6G-PATH: *6G Pilots and TriAls THroughout Europe*
Project Presentation

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6G-PATH Presentation
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Contents

6G-PATH at a glance

- *Title:* **6G Pilots and Trials Through Europe**
- *Grant Agreement No.:* **101139172**
- *H2020 Call:* **Horizon-JU-SNS-2023**
- *Funding Instrument:* **HORIZON-JU-IA**
- *Coordinator:* **OTE** – *Technical Coordinator:* **OneSource**
- *Duration:* **36 months** – *Starting Date:* **January 01, 2024**
- *EU Contribution:* **12.571 M€** – *FSTP:* **3.0 M€**
- ➢ **26 Partners – 13 Countries** (GR, FI, RO, ES, PT, FR, DE, SW, IE, CY, IT, CH, UK)
- ➢ **10 Use Cases (+30 Use Cases in FSTP)** – **7 Test-beds/Pilots**
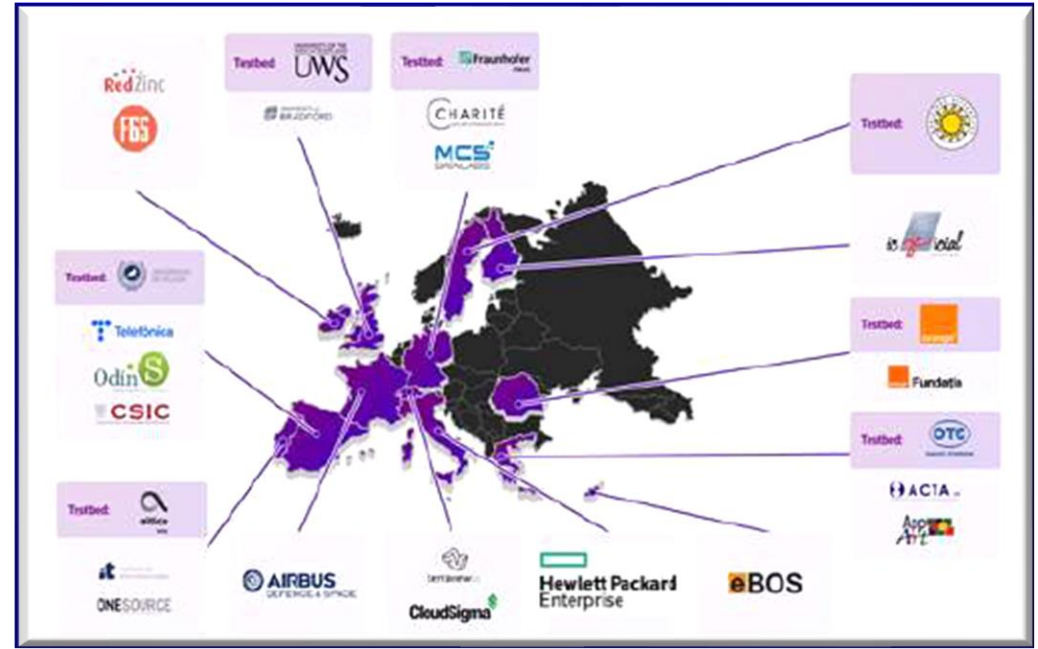
Budget allocation
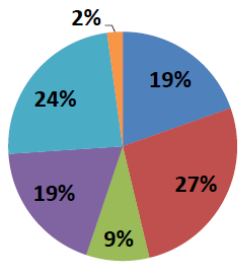
- Industry — 19%
- SME — 27%
- University — 9%
- Research — 19%
- FSTP — 24%
- NGO — 2%

5 industry partners

8 academic & research partners

12 SMEs & 1 NGO

6G-PATH - Main Scope

The Challenge:

- **The path towards 6G** is gradually taking place *following to the 5G's worldwide deployment both publicly and privately.*

- **Although 5G brought major benefits in many fields (e.g., performance and efficiency), more is always expected** *in terms of efficiency by the overall community* and *of performance by industry and technology providers* who want to further increase their offerings and products.

- **Continuous demands for higher throughput, lower latency and more energy efficient communications needs to be supported by relevant use cases,** *being able to claim & demonstrate the needs for such requests.*

The Way forward:

- **6G-PATH's goal is to help foster the further development and integration of new and improved tools and products from EU companies with 5G/6G, while also measuring relevant KPIs & KVIs.**

- **7 testbeds will be part of the project consortium**, which will be used by **10 use cases** spread across **four key verticals: Health, Education, Smart Cities and Farming**.

- **A portion of the budget will be used for FSTP**, where there is vision for the integration of **2 new Pilot Sites**, extension of the testbeds with **10 additional technologies, as well as 30 new Use Cases, through Open Calls**, *to further involve the community and obtain more metrics and outcomes*.

- **6G-PATH will work closely with other ongoing/starting Stream-B and Stream-C projects** in a feedback loop.

6G-PATH – Main Scope
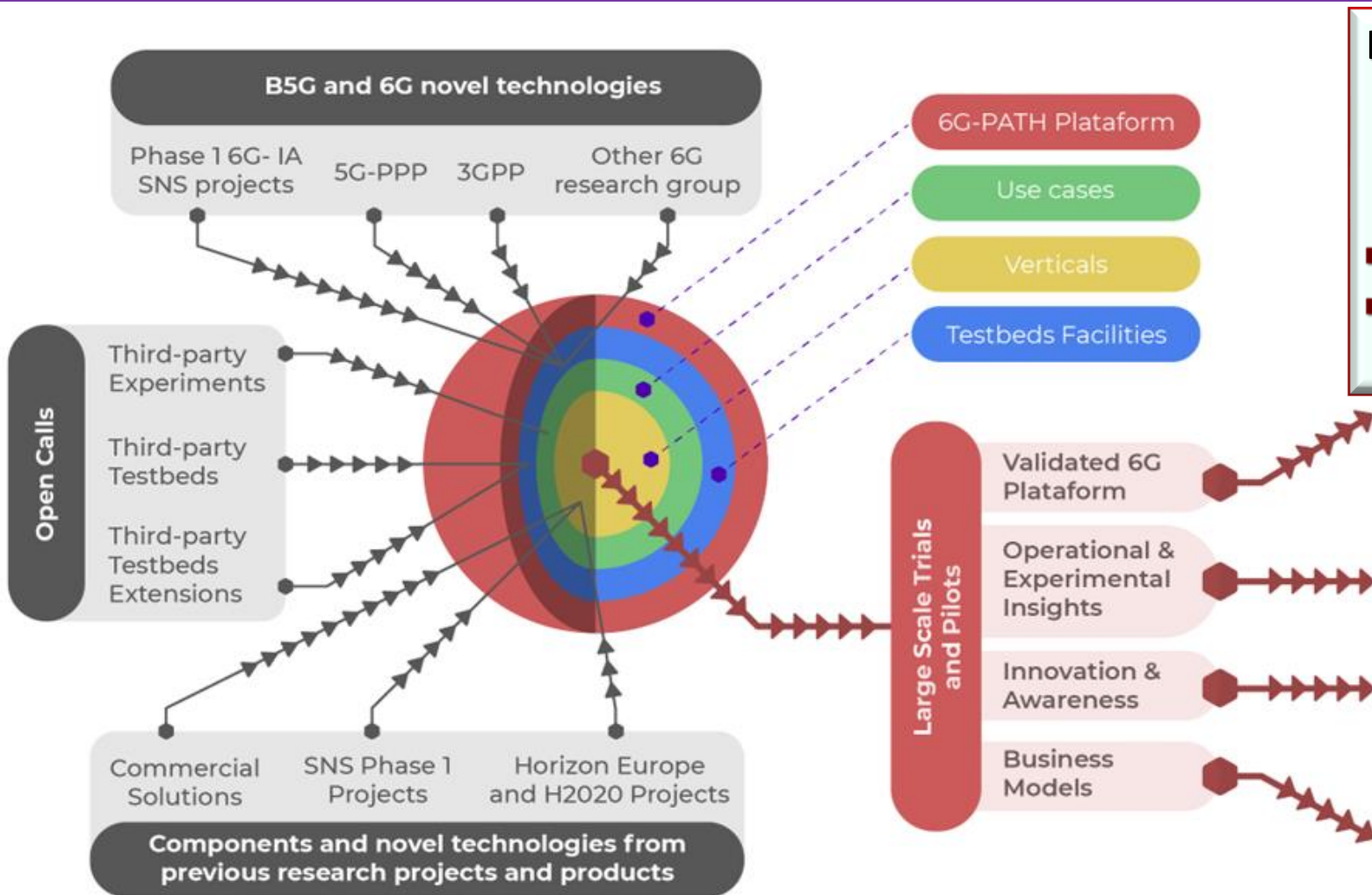
6G-PATH concept and driving innovation motivators

In the B5G/6G transition it is essential that
- *requirements are set and*
- *both new and demanding Use Cases (UCs) are specified*

➡ *as means of setting the 6G challenges, and*
➡ *for supporting 6G validation in realistic scenarios*

6G-PATH aims to foster the development of new technologies supporting 6G,
- *in close collaboration with other 6G-IA projects and*
- *through the process of Open Calls*
- **to engage European companies** developing innovations for B5G and 6G systems, as well as
- **to bring new UCs and pilot sites** to the 6G ecosystem.

6G-PATH - Goals

- **Integrate and operate** a large set of testbeds and pilot sites that will go beyond 5G and **follow** 3GPP Releases 18, 19 and 20. *(A total of 7 testbeds will be initially made available by the Consortium, and up to 2 more testbeds or pilot sites will be integrated by means of Open Calls).*

- **Use** these testbeds as a common infrastructure for systematic integration of B5G/6G innovations *being developed in the scope of other 6G-IA projects and/or by third parties (by means of Open Calls), so that those innovations can be demonstrated and validated across multiple testbeds, Use Cases, and applications (with a specific focus on the aforementioned Verticals).*

- **Offer** a transversal experimentation platform which will streamline: *(i)* the technical integration of demanding UCs and applications into the testbeds and; *(ii)* the collection of relevant metrics during the pilots and trials. *This transversal platform is also expected to considerably lower the barriers for innovative Use Case or application promoters interested in adopting or assessing the suitability of B5G/6G technologies for their services and applications.*

- **Integrate, demonstrate and evaluate** a wide range of demanding UCs in the four envisaged verticals. *At least 40 UCs will be evaluated (10 directly provided by the Consortium, and a minimum of 30 to be engaged by means of Open Calls).*

6G-PATH - Goals (cont'd)

- **Perform** a comprehensive and meaningful validation of technological innovations and pilot setups *to ensure an ambitious and clear path towards 6G by the end of the project.*

- **Perform** an extensive analysis of potential business models for the envisaged UCs, *to identify the most viable solutions from this perspective for each Use Case* in specific, *and for the related Verticals industry business model* in general.

Overall, 6G-PATH will build an extensive B5G/6G infrastructure where a set of core architectures and domain-specific capabilities will:
- *be brought together* and
- *be made available* for integration of applications and UCs of relevance (*within the four addressed verticals*),

to conduct large-scale pilots and trials.

The results of these pilots and trials will be collected and analysed in detail,
- to *generate* appropriate lessons and requirements for future 6G communications
- to *identify, characterize and refine* leading-edge business models

towards the commercialisations and exploitation of 6G use cases and technologies.

6G-PATH - Objectives

A total of seven specific objectives have been established for the project:

Obj1: **Setup the 6G-PATH experiment and validation infrastructure and evolve it into B5G/6G experimental infrastructures and pre-normative testbeds**

Outcome:
- *Multiple performance-oriented infrastructure deployments going beyond of "what the vertical use cases require" and span across different network types and services where verticals can run their use cases and leverage B5G/6G solutions and technologies.*
- *These deployments will support pilots for the extended validation of experiments with a high TRL.*

Obj2: **Deliver and refine a transversal integration and experimentation platform**

Outcome:
- *Establishment of a 6G-PATH integration and experimentation platform, covering the whole range of integrated testbeds.*
- *Provision of adequate support for application integration and management of trials and pilots execution.*

Obj3: **Expand user community and implement large scale field trials with internal and external experiments, through Open Calls**

Outcome:
- *Establishment of a large, diverse, and committed community of organizations and people that bring innovation and validate its impact on end-users and stakeholders alike.*

6G-PATH – Objectives (cont'd)

Obj4: **Collection and refinement of requirements stemming from Stream B and verticals**

Outcome:

- *Formulation of a diverse and wide set of requirements that will be used to evolve the infrastructure, to shape the experiments and their respective validation, as to influence standards and promote the future exploitation of 6G-PATH outcomes.*

Obj5: **Devise leading-edge business models towards the commercialisation and exploitation of 6G-PATH use cases and technologies**

Outcome:

- *Creation of leading-edge business models to exploit and validate the full potential of 6G-PATH solutions in a wide range of industrial sectors, which are also expected to bring the commercialisation of products arising from the project.*

Obj6: **Disseminate and communicate results to a wide community of stakeholders while ensuring impact on standardisation efforts**

Outcome:

- *Establishment of a successful communication and dissemination strategy via a comprehensive plan and by attaining or surpassing the expected KVIs/KPIs.*
- *Timely and key contributions to standards through knowledge-transfer and the participation of consortium members in standardisation bodies.*

6G-PATH – Objectives (cont'd)

6G-Path

Obj7: **Create repositories for both open knowledge transfer and for supporting the subsequent phases of the SNS programme**

Outcome:

- *Creation of two types of repositories* that *enable and foster* knowledge transfer, support subsequent phases of the SNS programme,
- *Establishment of a solid framework* for any other experimenters, innovations and infrastructures.
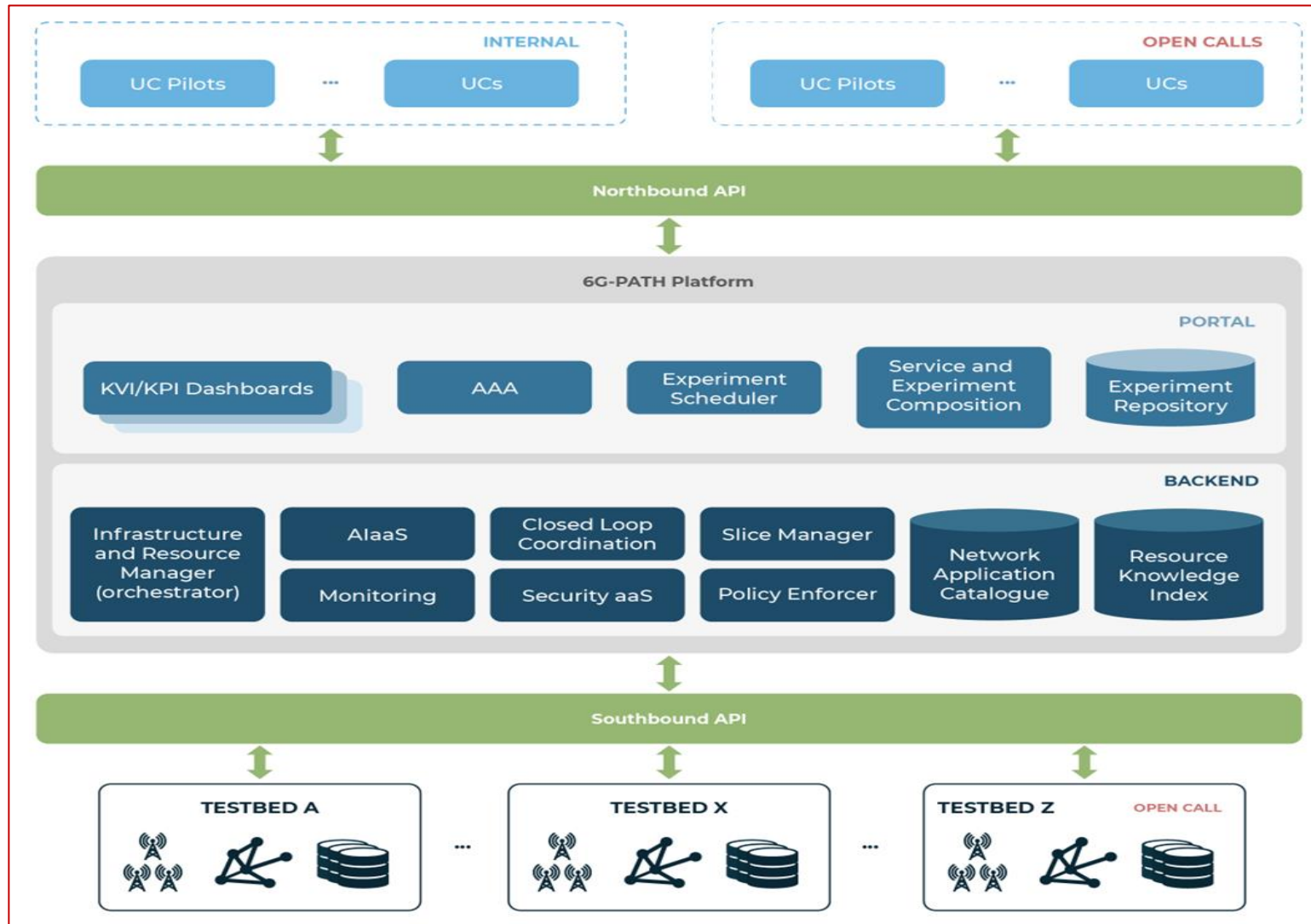
6G-PATH Ecosystem

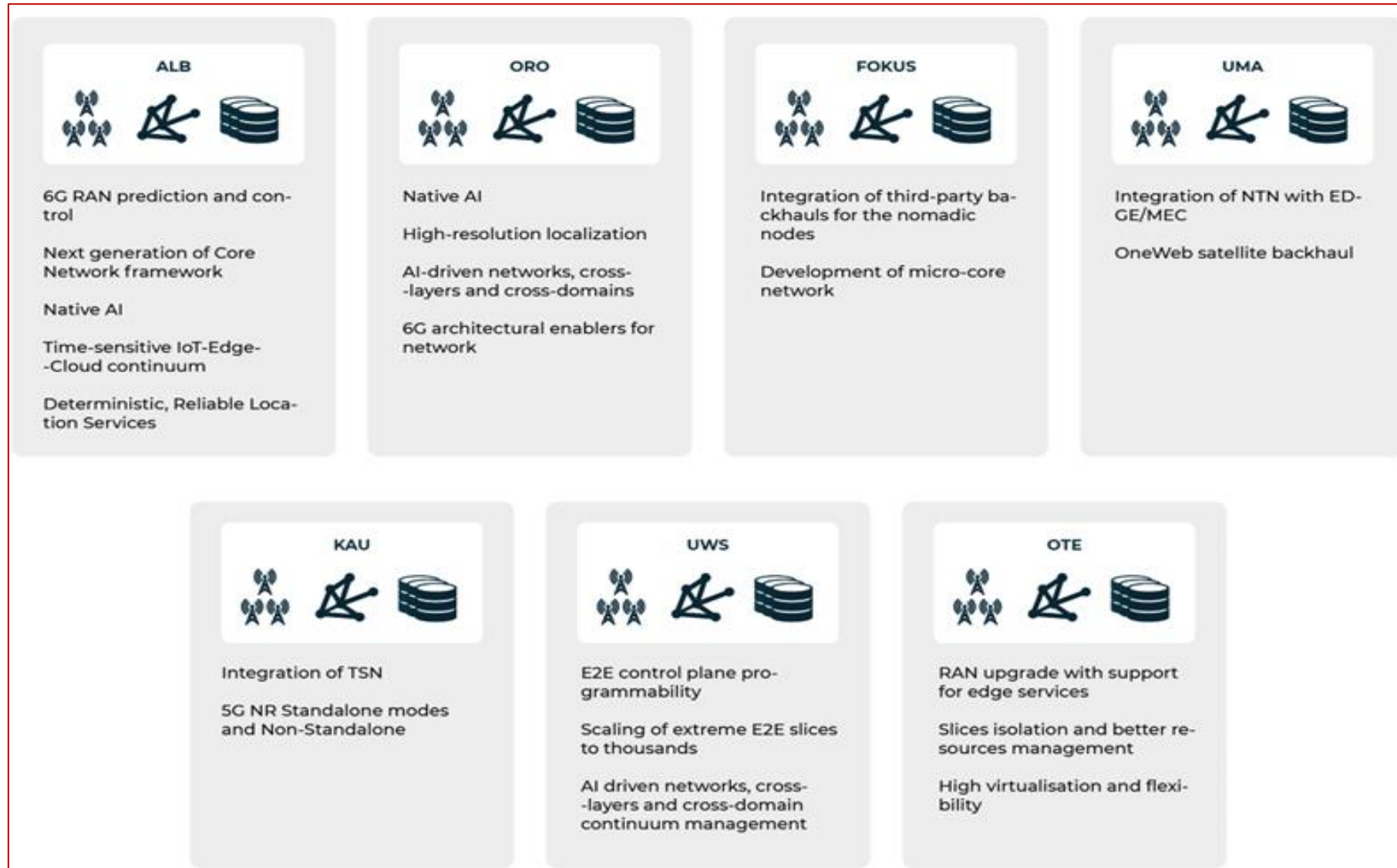**6G-PATH Use Cases, Testbeds and Open Calls and Third-parties**

6G-PATH Unified Platform

6G-PATH Architectural flavor

➡ **Native AI, AI-Driven Networks, Intelligent Cross-Domain continuum management and 6G RAN prediction capabilities** *are key features in the 6G roadmap*.

➡ **Deterministic, Reliable and High-Resolution Localization Services**.

➡ **Non-Terrestrial Networks (NTN) are being considered as a solution for extending cell coverage**, *especially in locations where terrestrial networks are difficult to deploy, such as across oceans, or are not cost-effective for traditional operators, such as rural areas.*

➡ **Time Sensitive Networks (TSN) and Time-sensitive IoT-Edge-Cloud Continuum address the need for a more deterministic network,** *required by some time-sensitive scenarios, such as IoT applications or, more significantly, the emerging Industry 5.0 concept.*

➡ **Next-Generation of Core, Backhauling and Micro-Networks**.

➡ **E2E Control Programmability, Extreme E2E slicing and resource isolation**.

➡ **De-biasing of metadata and co-creation,** *through the project's approach and methodology for the KPIs and KVIs, and the AIaaS containing metadata for AI/ML datasets and each AI/ML training set* **will be accompanied by information on how data is collected and annotated.**

➡ **Energy efficient core and management platform through the usage of advanced AI algorithms** *that are energy-aware and orchestrate energy-efficient solutions, including the optimization of edge-core continuum.*

6G-PATH – Testbed Innovations and Integrations (cont'd)

ALB

6G RAN prediction and control

Next generation of Core Network framework

Native AI

Time-sensitive IoT-Edge-Cloud continuum

Deterministic, Reliable Location Services

ORO

Native AI

High-resolution localization

AI-driven networks, cross-layers and cross-domains

6G architectural enablers for network

FOKUS

Integration of third-party backhauls for the nomadic nodes

Development of micro-core network

UMA

Integration of NTN with EDGE/MEC

OneWeb satellite backhaul

KAU

Integration of TSN

5G NR Standalone modes and Non-Standalone

UWS

E2E control plane programmability

Scaling of extreme E2E slices to thousands

AI driven networks, cross-layers and cross-domain continuum management

OTE

RAN upgrade with support for edge services

Slices isolation and better resources management

High virtualisation and flexibility

6G-PATH – Verticals & Use Cases

The Farming vertical is composed of **two use cases** (*water saving* and *smart vineyards*).
- It will be used to **evaluate different types of deployments** (*off-grid, intermittent and interconnected*), *network slicing with support for different kinds of QoS (i.e., eMBB, URLLC, eMTC).*
- It will also **study the integration with AI-driven capabilities of the Edge-Cloud computing**.

The Education vertical is composed of **three use cases** (*XR rural schools, classroom of the future* and *XR Health Training*).
- It will be mainly **devoted to XR (AR, VR and MR)** and **Holographic-based education and training scenarios**.
- **Focus will be upon** the **concepts of Edge Computing, location-sensitive processing** and **"how the network and continuum infrastructure can natively support the KPI and QoE measurement".**
- The education vertical will also serve to evaluate and explore the native integration with AI-driven capabilities for video and data processing.
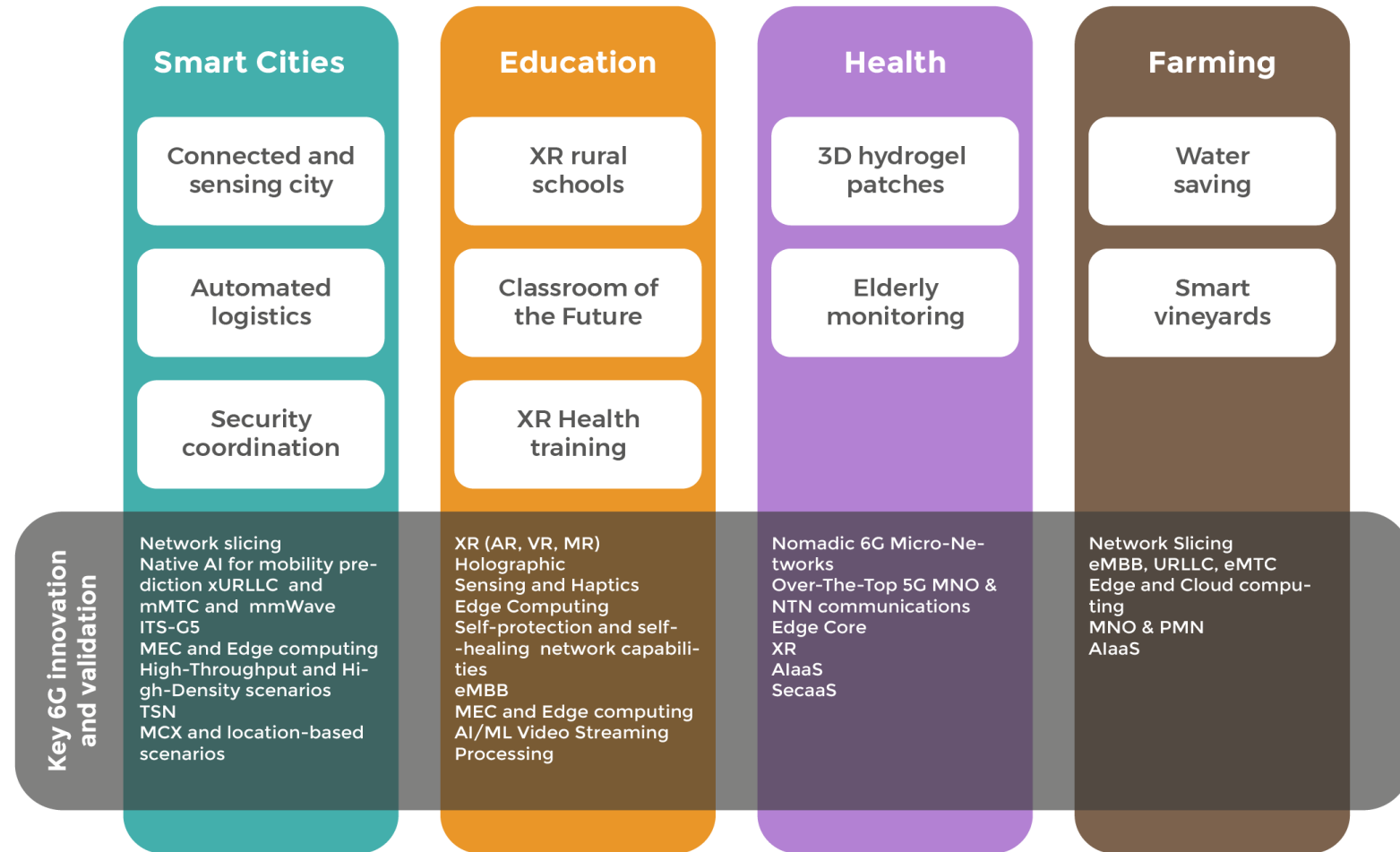
The Health vertical is composed of **two use cases** (*3D hydrogel patches* and *elderly monitoring*).
- It will be used to **evaluate the concept of micro and nomadic edge nodes and networks**, **Ubiquitous, Reliable and Secure connection Over-The-Top 5G MNO and NTN integration, XR with ultra-high bandwidth (>50 Gbps) available to the XR platform and ultra-low latency (<3ms).**
- This vertical **will also serve for** **testing security-related KPIs of network and infrastructure** (*e.g., mutual authentication and authorization of communication between the edge-core and the core network*).

The Smart Cities vertical is composed of **three use cases** (i.e., *connected and sensing city, automated logistics* and *security coordination*).
- It will **focus on exploring and testing the integration of large-scale extreme IoT-Edge-Cloud scenarios**.
- This includes **differentiated QoS support** (e.g., xULLC, mMTC) **applied to MCX (mission critical) communications and extreme high-throughput video/data streaming.**
- This vertical **will also serve for** **evaluating the emerging deterministic, reliable, and high-resolution services and the resilience, safety and security of the next-generation networks**, a *key aspect for PPDR (Public Protection & Disaster Relief) and emergency-related applications.*

Smart Cities

- Connected and sensing city
- Automated logistics
- Security coordination

Key 6G innovation and validation

Network slicing
Native AI for mobility pre-diction xURLLC and mMTC and mmWave
ITS-G5
MEC and Edge computing
High-Throughput and Hi-gh-Density scenarios
TSN
MCX and location-based scenarios

Education

- XR rural schools
- Classroom of the Future
- XR Health training

XR (AR, VR, MR)
Holographic
Sensing and Haptics
Edge Computing
Self-protection and self--healing network capabili-ties
eMBB
MEC and Edge computing
AI/ML Video Streaming Processing

Health

- 3D hydrogel patches
- Elderly monitoring

Nomadic 6G Micro-Ne-tworks
Over-The-Top 5G MNO & NTN communications
Edge Core
XR
AIaaS
SecaaS

Farming

- Water saving
- Smart vineyards

Network Slicing
eMBB, URLLC, eMTC
Edge and Cloud compu-ting
MNO & PMN
AIaaS

Use Case Innovations

6G-PATH – Expected Outcomes & Impacts

Contribution to the further refinement of sustainable seamless E2E 5G Advanced and 6G test infrastructures with fine-tuned capability to integrate vertical use cases specific performance/KPI requirements, as applicable also across public and non-public networks and services.

Validate infrastructure core technologies and architectures in the context of vertical large-scale pilot use-case implementations and relevant deployment scenarios.

Validate core technologies and architectures across the value chain (IoT, connectivity, services) for differentiated performance requirements originating from concurrent implementation of use-cases and specialized services for verticals.

Promote viable business models for innovative digital use cases tested and validated across a multiplicity of industrial sectors, including demonstration of required device/network/service resource control from the vertical industry business model perspective.

Support to impactful contributions towards standardisation bodies notably for 6G use cases and technologies

6G-PATH – Expected Outcomes & Impacts (cont'd)

European 5G Advanced and 6G know-how showcasing: *Visible events widely open to the public are particularly relevant.*

Stimulate large industrial stakeholders, SMEs and the European Academic and Research community to engage in experimental activities in a timely fashion, *aimed to validate technological trends for 6G networks.*

Repository of requirements from verticals and of "lessons learned" to prepare for subsequent phases of the SNS programme. *It should include records and evaluation of 6G KPIs considering 5G Evolution and the aforementioned requirements and validating them with services linked to specific vertical sectors and related KVIs.*

Contribution to a repository of open-source tools and modules *that may be openly accessed and used by SNS projects over the programme's lifetime*

Collection of new requirements that are needed in subsequent phases for the key 6G technological building blocks, notably those identified in Stream B. *Those requirements may stem from: (i) the emergence of new application domains (Internet of Senses, holographic type communications…); (ii) the native support of AI/ML by future networks; (iii) the introduction of zero-touch solutions; (iv) high resilience/availability needs.*

6G-PATH – Expected Outcomes & Impacts (cont'd)

Horizon Europe Key Strategic Impact: Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains to accelerate and steer the digital and green transitions through human-centered technologies and innovations.

Moving beyond a simple increase in speed or performance of connectivity platforms, and beyond 5G capabilities, bringing unique new service capabilities with wider economic implications.

Bring new actors from, and beyond the verticals. Contributions from industry, RTO, academics and SMEs actors in the connectivity, IoT and cloud/IT domains are expected to be complemented by appropriate participation of the microelectronics industry, in view of their potential impacts at downstream standardisation level.

Perform a strong European impact at future downstream 6G standardisation stages, including a Europe-wide consensus of 6G Key Performance Indicator (KPIs) that will frame future developments.

Stimulate strategic alliances, with vertical (industrial) sectors to build and offer powerful and persuasive Business to Business (B2B) and Business to Consumer (B2C) propositions.

"Position" Europe as a lead market and positively impact the citizen's quality of life, by supporting key Sustainable Development Goals (SDGs) while boosting the European data economy.

Thank you for you attention!

Company Name

Presenter & position

Email

Company website

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