5GENESIS: An experimentation 5G platform to validate 5G KPIs for various 5G use cases and vertical industries

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5GENESIS

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5th Generation End-to-end Network, Experimentation, System Integration, and Showcasing

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5GENESIS Platforms

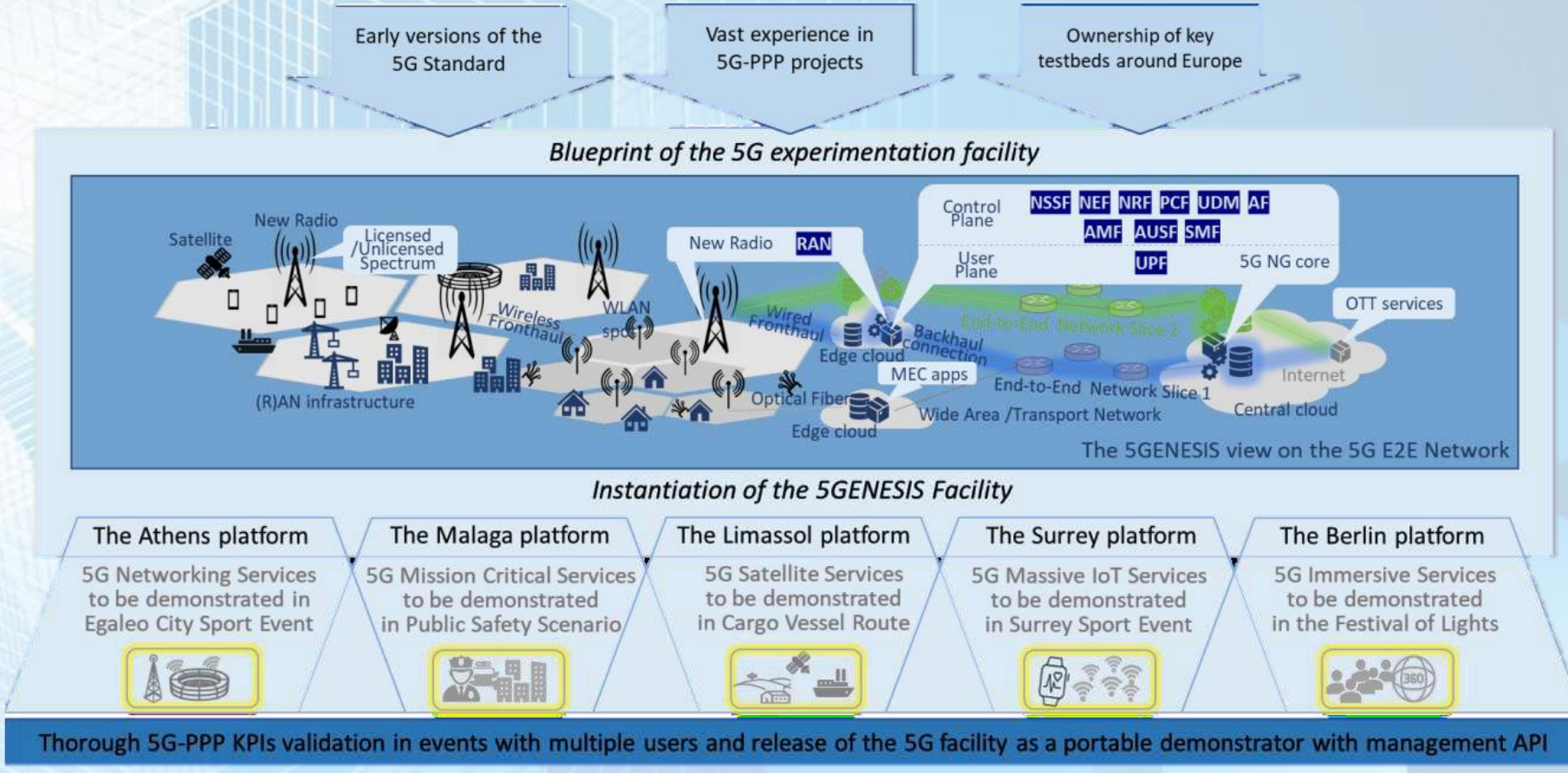
Platforms of the 5GENESIS Facility:

- The Athens Platform
- The Malaga Platform
- The Limassol Platform
- The Surrey Platform
- The Berlin Platform

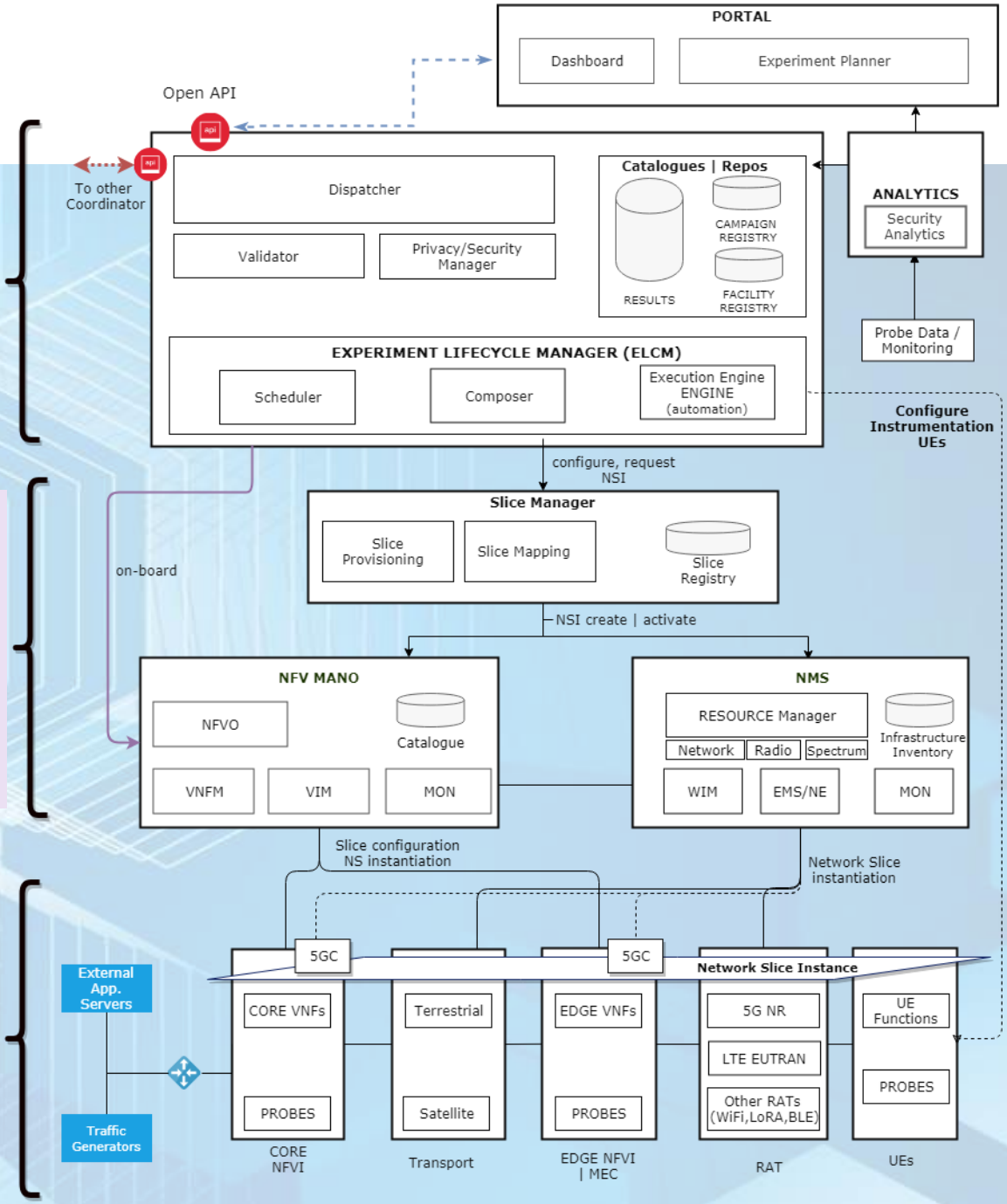
5GENESIS Vision

The 5GENESIS facility is based on an experimentation blueprint, that serves as a common architectural reference.

The main goal of 5GENESIS is to deliver an experimentation 5G facility capable of validating 5G KPIs for various 5G use cases and vertical industries.



Athens Platform Reference Architecture

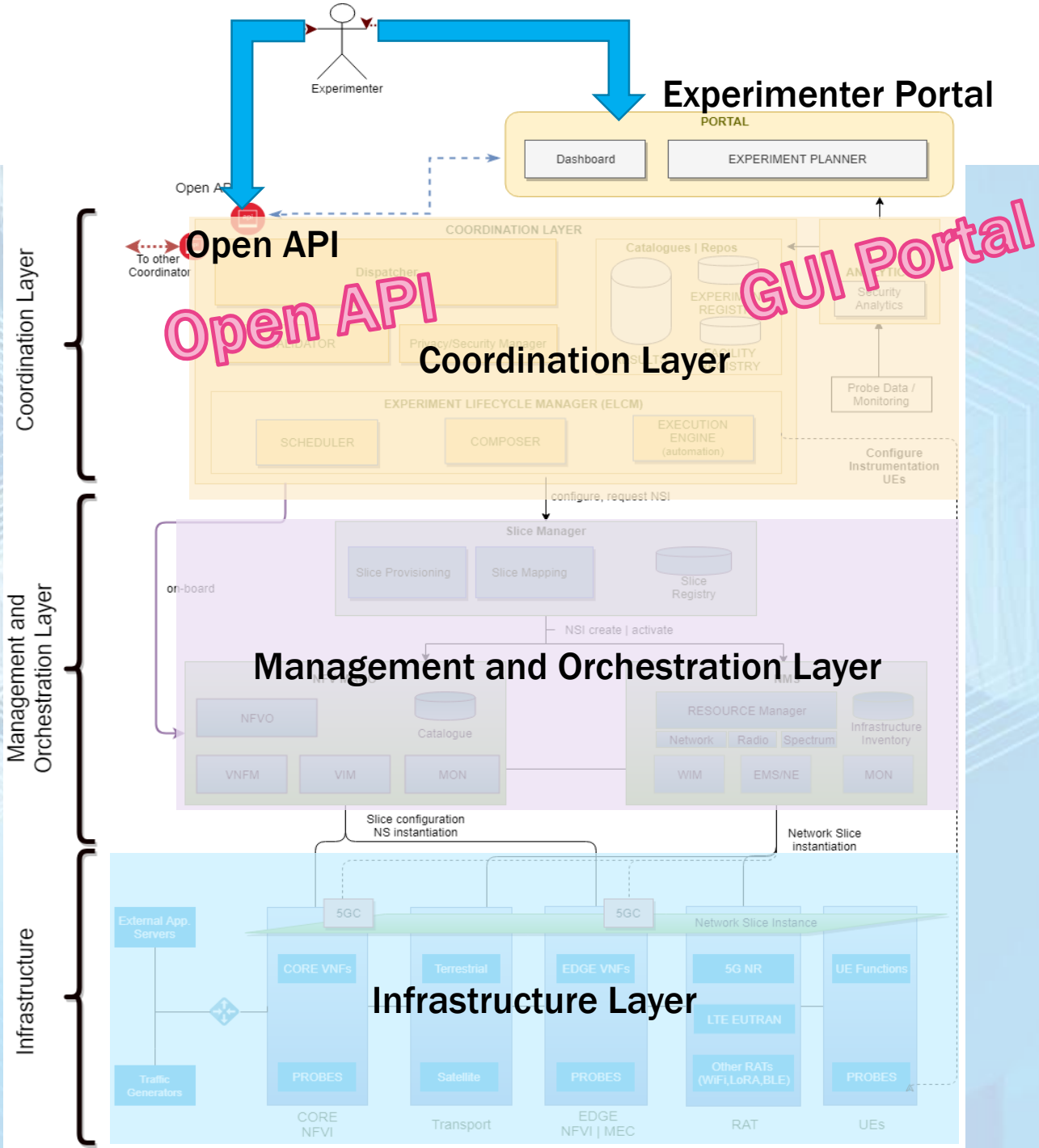


Coordination Layer

Management and Orchestration Layer

Infrastructure Layer

Engagement Options

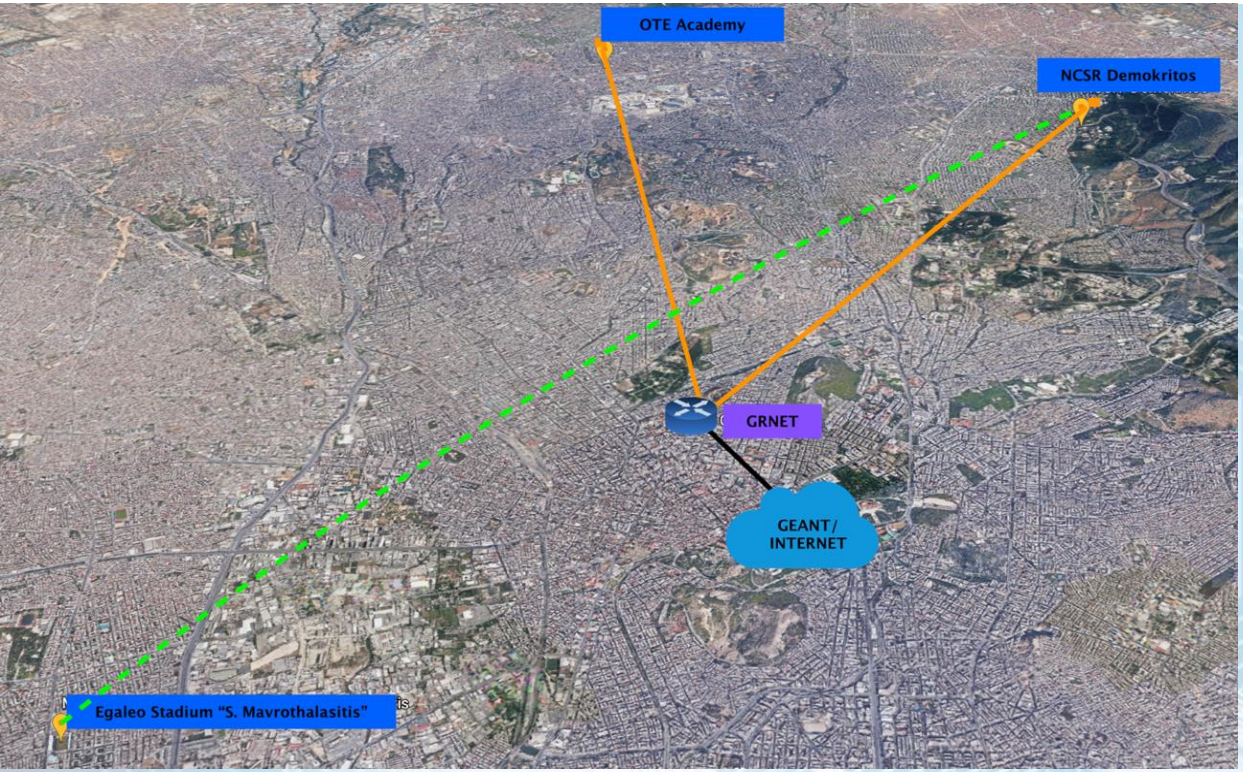


The experimenter/vertical has two options of performing the experiment:

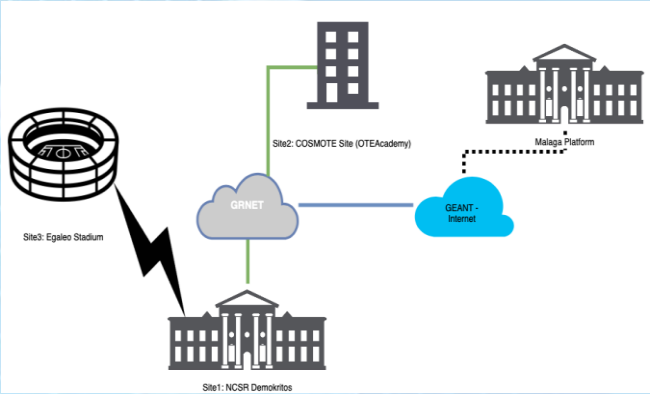
1. Through the 5GENESIS GUI/Portal, where the experiment descriptor is generated and sent to the dispatcher

2. Directly via the 5GENESIS open API, allowing the experimenter to use the facility with its own scripts.

ATHENS Platform Overview

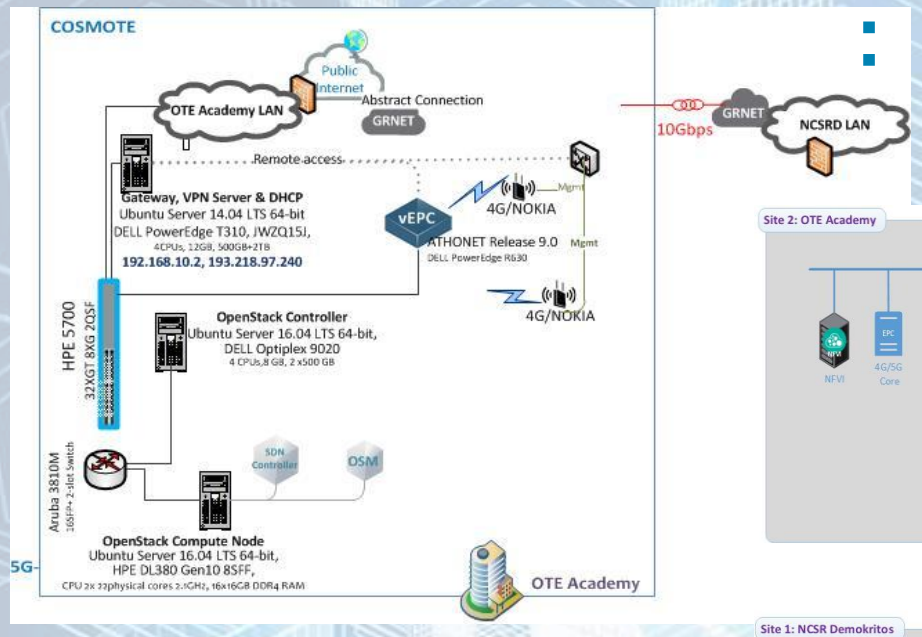


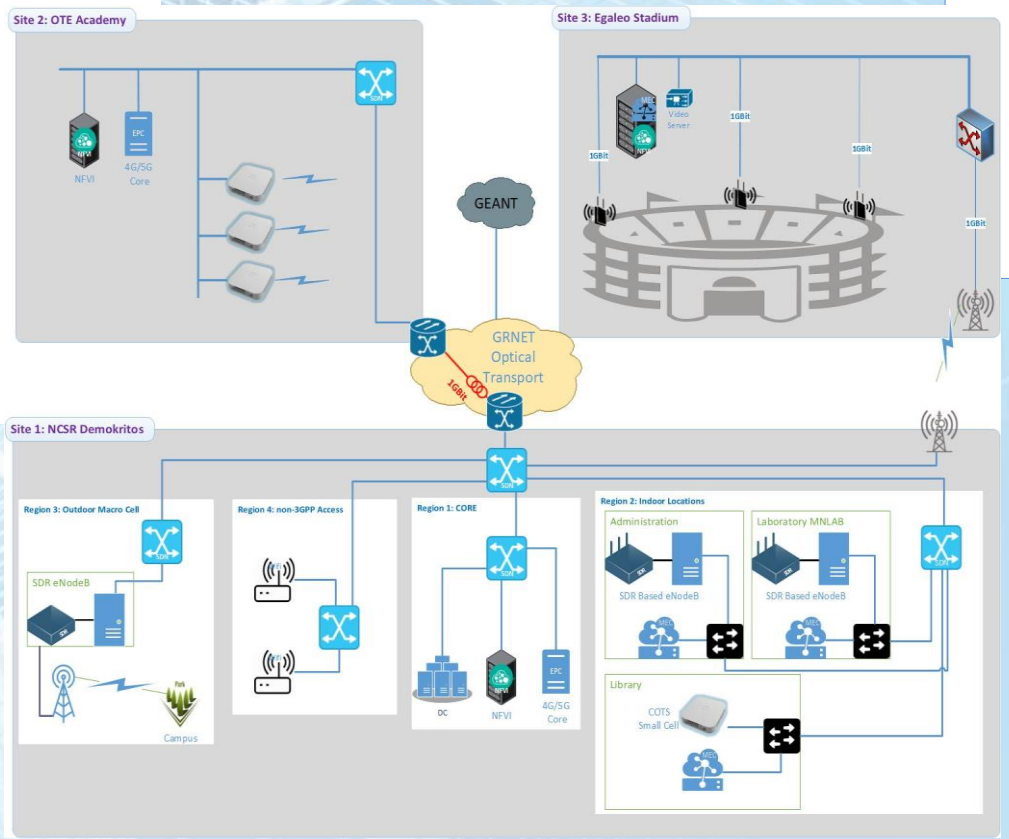
- NCSRD site is the main node interconnecting the other sites
- COSMOTE site is connected via optical links and hosts the Security use case
- EGALEO Stadium is interconnected via wireless backhaul link and hosts the massive event use case
- Best effort interconnection with Malaga platform is achieved via GEANT2

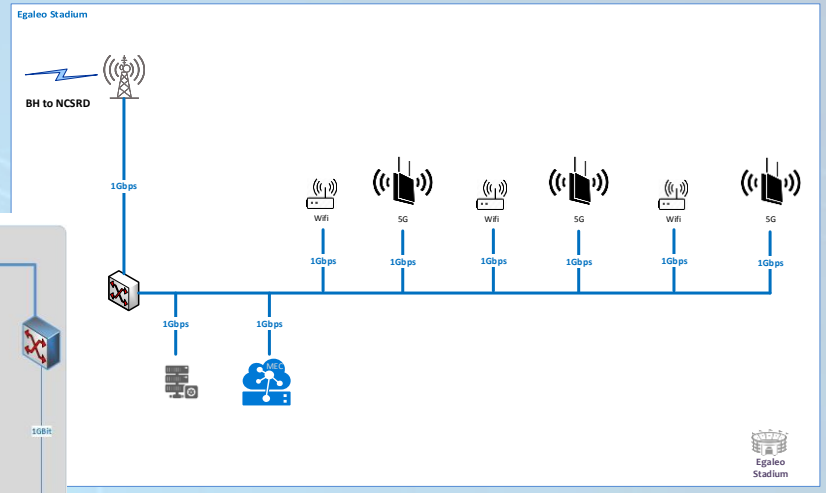


Athens Platform Infrastructure Layer

Physical Architecture







- 4G/5G deployments (Macro and Small Cell based)
- WiFi
- NFVI-PoP (Openstack/Kubernetes)
- Edge computing infrastructures
- GEANT2 interconnection

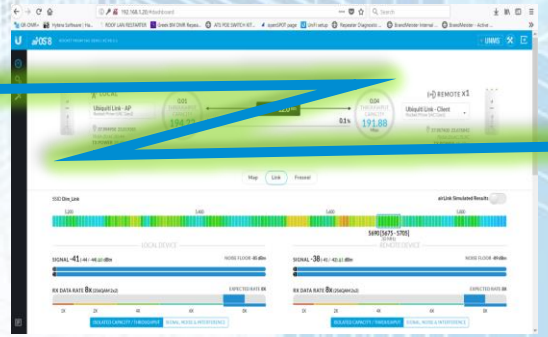
Athens Platform Infrastructure Layer

Radio access

Egaleo Antenna

Backhaul Link

(Ubiquity Rocket®Prism 5AC Gen 2 , 200 mbps)



UBIQUITI NETWORKS NCSRD Mast

Egaleo stadium cabins

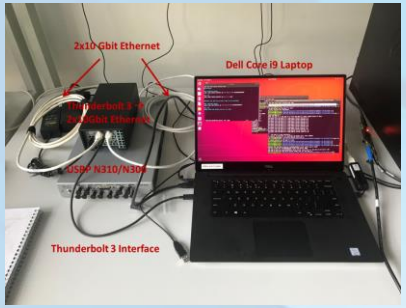
Macro Cell Mast

- Small Cells domain comprises of four devices and one macro cell
  - Currently based on 4G/4G+ technologies
  - Amarisoft/OAI/Nokia RAN
  - Athonet/Amarisoft/OAI CN
- 5G macro/small cell deployment (under procurement)
- Backhaul based on 5GHz Airmax/AirPrism2 technology

4G / 5G Small Cells

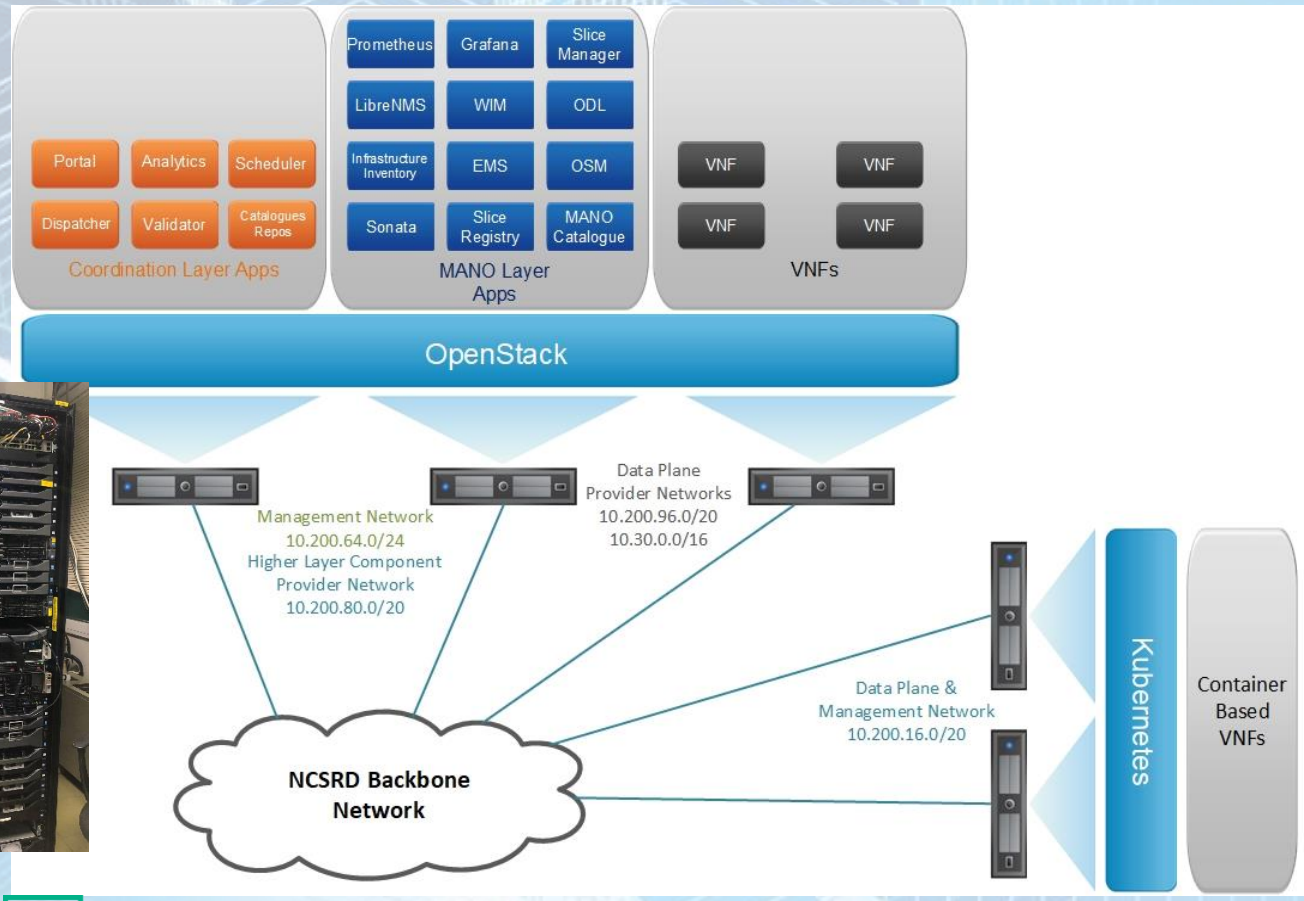
EURECOM Sophia Antipolis

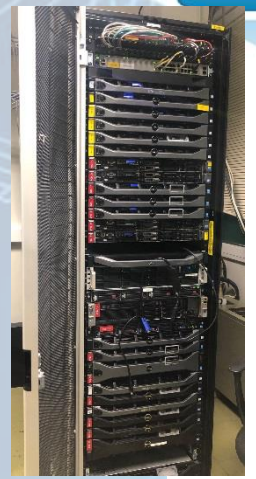
NOKIA



Athens Platform Infrastructure Layer

Core Network

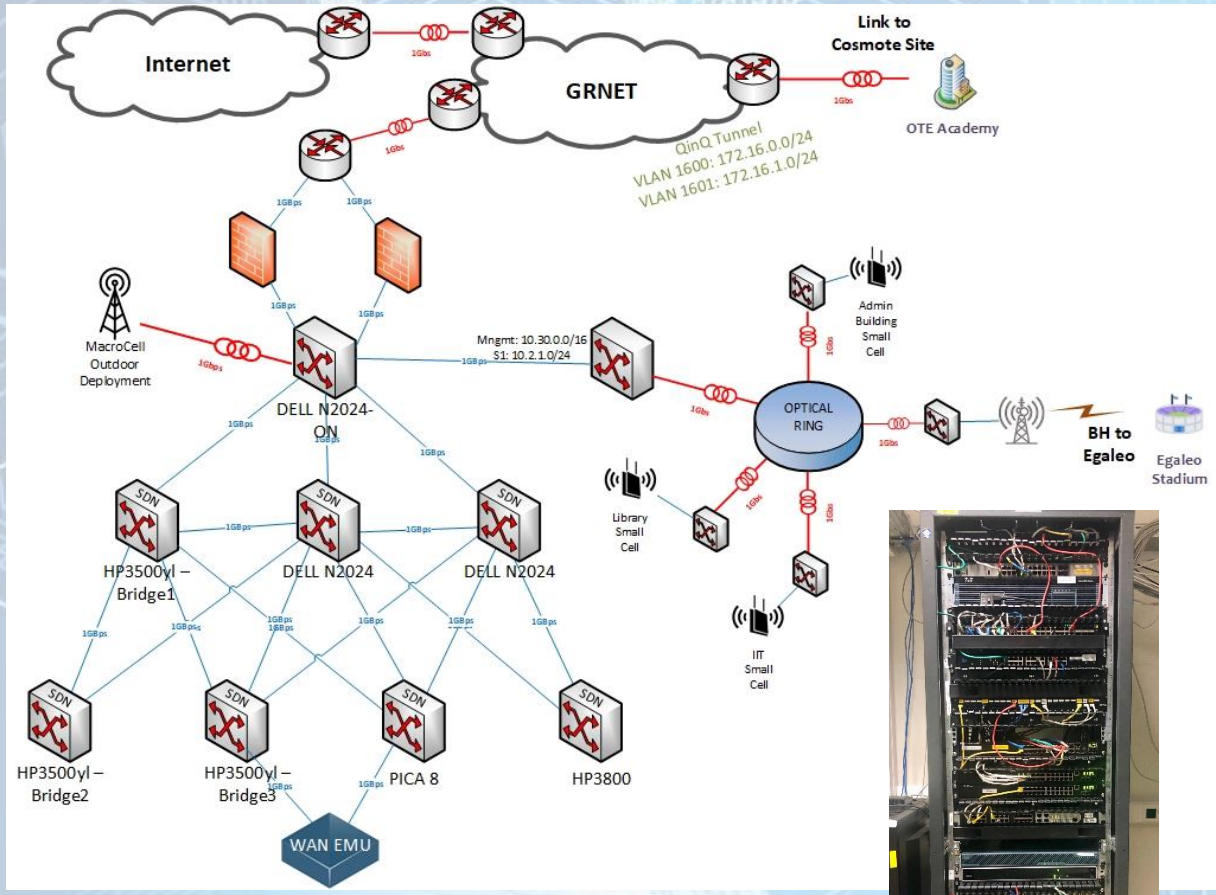


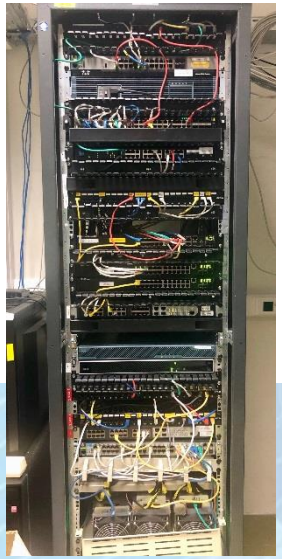


- Provides for the resources for the deployment of 5GENESIS virtualized components
  - Coordination Layer and
  - Management and Orchestration layer
  - 5G Core Network functions
- Provides for computing resources to be used by the NFV Orchestrator for the deployment of Network Services and VNFs (i.e. NFVI-PoP).
- Supports Kubernetes cluster either for Cloud Native NFV service deployment (i.e. container based VNFs) or for other types of applications related to 5GENESIS Coordination Layer.

Hewlett Packard Enterprise

Athens Platform Infrastructure Layer
Transport Network





- NCSRD Backbone Network
  - SDN (OF v1.3) and legacy switched in spine-leaf architecture, supporting network virtualization slicing and traffic engineered paths.
  - WAN emulator based on mininet allows for scalled up topologies testing
  - QoS and bandwidth allocation supported across the infrastructure
- Interconnected to GEANT via GRNET and providing VPN infrastructure.
- Interconnection with COSMOTE Site on top of GRNET optical fiber infrastructure at rates up to 1 Gbps, exploiting Q-in-Q for L2 connectivity.

The Athens Platform : Use cases

Use Case 1: Big event Use case

- Content creation - demonstrate adaptive upstream content transmission
- Low-latency AR applications - edge computing infrastructure will be used to i) host part of the AR application ii) serve the associated content

Use Case 2: UAV Use Case – “Eye in the sky” applications

- Control the drone over a low-latency 5G slice
- Transmit HD and 4K real-time video to the ground control station

Use Case 3: Security-as-a-Service (SecaaS) at the edge

- Intrusion Detection System VNF (vIDS) configured to be off-path to avoid introduction of latency due to processing
- Firewall VNF (vFW) configured to be in-line to perform actions on the passing traffic

The Athens Platform : research topics

1. Multi-tenancy and end-to-end slicing in small cell infrastructures
2. Interoperability between NFV and MEC management domains, under a common coordination
3. Multi-site NFV/MEC orchestration
4. Optimisation of virtualisation and functional split in 5G small cell infrastructures; integration of 5GNR

The Athens Platform : KPIs

KPI1 : Coverage

the use of multi-tenant small cells greatly improves coverage and capacity density for indoor underserved areas and crowded events – using an infrastructure which can be provided by the venue owner and can be fully sliced and shared among many tenants.

KPI2 : Latency

perceived latency is significantly decreased through edge processing and caching.

KPI3 : Data rate

the gain due to the upgrade of the radio front-end to 5GNR, compared with LTE, will be measured and assessed. Furthermore, edge processing significantly relieves the backhaul links, since portion of the user traffic is processed/re-routed locally. This will contribute to avoid backhaul congestion

KPI4: Service creation time

significant reduction of edge services is to be expected, due to the automation achieved by the cloud-enabled small cell management framework.

THANK YOU!

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