ICT-52 Workshop on 6G 2023

Special-purpose Functionalities: Intermediate Solutions

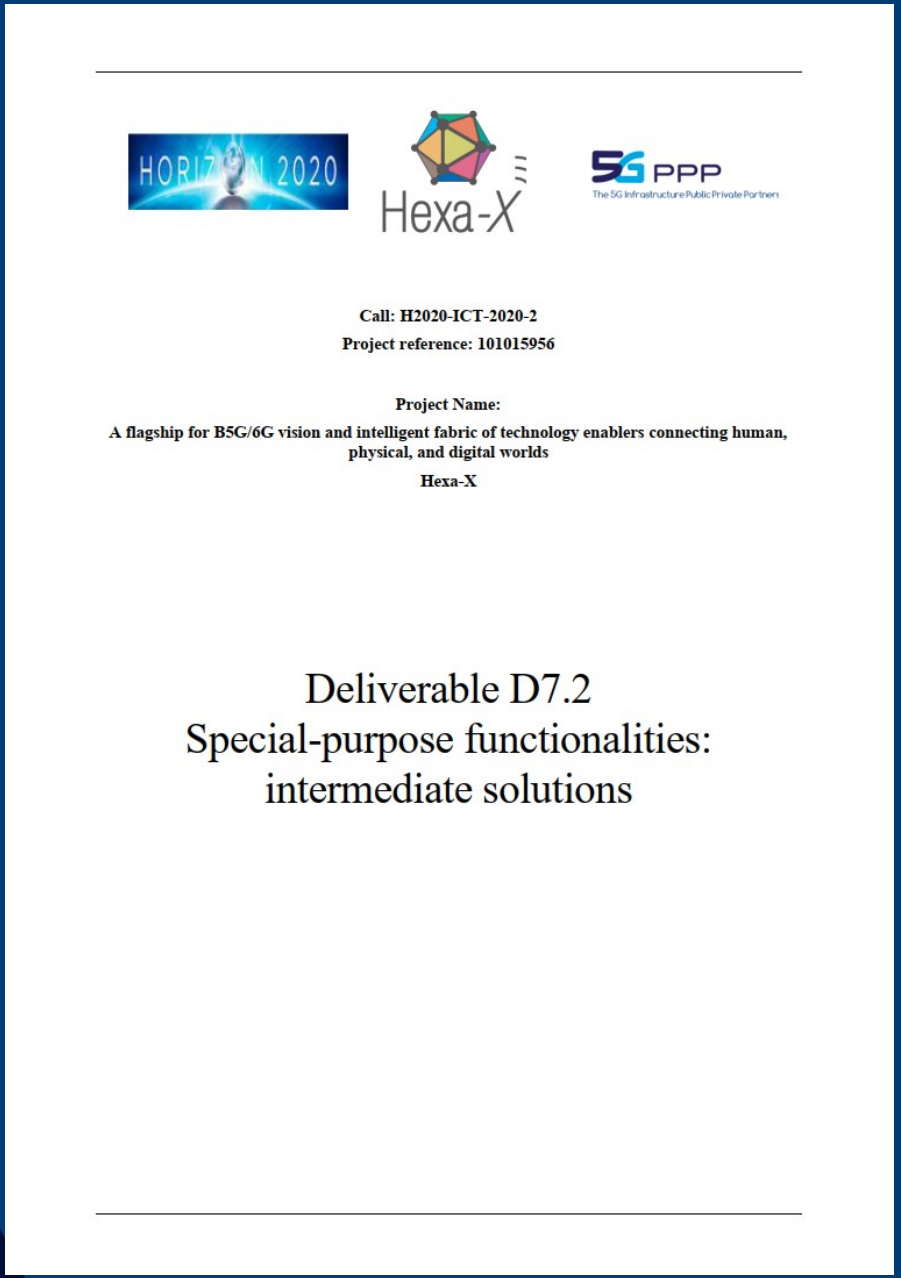
Björn Richerzhagen
(WP7 Lead, Siemens)

Hexa-X

hexa-x.eu

Mission and scope

- WP7 studies enablers for **increased dependability** and **sustainable coverage**, including **Digital Twins** and **novel HMIs** to enable extreme experiences
- It contributes to the expansion and evolution of the network into new use cases and value chains
- D7.2 contains an overview of intermediate solutions and their relation to other Hexa-X technical enablers and KPIs/KVIs



Call: H2020-ICT-2020-2

Project reference: 101015956

Project Name:

A flagship for B5G/6G vision and intelligent fabric of technology enablers connecting human, physical, and digital worlds

Hexa-X

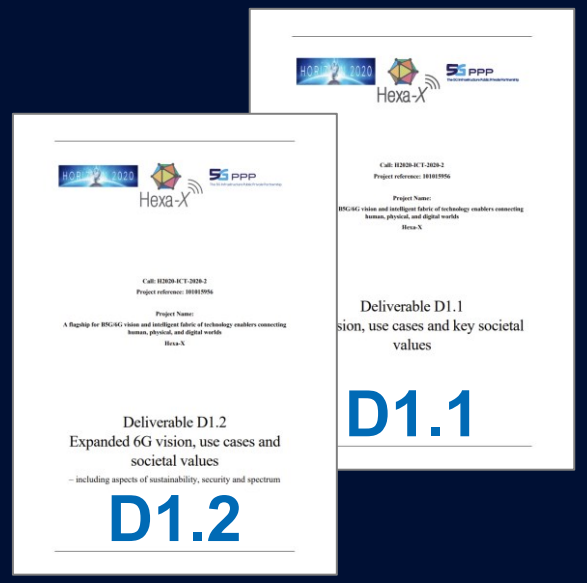
Deliverable D7.2

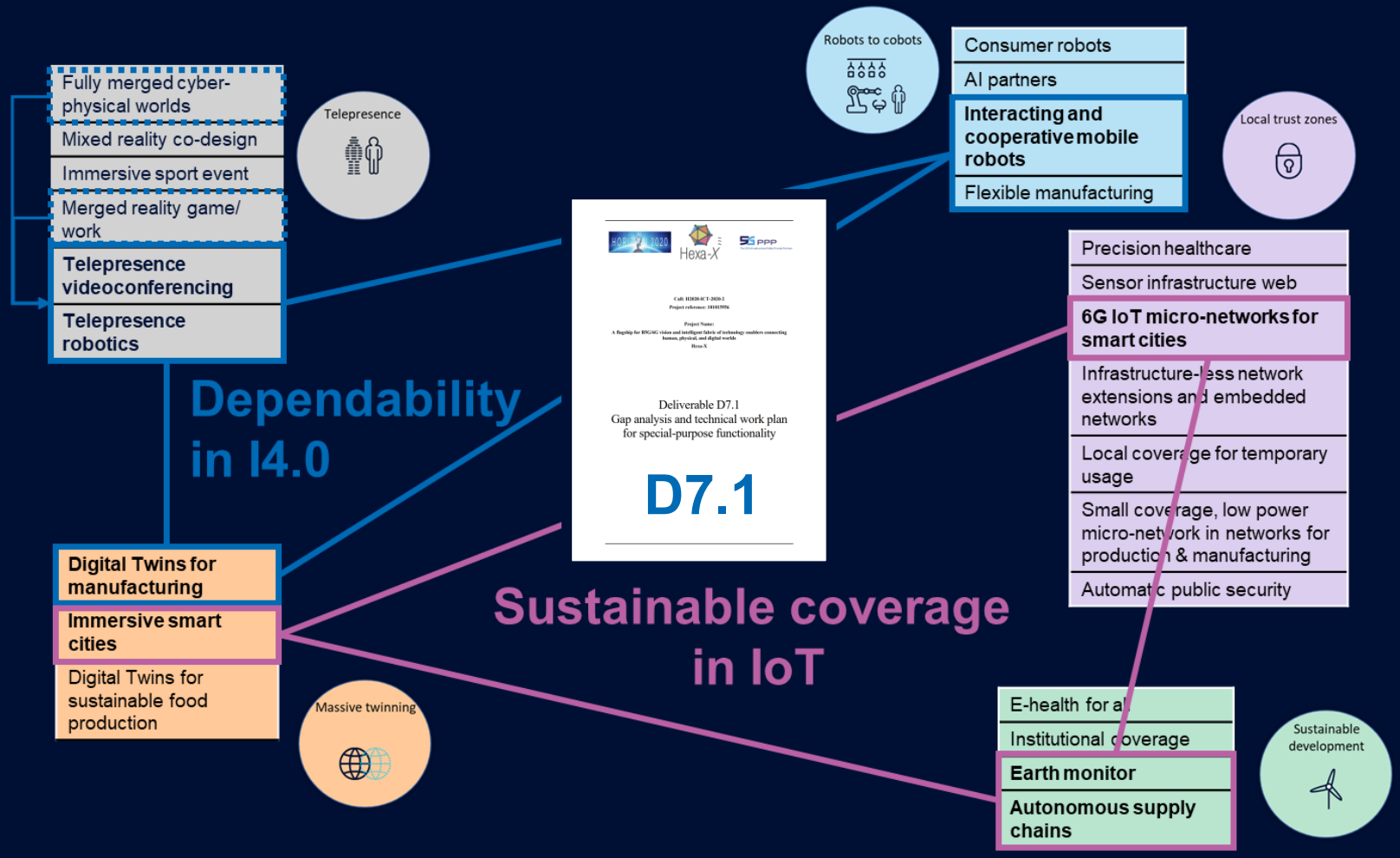
Special-purpose functionalities: intermediate solutions

Identification of key use cases for extreme experiences

(Recap of D7.1)

- Analysis of Hexa-X use cases
- Sharpened requirements (KPI and KVI definitions and target values in use cases)





Focus on dependability and sustainable coverage

(Recap of D7.1)

Dependability is the "ability to perform as and when required".
The underlying KPIs serve as an indicator for the Hexa-X key value ***trustworthiness***.

Sustainable coverage is the Hexa-X ambition to target spatial coverage and ***inclusion*** under explicit consideration of ***sustainability*** aspects and capabilities.

Cost of generated insight

increase in:
- required computational power
- energy consumption
- hardware production/distribution

Value of generated insight

reduction in:
- overall energy consumption
- environmental pollution
- electronic waste
- EMF exposure
- unnecessary behavior (e.g., traffic)

Flexibility - Ability to adapt to changing tasks related to sustainable coverage

- cost (monetary and resources) associated change
- grade of re-use of components

Intermediate solutions

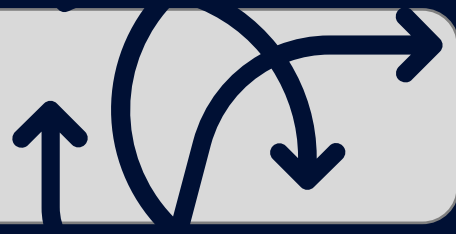
Overview of technical contributions discussed in D7.2

Three focus topics for special-purpose functionality

(Recap of D7.1)

Ultra-flexible resource allocation

Ultra-flexible resource allocation procedures in **challenging environments** such as those populated by mobile devices with special requirements and in need of coverage.



Dependability in I4.0

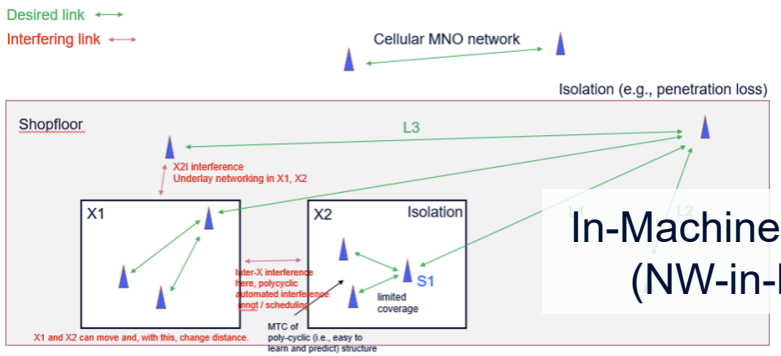
Mechanisms and enablers for **high dependability** in vertical scenarios, enabling efficient resource support of complex and dynamically changing availability requirements.

HMIs and digital twins

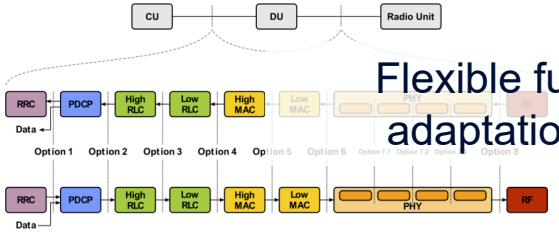
Convergence of the biological, digital and physical worlds with human interaction through **novel HMI** concepts and a **privacy-preserving high-availability Digital Twin**.

Enablers for ultra-flexible resource allocation

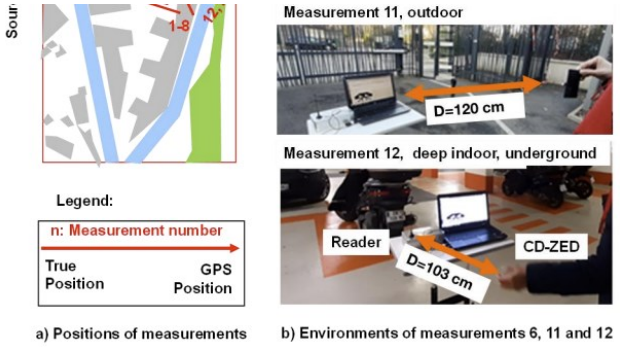
Network enablers in focus



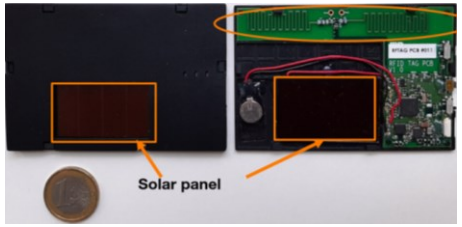
In-Machine communication (NW-in-NW) in factories

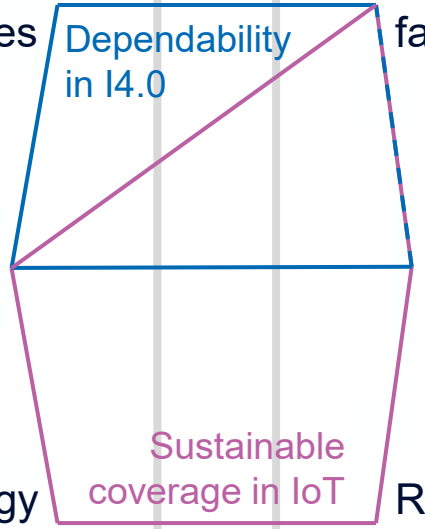


Flexible functional split adaptation in factories



Crowd-detectable zero-energy devices for smart tracking





Applications in focus

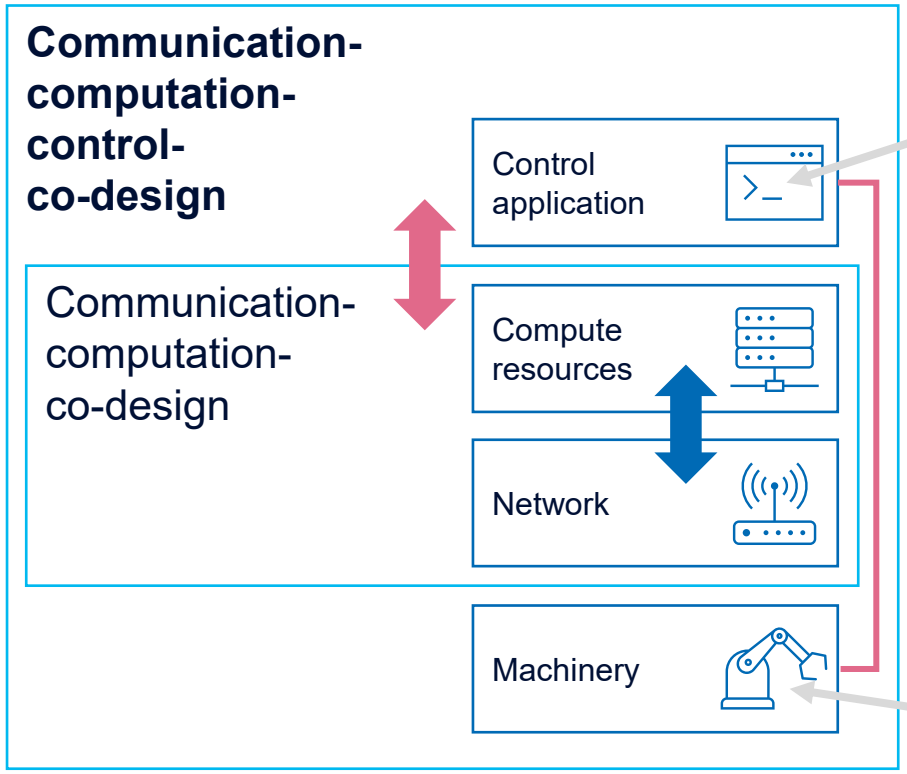
Radio-aware trajectory planning in factories, flexible radio mapping

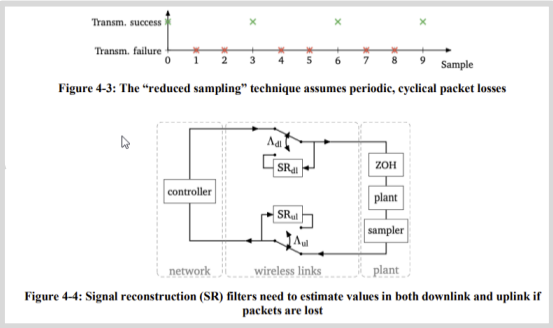
Resource allocation and function (re-)distribution in factories

Resource provisioning for Federated Learning in IoT

Enablers for dependability in I4.0

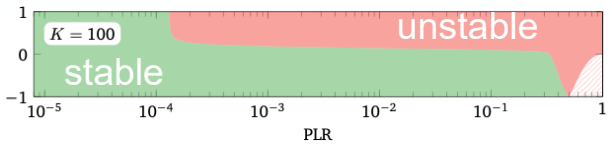
CoCoCo: modeling the impact of real-world constraints on applications





Focus topics

Impact of temporal correlation of packet losses on industrial control applications

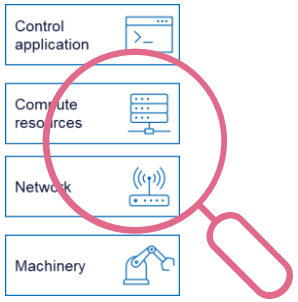


Cross-domain reliability modeling, demonstrated with inverted pendulum example

Development of method for best trade-off between sum-rate, power, delay and EMF exposure in computational offloading scenarios

Enablers for dependability in I4.0

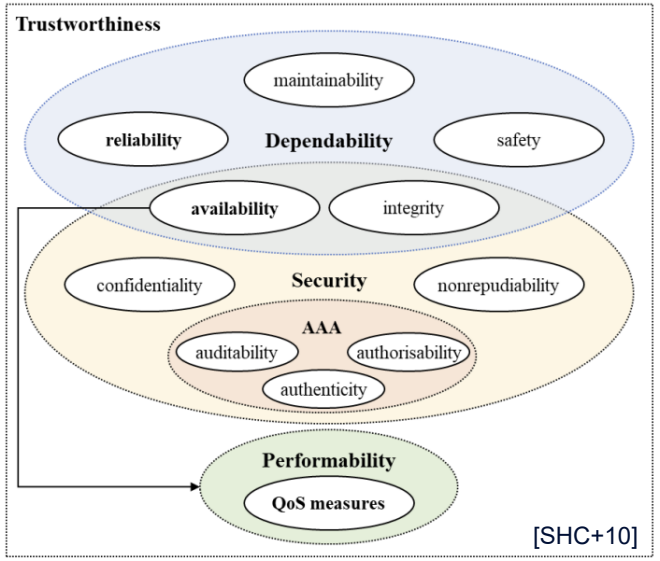
Quantifying and monitoring dependability, error identification



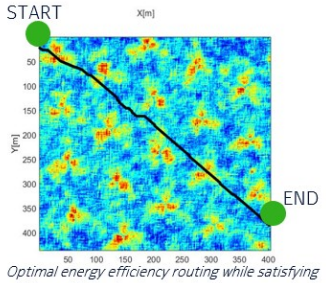
Capture application, network, and infrastructure events

Estimate impact on application productivity (→ CoCoCo)

Utilize resource allocation strategies to mitigate failures



Increasing dependability with digital twins



Optimal energy efficiency routing while satisfying minimum throughput constraint

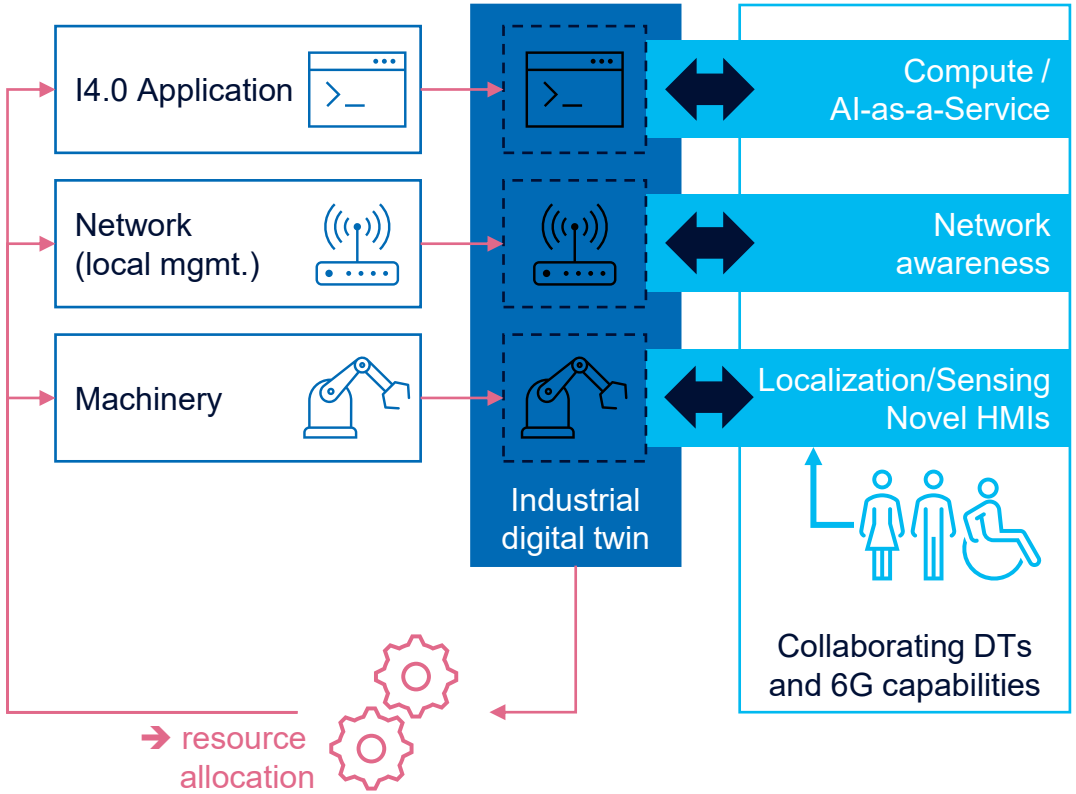
Incorporate BS/UE capabilities in models

Properties of transmitting nodes (trajectories, positions)

Create and maintain radio environment maps

HMIs and digital twins

Ecosystem of collaborating DTs in human-centric industrial environments

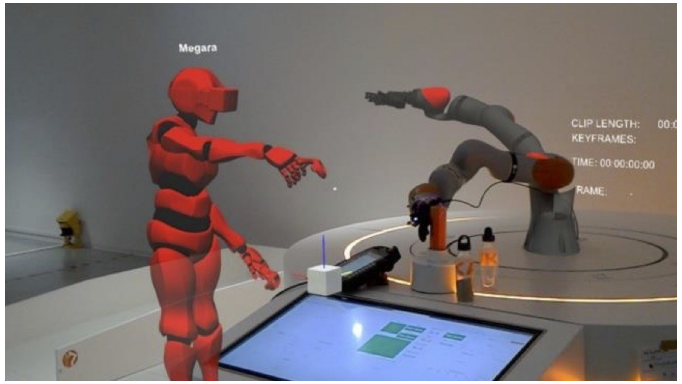


Focus topics

DT empowered collaborative robots
DTs for emergent intelligence

Impact of human presence on industrial deployments
Network-aware DTs for local insights

Novel HMIs for mobile human-machine interaction
Bringing the human in the loop



Relation to 6G KVIs

Question: how do contributions relate to the **KVIs** identified in the project [D1.3]?

KVI area	Contribution	Remarks
Sustainability	Ambient backscatter communication (3.5)	Novel zero-energy devices for massive IoT scenarios (e.g., earth monitor)
	Efficient ressource allocation (Sec. 3)	Efficient utilization of infrastructure, adapted to current load and conditions (c.f. flexibility KVI)
Trustworthiness	Dependability-related contributions (Sec. 4)	Increased and observable/quantifiable dependability is expected to contribute to the overall level of trust as an indicator of trustworthiness [Hexa-X D1.3]
	Trustworthy Digital Twin platform (5.1, 5.6, 5.7)	Privacy-preserving collaboration among digital twins, benefiting from novel 6G capabilities (e.g., localization, sensing)
Inclusiveness	Novel HMIs (5.2) and interaction with Digital Twins (5.4, 5.5)	Enable remote interaction, enable inclusion of a more diverse (remote/on-site) workforce. Reduced human exposure to hazardous/dangerous situations.
Flexibility	Flexible resource allocation (Sec. 3)	Mechanisms to adapt to changing requirements, mobility, device constraints, …

Want to know more?

- More details on these (intermediate) steps already available in D7.2
  - Online: hexa-x.eu/deliverables

- Deliverable D7.3 on **final results** will be available in June

Thank you!

HEXA-X.EU

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101015956.