MultiX Vision and Technical Approach

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Project Data

- HORIZON-JU-SNS-2024-STREAM-B-01-02
- MultiX - Advancing 6G-RAN through multi-technology, multi-sensor fusion, multi-band and multi-static perception
- Budget: 8.479.892,50
- Partners: UC3M, APP, OTE, INT, IDE, NEC, SAG, TSA, BBR, NXW, CNIT, i2CAT, IMDEA, IHP, IASA, KUL, UC

Key Objectives

Provide use cases and reference scenarios that can show the benefits of MultiX

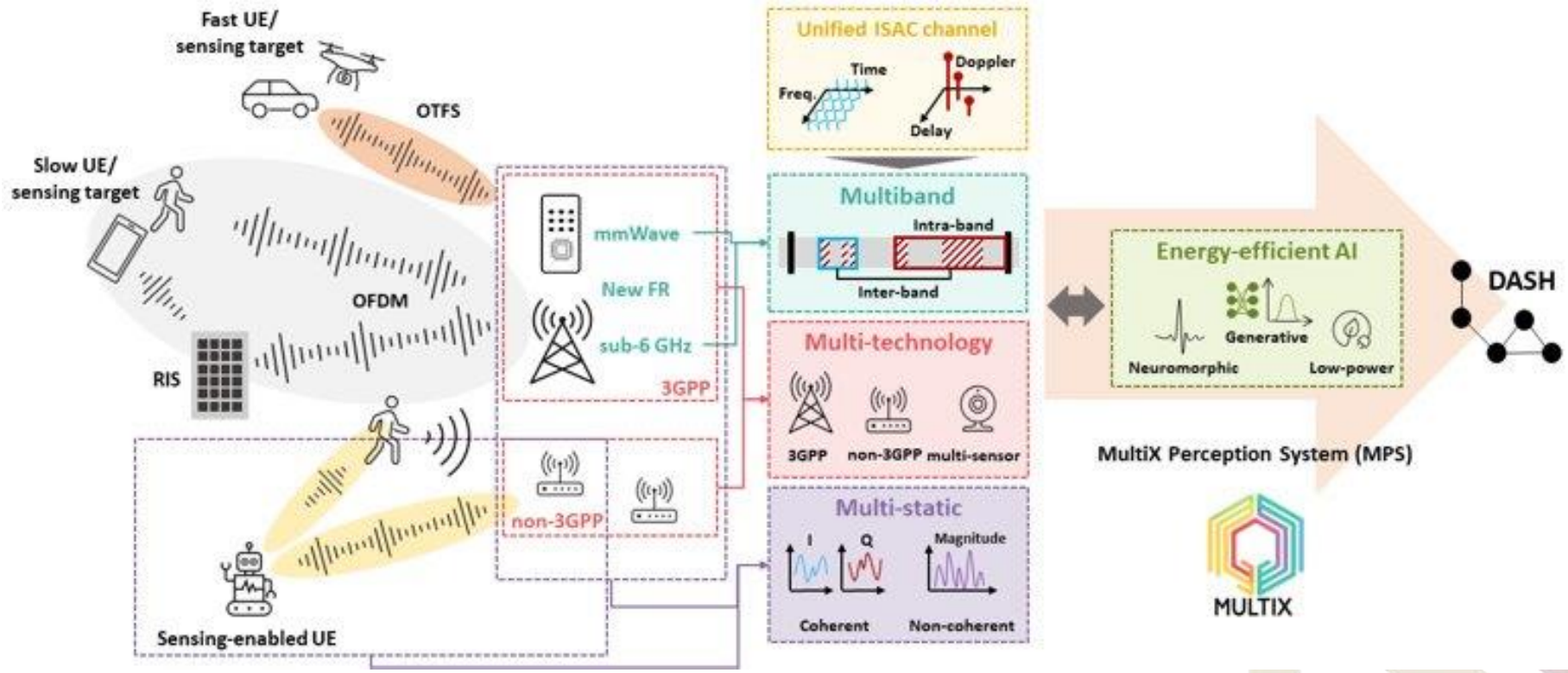
Integrate multi-technology, multi-sensor, multi-band, and multi-static perception into the MP6R

Design and develop the MultiX perception system (MPS)

Demonstrate the benefits of the MultiX system in Proof of Concepts (PoC)

MultiX Challenges

Most ISAC research focuses on a single wireless technology, either 3GPP or non-3GPP (e.g., IEEE 802.11). Meanwhile, traditional sensing relies on diverse sensors like LiDAR, cameras, and radars.

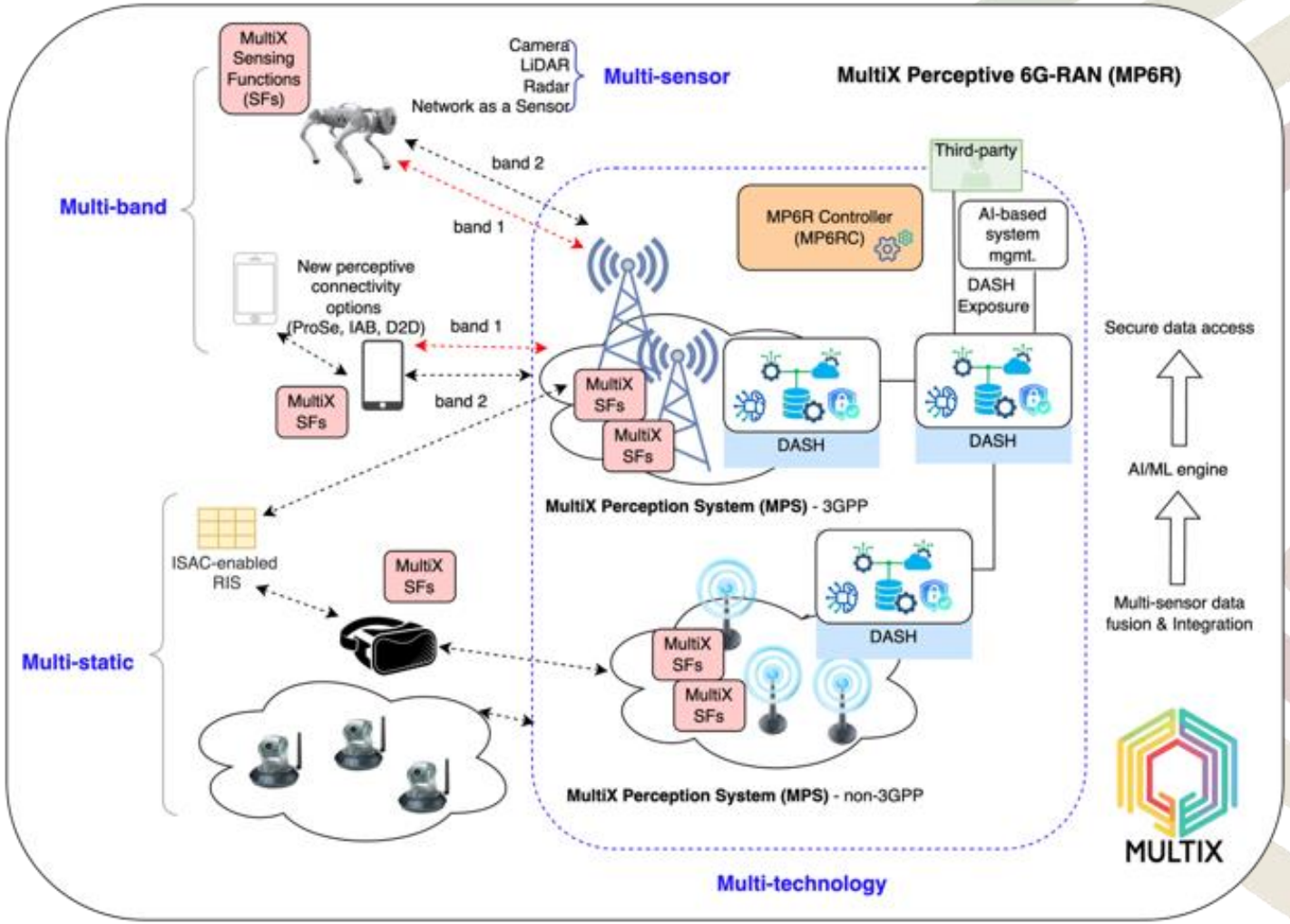


The key challenge for ISAC is how to manage network heterogeneity and fully integrate various sensing sources and ISAC technologies throughout the RAN up to the User Equipment (UE) across different layers of the RAN stack.

MultiX Vision

The MultiX project seeks to redesign the 3GPP RAN system to develop the MultiX fusion Perceptive 6G-RAN system (MP6R).

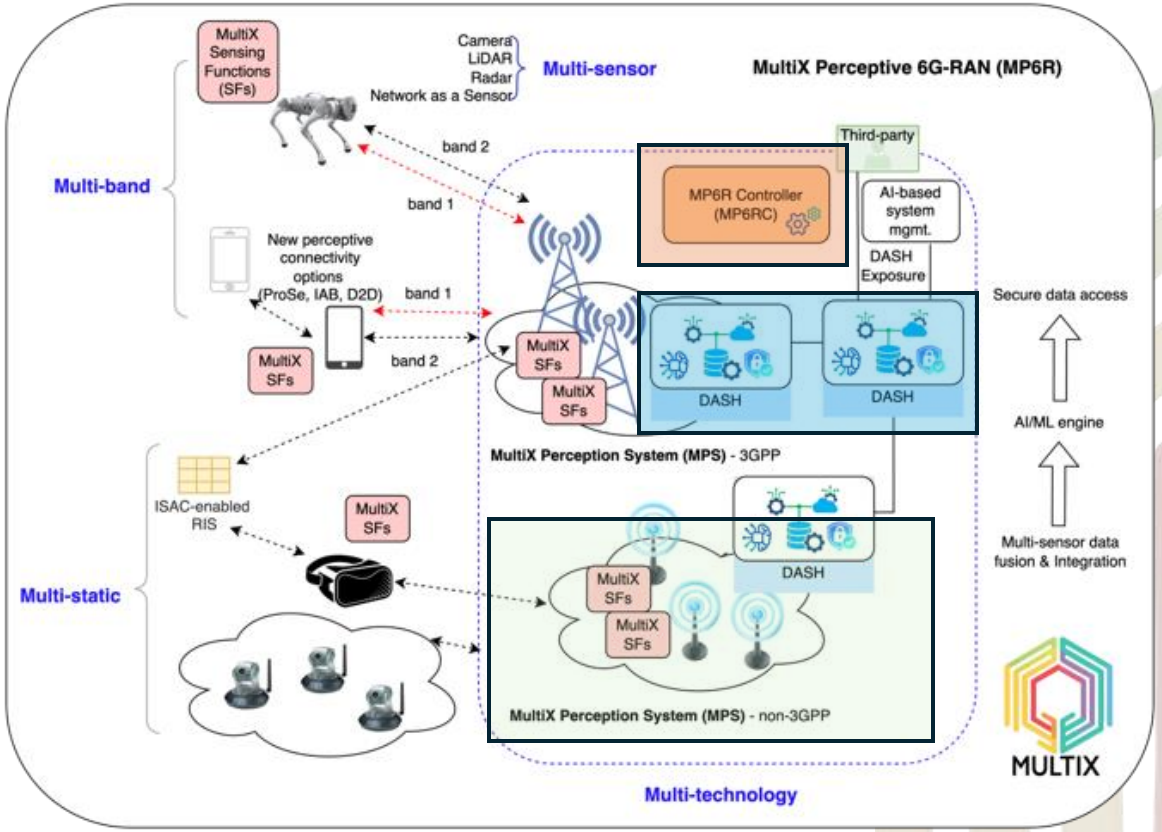
Multi-sensor fusion: Combining LiDAR, cameras, radar, and network-based sensors.
Multi-band operation: Leveraging Sub-6 GHz, mmWave, THz, and emerging frequency ranges like 7-24 GHz.
Multi-static processing: Utilizing signals transmitted by one or multiple nodes and processed by multiple receivers.
Multi-technology integration: Merging 3GPP cellular networks with non-3GPP technologies, including various Wi-Fi versions.



MultiX Concept

MultiX Perception System (MPS) focuses on developing MultiX sensing functions at the different layers of the RAN stack at the RU, DU, or a fully-fledged BS, and up to the UE device across the RAN system for multi-band, multi-static, multi-sensor, multi-technology deployments, and joint signal processing.

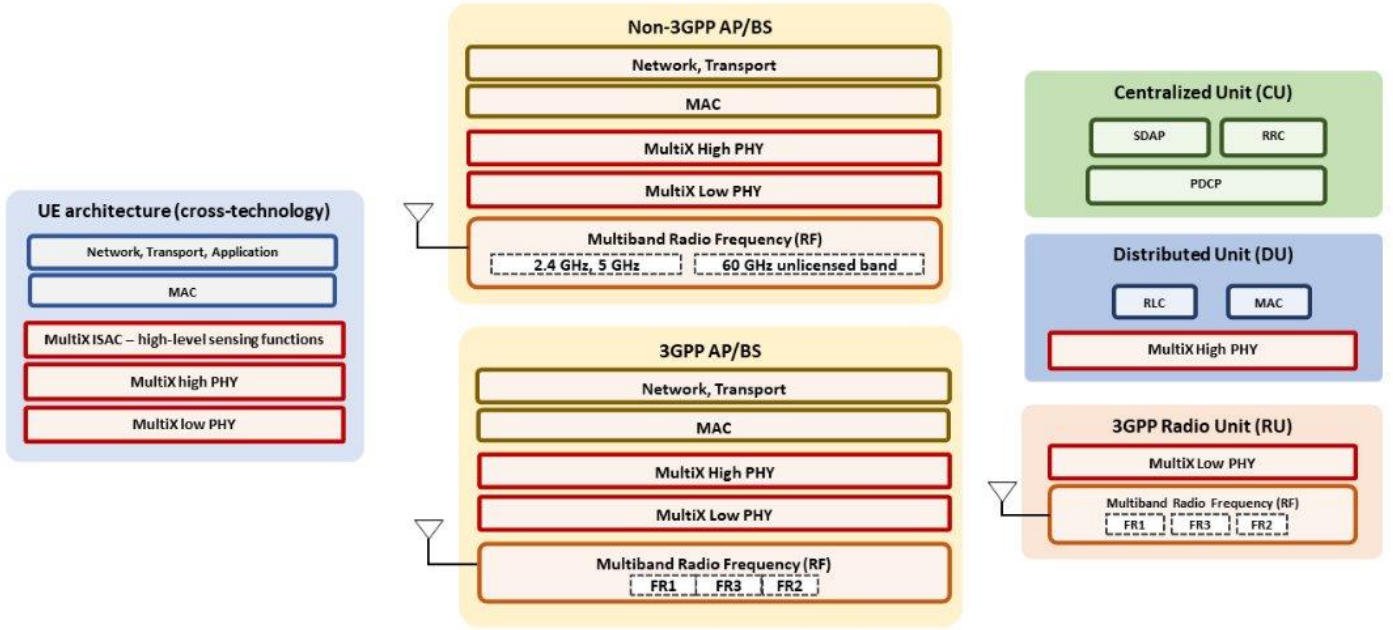
MP6R Controller (MP6RC) serving as the brain of the MP6R system, to i) coordinate and control multi-technology integration and mobility management of the sensing objects inside the RAN; and ii) interface and manage distributed DASH nodes throughout the RAN for handling multi-sensor, multi-connectivity, and multi-technology data integration.

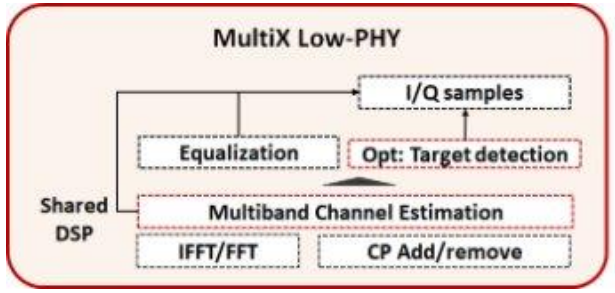


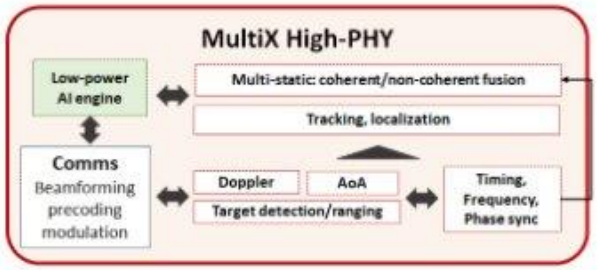
Data Access and Security Hub (DASH) designed as a novel RAN data plane entity that aggregates multi-sensor data of diverse technologies, providing secure data access, processing, storage, and exposure, ensuring data privacy and trustworthiness, and that can be fully distributed throughout the data plane wherever needed in the 6G-RAN.

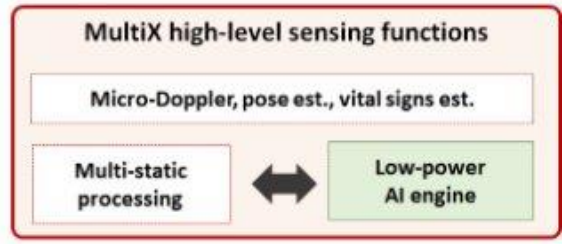
MultiX Perception System (MPS)

- **Unified ISAC channel** models for multi-technology and multi-band perception
- **Signal processing algorithms** that, leveraging on such unified channel models, provide multi-band ISAC functionalities
- **Multi-static sensing** through distributed MIMO to achieve high perception resolution through multi-static signal processing techniques.
- **Multi-modulation–based sensing** exploiting OFDM or OTFS modulated signals.
- **Design of novel Energy-efficient AI** architectures for adaptive, event-based ISAC receivers and distributed learning from multi-static sensing devices

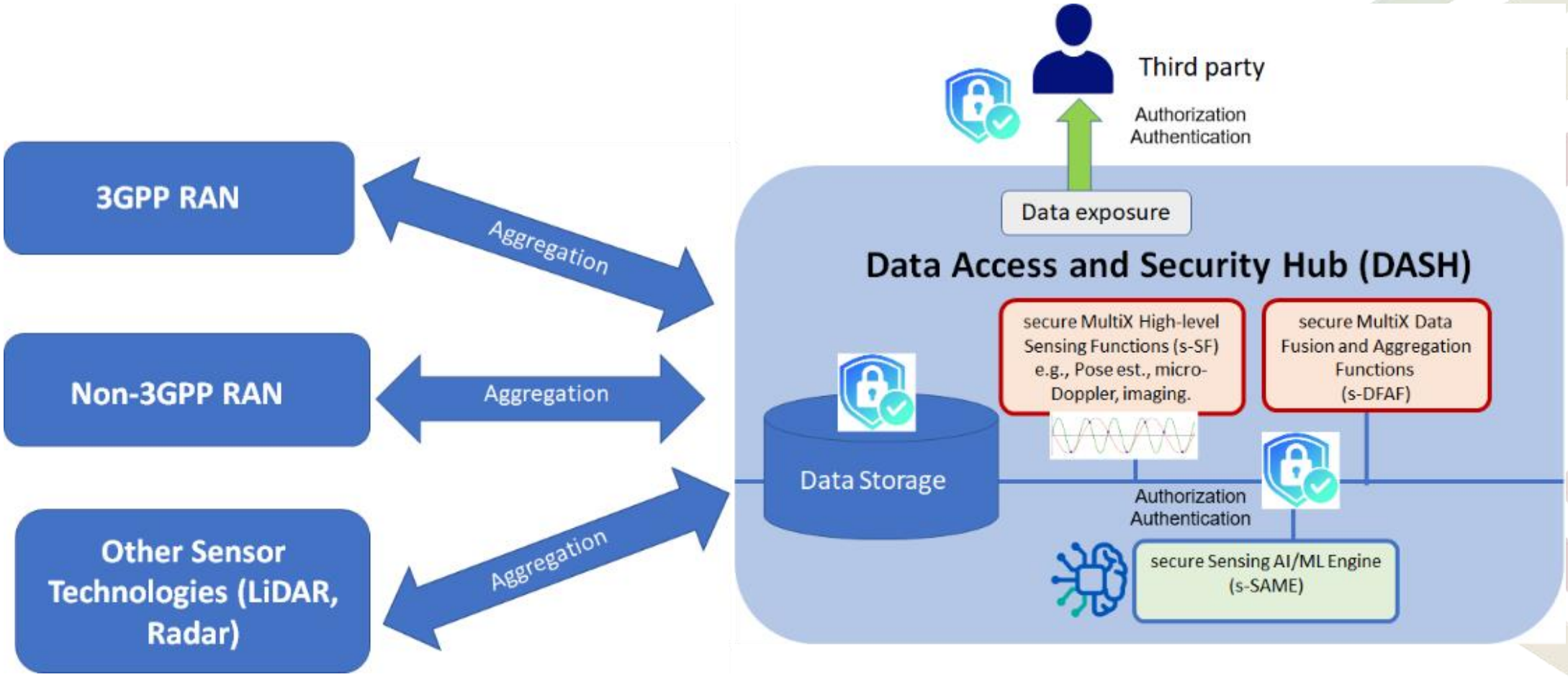






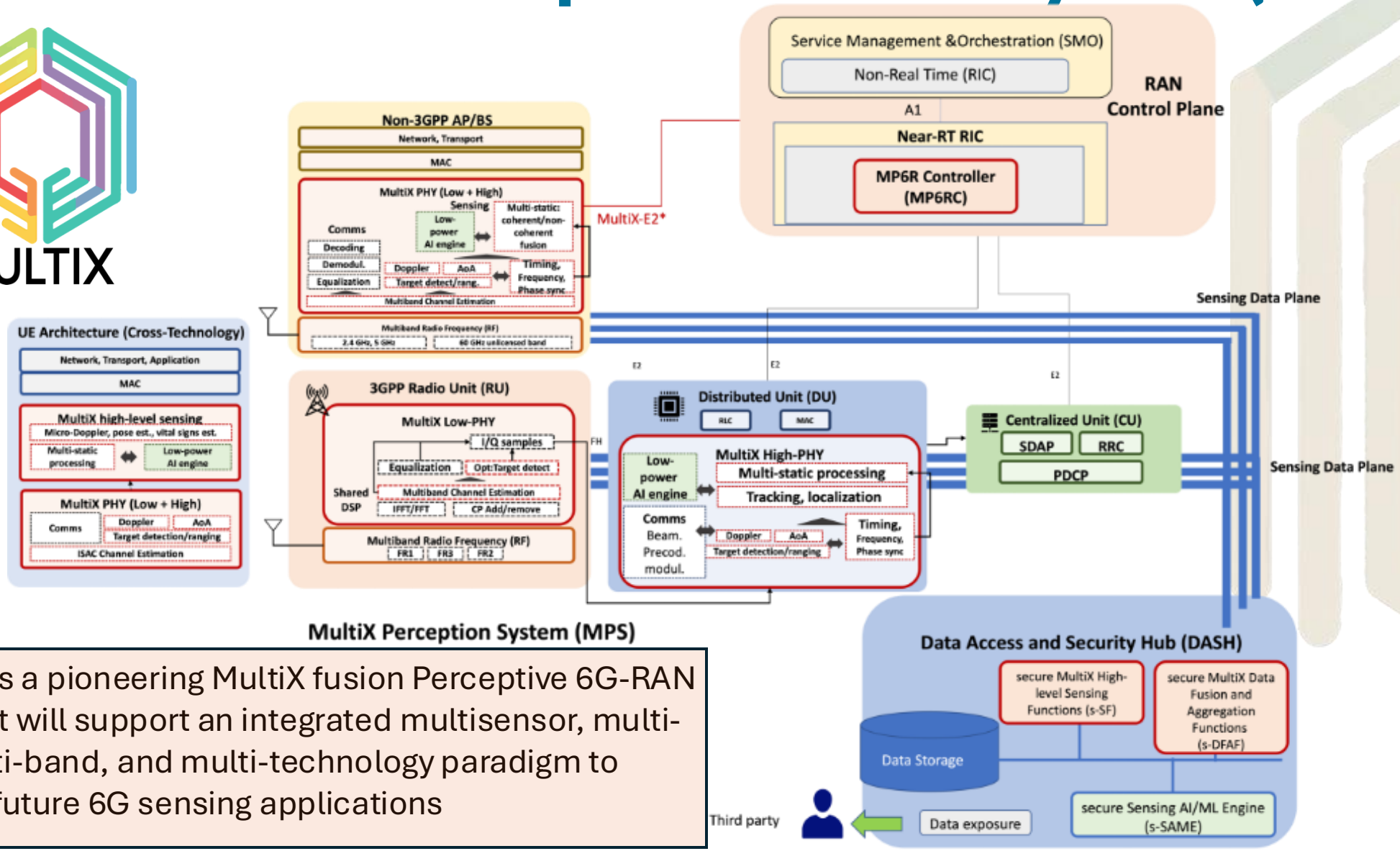


Data Access and Security Hub (DASH)



To develop a full distributed and secure Data pipeline, responsible for secure data collection, aggregation, and distribution.

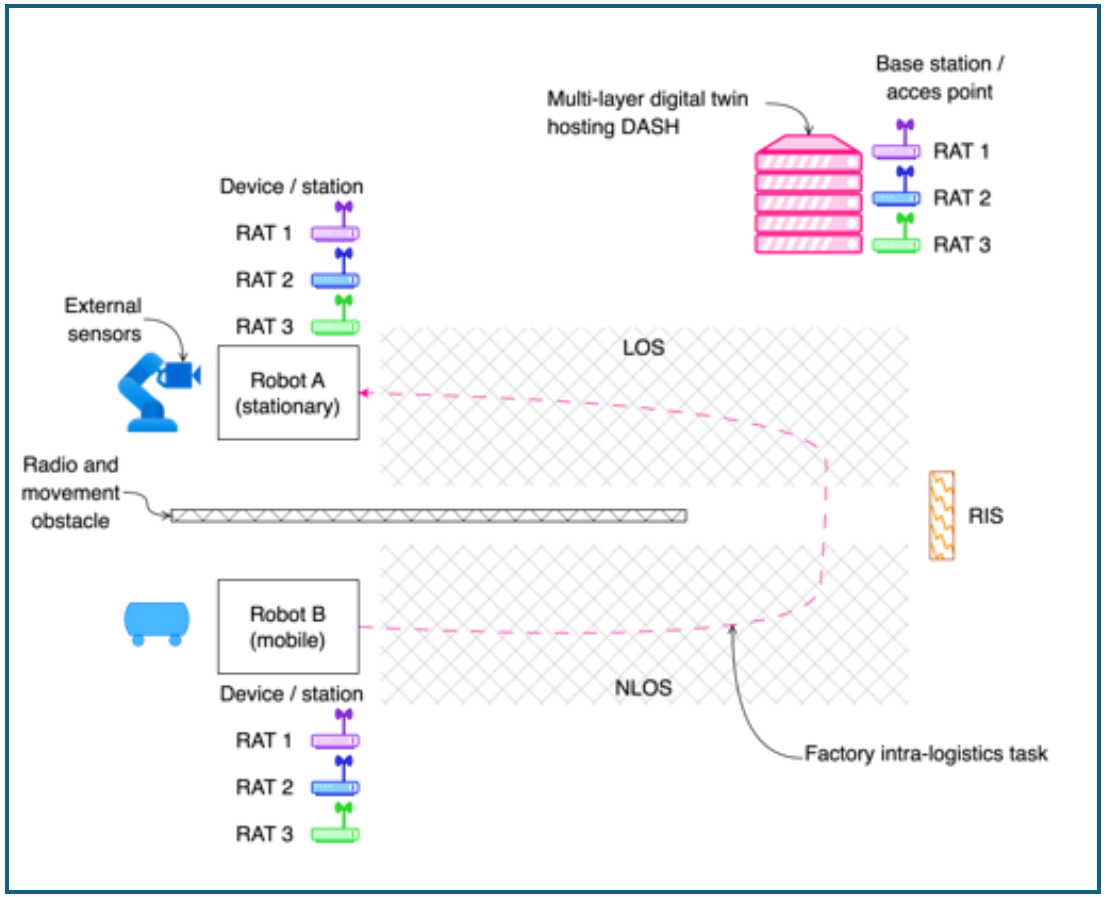
MultiX fusion Perceptive 6G-RAN system (MP6R)



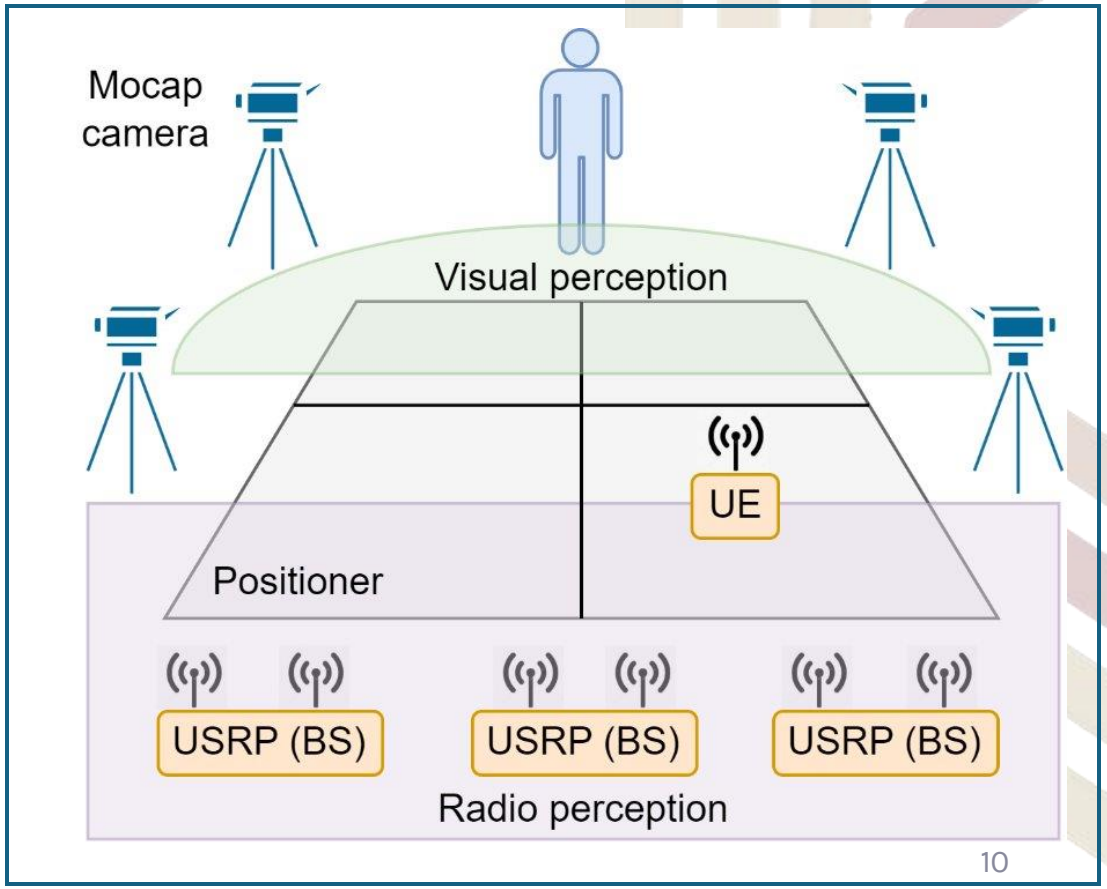
The MP6R is a pioneering MultiX fusion Perceptive 6G-RAN system that will support an integrated multisensor, multi-static, multi-band, and multi-technology paradigm to enable for future 6G sensing applications

Multi X Proof of Concepts (PoC)

PoC#1: Multi-layer Network Digital Twin for Industrial Manufacturing



PoC#2: Contact-free eHealth Monitoring at Home Environment



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