



Integrating Network Digital Twinning into Future AI-based 6G Systems

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Project Factsheet

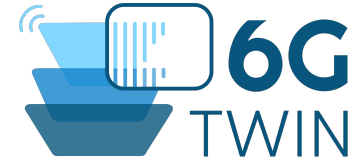


- **6G-TWIN vision:**

“To propose new methods, simulation and modelling tools around the concept of network digital twin and demonstrate their interest in tangible use cases”

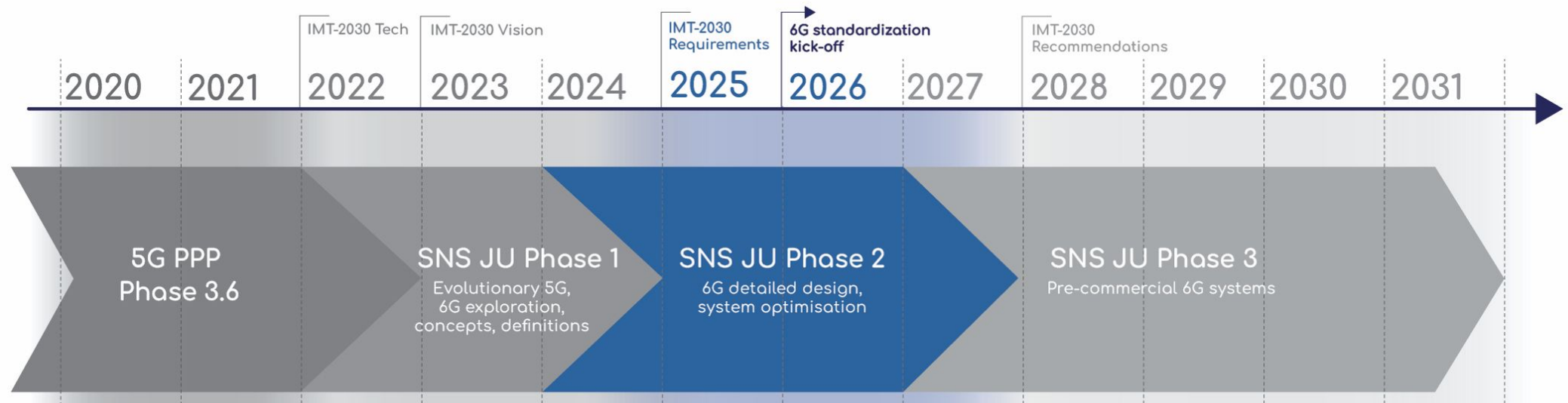
- **Duration:** 1 January 2024 – 31 December 2026
- **Budget:** 4.19 millions euros

SNS JU: Advance 6G research in Europe



- SNS JU enables the pooling of EU and industry resources into Smart Networks and Services.
- 6G-TWIN is part of the SNS JU project portfolio, Phase 2, STREAM-B-01-01: **System Architecture** (5 projects selected, in total)

6G SNS



The consortium



11 partners from 8 Member States or associated Member States



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The consortium



- 2 leading research organizations, 3 universities, 3 SMEs and 3 LEs.
- Half of the consortium is member of the 6G-IA association.



Beyond 5G



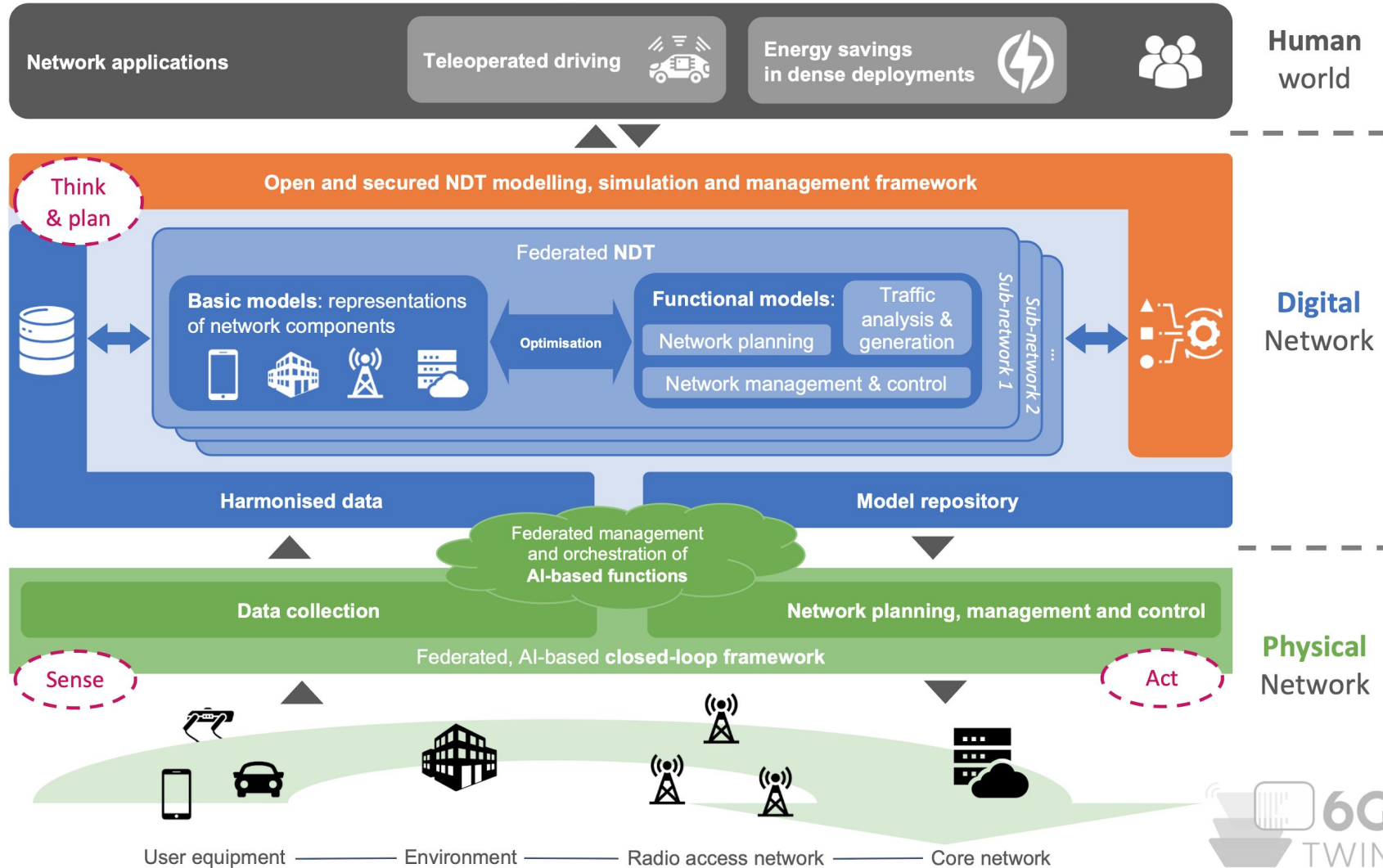
- The rapid integration of digital technology across industries like transportation and manufacturing has boosted the **need for efficient communication and computing services**.
- Networks are becoming increasingly complex and distributed, requiring a large variety of technologies to operate. With **6G**, which is now on the horizon for around 2030, it is essential to design, experiment and standardize **new network architectures with more intelligence and automation**.
- European 6G roadmaps prioritize an **AI-native management** system for complex networks. These networks need to be sustainable, energy-efficient, and adaptable to various services and business models. Establishing a consistent **unified communication and computing architecture** requires unconventional methods, along with collaboration among standardization groups and industry leaders for practical market integration.

Overarching objective

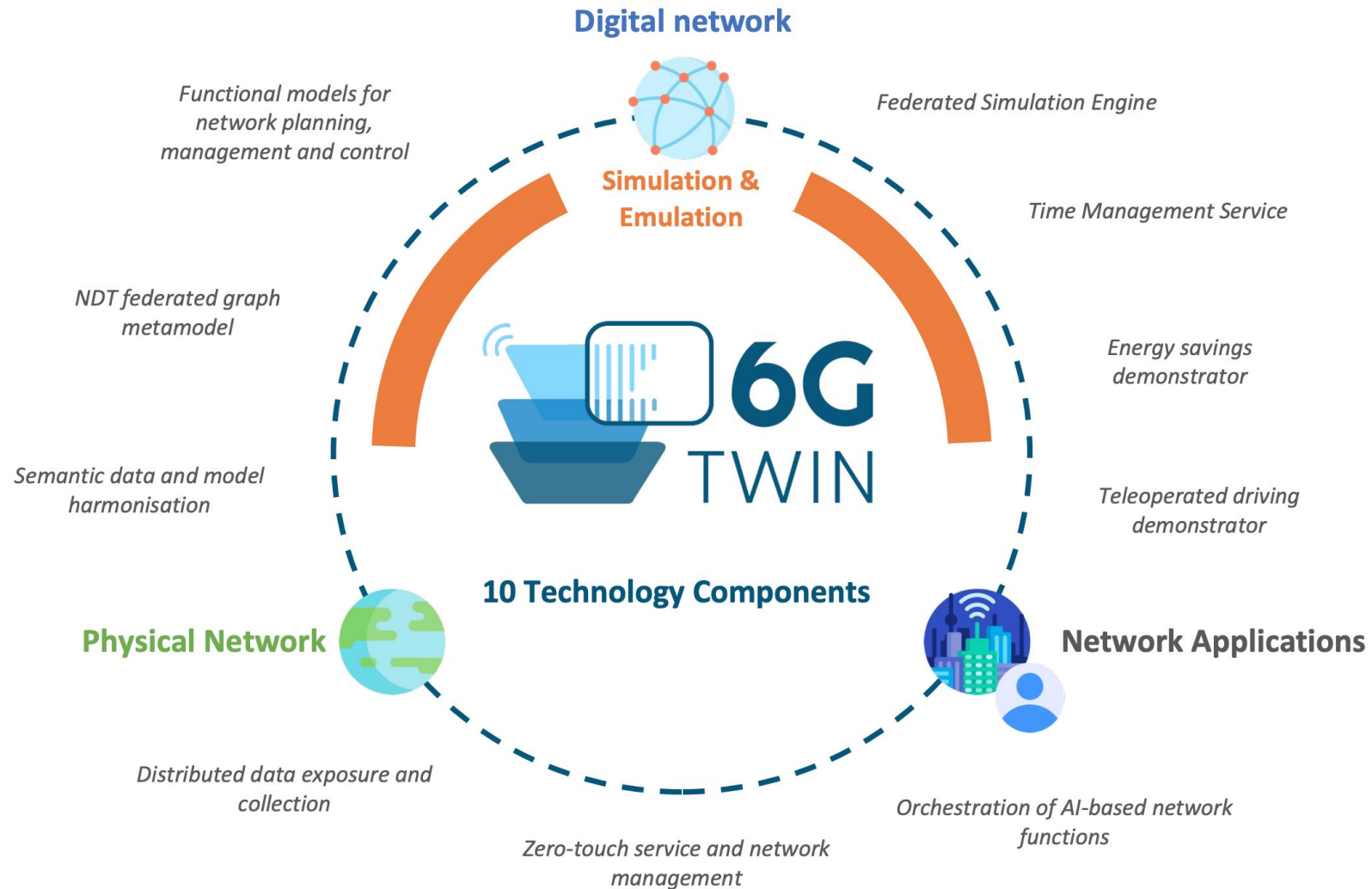


- To provide the foundation for the design, implementation and validation of an **AI-native reference architecture** for 6G systems that incorporates **Network Digital Twins (NDT)** as a core mechanism for the end-to-end, real-time optimisation, management and control of highly dynamic and complex network scenarios.
- Creating a real-time digital replica of the physical network infrastructure (i.e., NDTs) means creating a **sandbox** in which it is possible to train models and test different scenarios before deploying them on physical network controllers.

Concept



Technology solutions



6G-TWIN specific objectives



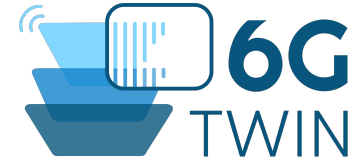
Area 1: advance the state of the art

SO1: To design and develop an **open, federated and AI-native network architecture** for future 6G systems that integrates NDT to enable intelligent data analytics and decision-making in real-time.

SO2: To design a **federated, graph-based NDT** that accurately represents highly dynamic and complex network scenarios and serves as a sandbox for optimising network planning, management and control applications.

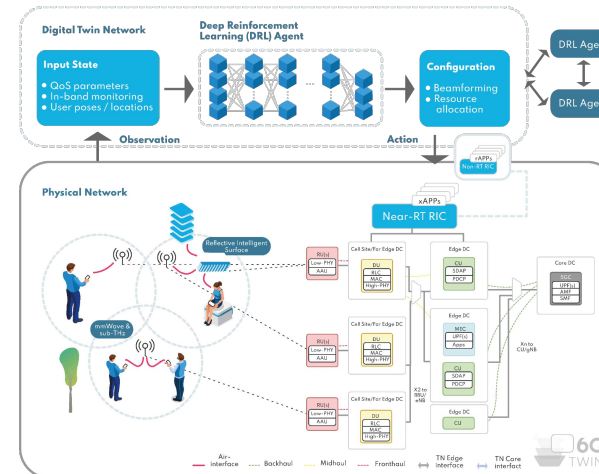
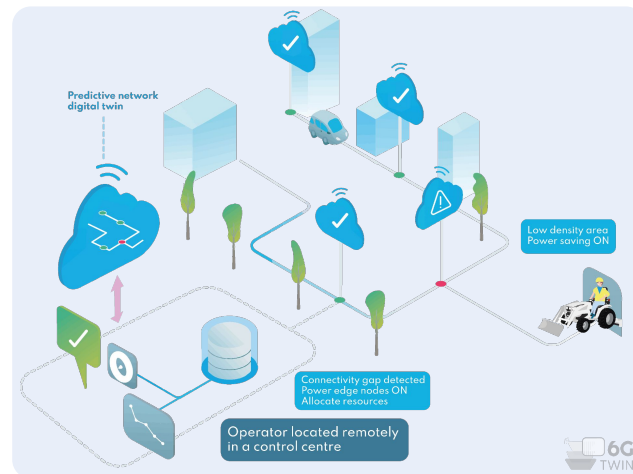
SO3: To implement an **accurate, reliable, open and secured modelling and simulation framework** to represent a networked environment and test the functionalities of the proposed 6G architecture.

6G-TWIN specific objectives



Area 2: demonstration

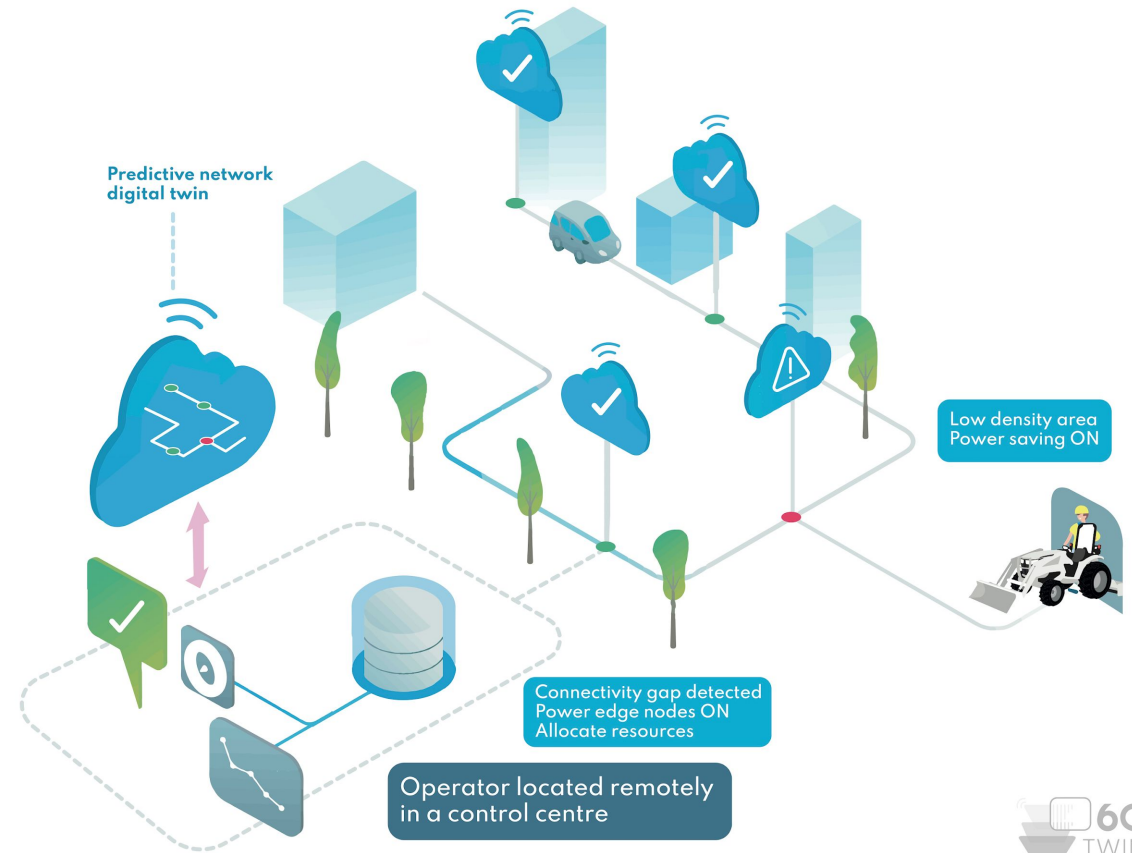
SO4: To test, validate and facilitate the transferability of the solutions developed in 6G-TWIN through the development of two demonstrators supporting highly dynamic use cases, with two key focus areas: **teledriving** and **energy efficiency**.



Demonstrator #1

Teleoperated driving demonstrator

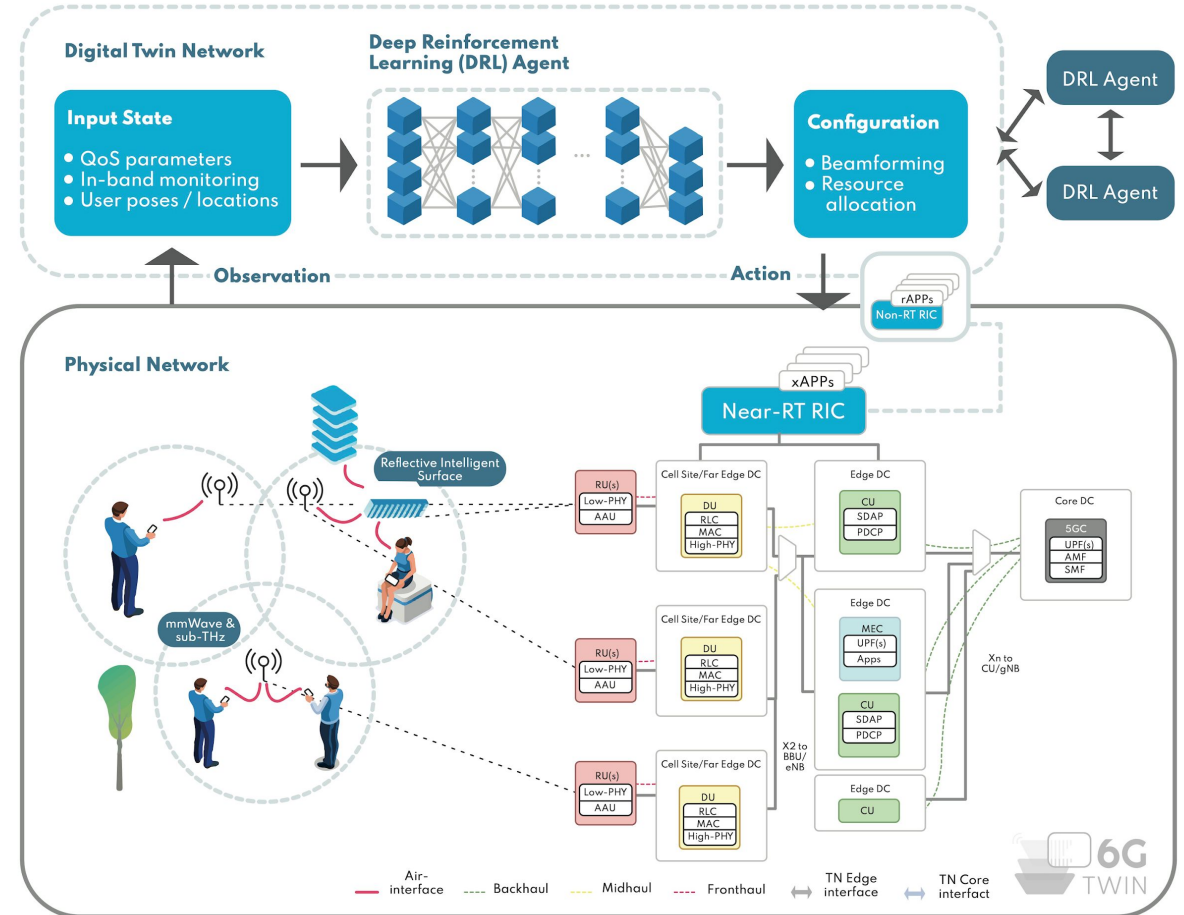
NDT solutions allow to anticipate (predictive DT) the network behaviour that could face a teleoperated vehicle prior to its departure, to ensure an extreme quality of service and availability of the network resources all along its journey.

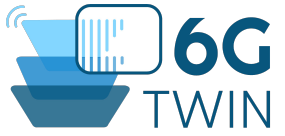


Demonstrator #2

Energy savings demonstrator

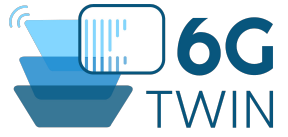
NDT solutions are used to adapt its behaviour in near real time with the objective to optimise the overall, end-to-end energy efficiency of the network (reactive DT).



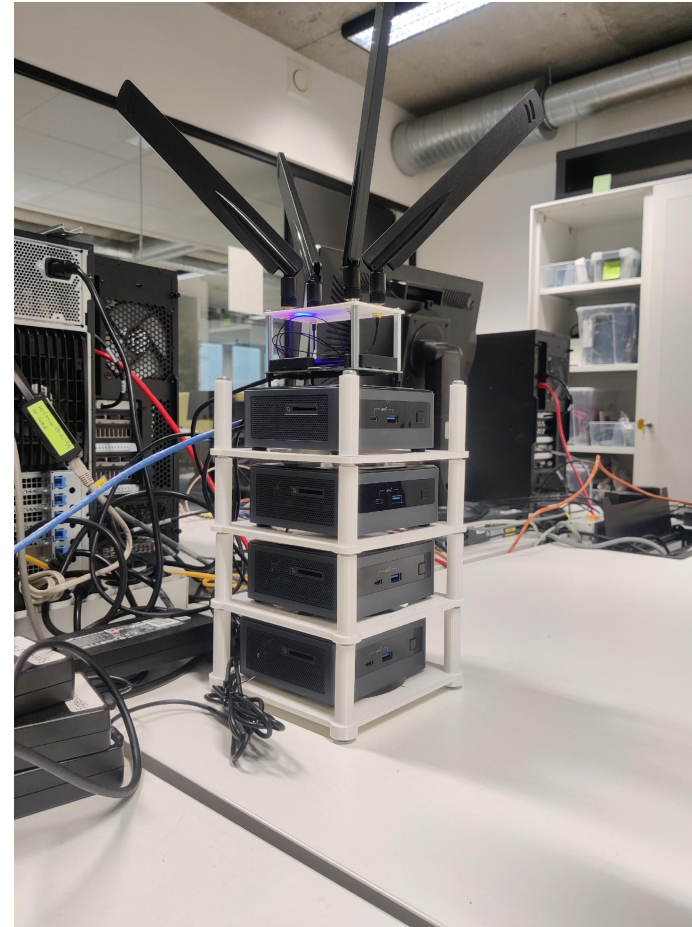
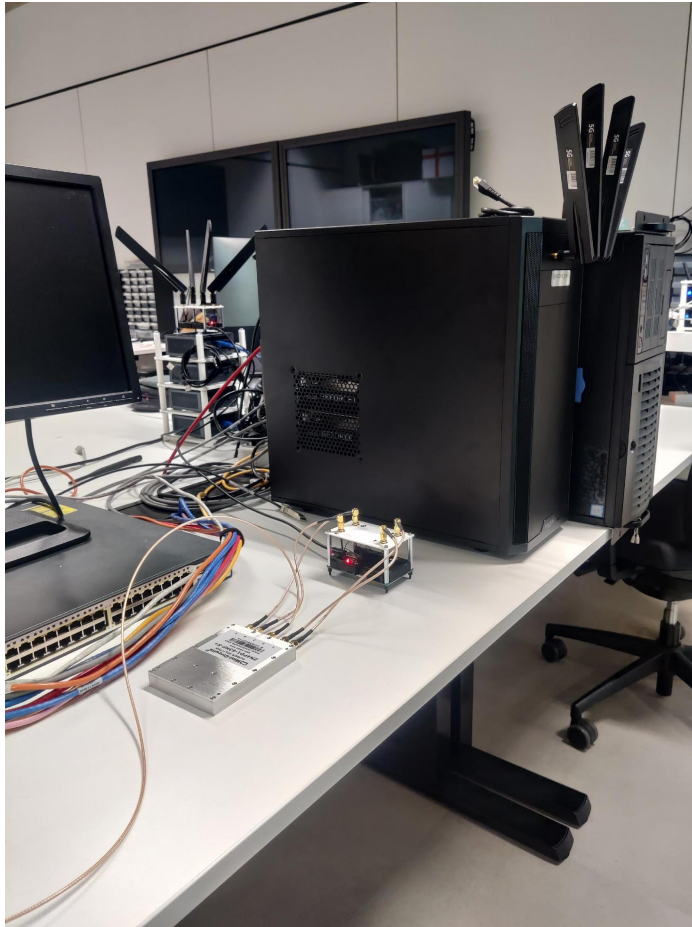


Labs hosting the demonstrations





Labs hosting the demonstrations



6G-TWIN specific objectives

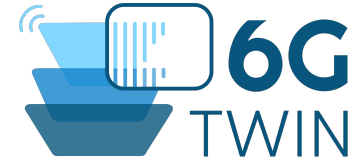


Area 3: adoption

SO5: To support the **standardisation** of the 6G-TWIN operation system to ensure the interoperability, platform openness and operation harmonisation of future 6G-TWIN Solutions.

SO6: To provide industry with insights on **innovative business models** based on 6G-TWIN solutions and visions.

Expected results



- Integration of the TCs in **one federated and AI-native network reference architecture that integrates multiple NDTs** for real-time data analytics and decision-making across at least two network domain
- **New on-the-fly AI approaches** to orchestrating network functions and services.
- At least **3 AI-based NF/NS for data analytics or/and decision-making to optimise network performance.**
- Accurate, reliable, **open and secured modelling and simulation framework for representing a networked environment and testing the functionalities of the 6G architecture.**
- Monitored KPIs & KVIs for each demonstrator, including **at least 30% end-to-end improvement in energy efficiency.**

Expected outcomes (1/2)



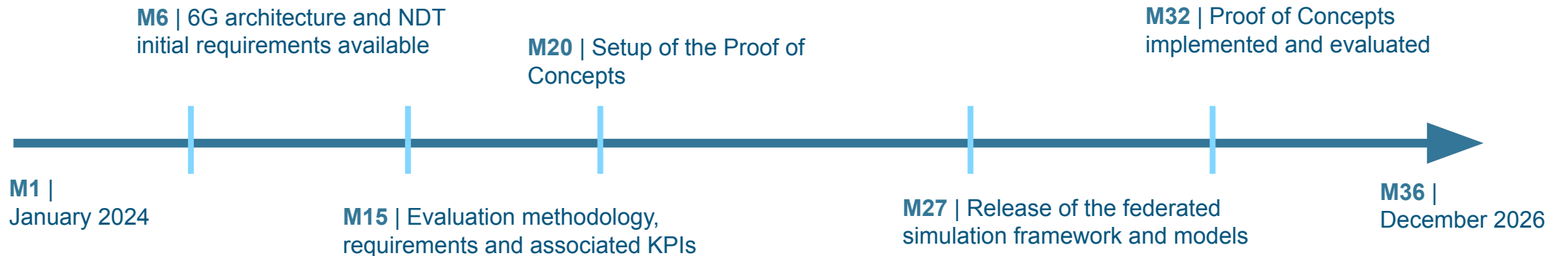
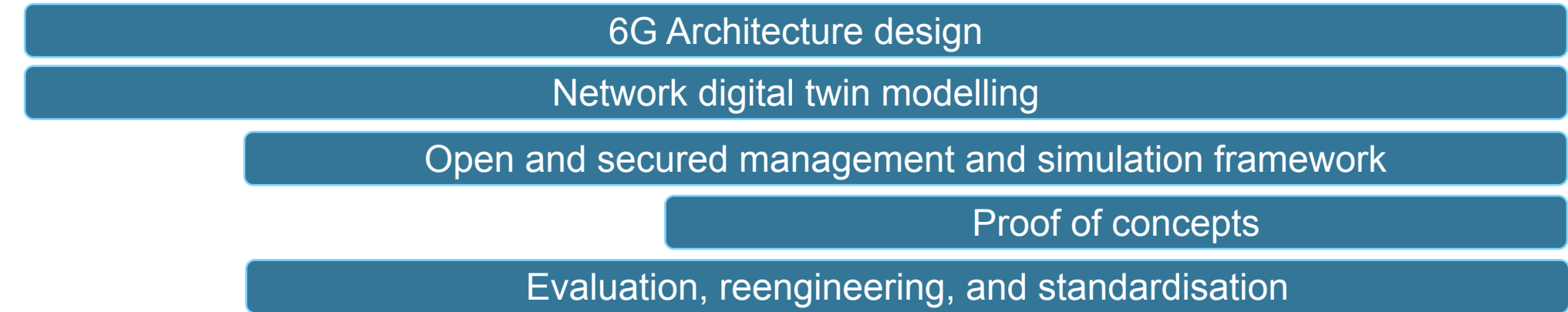
- 6G-TWIN will provide an **AI-native IT architecture for 6G systems that integrate NDT as a core mechanism**: enhanced control, management and deployment in a highly dynamic and complex network environment is achieved.
- **Innovative protocols** for overcoming known Internet limitations are made available by 6G-TWIN as originating from new scenarios and vertical requirements (ultra-low latency, extreme mobility, ultra-high data rates, integration of end-terminals, controlled security, space applications).

Expected outcomes (2/2)



- **Proven high reactivity to network changes** in line with high topology and load dynamics beyond what semi-rigid network architectures, thanks to AI driven on-the-fly optimisation of both communication and computation aspects of mobile networks based on DTs.
- **Single, unifying, and open controllability framework** providing a unified view of the network, allowing the connectivity and service infrastructure to be programmable.
- **Uptake of project results** by industrial partners (both large enterprises and SMEs), push toward standardisation and further replication.

Timeline and core activities



Follow us and get in touch



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