6G series workshop
February 11, 2025

Hexa-X-II WP2
E2E system view

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Hexa-X-II

hexa-x-ii.eu

Hexa-X-II: Blueprint of the 6G platform

Top-down approach
Design principle
Evolution towards 6G
System requirements
System blueprint
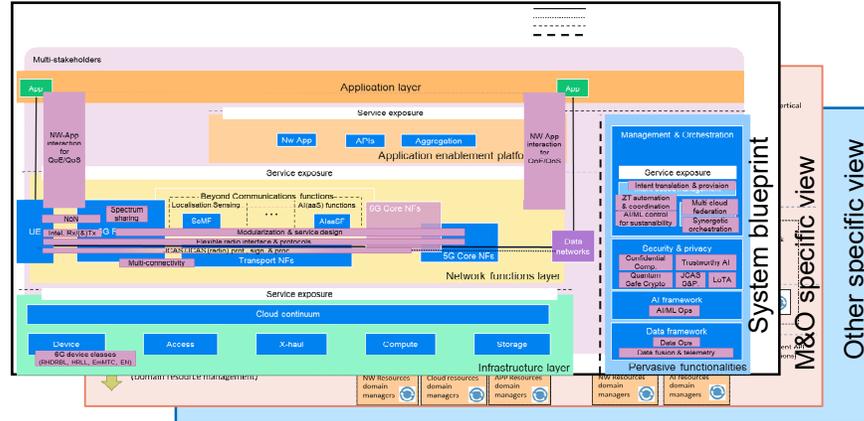
Holistic E2E system and specific views
Selection of enablers
System-PoC for Validation

Bottom-up approach
Architecture enablers
Radio protocols
Intent-based M&O
Security, privacy and resilience, …

Coming April 2025

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 D2.5
Final overall 6G system design

System PoC A   System PoC B   System PoC C

6G

Gradual addition

2

Architectural design principles

- Achieving the 6G key values realization of environmental, social, and economic sustainability

- Crystallized around simplification, security/privacy, and sustainability

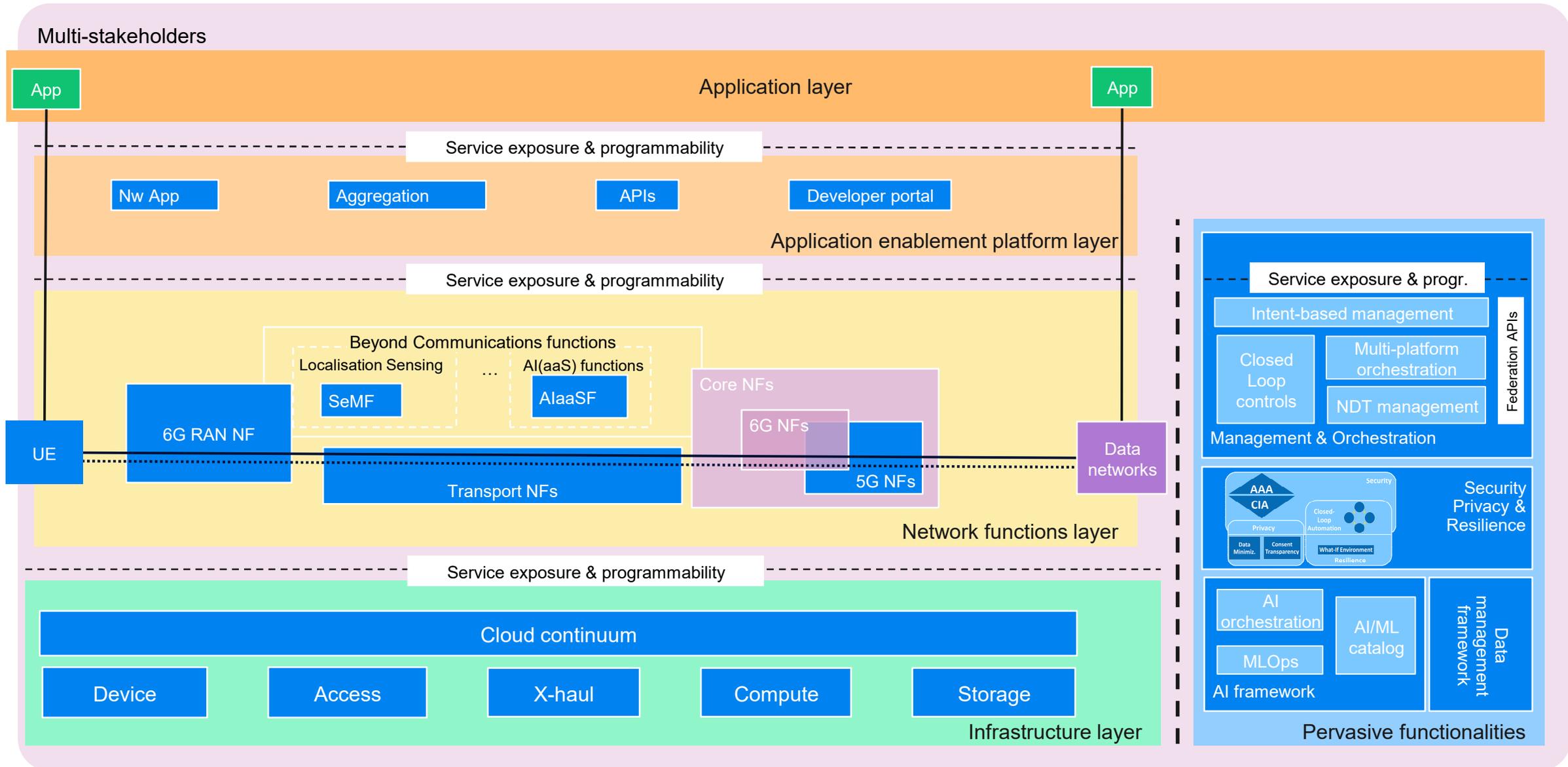|			
Principle 1 Support and exposure of 6G services and capabilities	**Principle 2** Full automation and optimization	**Principle 3** Flexibility to different network scenarios	**Principle 4** Network Scalability
Principle 5 Resilience and availability	**Principle 6** Persistent security and privacy	**Principle 7** Internal interfaces are cloud optimized	**Principle 8** Separation of concerns of network functions
	Principle 9 Network simplification in comparison to previous generations	**Principle 10** Minimizing environmental footprint and enabling sustainable networks	

Overarching 6G system blueprint

User/Data plane
Control plane
API/Interface//Intents
Control/Observability

Multi-stakeholders

Application layer

App

App

Service exposure & programmability

Nw App

Aggregation

APIs

Developer portal

Application enablement platform layer

Service exposure & programmability

Beyond Communications functions

Localisation Sensing   …   AI(aaS) functions

SeMF

AIaaSF

Core NFs

6G NFs

6G RAN NF

UE

Transport NFs

5G NFs

Data networks

Network functions layer

Service exposure & programmability

Cloud continuum

Device

Access

X-haul

Compute

Storage

Infrastructure layer

Service exposure & progr.

Intent-based management

Closed Loop controls

Multi-platform orchestration

NDT management

Federation APIs

Management & Orchestration

AAA CIA

Security

Privacy

Data Minimiz.

Consent Transparency

Closed-Loop Automation

What-If Environment

Resilience

Security Privacy & Resilience

AI orchestration

AI/ML catalog

MLOps

AI framework

Data management framework

Pervasive functionalities

Migration Path view

- Core design in 6G based on evolution of 5GC with 6G NFs and Shared NFs

- Interworking between 5G and 6G is done by Multi-Radio Spectrum Sharing (MRSS)

- Lower layer split (LLS) in the RAN
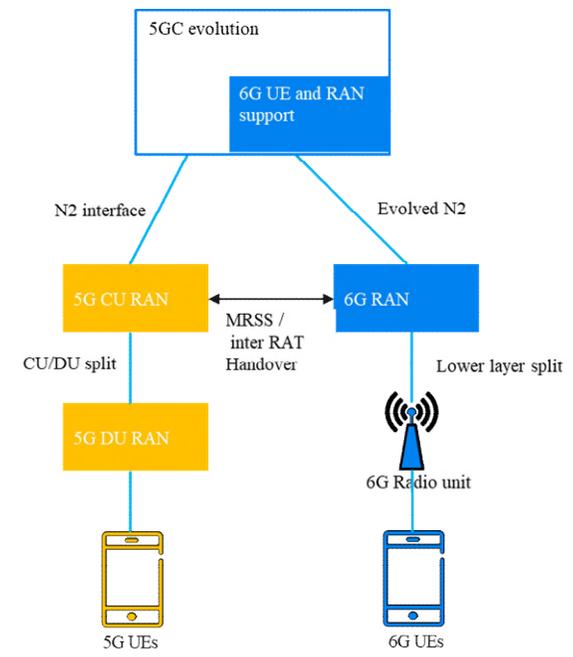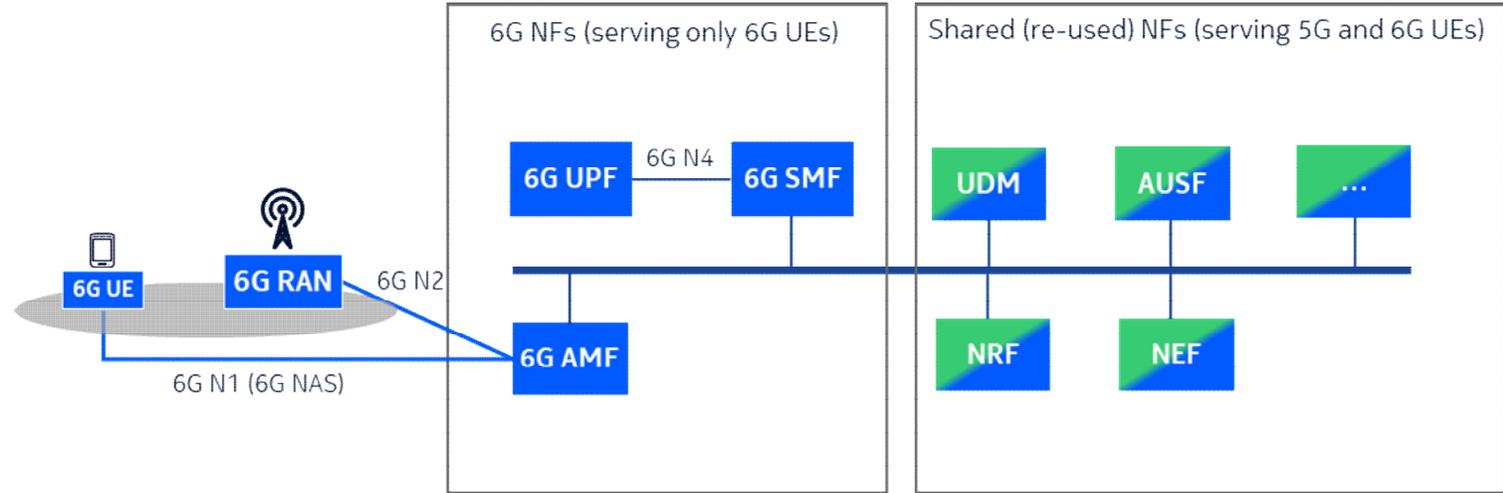
System view on new 6G services & exposure framework
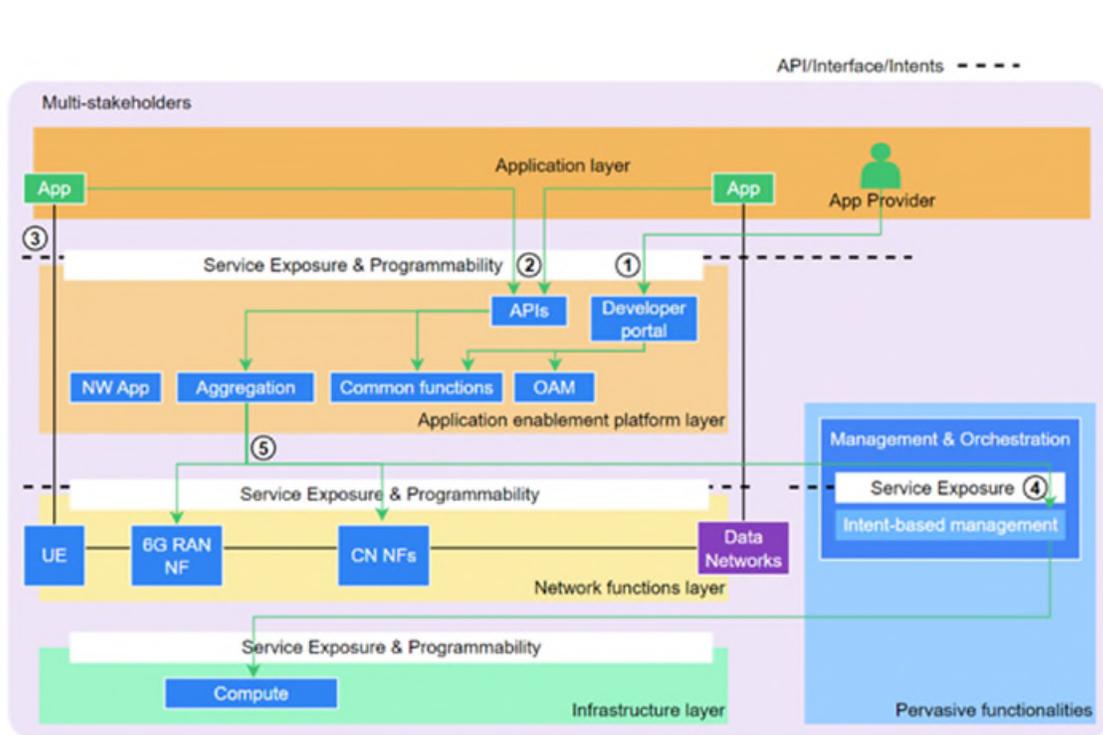
Exposure centric view

Support various flavors of the service exposure delivery

Enabling the exposure of new 6G services and network programmability capabilities
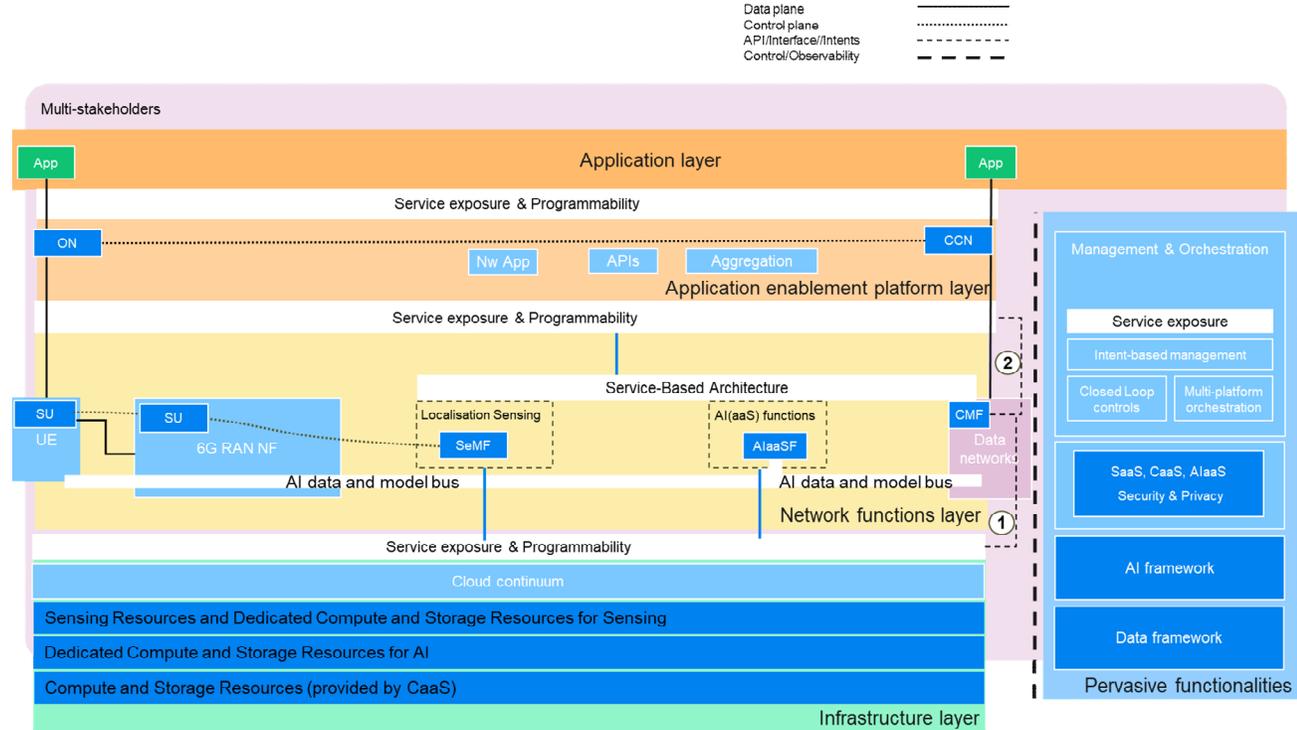
Integrated new services view

Sensing functions (SU, SeMF), AI as a Service (AIaaS)

Processing offloading functions (ON,CNN)

Compute Management (CMF) – In-network compute resource

System view on radio protocols

- Enablers for Radio Connection Management (e.g. mobility management and L2 data recovery mechanisms)

- Integrated new services (SaaS, AIaaS, and CaaS) signaling

- 6G Transceiver Architecture

- 6G System-on-Chip (SoC)
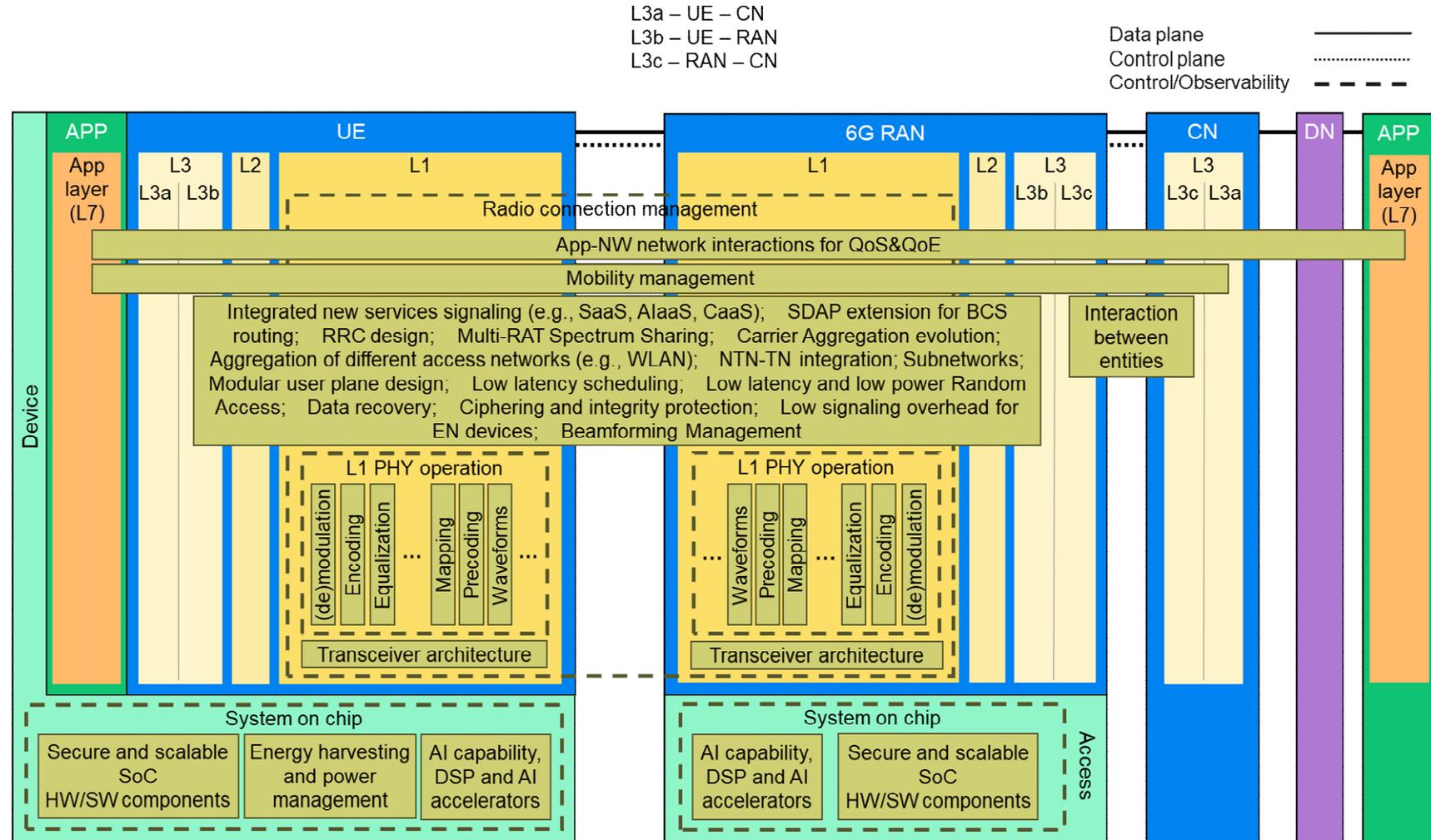
System view on new accesses and flexible topologies

- TN-NTN

- Subnetworks

- UAV-based Multi-hop Backhaul

- Multi-connectivity

UE

- Subnetwork CP and UP
- MgtN-SA, BS-MgtN DC, BS-SA with MgtN support
- RRC procedures: Offloaded RRC configuration, connection establishment
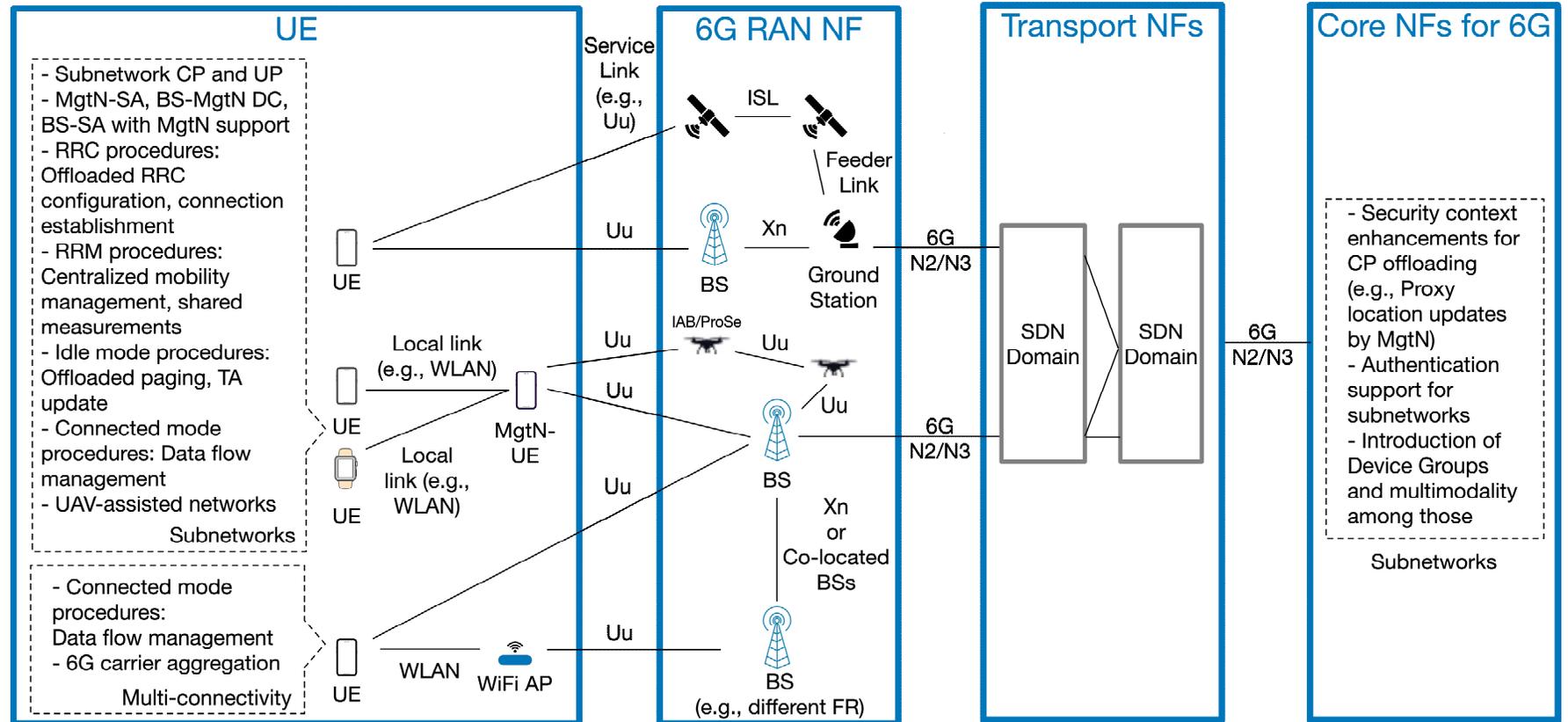- RRM procedures: Centralized mobility management, shared measurements
- Idle mode procedures: Offloaded paging, TA update
- Connected mode procedures: Data flow management
- UAV-assisted networks

Subnetworks

- Connected mode procedures: Data flow management
- 6G carrier aggregation

Multi-connectivity

UE

UE

UE

Local link (e.g., WLAN)

MgtN-UE

Local link (e.g., WLAN)

UE

WLAN   WiFi AP

6G RAN NF

Service Link (e.g., Uu)

ISL

Feeder Link

Uu   Xn

BS   Ground Station

IAB/ProSe   Uu

Uu

Uu

Uu

BS

Xn or Co-located BSs

Uu

BS (e.g., different FR)

Transport NFs

6G N2/N3

SDN Domain   SDN Domain

6G N2/N3

6G N2/N3

Core NFs for 6G

- Security context enhancements for CP offloading (e.g., Proxy location updates by MgtN)
- Authentication support for subnetworks
- Introduction of Device Groups and multimodality among those
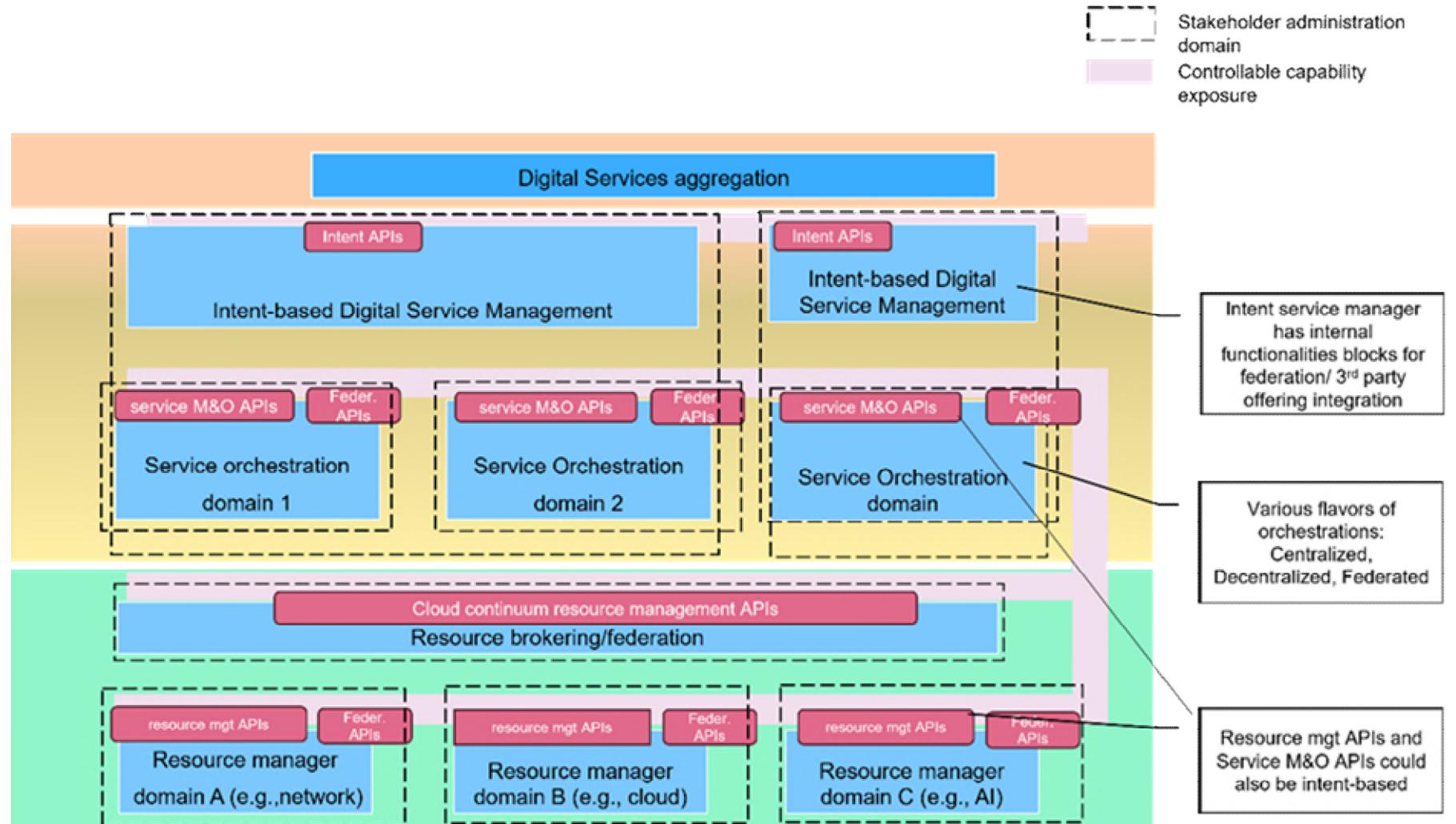
Subnetworks

System view on multi-stakeholder support

A single Federation interface supporting various models (peer to peer/brokering)

Controllable capability exposures (of services, M&O and federation capabilities)

A same Intent APIs on NBI or E/WBI for service requests from a service customers

System view on AI/ML and data framework

Each layer contributes to AI/ML processes.

AIaasF: exposure framewok for various consumers, providing customized AI services tailored for the 6G ecosystem.

AI Orchestrator: Manages AI service deployment, execution, and lifecycle.

AI/ML Catalogue: Stores pre-trained AI models, algorithms, and metadata.

MLOps Orchestrator: Manages the end-to-end lifecycle of AI/ML models.

Data Framework: ensures data collection, processing, and governance, adhering to regulatory requirements.
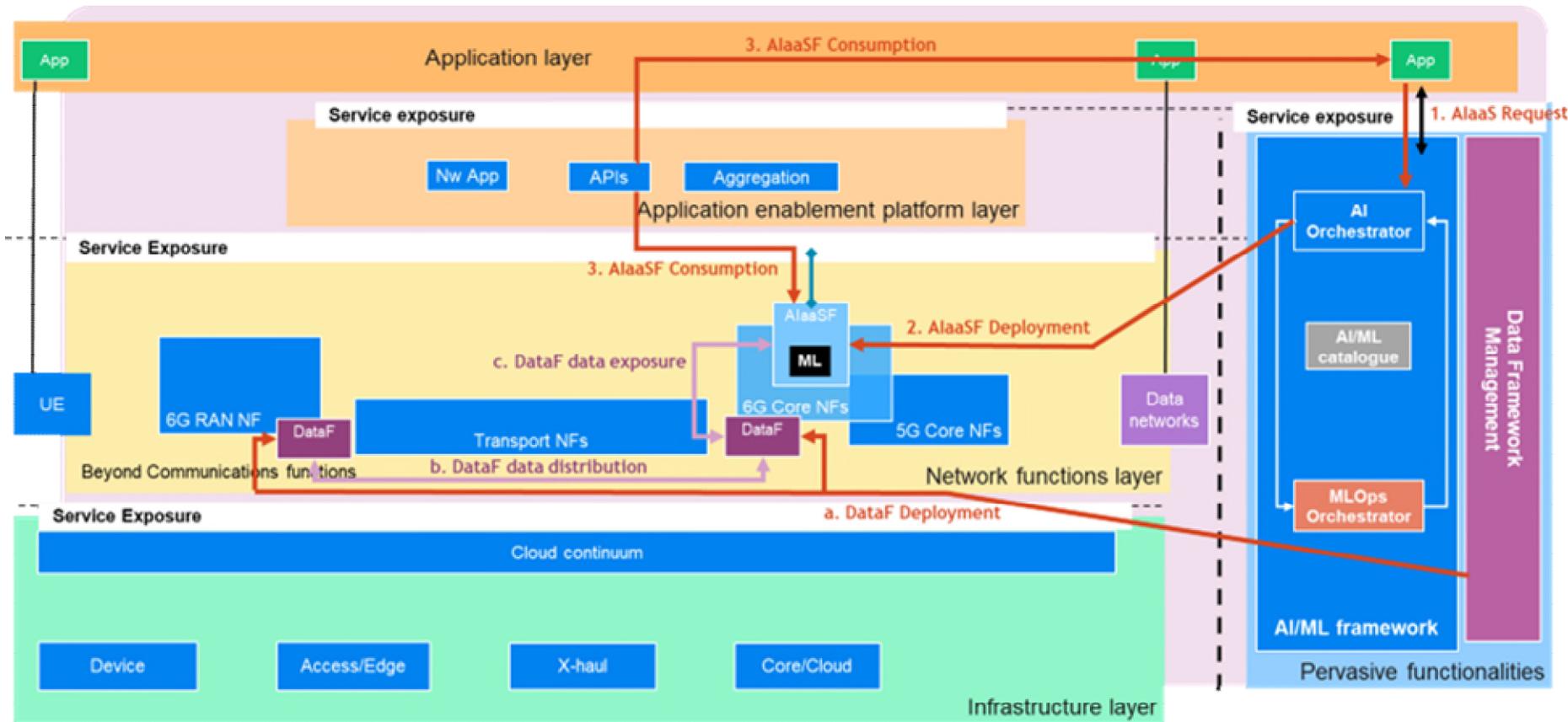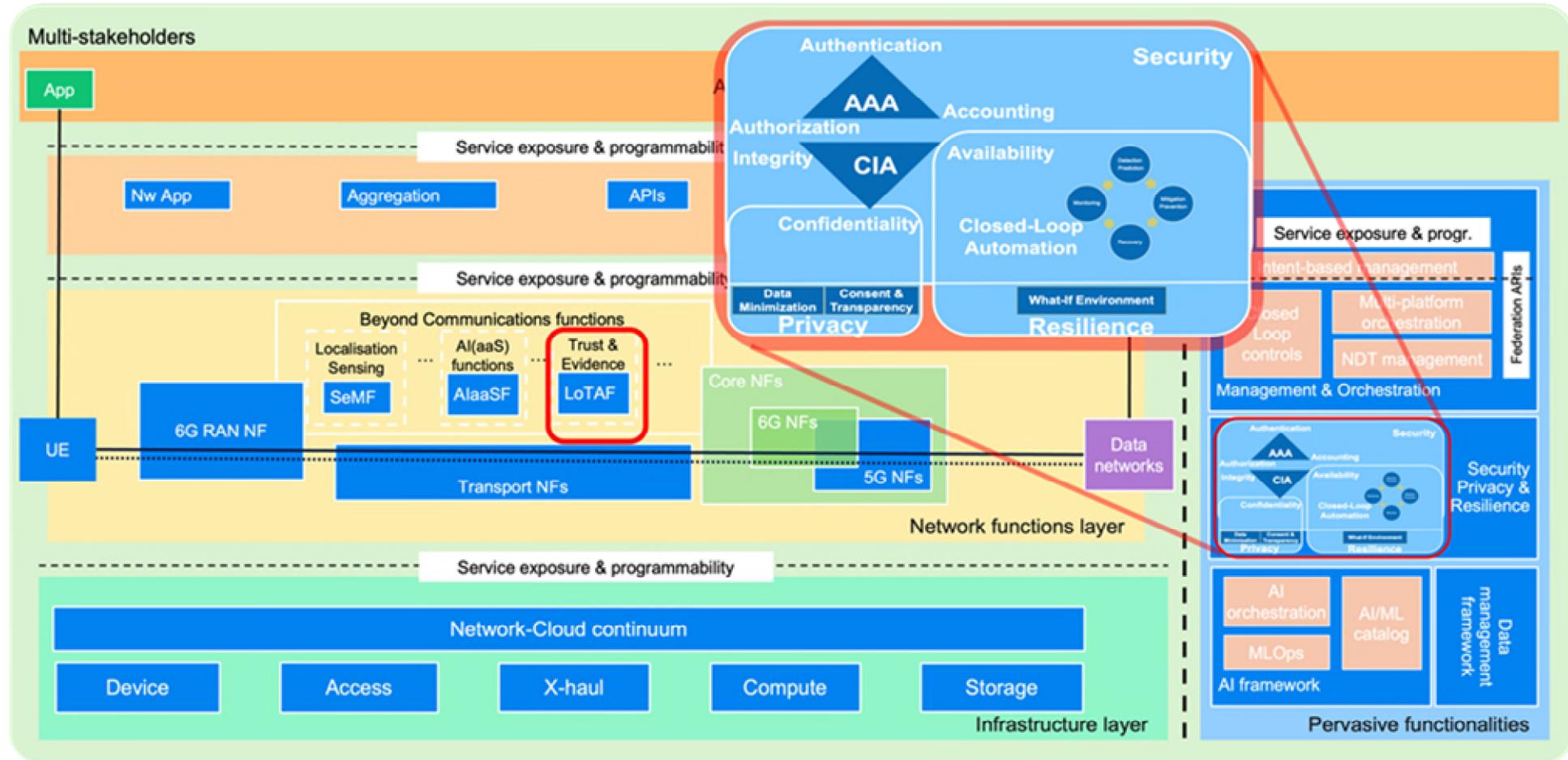
System view on Security, Privacy & Resilience (SPR)

SPR controls featuring confidentiality, integrity, availability, authentication, authorization, privacy and resilience.

applied across different layers of the 6G system

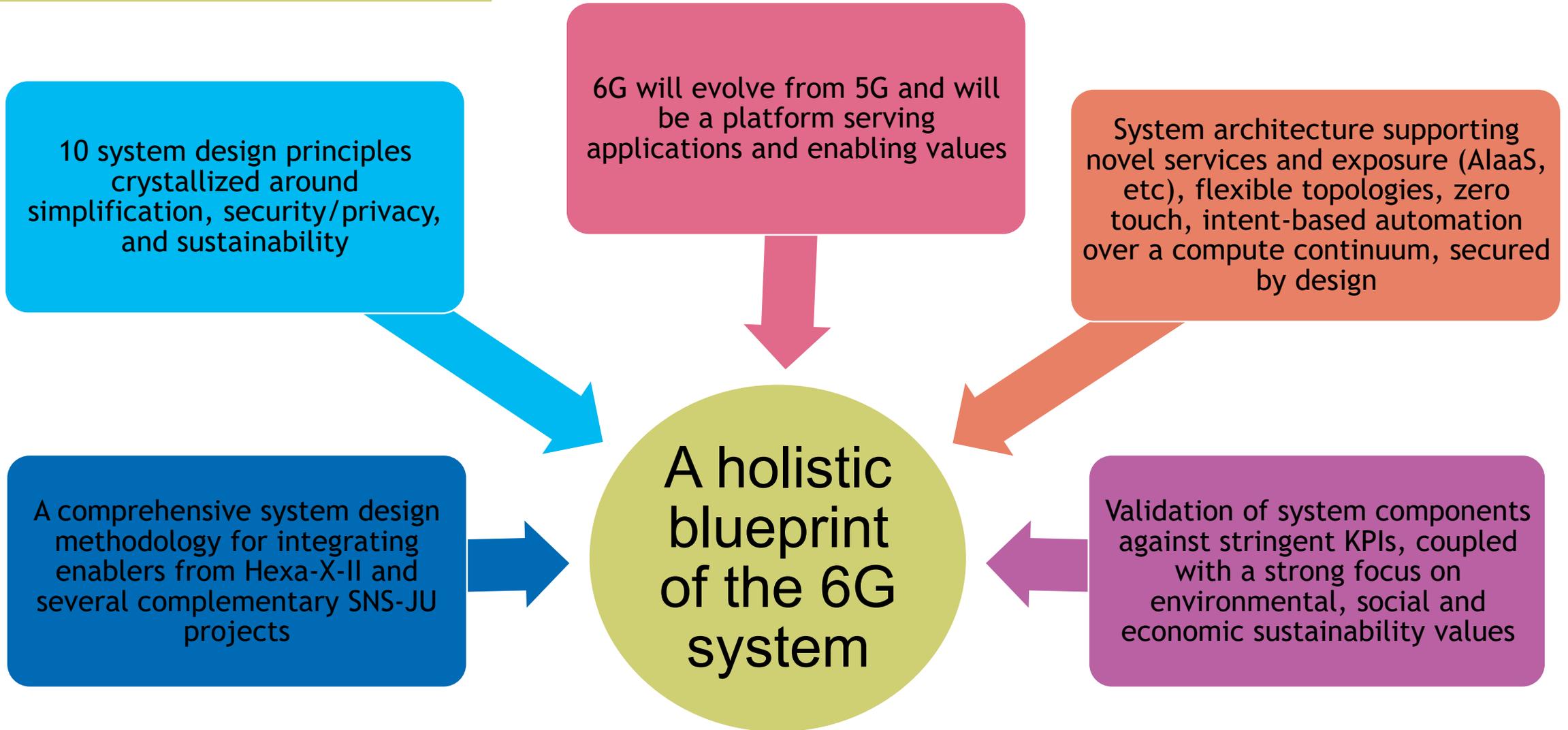- **System-level resilience:** Ensuring closed-loop automation for security management.

- **Multi-stakeholder ecosystem:** Addressing security challenges t with proper isolation and trust mechanisms.

- **New 6G services:** Securely exposing services and capabilities provided by the 6G platform with strong authentication, authorization, and quantum-safe cryptography.

- **LoTAF and notary services**

Concluding remarks

Key take-aways

10 system design principles crystallized around simplification, security/privacy, and sustainability

6G will evolve from 5G and will be a platform serving applications and enabling values

System architecture supporting novel services and exposure (AIaaS, etc), flexible topologies, zero touch, intent-based automation over a compute continuum, secured by design

A comprehensive system design methodology for integrating enablers from Hexa-X-II and several complementary SNS-JU projects

A holistic blueprint of the 6G system

Validation of system components against stringent KPIs, coupled with a strong focus on environmental, social and economic sustainability values

D2.1, D2.2, D2.3 and D2.4 (soon) WP2 deliverables are available on https://hexa-x-ii.eu/results/

Want to learn more on deliverables of Hexa-X-II WP2?

- "Deliverable D2.1: Draft foundation for 6G system design," June 2023

- "Deliverable D2.2: Foundation of overall 6G system design and preliminary evaluation results," December 2023.

- "Deliverable D2.3: Interim overall 6G system," June 2024.

- "Deliverable D2.4:End-to-end system evaluation results from the interim overall 6G system," September 2024.

https://hexa-x-ii.eu/results/

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Deliverable D2.5
Final overall 6G system design

Co-funded by the European Union

6GSNS

Hexa-X-II project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101095759.

Date of delivery:	30/04/2025	Version:	0.1
Project reference:	101095759	Call:	HORIZON-JU-SNS-2022
Start date of project:	01/01/2023	Duration:	30 months

Coming June 2025

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 D2.6
Final end-to-end system evaluation results of the overall 6G system design

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