ETSI Conference on
Non-Terrestrial Networks,
A Native Component of 6G

6G-NTN

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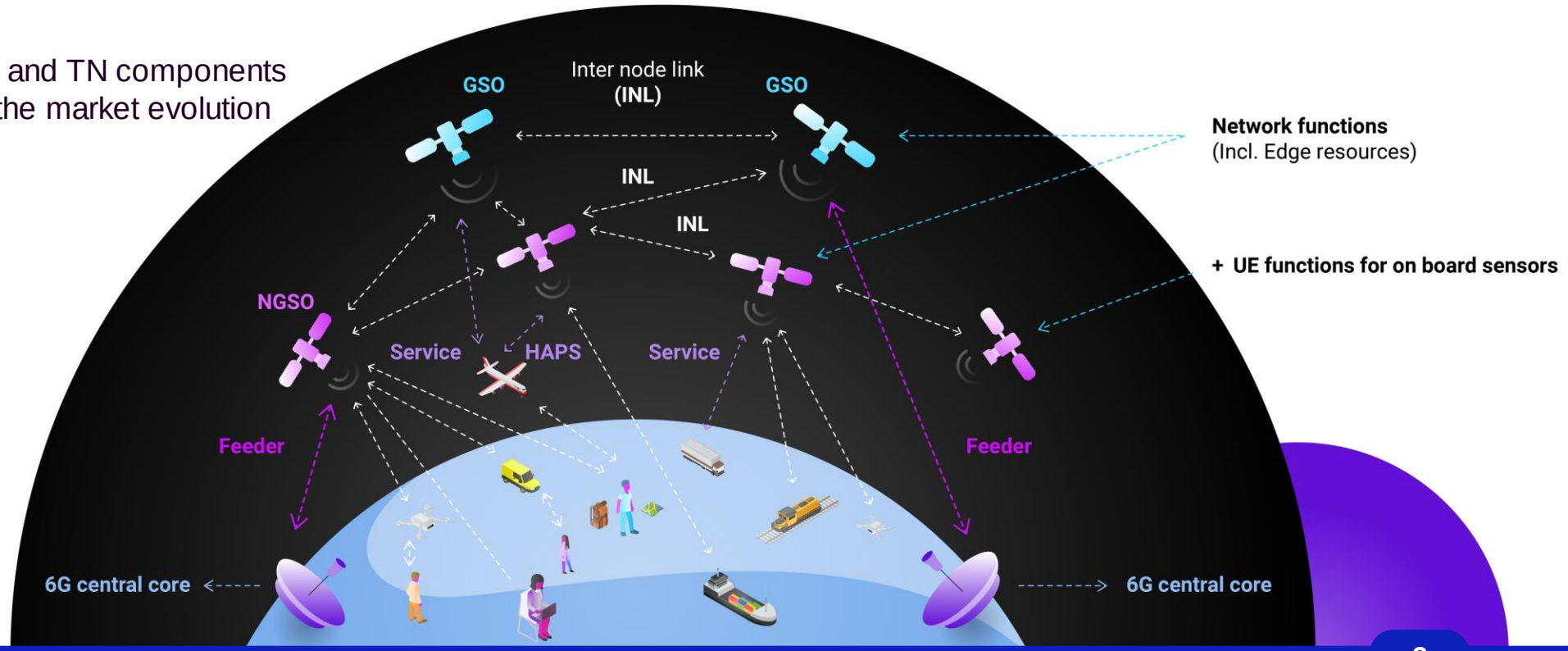
The 6G NTN project vision

An NTN component fully integrated into the future 6G infrastructure to better meet the needs of vertical markets and end-users

- Disruptive performance with respect to the 5G-NTN
- Global coverage
- Increased resiliency
- Improved sustainability
- Interoperability between NTN and TN components
- Flexibility and agility to meet the market evolution



Project and Team overview

6G-NTN is an SNS JU Call 1 project

Duration: 36 months from 1 January 2023 to 31 December 2025

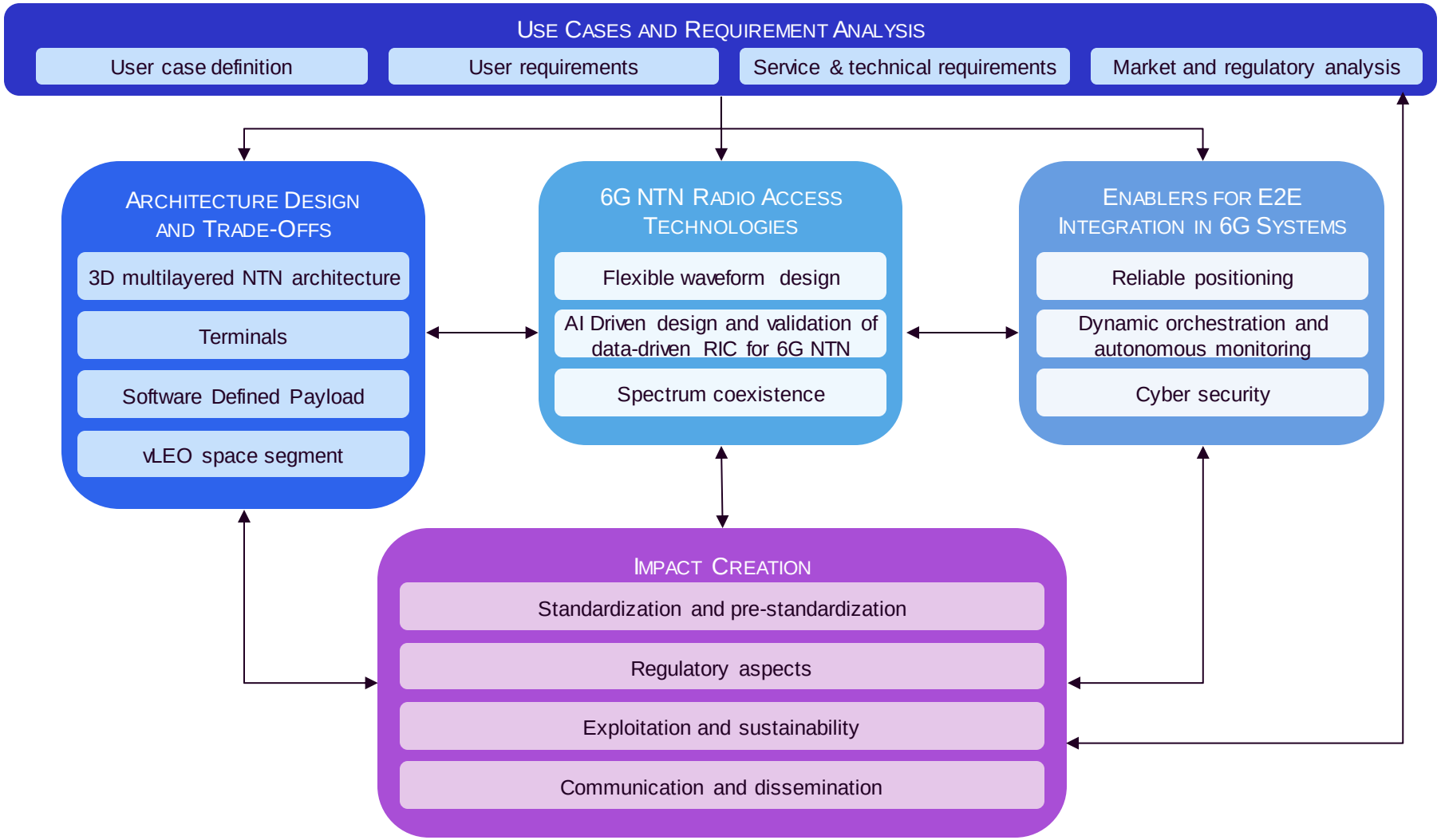
Objectives: Develop an NTN component fully integrated with the 6G infrastructure able to provide services to vertical industries and consumers terminals in outdoor and light indoor conditions and to drive its standardization phase in 3GPP as part of Rel-20+

Coordination Team

- **Alessandro Vanelli-Coralli,** Project Coordinator (UniBo)
- **Nicolas Chuberre,** Technical Manager (TAS-F)
- **Sandro Scalise,** Innovation Manager (DLR)
- **Monique Calisti**, Communication & Dissemination Manager (MAR)

Partners (15)	
University of Bologna	IT
Thales Alenia Space (France & UK)	FR/UK
CTTC	ES
German Aerospace Center (DLR)	DE
Thales SIX	FR
Telit Cinterion	DE
Orange	FR
SES Techcom	LU
Ericsson (Sweden and France)	SE/FR
Qualcomm	FR
Greenerwave	FR
Martel Innovate	CH
Digital for Planet	CH

6G-NTN Methodology



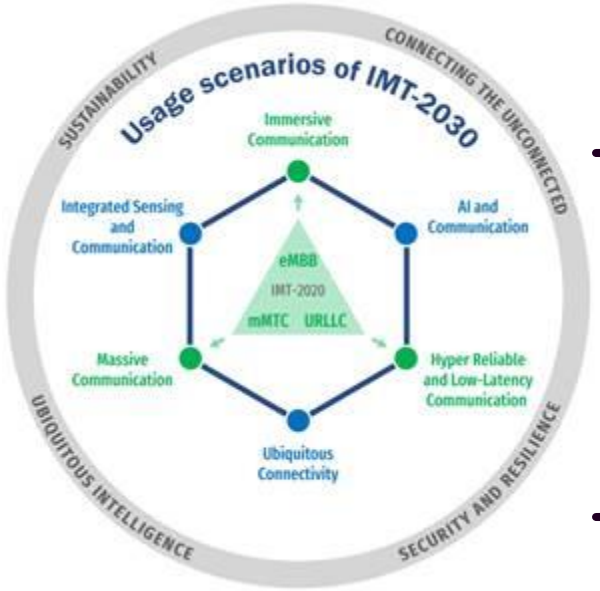
Use Cases

From 3GPP Rel 17-18 Use Cases to 6G-NTN

Primary focus on coverage extension & Backhauling → Key interest for enh. Direct to device

mono-connectivity → Enh. multi-connectivity / true service versatility

Mobility mostly in idle mode or roaming → Seamless mobility in connected mode as a critical enabler



- **UC1:** Maritime Coverage for search and rescue coast guard intervention
- **UC5:** Consumer Handheld Connectivity and Positioning in Remote Areas
- **UC6:** Continuous Bi-directional Data Streams in High Mobility
- **UC7:** Direct Communication over Satellites

- **UC3:** Urban air mobility
- **UC2:** Autonomous power line inspection using drones
- **UC4:** Adaptation to PPDR or Temporary Events

Source: 6G-NTN deliverable D2.1/D2.2/D2.3

Use cases & scenarios

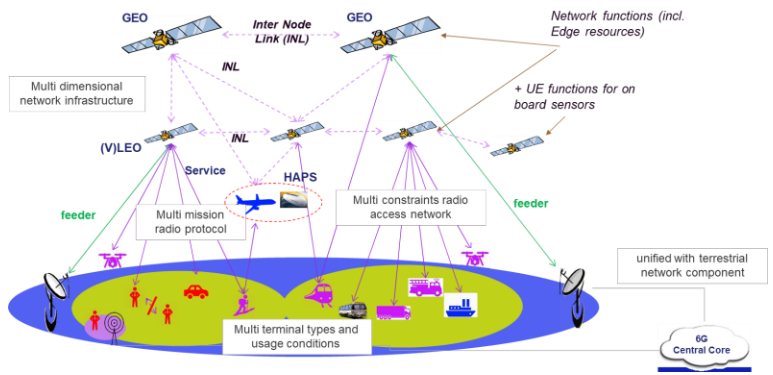
Description	Scenarios
Consumer Handheld Connectivity and Positioning in Remote Areas	1. Emergency situation management
Continuous Bi-directional Data Streams in High Mobility	1: NTN only usage 2: NTN – TN switching usage 3: NTN – NTN switching in cross border usage
Direct Communication over Satellites.	1: Public safety 2: Maritime 3: IoT 4: Automotive
Maritime Coverage for search and rescue coast guard intervention	1: Coast Guard Intervention with Terrestrial Coverage 2: Coast Guard Intervention without Terrestrial Coverage and with only NTN coverage 3: Coast Guard Intervention with Multi-link Support for Reliable Roaming 4: Coast Guard Intervention with Seamless Handover to Different Feeder Links for NTN connect.
Urban air mobility	1: On-demand creation of aerial corridors for last-mile delivery 2: Anti-collision and autonomous deconfliction 3: Emergency situation management
Autonomous power line inspection using drones	1: Routine inspection 2: Manual inspection
Adaptation to PPDR or Temporary Events	1: First-Responder (FR) communications 2: Population communications in distress

Source: 6G-NTN deliverable D2.1/D2.2/D2.3

The 6G-NTN Architecture: a split architecture (1/2)

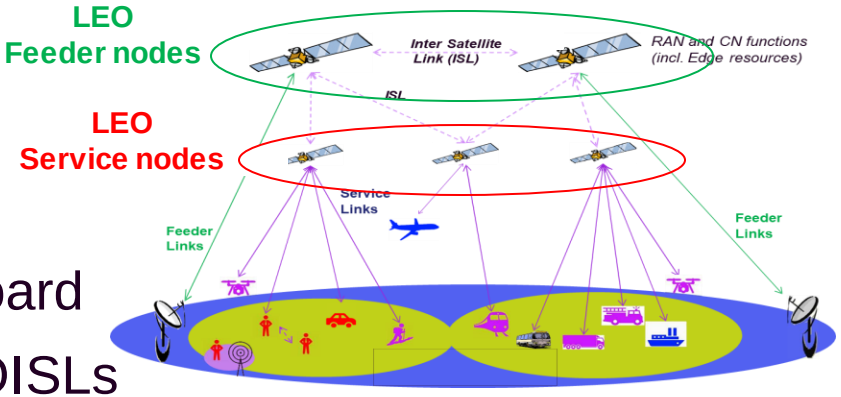
6G-NTN addresses 3D multi-layered architectures

- limits of existing constellations:
  - Almost identical satellites (same functions and power sharing between feeders and service links)
  - Not suitable to serve the identified use cases
    - High service link throughput
    - RAN / CN / Edge functionalities on board



Proposed solution: Split architecture

- Split of payloads and gNB functionalities
  - LEO Service satellites (user link + OISL) with RU on-board
  - LEO Feeder satellites (feeder link + OISL) with CU/DU on-board
  - Service and Feeder satellites interconnected by low SWaP OISLs



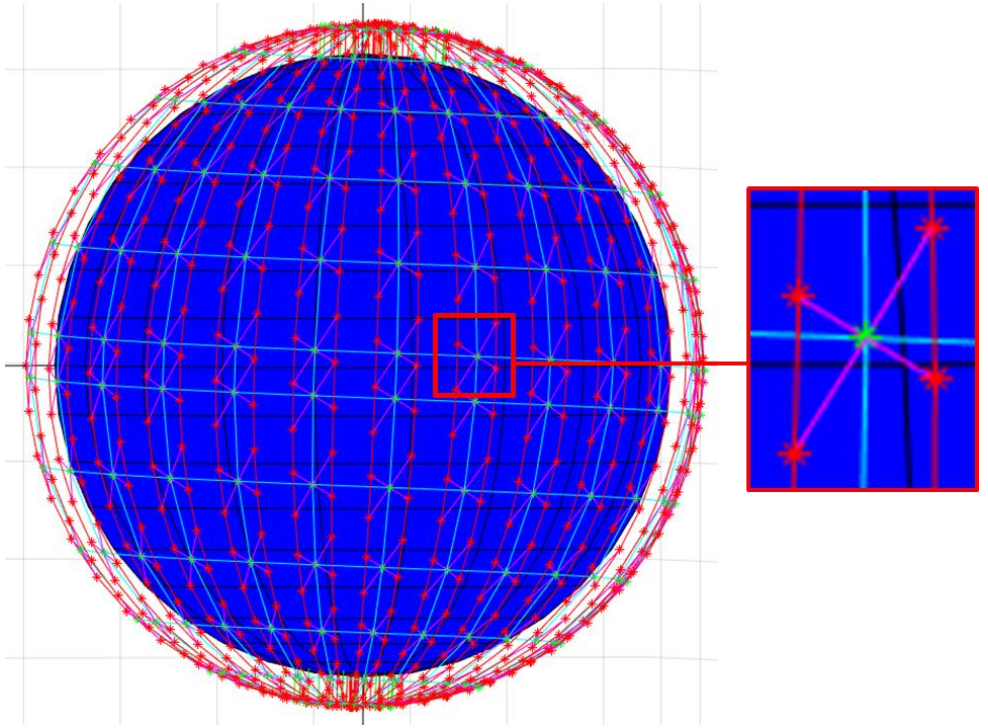
Research outcomes / not for standardization purposes

Source: 6G-NTN deliverable D3.5

The 6G-NTN Architecture: a split architecture (2/2)

Preliminary constellation:

- 600km altitude
- Near-polar inclination (~87°)
- 45° min user elevation
- Minimum of 1 satellite always visible
- Minimum 10 s of overlap between 2 satellites for user handover
- 1605 satellites
  - 1269 service nodes
    - 27 planes, 47 nodes per plane
  - 366 feeder nodes
    - 14 planes, 24 nodes per plane
    - Each feeder node serves 3/4 service nodes (OISLs)



Source: 6G-NTN deliverable D3.5

Research outcomes / not for standardization purposes

NTN radio interface: design drivers

Target features

- Compatibility with terrestrial network
- Possibility for spectrum sharing
- Robustness to co-channel interference
- Possibility for seamless connectivity
- Ability to provide additional link margin in C band and Q/V
- Support of accurate network-based positioning
- Support to UE without GNSS
- Backward compatibility with 5G
- Support of FDD and TDD
- Low Computational complexity

Research outcomes / not for standardization purposes

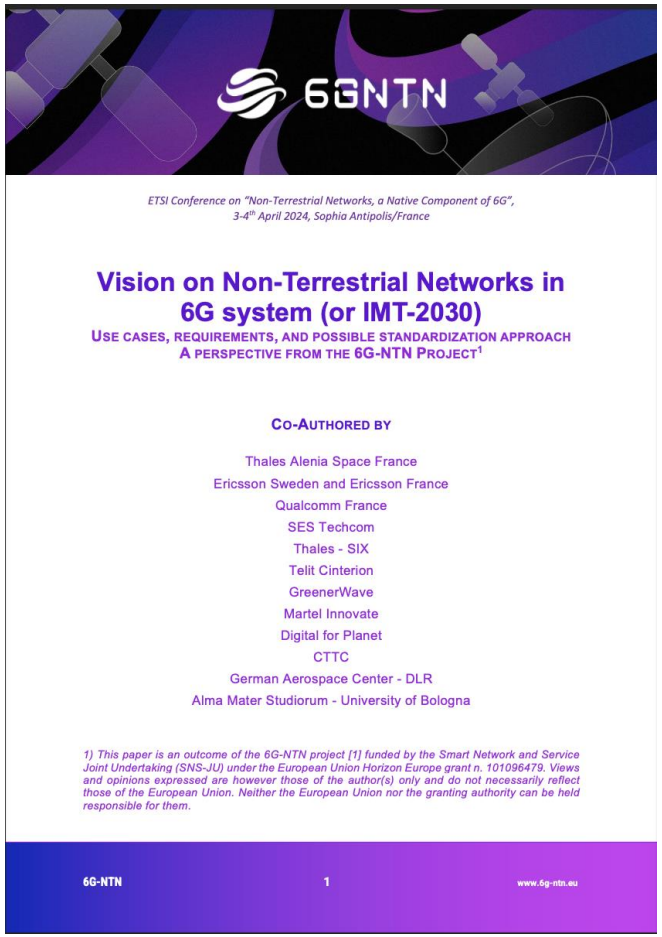
Source: 6G-NTN deliverable D4.1

6G-NTN White paper (April 2, 2024)

On April 2, 2024, the 6G-NTN Project released a white paper entitled

“Vision on Non-Terrestrial Networks in 6G system (or IMT-2030): Use cases, requirements, and possible standardization approach – A perspective from the 6G-NTN project”

- The paper presents
  - The use cases for NTN connectivity by 2030 and beyond
  - 6G and drivers for native integration of satellite components
  - The 6G NTN standardization approach



ETSI Conference on “Non-Terrestrial Networks, a Native Component of 6G”, 3-4th April 2024, Sophia Antipolis/France

Vision on Non-Terrestrial Networks in 6G system (or IMT-2030)

USE CASES, REQUIREMENTS, AND POSSIBLE STANDARDIZATION APPROACH
A PERSPECTIVE FROM THE 6G-NTN PROJECT[1]

CO-AUTHORED BY

Thales Alenia Space France
Ericsson Sweden and Ericsson France
Qualcomm France
SES Techcom
Thales - SIX
Telit Cinterion
GreenerWave
Martel Innovate
Digital for Planet
CTTC
German Aerospace Center - DLR
Alma Mater Studiorum - University of Bologna

1) This paper is an outcome of the 6G-NTN project [1] funded by the Smart Network and Service Joint Undertaking (SNS-JU) under the European Union Horizon Europe grant n. 101096479. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

6G-NTN 1 www.6g-ntn.eu

6G-NTN standardization approach

3GPP

- 6G-NTN partners **propose that the native inclusion of satellite components be fostered, in line with the following white paper principles:**
  - Common TN/NTN technology framework (architecture and protocols) with no specific add-ons to support NTN
  - Rel.20: NTN included in the baseline 6G study items
  - Rel.21: NTN included in the first normative 6G work items **endorsing the inclusion of satellite radio components as part of 6G targeting the most prominent mass market and corresponding access networks**
  - Subsequent releases could elaborate on additional improvements to address further needs.

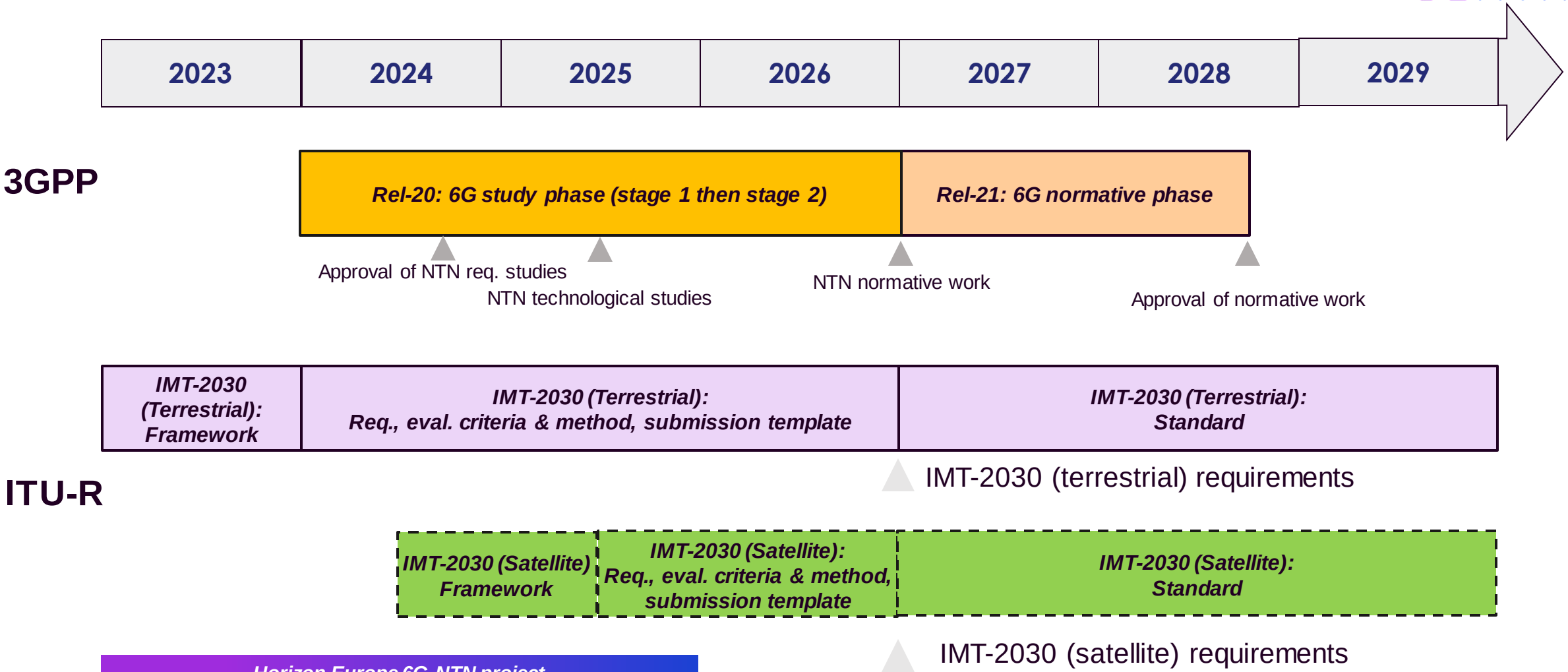
ITU

- 6G-NTN Partners propose that the **same effort is to be engaged also in ITU to promote the corresponding specifications as a candidate radio technology for IMT-2030 and to support its approval by ITU**. It is expected that a submission in response to IMT-2030 requirements will be based on Rel-21

WRC-27

- It is also believed that that the **outcome of 3GPP activities should be promoted in WRC-27** to create the technical and regulatory conditions essential for a fair access to spectrum fostering the development of a number of radio networks accessing the same frequency bands

6G-NTN standardization timeline



6GNTN

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Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

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The Consortium

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