6G series workshop by Hexa-X-II

6G Architecture design

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Hexa-X-II

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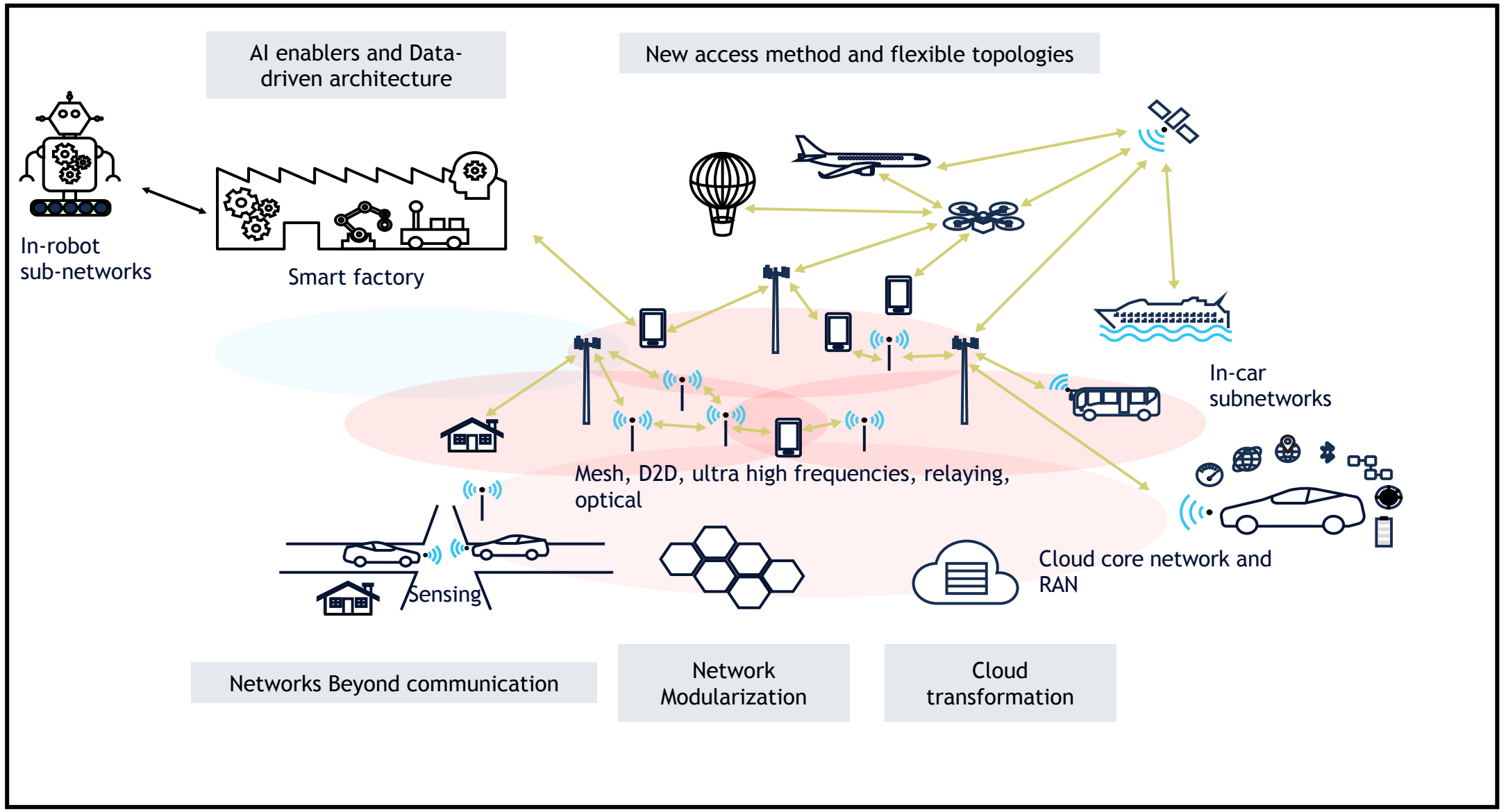
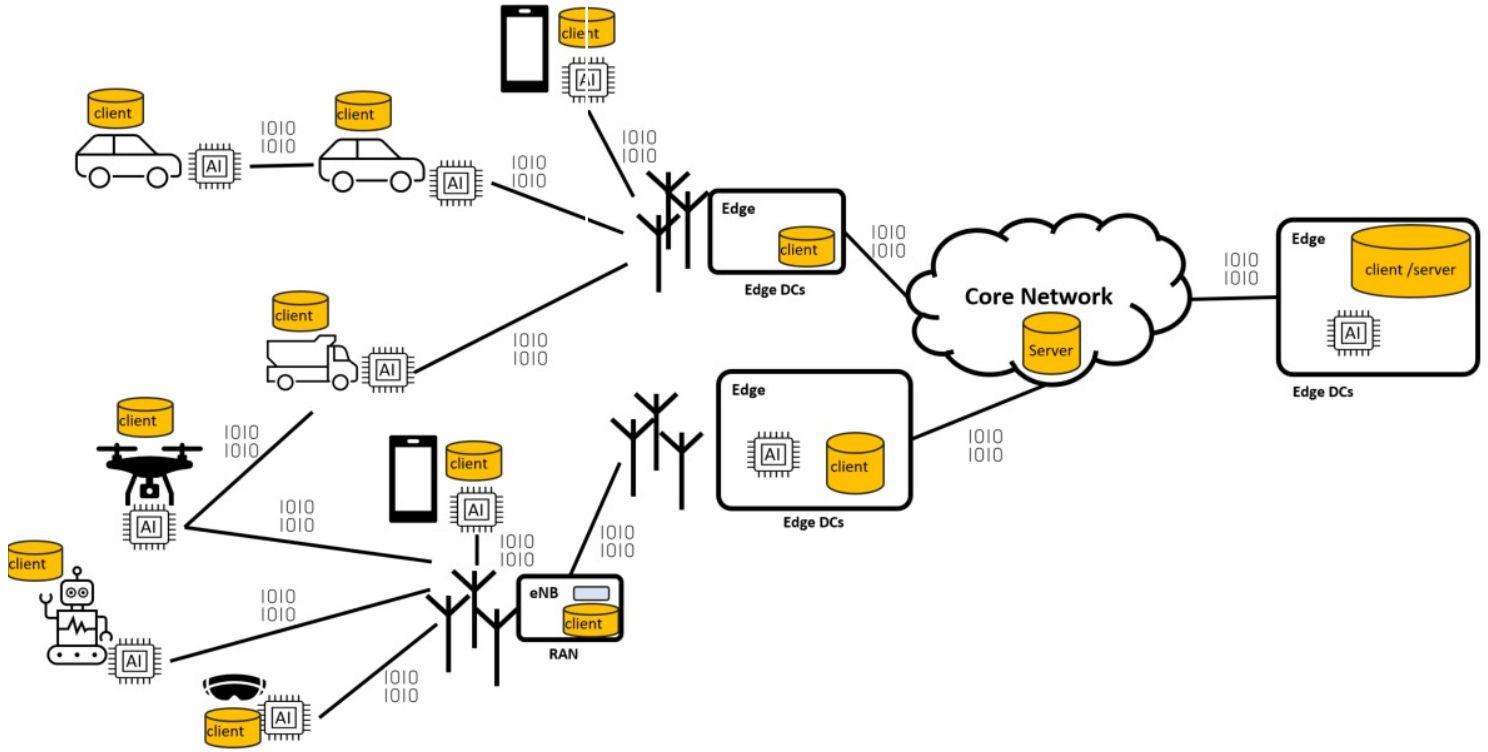
Hexa-X-II 6G Architecture design in nutshell



AI enablers for data-driven architecture

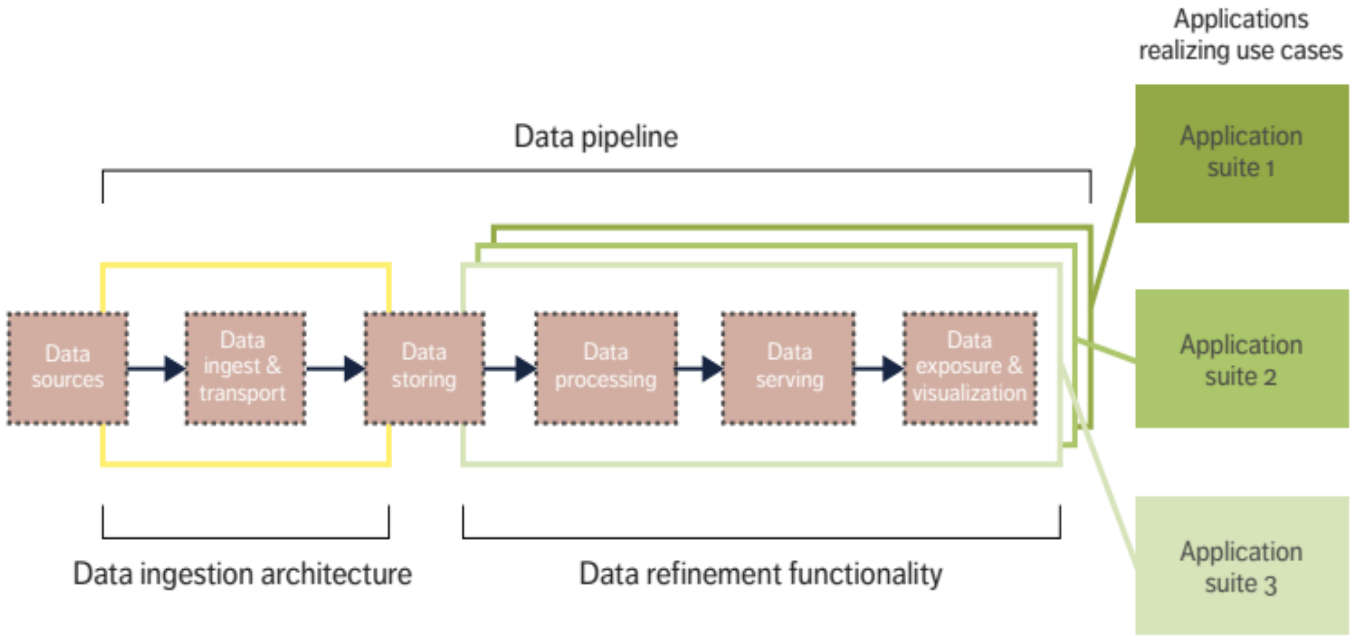
AI enablers for data-driven architecture
MLOps (ML operations)

Enabler	Background	Benefits	Implications
MLOps	AI execution environments will be everywhere (e.g., UE, RAN and Core)	Improve operation, management, and maintenance of the E2E system design	Privacy-aware data collection, AI management.



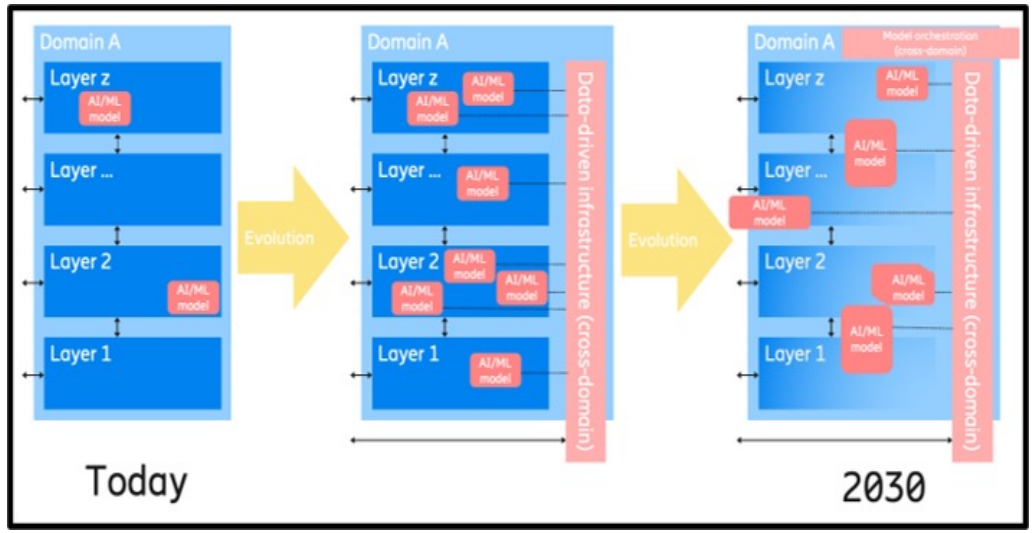
AI enablers for data-driven architecture
DataOps (Data operations)

Enabler	Background	Benefits	Implications
MLOps	AI execution environments and LCM will be everywhere (e.g., UE, RAN and Core)	Improve operation, management, and maintenance of the E2E system design	Privacy-aware data collection, AI management.
DataOps	Data shall be delivered, pre-processed, and stored where and when required.	Efficiently collect and process data	Impact on the RAN and CN architecture; functions, protocols and interfaces may be needed.



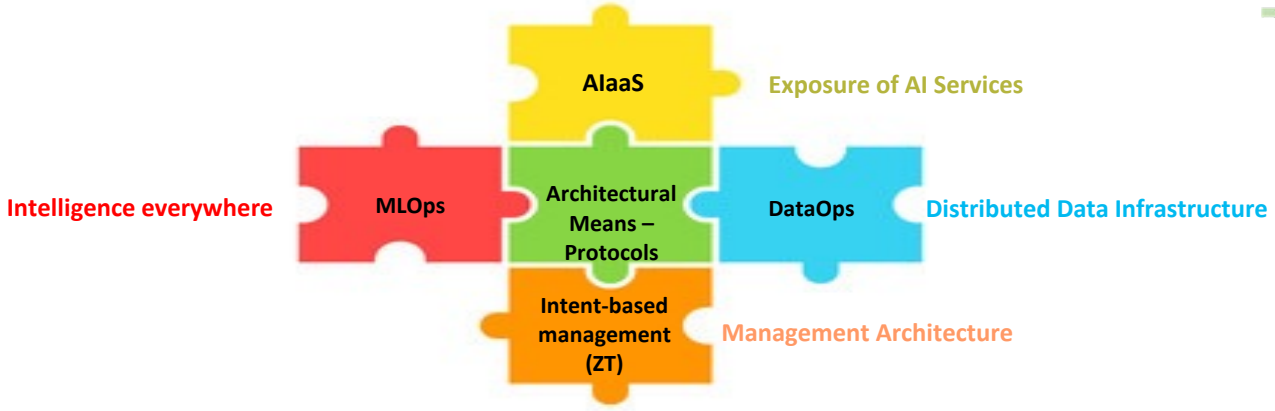
AI enablers for data-driven architecture Protocols

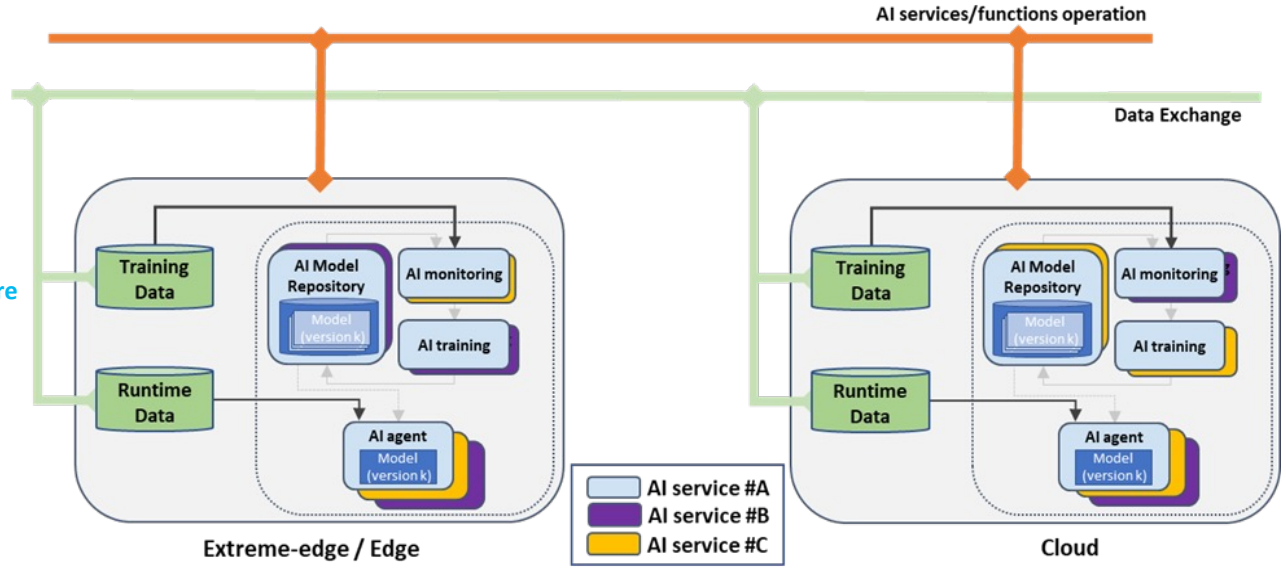
Enabler	Background	Benefits	Implications
MLOps	AI execution environments and LCM will be everywhere (e.g., UE, RAN and Core)	Improve operation, management, and maintenance of the E2E system design	Privacy-aware data collection, AI management.
DataOps	Data shall be delivered, pre-processed, and stored where and when required.	Efficiently collect and process data	Impact on the RAN and CN architecture; functions, protocols and interfaces may be needed.
Architectural means and protocols	Protocols, APIs, functions etc	Can help define the inter-layer APIs and the protocols used to connect the layers of an E2E system design	Define internal and external APIs that realize the inter-layer interaction



AI enablers for data-driven architecture AIaaS

Enabler	Background	Benefits	Implications
MLOps	AI execution environments and LCM will be everywhere (e.g., UE, RAN and Core)	Improve operation, management, and maintenance of the E2E system design	Privacy-aware data collection, AI management.
DataOps	Data shall be delivered, pre-processed, and stored where and when required.	Efficiently collect and process data	Impact on the RAN and CN architecture; functions, protocols and interfaces may be needed.
Architectural means and protocols	Protocols, APIs, functions etc	Can help define the inter-layer APIs and the protocols used to connect the layers of an E2E system design	Define internal and external APIs that realize the inter-layer interaction
AIaaS	AIaaS is a framework that offers a wide range of AI services	AI can improve performance in-network and expose service to end users	Impact on the E2E system design, AIaaS needs DataOps, MLOps and protocols



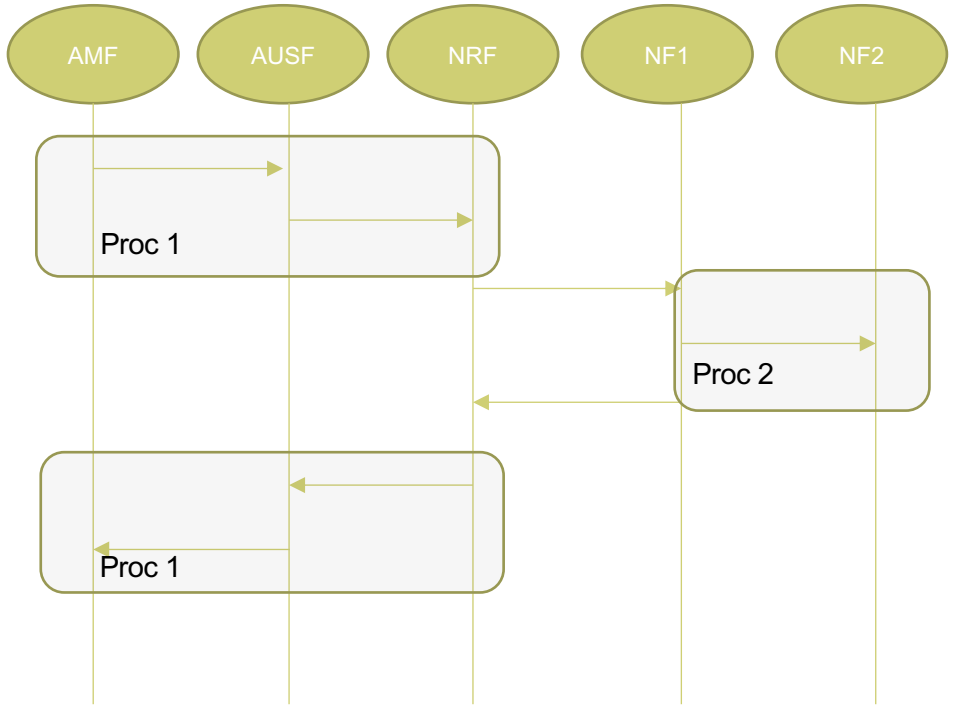


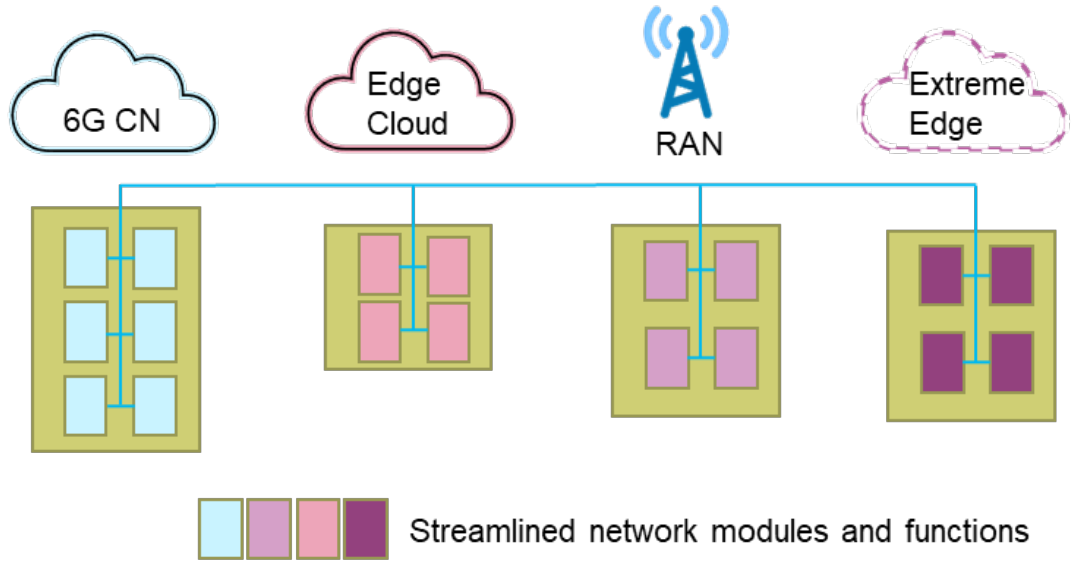
AIaaS overview

Network modularisation

Network modularisation

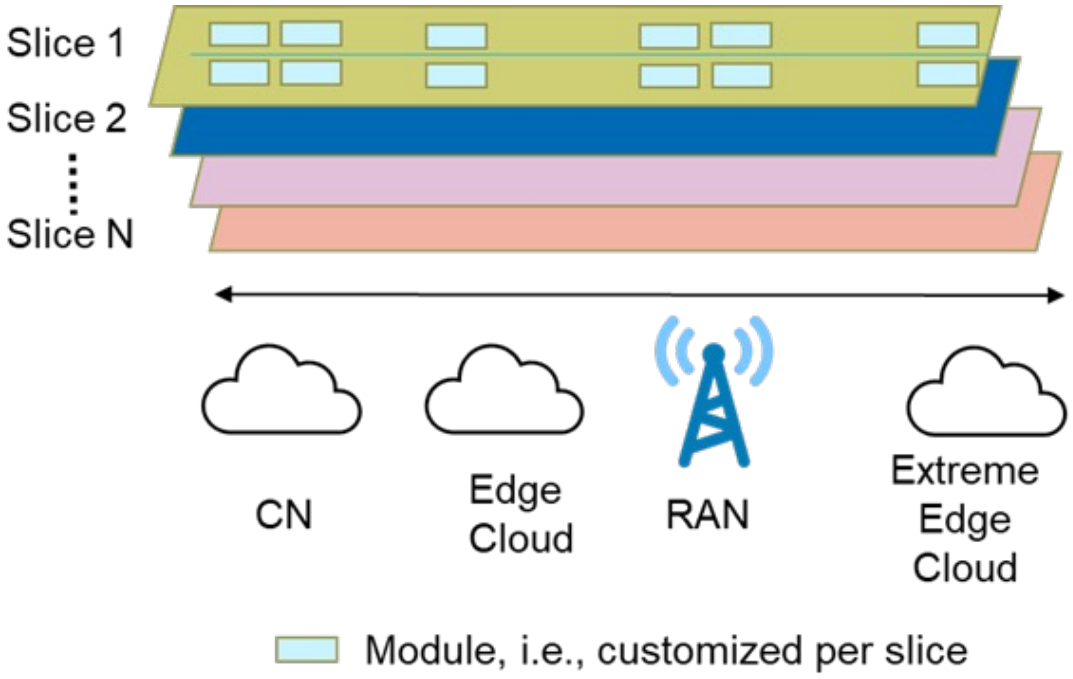
Enabler	Background	Benefits	Implications
Network modularisation	Defining 6G NF compositions and their interfaces based on various granularities and deployment scenarios	Enhanced latency and energy efficiency	Impact on network function design and procedures

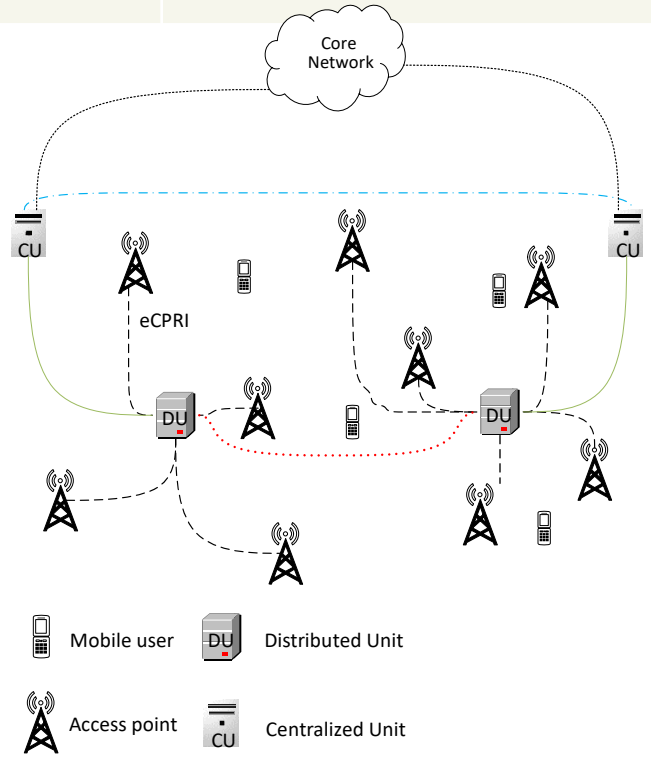




Network modularization E2E design

Enabler	Background	Benefits	Implications
Network modularisation	Define network modules (network functions) and their interfaces.	Streamlining modules, improve support for new and existing use cases, better suited for cloud	Impact on network function design and procedures
E2E design	Exploring the possible enhancements to the E2E interfaces using modularization	Enhanced customization of E2E functionality	New or modified interfaces between entities.

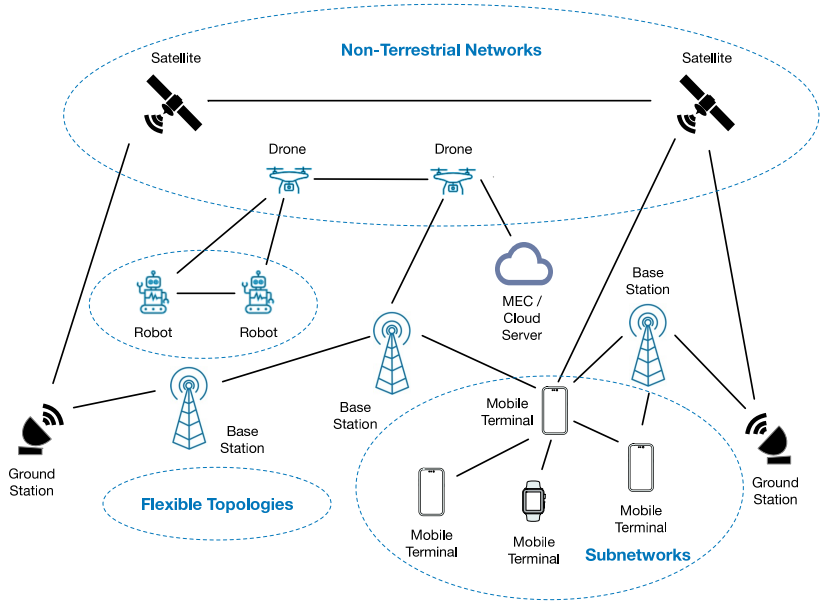


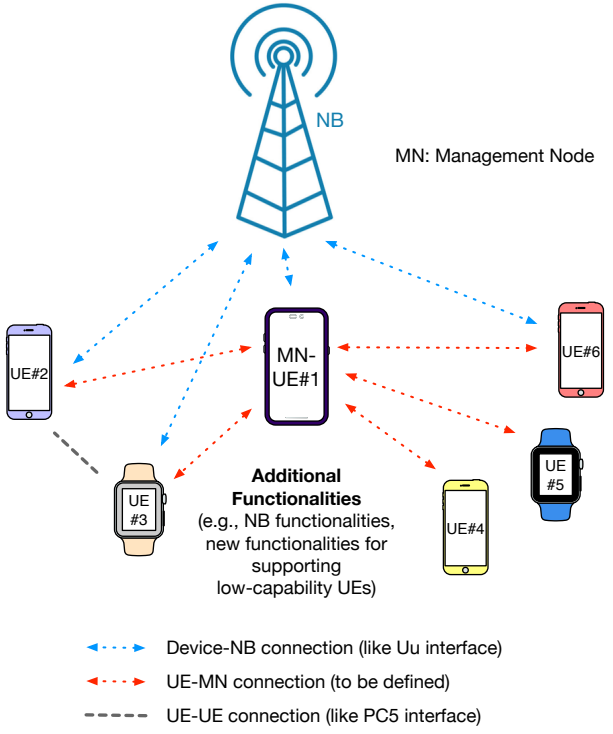


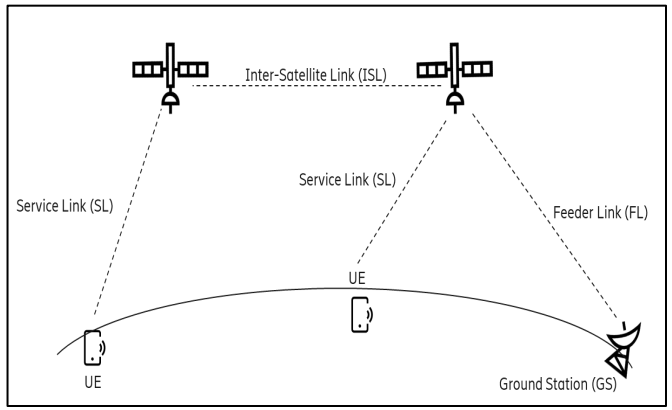
New access and flexible topologies

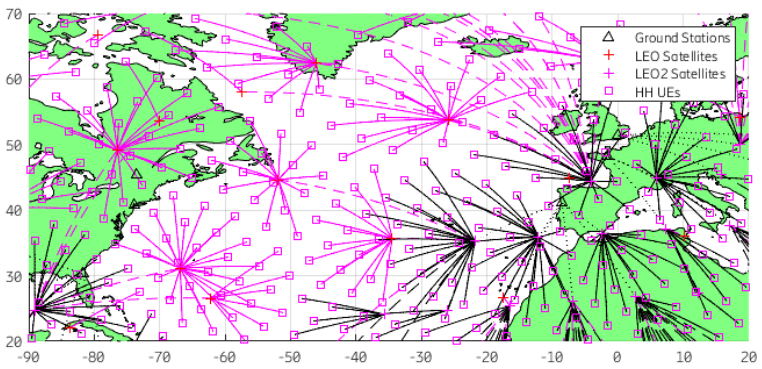
New access and flexible topologies
Network of networks

Enabler	Background	Benefits	Implications
Network of networks	Integration of multiple subnetworks, including terrestrial and non-terrestrial networks	Improved coverage, reduced complexity, increased reliability and more efficient management of network resources	New UE roles and responsibilities in a subnetwork, communication between non-terrestrial nodes, trust of diverse network nodes



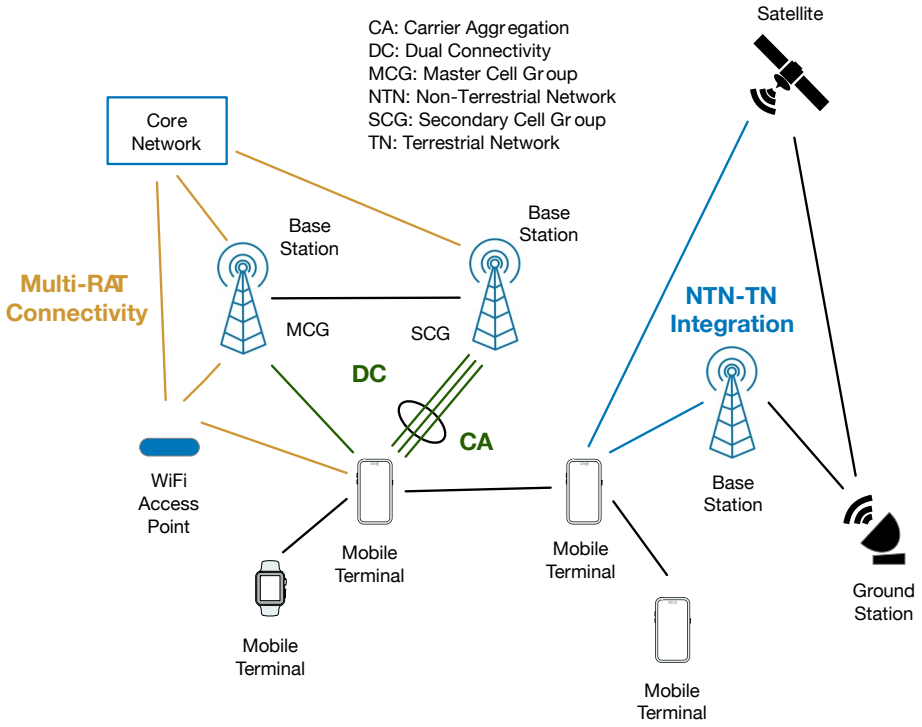






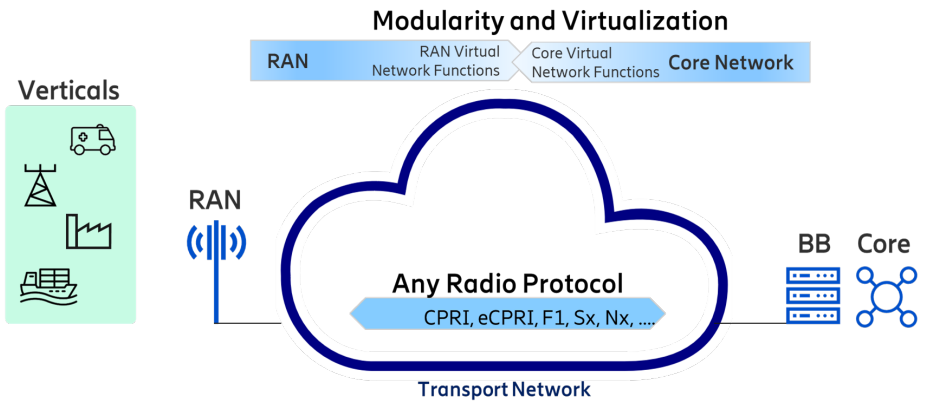
New access and flexible topologies
Multi-connectivity

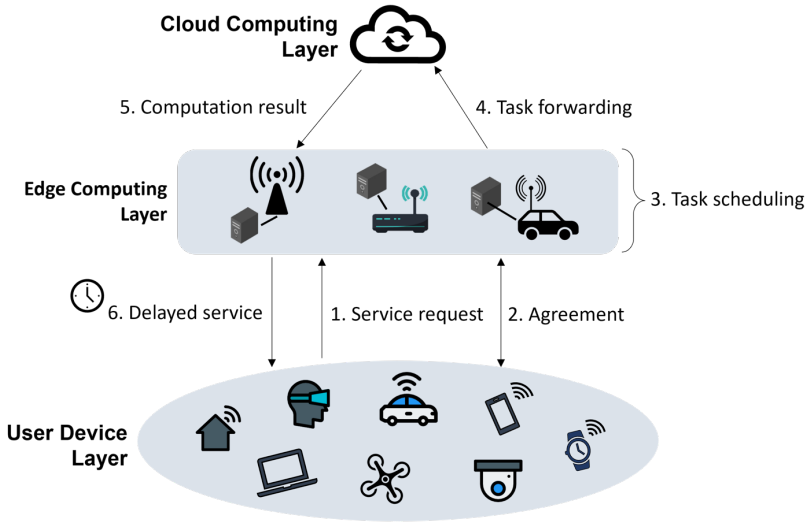
Enabler	Background	Benefits	Implications
Network of networks	Integration of multiple subnetworks, including terrestrial and non-terrestrial networks	Improved coverage, reduced complexity, increased reliability and more efficient management of network resources	New UE roles and responsibilities in a subnetwork, communication between non-terrestrial nodes, trust of diverse network nodes, communication and computation resource management
Multi-connectivity	Multi-connectivity enables efficient utilization of multiple frequency ranges, the aggregation of different radio access technologies, carriers, and access networks	Robustness and reliability, increased throughput	Depending on the solution, new interfaces and protocols between nodes may be needed, which may lead to an increased complexity in coordinating different NW nodes.



New access and flexible topologies
E2E context awareness management

Enabler	Background	Benefits	Implications
Network of networks	Integration of multiple subnetworks, including terrestrial and non-terrestrial networks	Improved coverage, reduced complexity, increased reliability and more efficient management of network resources	New UE roles and responsibilities in a subnetwork, communication between non-terrestrial nodes, trust of diverse network nodes, communication and computation resource management
Multi-connectivity	Multi-connectivity enables efficient utilization of multiple frequency ranges, the aggregation of different radio access technologies, carriers, and access networks	Robustness and reliability, increased throughput	Depending on the solution, new interfaces and protocols between nodes may be needed, which may lead to an increased complexity in coordinating different NW nodes.
E2E context awareness management	Managing a network so that it can adapt dynamically to the context	Mission-critical operations to reduce the network overhead and to allocate edge resources flexibly	Different network components e.g., RAN/CN, transport, applications, should become aware of the context and need to interact, implying the need for signalling and synchronisation.

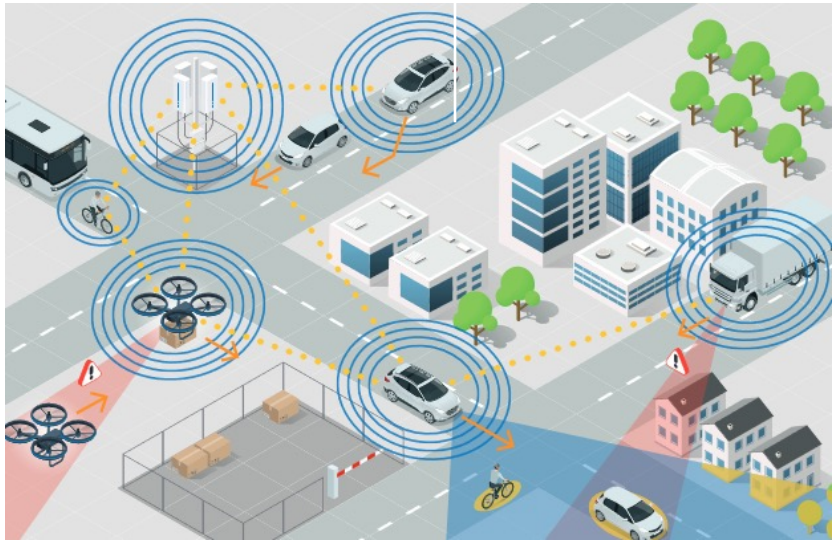




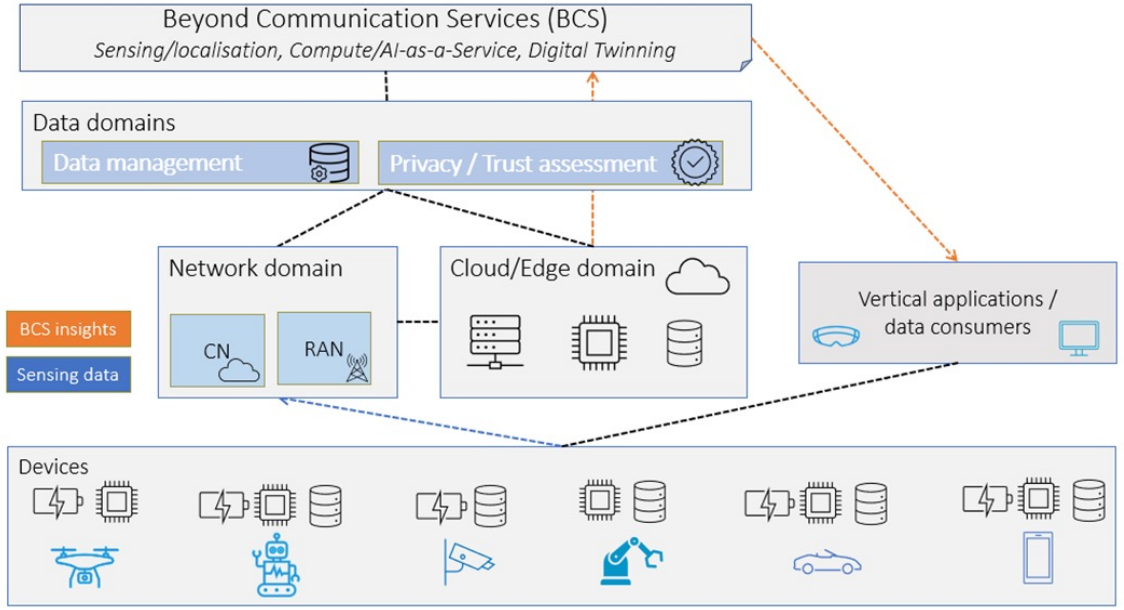
Network beyond communications

Network beyond communications
Exposure and data management

Enabler	Background	Benefits	Implications
Exposure and data management	Functions to process the data collected and how to expose the data	Expose data that may enable new 6G services	Impact mainly on the CN architecture and the Network-centric application layer; new functions, protocols and interfaces may be needed

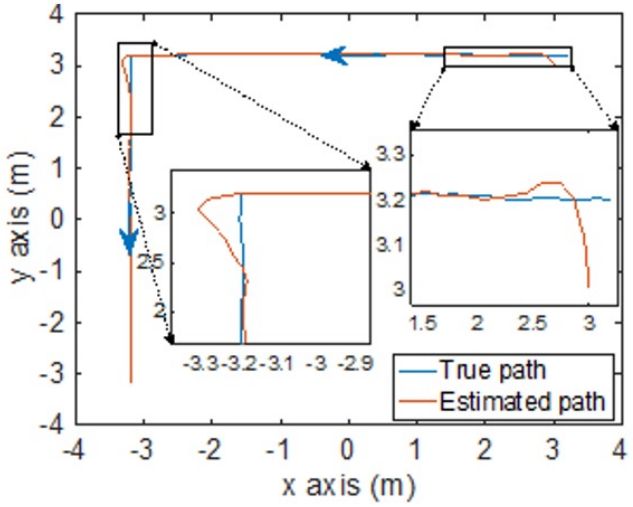


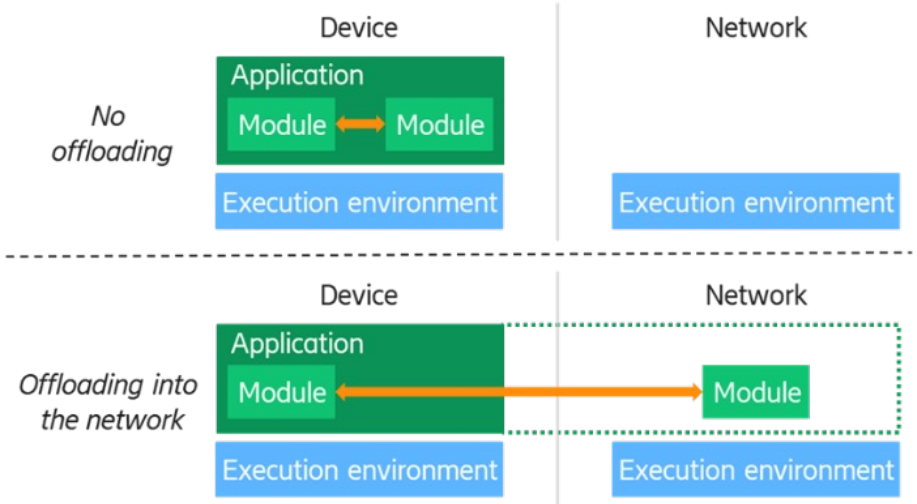
Joint Communication and Sensing (JCAS)



Network beyond communications
Protocols, signalling and procedures for JCAS and Compute

Enabler	Background	Benefits	Implications
Exposure and data management	Functions to process the data collected and how to expose the data	Expose data that may enable new 6G services	Impact mainly on the CN architecture and the Network-centric application layer; new functions, protocols and interfaces may be needed
Protocols, signalling and procedures for JCAS and Compute	Discovery of compute nodes and impact of new sensing services on RAN interfaces and functionality	Critical to implement the Beyond Comm. Functionalities	New radio measurements needed; protocols needed to collect data to the data management.





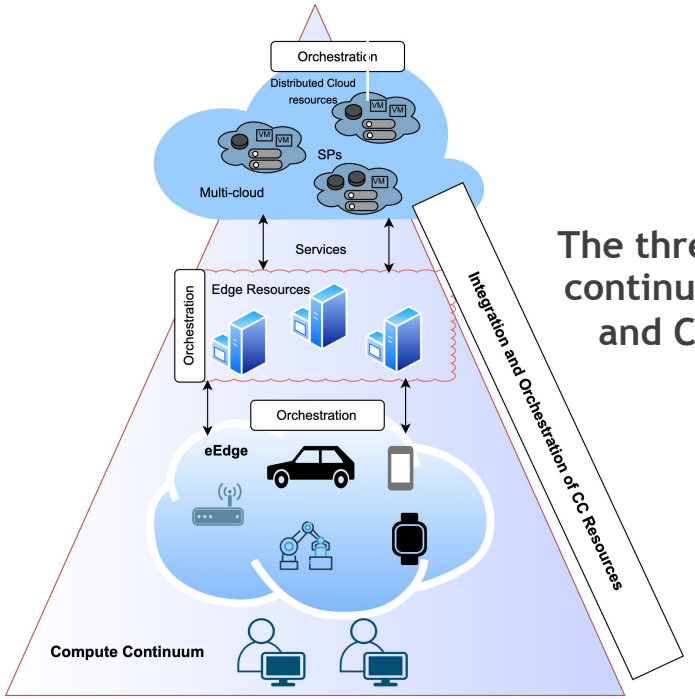
Device compute offloading

Virtualization and Cloud transformation

Virtualization and Cloud transformation

Integration and orchestration of extreme edge resources in the computing continuum

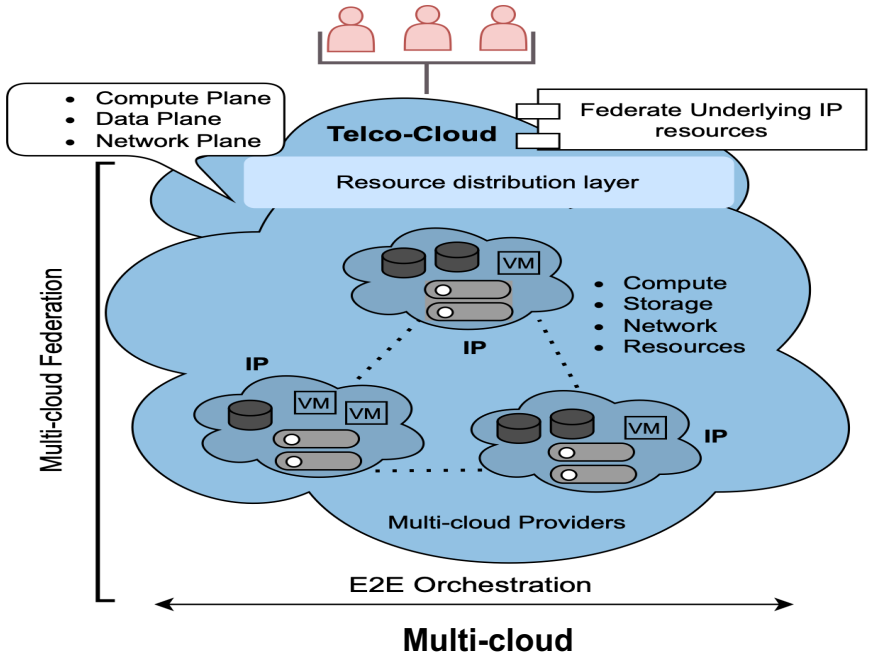
Enabler	Background	Benefits	Implications
Integration and orchestration of extreme edge resources in the compute continuum	Future 6G networks will consider computing resources across the full network, from the extreme edge (including the UE) to Telco grade clouds	Better management of the resources and services in the Compute Continuum	Impacts the extension of the Compute Continuum Emphasis is given on the extreme-edge integration, management and usability



The three layer compute continuum: xEdge, Edge and Cloud resources

Virtualization and Cloud transformation

Enabler	Background	Benefits	Implications
Integration and orchestration of extreme edge resources In the compute continuum	Future 6G networks will consider computing capabilities across the full network, from the extreme edge (including the UE) to Telco grade clouds (CC, Compute Continuum	Better management of the resources and services in the CC	Impacts the extension of the CC, where strong emphasis is given on the extreme-edge integration, management and usability
Multi-domain/Multi-cloud federation	Different Telco-Cloud Providers are offering Compute, Storage and Network resources as a service on different platforms complicates management	Unification of existing domain specific orchestration frameworks into an e2e federated architecture	It has fundamental impact in addressing the exiting challenges in multi domain federation as it will define important design, integration and orchestration principles for federation of services or/and resources.



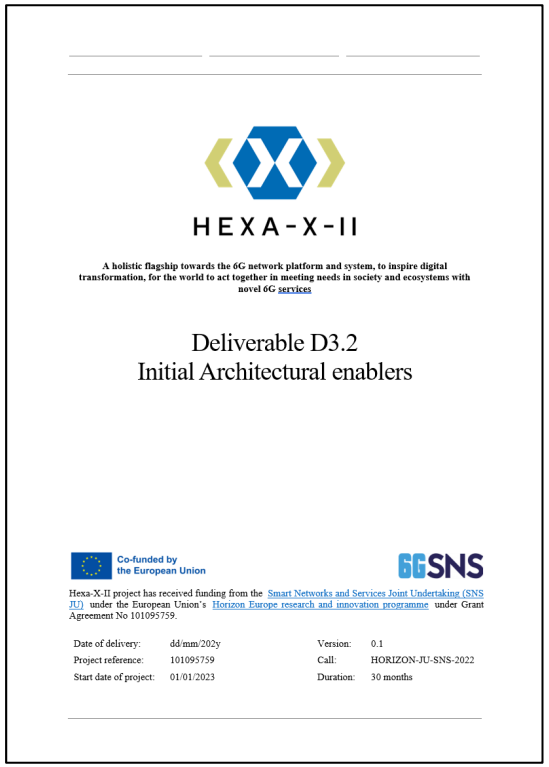
6G architecture design summary

More modular design of the network functions

Enable several new services such as AIaaS, JCAS and Compute

Transform the cloud to handle telco resources over whole cloud, as well as between clouds

Improve the network's flexibility via network of networks and context aware transport



HEXA-X-II

A holistic flagship towards the 6G network platform and system, to inspire digital transformation, for the world to act together in meeting needs in society and ecosystems with novel 6G services

Deliverable D3.2
Initial Architectural enablers

Co-funded by the European Union

6GSNS

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Start date of project:	01/01/2023	Duration:	30 months

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