

6G-SANDBOX activities towards NTN-6G

David Artuñedo – Telefónica Innovación Digital



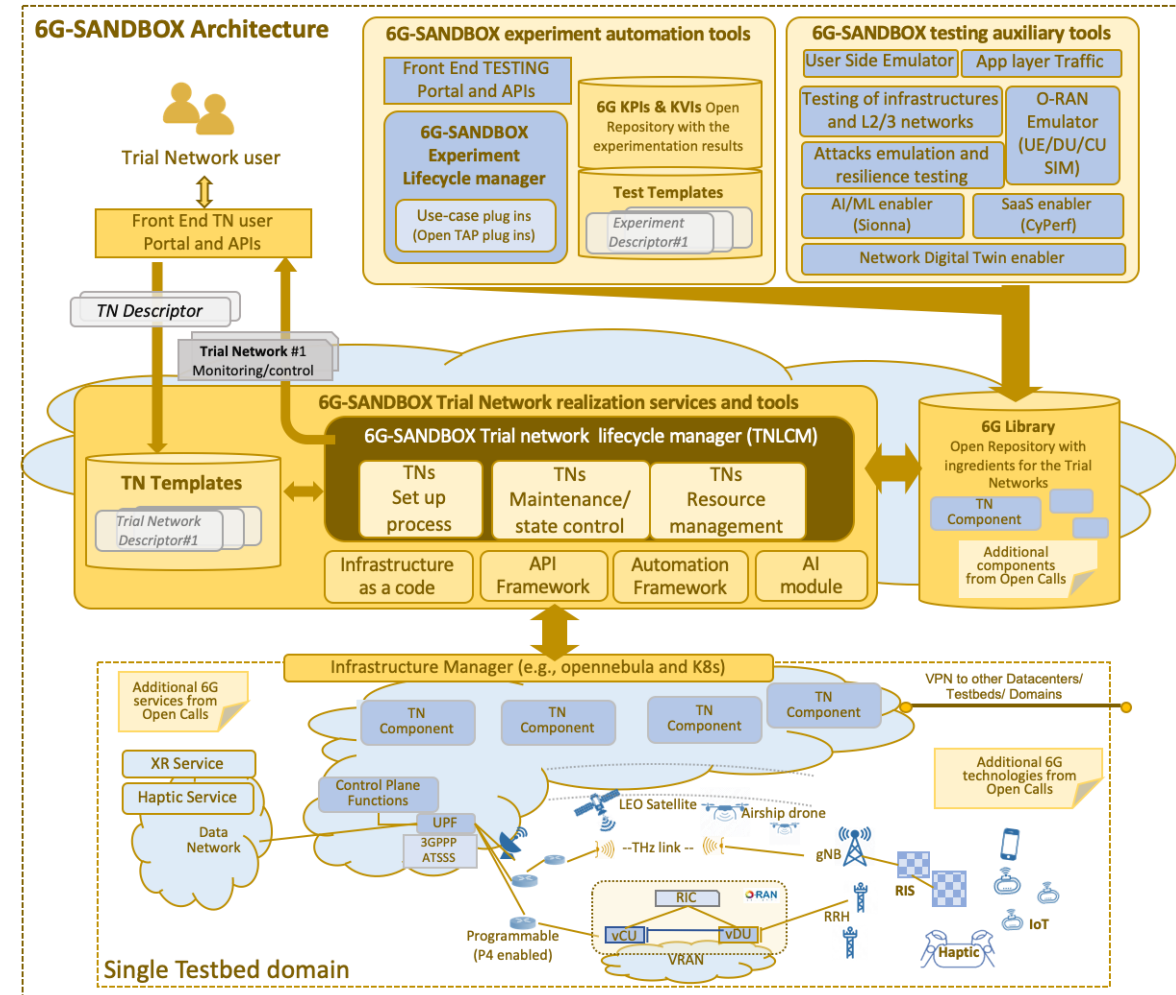
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Definition of **Trial Network**: A *Trial Network (TN)* is a fully configurable, manageable, and controllable network which may be composed of virtual and/or physical elements, and it can support experimentation services, such as technology validations and measurement campaigns.

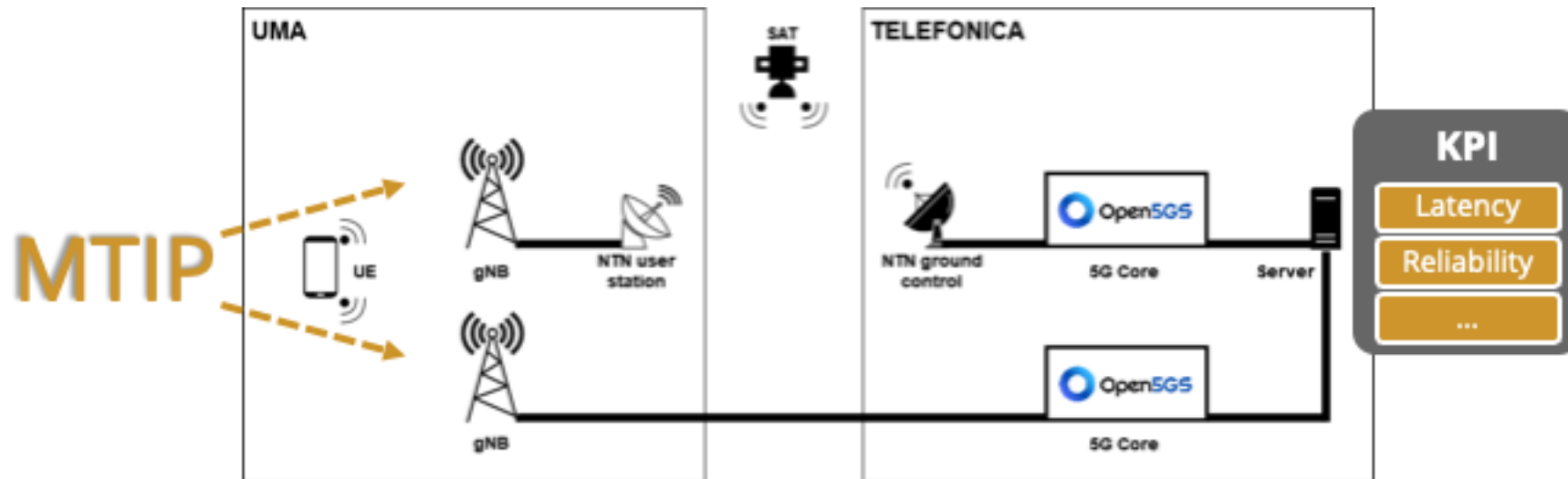
Trial Networks can be connected to **Satellite LEO** constellations (Starlink, OneWeb) to perform experiments involving NTN comms

Satellite Emulators are also available in **6G Library** to define custom Satellite topologies



NTN-5G integration, already deployed and working in Málaga, Athens and Berlin Platforms

- **Private 5G cores** deployed and tested with simulator and real Nokia Radio Access Network.
- NTN communications as **backhaul**
- **MTCTP** and **MTIP** protocols experiments in testing
- **Prototype Application-Layer ATSSS** (AL-ATSSS) with impact in 3GPP

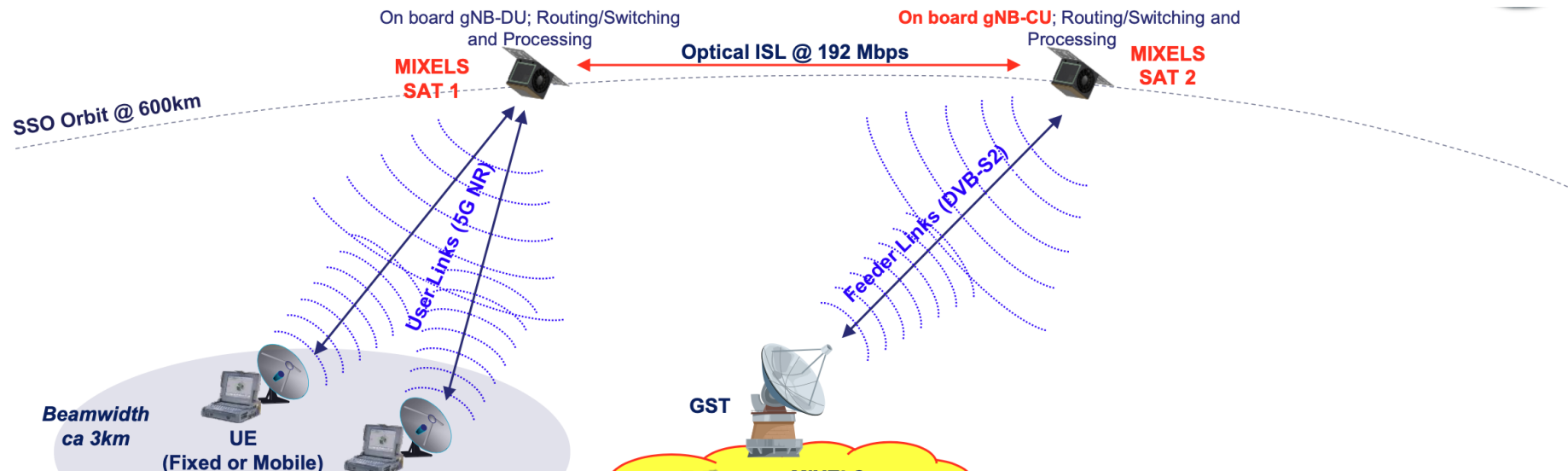


EUCNC 2023 6GSANDBOX announced MOU with ESA for collaboration

Victoria Network and ECSAT Labs are now Connected!!!

ESA to launch a 5G gNodeB:

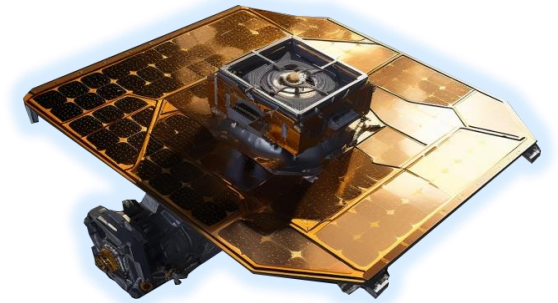
- **Distributed DU & CU**
- **Test 5G UE to LEO Satellite and Ground Station**



6G Sterling AI powered In-Orbit Laboratory (ESA): A 6G European Satellite demonstrator to strengthen European Space Technology Sovereignty

Potential use cases:

- Dynamic Satellite-Terrestrial Spectrum Management/ Sharing in S-Band
- 5G/6G handover operations between the on board gNB and terrestrial 5G/6G radio nodes
- AI-based dynamic beam management
- Dynamic software upgrades to test novel NTN waveforms, as well as 5G NTN protocol stack and core network adaptations.
- Voice calls over NTN NR, utilizing both transparent and regenerative payload architectures
- Edge compute application deployments and user plane integration with the on-board 5G/6G radio access
- Anti spoofing/antijamming capabilities



Málaga testbed is building a terrestrial Gateway to connect to ESA satellites by H2-2024/H1-2025

Standardization activities in 3GPP to support NTN in 5G networks:

•Rel-16: Work started in SA1 with the “**Study on using Satellite Access in 5G**” followed by the work item on “**Integration of Satellite Access in 5G**”

Rel-17: First normative specifications created.

- SA2 defined architectural changes for supporting “**Integration of satellite components in the 5G architecture**”
- RAN specified “**NB-IoT/eMTC support for Non-Terrestrial Networks**”

Rel-18: Phase-2 work completed.

- SA2 completed their studies on “**Support of Satellite Backhauling in 5GS**” and “**5GC enhancement for satellite access phase 2**” and defined normative specifications for phase-2.

Rel-19: Phase-3 work completed with additional enhancements.

- SA1 completed the “**Satellite access - Phase 3**” study and normative work.
- SA2 completed the “**Integration of satellite components in the 5G architecture Phase 3**”

Rel-20: SA1 recently approved a new study item on “**Satellite access - Phase 4**” to create requirements for supporting:

- Emergency communications and mission critical services using satellite access
- IMS voice calls using GEO satellite access
- Multi-orbit satellite access (LEO, MEO and GEO) for different services
- User notification that a mobile terminated communication failed when the UE was unreachable in satellite access

Two different **architectures** are considered in 3GPP:

- **Transparent payload:** The satellite is an RF repeater in the sky that forwards RF signals between the gNB and the UE. The feeder link and the service link are based on NR.
- **Regenerative payload:** The satellite carries either an entire gNB or parts of it, such as the radio unit which makes it possible to decode and process packets on the satellite. The service link is NR but the feeder link can be anything -- it corresponds to backhaul/fronthaul.

6G-SANDBOX is the first SNS Platform enabling open experimentation with these technologies

A satellite with a large solar panel is shown in space, orbiting Earth. The Earth's surface is visible on the left, showing clouds and landmasses. The background is a dark blue space filled with stars. The satellite is white and gold, with a large blue solar panel extending to the right. The text "Thank You" is centered in a white font on a semi-transparent blue horizontal band.

Thank You