



Greek Living Lab Overview

Lead: NCSR

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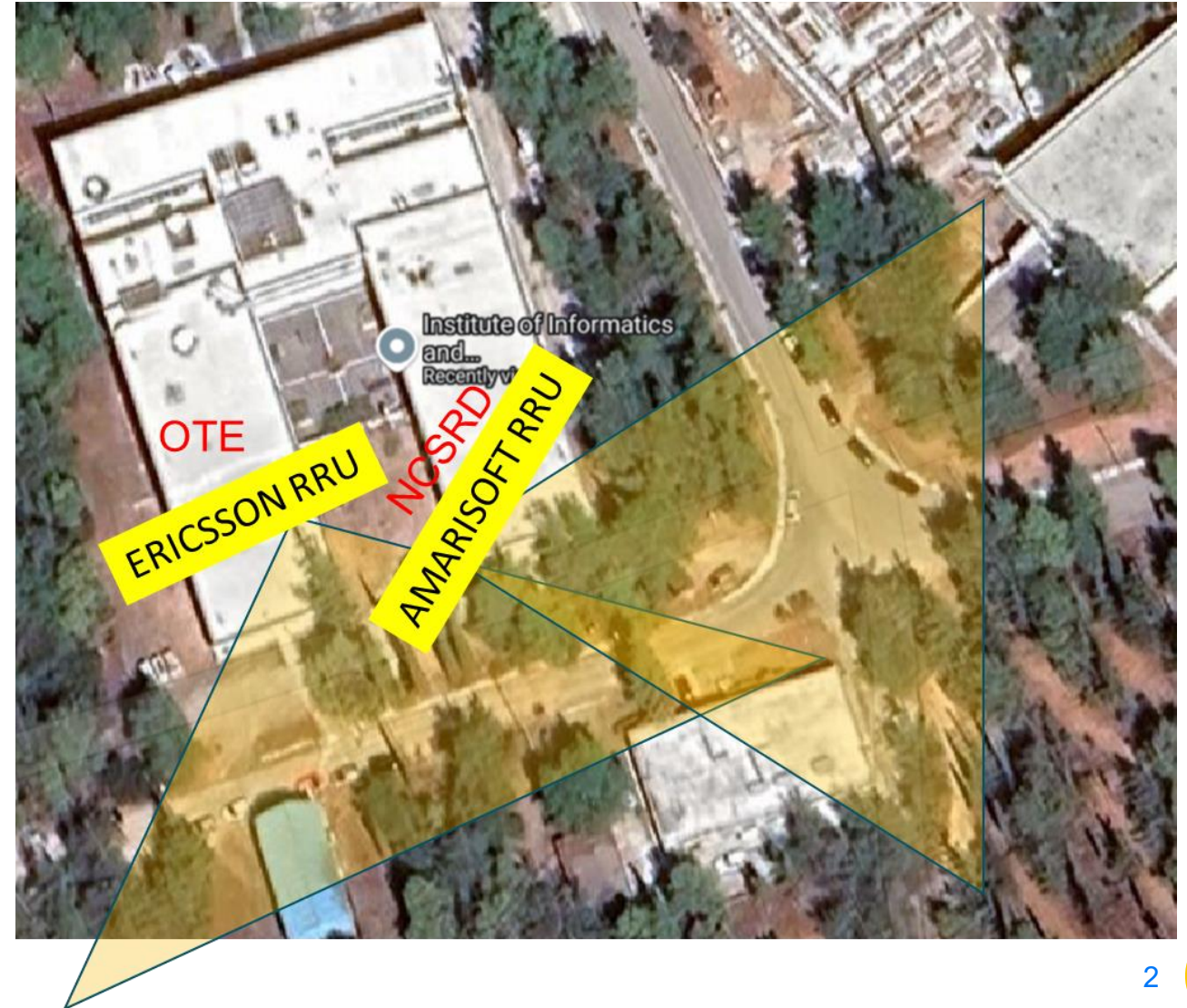


Co-funded by
the European Union

6GSNS

Greek Living Lab

- The Greek Living Lab is located at NCSR “Demokritos” campus
- One UC to be demonstrated
 - Title: MEC service handover between multiple MNOs
 - Purpose: Data sharing for Real-Time Situation Awareness
- Technical focus on
 - Providing LBO solution for session management in the 5GC
 - Dynamic (re)-configuration of the network utilizing ENVELOPE APIs



Greek Trial Site Infrastructure

- **RAN & Core**

- 5G SA CN implementations including Open5GS, Free5GC, Amarisoft and HPE.
- 1 Amarisoft gNB (2 cells) connected to Open5GS CN
 - N78 @3489 MHz, maximum bandwidth 50MHz, academic license for 10MHz (provided by OTE)
- 1 Ericsson BBU connected to HPE APN 5GC (CN)
 - N78 @3500Mhz, 100MHz bandwidth

- **Edge infrastructure**

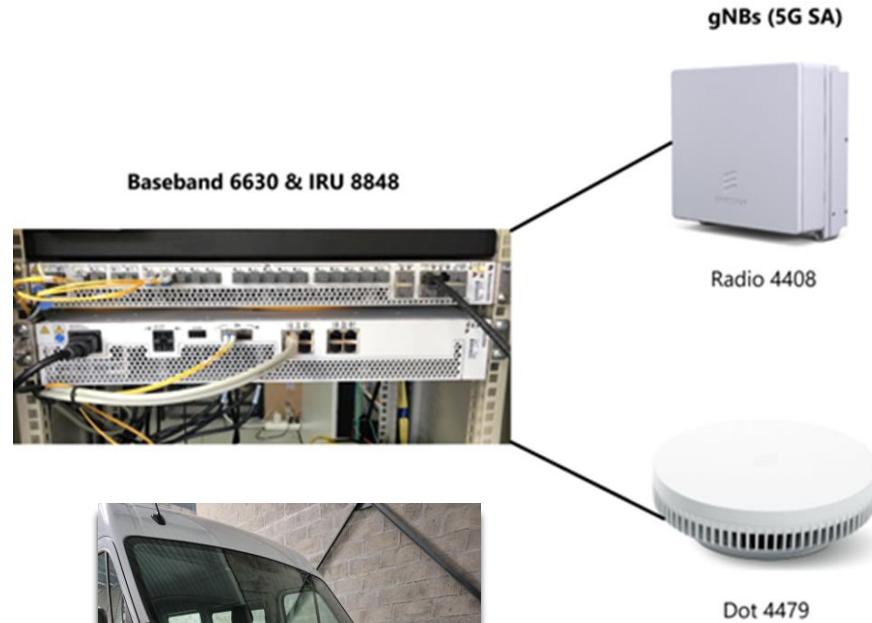
- 10x physical servers under **OpenNebula** (RAM: 256GB x10, Storage: 2,4TB, CPU: 2x12 cores per server)
- 3x physical servers under **Proxmox** (RAM: 128GB x 3, Storage 2.7 TB, CPU: 4x4 cores per server)
- K8s clusters

- **End Devices**

- Vehicle and OBU system provided by ISFM (N78, CAM - ETSI EN 302 637-2, DENM - ETSI EN 302 637-3)
- Test vehicle provided from OTE

Greek Trial Site Infrastructure

Amarisoft RAN (NCSRD)



MILLA Shuttle/OBU

Ericsson RAN (OTE)



Greek Trial Site Infrastructure – Technical Specs

NCSRD Amarisoft	
Band	n78, ARFCN 632628, 3489.42 MHz
Mode	TDD
Bandwidth	50 MHz
Carrier-Components	1 carrier
MIMO-layer	2T1R
DL MIMO Mode	2X2
Beams	NA
Subcarrier-spacing	30 KHz
Uplink/Downlink slot ratio	7 DL slots, 2 UL slots, 1 special slot
COSMOTE Ericsson	
Band	n78, ARFCN 636666, 3500 MHz
Mode	TDD
Bandwidth	100 MHz
Carrier-Components	1 carrier
MIMO-layer	4T1R
DL MIMO Mode	4X4
Beams	NA
Subcarrier-spacing	30 KHz
Uplink/Downlink slot ratio	DDDSUDDDD

Greek Trial Site Infrastructure – Technical Specs

OctoPort Multi-Band Antenna

- Five foot (1.4 m), Multiband, Eight port antenna with a 65° azimuth beamwidth, covering 1427-2690 MHz and 3100-4200 MHz frequencies
- Four wide band ports covering 1427-2690 MHz and four wide band ports covering 3100-4200 MHz, all within in a low weight and low profile antenna
- The Low weight and Low profile of this panel antenna, makes this an ideal solution for Small Cell/C-RAN Densification deployments in difficult jurisdictional urban, suburban and rural environments
- LTE Optimized FBR and SPR performance, providing for an efficient use of valuable radio capacity
- LTE Optimized FBR and SPR performance, providing for an efficient use of valuable radio capacity LTE Optimized Boresight and Sector XPD and USL performance, essential for LTE Performance
- Equipped with Two Field Replaceable, Type 17 integrated AISG 2.0 compliant Remote Electrical Tilt (RET) controllers

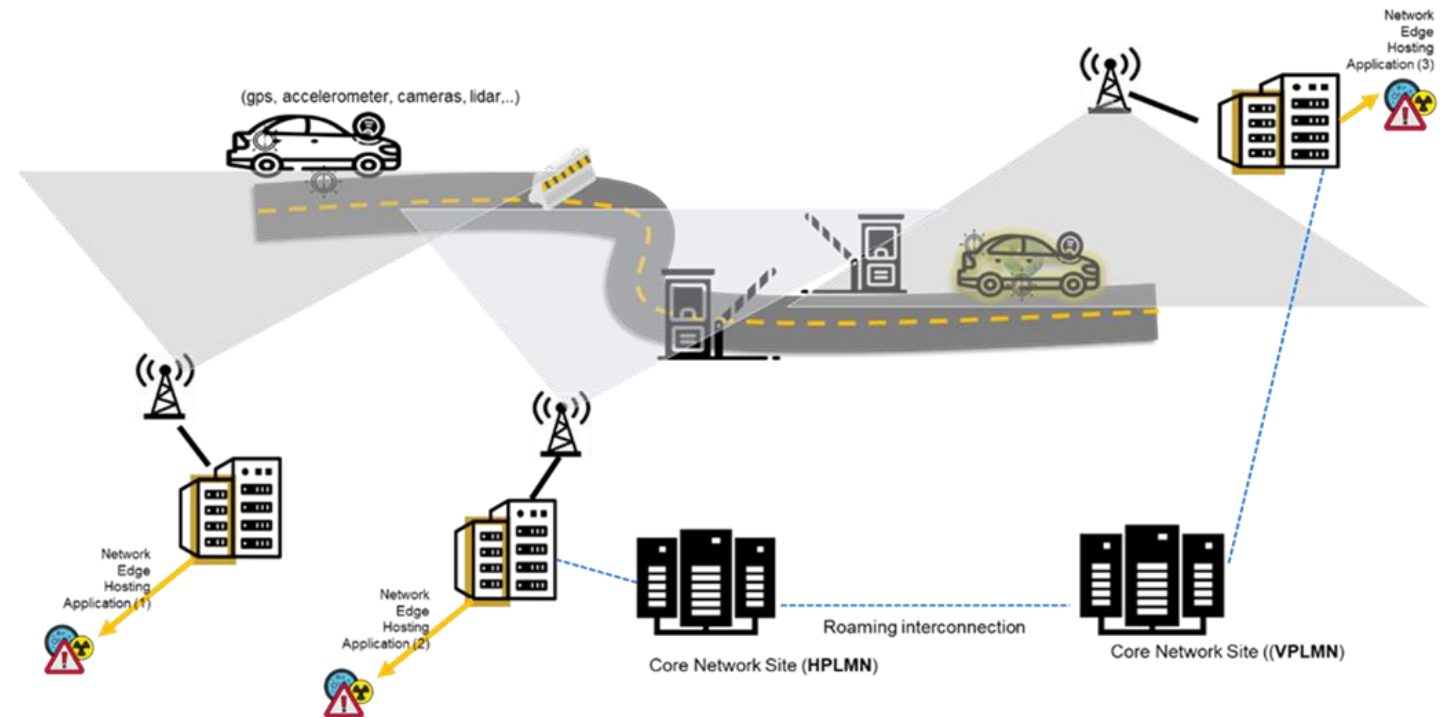


 gNBs

- 1 Amari gNB, 2 cells
 - Cell maximum bandwidth 50MHz
 - gNB operates in n78 band, (3.5 GHz), but can be configured to operate in more bands (such as n77, n28)
 - Supports 4T4R via the SDR cards in the callbox
 - Output power of each SDR card is 0 dBm maximum (1 mW)
 - Academic license for 10MHz, but additional channels provided in OTE spectrum for Athens platform
- 1 Ericsson BBU (HPE core)
 - Licensed spectrum

Greek Trial Site Elements

- The Use Case consists of the following sub-tasks:
 - Inter-PLMN handover
 - pQoS
 - ATSSS like multi-connectivity
 - ENVELOPE/Network API Exposure
 - Edge service migration
 - CAM service
 - Experimentation as a Service (EaaS)



List of ENVELOPE APIs

API name	API Category	Standards Compliance	Description
MonitoringEvent	Native	3GPP NEF compliant (3gpp-monitoring-event) – cell ID	Enables external AF to monitor specific network events through the NEF. One of the exposed events is location reporting which allows AFs to receive notifications about a UE's location updates.
AsSessionWithQoS	Native	3GPP NEF compliant (3gpp-as-session-with-qos)	Enables an AF to request from the network to provide specific QoS to an application session for one UE or for a list of UEs, in accordance with 3GPP TS 29.122 and 3GPP TS 23.502.
Edge-Cloud Continuum	Native	aerOS APIs	Allows the deployment and management of applications on compute resources and they provide information to vertical applications about the closest edge cloud server given the current device location.
Edge	ENVELOPE	CAMARA compliant	Edge orchestration and selection in a simplified way.
ATSSS-T, ATSSS-Cu, ATSSS-Cp	ENVELOPE	ENVELOPE-ATSSS (T, Cu, Cp)	Enables traffic flow through multiple paths (5G and WiFi) with multipath scheduling based on ATSSS rules and network metrics. ATSSS-T : Exposed between the vertical application and the ATSSS policy function; ATSSS-Cu : Exposed between UE and ATSSS policy function; ATSSS-Cp : Exposed between the core network and ATSSS policy function. Implements MP-QUIC scheduler with policies including MinRTT and Load-Balancing (using Reinforcement Learning agent).
Nwdaf_analytics_subscribe, Nwdaf_AnalyticsInfo_Request (ref. to QoS Sustainability and DN Performance Analytics params)	ENVELOPE	PQoS-Inference (PQoS-I)	Provides analytics and proactive alerts to vertical services based on predicted changes in network or service QoS KPIs.
Nwdaf_model_provision, nwdaf_model_monitor, nwdaf_model_training	ENVELOPE	PQoS-Training (PQoS-T)	Allows vertical services to configure the platform for training and deploying AI/ML predictive QoS models.
Location Retrieval	ENVELOPE	CAMARA compliant (https://camaraproject.org/location-retrieval/)	Allows the retrieval of geographical information of a device.
Quality on Demand	ENVELOPE	CAMARA compliant (https://camaraproject.org/quality-on-demand/)	Allows vertical applications to request adaptation of QoS parameters for specified PDU sessions to guarantee their network requirements, e.g., minimum requested bandwidth for the uplink or downlink.

Use Case Outcomes

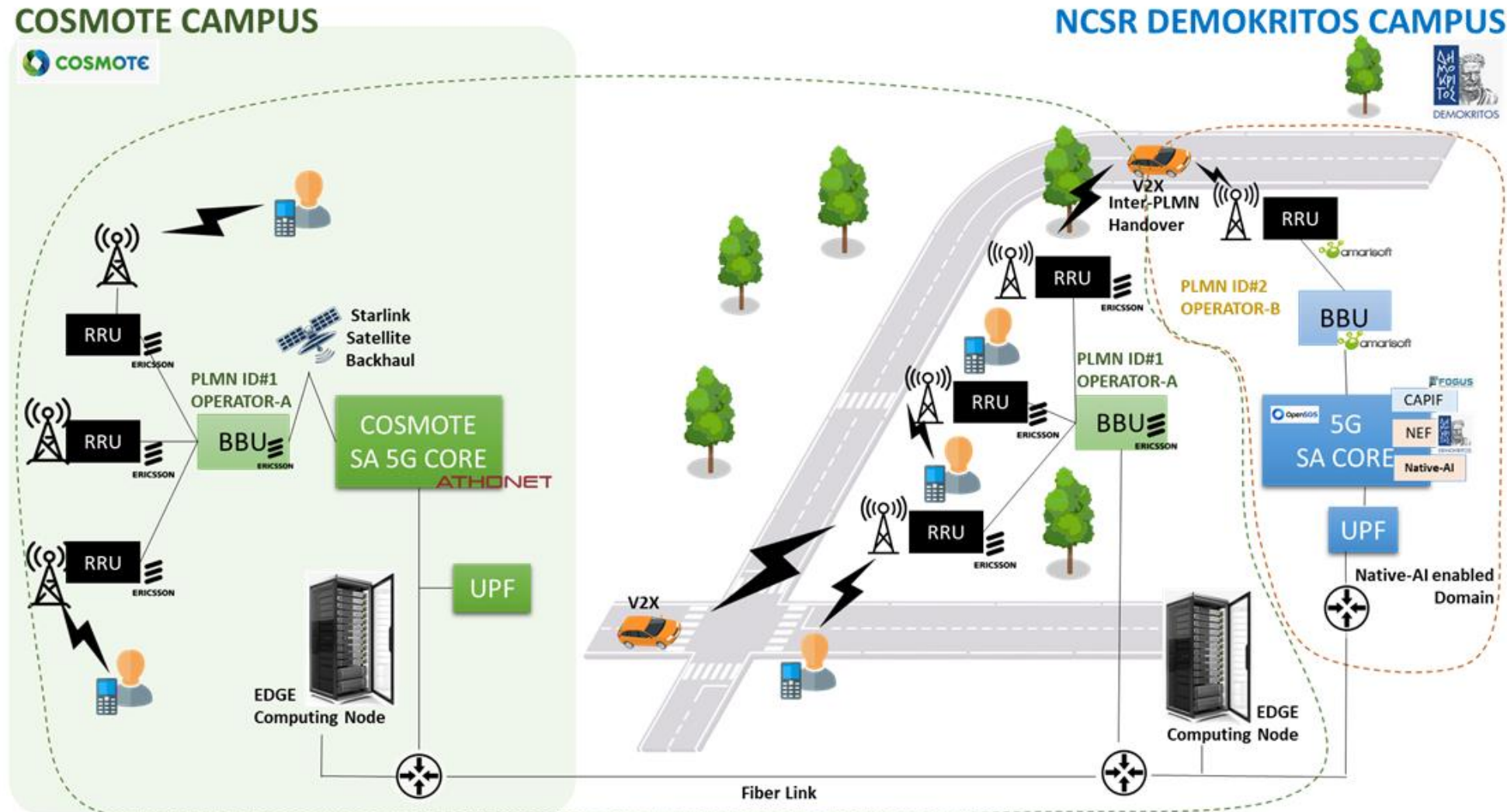
Gr-UC6: MEC service handover between multiple MNOs

With this use case the Greek Living Lab enables

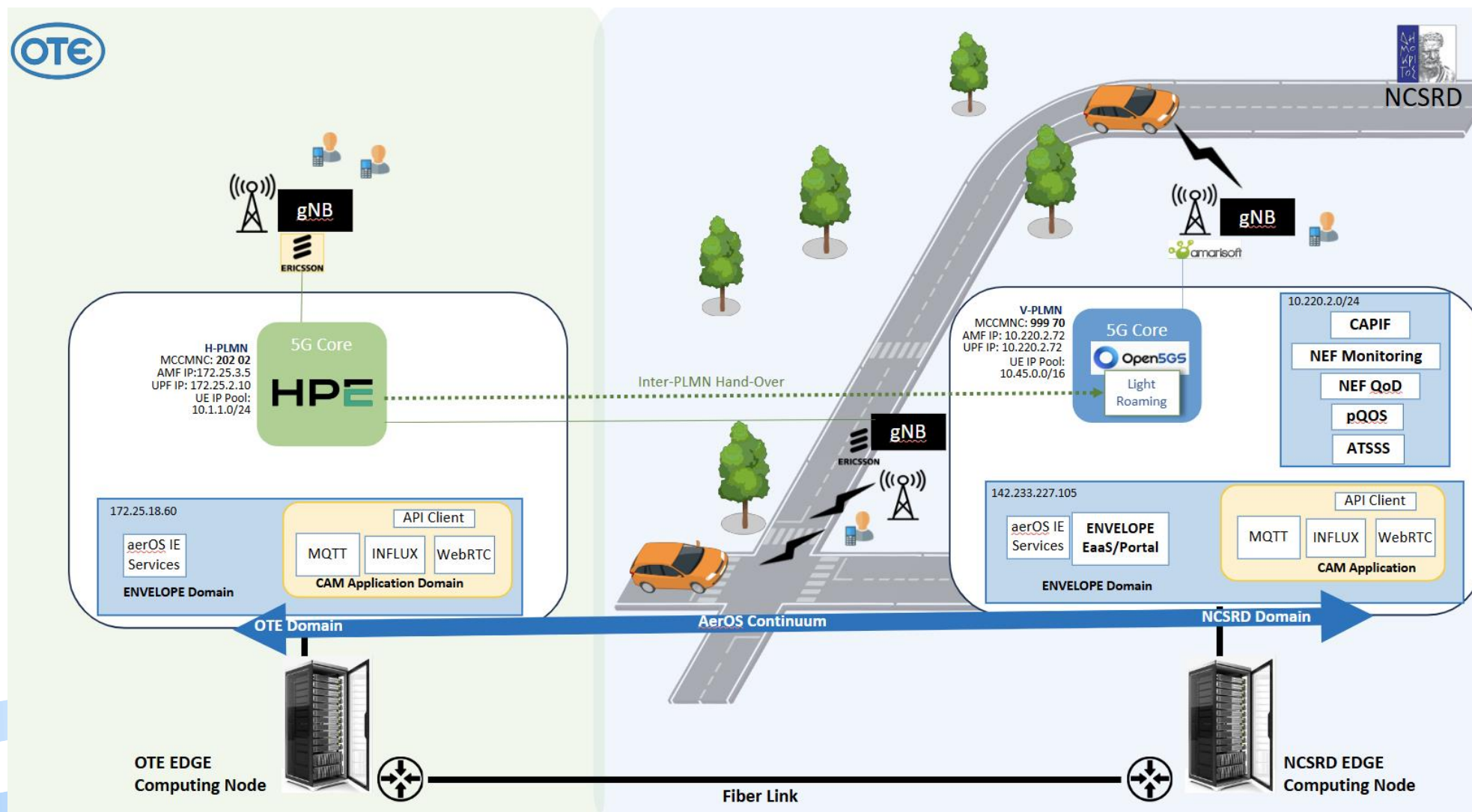
- **Local situation awareness for vehicles:** Vehicles continuously share data from onboard sensors (such as LiDAR, radar, cameras, etc.) with a traffic management application via the 5G network. This enables the system to detect local hazards (e.g., sudden obstacles, accidents, harsh weather, or roadworks) in real time
- **Provision of traffic information notifications:** When a hazard or traffic event is detected, instantly issues notifications and alerts to other vehicles in the vicinity. These alerts are delivered with minimal latency, ensuring timely warnings for drivers or automated driving systems
- **Seamless service continuity across mobile network operators:** As vehicles move between coverage areas of different MNOs, the system supports real-time migration of vehicle communication and application context between edge servers, maintaining uninterrupted service and low latency for safety-critical notifications
- **Enhanced reliability through multi-connectivity:** The system can leverage multi-connectivity (e.g., simultaneous 5G and Wi-Fi or ITS-G5 connections) to ensure that critical information is delivered even in the event of network congestion or handover, further improving the reliability and timeliness of hazard notifications
- **Predictive Quality of Service (pQoS):** The platform supports predictive analytics to anticipate potential network performance degradations, enabling proactive adaptation of services and maintaining the safety and effectiveness of notifications



Trial site infrastructure



Trial site infrastructure





Thank you