6G BRICKS

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6G-BRICKS: Building Reusable testbed Infrastructures for Cloud-to-device breaKthrough technologieS

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Why 6G-BRICKS?

6G-BRICKS is a continuation of key ICT-20 and ICT-52 B5G projects (MARSAL, MonB5G, RISE6G, REINDEER) joining forces with the aim to shape the next generation of Smart Networks

Mature experimentation tools from the ICT-41 5GMediaHUB project were leveraged for the federation of 2 well established platforms (KUL, EUR) and an Experimentation site (ISI/ATH & IQU).

Experience from past 5G-PPP efforts has shown that the enormous complexity of the software stacks and interoperability challenges makes evolvability extremely challenging.

6G-BRICKS Objective

6G-BRICKS bringing together specialists on breakthrough 6G technologies, such as cell-free networking, distributed processing and Reconfigurable Intelligent Surfaces (RIS), and adopting principles of modularity and softwarization **to deliver the first truly modular end-to-end 6G experimentation platform in Europe.**

6G-BRICKS will structure the various architecture tiers **around the concept of "LEGO Bricks",** delivering self-contained testbed nodes that can be reused across testbed infrastructures.

This significantly lowers the barrier of entry to an end-to-end experimentation platform for specialists to bring their breakthrough technologies for validation and experimentation.

6G BRICKS Objectives

Objective 1: To deliver an evolvable 6G experimentation facility that will integrate breakthrough 6G technologies

Objective 2: To validate and showcase advanced use cases in metaverse and digital twinning

Objective 3: Adopt virtualization, softwarization and Open RAN interfaces to promote modularity and reusability

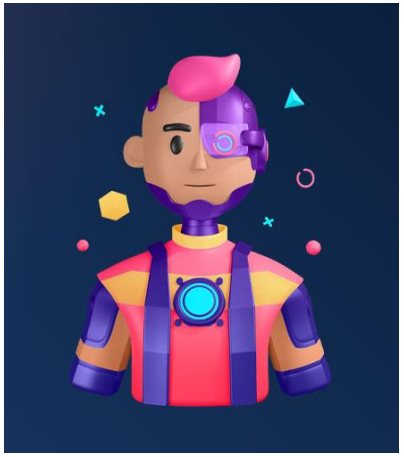
Objective 4: Offer a decentralized management plane, supporting zero-touch orchestration based on Explainable AI

Objective 5: Offer a Compute Continuum abstraction framework supporting a disaggregated wireless X-Haul

Objective 6: Deliver breakthrough 6G RAN technologies via distributed Cell-free and RIS enablers

General Information

- ✓ **Grant Agreement:** 101096954
- ✓ **Duration:** 36 months
- ✓ **Starting date:** 01/01/2023
- ✓ **Total budget:** 8,849,599.50 €
- ✓ **EC funding:** 8,404,533.38 €
- ✓ **Cascaded funds:** 1,696,563.18 €
- ✓ **Total PMs:** 833
- ✓ **Project Coordinator:** Prof. Christos Verikoukis (ISI/ATH)
- ✓ **Technical Manager**: Dr. Kostas Ramantas (IQU)
- ✓ **URL:** www.6gbricks.eu
- ✓ **Project Officer**: Dr. Odysseas Pyrovolakis



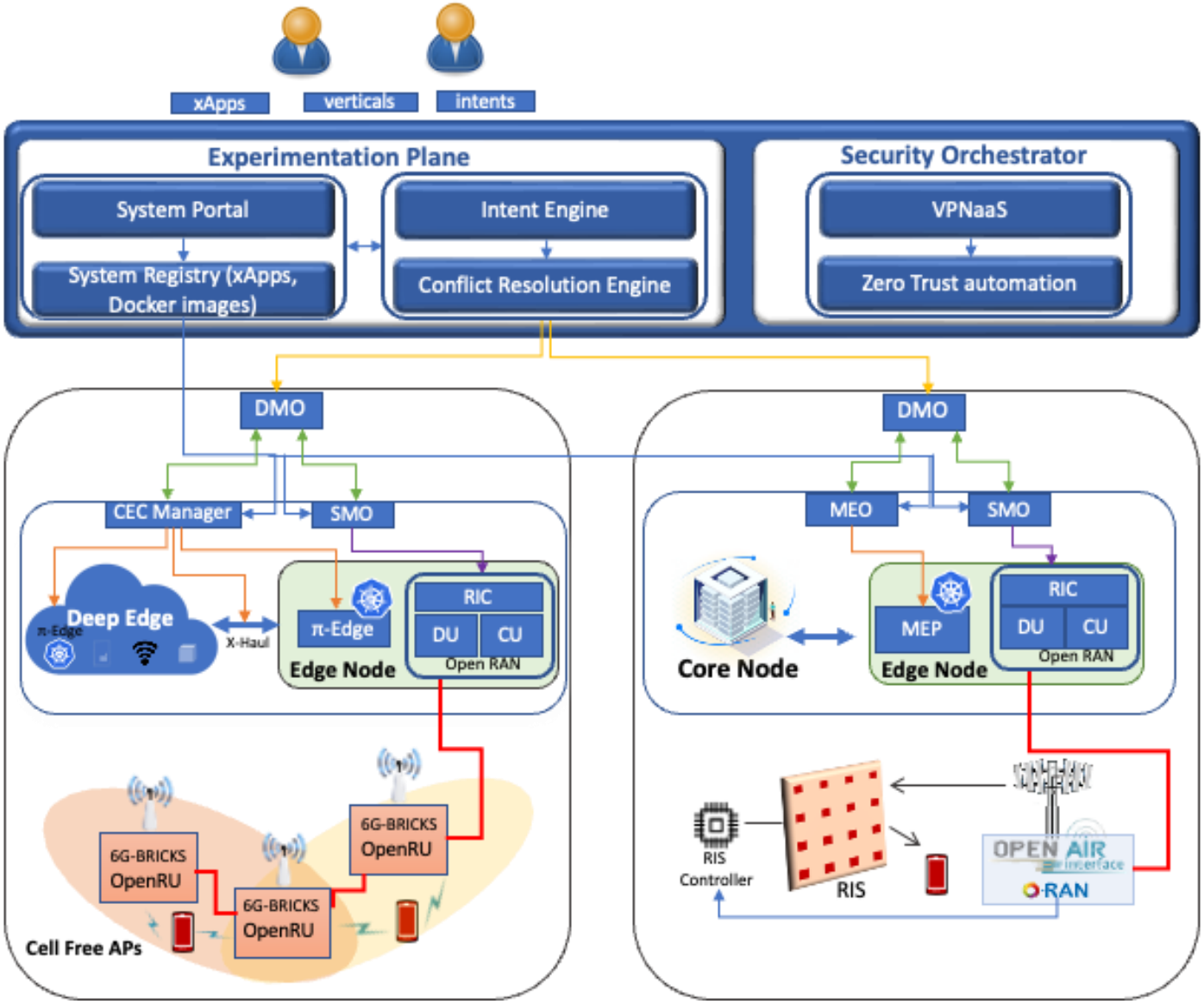
@6gbricks

Project Partners

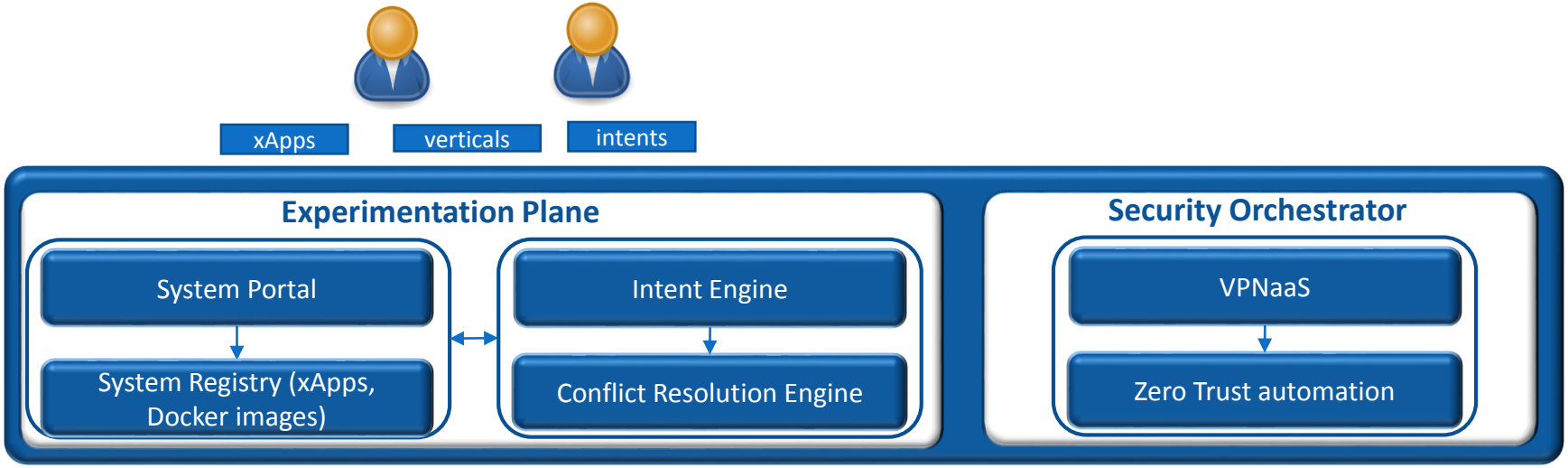
17 consortium partners
8 member states

5 RTOs
6 Large companies
5 SMEs

Overall Architecture

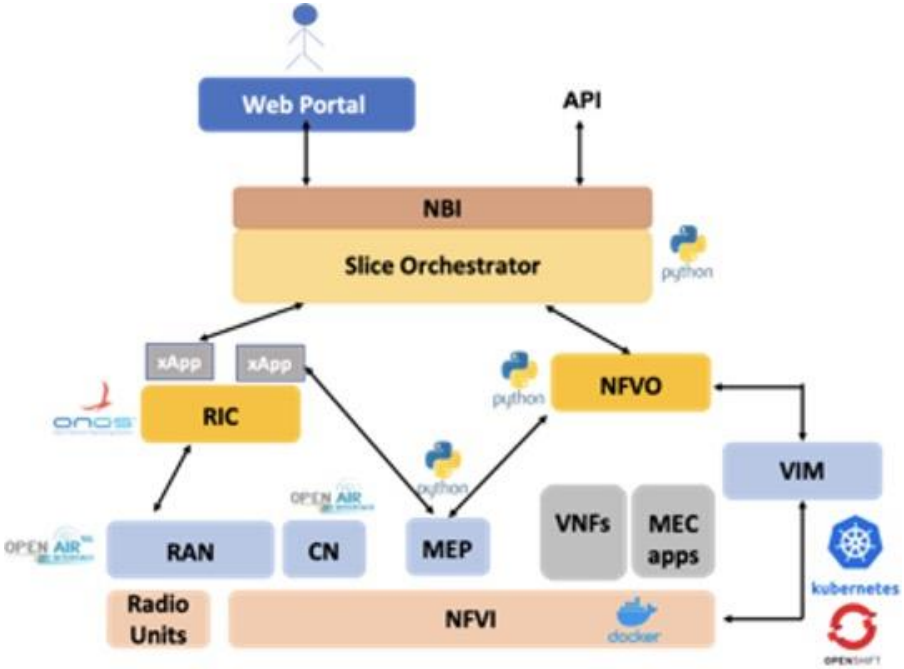


ISI/ATH Experimentation Facility



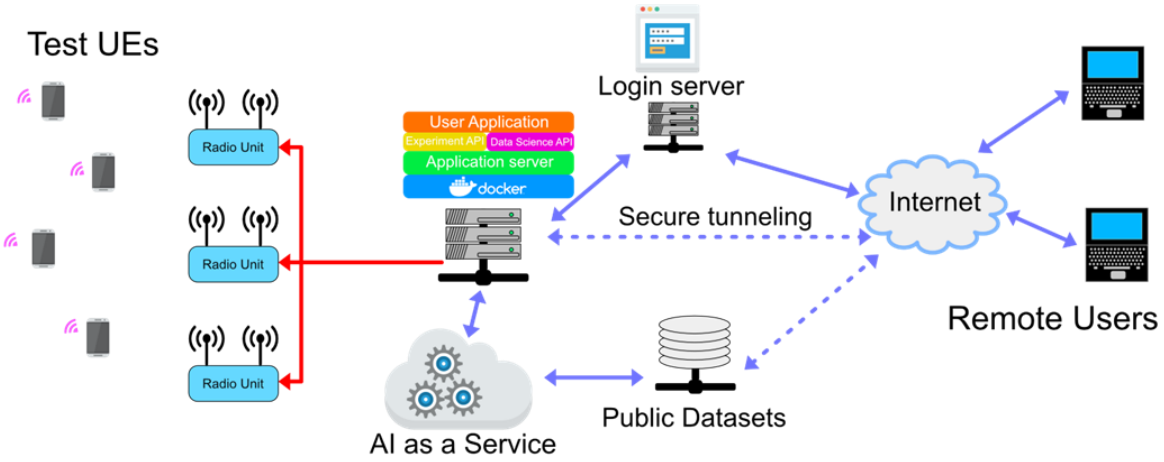
- **Federation of testbeds with an E2E experimentation facility**, which automates experiment execution.
- **Experimentation Engines**, offering automated onboarding of experiments and for the first-time experimentation down to Radio Units (RUs) via Open-RAN compliant xApps
- **Business Support System towards vertical applications**, offering a service catalogue with Service-level Intents and SLAs definition support

EURECOM testbed - OAI



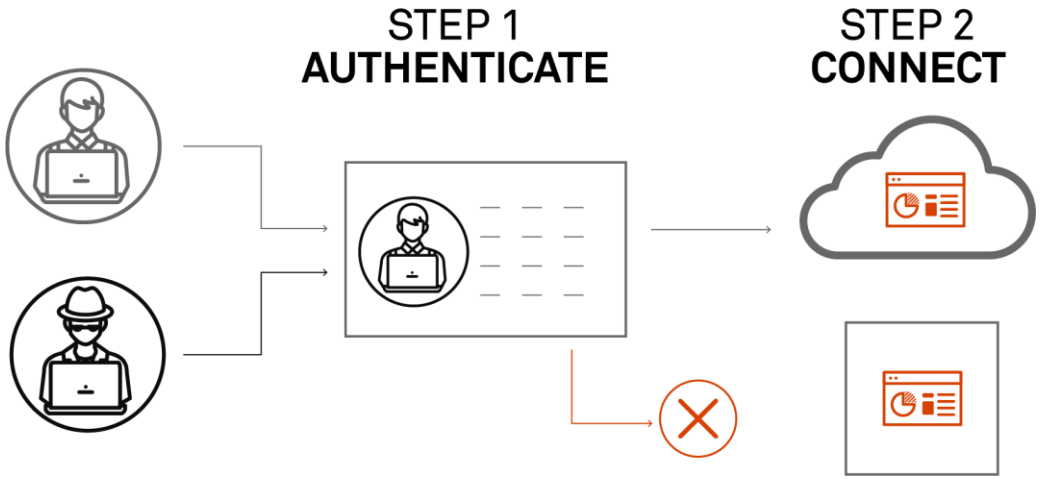
- The radio infrastructure includes indoor and high-power outdoor radio-units operating in several frequency bands in the immediate vicinity of the test site.
- The testbed also includes an O-RAN (RIC based on ONF xONOS) platform, and a compliant MEC ETSI platform.
- The edge infrastructure uses a cluster of computing resources managed.
- To be upgraded with RIS platform

KUL testbed



- KUL operates a distributed cell-free massive MIMO testbed since 2014.
- 32 National Instruments USRPs (2942R/USRP RIO) divided into sub-systems, where each of them supports 32 APs.
- Interoperability with NI and ISRD to define a common interface and data exchange specification. ISRD will install their experimental DU.
- mmWave connectivity and advanced features such as full duplex communication and joint communication and sensing.
- Local data processing and analysis without transfering large amount of data.
- **The datasets of all experiments will be made openly available to external users.**

Security of the facility



- **Innovative security framework** based on Software Defined Perimeters (SDP) and VPNaaS support, offering zero-trust security.
  - The SDP gateways' management planes will be connected with an SDP controller and Security orchestrator deployed at the ISI/ATH site.
  - VPN-as-a-Service for simplifying the establishment towards cross-site VPN encrypted tunnels, even outside GEANT (catering to future expansion, e.g., via Open Calls).
- **Dynamically configurable zero trust environment** where privileged infrastructure is completely isolated from less privileged one.

Innovative “BRICKS”

1. Network-controlled open RIS platform
2. Distributed CFmMIMO processing and synchronization
3. Multi-band and mmWave CFmMIMO
4. Communication and sensing: RIS and cell-free based approaches
5. Explainable AI and Machine Reasoning for Unified, Zero Touch Orchestration

Platform as a Service Abstraction for a self-synthesized compute continuum

UC1 – Metaverse for the Workplace

- A Multi-point Control Unit application handles the real-time processing of “holograms” (i.e., the 3D representation of users) and streaming 360 VR Spheres of the VE to each participant
- Distributed Cell-Free ensures increased Spectrum Efficiency (2x) and 80% reduction in blocking, helping ensure QoE. The PaaS enabler helps exploit a continuum of resources to facilitate computational offloading and real-time service migration.

Scenario 1: **Holoconferencing in a virtual meeting room**

Scenario 2: **Virtual Team building activities**

UC2 – 6G I4.0 applications

- Autonomous robots and Digital Twins are a rapidly growing market for industrial applications.
- 6G-BRICKS technologies will provide the required reduction in blocking probability, as well as JCAS functionality required for efficiently tracking and beam steering.
- Autonomous robots in a factory environment with low latency and 100% coverage (no disconnection).
- Very high bandwidth for video and 3D streaming with low latency and 100% coverage (no disconnection).

Scenario 1:
Autonomous robots in Industry 4.0

Scenario 2: **AR inspection of digital twin**

Bring your BRICK to open calls

- Plug your testbed under our experimentation facility.
- Digital Twins solutions for RAN emulation.
- NWDAF functions and O-RAN ML frameworks.
- Experimentation xApps.
- RIS and other devices in the form of O-RAN Rus.
- XAI driven Causal Reasoning and Anomaly Detection modules for the 6G-BRICKS Orchestrator.
- IoT Edge computing platforms for expanding the 6G-BRICKS compute continuum.
- Joint Communication & Sensing technologies.
- Digital beamforming algorithms and/or synchronization algorithms validated on offline datasets of 5g waveforms and motion capture data collected at KUL.
- Expanding the 6G-BRICKS facility experimentation capabilities as well as further topics of community interest

THANK YOU!

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