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

6G series by Hexa-X-II
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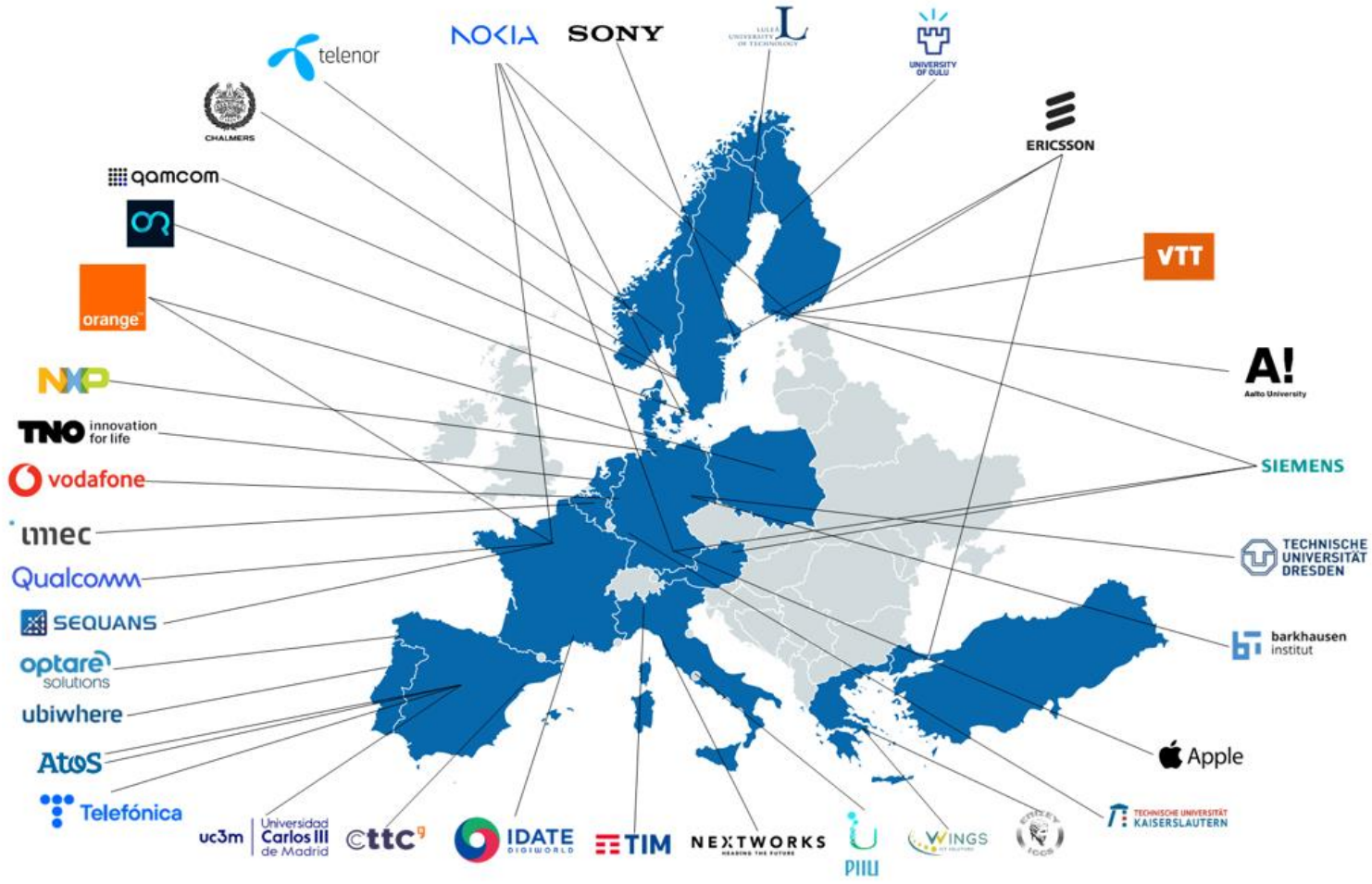
Hexa-X-II

hexa-x-ii.eu

Hexa-X-II overview

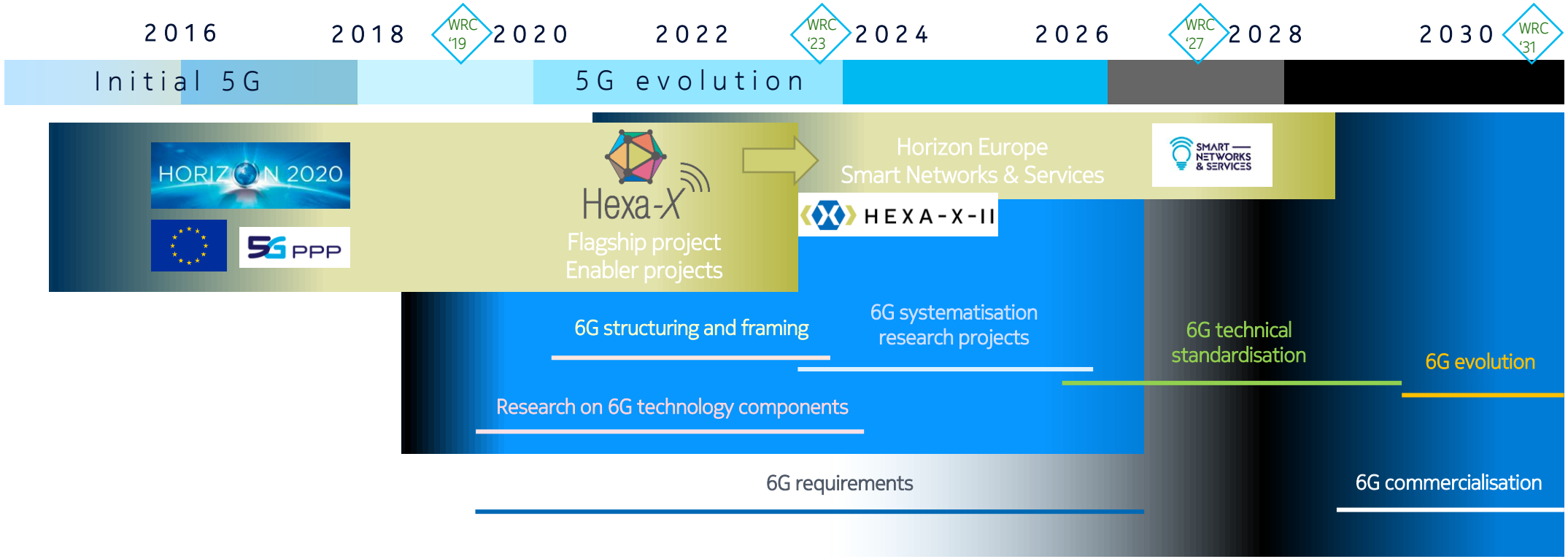
- Hexa-X-II is the next European level 6G Flagship
- Focus will be continued development of technology and define the 6G platform and system
- Funded through Horizon Europe SNS-JU
- 44 partners
  - Cover the entire value-stack from hardware to system to platform to applications to service providers and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



Consortium

Service providers	PIIU, TNO		orange, TIM, vodafone, Telefónica, telenor
Applications and software		IDATE DIGIWORLD, optare solutions, ubiwhere SUITING THE FUTURE	
Platform	TECHNISCHE UNIVERSITÄT DRESDEN, ttc, UNIVERSITY, VTT, CHALMERS UNIVERSITY OF TECHNOLOGY, ICCS	WINGS ICT SOLUTIONS, NEXTWORKS ENGINEERING FORWARD	SONY, SIEMENS, NOKIA, ERICSSON, Atos
System and technology	Aalto University, TECHNISCHE UNIVERSITÄT KAISERSLAUTERN, uc3m Universidad Carlos III de Madrid, LULEÅ TEKNISKA UNIVERSITET, barkhausen institut	qamcom	Apple
Chipset and hardware	imec	SEQUANS COMMUNICATIONS	Qualcomm, NXP
6G ecosystems and offering	Academia and RTO	SME	Large enterprise

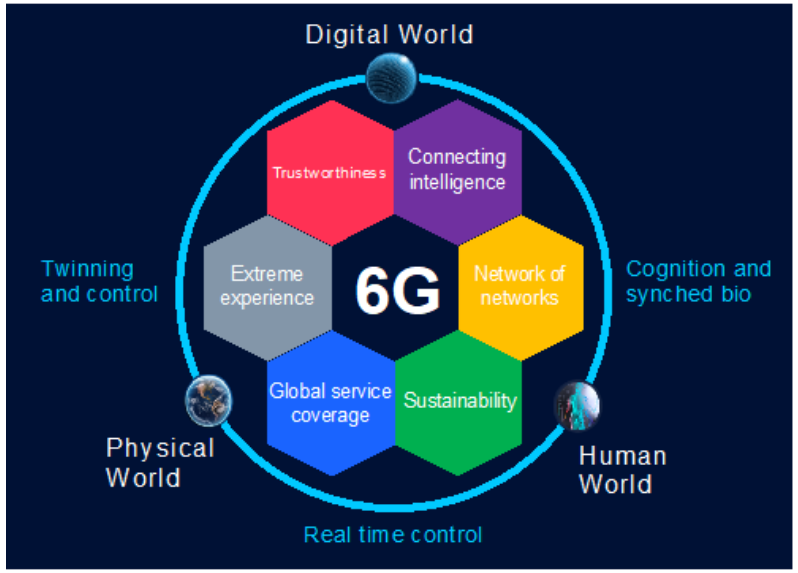
Timeline


2016
2018
WRC '19
2020
2022
WRC '23
2024
2026
WRC '27
2028
2030
WRC '31
Initial 5G
5G evolution
HORIZON 2020
5G PPP
Hexa-X
Flagship project
Enabler projects
Horizon Europe
Smart Networks & Services
SMART NETWORKS & SERVICES
HEXA-X-II
6G structuring and framing
6G systematisation research projects
6G technical standardisation
6G evolution
Research on 6G technology components
6G requirements
6G commercialisation

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



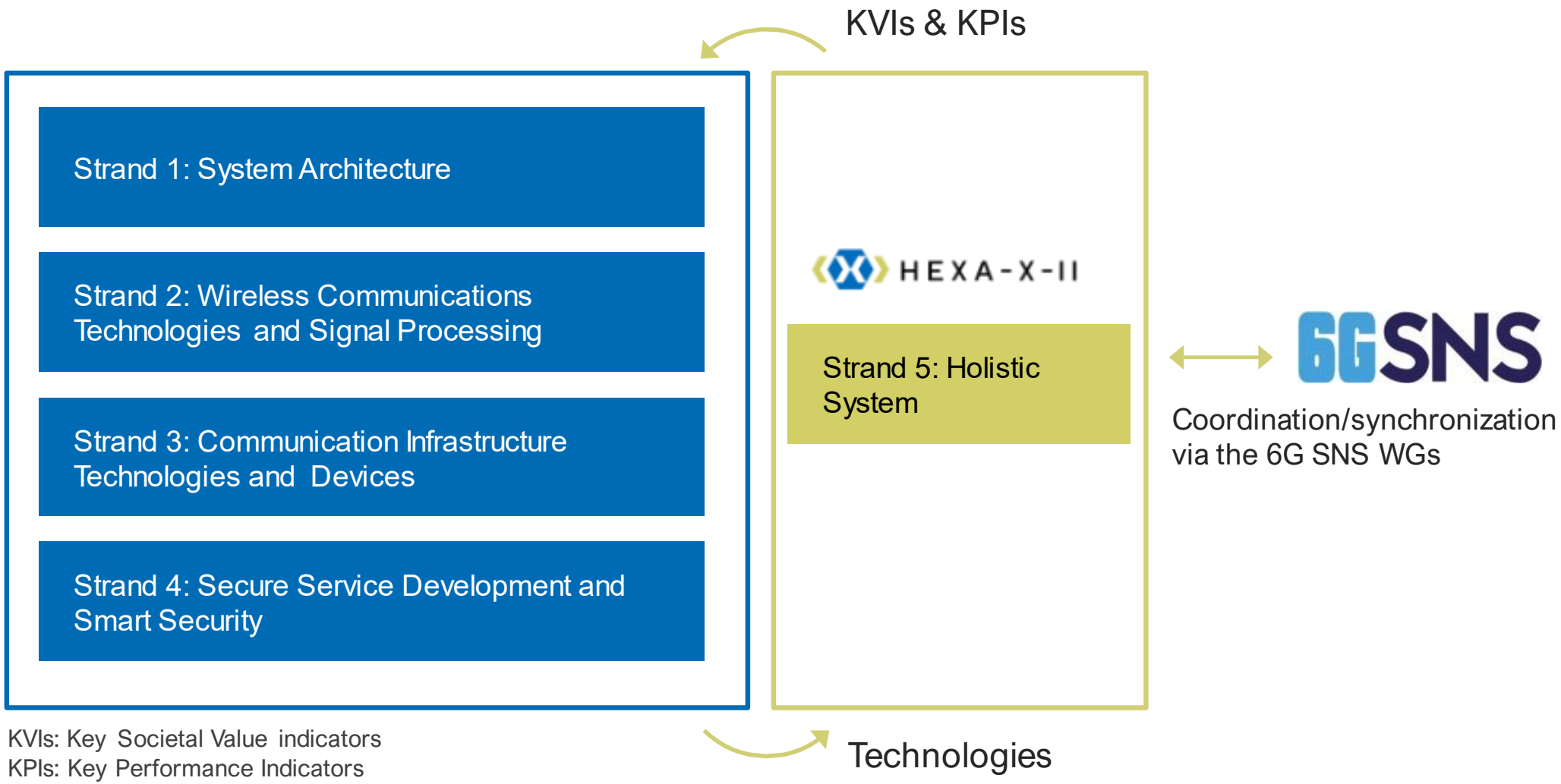
Hexa-X & Horizon-2020 candidate enablers

HEXA-X-II

- 6G use cases, services, and requirements → Value for society
- 6G system blueprint and platform → Global dissemination impact
- 6G technology readiness → Strategic autonomy

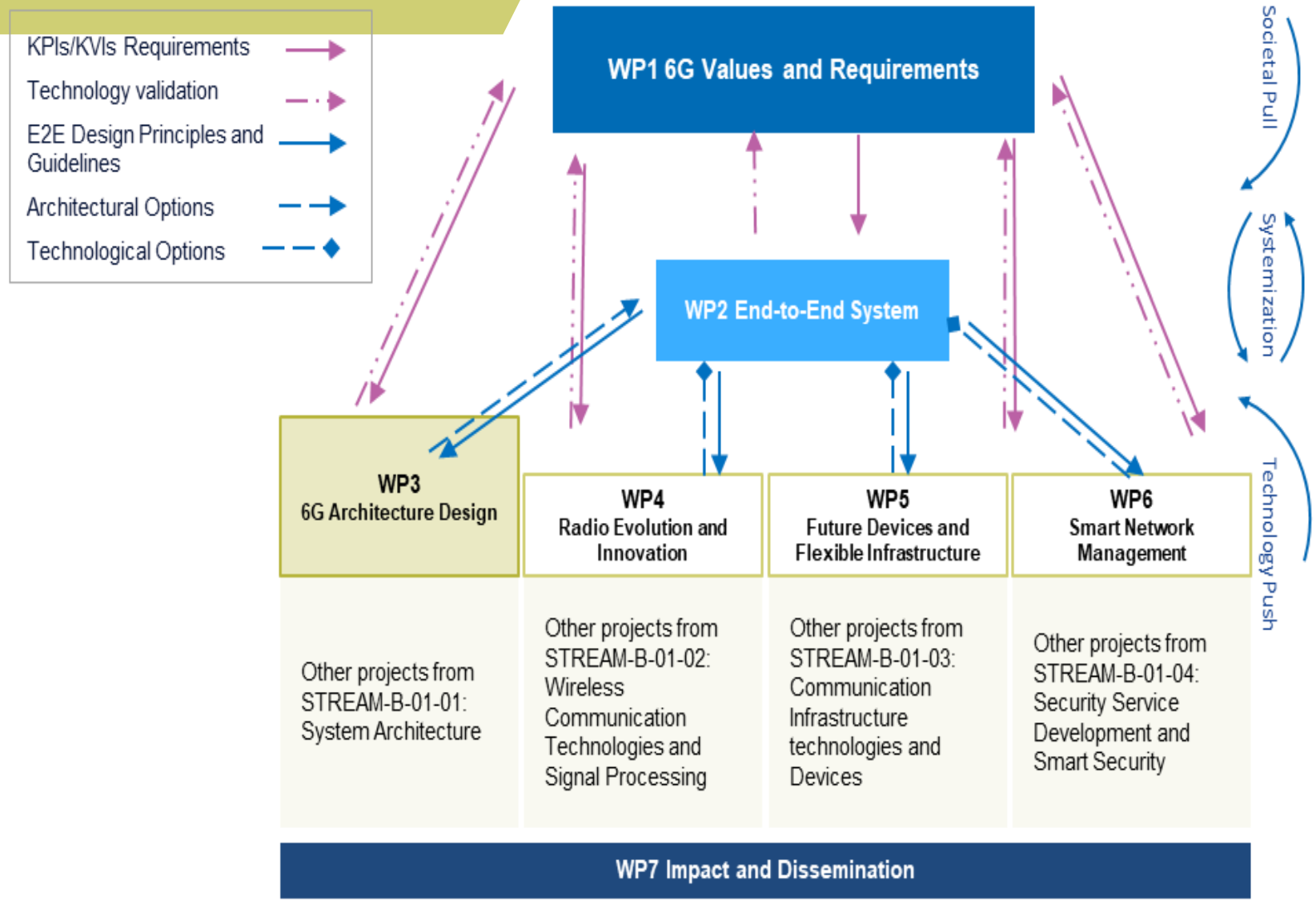
SNS stream B projects

Interactions with other SNS JU projects



KVIs: Key Societal Value indicators
KPIs: Key Performance Indicators

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

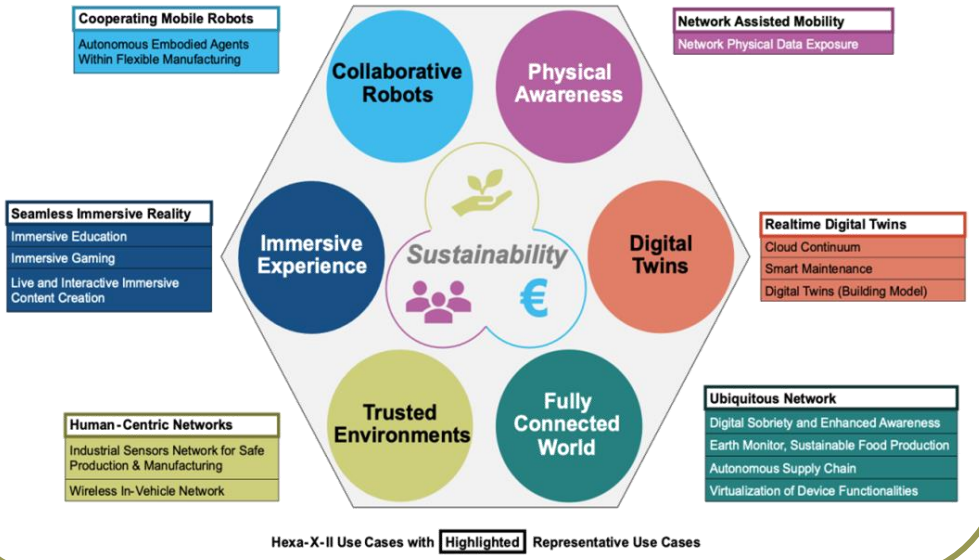
First round of deliverables ready

8 public technical deliverables finalized

Available at hexa-x-ii.eu/deliverables/

D1.2 Use cases and requirements

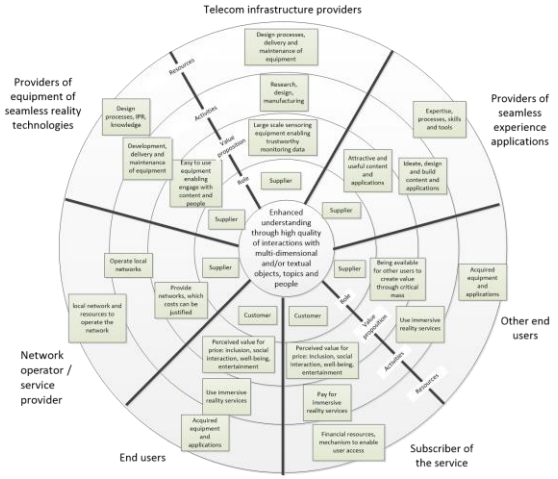
Updated use cases



Business models for 6G ecosystem

Stakeholder map for:

- Seamless immersive reality
- Realtime digital Twin
- Ubiquitous network



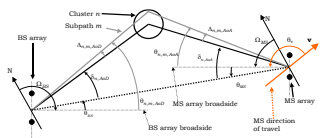
Requirements

Representative use cases
Cooperative mobile robots
Seamless immersive reality
Human-centric networks
Physical awareness
Digital twins
Fully connected world

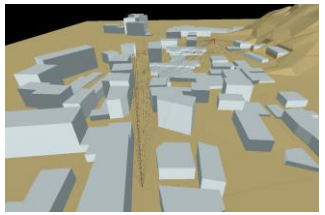
Aspect	KPI
Communication	User-experienced data rate [Mb/s]
	Area traffic capacity [Mb/s/m^2]
	Mobility
	End-to-end latency [ms]
	Reliability [%]
New Capabilities	Positioning accuracy
	Sensing-related capabilities [Y/N]
	AI/ML-related capabilities [Y/N]

Channel models

Statistical geometric



Deterministic ray-tracing

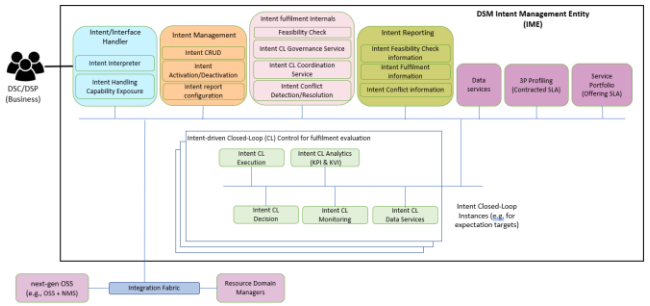


D2.2 Foundation of overall 6G system design and preliminary evaluation results

E2E system requirements

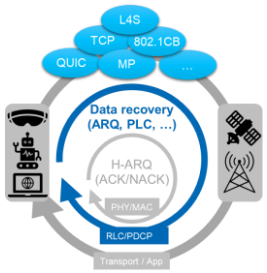
Requirements\Use case	Ubiquitous Network	Real-time digital twin	Seamless immersive Reality	Cooperating mobile robots	Human centric services	Network assisted mobility
Ubiquitous connectivity	●	●		●	●	●
Indoor coverage	●	●	●	●	●	
Extreme connectivity (high bitrate)			●			
Mobility	●		●	●	●	●
Pervasive AI/ML		●	●	●	●	●
Efficient sleep states	●		●		●	●
Compute as a Service		●	●	●		●
Intent-based interfaces		●		●		
Reliability	●	●		●	●	●
Positioning/sensing		●	●	●	●	●
Ultra-low-cost	●					
Energy neutral	●					
Predictable low-latency E2E communication		●	●	●		●
Security/Privacy	●	●	●	●	●	●
Resilience	●	●		●		●
Service continuity	●		●			●

Intent-based management

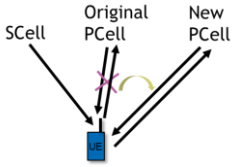


Radio protocol enablers

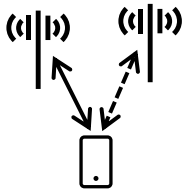
Data recovery



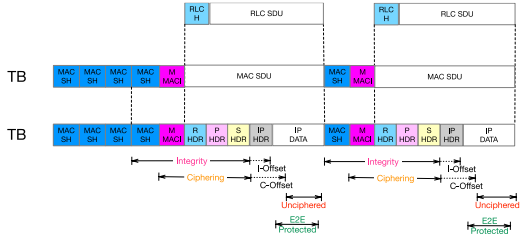
Pcell recovery in CA



UE initiated HO

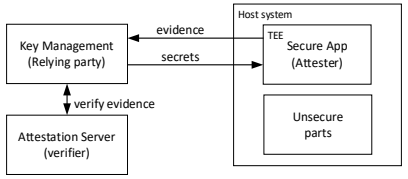


MAC layer ciphering/ integrity protection

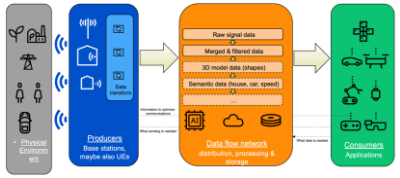


Security

Trusted Execution Environments

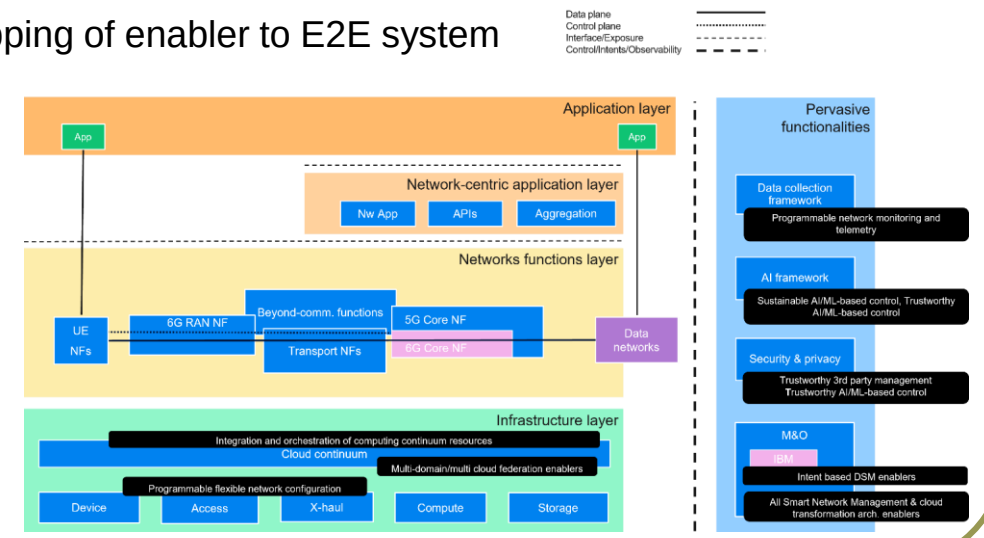


Security and privacy in JACS



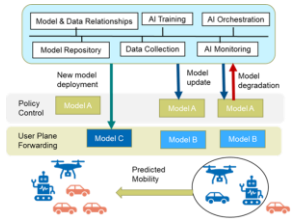
E2E system

Mapping of enabler to E2E system

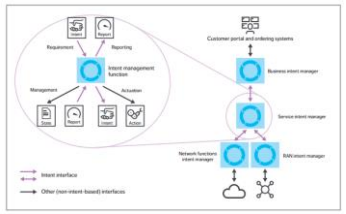


WP3 D3.1/D3.2 Initial architectural enablers

AI enablers for data-driven architecture



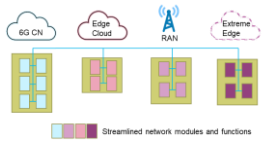
ML orchestration



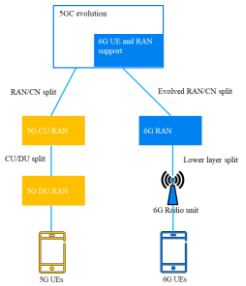
Intent-based management

Network modularization

Streamlined NW function

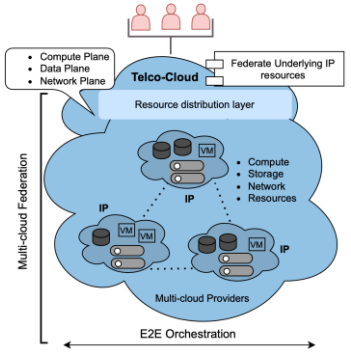


Network migration

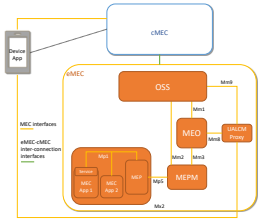


Virtualization and cloud transformation

Multi-cloud orchestration

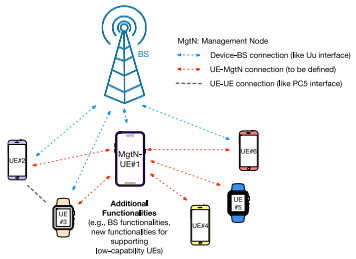


Edge-computing with constrained devices

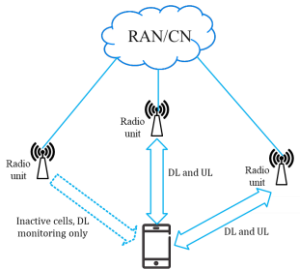


New access and flexible topologies

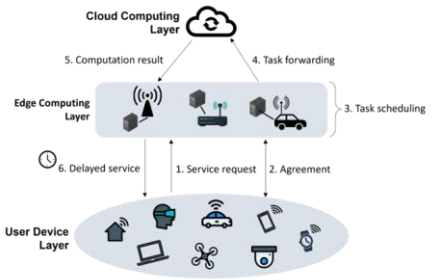
Management node



6G Multi-connectivity



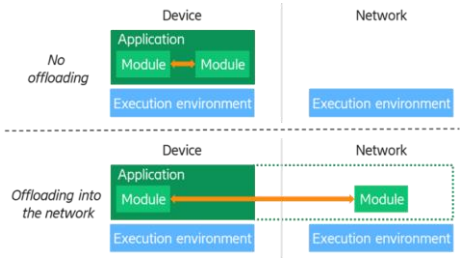
Delayed computing



Networks beyond communications

JCAS

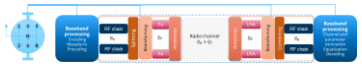
Dynamic device offloading



WP4 D4.2 Key enablers for 6G radio design and spectrum access

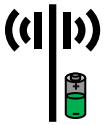
Radio design

Flexible radio

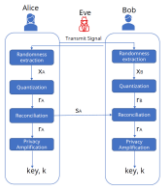


Inclusive

Sustainable



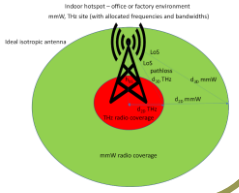
Trustworthy



Radio-link modeling

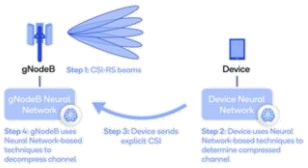
Channel modelling

Sub-Thz Coverage



Intelligent radio design

Intelligent Rx, Tx, TRx

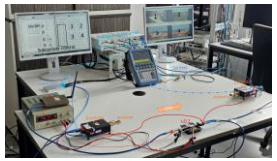


CSI acquisition

PoC

AI-native air interface

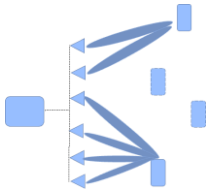
Flexible modulation and TRx design



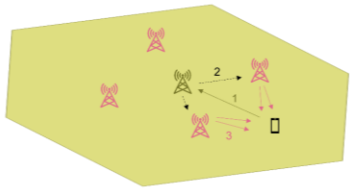
Bi-static JCAS

MIMO

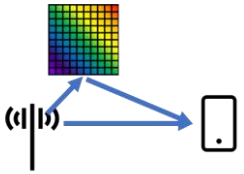
D-MIMO



Massive MIMO

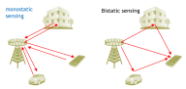


RIS-assisted MIMO

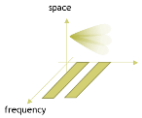


JCAS

Architecture

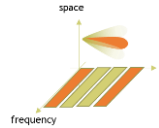


Waveforms



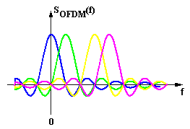
Privacy and security

Resource allocation

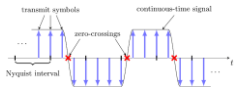


Waveforms and modulations

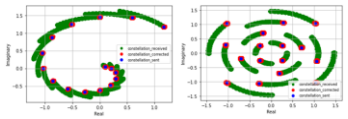
Legacy @ sub-THz



Zero-crossing modulation

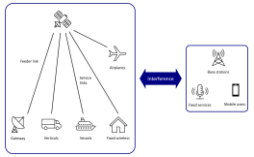


Polar constellations

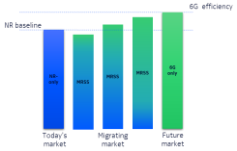


Flexible spectrum access

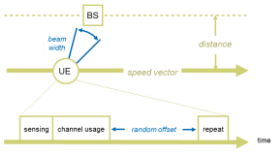
NTN/TN coexistence



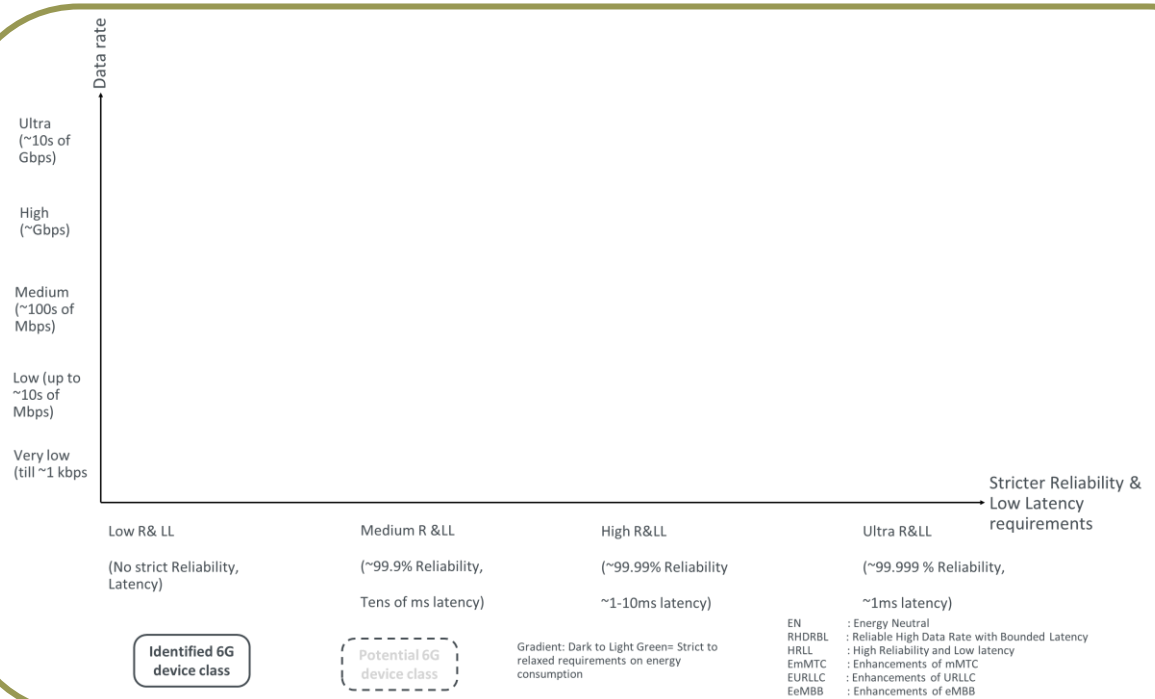
Multi-RAT spectrum sharing



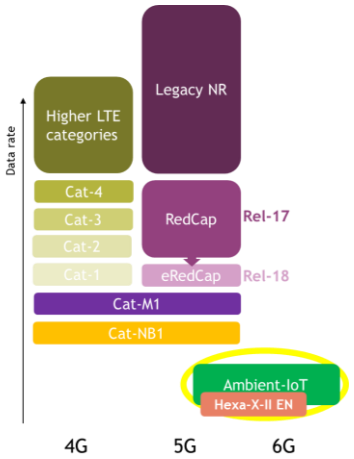
Low-latency Random Access



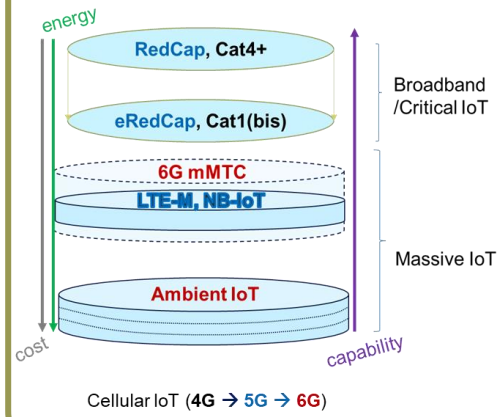
WP5 D5.2 Characteristics and classification of 6G device classes



Energy Neutral devices

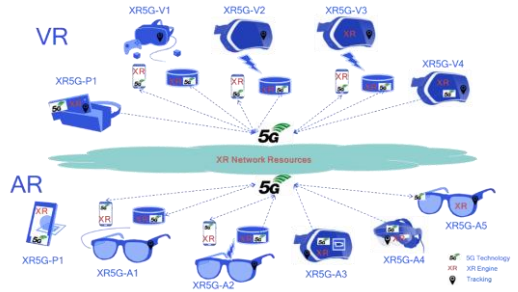


Enhancements of mMTC devices

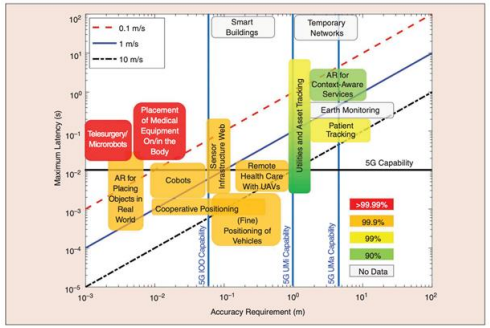


Cellular IoT (**4G** → **5G** → **6G**)

Reliable High Data Rate with Bounded latency devices



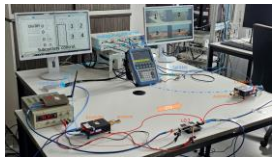
Highly Reliable Low Latency devices



PoC

AI-native air interface

Flexible modulation and TRx design



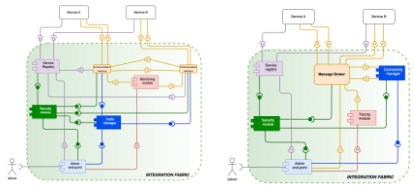
Bi-static JCAS

WP6 D6.3 Initial Design of 6G Smart Network Management Framework

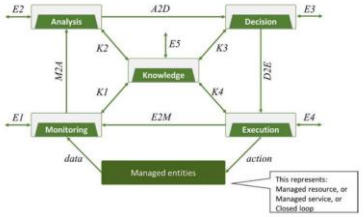
Trustworthy management

Integration fabric

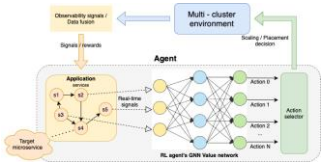
Service mesh *Message broker*



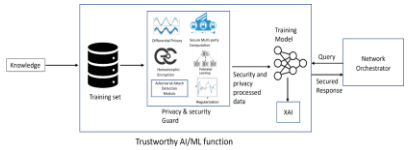
Trustworthy 3rd party management



Orchestration mechanism for computing continuum

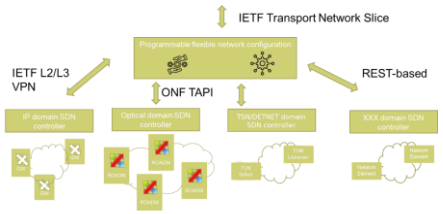


Trustworthy AI/ML based control

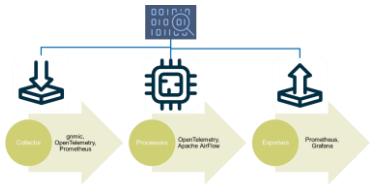


Energy consumption

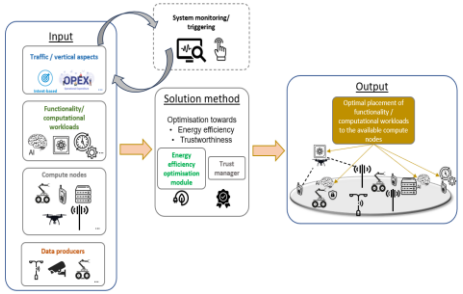
Programmable flexible network configuration



Programmable network monitoring and telemetry

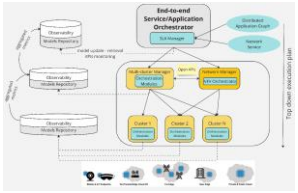


Sustainable AI/ML based control

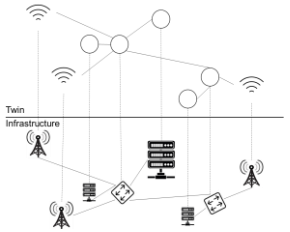


Automation

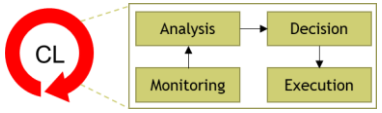
Multi-cloud management mechanisms



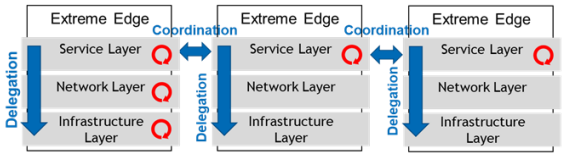
Network Digital Twin



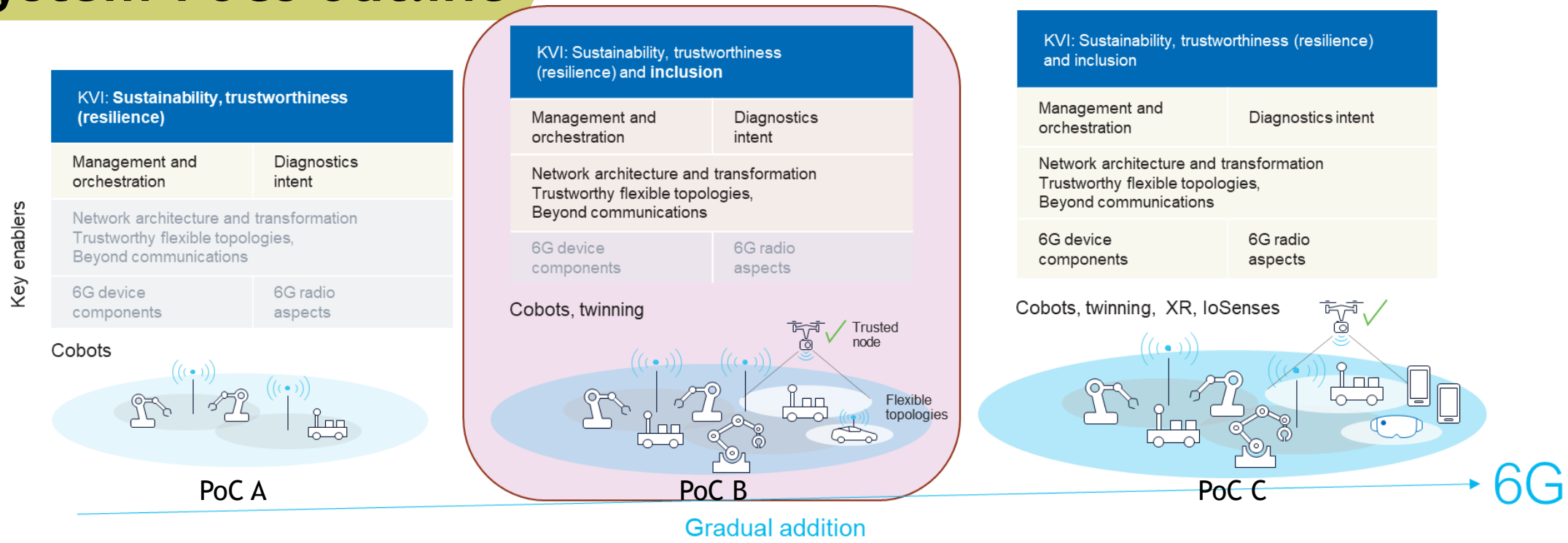
Closed loop governance



Coordination of multiple closed loops



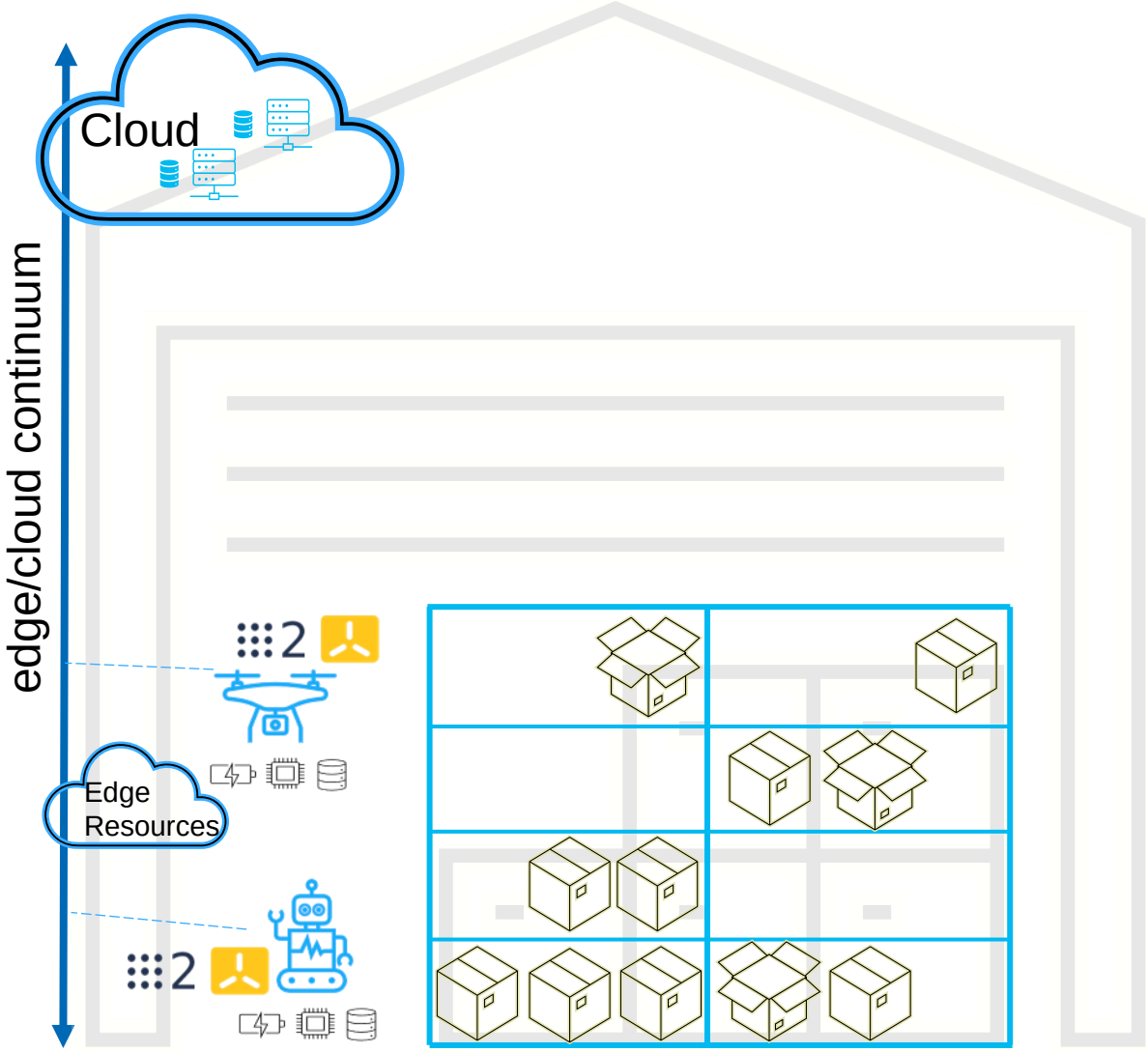
System-PoCs outline



Preamble:

- **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

Inventory Management



Advanced Features for Applications:

- Cobots (autonomous robots, UAVs, human in the loo), Massive Twinning, XR

Social Considerations

- Sustainability (Environmental and other perspectives), Inclusion, Trustworthiness

Scenario

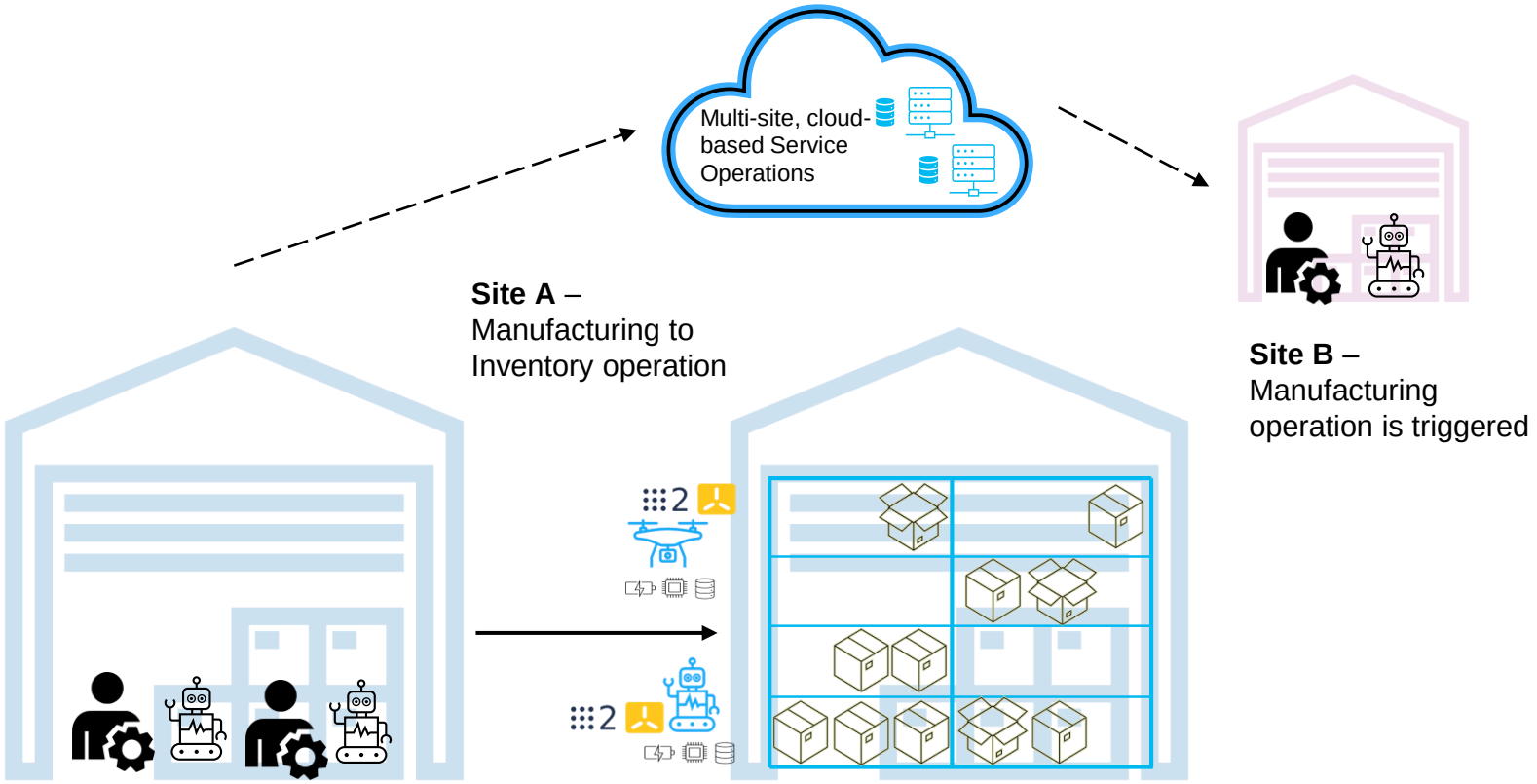
- Intent: area to be covered
- Task allocation: devices to sub-areas
- Functionality deployment
- Task realization through cooperation of devices and humans.

Requirements for next generation:

- Extreme connectivity: latency, bit rate
- Joint Communications and Sensing
- Flexible allocation of functionality & topology formulations

System-PoC B

- Pre-condition: A manufacturing task is conducted in a certain site, e.g., site A
- In the particular site a role needs to be changed (e.g., from manufacturing to inventory)
- Manufacturing is transferred to another site, e.g., site B
  - Manufacturing in site B uses components from site A
  - Show case of multi-site, synergetic orchestration
  - requirements on connectivity
  - complementary use of software and hardware components (no duplication)



Multi-site, synergetic monitoring and orchestration

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      "metricUnit": "Percent",
      "metricType": "Application"
    },
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      "metricType": "Application"
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  }
}
```

HEXA-X-II.EU //

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6GSNS

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