InfoCom 2021 – Smart5Grid

OTE's contribution to Wide Area Monitoring

Michalis Rantopoulos,
Fixed Network R&D Programs Section
Research & Development department, Fixed & Mobile
Hellenic Telecommunications Organization S.A.

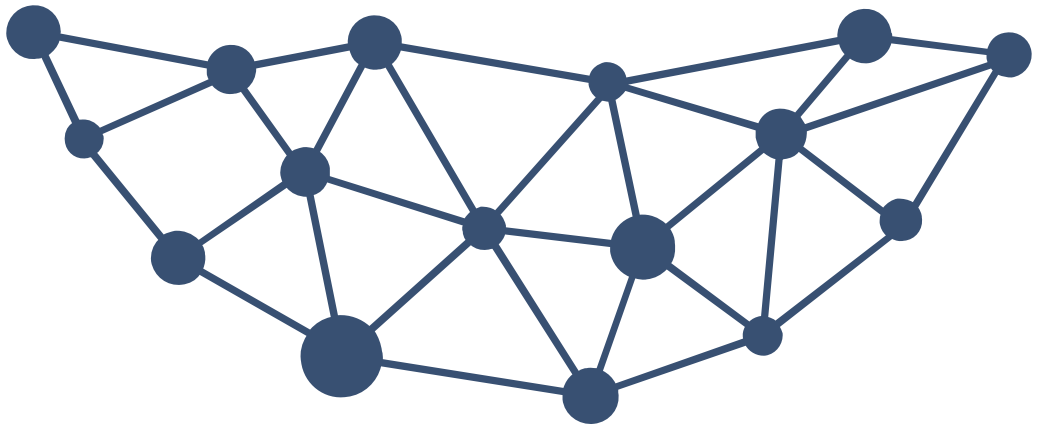
26th November 2021

This project has received funding from the European Union's *Horizon 2020 research and innovation programme* under grant agreement n° 101016912

Demonstration of **5G** solutions for **SMART** energy **GRID**s of the future

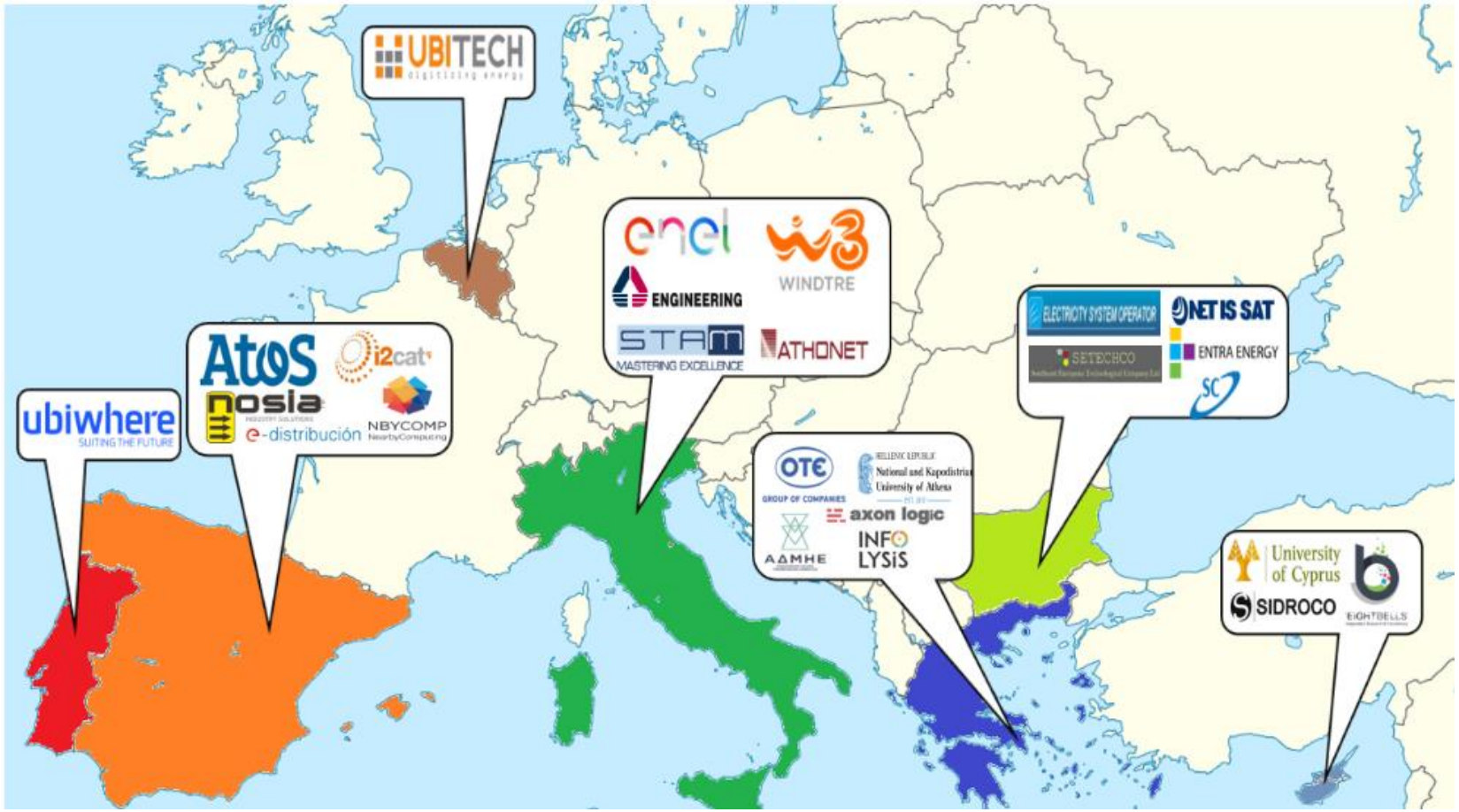
OTE GROUP OF COMPANIES

Smart5Grid



Demonstration of **5G** solutions for
SMART energy **GRID**s of the future

25 partners from Energy Verticals, Telco operators, SMEs



Overview 1/3 – Integration of previously unconnected devices

- **5G mobile networks will help to integrate previously unconnected devices to smart grids for accurate monitoring and improved forecasting of their energy needs.**
- **Managing energy demand will become** more efficient, requiring less investments
- **The smart grid** will be able to :
  1. Balance easier the energy load;
  2. reduce electricity peaks;
  3. reduce energy costs.
- **Large cities** will be able to plan their energy infrastructure based on collected data ,thus:
  1. Spending less resources, and;
  2. reducing the “downtime”.
- **From the perspective of power supply, 5G is expected to enable better efficiency, observability and controllability of the power system.**
- **Energy suppliers will be able to collect and store power grid related data at much faster rates**, ensuring secure and stable power supply, ***while risk mitigation and fault management will become simple and more straightforward.***

Overview 2/3 – Little application of mobile-network technology in the highly demanding Energy Vertical

- ***The power distribution grids have only seen very little application of mobile-network technology so far!***

- ***Inactive involvement of telecom operators in the highly demanding Energy Vertical due to various reasons:***
  - *Variety of network technologies, in use by the power grid operators.*
  - *Traditional 3G/4G cannot provide different network slices to preferred customers.*
  - *Using FOC to build communication networks on the distribution level has difficulties in the deployment.*

Overview 3/3 – Main Target

- The **main target of Smart5Grid project** will be to complement contemporary energy distribution grids with access to 5G network resources through an **open experimentation 5G platform** and innovative **Network Applications (NetApps).**

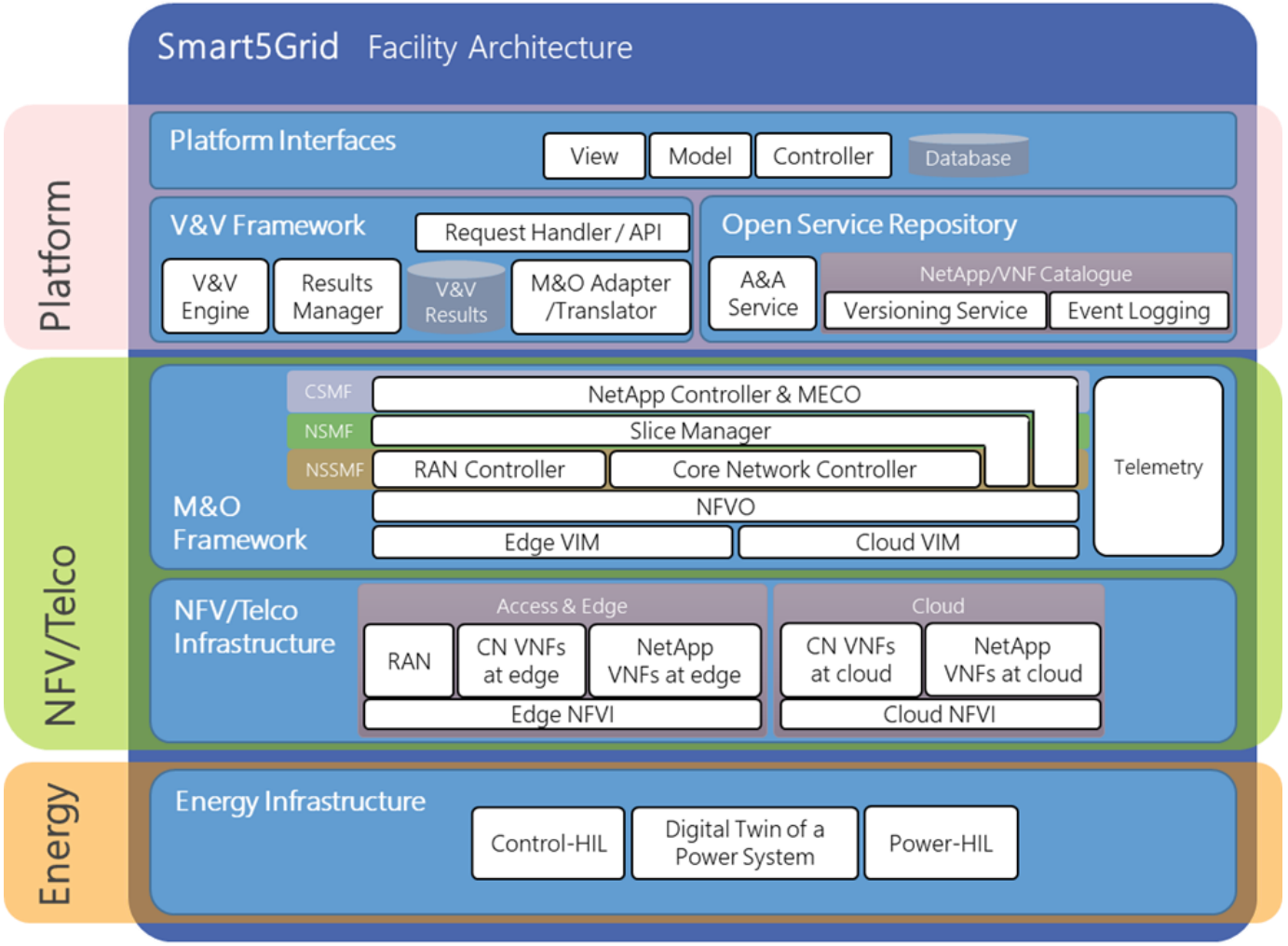
- Smart5Grid administers **four meaningful use cases** for the energy vertical ecosystem, in order to demonstrate efficiency, resilience and elasticity provided by the 5G networks.

- Smart5Grid provides an **open environment** to third parties for experimentation, which will be able to support development, testing, and validation of 5G Network Applications specialised for the Energy Vertical.

Project Objectives

PO1	To specify the critical architectural and technological enhancements from previous 5G PPP Phases needed to fully enable an open experimental platform for the Energy vertical (WP2)
PO2	To design, deploy, operate, and evaluate in real world conditions a fully featured 5G network platform customised for smart energy distribution grids (WP2, WP3)
PO3	To develop an open NetApp repository (WP3)
PO4	To develop high-performance NetApps (WP4, WP5, and WP6)
PO5	To provide a Validation and Verification (V&V) experimentation framework for NetApp automatic testing, certification, and integration (WP4)
PO6	To realise four advanced 5G real-life demonstrations over a wide set of energy related use cases. To exhibit that performance has been conforming to 5G PPP KPIs
PO7	Detailed techno-economic analysis and road mapping towards exploitation and commercialisation by industry partners and SMEs are also of high priority for the project (WP2, WP7)
PO8	To ensure maximisation of Smart5Grid impact to the realisation of the 5G vision by establishing close liaison and synergies with 5G PPP Phase-2 and 3 projects and the 5G PPP (WP7)

Facility Architecture



Adoption of Cloud Native paradigm

- *In Smart5Grid we will embrace and adopt - where possible - the cloud native paradigm to pave the way towards the integration of the energy infrastructure and the 5G Core Network (CN) Service Based Architecture.*
  This 5G CN SBA will require several techniques being applied in unison, i.e., NFV and SDN that will require the deconstruction of VNFs into microservices.

- *This effectively translates to the containerization of the 5G Core, and the gradual decoupling of network functions from VMs in support of containerized network functions.*

- *For this reason, the adoption in the early stage of a cloud native approach for the NetApp development will increase the compatibility between telco and vertical infrastructure.*

MEC platform and 5G Network Exposure Function (NEF)

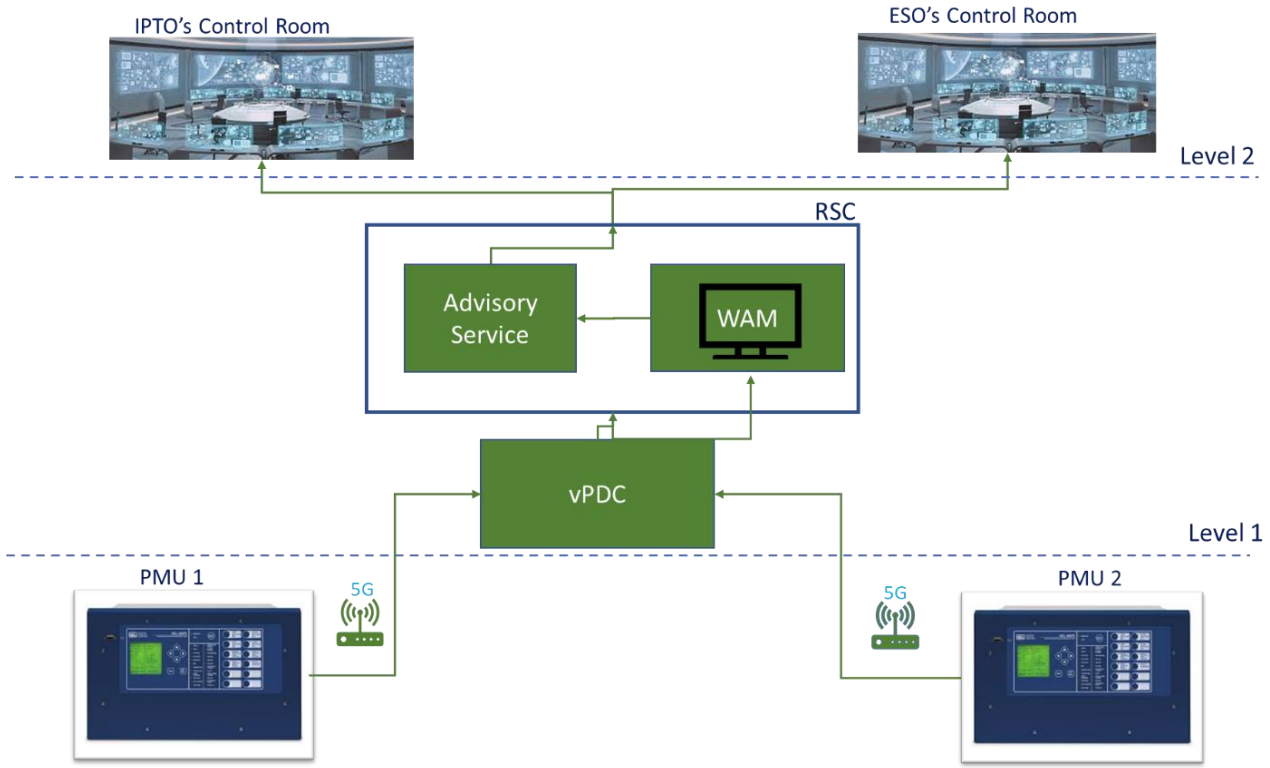
- **gNodeBs (gNBs) handle 5G radio communications using the 5G NR (New Radio) air interface** and they are connected to the 5G Core Network via the NG interface and to each other via an Xn interface.

- **MEC nodes will be additionally deployed to host Smart5Grid NetApps targeting to gain a strong advantage from localised communication, storage, processing and management and thus to dramatically decreasing service response times.**
  i. ***They will be able to be remotely instantiated, removed, and orchestrated, and also connectivity between MEC nodes is also provided through the 5G network.***
  ii. ***They will help to avoid unnecessary transmission latency and bandwidth consumption of routing messages to its consumers (i.e. MEC applications) via the 5G Core Network.***

- **NEF (Network Exposure Function) instance handles the exposure of the local network information.**

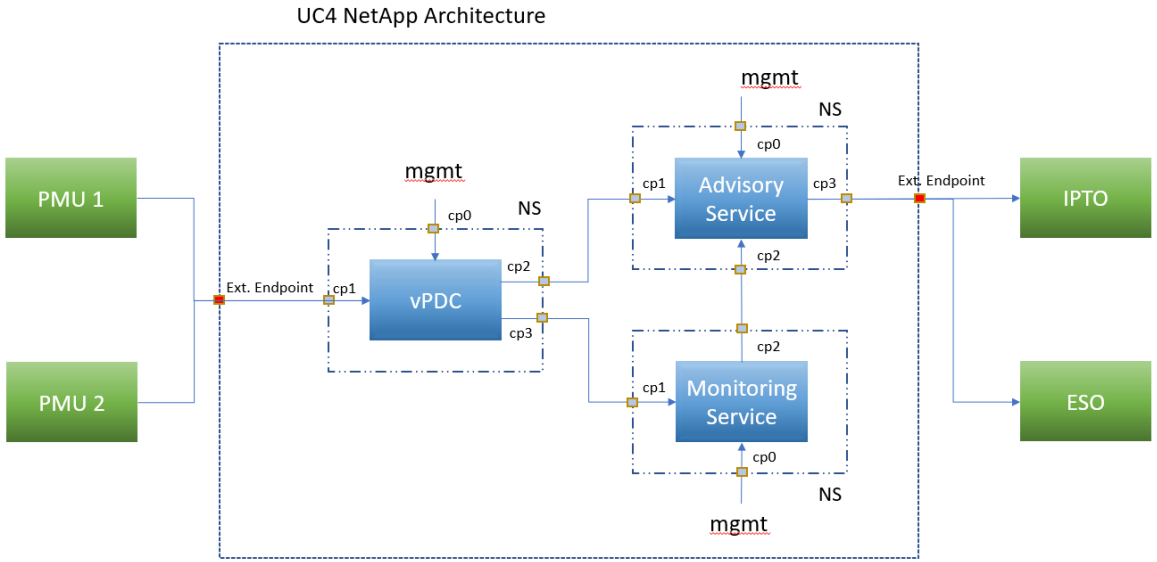
Real-Time Wide Area Monitoring (Use Case 4)

- The interconnection flow between Greece and Bulgaria is monitored leveraging the advantages that the 5G telecommunications infrastructure provides.



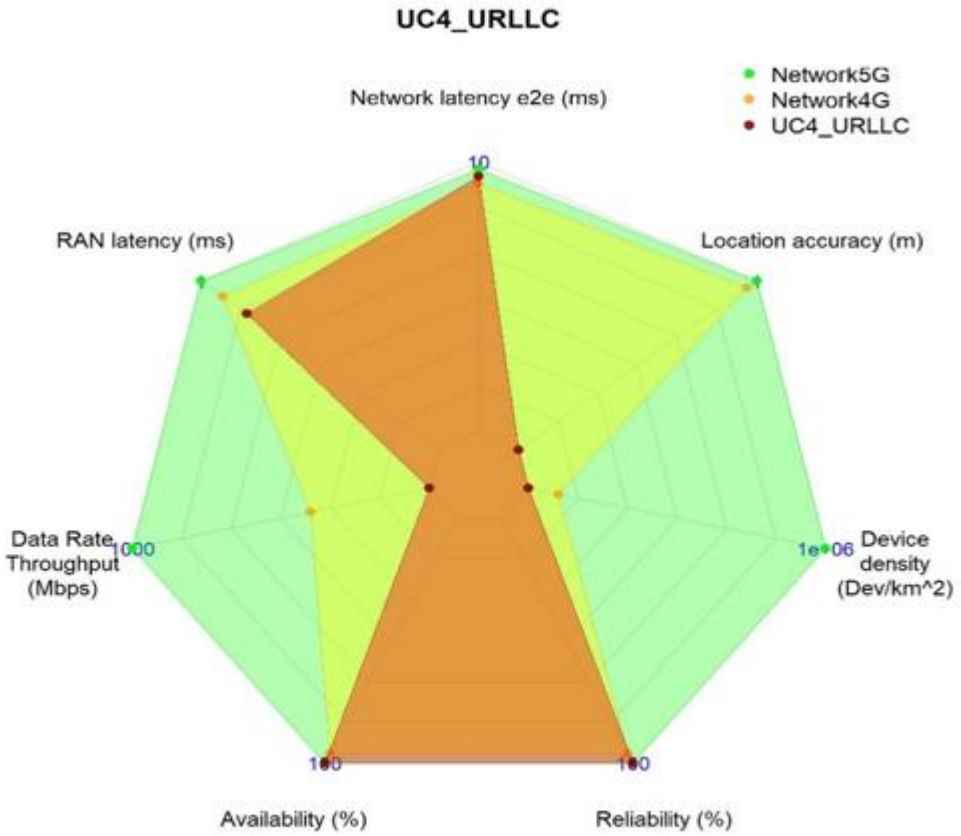
Use Case 4 – NetApp Architecture

- NetApp consists of three components:
  - ❖ vPDC VNF
  - ❖ Monitoring VNF
  - ❖ Advisory VNF

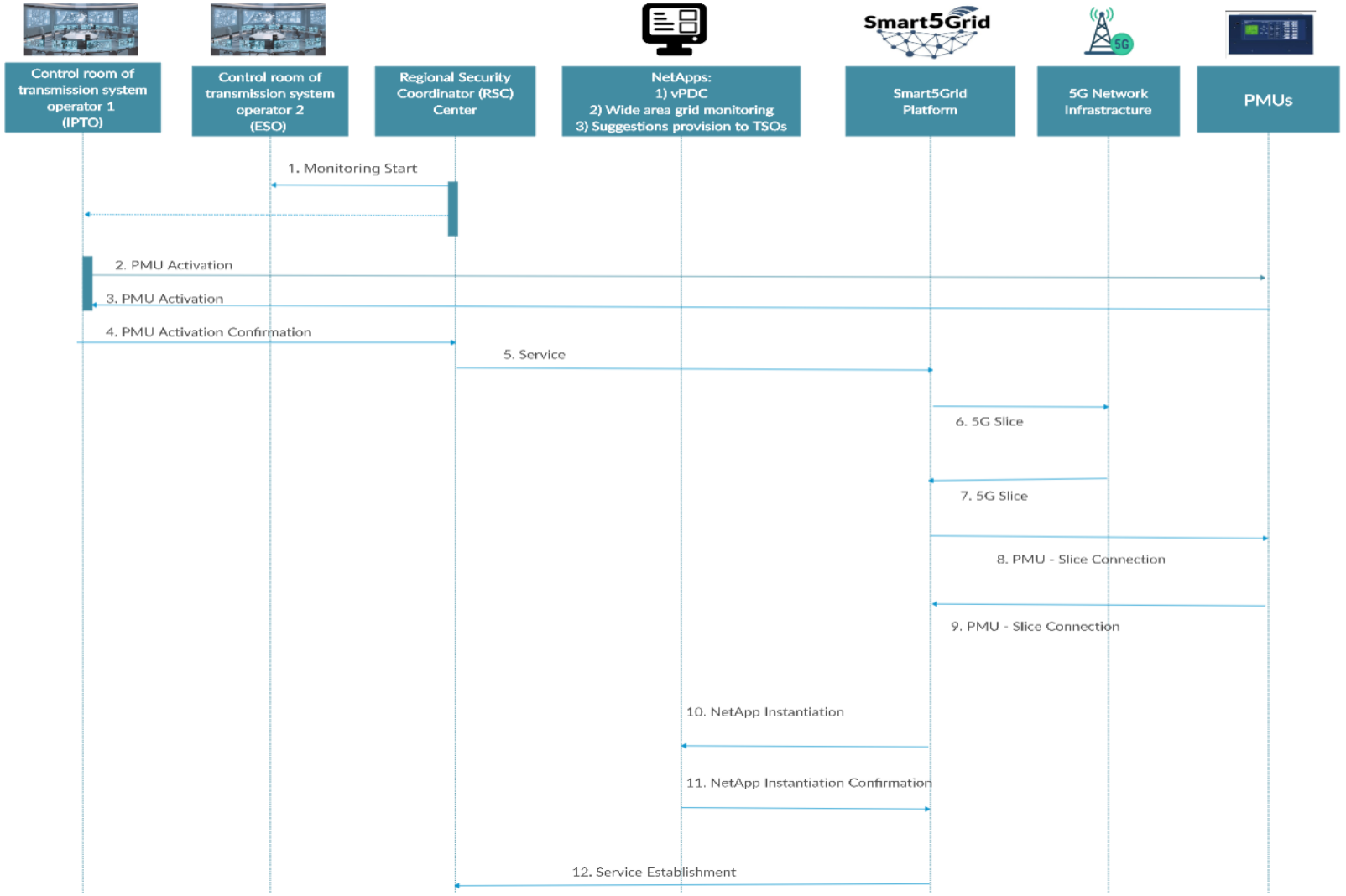


Use Case 4 – Requirements for the 5G network

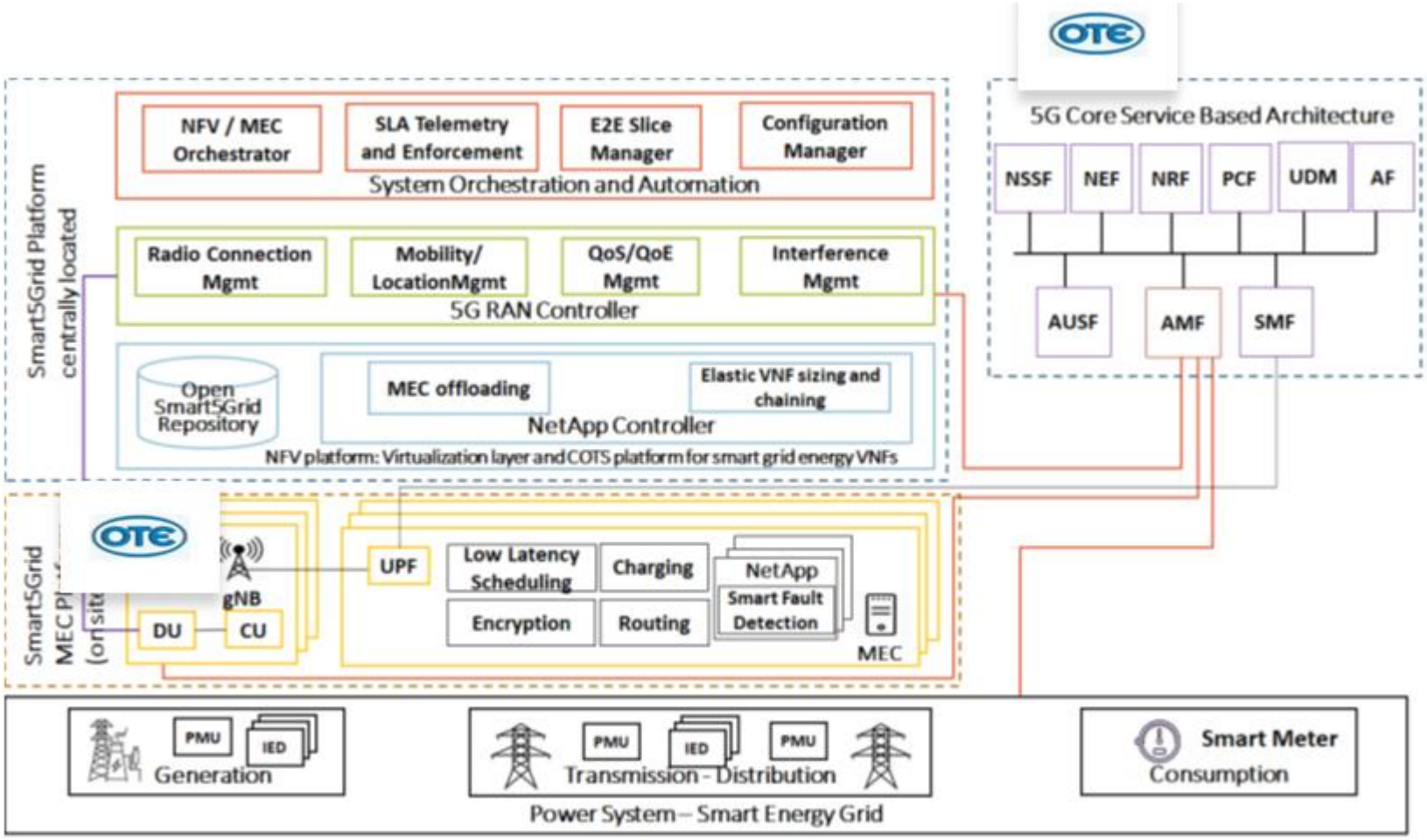
	Use case Requirements	Units	UC #4		
			Real-time Wide Area Monitoring		
			5G Use case category/Slice Type		
			URLLC	eMBB	mMTC
1	Communication service **Availability**	%	99.999	-	-
2	Communication service **Reliability**	%	99.999	-	-
3	End-to-end **latency**	msec	20-200	-	-
4	vPDC absolute waiting time	msec	40	-	-
7	Device Density	Dev/km2	1	-	-
8	Location Accuracy	m	-	-	-
9	Security	Y/N	Y	-	-
10	Network slicing	Y/N	Y	-	-
11	Private slicing	Y/N	Y	-	-



Use Case 4 – Sequence Diagram of the Day-0



OTE's contribution to Use Case 4



Alignment with other 5G-PPP projects

5G Vision's current hurdle is the noticeable difficulties on reconciling the expertise across multiple knowledge domains, *such as, for example, the Telco and Energy industries.*

Several 5G-PPP projects have tackled in recent initiatives the challenge of easing the adoption of 5G technologies for vertical applications:

- ***5G-TRANSFORMER*** *proposes an architecture where vertical applications can be defined by selecting from a set of Vertical Service Blueprints (VSB), available from a catalogue*
- ***MATILDA*** *aimed at providing software developers with the necessary tools to develop vertical applications as 5G-ready applications.*

✓ **Smart5Grid aims to progress on these two ideas, extending the concept of vertical applications by defining a NetApp.** *The NetApp concept improves the vertical application by the specification of performance requirements that define how an application leverages edge deployments and how it connects and interacts with the 5G networks.*

Alignment with other 5G-PPP projects

Other 5G-PPP projects funded under ICT-41-2020 propose NetApps as solutions to vertical challenges:

The common denominator of this grant is to enable experimentation facilities that help open new markets within the verticals and ease the entrance to these markets for application developers.

- ***5GASP:*** *Automotive and Public Protection and Disaster Relief (PPDR)*
- ***5G-EPICENTRE:*** *Service public security Use Cases*
- ***5G-ERA:*** *Industry 4.0, Transport & Logistics, Public Safety, and eHealth & Wellness*
- ***5G-IANA:*** *Automotive sector*
- ***5G-INDUCE:*** *Industry 4.0 applications*
- ***5GMediaHUB:*** *Validating media-oriented applications in two testbeds*
- ***EVOLVED-5G:*** *Manufacturing industry*
- ***VITAL-5G:*** *Transport and logistics*

Alignment with other 5G-PPP projects

- ✓ ***Smart5Grid 5G Experimental Platform aims to provide an experimentation environment for 3rd party developers to implement, verify and validate energy vertical applications as NetApps, composed of a chain of VNFs.*** *These applications, once validated, will be hosted and accessible from an Open NetApp repository, encouraging the reutilization of VNFs and fostering the introduction into the market of start-ups and SMEs*

- ✓ ***Smart5Grid´s intention is to collaborate with the other projects under ICT-41-2020 grant****, aligning with them, finding commonalities, and mutually benefiting from the advantage of potential synergies.*

Thank you

Wishing all the best for our common success!


???
Q
&
A