



INTEGRATED SENSING, ENERGY
AND COMMUNICATION FOR 6G
NETWORKS



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6G SNS

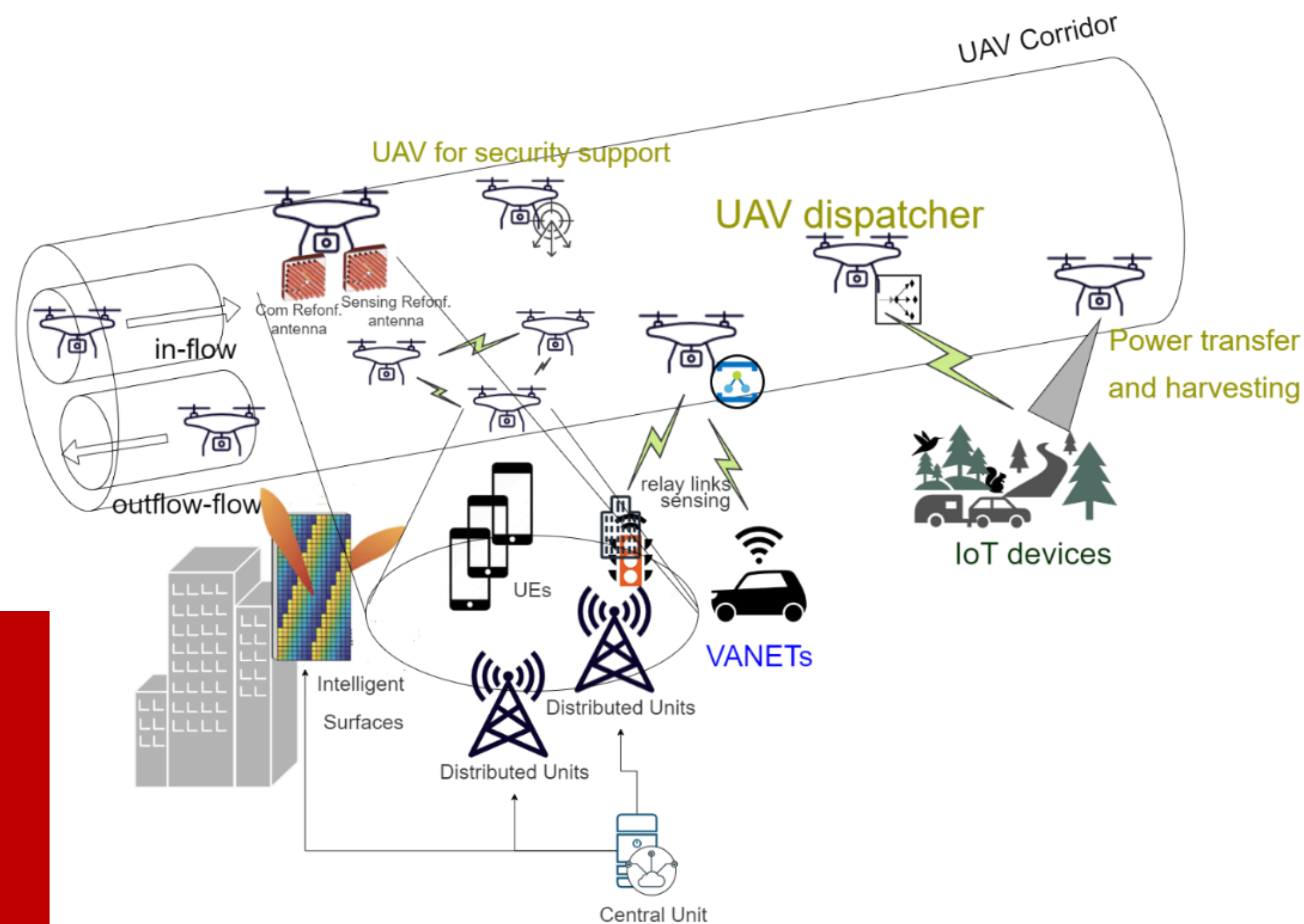
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CONSORTIUM



iSEE-6G INTEGRATED SENSING, ENERGY AND COMMUNICATION FOR 6G NETWORKS

- Beyond joint communication and sensing
- Definition & development of Joint Communication, Computation, Sensing, and Power transfer (JCCSP) unified radio paradigm



Use Case: 6G-enabled/supported Aerial Corridors

- JCCSP-oriented passive and active antennas solutions with intelligent reconfiguration capabilities
- JCCSP-optimized Physical Layer design
- JCCSP-enabled cross-layer schemes design
- Positioning with MEC support using 6G and UAVs network.

iSEE-6G In a Nutshell

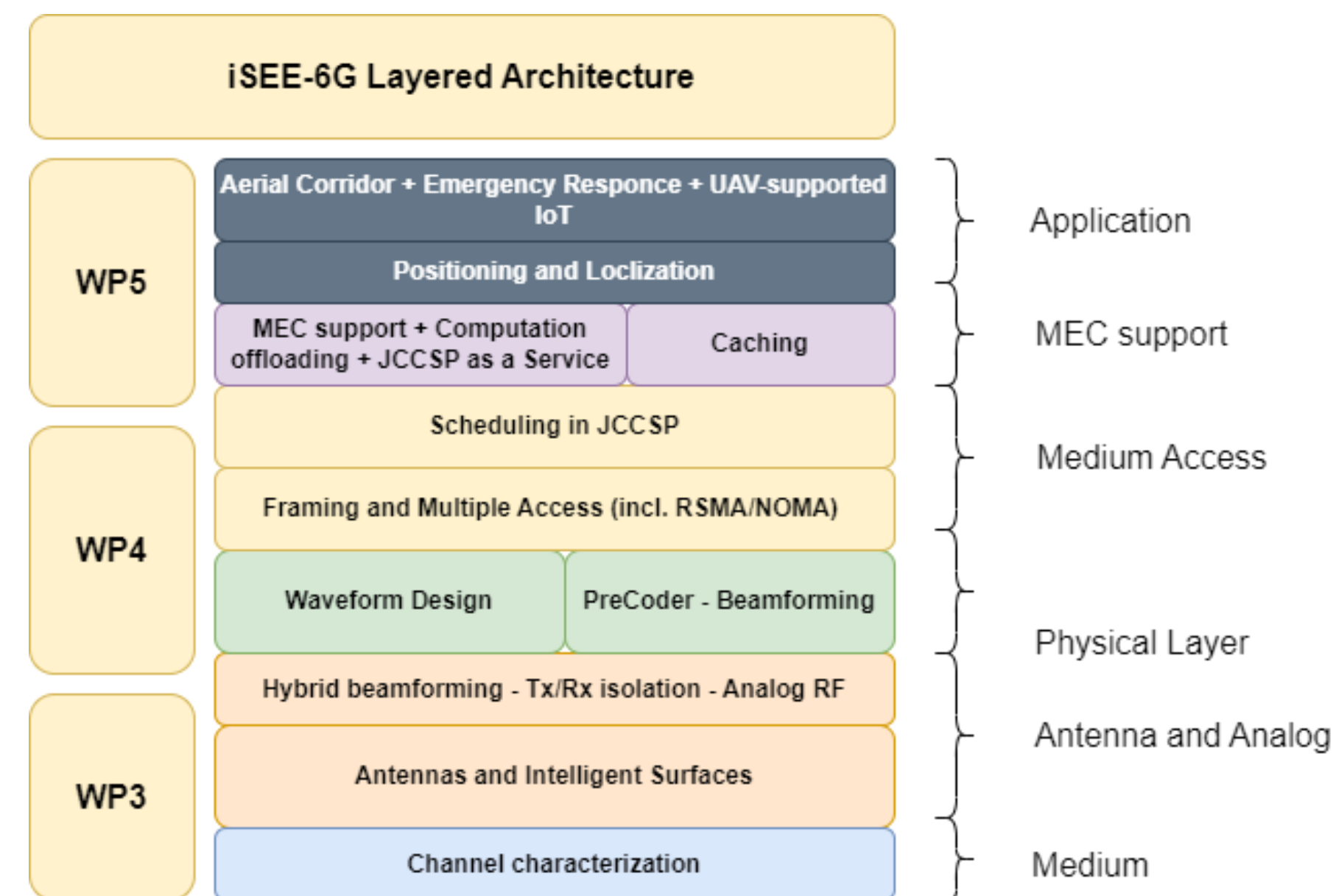
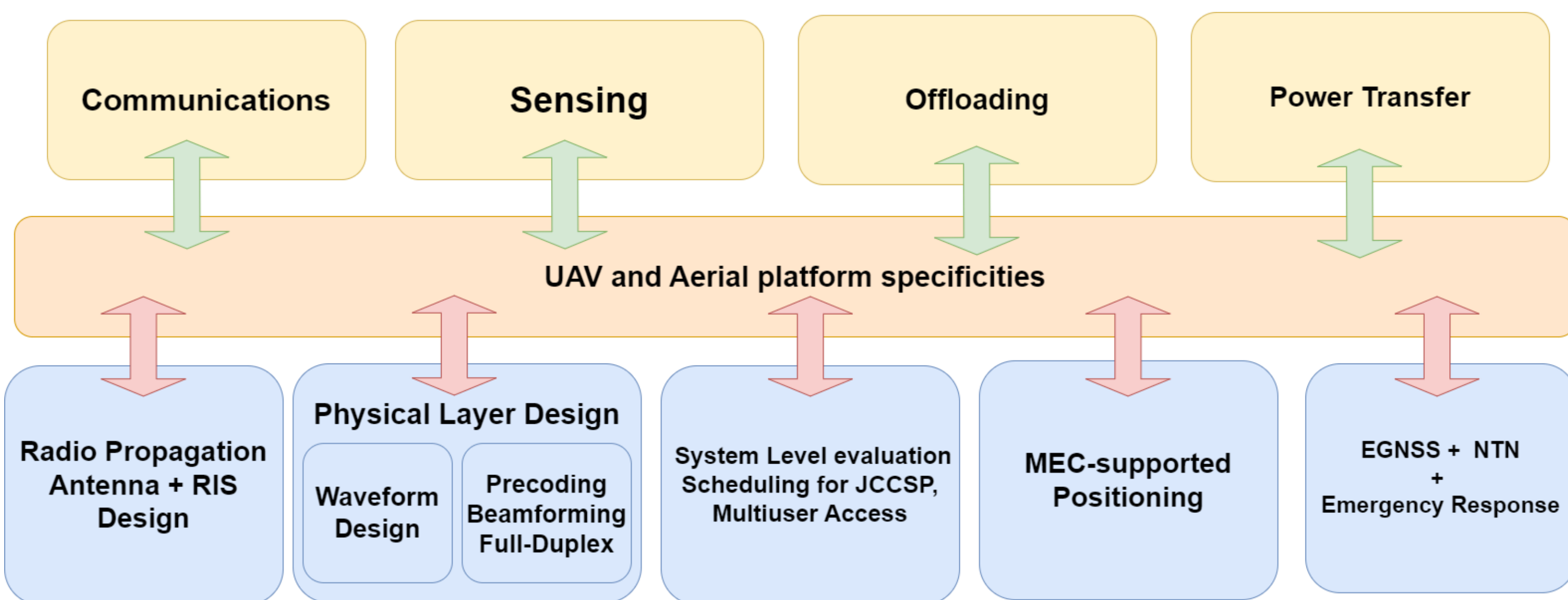
iSEE-6G proposes:

investigation, definition, and development of a Joint Communications, Computation, Sensing and Power harvesting/transfer (JCCSP) unified platform accompanied with all supporting elements of the proposed solution in the future 6G protocol by integrating, exploiting, and supporting 6G key enabling technologies.

The framework focuses on:

- *novel passive and active antenna solutions with intelligent reconfiguration capabilities;*
- *jCCSP-optimized physical layer design including waveform design and analysis, frame structure design, pre-coding/beamforming with respect to the Open Radio Access Network (ORAN) architectural paradigm;*
- *cross-layer schemes under the new capabilities (scheduling for JCCSP) and integrating JCCSP in the service-oriented architecture with introduction of new functionalities (enhanced positioning and topology management) towards a cell-free 6G network.*

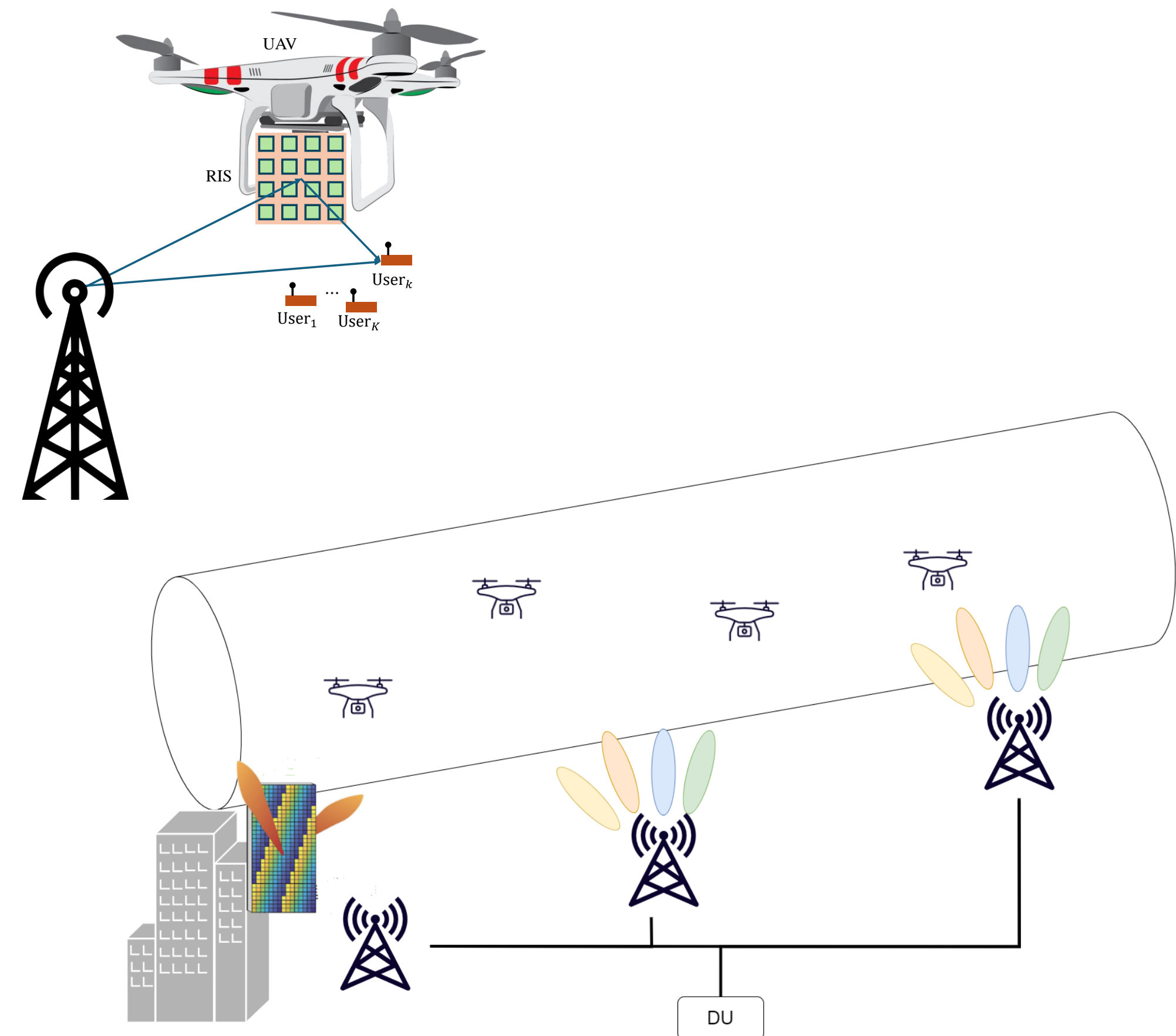
Main research axes and domains



UAVs (and corridors) as USE CASE

UAVs with multiple roles in 6G:

- Contributors for the “cell-free” 6G paradigm in conjunction with multi-dimensional antennas, reconfigurable intelligent or holographic surfaces, and more – providing exceptional beamforming capabilities in the three-dimensional (3D) space.
- Support next generation of backscatter communication.
- Energy harvesting and are expected to become the means for wireless charging.
- Means for designing energy efficient communication systems and green communications in general offering new 3D tools for radio planning and optimization, as well as enabling energy-efficient relays.
- Flying mobile edge computing devices servicing low-end devices under the massive connectivity IoT paradigm.



Overarching Objective

iSEE-6G proposes a holistic layered architecture that investigates, for the first time, Joint Communications, Computation, Sensing and Power transfer

- from radio channel and the reconfigurable, intelligent antenna to
- the UAV-supported applications focusing on accurate localization, Public Protection and Disaster Relief (PPDR) and IoE.

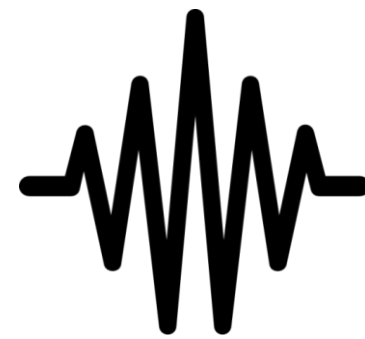
Following a bottom-up methodological approach with continuous verification, iSEE-6G validates the developed technologies through:

- simulation;
- laboratory, clean-room experiments (with hardware-in-the-loop),
- and two large-scale PoCs in testbed facilities.

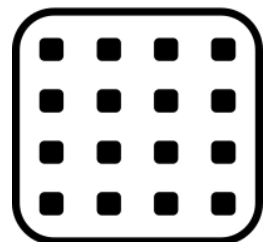
Objectives



To measure and characterize the JCS-radio propagation channel (focusing on mmWave and aerial platforms).



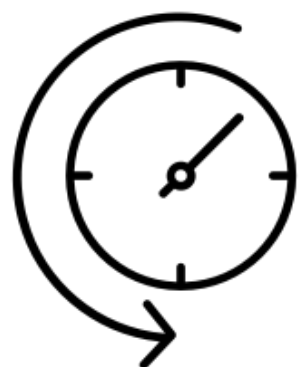
To design and evaluate waveforms for JCCSP.



To design, fabricate and measure antenna systems and reconfigurable surfaces for the iSEE-6G use cases.

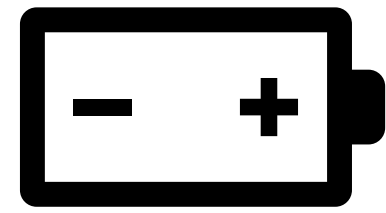


To investigate beamforming schemes (hybrid, widely-distributed, aerial-supported) for the contradicting requirements of the JCCSP concept.

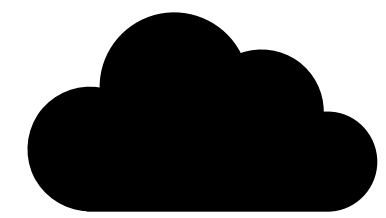


To investigate new framing schemes, new scheduling and multiple access schemes (orthogonal or not) for the JCCSP paradigm.

Objectives



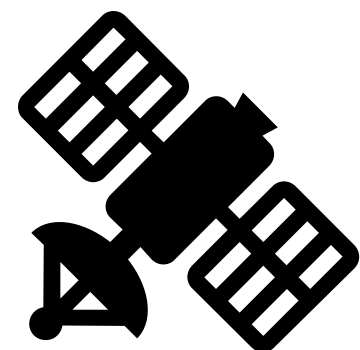
To investigate system-level energy efficiency in the JCCSP context considering MEC support



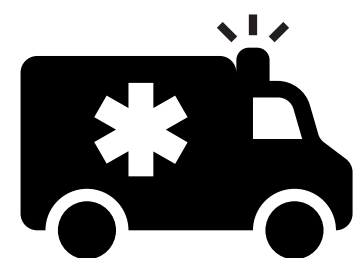
To develop wireless edge caching schemes and techniques to support sensing or power related information exchange



To develop a MEC-enabled system for enhanced positioning and mapping.

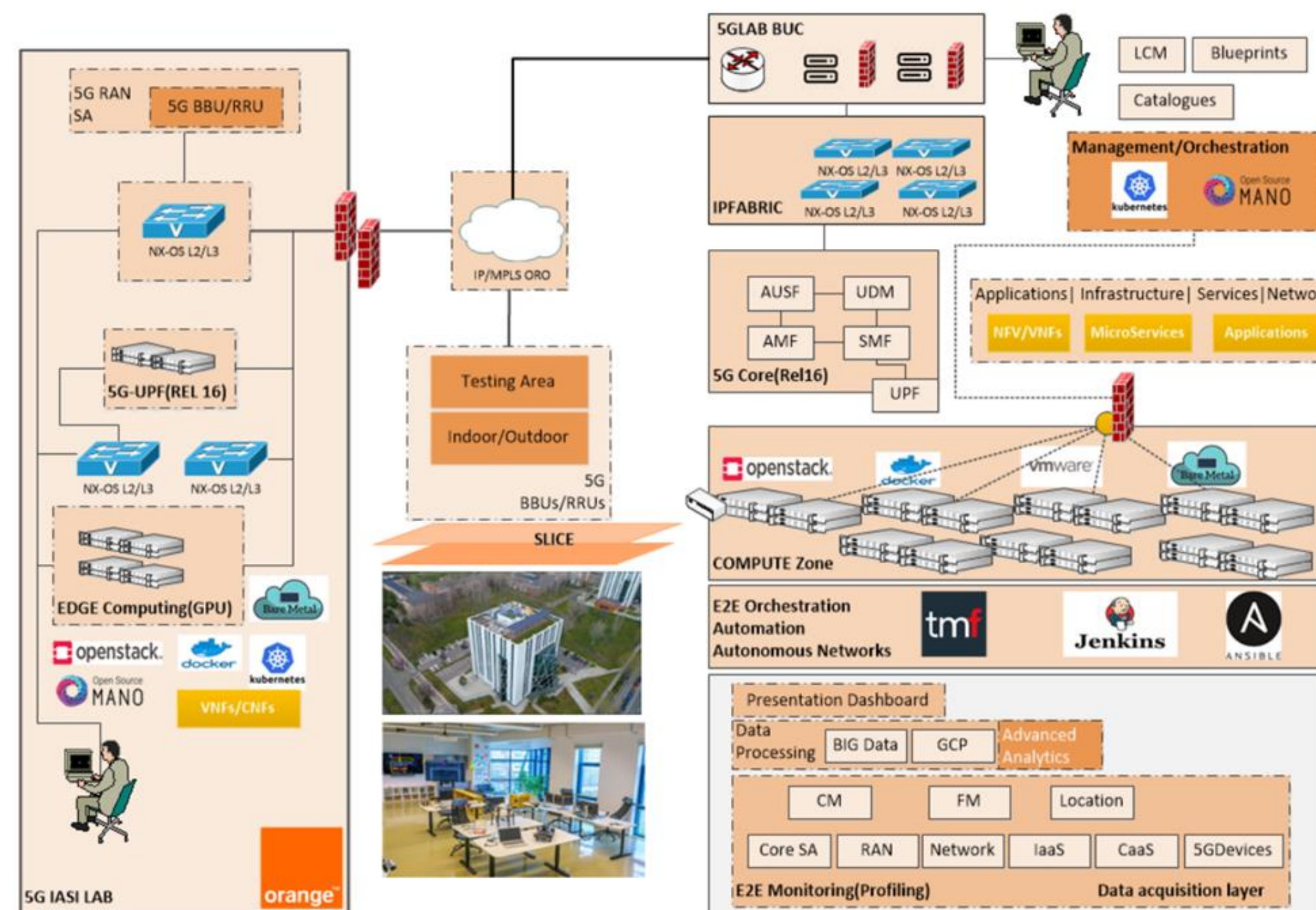


To develop AI-enabled collaborative positioning algorithms fusing also information from EGNSS.

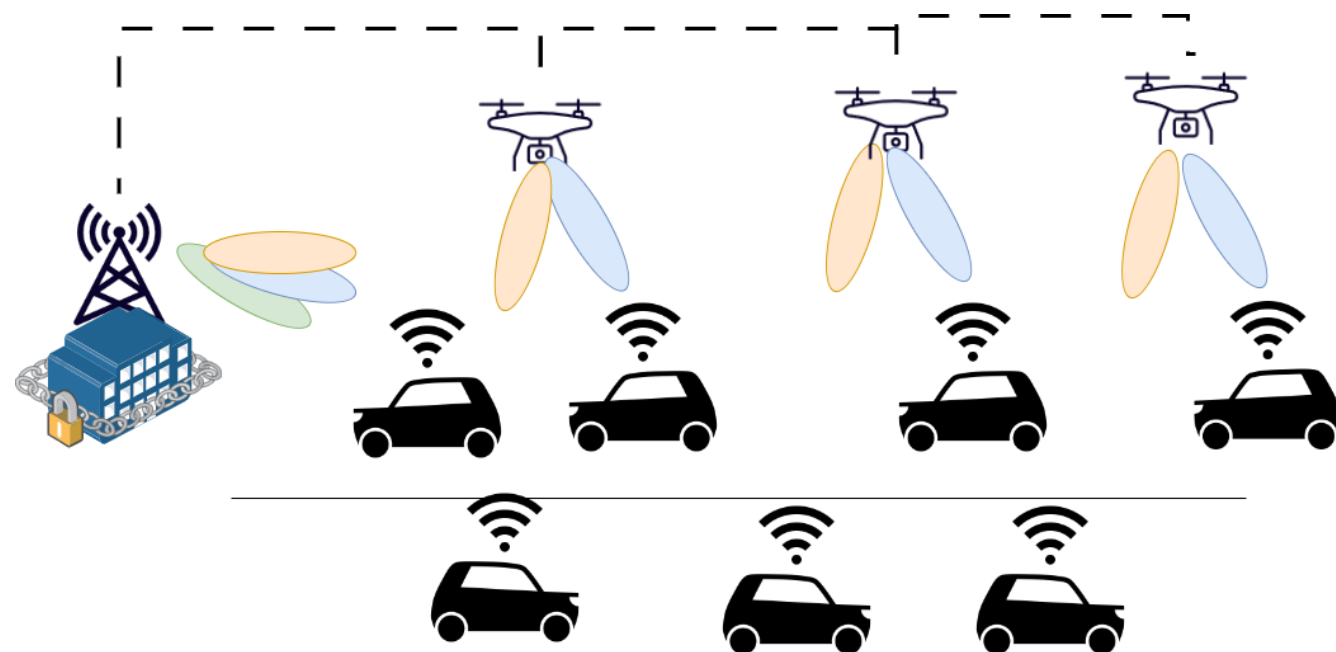


To integrate the new services to an emergency response collaborative platform.

Proof-of-Concept experiments



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THANKS!

Any questions?

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