Orchestrating a brighter world

NEC

Network Slicing for Verticals from a System's Perspective

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5G-TRANSFORMER

5GTRANSFORMER

- EC Contribution: 7.985.582 €
- Duration: 30 Months

- Effort: 996 PMs
- Starting date: 01/06/2017
- 18 partners

5G-TRANSFORMER

Objectives

- Enable **Vertical Industries** to meet their service requirements within customized **MTP** (i.e. mobile transport infrastructure) **slices**; and

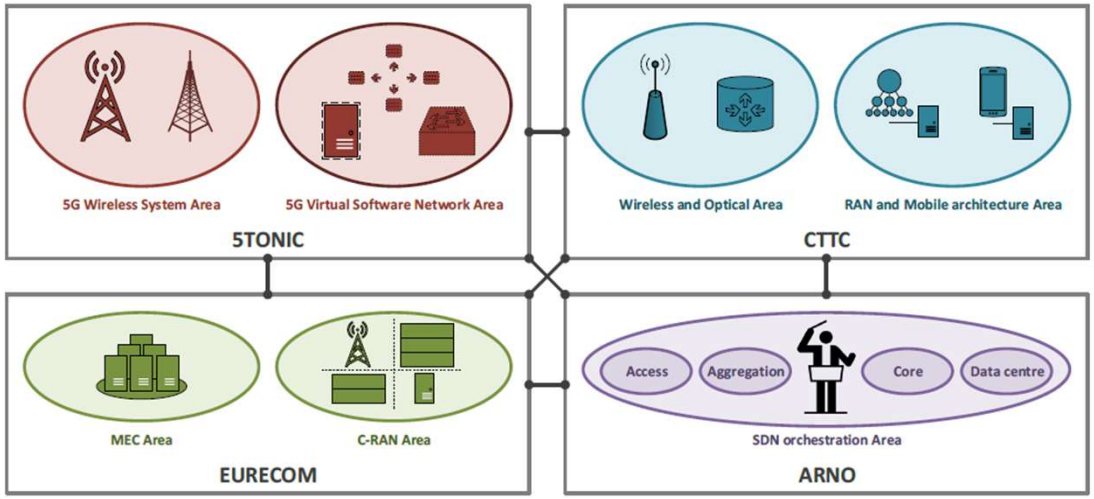
Automotive

Healthcare

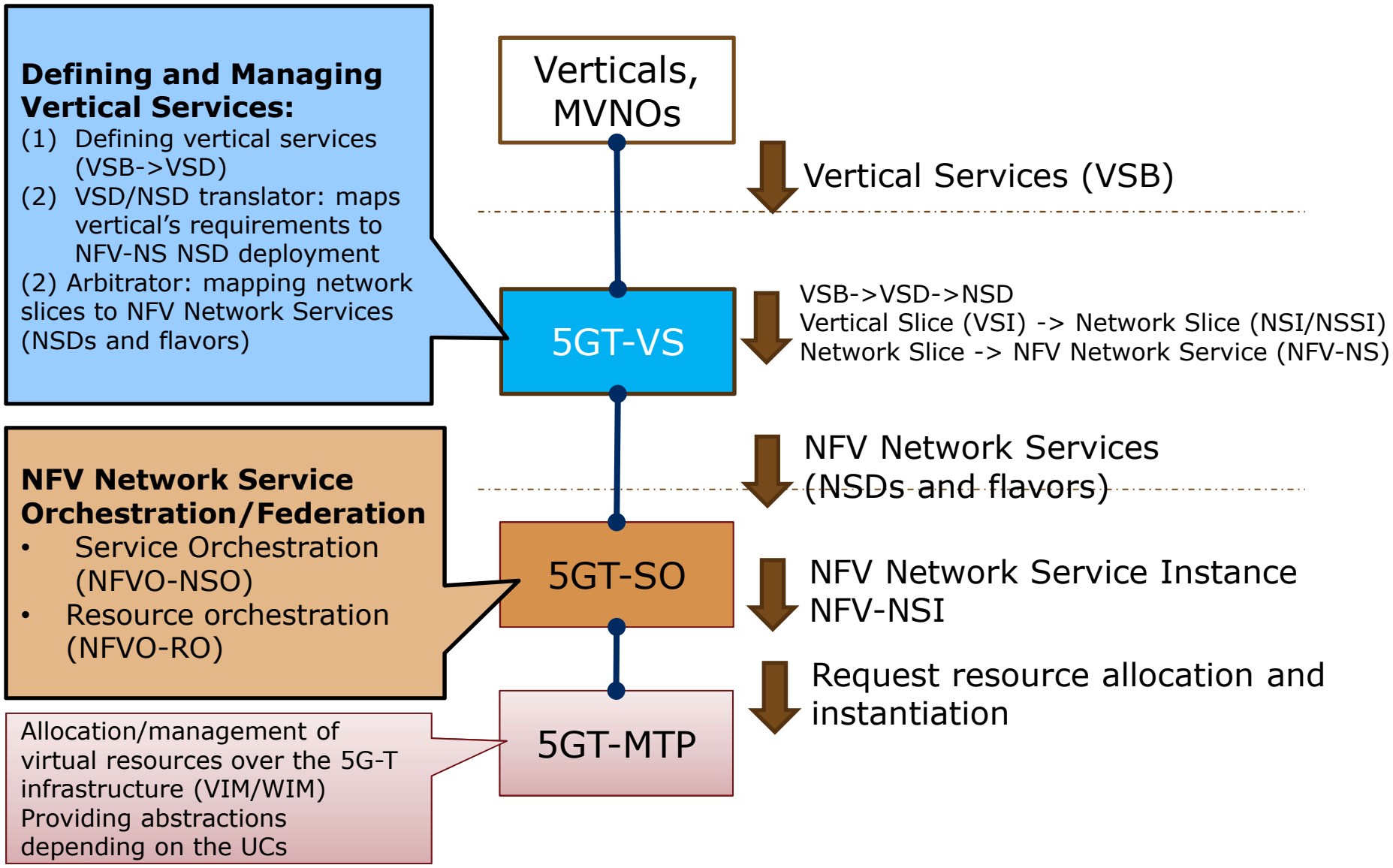
Media

M(V)NO

- Aggregate and **Federate transport networking and computing fabric**, from the edge up to the core and cloud, to create and manage **MTP slices throughout a federated virtualized infrastructure**



From Service to Network Slice to Network Service Instantiation



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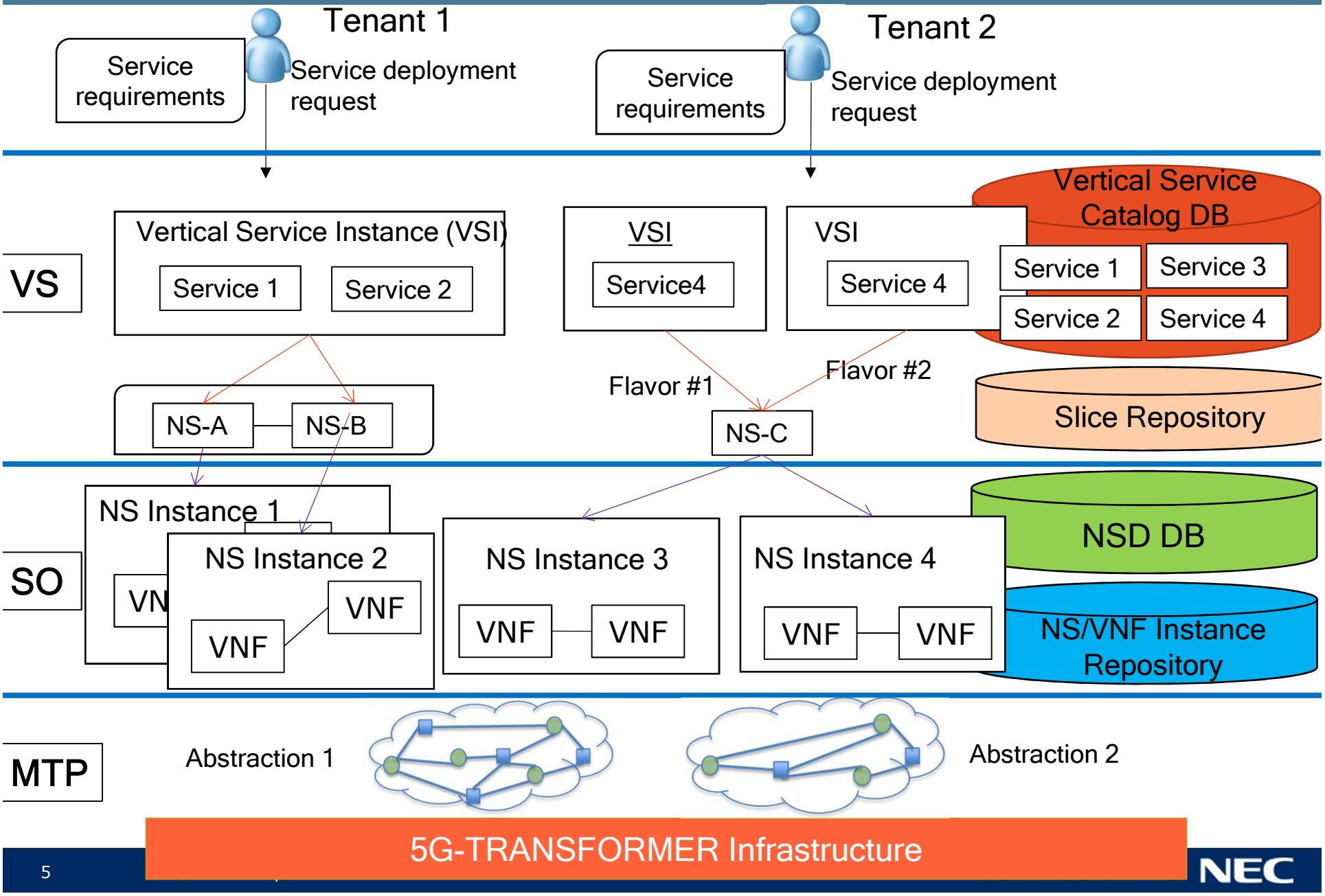


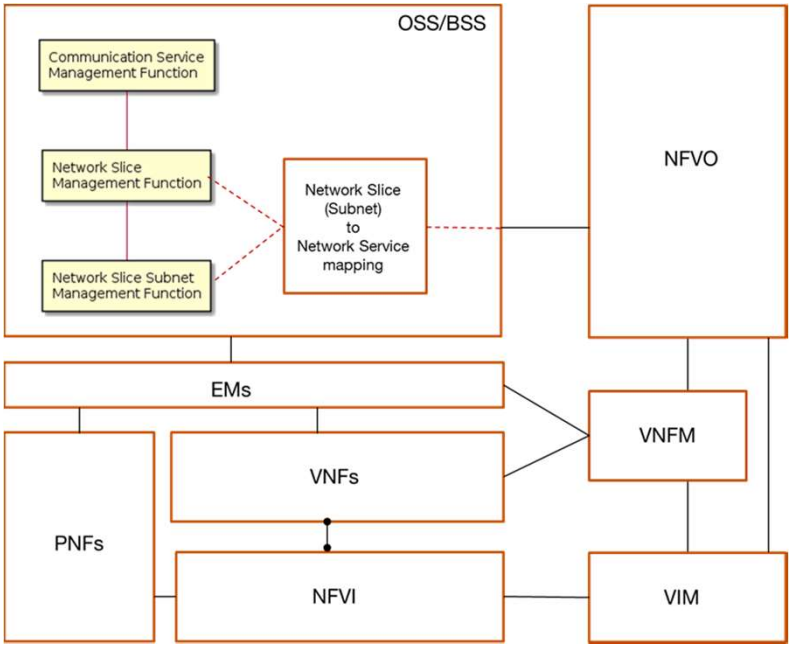
3GPP/ETSI NFV

3GPP TR 28.801 – Architecture

- **CSMF**: Translates the communication service requirements to network slice requirements
- **NSMF**: Manages the NSIs, including their lifecycle and their mapping with the NSSIs that compose them
- **NSSMF**: Manages the NSSIs and their lifecycle

Map to NFV architecture

- CSMF, NSMF and NSSMF are part of the OSS/BSS
- An **additional «mapping function»** is required to translate between Network Slices and Network Services and interact with the NFVO



Relationship of 5G-TRANSFORMER with 3GPP/ETSI NFV

Vertical Slicer:

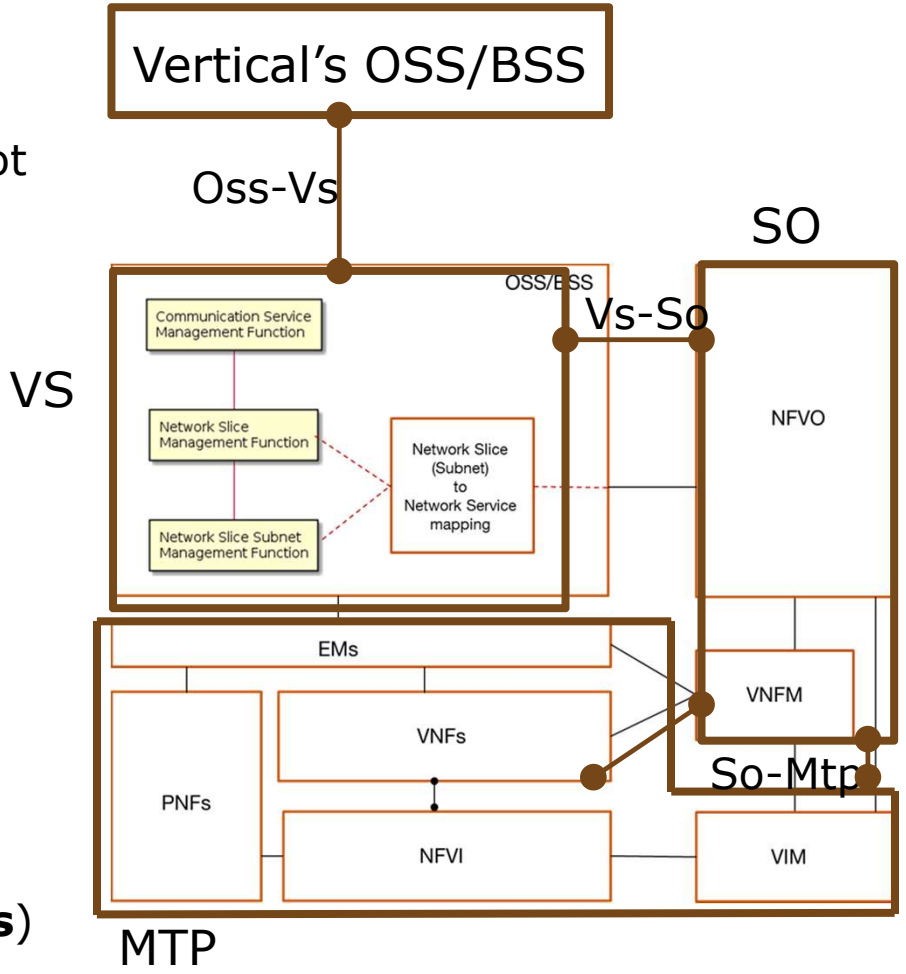
- CSMF (extended to deal with requirements of generalized services, not only communication ones)
- NSMF & NSSMF
- Mapping function
- Extended with an Arbitrator

Service Orchestrator:

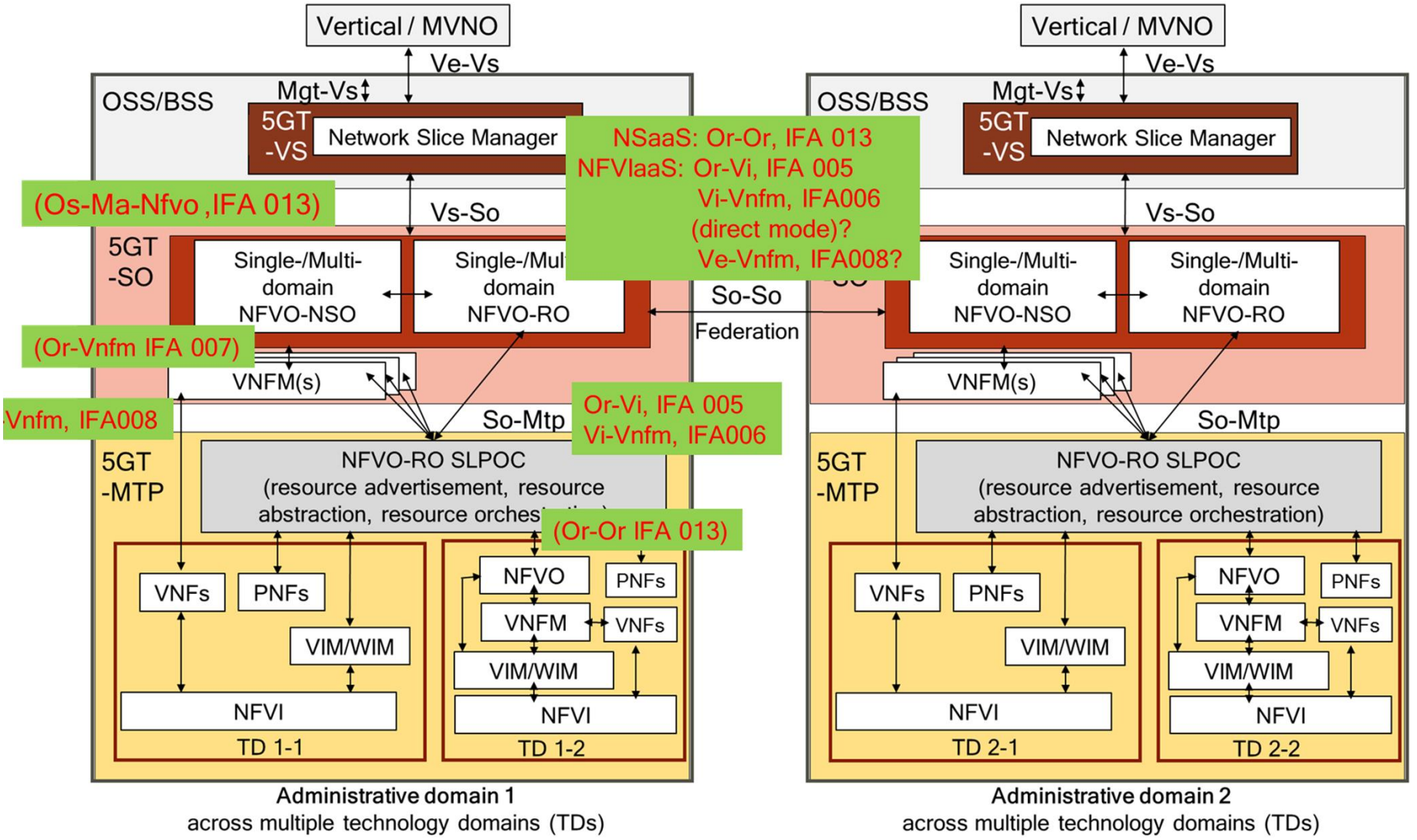
- NFVO (NSO + RO)
- VNFMs

MTP:

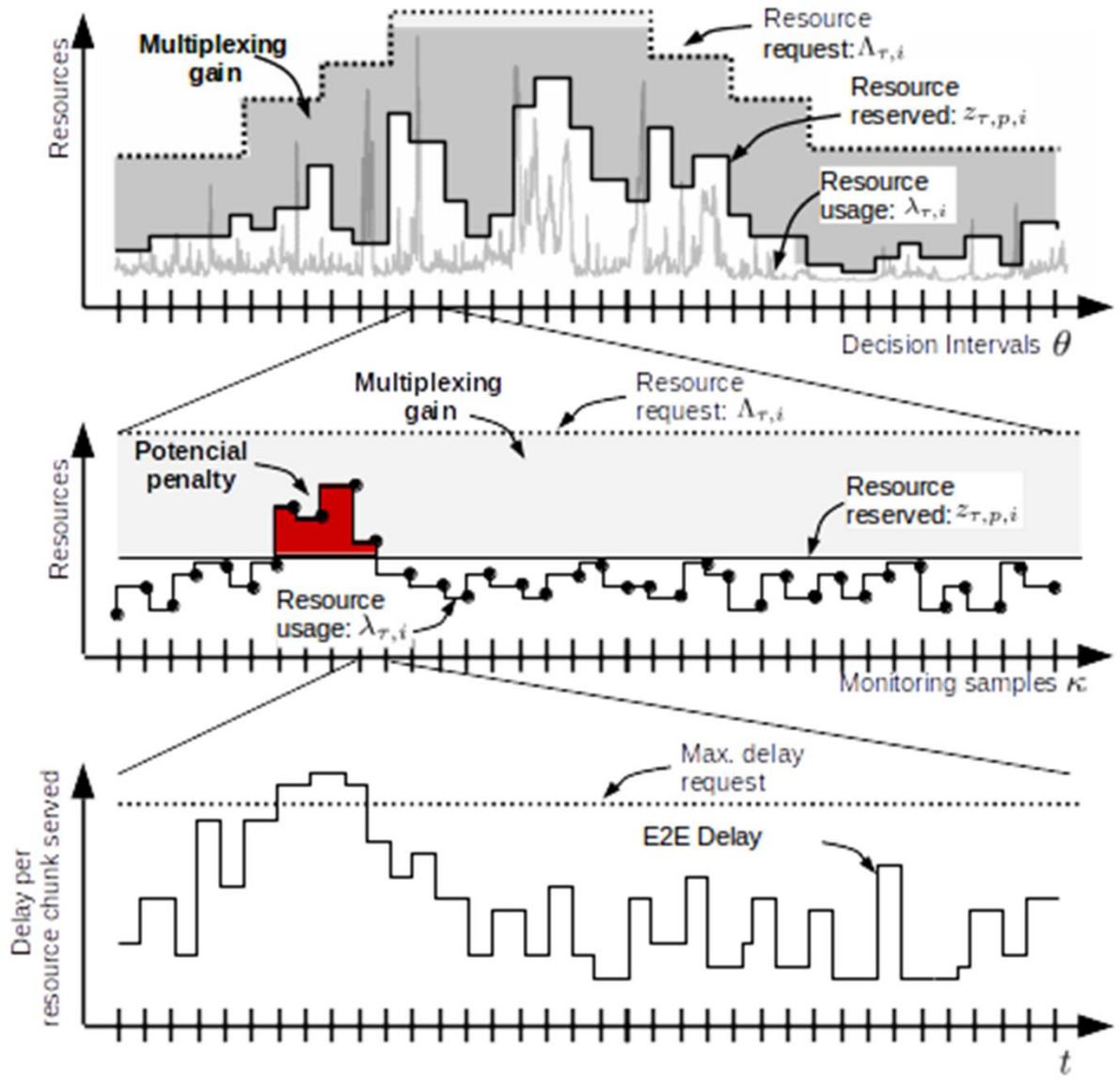
- one or multiple VIMs/WIMs
  - SDN controllers, Radio controllers, Cloud controllers
- NFVI (**extended to Mobile Edge Hosts**)
- VNFs/PNFs



Architecture



Use Case: Business Model based on Overbooking



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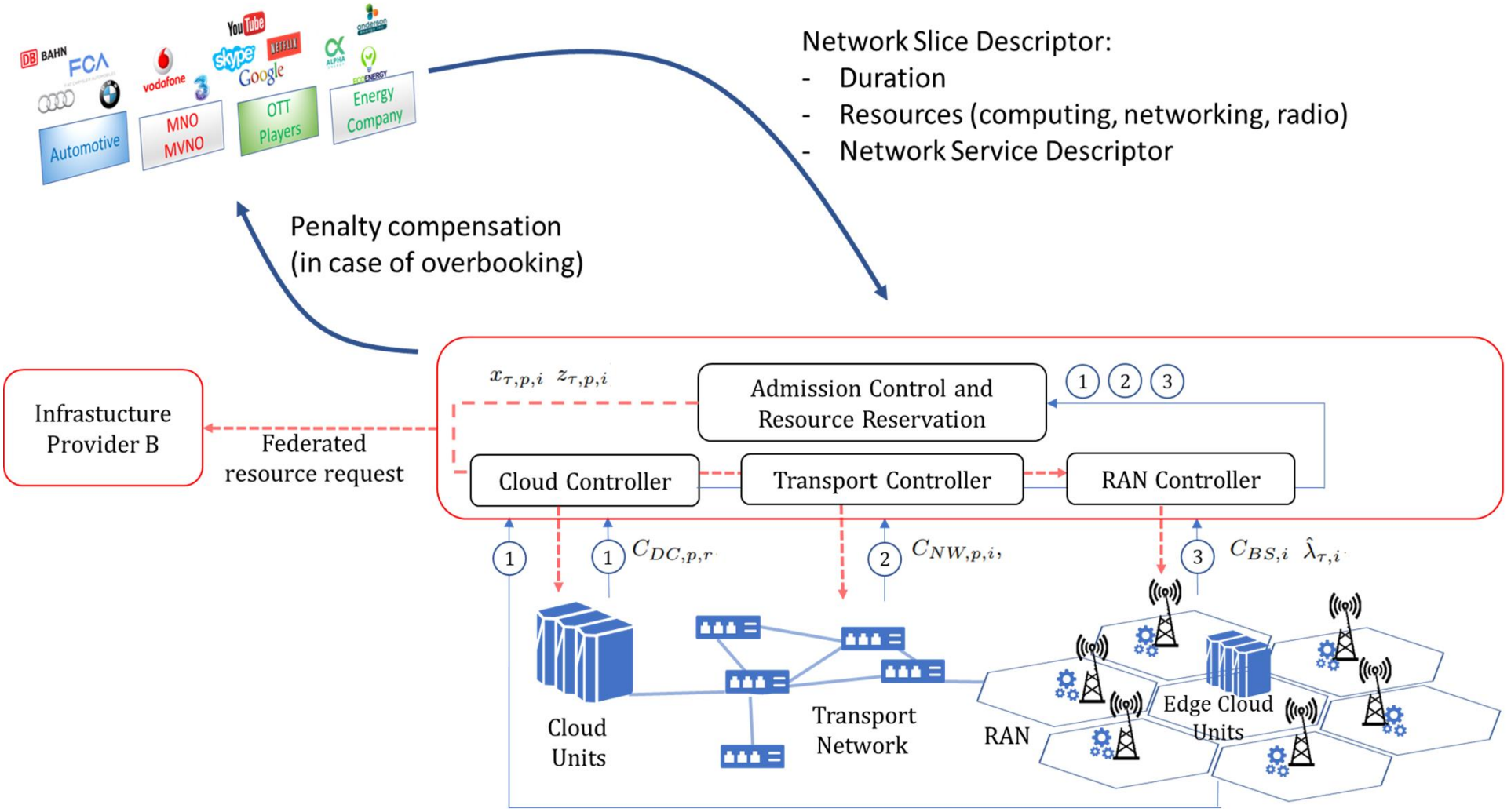

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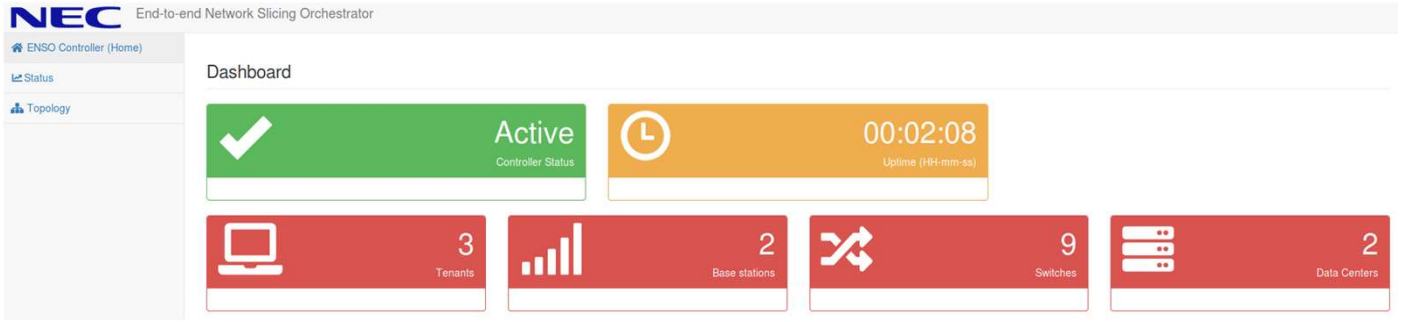

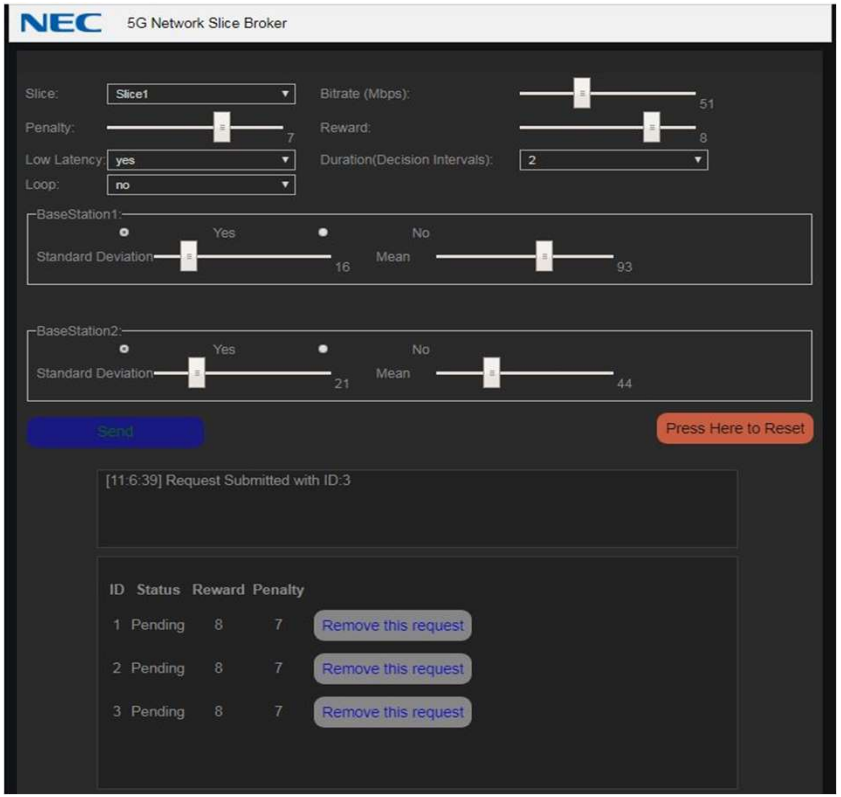

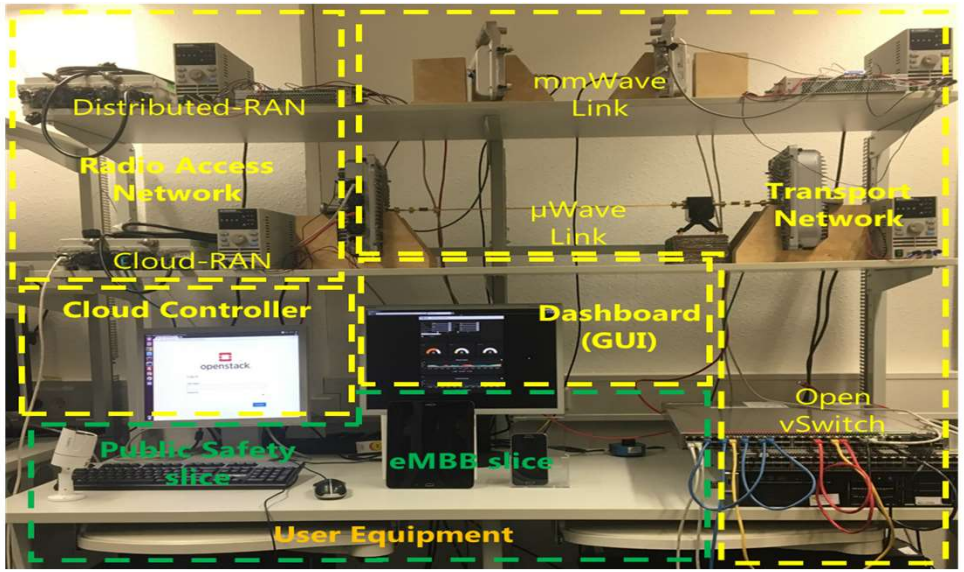

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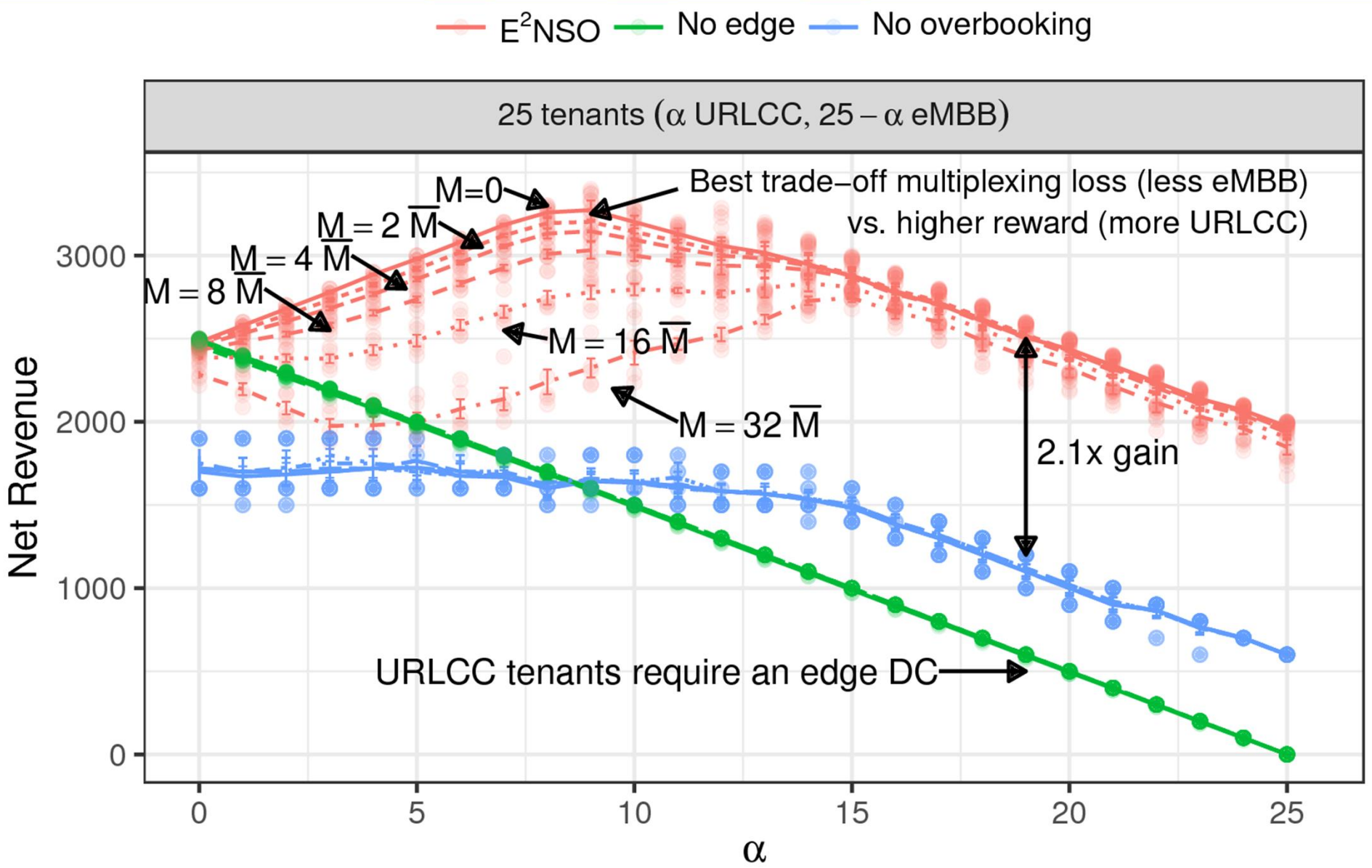
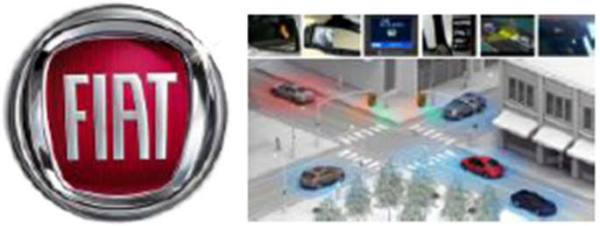


Backup slides

5G-TRANSFORMER: Use Cases



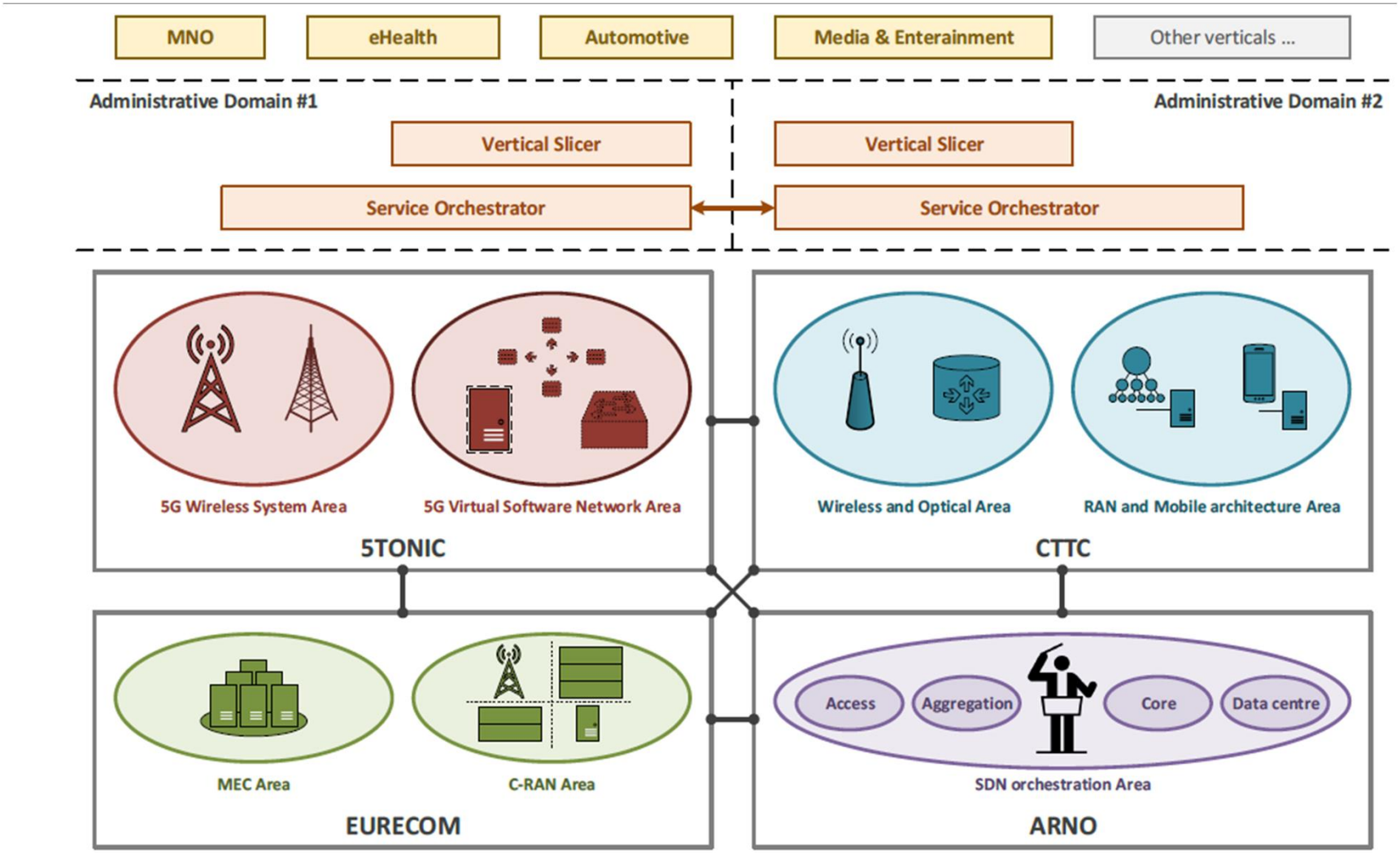
Automotive

Healthcare

Media

M(V)NO

Global integration scenario



Vertical Use Cases: Automotive

- **UC1: Safety**: through the exchange and processing of safety messages, warnings and traffic information, the risk of accidents involving vehicles as well as vulnerable roads users (pedestrians, cyclers, …) can be significantly reduced;

  Requirements: Low Latency, High Reliability, High Node Speed.

- **UC2: Mobility**: vehicle navigation and delivery of information on traffic intensity and parking availability can significantly reduce drivers' stress and improve the quality level of daily driving experience;

  Requirements: High Reliability, Low Latency, High Node Speed.

- **UC3: E-road**: information on the road status and driving conditions can significantly reduce the risk of accidents and ease the driving experience in harsh situations;

  Requirements: Low Latency, High Bandwidth, High Reliability and High Node Speed.

- **UC4: Entertainment**: passenger can enjoy a vast range of applications including, video streaming and mobile gaming, possibly with an enhanced experience through augmented reality;

  Requirements: High Bandwidth and High Node Speed.

- **UC5: Digitalized Vehicles**: vehicles can automatically download software updates when needed, as well as exploit data collected through on-board sensors for remote vehicle monitoring and for enabling predictive maintenance;

  Requirements: Low Latency, High Bandwidth, High Node Speed.

- **UC6: Automated Driving**: vehicle control can be performed by an electronic system instead of a human driving in the case of, e.g., car overtaking, intersection crossing and vehicle platooning.

  Requirements: High Reliability, High Bandwidth, Low Latency, High Node Speed.

Vertical Use Cases: Entertainment

- **UC1: On-site live event experience:** Large scale event sites, such as stadiums are more and more being connected in order to give better experience to their customers.

  Requirements: High User Data Rate, High Reliability, Low Latency and High Density.

- **UC2: Ultra-high fidelity media:** Consumers (fans) will demand 4k and 8k quality in their media consumption through their user devices. Both linear (e.g. live programming, streaming) and non-linear (e.g. on-demand) content will be used for providing this Ultra High Fidelity Media experience.

  Requirements: High User Data Rate, High Reliability, Low Latency and High Density.

- **UC3: Immersive and Integrated Media:** To provide the fans with immersive experiences from player perspectives to 360-degree views and behind-the-scenes content.

  Requirements: High User Data Rate, High Reliability, Low Latency and High Density.

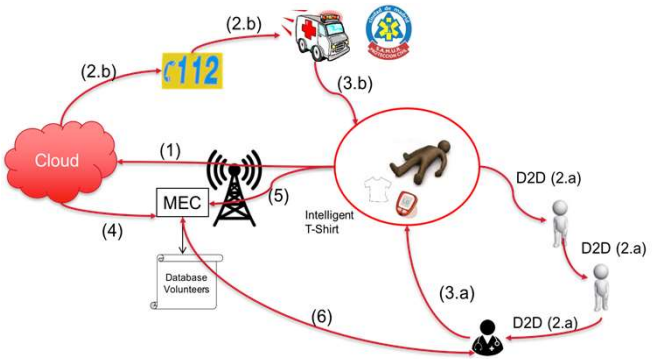
- **UC4: User Generated Content:** People and objects are and will capture more and more content in order to share it with others in the cloud via social networks. Video and virtual reality will be the killer contents of the "user generated content" evolution. Fans will create and consume content generated by them in any sport venue.

  Requirements: High User Data Rate, High Reliability, Low Latency and High Density.

Vertical Use Cases: eHealth

- **UC1: Heart attack emergency:** test the request and instantiation of different network slices with different requirements: a network to upload user data from a smart shirt to the cloud; a network to exchange video, audio, patient's electronic health record, etc. between paramedics and doctors in the hospital; and, a network to detect volunteers in the surrounding area to help the patient.

  Requirements: High Reliability and Low Latency.



- **UC2: Environmental information:** IoT to generate environmental information that can be analyzed by eHealth servers to detect in advance potential problems of users, that can be informed about areas that should be avoided.

  Requirements: Massive connected devices.

- **UC3: Remote surgery:** A surgeon may help other local surgeons, or completely replace local surgeons to perform remote surgeries, managing local robots. This use case requires haptic technologies, which requires high bandwidth and low latency in the underlying communication network.

  Requirements: High bandwidth and Low Latency.

Vertical Use Cases: e-Industry

- **UC1: Monitoring:** Sensors are used to constantly monitor essential production line equipment and the production status. Collected data are processed in real time in cloud by analytics functions for preventive maintenance.

  Requirements: Bandwidth: 2-3 Mbit/min.

- **UC2: Cloud robotics:** Highly automation of the factory plant is provided moving the control of the production processes and of the robots functionalities in cloud, exploiting wireless connectivity to minimize infrastructure, optimize processes, implement lean manufacturing.

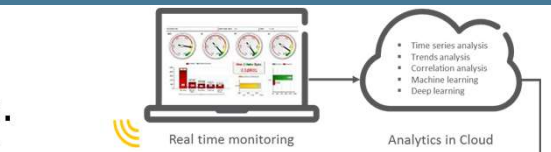
  Requirements: High Availability and Reliability, Low Latency.

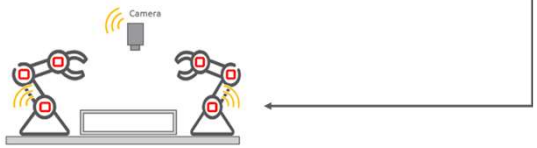
- **UC3: Automated logistics:** Robotized logistics in a port environment to enhance efficiency in the logistic chain in the port and in the infrastructures connecting the port area.

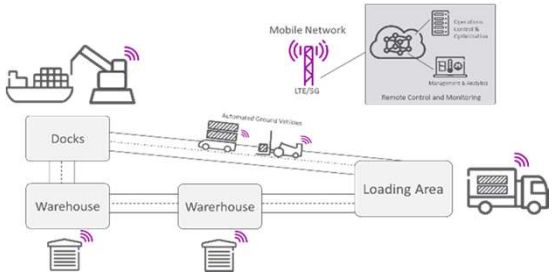
  Requirements: Low Latency, High Availability, High Reliability, and Support of narroband technologies (e.g. NB-IoT).

- **UC4: Electrical utilities: Generation, Transmission and Distribution:** The remote control of the power generation, transmission and distribution process is critical to maximize net revenue, particularly in wind power farms where the energy income is volatile.

  Requirements: Low Latency, High Availability, Precise synchronization, Support of narrowband technologies, Packet loss rate: generally around 1%, Jitter, Redundancy.





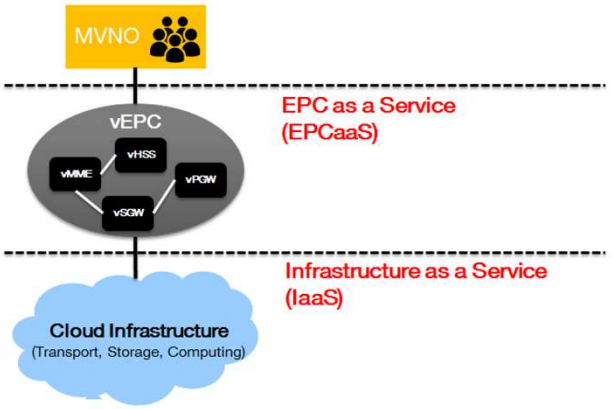


MNO/MVNO Use Cases

- **UC1: vEPCaaS**: The vEPC can be instantiated as a virtualized Control plane only or as a complete virtualized Control and User planes core network. The vEPC is supposed to provide the same implementation and performances of a real EPC that is deployed on a real infrastructure. The use of a vEPC should be totally transparent and should not impact services end to end latency.

  Requirements:

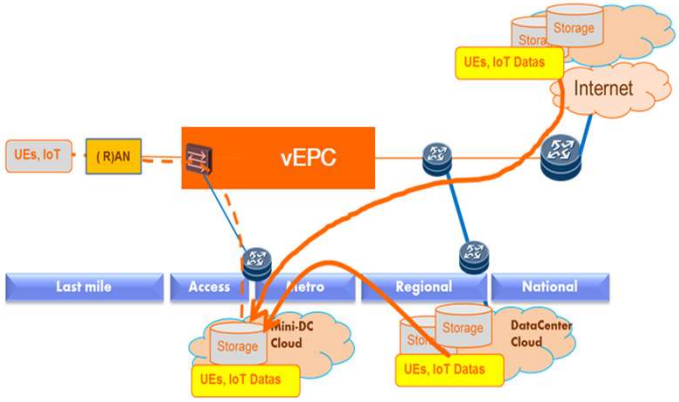
  - Maintaining the complete consistency with legacy networks.
  - Behave transparently as a non-cloudified implementation of EPC.
  - Full compliance with the 3GPP standards.
  - Latency <1s for the signaling in the control plane.
  - Capability to adapt the QoS allocation and throughput at the user plane according to the user application flow type (minimum value of throughput depends on the service type).



- **UC2: Cloud data for URLLC**: This use case is supposed to introduce different levels of data storage depending on service type (better fluidity, speed, reactivity for the UEs) for URLLC. It allows for an MNO or an MVNO to optimize the Core network resources providing local cloud services.

  Requirements:

  - Administrate and configure a dynamic data cloud service over several distributed data centers
  - Ability to detect the path on which the traffic data need to be transmitted.
  - Ability to define and deploy Mini-cloud data services in access/Metro area.
  - Ability to define dedicated internal slices for inter-cloud communication.
  - Ability to reroute the user traffic flows towards dedicated slice.
  - Ability to define the best area (access or metro or regional) for "local cloud" depending on the Service type.
  - Latency between 1 and 5 ms.



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