6G-INTEGRATION-04-E23: Subproject 4 activity plan

6G-INTEGRATION

Full Title: Construction of an ecosystem for research and development in non-terrestrial networks (satellite and HAPS) and B5G (3GPP rel. 17 and beyond): NTN networks for LEO satellites and for HAPS platforms.

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Plan de Recuperación, Transformación y Resiliencia
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Executive Summary

This document contains the Ericsson's work plan within the subproject 6G-INTEGRATION-04 devoted to supporting UC3M Non-Terrestrial Network contractor on the simulation of an integrated architecture for NTN and B5G networks.

The main task will be the focused on the assistance in the B5G network infrastructure simulation for onboarding it in a High-Altitude Platform Station (HAPS). The second task aims to support the experimentation of the former simulation, whether real or through emulation/simulation.

Este documento contiene el plan de trabajo de Ericsson dentro del subproyecto 6G-INTEGRATION-04 dedicado a dar soporte al contratista de "Non-Terrestrial Network" de la UC3M en la simulación de una arquitectura integrada para redes NTN y B5G.

La tarea principal se centrará en el soporte a la simulación de la infraestructura de red B5G que se encuentra a bordo de una Estación de Plataforma de Gran Altitud ("HAPS"). La segunda tarea tiene como objetivo dar soporte a la experimentación de la simulación anterior, ya sea real o mediante emulación/simulación.

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Glossary

3GPP	3rd Generation Partnership Project
5G	5th Generation technology standard for cellular networks
5GS	5G System
5GC	5G Core
B5G	Beyond 5G
CP	Control Plane
gNB	gNodeB – RAN node in a 5G network
HAPS	High Altitude Platform Station
IETF	Internet Engineering Task Force
IPR	Intellectual Property Rights
ISO	International Organization for Standardization
NPN	Non-Public Network
NTN	Non-Terrestrial Network
PNI-NPN	Public network integrated - Non-Public Network
RAN	Radio Access Network
UP	User Plane
UPF	User Plane Function

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1 Introduction

The main objective of the 6G-INTEGRATION project is to develop the knowledge and technology to lead the integration of B5G and NTN. It is divided into 4 subprojects, each of them focused on specific but related aspects:

- 6G-INTEGRATION-01: Integration of non-terrestrial networks in mobile devices and backhaul for B5G networks.
- 6G-INTEGRATION-02 – Extension of network operators through non-networks terrestrial.
- 6G-INTEGRATION-03 - The hyper-distributed edge and its orchestration in non-networks terrestrial (including HAPS)
- **6G-INTEGRATION-04 - Onboard B5G systems in non-terrestrial networks included HAPS.**

This document is called deliverable **6G-INTEGRATION-04-E23**, **"Subproject 4 activities plan"**. It contains the activities plan within the scope of the work under subproject 6G-INTEGRATION-04 awarded to *Ericsson España S.A.U.*

In the technical specifications sheet of the public bidding, it is described that this subproject is focused on the integration of non-terrestrial networks in mobile devices for B5G networks (focusing on 3GPP release 17 and beyond).

Ericsson's contribution to this subproject focuses on researching on a specific use case and supporting the design and analysis of an onboard B5G system using a non-terrestrial network (HAPS).

More information about 6G-INTEGRATION project can be found at the website: [6G-INTEGRATION - UNICA 6G, 2024]

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2 Activities plan

The goal of this subproject is to simulate the development of an integrated architecture for NTN and B5G networks. The focus is on understanding how to integrate the NTN segment (HAPS) into a 3GPP R17 network, including all possible system interactions and the creation of a reference architecture. To achieve this, one use case is proposed:

- Simulation of a 5G RAN on-board a HAPS

The objective of the simulation is to analyze the High-Altitude Platform Station (HAPS) integration into the 5G system and the study activity of this NTN scenario. The integration will connect a 5G non-public network (NPN) segment with a 5G public network, providing coverage in areas where fixed network deployments (e.g., fiber optics) cannot be assumed to exist, and therefore alternatives are needed to connect the non-public segment to the network.

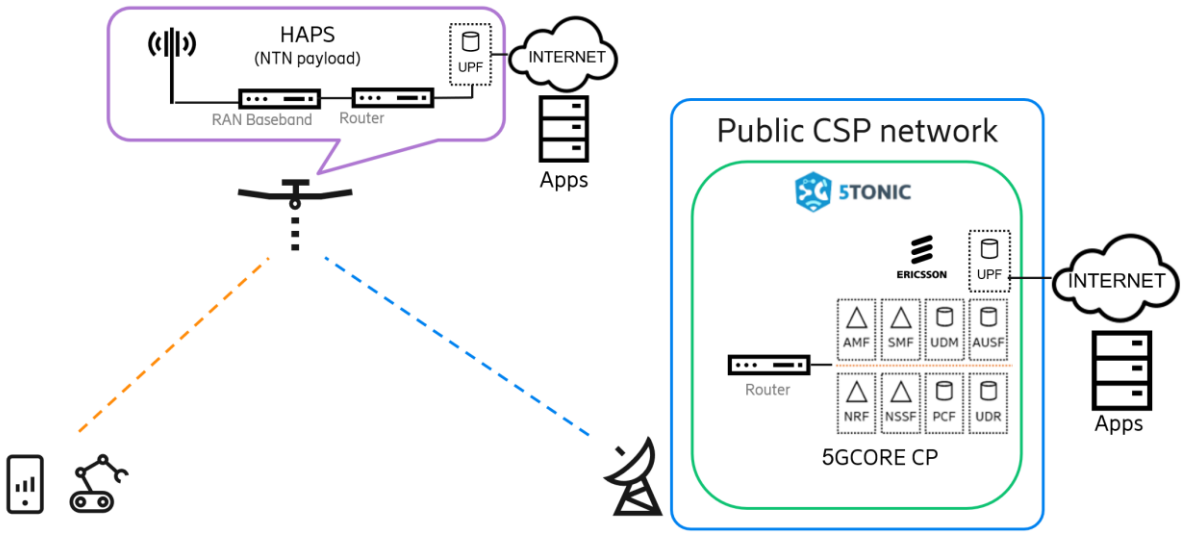
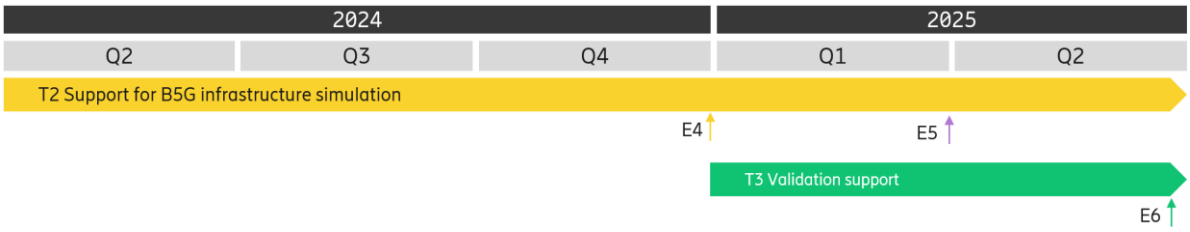


Figure 1. 5G RAN on-board a HAPS

The Figure 1 describes a possible non-public network deployment, where an industrial use case is served through the local deployment of the radio access network (RAN) and the user plane function (UPF) which are on-board a HAPS, while the public network provides the service for the rest of the 5G core.

The plan will be focused on providing 5G network equipment and performance details in support for the study and validation.

The original project plan was included in the proposal delivered by Ericsson during the public bidding process. However, as the project starting date has been finally established in January 2024, the following Figure 2 reflects the plan adapted to such modification for the subproject 6G-INTEGRATION-04:



Deliverables:
E4 (6G-INTEGRATION-04-E23), December/24. Activity plan for the first year
E5 (6G-INTEGRATION-04-E24), April/25. Analysis report regarding needs and requirements for implementing the NPI-NTN gNB.
E6 (6G-INTEGRATION-04-E25), June/25. Integration testing report

Tasks:
T2 (6G- INTEGRATION-01-A10), March/24 to June/25. – Support for B5G infrastructure testing
T3 (6G-INTEGRATION-04-A13), January/25 to June/25. – Support for experimental validation of the test bench.

Figure 2: Project plan

Based on this project plan, the following subsections detail the activities that will be performed during the first year within the tasks that have planned effort in that period, which are: Task 2 (T2) already implemented for 6G-INTEGRATION-01 subproject and Task 3 (T3).

2.1 Task 2: Support for experimentation in a B5G network

(March 2024 – June 2025)

Ericsson will provide support for the simulation of the B5G network in the NTN segment, providing the 5TONIC 5G CORE, in order to prepare for the experimental phase defined in the next task.

The support for the onboarding of the 5G network in NTN is mentioned among the verification tasks. This task is not included in the scope of this Ericsson proposal, as providing the necessary equipment is beyond the scope of *Ericsson España S.A.U* and, given the nature of the project, Ericsson cannot commit to supporting the integration of a non-Ericsson gNB.

This task has the following deliverable:

- 6G-INTEGRATION-04-E23 Activity plan for the first year (December 2024)
- 6G-INTEGRATION-04-E24 Analysis report regarding needs and requirements for implementing the NPI-NTN gNB (April 2025)

2.2 Task 3: Support for experimentation and validation

(January 2025 – June 2025)

During this phase, Ericsson will provide support for the study, experimentation and validation of the B5G network simulation.

This task has the following deliverable for the subproject-04:

- 6G-INTEGRATION-04-E25 Integration testing report. (June 2025)

2.3 Risk analysis

Below, the detected risks are detailed, and possible mitigation actions are described.

2.3.1 R01: Integration of other subprojects

As the requirements from other 6G-INTEGRATION subprojects are not known in advance, it could happen that some requirements are out of scope for this project. Ericsson will share the foreseen evolution of their network equipment and which functionalities can be expected from them.

6G-INTEGRATION-04 subproject requires a UC3M partner for the gNB onboarding in a HAPs. Ericsson may only provide support for the integration with the 5G CORE CP deployed at 5TONIC data center so it will be needed to clarify its scope.

2.3.2 R02: NTN technology

For the use cases' experimentation defined in this proposal, Ericsson assumes that an expert NTN contractor will provide UC3M with both the NTN devices necessary for communication and the network itself, whether real or through emulation/simulation.

The study of different HAPS communication aspects (doppler shift, beam management, mobility management…) will be managed by the NTN contractor.

3 Expected results and exploitation plan

For the 6G-INTEGRATION, Ericsson foresees the next results.

3.1 Demonstration results

The Proof of Concepts and demonstrations performed at 5TONIC laboratory will provide valuable results, as they will allow to obtain information about the performance of the project in a real mobile network. With the obtained data, Ericsson plans to do several technical publications in collaboration with the rest of participants in the demonstration, if all the participants agree that the scientific quality is enough for the publications.

Also, these results will allow to Ericsson to analyze and demonstrate how a NTN can be integrated in a 5G mobile network, bringing support of new use and business cases. *Ericsson España S.A.U* will use these results to provide internal feedback to Ericsson product development groups and will be in charge of disseminating the results and the research internally in the different units of Ericsson that might be interested in this project.

3.2 Integration results

The integration of the non-terrestrial network communications into the 5G networks is a valuable source of results that are useful for analyzing. Ericsson will focus in two areas of interest:

(i) How non-terrestrial network can be integrated as part of the 5G system
(ii) How NTN enhances PNI-NPN for verticals to use 5G mobile communications in uncovered or under-covered areas

As result of this activities, Ericsson could publish *White Papers* with the topic of the integration of HAPS in the mobile networks.

3.3 Standards and IPR

Ericsson plans to bring the innovations of this project to standardization groups such as 3GPP or IETF, if they have enough entity to be standardized. Ericsson will use its presence in those organization to support the standardization efforts of this project.

In the same way, Ericsson will determine the possibility of protecting its innovations with the use of IPRs. This process is out of scope of this project, and it will be handled internally in Ericsson.

4 Quality plan

Ericsson has a quality plan named *Ericsson Operational Quality Manual* (Ericsson, 2024), which includes all Ericsson operations, where it is defined how the company handles its business by following the well-defined core values.

Our *Ericsson Group Management System* is globally certified in ISO 9001, ISO 14001, ISO 45001 and ISO 27001.

For more information, please refer the main website of the quality plan (Ericsson, 2024)

5 Works Cited

Ericsson. (2024). *Ericsson*. Retrieved from Quality of work: https://www.ericsson.com/en/about-us/quality-work