

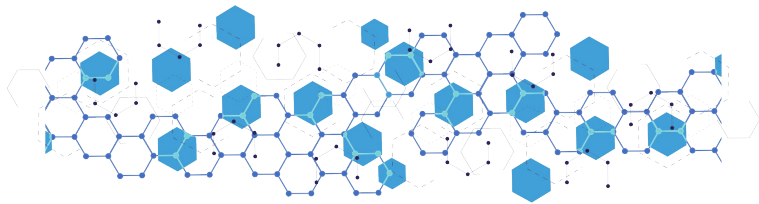
6G SNS

Open Calls – Results 6G-BRICKS Project



SUMMARY OF EXPERIMENTS AND IMPLEMENTATIONS

Results Achieved by 3rd Parties involved in 6G SNS Projects through the mechanism of Cascading Funding – Open Calls



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6G-BRICKS PROJECT

Building Reusable testbed Infrastructures for validating
Cloud-to-device breakthrough technologies

OVERVIEW

6G-BRICKS aims to deliver an open, modular, and evolvable 6G experimentation facility that builds on mature ICT-52 platforms. It combines cell-free networking, distributed processing, and Reconfigurable Intelligent Surfaces (RIS) under a unified, software-defined and open architecture. Adopting virtualisation, softwarisation, and Open RAN interfaces, the project ensures interoperability and scalability. Its modular “LEGO Bricks” concept structures the architecture into self-contained, reusable testbed nodes that can be easily federated across infrastructures, reducing integration complexity and enabling fast experimentation.

Main Objectives

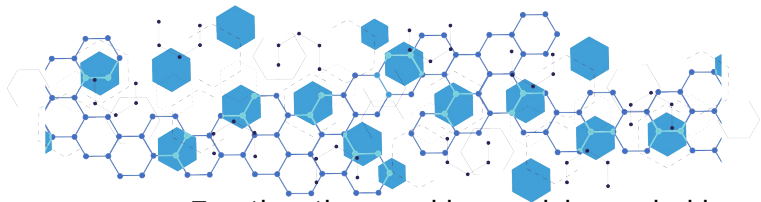
- 1) Deliver an evolvable 6G facility integrating breakthrough technologies.
- 2) Validate and showcase advanced use cases in the metaverse and digital twinning.
- 3) Promote modularity and reusability through virtualisation, softwarisation, and Open RAN.
- 4) Provide a decentralised management plane with Explainable AI for zero-touch orchestration.
- 5) Develop a Compute Continuum framework for disaggregated wireless X-Haul.
- 6) Deliver breakthrough 6G RAN technologies via distributed Cell-free and RIS enablers.

Architecture and Innovation Areas

The facility federates two experimentation sites (Belgium – KUL and France – EUR) under a Core Site (ISI/ATH), which acts as the facility entry point and offers Public Cloud and experimentation services.

Innovation areas include:

- Network-controlled open RIS platform
- Distributed CFmMIMO processing and synchronisation
- Multi-band/mmWave CFmMIMO
- Joint communication and sensing via RIS and cell-free networks
- Explainable AI and Machine Reasoning for orchestration
- Platform-as-a-Service abstraction for the compute continuum



Together, these enable a modular, evolvable, and programmable 6G experimentation ecosystem supporting advanced vertical applications.

Open Calls

To foster openness and community engagement, 6G-BRICKS launched two Open Calls inviting third-party experimenters, SMEs, big companies and research institutions to participate.

Open Call 1 – Experimentation Tools and 6G Enablers

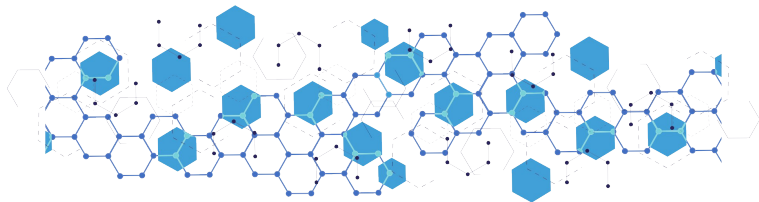
Focused on enhancing the facility's core capabilities through:

- Digital Twins or O-RAN emulation
- NWDAF functions and O-RAN ML frameworks
- Data monitoring and analytics tools
- Experimentation xApps
- RIS or simulated RIS experiments
- Joint Communication & Sensing trials
- XAI-driven causal reasoning and anomaly detection
- Digital beamforming and synchronisation algorithms
- Expansion of facility experimentation capabilities

Open Call 2 – Validation through Vertical Applications and Advanced xApps

Dedicated to validating the 6G-BRICKS testbeds through real-world verticals and advanced xApps:

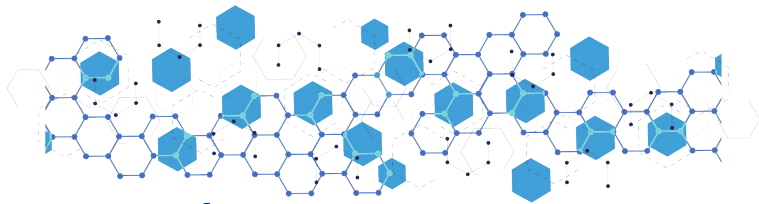
- Vertical applications (e.g., PPDR, media, eHealth, transport, Industry 4.0) validating throughput, latency, coverage, location accuracy, and intent-driven service deployment.
- Experimentation xApps for RIS and cell-free experimentation, including trajectory prediction.



PRESENTATION OF OPEN CALLS PROJECTS

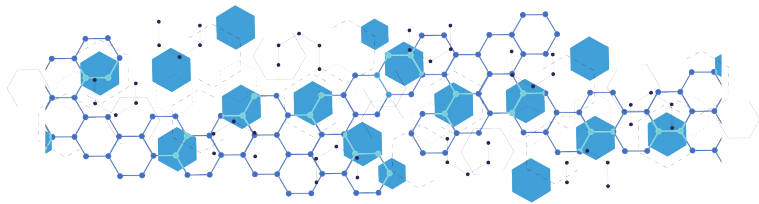
6G-LORE

OC Project Title	6G-LORawan Extension for IoT /6G-LORE
Beneficiary(s)/ Country	ENERGY COMMUNITY BESSARION LIMITED LIABILITY COOPERATIVE
Project Description	Novel communication technologies like LoRaWAN provide a disruptive alternative to cellular networks for large-scale IoT applications. This is particularly evident in rural areas where there is either no 5G coverage or where the cost of 5G is prohibitive (one SIM/cellular connection per point of presence). Moreover, Low-Power Wide-Area Network (LPWAN) technologies prioritize energy efficiency over high data rates. As IoT services rely on battery-powered sensors, ensuring a long network lifetime is the primary objective. 6G-LORE evaluates LoRaWAN as a low-cost, energy-efficient IoT connectivity solution. We are using our deployed LoRaWAN gateway, which covers an underserved rural area in central Greece. Three of our existing end devices have been equipped also with LoRa radio units. We are also developing an application to monitor energy consumption at each endpoint. Our objective is to evaluate the potential energy savings of such LoRaWAN deployments and compare them with those of our current commercial 5G deployment.
Testbed	The testbed developed in 6G-LORE extends the demonstration and experimentation capacity of 6G-BRICKS by deploying a new non-3GPP testbed. It will serve as an open testing environment for real-life experimentation with LoRaWAN in rural areas. Authorized users will be granted access via the ISI/ATH experimentation platform.
Implementation Period	14/10/24-14/06/2025 (extended by 2 months)
Added value/ Results	6G-LORE provides an open framework for testing and evaluating potential energy savings from a LoRaWAN deployment versus 5G. The 6G-LORE deployment and experimentation framework are applicable to all verticals. Experiments conducted on the 6G-LORE platform will enable us to assess the potential of integrating new communication technologies—beyond WLAN—into 5G systems, which could inform decisions on adopting additional access types for 6G.



6G-TC

OC Project Title	Leveraging NWDAF and O-RAN Intelligence Services for Slice-Aware Abnormal Behaviour Detection and Traffic Classification in 6G Mobile Networks (6G-TC)
Beneficiary(s)/ Country	iTherMAI B.V. / Belgium
Project Description	The 6G-TC project focuses on traffic classification (TC) and anomaly detection (ABD), essential for boosting network security and creating an intelligent, responsive infrastructure. Utilizing open-source solutions for Open-Radio Access Network (O-RAN) and core networks, we aim to deliver a 3GPP TSs compliant AI product, enhancing 6G service adaptability and efficiency. In this project, iTherMAI will develop an AI product on a testbed designed to simulate a 6G environment, encompassing the core network (CN), radio access network (RAN), and a near-real-time (near-RT) RAN Intelligent Controller (RIC). For this purpose, we will incorporate Open Air Interface (OAI) packages due to their commitment to quickly rolling out new services aligned with 3GPP standards. OAI also aligns well with the architecture of the 65-BRICK experimentation facility. Additionally, we will leverage OAI's NWDAF, which provides essential support for event subscriptions and analytics services, for the purposes of data collection and identifying slice-specific abnormal behaviors. For the near-RT RIC, we utilize FlexRIC, an open-source option, alongside OAI's CN and RAN components to create a comprehensive end-to-end framework. This framework's architecture highlights the critical roles of slice-load monitoring and abnormal behaviour detection as key functions of the NWDAF. In this setup, the NWDAF collects data, which is then processed by specialized ML engines trained for these tasks.
Testbed	EURECOM testbed
Implementation Period	October 2024-March 2025
Added value/ Results	The 6G-TC project delivers a standards-compliant AI solution that enhances 6G network security and adaptability by addressing unexpected large rate flows (ULRF) through slice-based anomaly detection. By training ML models per slice using NSSAI from the NSSF, the system enables precise, real-time identification of abnormal UE behavior. Validated on a full OAI-based 6G testbed with integrated NWDAF and FlexRIC, the solution offers intelligent, slice-aware monitoring and analytics aligned with 3GPP TSs.



ADA-BEAM

OC Project Title	ADA-BEAM
Beneficiary(s)/ Country	University of Twente, the Netherlands; University of Bristol, U.K.
Project Description	In this project, we focus on evaluating the capability of the KU Leuven testbed for one core 6G feature, that is, joint communication and sensing, at lower mid-band (close to 7 GHz). We compose distributed MIMO at three sites, each with one USRP providing 1 Tx and 3Rx, and each port connected to a specially designed directive antenna. The distributed MIMO links do not only communicate with OFDM modulated data, but also their channel information will be used for human sensing purposes. Due to phase incoherence among the USRP ports, we can not directly do digital post-processing for beamforming, but we mimic the adaptive beam by randomly orienting the directive antennas. The measured data will be exploited for training and validating AI models for, e.g., multi-person tracking.
Testbed	KU Leuven 3 USRP X410 + host PC/server + MoCAP system
Implementation Period	2025.01.13 – 2025.07.13
Added value/ Results	In ADA-BEAM project, we spent quite some effort/time testing the capability of the prototype. The testing has been focused on determining the maximum stable sample rates under various URSP configurations: comparing (i) comparing transmission from one USRP's DRAM and receiving at other URSPs then save to host PC; (ii) each USRP handling both transmission and reception with USRP's DRAM; and (ii) each USRP managing transmission and reception with the host server. Results indicated that due to (a) FPGA compatibility constraints, (b) measurement scenario requirements, and (c) RF cable length limitations, the optimal configuration was each USRP handling 1 transmission and 3 reception channels using host server storage. To minimize USRP error, transmission signals were stored on SSD while received signals were saved in RAM. The maximum achievable sample rate was established at 20MHz per channel. Additional testing of digital gain settings revealed that extremely high gain values triggered signal energy thresholds in the USRP, causing unstable variations in received signal amplitudes; consequently, the gain was set to 50 to ensure stable signal energy levels. We also spend time/effort in training AI models, first using simulation framework, and then using the measured data. For simulation framework, we use the open-source ray-tracing software qd-realization to model various indoor wireless sensing scenarios. The simulation settings include a single person standing, walking, and multi-person walking, under different room layout with varying degrees of complexity. Based on simulated signal data, we developed neural network regression models to predict human positions. The results for the single person standing scenario are presented in Fig. 2. Currently we are extending our work to address the challenges of accurate position prediction in walking scenarios and multi-target sensing.

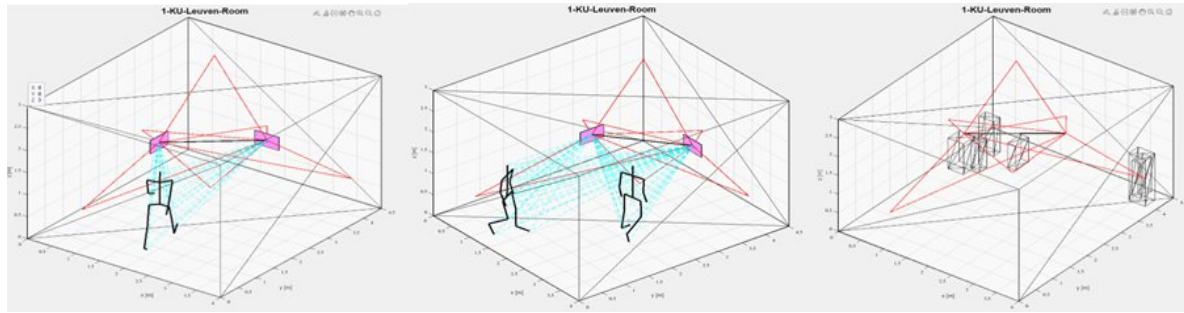


Figure 1: Visualization of simulation for sensing single and multiple targets, as well as a room with increased scattering.

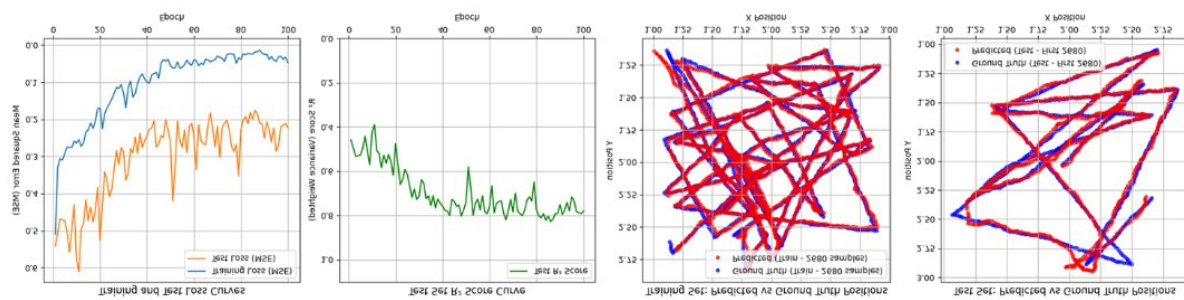
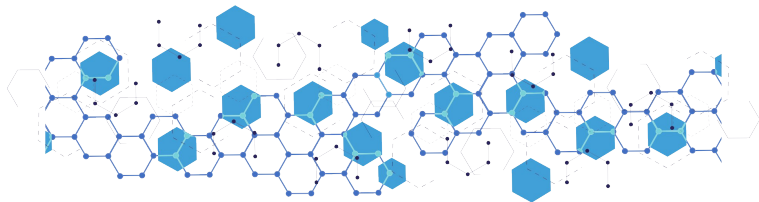
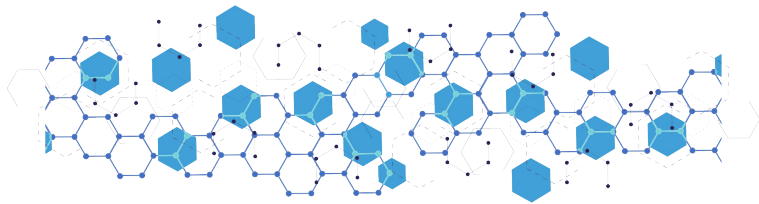


Figure 2: Training and testing loss curves, as well as the predicted walking trajectory and ground truth trajectory for both training and testing dataset.



Matriach

OC Project Title	MATRIACH
Beneficiary(s)/ Country	FAVIT (SPAIN), UNIVERSITAT POLITÈCNICA DE VALÈNCIA (SPAIN)
Project Description	MATRIARCH integrates the aerOS meta-operating system into the 6G-BRICKS infrastructure to establish a modular, decentralized compute continuum from cloud to edge. aerOS enables seamless orchestration, cybersecurity, and intelligent service management across heterogeneous nodes, including O-RAN-compliant environments, supporting advanced use cases in future 6G networks. The platform's AI-driven mechanisms ensure secure, scalable, and energy-efficient resource management within the edge-cloud continuum. The project is being implemented over a 6-month period, with a pilot demonstration planned at the ISI/ATH experimentation facility. This pilot will validate the integration of aerOS components with 6G-BRICKS resources and showcase the project's ability to enable service orchestration, intelligent workload distribution, and real-time monitoring. MATRIARCH is fully aligned with 6G-BRICKS' objectives, contributing to the development of a robust and reusable experimentation ecosystem for next-generation digital infrastructures.
Testbed	ISI/ATH
Implementation Period	14/10/2024-13/04/2025
Added value/ Results	MATRIARCH brings added value to the 6G-BRICKS infrastructure by deploying three interconnected aerOS domains—at FAVIT, UPV, and the ISI testbed—forming a decentralized, intelligent edge-to-cloud computing continuum. Within these domains, multiple services have been deployed to continuously monitor the behaviour of pods running within the meta-operating system, enabling proactive and efficient resource management. In addition to orchestration capabilities, the project has implemented advanced anomaly detection services to identify issues such as pod malfunction, unexpected resource consumption, and behaviours potentially linked to cybersecurity breaches. These insights are made actionable through an integrated dashboard that provides real-time visualization of service monitoring activities and detected alerts. MATRIARCH positions 6G-BRICKS as a robust and future-ready testbed for validating critical 6G services and infrastructure.



ORIX

OC Project Title	Orchestration of Reconfigurable Intelligent Surfaces with xApps (ORIX)
Beneficiary(s)/ Country	Turkiye Bilimsel Ve Teknolojik Arastirma Kurumu & Koç University - Communications Research and Innovation Laboratory / Turkiye
Project Description	Orchestration of Reconfigurable Intelligent Surfaces with xApps (ORIX) aims to develop xApps-based controller for open reconfigurable intelligent surfaces (RISs) platform in the 6G-BRICKS testbed's simulation environment by integrating the RIS into next-generation wireless communication systems. Before the deployment of the network-controlled RIS into a real-world end-to-end an open radio access network (O-RAN) network, the validation of the RISs' control algorithms through a simulation environment is required to adjust the algorithm parameters and evaluate their performance. The ORIX project develops xApps-based phase shift controller for RISs in order to demonstrate the practical RIS phase shift optimization algorithms, which directly focus on autonomous robots in Industry 4.0 scenarios. In order to validate the RIS control algorithms utilizing the xApps tool for Industry 4.0 scenarios, the RIS simulator within the 6G-BRICKS testbed will be enhanced to mimic the Industry 4.0 environment. The PoC scenarios considering the autonomous robots in Industry 4.0 is defined in the RIS simulator environment, where the network-controlled RIS is deployed. The phase shift optimization algorithms of the RIS will be implemented and validated by leveraging the capabilities of the RAN intelligent controller (RIC) to orchestrate and manage the optimization process through the xApps software tools. The extended RIS simulator for the Industry 4.0 scenarios and the developed xApps to control the RIS according to the practical phase shift algorithms will be integrated and validated in the 6G experimentation platforms layer of the 6G-BRICKS testbed.
Testbed	EURECOM - 6G Experimentation Platforms layer
Implementation Period	14 th October 2024 – 14 th June 2025
Added value/ Results	ORIX aims to contribute enhancing the current RIS simulator within the 6G-BRICKS testbed by introducing RIS-assisted Industry 4.0-related scenarios utilizing 3GPP channel models for factory environments. Additionally, ORIX targets developing low-latency and low-complexity RIS optimization algorithms through a custom xApp within FlexRIC to overcome the critical latency requirements caused by the near-RT RIC. Recent outputs include the ORIX's proof of concept definition for RIS-assisted Industry 4.0 scenarios showcasing how network-controlled RISs and xApps can improve connectivity for autonomous robots. The 6G-BRICKS RIS simulator has been enhanced to cover more than one 3GPP Indoor Factory channel models and to provide an end-to-end connection with the near-RT RIC entity.

OC Project Title	6G-BRICKS: Building Reusable testbed Infrastructures for validating Cloud-to-device breakthrough technologies
Beneficiary(s)/ Country	Turkcell Technology / Turkiye, BTS Group / Turkiye
Project Description	The TwinRAN initiative is a sub-project within the larger 6G-BRICKS framework, aimed at designing and implementing a Digital Twin-as-a-Service (DTaaS) platform specifically tailored for 6G Radio Access Network (RAN) environments. Developed to address the complexity and inefficiencies in Open RAN (ORAN) experimentation and deployment, TwinRAN provides a modular and scalable platform for real-time simulation, performance optimization, and interoperability validation. It integrates containerized OpenAirInterface (OAI) elements within a Kubernetes orchestration environment, enabling the emulation of large-scale RAN scenarios with over 1,000 user equipment (UEs) and multiple radio units (RUs). The platform supports artificial intelligence (AI)-driven parameter optimization and provides near real-time feedback, thereby reducing the trial-and-error costs typically associated with ORAN testing.
Testbed	EURECOME - Through containerized and virtualized components, it enables seamless integration with industry-standard APIs, allowing researchers to simulate and analyze various RAN deployment strategies and optimization algorithms.
Implementation Period	The TwinRAN sub-project began on October 14, 2024, and is scheduled for completion by June 14, 2025.
Added value/ Results	TwinRAN adds significant value to the 6G-BRICKS ecosystem by addressing existing gaps in ORAN deployment and performance testing. It enables cost-effective, scalable, and real-time simulations, reducing the dependency on physical infrastructure for early-stage experimentation. Its AI-based optimization capabilities allow for dynamic tuning of network parameters, enhancing both efficiency and adaptability. Furthermore, the platform provides a robust validation environment for 6G technologies, accelerating innovation and de-risking deployment scenarios. The results demonstrate a viable path toward integrating digital twin technologies into next-generation RAN management, supporting the evolution of software-defined and AI-native mobile networks.