Update from Hexa-X-II and global alignment

EUCNC & 6G Summit June 2024

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Hexa-X-II

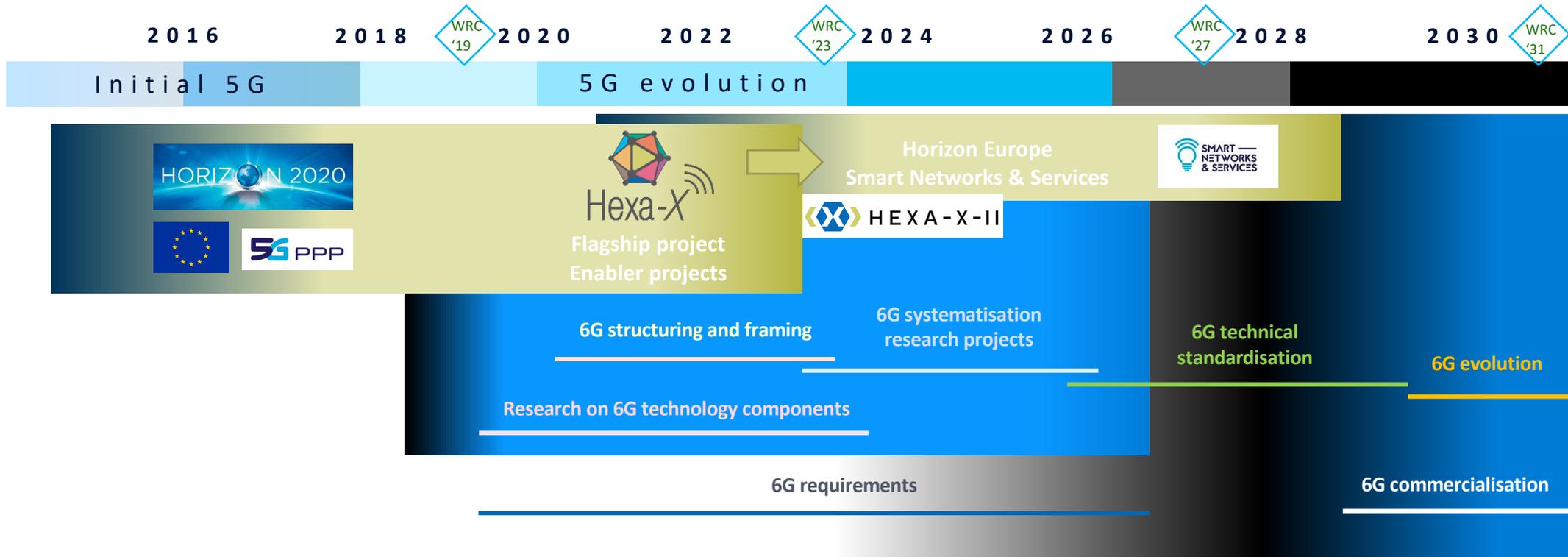hexa-x-ii.eu

Hexa-X-II European 6G Flagship Consortium covering the entire value stack

- Nokia is overall leader
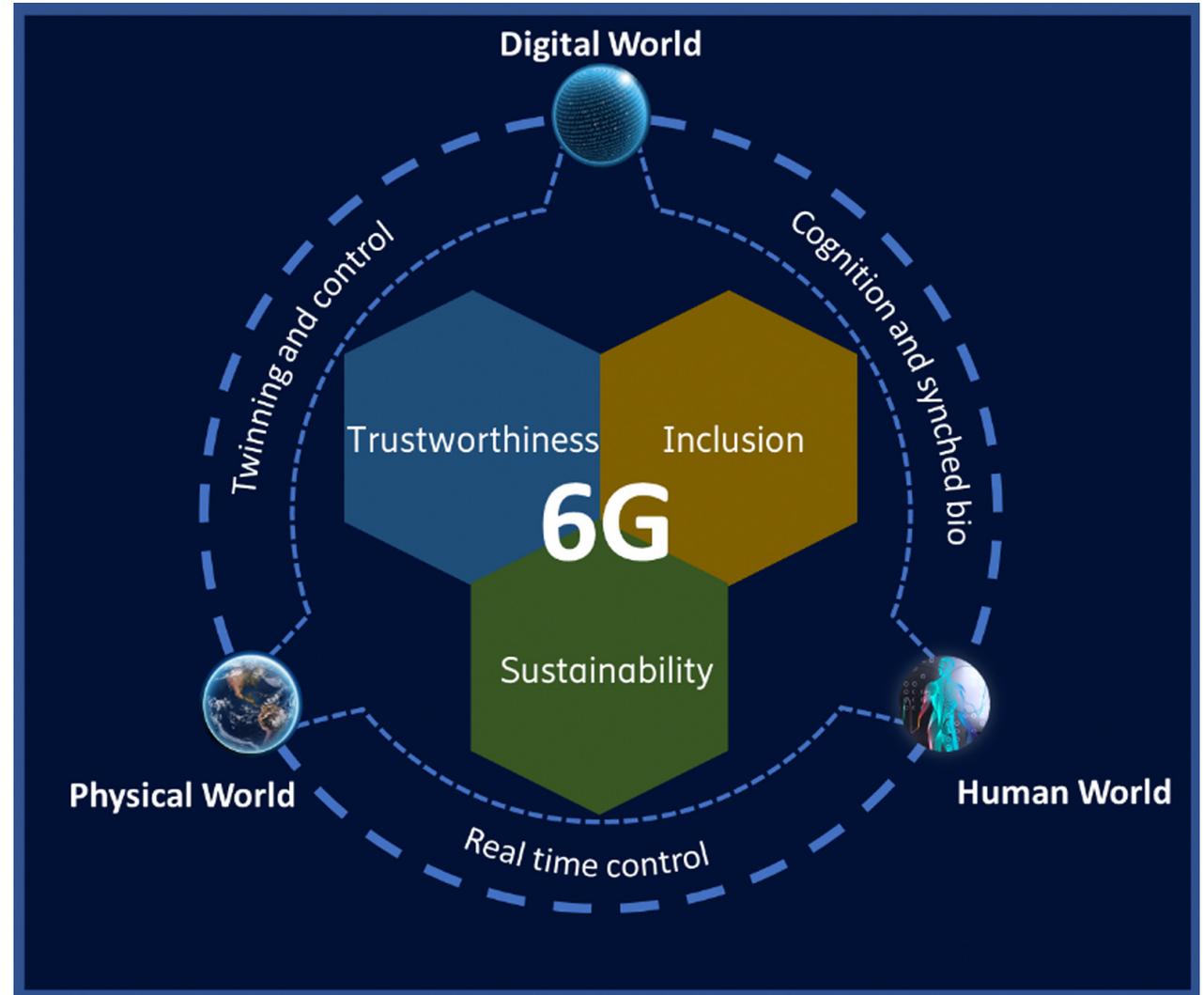- Ericsson is technical manager

Timeline

Hexa-X vision on 6G

- Connecting the physical, digital and human world

- Key values:
  - Sustainability
  - Inclusion
  - Trustworthiness

- Research challenges:
  - Connecting intelligence
  - Network of networks
  - Sustainability
  - Global service coverage
  - Extreme experience
  - Trustworthiness
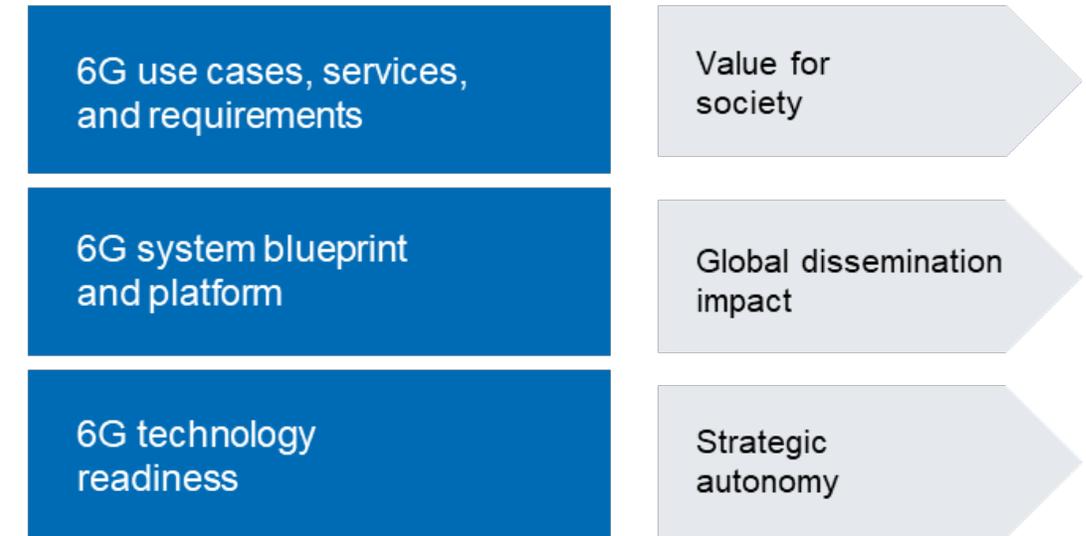
UN Sustainable development goals as basis

Overall objectives of Hexa-X-II

A holistic flagship towards the 6G platform and system
to inspire digital transformation for the world to act together in meeting needs in society and ecosystems with novel 6G services
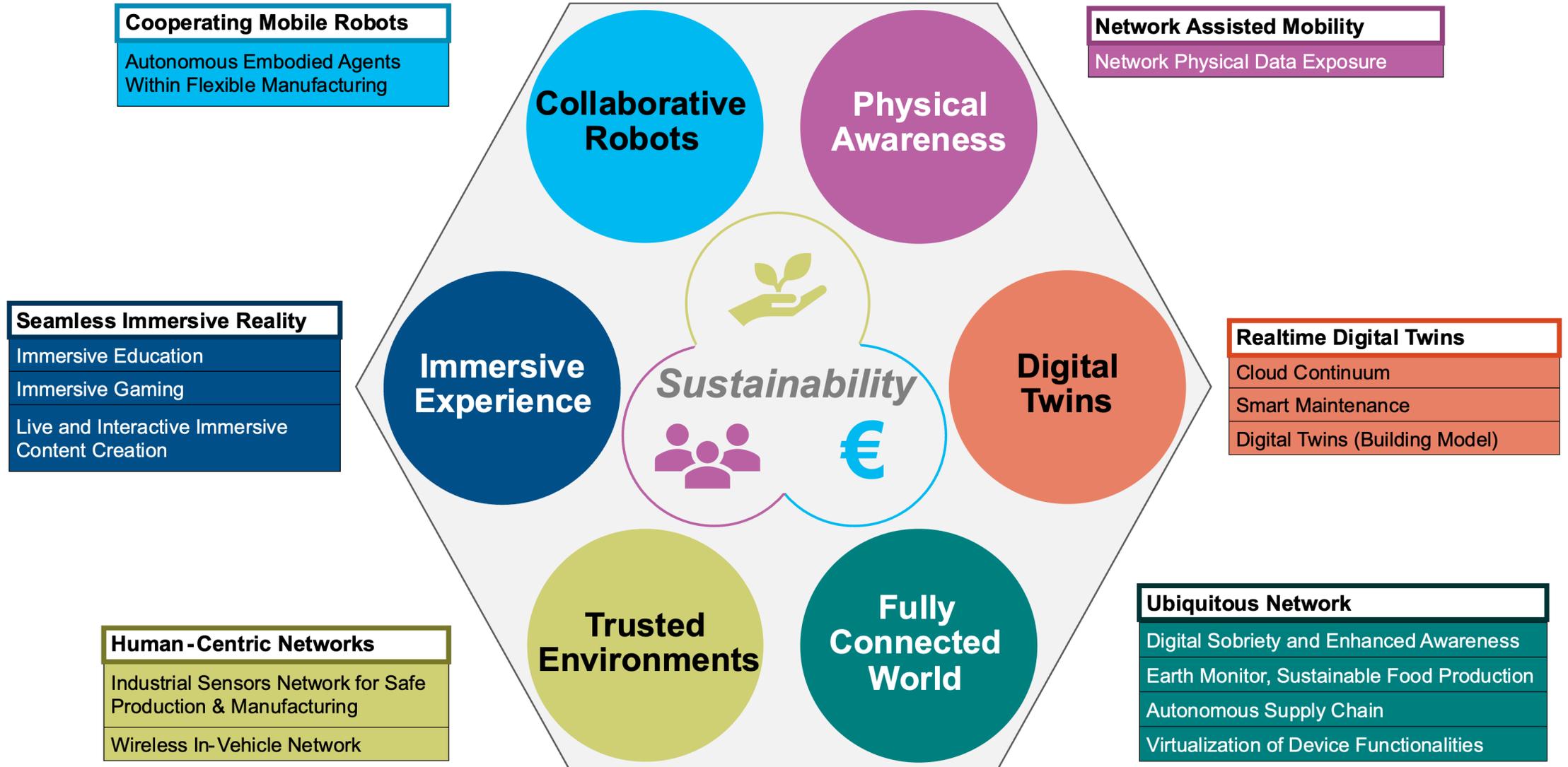
Hexa-X-II Use Case Families

Cooperating Mobile Robots
- Autonomous Embodied Agents Within Flexible Manufacturing

Seamless Immersive Reality
- Immersive Education
- Immersive Gaming
- Live and Interactive Immersive Content Creation

Human-Centric Networks
- Industrial Sensors Network for Safe Production & Manufacturing
- Wireless In-Vehicle Network

Collaborative Robots

Physical Awareness

Immersive Experience

Sustainability

Digital Twins

Trusted Environments

Fully Connected World

Network Assisted Mobility
- Network Physical Data Exposure

Realtime Digital Twins
- Cloud Continuum
- Smart Maintenance
- Digital Twins (Building Model)

Ubiquitous Network
- Digital Sobriety and Enhanced Awareness
- Earth Monitor, Sustainable Food Production
- Autonomous Supply Chain
- Virtualization of Device Functionalities

Hexa-X-II Use Cases with [Highlighted] Representative Use Cases

Usage scenarios

So called "Wheel diagram"
Source: Document 5/131 and edited in SG 5
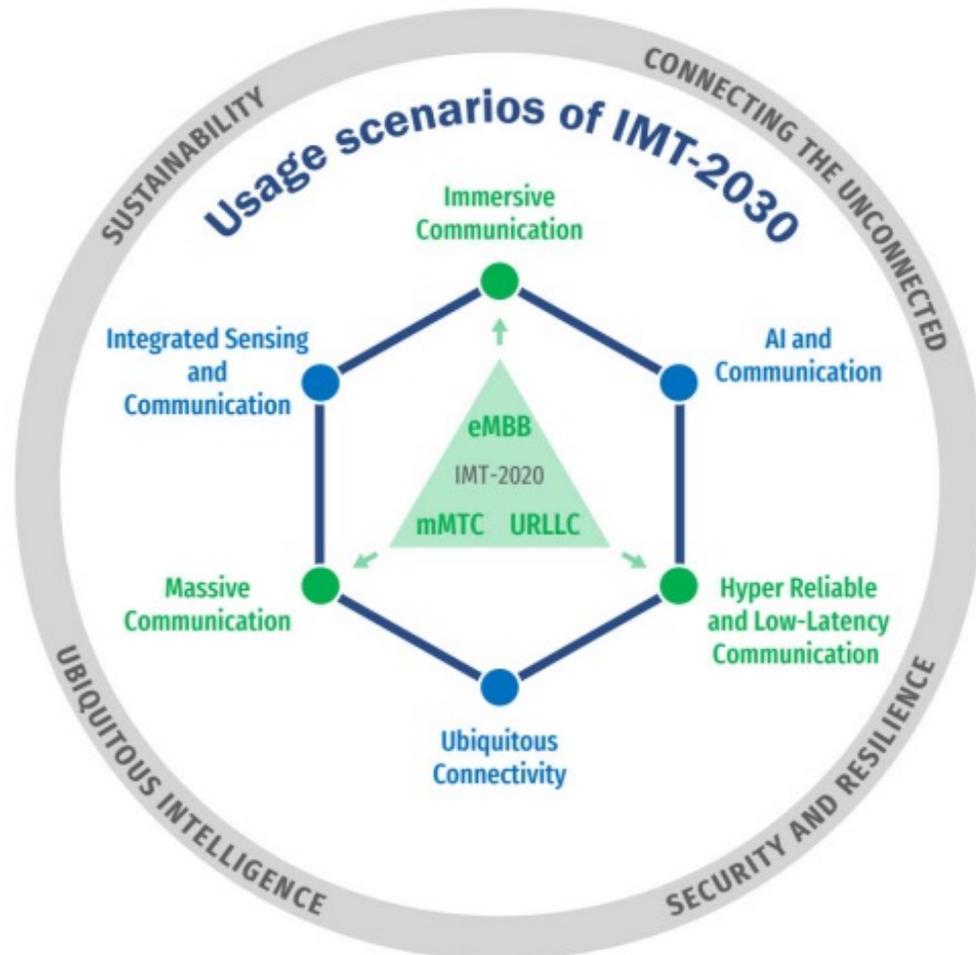
- ITU-R has set up the basic framework and timeline for the development of 6G

- 6 usage scenarios have been identified:
    - 3 scenarios extending from IMT-2020
    - 3 new scenarios

- Complemented by 4 overarching aspects

Key Worldwide Activities in 6G

Key worldwide initiatives were studied to comprehend their approach, proposed use cases, and intended capabilities for 6G.
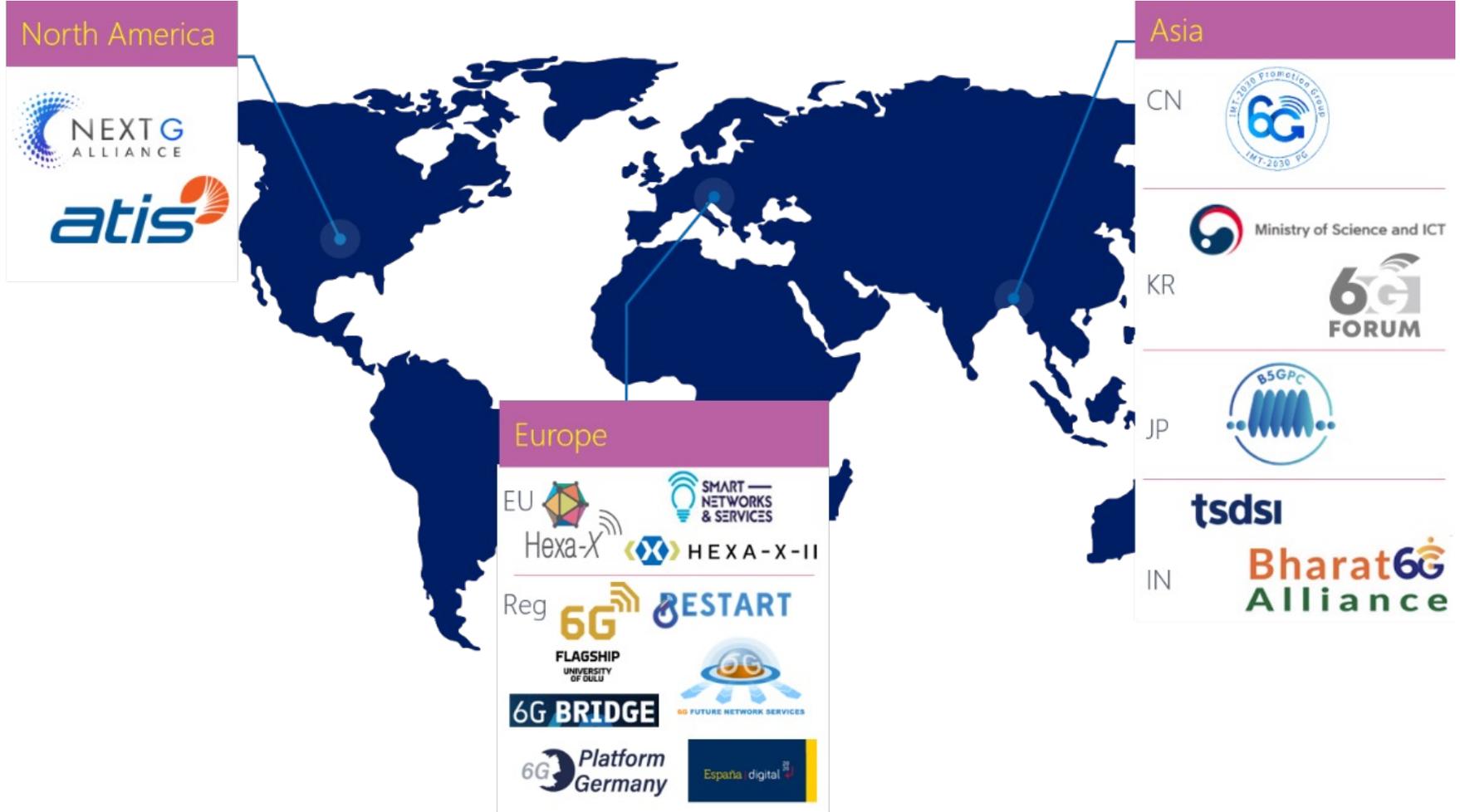
- **Europe**
  - HEXA-X-II
  - NGMN
  - Other national initiatives
- **United States**
  - ATIS NGA
- **China**
  - IMT-2030 Promotion Group
- **Japan**
  - Beyond 5G Promotion Consortium
- **South Korea**
  - Ministry of Science and ICT
- **India**
  - TSDSI (Telecommunications Standards Development Society, India)
  - Bharat 6G (Ministry of Communications)

Key Worldwide Activities in 6G: Similarities and Differences

Extreme Communication Requirements

- All initiatives have further pushed the limits of current 5G capabilities:
  - Enhanced Mobile Broadband
  - Ultra Reliable Low-Latency Communications
  - Massive Machine Type Communications
- All initiatives have acknowledged the need for ubiquitous connectivity (indoor and outdoor)
  - Various applications requiring ubiquitous connectivity (IoT, DTs, Sensing, Entertainment)
  - Scope differs throughout initiatives (pure terrestrial or including sea, air, space)

Technologies

- Immersive experiences frequently mentioned
  - The use of AR/VR/MR devices play a key role
  - Among the few applications aimed at the mass market
- Digital Twins
  - Fully embedded in many use cases
  - Interacts with other 6G capabilities

New Capabilities

- AI/ML widely present for a wide variety of applications
  - Strongly embedded in 6G designs
- The use of robots is widely mentioned for different purposes
  - Residential (aid/support)
  - Industrial use (efficiency purposes or replacing humans in risky tasks)
- Sensing, positioning/tracking, AI orchestration capabilities are widely mentioned as enablers for several use cases

Sustainability

- Where the most diverse approaches were identified
- Energy efficiency and CO_2 reduction are widely mentioned
- Some initiatives mention broader sustainability challenges (e.g., digital inclusion). However, these are rarely identified
- Current approach falls short. Room for improvement.
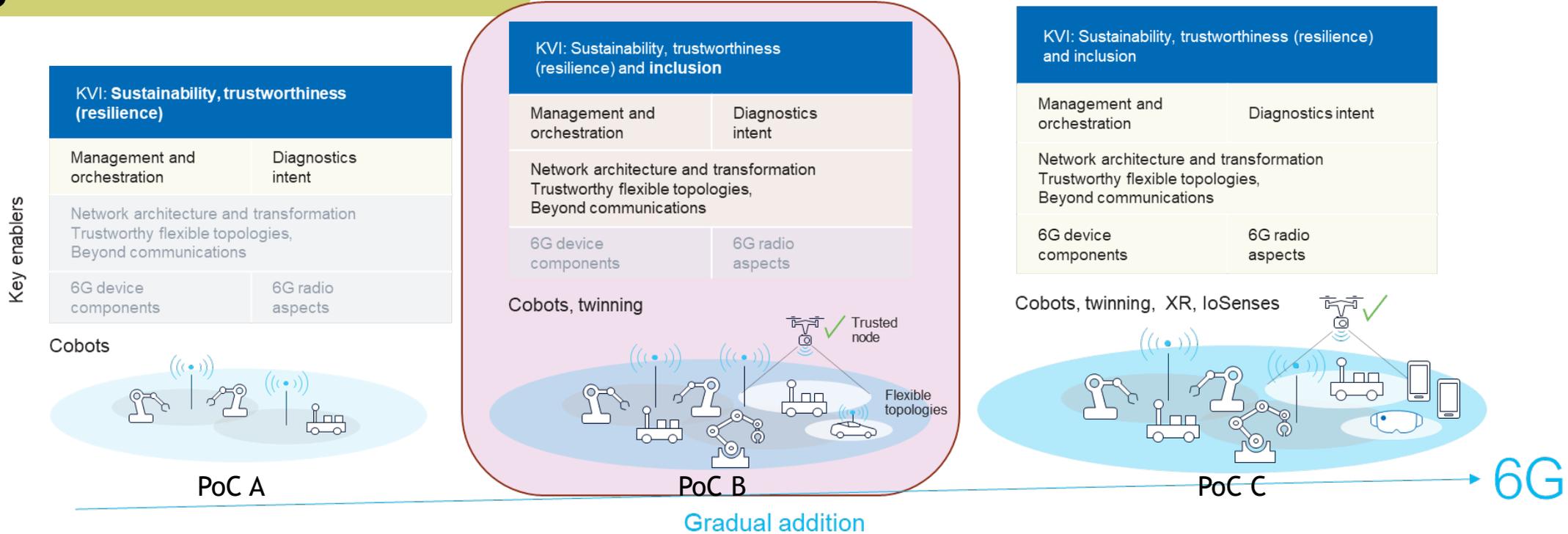
Hexa-X-II results from https://hexa-x-ii.eu/results/

- D1.2 – 6G use cases and requirements
- D1.3 – Environmental and social view on 6G
- D2.2 – Foundation of overall 6G system design and preliminary evaluation results
- D3.3 – Initial analysis of architectural enablers and framework
- D4.3 – Early results of 6G Radio Key Enablers
- D5.3 – Initial design and validation of technologies and architecture of 6G devices and infrastructure
- D6.2 – Foundations on 6G Smart Network Management and Orchestration Enablers
- Also presentations and videos from our workshops

Upcoming deliverables July 2024:

- D2.3 – Interim overall 6G system design
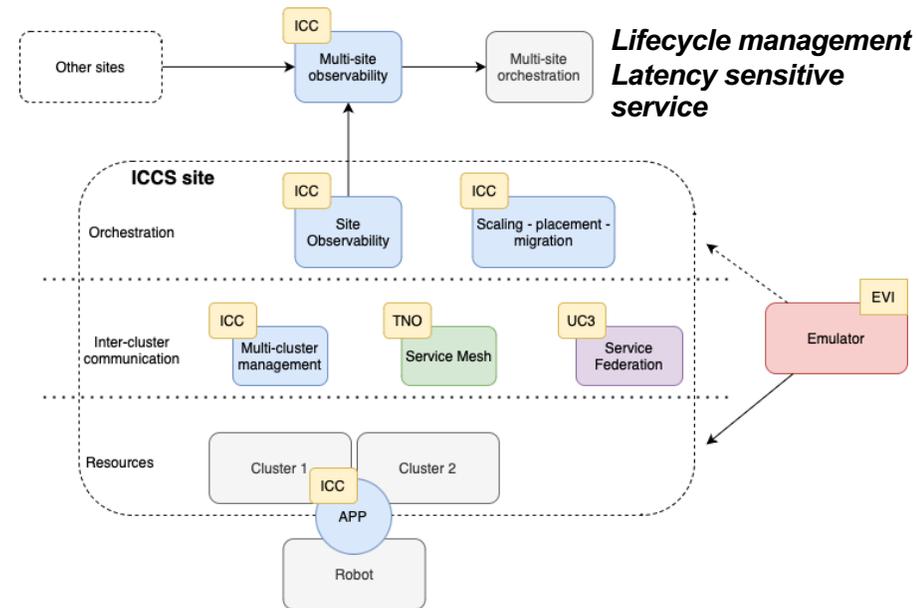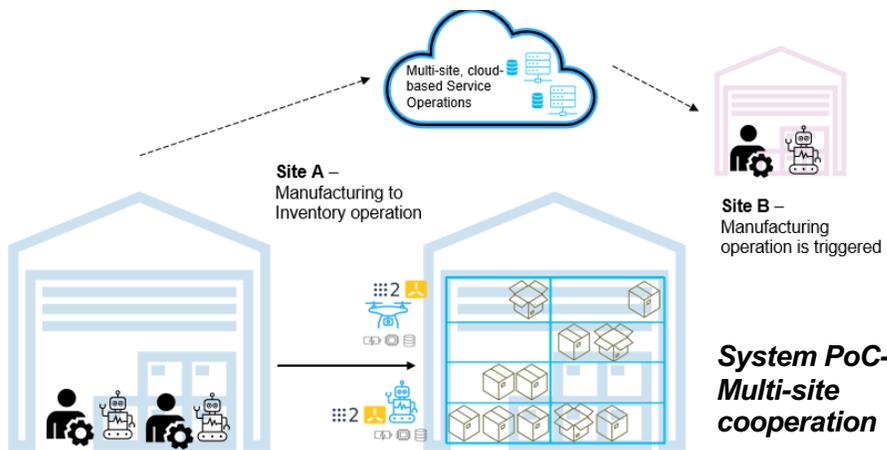- D6.3 – Initial Design of 6G Smart Network Management Framework

Remember also: https://hexa-x.eu/insightful-new-book-on-6g-now-available/

System-PoCs outline

KVI: **Sustainability, trustworthiness (resilience)**

Management and orchestration	Diagnostics intent
Network architecture and transformation Trustworthy flexible topologies, Beyond communications	
6G device components	6G radio aspects

Cobots

PoC A

KVI: Sustainability, trustworthiness (resilience) and **inclusion**

Management and orchestration	Diagnostics intent
Network architecture and transformation Trustworthy flexible topologies, Beyond communications	
6G device components	6G radio aspects

Cobots, twinning

Trusted node

Flexible topologies

PoC B

KVI: Sustainability, trustworthiness (resilience) and inclusion

Management and orchestration	Diagnostics intent
Network architecture and transformation Trustworthy flexible topologies, Beyond communications	
6G device components	6G radio aspects

Cobots, twinning, XR, IoSenses

PoC C

6G

Gradual addition

- **Three waves.** Currently in PoC B (PoC A laid a foundation, PoC B evolves and introduces new features, PoC C will evolve the previous two)

- In each wave: gradual addition of **technical** enablers. M&O, network enablers (flexible technologies, beyond coms), radio aspects, with respective KPIs

- Gradual placement of focus to **sustainability** (societal) aspects. **Environmental**, **Social** (Trust, Inclusion), **Financial** (where possible), with respective indicators

Visit our booth, see Hexa-X-II EuCNC 2024 PoCs

Site A – Manufacturing to Inventory operation

Site B – Manufacturing operation is triggered

Multi-site, cloud-based Service Operations

System PoC-B Multi-site cooperation

Lifecycle management Latency sensitive service

ML-ops in Data-driven systems

6G-PoC - feature	Scope
System-PoC A/B: Industry / inventory; Cobots, Twinning, XR; AMRSs UAV.	**6G enablers**: **Management and Orchestration** (M&O), **Networks Beyond Communications, Flexible Networks**. **KVI**: Sustainability environmental, social (trustworthiness);
#B.1. M&O component PoC	AI-assisted end-to-end lifecycle management of a 6G latency-sensitive service across the continuum
#A.1/B.1 M&O component	Sustainability and trustworthy-oriented orchestration in 6G
#B.3. Networking enabler	Trustworthy flexible topologies in 6G, leveraging on "beyond communication" aspects
#C.2(a). Radio enabler	AI-native interface
#C.3. Device enabler	Crowd-detectable zero-energy devices
#C.4. Device enabler	End-to-end extended reality
#C.5 Radio enabler	Flexible modulation and transceiver design
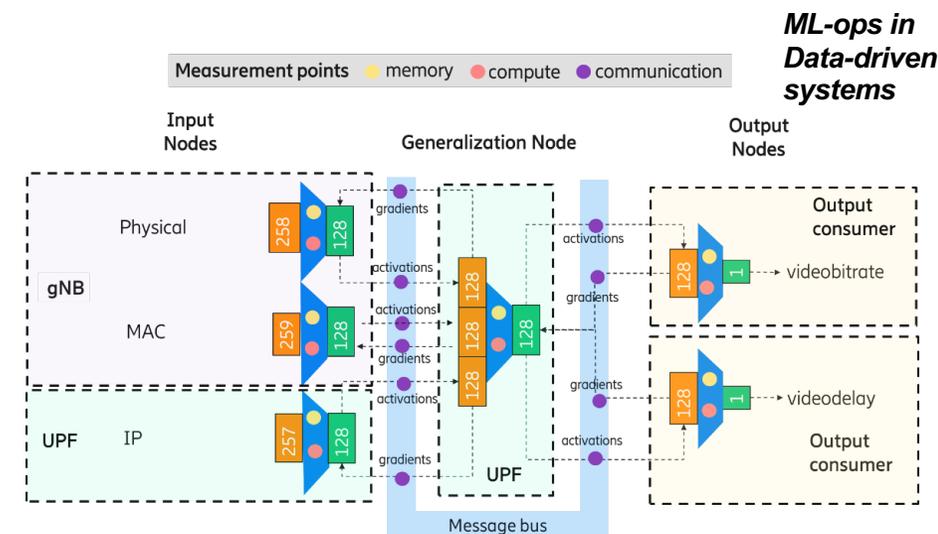
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6GSNS