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6GSNS

IMAGINE-B5G

Advanced 5G Open Platform for Large Scale Trials and Pilots across Europe

IMAGINE-B5G Platform Extensions

Version v2.0

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Imagine B-5G

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1. Radio Equipment and Advanced Modem Devices (Spanish, Norwegian, Portuguese Facilities)

1.1 Description

IMAGINE-B5G aims to extends its facilities with several units of advanced 5G connected devices, including 5G Indoor routers, 5G Industrial gateways, 5G Outdoor CPEs, and 5G Mobile hotspots. These devices will support advanced features of 5G, enabling new Use Cases (UCs) and Vertical Experiments (VEs) in future Open Calls (OCs) of IMAGINE-B5G. The main integration of the devices will take place in the Spanish facility, however, a subset of them will be used by the Portuguese and Norwegian facilities as well.

1.2 What is available

Release-16 (Rel-16) 5G modem devices supporting commercial 5G bands in Europe. The available devices do not offer support for multiple slices in standalone (SA) configuration mode. In addition, access to 5G modem or debug traces can't be provided.

1.3 Desired extension

Advanced 5G modem devices that support, at least, Rel-16, but preferably Release-17 (Rel-17) and beyond. Such devices should:

- Use new bands not currently available in commercial deployments (e.g., n257, n40, and n77)
- Have the potential to accept adb commands for device configuration.
- Have access to the Qualcomm logs (or similar) for analysing the network packet activity inside the device.
- Support frequency band and operation mode (NSA or SA) configuration.

The Portuguese facility is particularly interested in a platform extension that provides extended radio coverage to adequately support the needs of sports and media facilities. This involves extending its facility with additional 5G-connected devices capable of supporting cutting-edge features tailored for these environments.

Maintenance and support must be included until the end of the project. In addition, during the project the provider can include additional 5G connected devices that could support new advanced features. The provided products should support network slicing configurations on the experimentation platforms (supporting several slices simultaneously will be of additional value).

The provider will propose a price per unit for each type of proposed device. The capacity of the provider to provide some level of ruggedization or to integrate renewable sources of energy or batteries will also be considered of added value. The beneficiary will provide support for the integration of other modems.

2. Immersive Equipment (Spanish, Norwegian Facilities)

2.1 Description

Bi-directional transmission of immersive technology data is one of the key drivers of 6G, as this information has very strict E2E latency and bandwidth requirements. In IMAGINE-B5G, we take a step closer to 6G by integrating XR, haptics, and robotics technologies with the B5G platform to test and validate immersive

applications. These B5G applications will be developed and tested between Spain (UPV) and Norway (UiO), and trials for the education vertical will be performed, under the project's UC: Immersive Remote Education. In addition, holographic B5G applications will be developed and tested in the Spanish facility (UPV campus), under the project's UC: Holographic communications, with the objective of assessing KPIs and KVIs of holographic and XR communications and perform trials for the education vertical and others. This PE aims to extend UPV's Immersive Lab with additional immersive media equipment and novel streaming technologies leveraging the capabilities of 5GA/6G networks.

2.2 What is available

Norwegian Facility:

UiO's SIN-Lab is a playground for immersive networking research. SIN-Lab consists of:

- State-of-the art cameras and LIDARs (e.g., tracking camera, Velodyne LIDAR, Intel RealSense LIDAR(L515), Azure Kinect, and several headsets for VR and AR)
- A Shadow Hand and a UR10e arm
- Haptic gloves and Suit Full Body

The lab's access to an advanced 5G indoor network is in progress and can potentially be used to enable wireless and remote scenarios.

Spanish Facility:

UPV's Immersive lab is an experimental facility that supports multiple immersive communication technologies, such as haptics and remote driving. UPV's Immersive lab consists of:

- Haptic gloves and suites with feedback and control capabilities
- Immersive cockpits with monitors, controls, and VR/AR headsets
- Volumetric and 360° video capture
- Multiple AGVs and a robot arm
- Chromas suited with specific processing HW and SW
- LEDWalls
- Holographic cabin display

The lab also has advanced 5G connectivity, with both indoor and outdoor coverage to enable wireless and remote scenarios. The 5G network also has advanced capabilities such as edge computing, network slicing and configuration via core VNF interfaces.

2.3 Desired extension

This PE aims to extend the UiO and UPV labs with advanced telepresence, haptic, holographic and XR HW and SW. Since OC1 focused on the incorporation of new HW equipment, OC2 will mainly focus on SW enhancements, preferably open-source for replicability purposes. The list of features and equipment of interest is the following:

- XR equipment and applications that allow interaction between real and virtual elements by the users in real time. XR applications should perform streaming of immersive media in real time with high quality and low latency using novel technologies, especially leveraging the 5GA/6G network capabilities to achieve it, such as edge computing, ultra-low latency and streaming technologies integrated in the network itself, such as 5G media streaming. The streaming technology should be optimized for immersive media using cutting-edge codecs, decoders and transmission protocols.

- Software enhancements to improve the delivery of media content in general and immersive content in particular, such as 5G Media Streaming (5GMS) architecture Network Functions, which allows Quality of Experience metrics reporting and consumption reporting, among other features.
- Data collection application function to synthetize UE events such as per-application energy consumption and expose them to the event consumers, e.g. NWDAF.
- Advanced 5G procedures and tools to optimize energy consumption delivery of multimedia content.
- Advanced 5G multicast-broadcast procedures (i.e., 5G-MBS Multicast-Broadcast Services) to deliver the same content to multiple users simultaneously and saving resources.
- Body sensors (e.g., gloves, vests, suits, etc.) for capturing different parts of the remote participants, especially those that include haptic and force feedback.
- Volumetric capture setups, capable of capturing and transmitting point clouds, representing the remote participants and large volumetric displays capable of representing in real-time remote subjects, either as 3D video or avatars.
- Actuators that can reflect in the local scenario the actions of remote participants (robotic hand and arms, hand, and arm exoskeleton, etc.).
- Realistic avatar technology capable of animating photorealistic models of remote participants (ideally presenting their real aspect), including clothes.

Maintenance and support for the VEs experiments of the Immersive Remote Education or the Holographic Communications UCs until the end of the project.

3. NaC & CAPIF GUI for Infrastructure operation (Spanish Facility)

3.1 Description

The operation of infrastructure using Graphical User Interfaces GUIs by Operators is a must for small companies and integrators that don't have resources to create a full automation of the infrastructure with their operative backends. NaC and CAPIF APIs are mainly focused in supporting the automation of operations of the telecommunication infrastructures and services, but some integration is needed also as a general architecture in the Imagine-B5G project OpenSlice is been used as a global portal to order services from a user perspective, some integration between the global portal and the GUI will be a must. To support the manual operation of the infrastructure is required to build a GUI to interact with the NaC & CAPIF APIS that currently is not available in the Spanish Facility. Empower the GUI portal with AI through Large Language Models (LLMs), enabling management and querying of the network status using natural language.

3.2 What is available

The Spanish facility has:

- NaC APIs to support the integration of 5G mobile infrastructure provisioning, monitoring, and operation. These APIs functions will support the creation of new mobile users and the creation of new infrastructure services for these users like QoS under demand or KPIs monitoring.

- CAPIF APIs to support the Telecommunication product and services offering. 3GPP specified the Common API Framework (CAPIF) in Rel-15 to provide a framework for accessing 3GPP northbound APIs. In Rel-18 SNAAPP work, 3GPP SA6 studied CAPIF (3GPP TS 23.222) enhancements to support Resource owner-aware Northbound API Access (RNAA), which enables the authorization of API invokers when the APIs are invoked in the context of resource owners.

3.3 Desired extension

We are interested in extending the facility with:

- A GUI that can be used by end users or CSP users that can use credentials to reach access to allowed infrastructure of NaC and CAPIF.
- A GUI that can be used to facilitate the operation of the NaC and CAPIF functions.
- A GUI with LLMs interoperability.
- A GUI that can be integrated in OpenSlice product, used as a global portal, to support service ordering (NaC services exposes through CAPIF) OpenSlice support TMF APIs while NaC are proprietary APIs, so the integration might need APIs translation.

The list of required functionality includes the following:

- CAPIF: Monitoring of supported APIs functions
- NaC: Creation and management of users
- NaC: Creation and management of SIMs subscriptions
- NaC: Creation and management of QoS allocations to SIMs
- NaC: Send application KPIs
- NaC: Read KPIs
- LLMs: Training LLMs models with NaC and CAPIF APIs format
- LLMs: Translate natural language into API (NaC/CAPIF) format
- LLMs: Automate the execution of APIs created by the LLMs

Maintenance and support must be included until the end of the project.

4. Observability and Analytics Framework (Norwegian Facility)

4.1 Description

Observability and analytics are fundamental components towards enabling service assurance and closed-loop automation. Observability can include metrics, events and logs from different systems such as the container platform and network functions, among others. Analytics can give insight in terms of performance/energy efficiency objectives, system health and even troubleshooting, potentially leveraging AI technologies.

4.2 What is available

The Norwegian facility has:

- different data sources (i.e., Openshift and Microk8s clusters, 5G SA Core CNFs, active testing tools) available and planned to be exposed to a central data warehouse; and
- an Openshift cluster that will act as data warehouse, as well as host advanced analytics solutions.

4.3 Desired extension

We are interested in extending the facility with:

- A streamlined observability and analytics framework that integrates seamlessly with existing data sources and adds new data exporters as needed. Also including APIs for interacting with the active testing tools and visualizing results, as well as for integration with external AI models.
- Advanced analytics related to performance, energy efficiency and system health at the infrastructure, network function/service/slice and vertical application levels, as well as troubleshooting, to be visualized with diagnostics / recommendations, potentially leveraging AI technologies.

Maintenance and support must be included until the end of the project.

5. Precise Positioning (Norwegian Facility)

5.1 Description

5G precise positioning is crucial for both indoor and outdoor 5G networks for number of different verticals like PPDR and Industry. In indoor settings, it enables accurate tracking of people, assets, and devices, even when GPS signals are weak or unavailable. This is essential for applications like asset management, tracking individuals in case of emergencies and also indoor navigation. In outdoor environments, 5G precise positioning provides highly accurate location information, aiding in various scenarios. It allows for efficient resource allocation and crowd control. Hybrid positioning, which combines different technologies such as GPS, Wi-Fi, Bluetooth, and 5G, further enhances outdoor positioning accuracy. Overall, 5G precise positioning ensures accurate tracking and efficient management of resources in both indoor and outdoor contexts, facilitating a range of applications.

5.2 What is available

The Norwegian facility comprises a primary public network, serving as the main platform, alongside multiple 5G private networks, like Network on Wheels and customer-premise NPNs installed at various use case premises. However, it is imperative to note that at present, these infrastructure components do not possess any inherent positioning capabilities or offer solutions for tracking activities of any nature.

5.3 Desired extension

We are seeking for comprehensive end-to-end solutions for precise 5G positioning to enhance our existing 5G facility. These solutions should encompass the entire process and enable accurate positioning capabilities.

References

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