

SNS JOURNAL /2023

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Stream A

SMART
COMMUNICATION
COMPONENTS,
SYSTEMS, AND
NETWORKS FOR
5G EVOLUTION
SYSTEMS

5G-STAR DUST

5G-STAR DUST's ambition is to deliver a fully integrated 5G-NTN autonomous system with novel self-adapting end-to-end connectivity models for enabling ubiquitous radio access.

PROJECT OVERVIEW

To this end, the project will design, develop, and demonstrate a **flexible satellite system** integrated with the terrestrial infrastructure by means of self-organised network architecture,

and will deliver an **innovative framework to support the operation of multi-orbit constellations**, with transparent and regenerative space nodes, to deliver 5G/6G NTN services.

OBJECTIVES

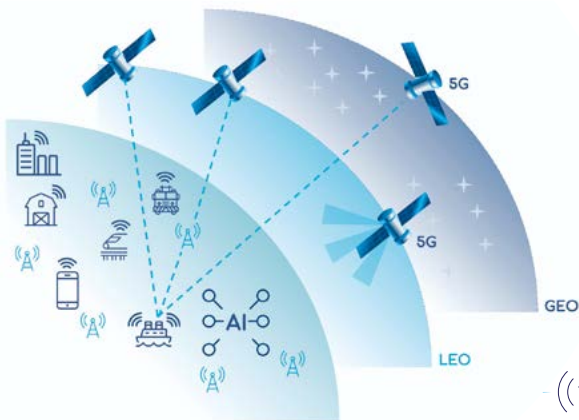
A full-fledged AI-based network architecture concept will be taken as baseline to enable a self-organising network paradigm, whereby multi-connectivity and radio resource management will be data driven and allow for rapid auto-tuning of the end-to-end system according to the varying operating conditions.

In order to develop such an ambitious system concept, the project will pursue the following specific objectives:

- Study, design and develop a **5G-based satellite network**, implementing onboard processing and storage capabilities towards effective networking and mobile computing in the sky.
- Define and design **data-driven management system components**, building on AI/ML based solutions for resource allocation and service provision in highly dynamic integrated hybrid networks.
- Design, implement, and demonstrate **E2E services over a fully integrated Terrestrial Networks (TN)-NTN** advanced network architecture with regenerative space nodes.
- Contribute to the development of a **European Research and Technology roadmap** to ensure strategic positioning and global competitiveness of Europe in integrated TN-NTN communications

KEY TECHNOLOGIES

- Regenerative payloads for Geostationary Earth Orbit (GEO) and Non-Geostationary (NGSO) systems
- Unified radio interface for cost-effective converged TN/NTN multi-tenant networks
- Softwarised self-organised network architecture
- E2E AI-Driven Network Design



5G-STAR DUST
key technologies

CONCEPT AND APPROACH

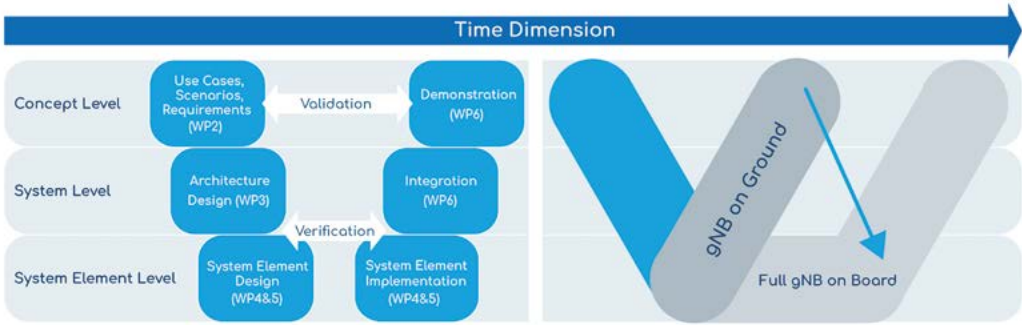
5G-STARLUST will enable ubiquitous 5G coverage with special focus on low-density areas through a deeper integration of TN and NTN. In order to provide coverage and services to a wide area economically, 5G-STARLUST will investigate the use of space-borne components, namely satellite communication (SatCom) from Low- and Geostationary Earth Orbit (LEO and GEO).

The challenging objectives of 5G-STARLUST will be achieved by implementing an incremental system engineering approach relying on the Vee model and consisting of two phases, as depicted below, whereby the system will be progressively expanded through the concept, system,

and system element level towards the system demonstration.

The baseline used for such an approach will consider the next-generation Node B (gNB) located at the ground segment (step 0), as addressed in the current state of the art following 3GPP-Release 17. The first phase (1) will then consist in moving some gNB functionalities to the space segment according to widely accepted RAN Centralised Unit (CU)/Distributed Unit (DU) functional splitting. Finally, the second and last phase (2) will be aimed at moving the gNB entirely to the space segment, hence giving a more futuristic view of the so-called **Satellite-as-a-Service concept**, while also offering new services such as edge computing in space

5G-STARLUST
concept and approach



TRL 5 PLANNED DEMONSTRATION

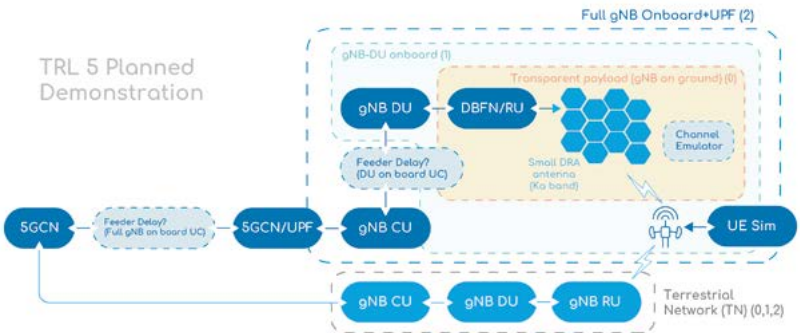
The aforementioned incremental approach (from steps 0 to 2) will be pivotal to achieving effective demonstration of the system designed in the course of the project. As such,

intermediate demonstrations will be possible until the system being designed reaches full maturity, after which it will be demonstrated as part of a final project dissemination event.

Satellite And Terrestrial Access For Distributed, Ubiquitous And Smart Telecommunications



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Incremental gNB in space implementation towards the final demonstration

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