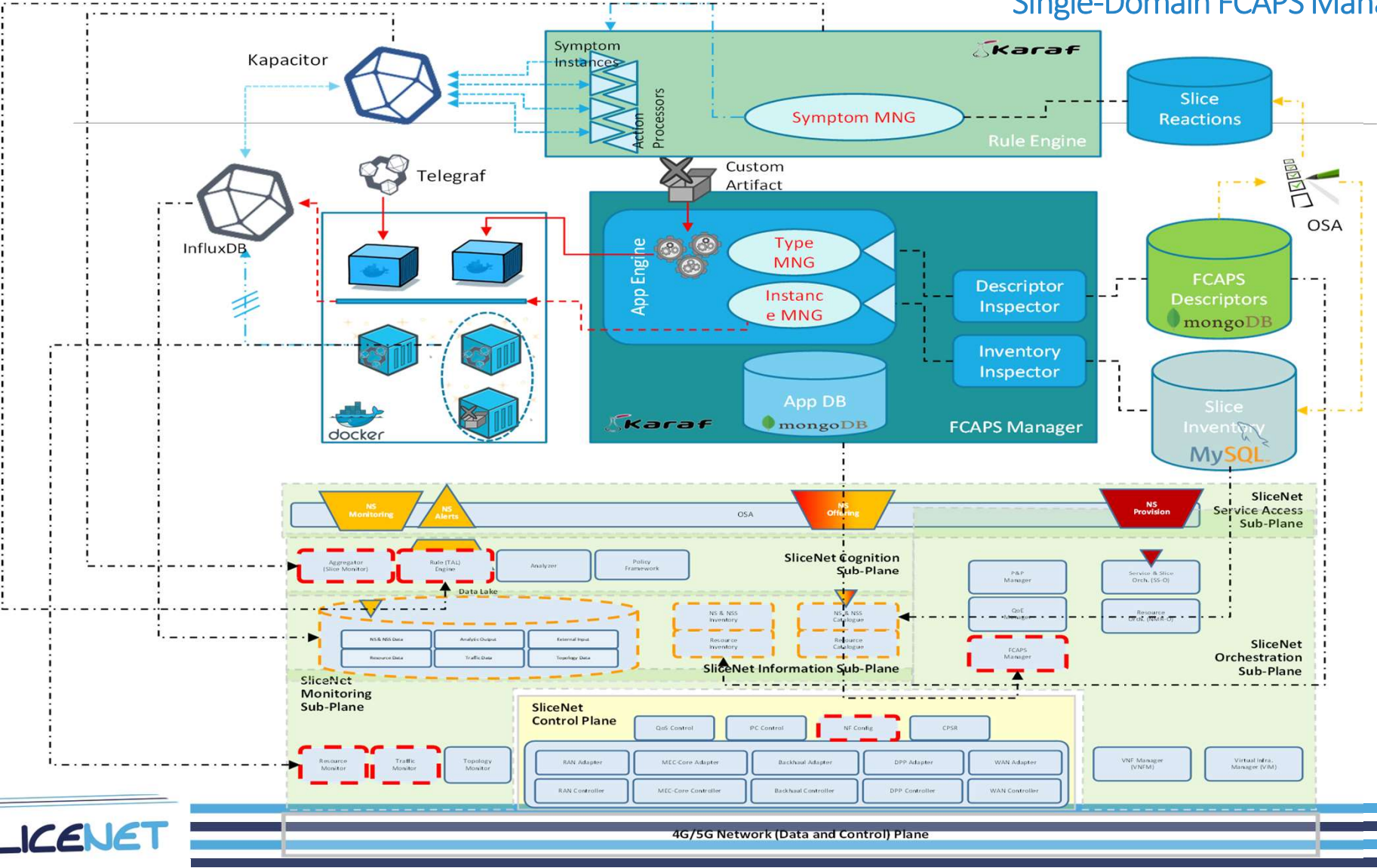
- ❖ **Lifecycle management of the P&P Control instances exposed to the verticals** (developed in the SliceNet control plane)
- ❖ **Integration with Service/Slice Orchestration** at NSP and DSP in support of per-slice management features
- ❖ **Evolution of the P&P approach** towards a more comprehensive slice control and management customization framework
 - ❖ go beyond the customization of runtime control for the vertical only
 - ❖ apply the same model for customization of per-slice control and management applications to be deployed
 - ❖ explore and integrate Function as a Service (FaaS) paradigm for on-demand deployment of cognitive functions based on triggers

Single-Domain FCAPS Management



- Not foreseen for transactions with Intra-domain FCAPS
- Mainly for transactions with Intra-domain FCAPS
- Partly for transactions with Intra-domain FCAPS

Single-Domain FCAPS Management



Multi-Domain FCAPS Management

- ❖ The design of SliceNet system imposes that the service features that the DSP is serving the verticals are exposed by mean of 3 main DSP processing categories:
 - ❖ Plug and Play slice exposure
 - ❖ QoE management
 - ❖ Cognitive processing.

- ❖ The multi-domain FCAPS management, therefore, does not directly manage the service features toward the verticals.

- ❖ The multi-domain FCAPS management supports the DSP's P&P, QoE Optimizer and Cognitive workflows to fulfil the service requests that have been made by the verticals and have been specified in the SLA agreements

Multi-Domain FCAPS Management

- ❖ The multi-domain FCAPS Management addressing mainly three aspects:
 - ❖ Formulation for the **sensing and actuation information** to be added in the service blueprint and activating these sensing and actuation artefacts accordingly during the slice instantiation.
 - ❖ **Merging the information of sub-slices** from domain providers to have E2E slice sensing information that can be fed to the service feature components.
 - ❖ **Supporting the P&P, QoE and/or Cognitive workflows** by mean of providing the service information collected and aggregated from domain providers for their workflows.

- ❖ For security management, SliceNet focuses on four main aspects: i) Security Orchestration; ii) Security Events Monitoring, Detection and Response; iii) Identity and Access Management; and iv) Mechanisms to secure the System, User Data and Network Traffic.

FCAPS Management

Definition, modelling and implementation of

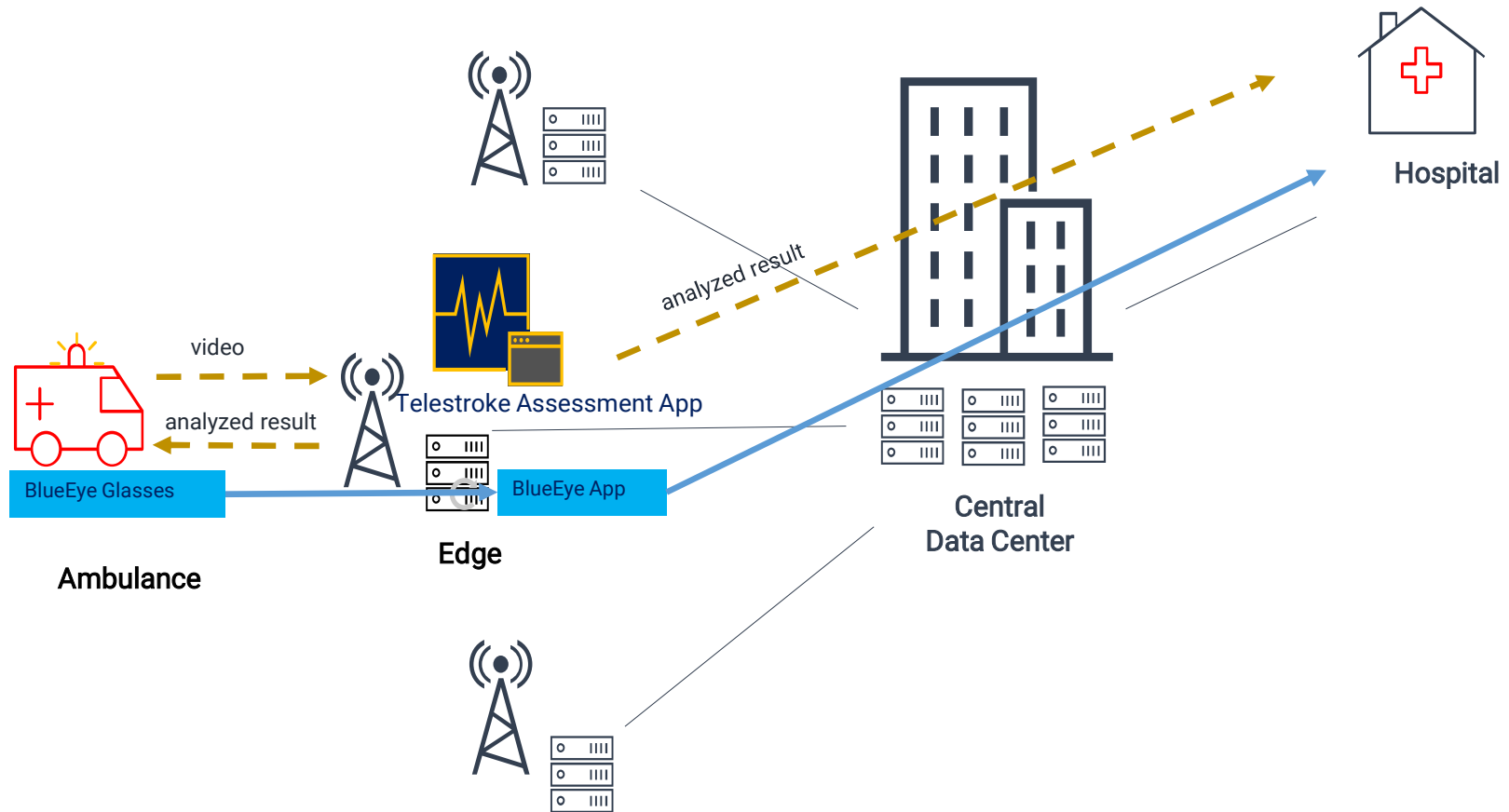
- ❖ **Automation** principles that allow the FCAPS management to be activated per slice during the orchestration process
- ❖ **Abstraction** techniques that allow the separation between business and technology domains
- ❖ A **granular and configurable information collection framework** for fault, performance and security event detection
- ❖ A **complete control loop framework** that can enforce the FCAPS practices, but also support interaction with cognitive processing components

Prototyping Examples

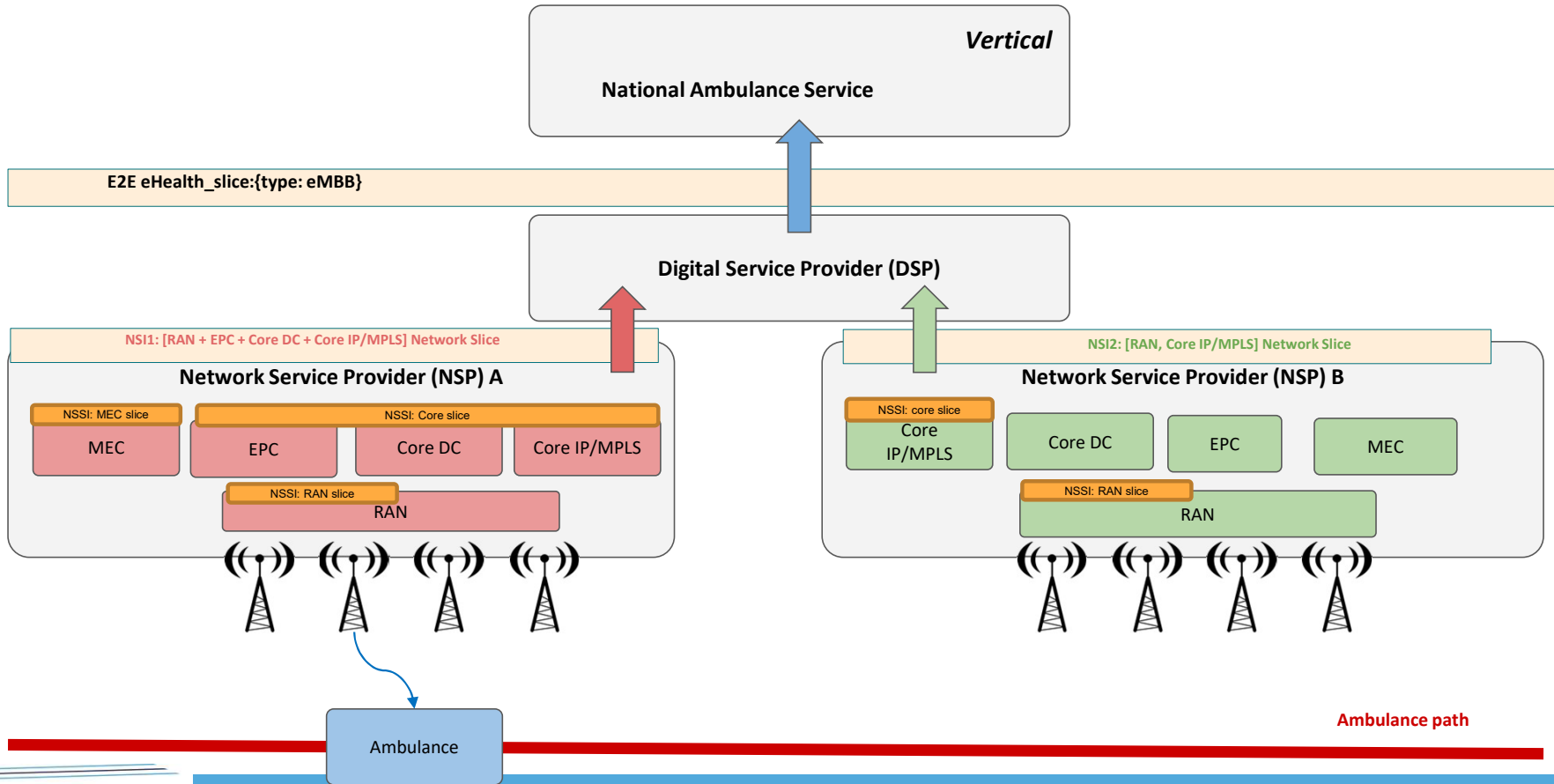
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eHealth use-case

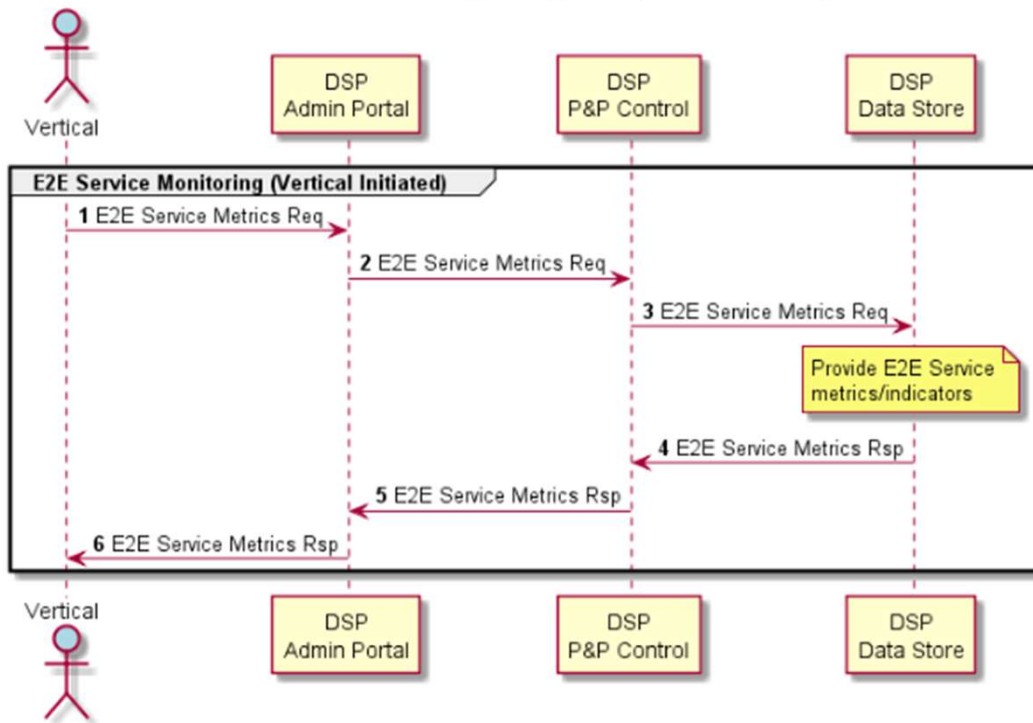


Vertical Perspective



E2E Service Monitoring through P&P

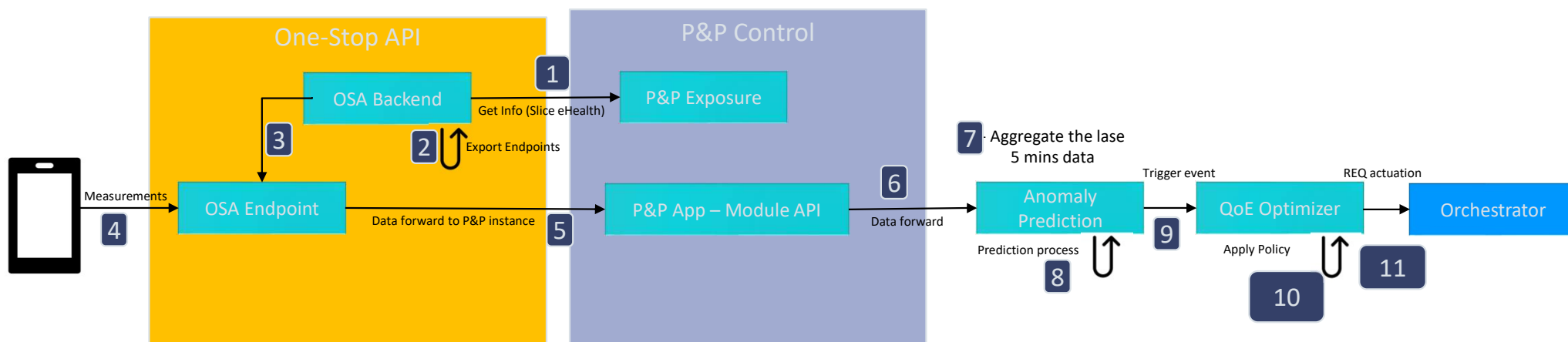
E2E Service Monitoring Through P&P (Vertical Initiated)



- With the DSP OSA, the Vertical requests to have E2E runtime performance monitoring (BW, Latency)
- DSP OSA sends request to P&P Control
- P&P Control collects data from the DSP Datastore/InfluxDB and returns to the DSP OSA
- DSP OSA displays the data onto the vertical web portal.

E2E Performance & Configuration Management based on Vertical Feedback

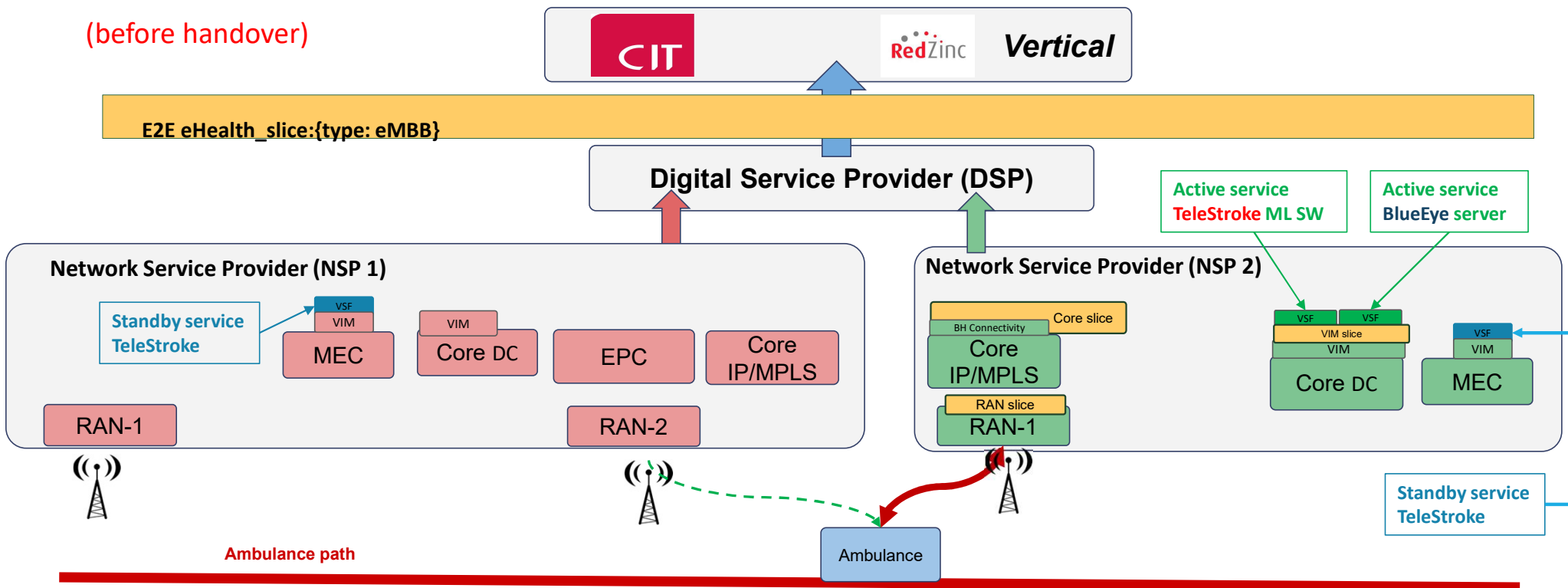
- eHealth UC is delay sensitive UC
- It's important to anticipate the **quality of communication** to guarantee QoS/QoE requirements



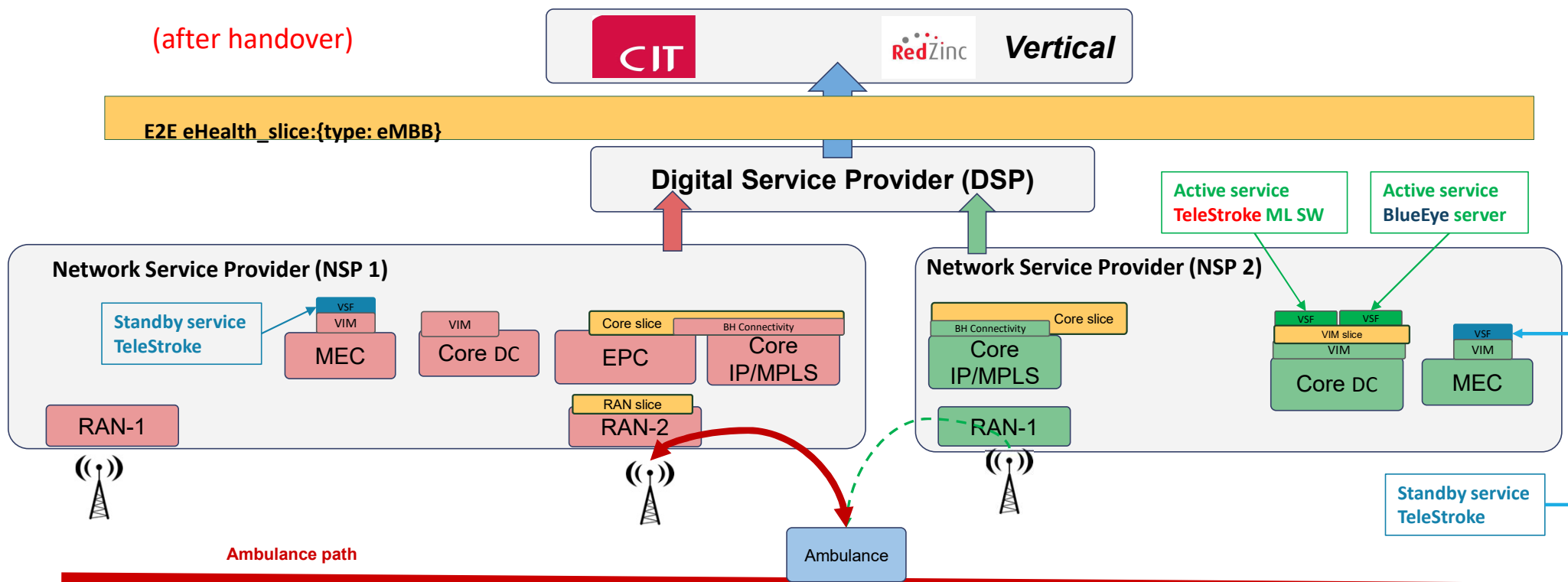
- ❑ To predict future anomalies/events in advance (at least 5mins in advance)
- ❑ By observing curves of QoS indicators, the problem will be resolved before it occurs.
- ❑ Integrity KPIs: Throughput, CQI, RSRP, RSRQ, SINR, etc.

E2E Performance & Configuration Management based on Vertical Feedback

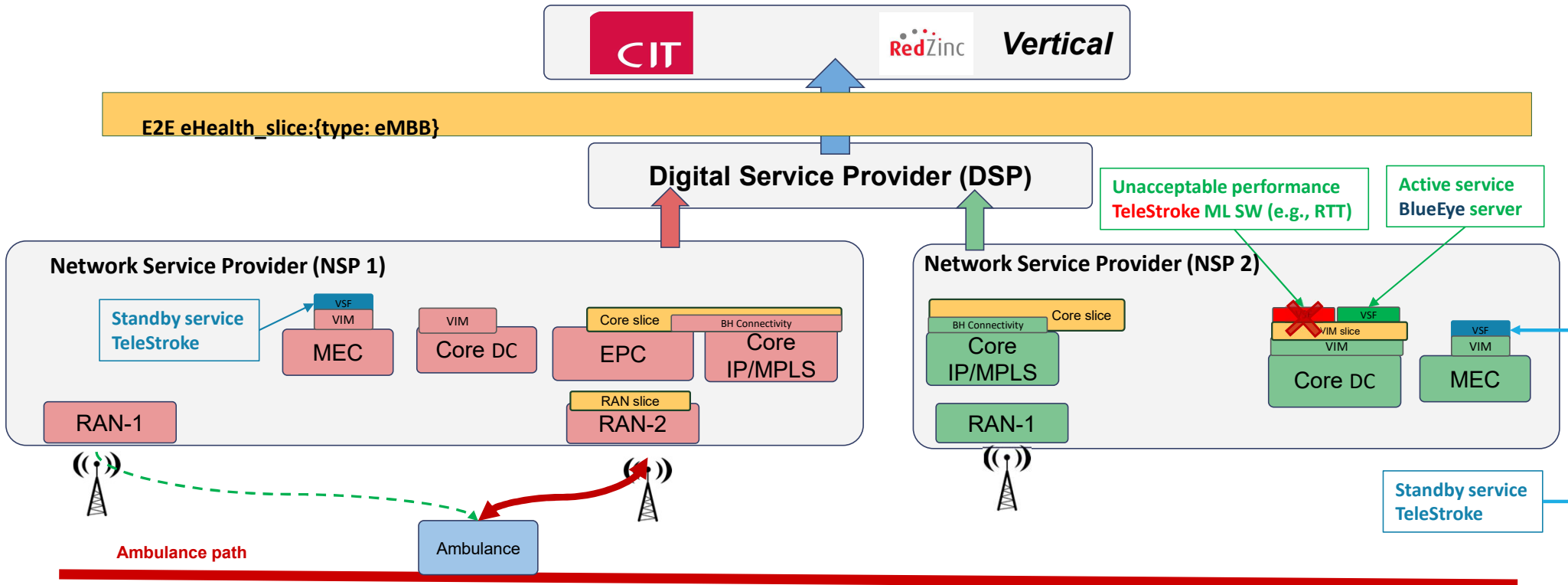
(before handover)



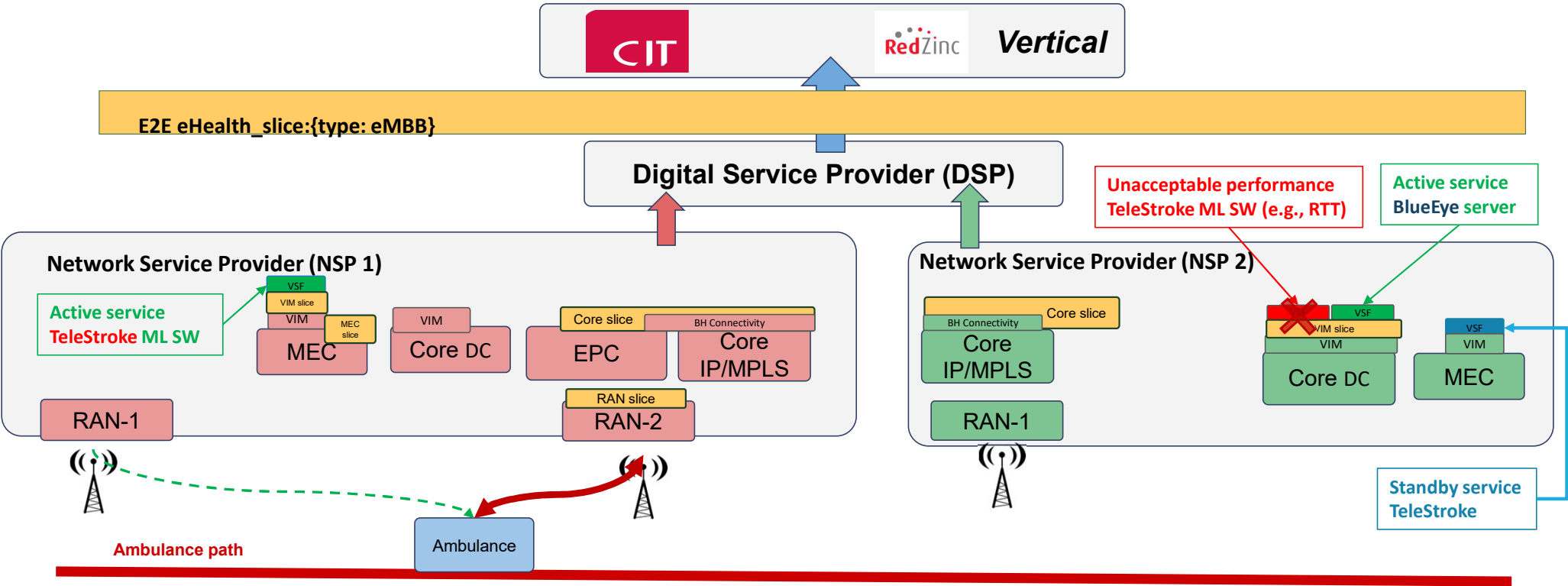
E2E Performance & Configuration Management based on Vertical Feedback



E2E Fault & Configuration Management (Fault)



E2E Fault & Configuration Management (Response)

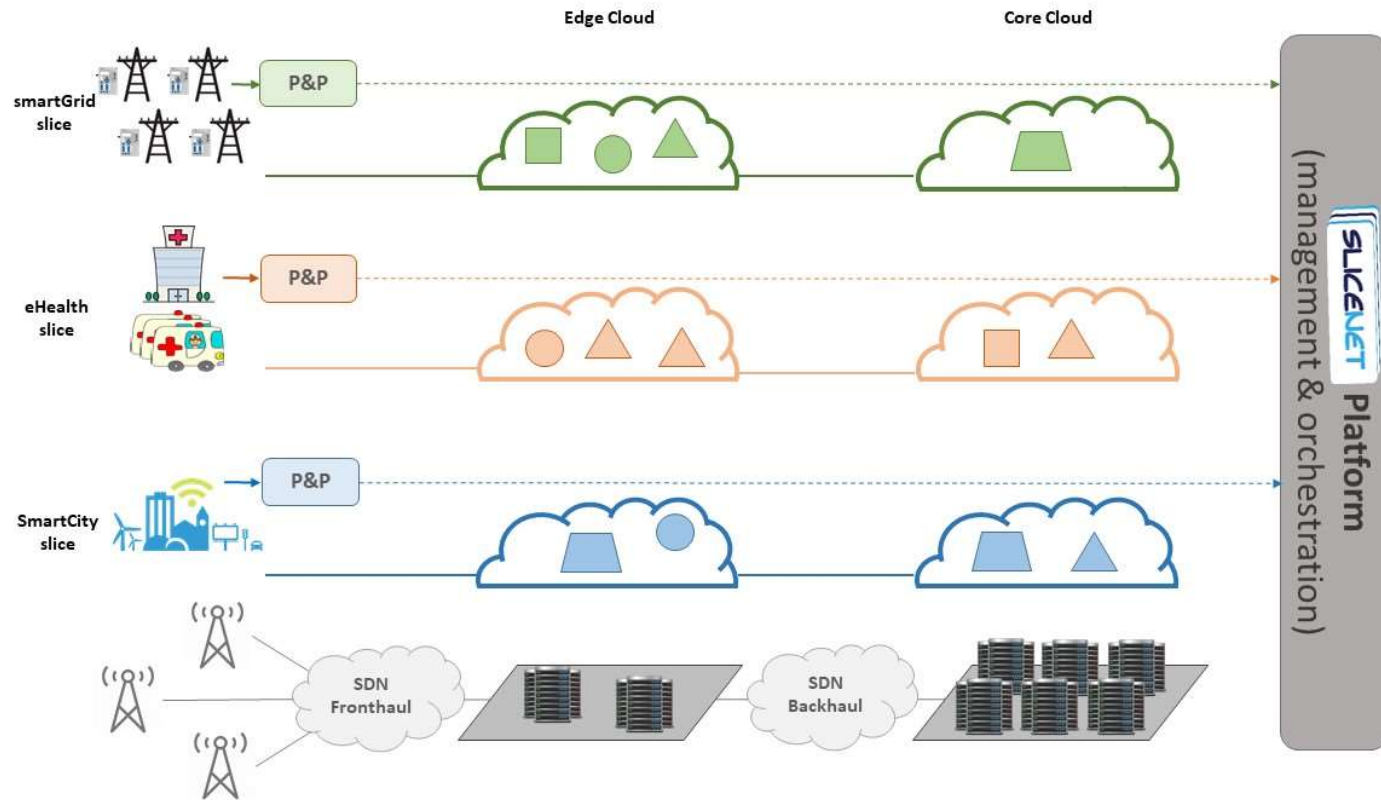


Technical achievements

- ❖ SliceNet designs and implements the **P&P management framework** that provides an automated deployment & configuration approach that has been applied to the per-slice/per-service functions in SliceNet control instances serving the verticals, and also the functions in SliceNet control plane and cognition sub-plane.
- ❖ SliceNet designs and implements **the FCAPS framework** that aims to address more accurately and consistently the **operation management of slices**.
- ❖ **Exploitations of the standardisation** (3GPP, ETSI) topics relating to the design choices adopted for FCAPS framework & **Exploitation of SELFNET** methods/suites/automation in the FCAPS Framework
- ❖ **Standardization Contribution** – to the ITU-T FG 5GML
 - ❖ Proposal led by ORANGE FRANCE
 - ❖ Enabling vertical feedback; Integrating FCAPS with SliceNet cognition sub-plane (Anomaly prediction in the Quality of Communication)



Industry Vertical Applications



Prototyping

- ❖ **Delivered SW components prototypes and interfaces available at SliceNet GitLab:**
 - **P&P Manager:** <https://gitlab.com/slicenet/plug-and-play-manager>
 - **FCAPS:** <https://gitlab.com/slicenet/wp6-fcaps>

Summary of innovations

- ❖ **Automation framework of the FCAPS and P&P** that allows the operation management to be activated per slice.
- ❖ **Definition, modelling and implementation of abstraction techniques** that allow separation between business and technology domains.
- ❖ **Technology agnostic approach** to support system agility.

Further Information

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

Email: contact@slicenet.eu

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

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

Questions ?



Thank you!



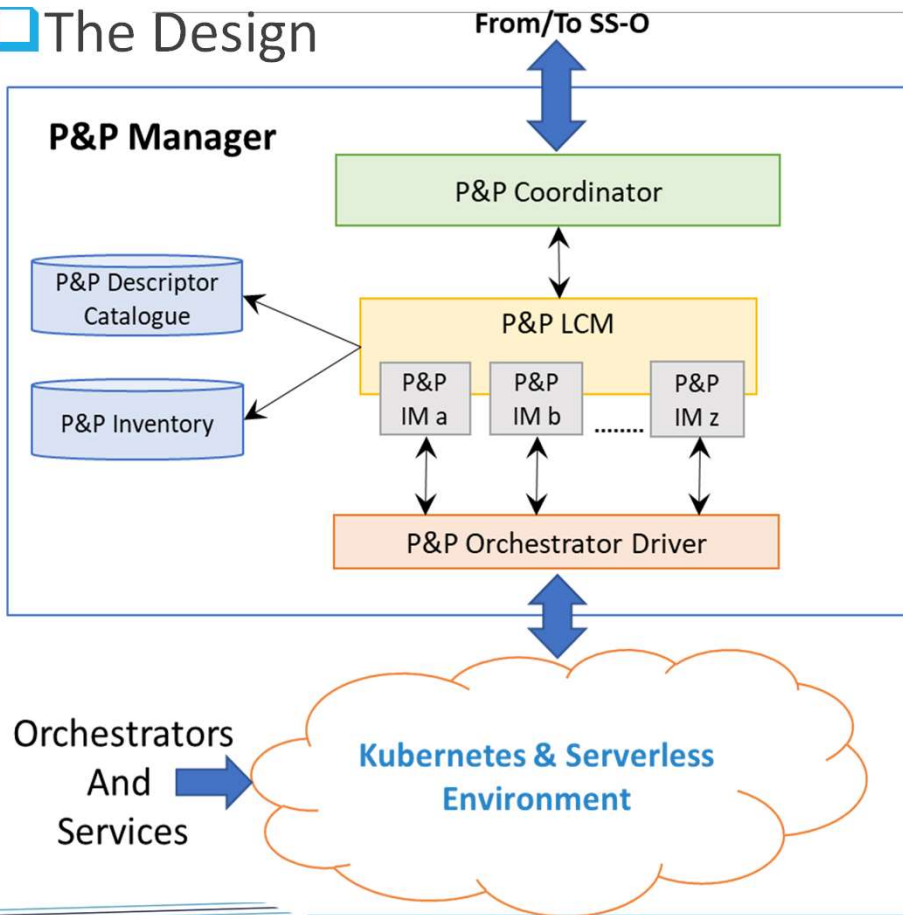
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PnP Manager

The Design



P&P Coordinator: offers to the SS-O a set of lifecycle management primitives to activate new Plug & Play control instance

P&P LCM: responsible to coordinate the individual Plug & Play lifecycle managers to be dynamically created to manage each Plug & Play control environment

P&P IM: Provides the actual logic to manage the lifecycle of each Plug & Play control instance: creation, configuration and deletion.

P&P Orchestrator Driver: offers to each P&P IM a common interface to create and configure new Plug & Play control instances in their deployment environment

P&P Descriptor Catalogue: Contains the *descriptors* of the various plugin

P&P Inventory: Contains all configuration files (slice views, Kubernetes Yaml, etc)

PnP Manager

Software architecture of P&P Manager prototype

