NANCY

An Artificial Intelligent Aided Unified Network for Secure Beyond 5G Long Term Evolution

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Consortium

8 Research Institutes

5 Industry Organizations

9 SMEs

22 Partners
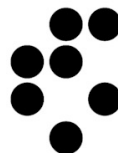
8 Countries

NANCY Aim

The aim of NANCY is to introduce **a secure and intelligent architecture** for B5G networks. By leveraging **AI and blockchain**, NANCY enables secure and **intelligent resource management and flexible network orchestration**. In this direction, novel architectures, namely point-to-point (P2P) connectivity for device-to-device connectivity, mesh networking, and relay-based communications, as well as protocols for medium access, mobility management, and resource allocation are designed. These architectures and protocols will achieve the most by jointly optimizing the midhaul and fronthaul. This is expected to enable truly distributed intelligence and transform the network into a low-power computing unit. Finally, a new experimentally verified **network information-theoretic framework** will be presented to address the particularities of the new RAN arising from the use of novel building blocks such as blockchain, multi-access edge computing, and AI.

NANCY Concept
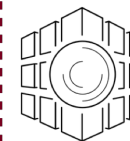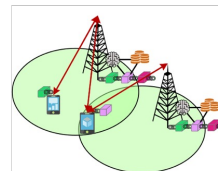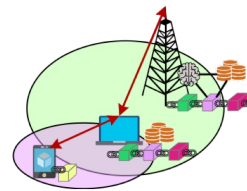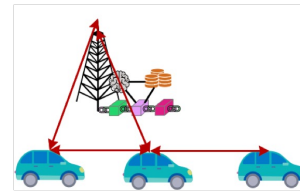
High-level Architecture
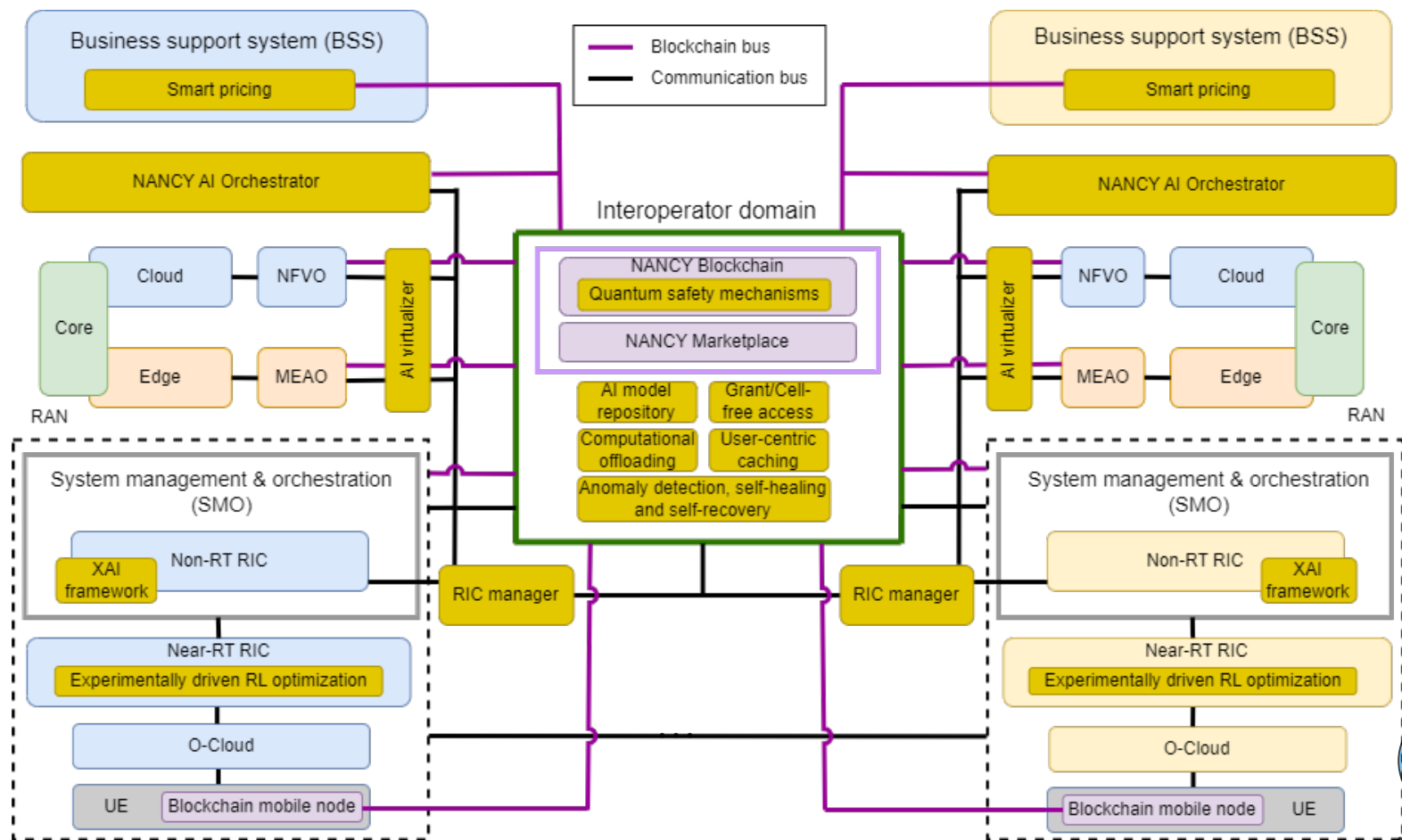
Demonstration and Validation

3 Large-scale Demonstrators

Massive IoT (Italy)

High-mobility Vehicles (Spain)

Advanced Service Provisioning (Greece)

2 Laboratory Testbeds

University of Western Macedonia (Greece)

Italtel (Italy)

iTHACA

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Coverage Expansion Scenario
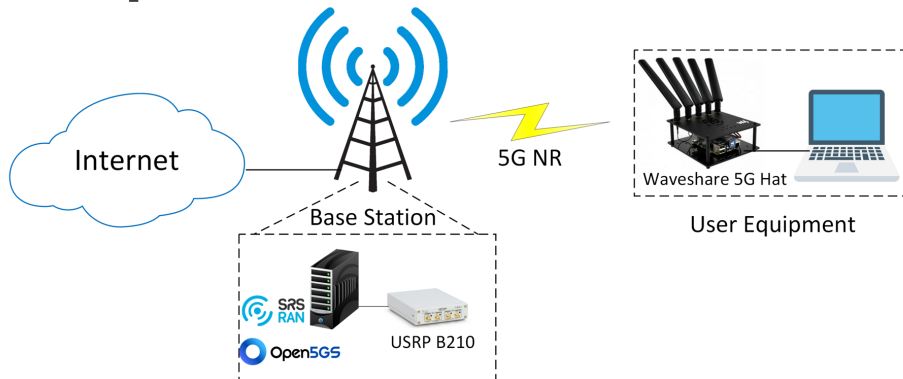
Topology A
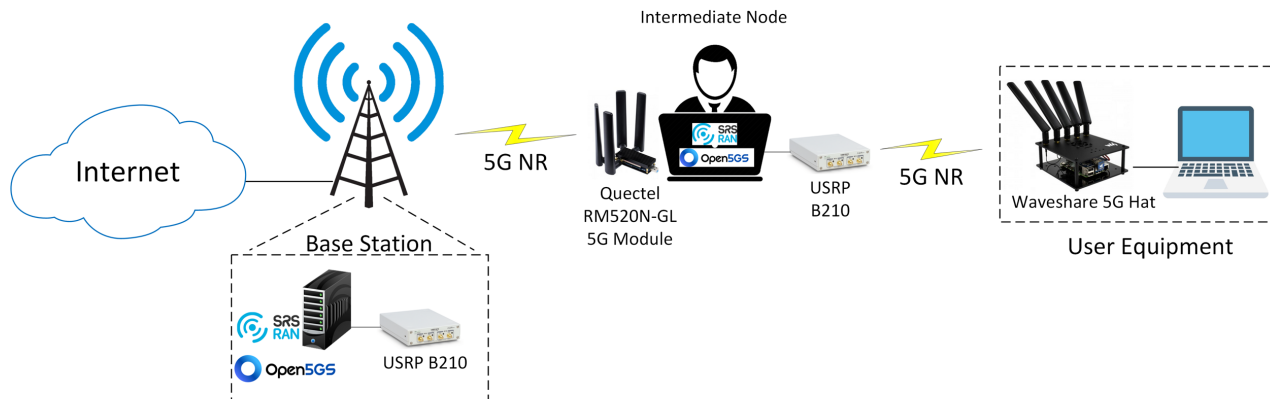
Topology B

Hardware Equipment

A. **2x Ettus Research USRP B210**
- 70 MHz – 6 GHz Radio Frequencies
- Up to 2x2 Multiple Input Multiple Output
- 56 MHz Real-time Bandwidth

B. **Quectel RM520N-GL 5G Module**
- Mounted in a USB adaptor

C. **SIMCom SIM8200EA-M2 5G Module**
- Mounted in Waveshare 5G Hat

D. **sysmocom Programmable SIMs**

Software

- **srsRAN** (https://www.srsran.com/)
  - Deploys a 5G Base Station using the Ettus Research USRPs
  - Supports 5G Non-Standalone (NSA) and 5G Standalone (SA)
- **Open5GS** (https://open5gs.org/)
  - Provides 5G Core Network Functionalities
- **FlexRIC** (https://gitlab.eurecom.fr/mosaic5g/flexric)
  - Serves as Radio Access Network Intelligent Controller
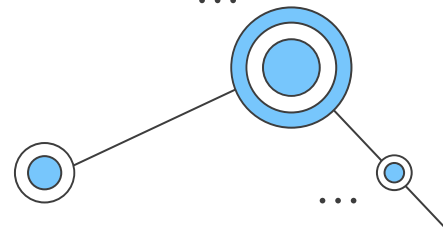
Laboratory Deployment
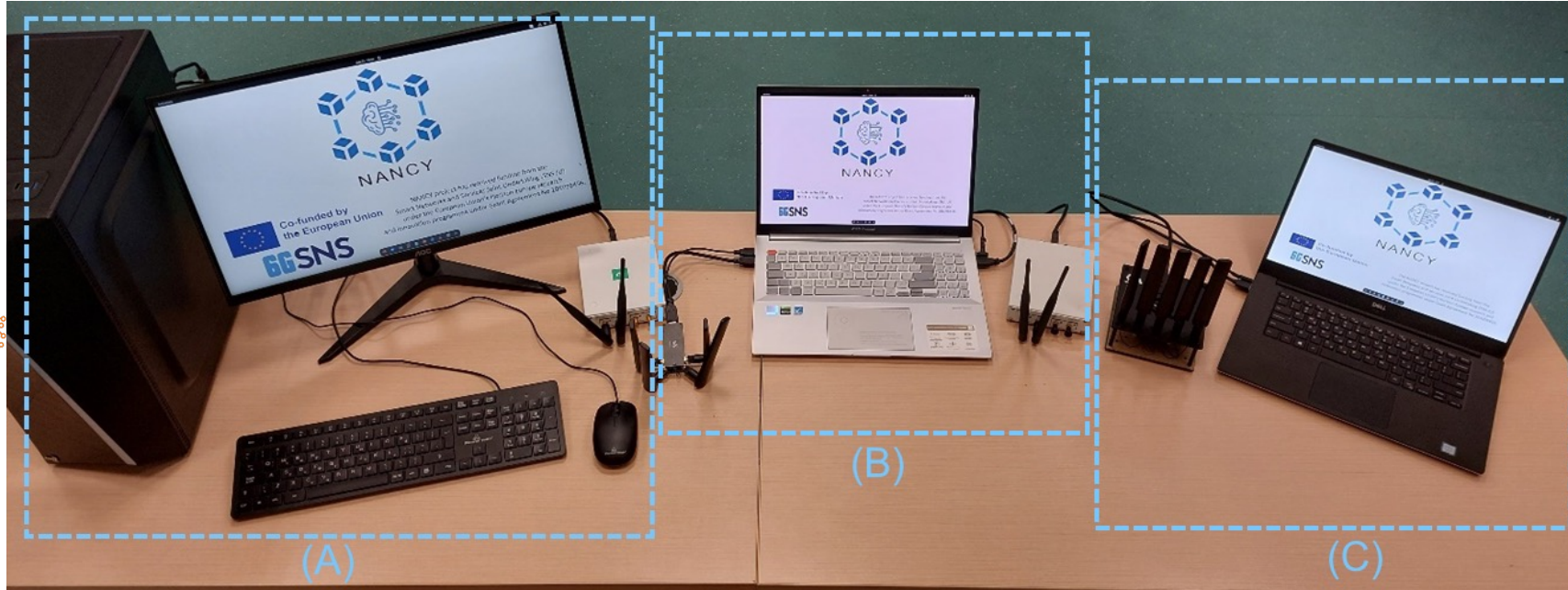
(A) Main Base Station   (B) Intermediate Node   (C) User Equipment

5G Coverage Expansion Dataset 1

Athanasios Liatifis[1], Sotiris A. Tegos[1], Nikos A. Mitsiou[1], Ioannis Makris[2], Konstantinos Kyranou[3], Dimitrios Pliatsios[1], Thomas Lagkas[1], Panagiotis Sarigiannidis[1]

[1] Laboratory of Internet of Things and Applications (ITHACA), Department of Electrical and Computer Engineering, University of Western Macedonia [https://ithaca.ece.uowm.gr/]
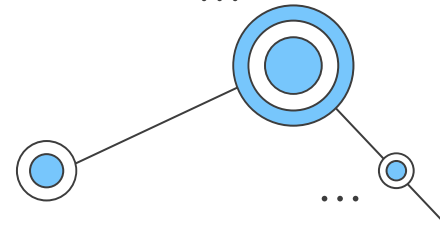[2] MetaMind Innovations P.C. [https://metamind.gr/]
[3] Sidroco Holdings Ltd. [https://sidroco.com/]

Configuration Parameters

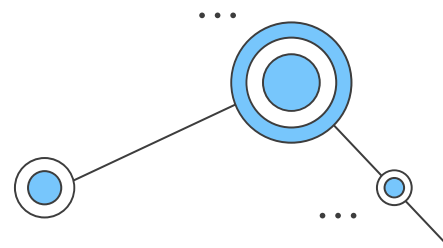| Parameter	Main Base Station	Intermediate Node
Device	Ettus Research USRP B210	Ettus Research USRP B210
5G NR Band	n78	n77
Frequency	3489.39 MHz	4050 MHz
Duplexing	Time Division Duplexing (TDD)	
Bandwidth	40 MHz	
Subcarrier Spacing	30 kHz	
Modulation	256 Quadrature Amplitude Modulation (256-QAM)	
Antenna Configuration	Single Input Single Output (SISO)	

Evaluation Scenarios

➢ **iPerf3**
- TCP and UDP Modes

➢ **VLC Media Player Streaming**
- 720p – High definition (HD) with a resolution of 1280x720
- 1080p – Full high definition (FHD) with a resolution of 1920x1080
- 1440p – 2K resolution of 2560x1440
- 2160p – 4K resolution of 3840x2160

Highlights & Results

➢ **Prototyping using Software Defined Radio technologies**

➢ **All software used is open source**

➢ **Network traffic can be captured from three locations**

- Main base station
- Intermediate node
- User equipment

➢ **Over 16 GB of data included in the first dataset release**

- Network traffic
- System resource utilization statistics
- Streaming statistics from VLC media player

Threat Detection using Artificial Intelligence
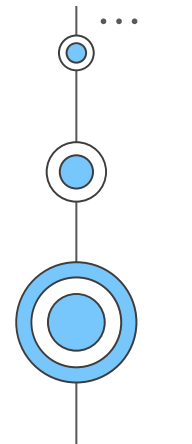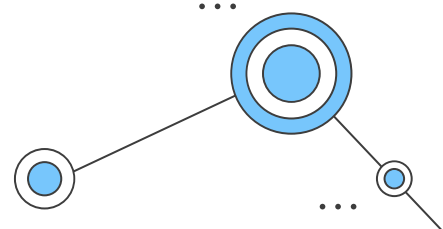# ETSI AI Conference
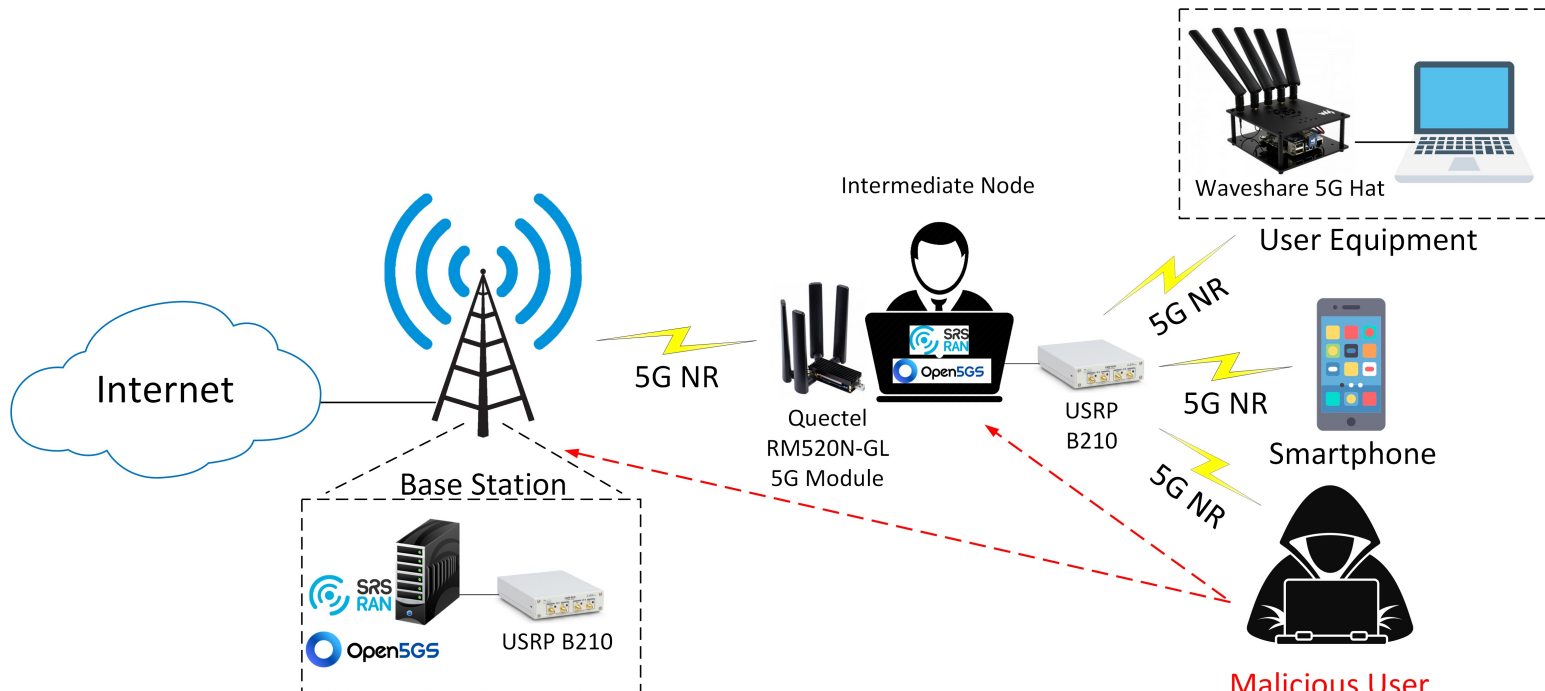
Next Steps

➤ **Integration of eXplainable AI (XAI)**
  - XAI will provide insights about the impact of the network variables on the decisions taken by the AI model

➤ **Adding offloading capabilities**
  - Devices with constrained resources will be able to offload their processing tasks to the intermediate node in order to reduce processing time
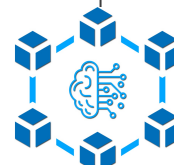
Thank you for your attention!

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