

Welcome and update from the organizing project Hexa-X-II

6G series by Hexa-X-II
February 11-12, 2025

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Hexa-X-II

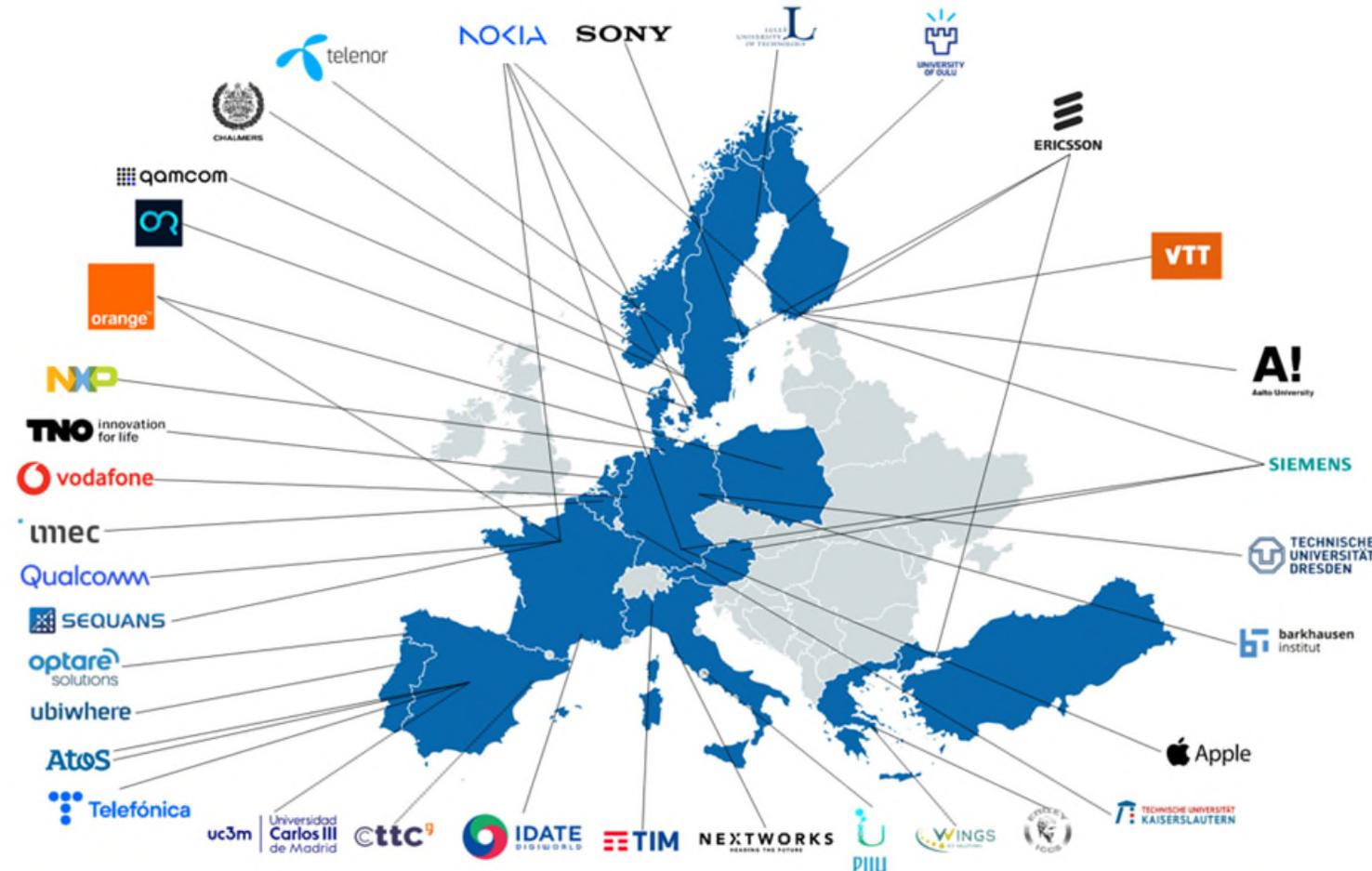
hexa-x-ii.eu



Hexa-X-II overview



- Hexa-X-II is the European level 6G Flagship
- Focus is continued development of technology and define the 6G platform and system
- Funded through Horizon Europe SNS-JU
- 44 partners
 - Cover the entire value-stack from hardware to system to platform to applications to service providers and a strong academic presence
- Nokia is overall leader
- Ericsson is technical manager



Consortium



UN Sustainable development goals as basis



SUSTAINABLE DEVELOPMENT GOALS



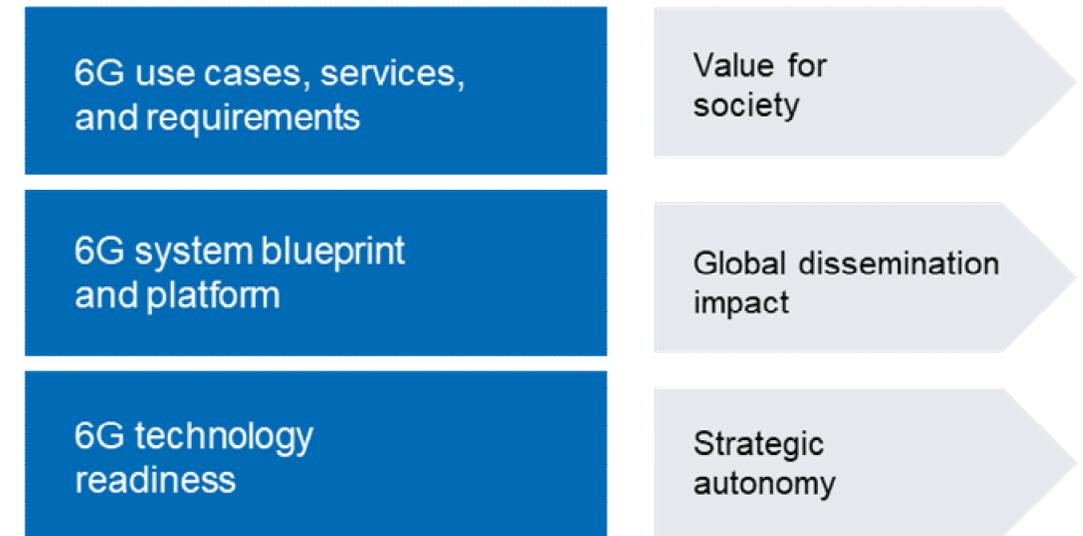


Overall objectives of Hexa-X-II

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

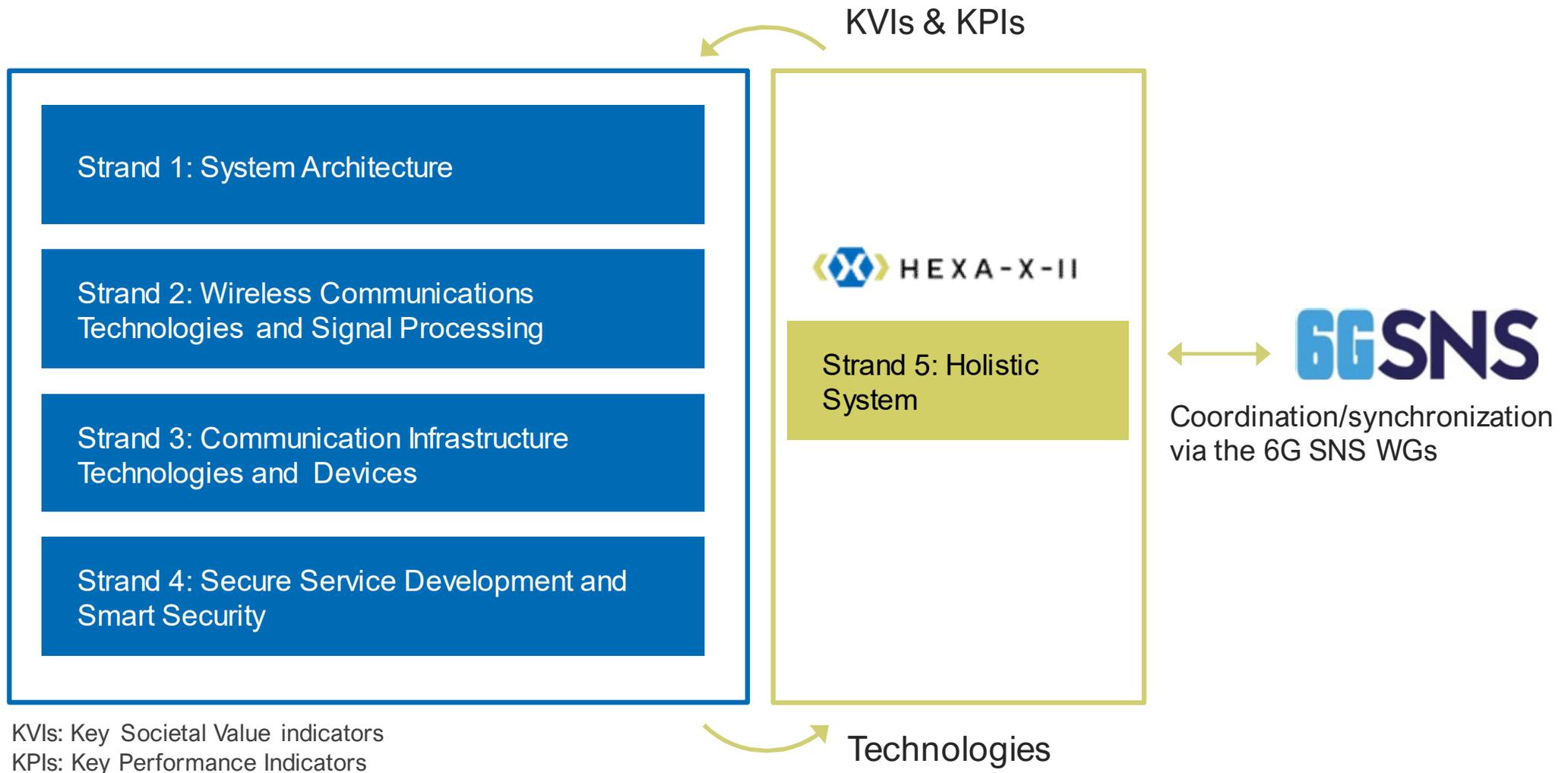


Hexa-X & Horizon-2020 candidate enablers

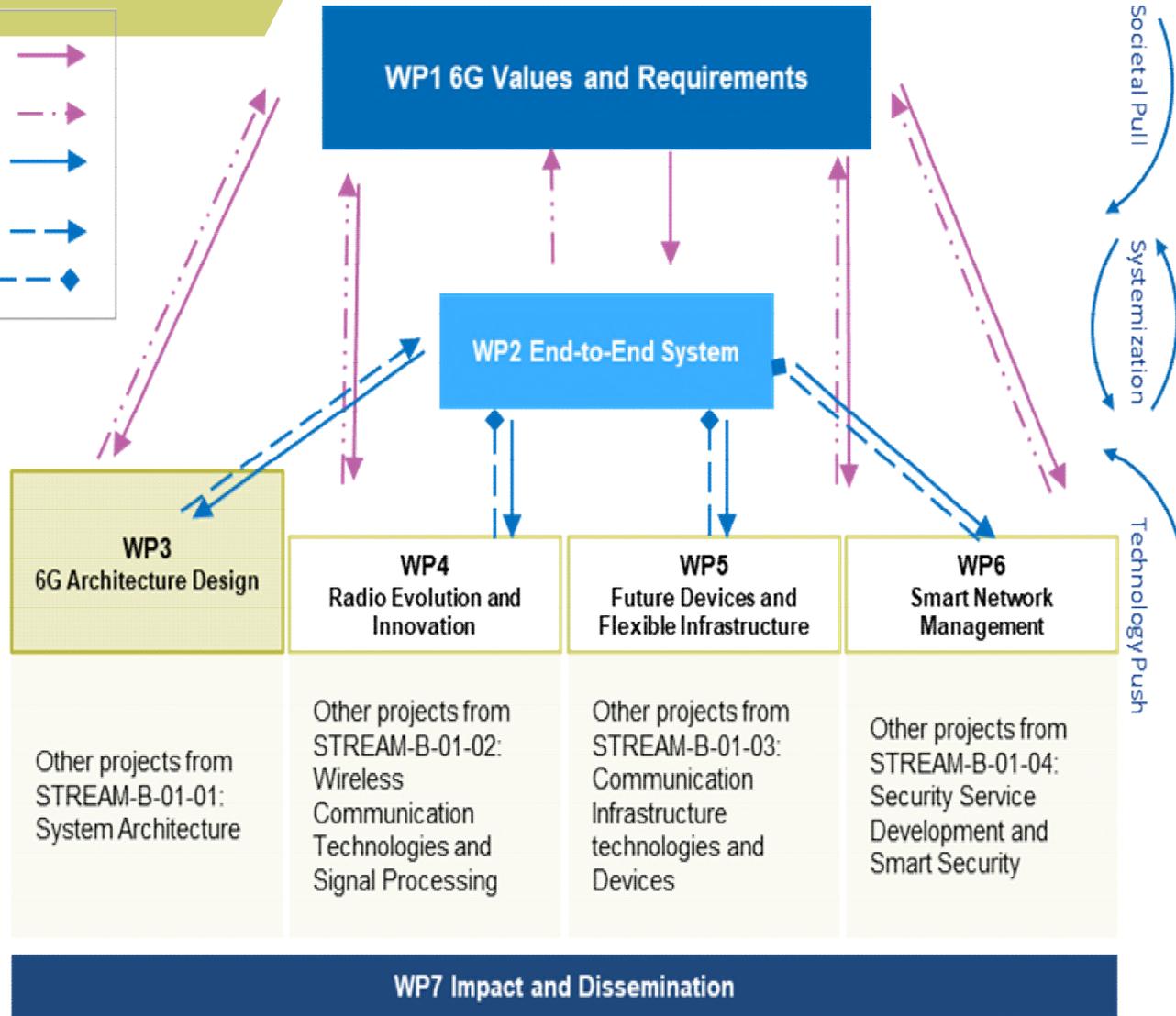
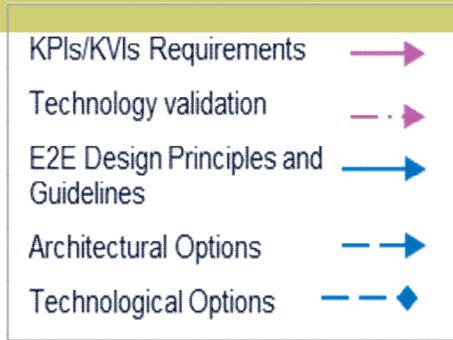


SNS stream B projects

Interactions with other SNS JU projects



WP structure



6G Use cases and requirements

Objective 1 – WP1 Requirements for the sustainable, inclusive, and trustworthy network platform

6G system blueprint and network platform

Objective 2 – WP2 Design blueprint of the sustainable, inclusive, and trustworthy network platform, and system validation

6G technology readiness

Objective 3 – WP3,4,5 Enhanced connectivity for 6G service

Objective 4 – WP3, 4, 6 Network sensing, compute, and AI novel digital services

Objective 5 – WP2, 3, 5, 6 Efficient network realization, implementation, and management

6G harmonisation

Objective 6 – WP7 Impact creation towards a global & holistic 6G era

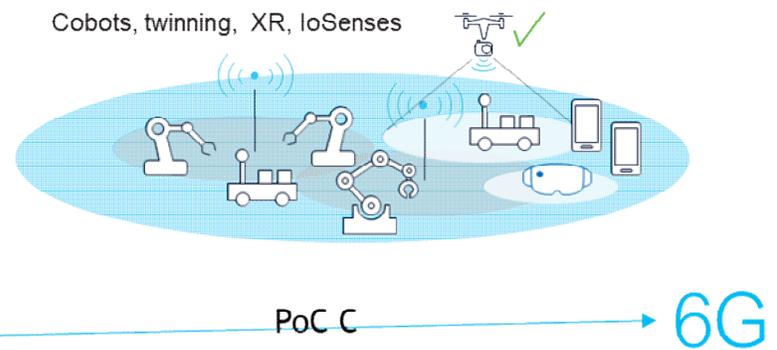
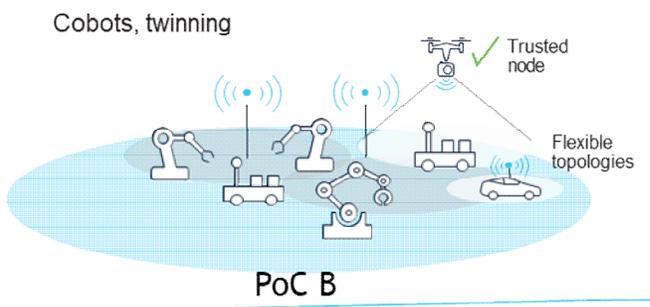
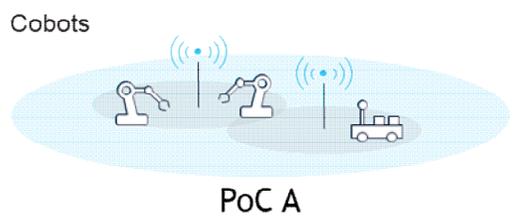


System-PoCs work evolution

Sustainability Aspects	Social	Environmental	Economic
	Trustworthiness; Time related KPIs	Energy efficiency / Power consumption	Resilience / limited downtime; OPEX
	Management and orchestration	Diagnostics intent	
	Network architecture and transformation Trustworthy flexible topologies, Beyond communications		
Key enablers	6G device components	6G radio aspects	

Social	Environmental	Economic
Trustworthiness; Exposure, security / privacy; Digital inclusion	Energy efficiency / Power consumption	Resilience / Limited downtime; OPEX; CAPEX
Management and orchestration	Diagnostics intent	
Network architecture and transformation Trustworthy flexible topologies, Beyond communications		
6G device components	6G radio aspects	

Social	Environmental	Economic
Trustworthiness; Exposure, security / privacy; Digital inclusion	Energy efficient radio, zero-energy devices	Resilience / Limited downtime; OPEX; CAPEX
Management and orchestration	Diagnostics intent	
Network architecture and transformation Trustworthy flexible topologies, Beyond communications		
6G device components	6G radio aspects	



Gradual addition

- **Three waves.** Currently in PoC C (PoC A laid a foundation, PoC B evolved and introduced new features, PoC C will evolve the previous two) – see end result at EuCNC 2025 & 6G Summit, June 2025!
- 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 diverse **sustainability** (societal) facets. **Environmental**, **Social** (Trust, Inclusion), **Financial** (to the degree possible), with respective indicators



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
- D2.3 - Interim overall 6G system design
- D2.4 - End-to-end system evaluation results from the interim overall 6G system design
- 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
- D6.3 - Initial Design of 6G Smart Network Management Framework
- Also presentations and videos from our workshops
- Final deliverables to appear March-July this year

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



Preview of upcoming deliverables

D1.4 6G Value, Requirements, and Ecosystem



Use cases



Collaborative robots



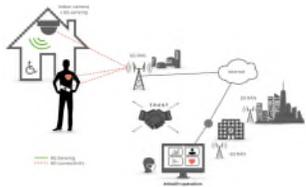
Real-time digital twins



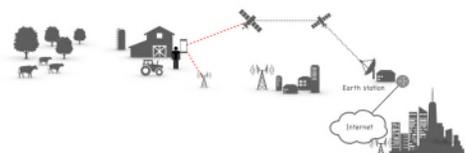
Immersive experiences



Network assisted mobility



Human-centric services

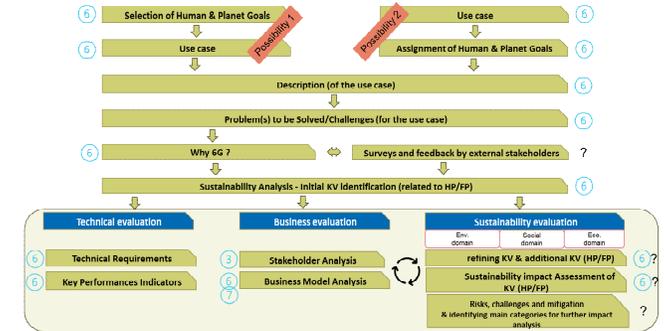


Ubiquitous connectivity

Stakeholder survey



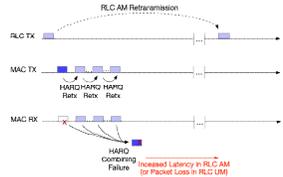
Value creation process





D2.5 Final overall 6G system design

Radio interface and protocols

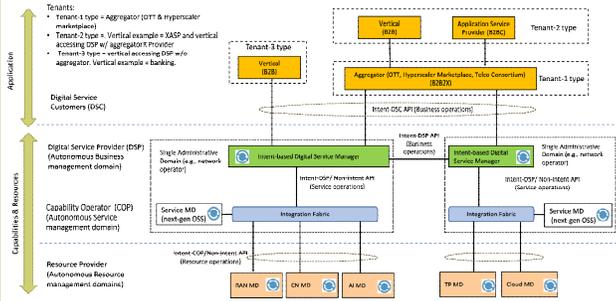


MAC retransmission



RACH-less handover

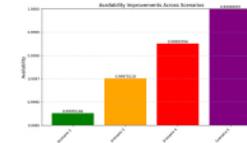
Intent-based service management



Security, Privacy, Resilience



Experimental results on physical layer security



E2E resilience simulation using redundancy

Complementary enablers



40 enablers from WP3,4,5 & 6

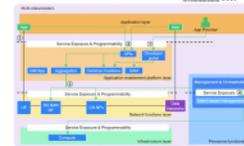


17 enablers from 9 different projects

Specific views of E2E architecture



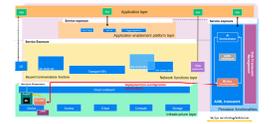
Radio protocols



Service exposure

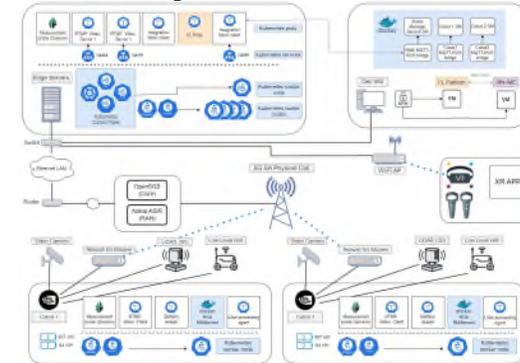


Multi-stakeholder



Pervasive functionalities

System-PoC#C

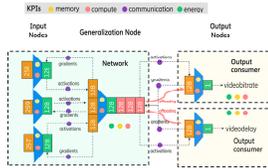


More details to come in D2.6

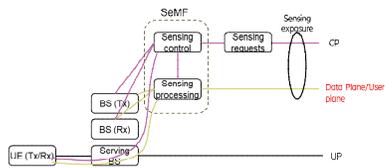
D3.4 Preview of the final architectural framework and analysis



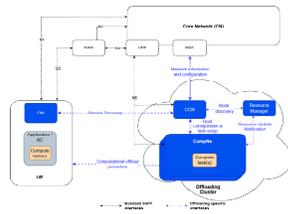
Novel services



MLOps

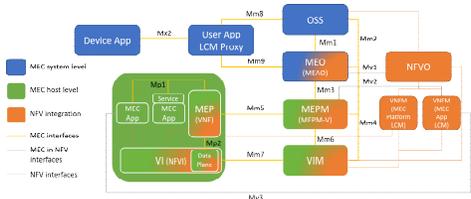


Joint communication and sensing



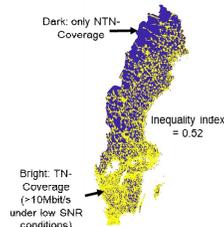
Compute offloading

Orchestration

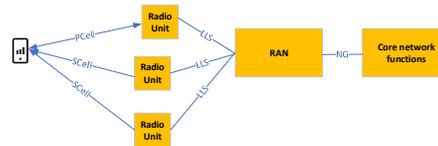


Orchestration of cloud continuum

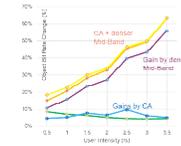
Flexible topology



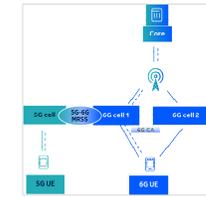
TN/NTN coverage



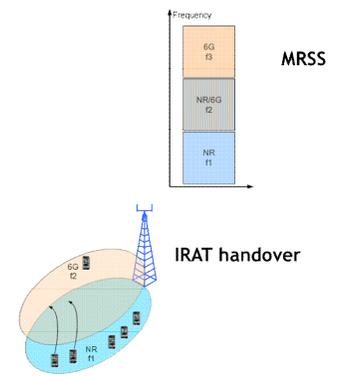
Multi-connectivity



Migration

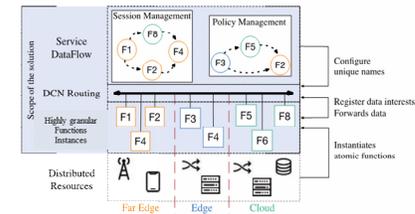


General architecture

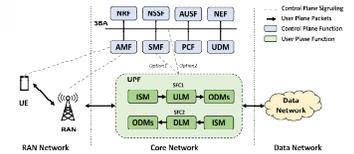


IRAT handover

Modularization



Data centric SBA



Modular UPF

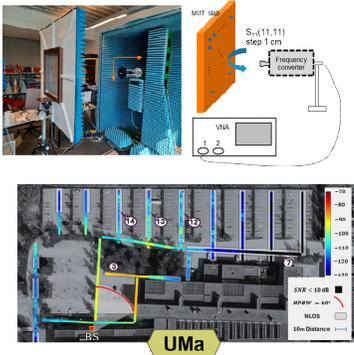


Intent-based control of 6G slices

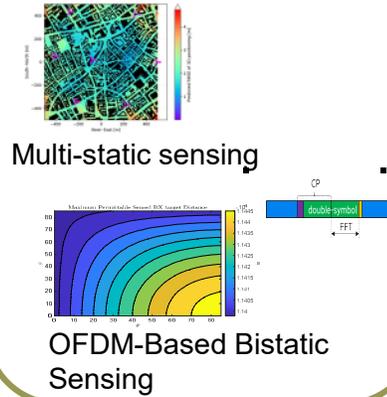
D4.4 Preview of the final design of 6G Radio solutions and Promising Radio Innovation



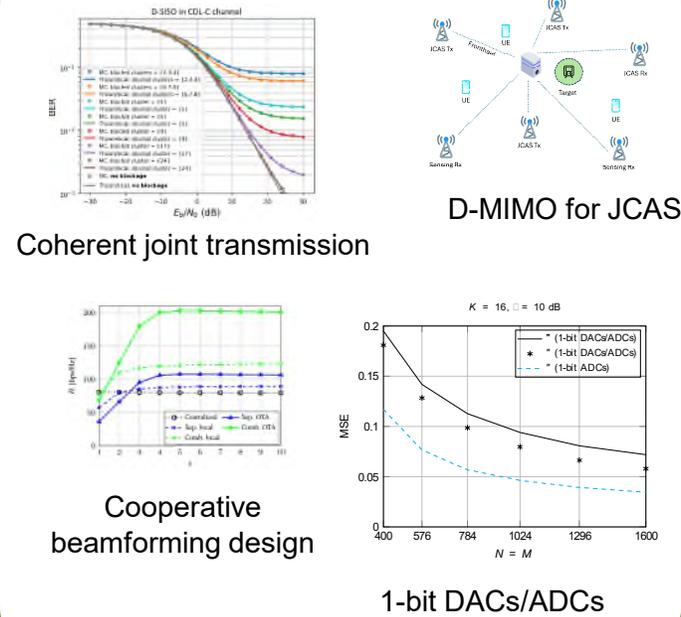
Channel modelling



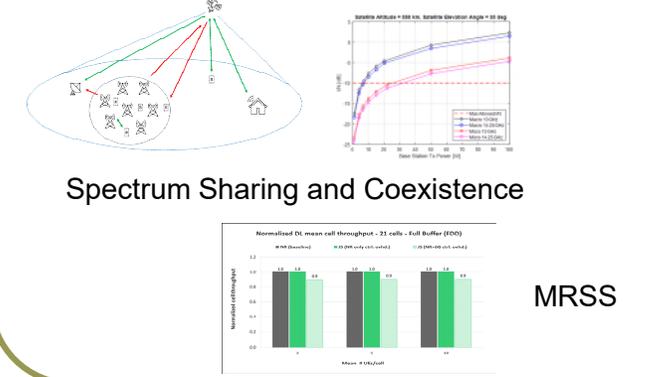
JCAS



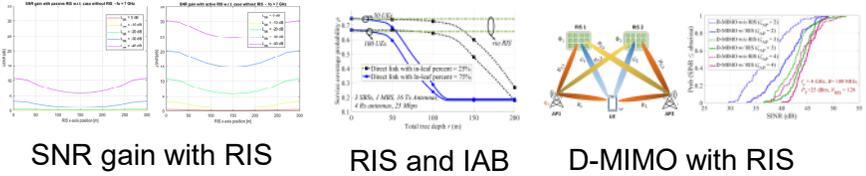
MIMO



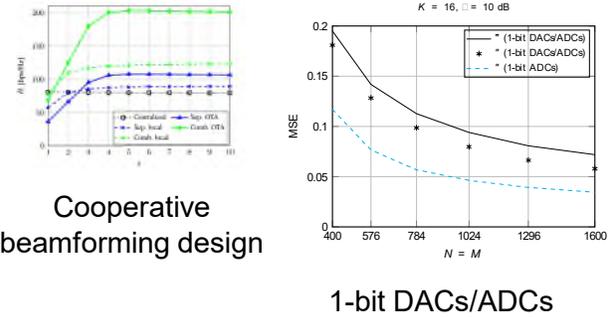
Flexible Spectrum Access



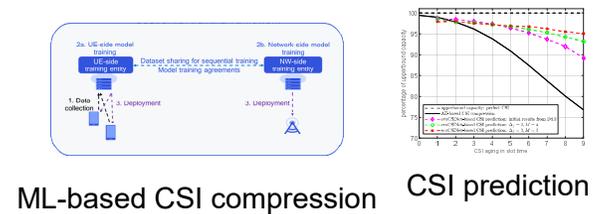
RIS



Cooperative beamforming design

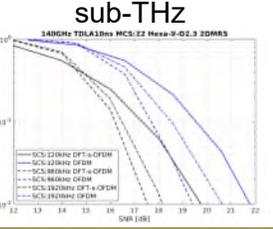


AI/ML

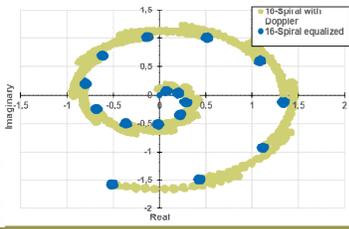


Waveforms

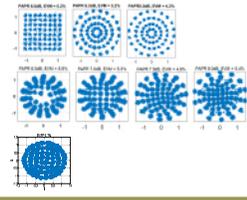
NR numerology at sub-THz



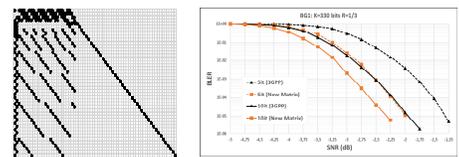
Polar constellations



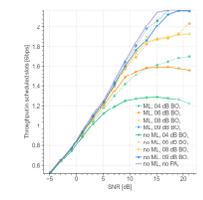
HW friendly constellations



LDPC code parity matrix



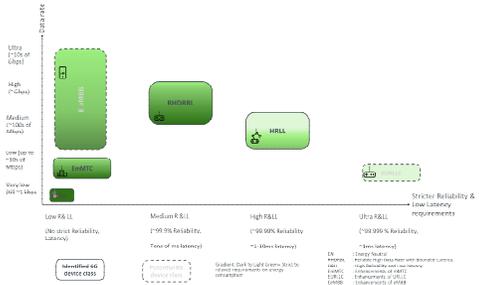
PA non-linearity compensation



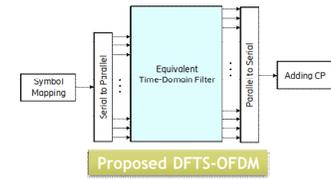
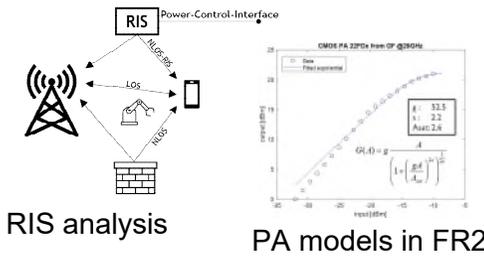
D5.4 Presentation on final design of enabling technologies for 6G devices and infrastructure



Update to device classes

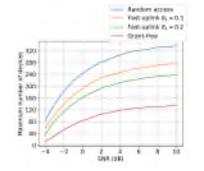
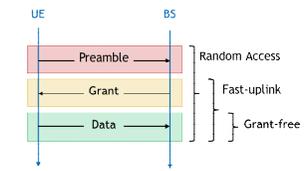


FR1/FR2/FR3 transceivers

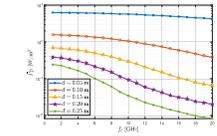


Low complexity DFTS-OFDM implementation

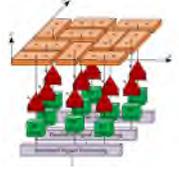
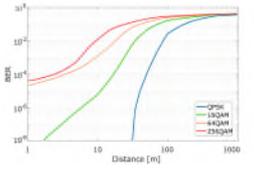
Ultra-low power devices



ZED prototypes

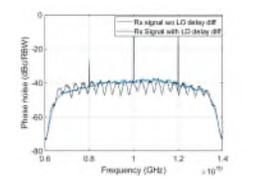


Sub-THz transceivers



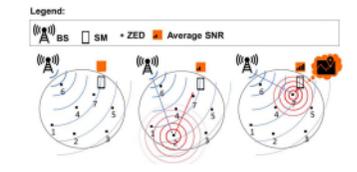
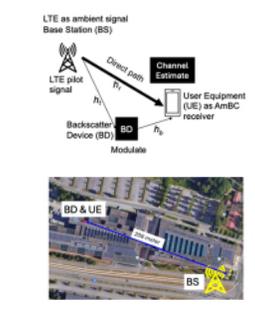
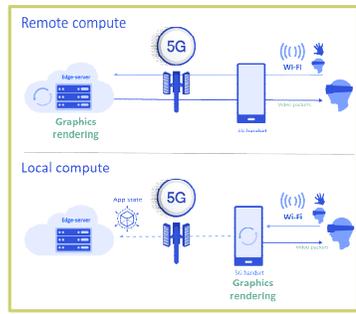
Antenna array integration

RTD-based devices

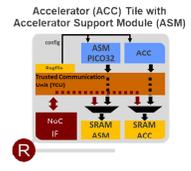


Phase-noise reduction

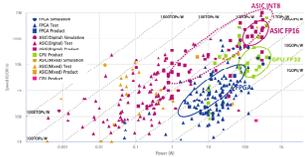
PoC



SoC



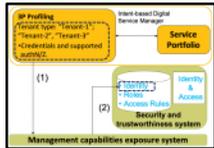
HW accelerator integration



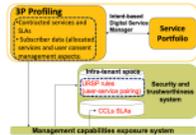
D6.4 Presentation on final design and validation of Smart Network Management framework



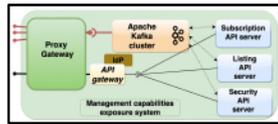
Specific systems



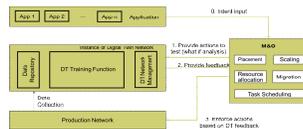
3rd party resource control separation



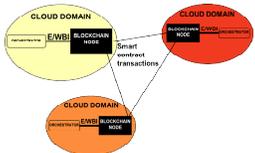
User-centric service provisioning system



Management capabilities exposure



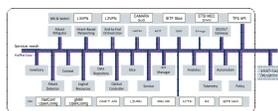
NW DT creation mechanism



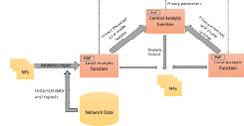
Federated orchestration



Sustainable MLOps

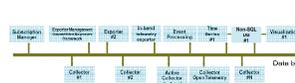


Network programmability

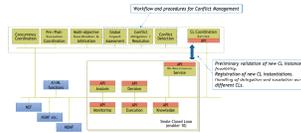


Privacy protection for data analytics

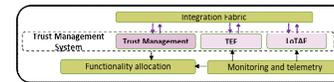
Overall functionality



Monitoring and telemetry

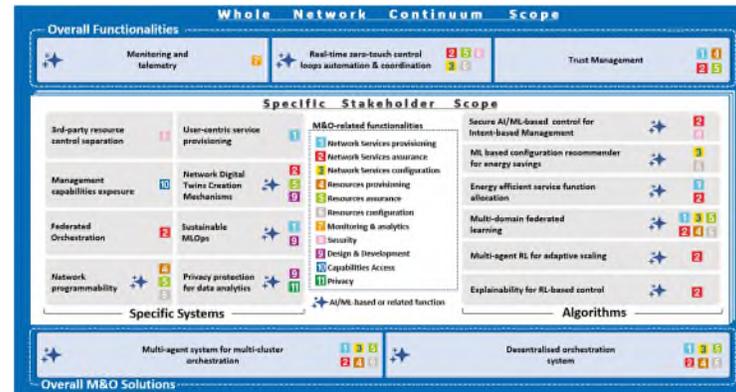


Closed loop coordination

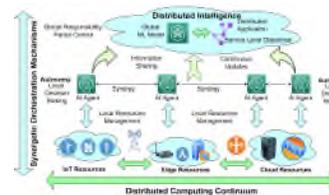


Trust management

Smart management framework



Overall M&O solutions

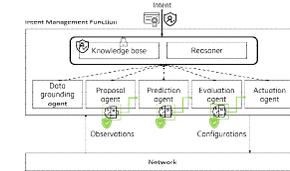


Multi-agent for multi-cluster orchestration



Distributed orchestration system

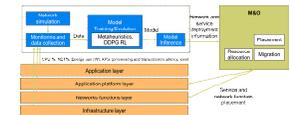
Algorithms



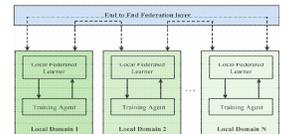
Secure AI/ML-based control for IBM



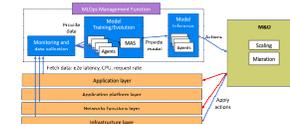
ML-based recommender for energy savings



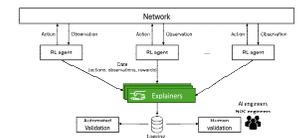
Efficient NW and service function allocation



Multi-domain federated learning



Multi-agent RL for adaptive scaling



Explainability for RL-based control



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