

# 14 - 15 NOVEMBER 2023

Northeastern University - Innovation Campus at Burlington  
147 S. Bedford St  
Burlington, MA 01803  
United States

## JOINT OSC/OSFG-OAI WORKSHOP: E2E REFERENCE DESIGNS FOR O-RAN

### DAY 1 DEMOS -



Chieh-Chun Chen  
Ilias Chatzistefanidis

**Demo:** xApp DevOps Evolution and Observable OAM in Open RAN Ecosystem

**Affiliation:** BubbleRAN & National Taiwan University of Science and Technology (NTUST)

**Abstract:** We demonstrate BubbleRAN OAM platform, a versatile, cloud-native Operating and Management (OAM) solution tailored for operators, maintainers, and developers. This platform enables a smart and scalable deployment of a 5G infrastructure, E2E performance test, metric and service monitoring, and day-2 operations with user and application in the loop. Our demonstration highlights the evolution of xApp with DevOps from the perspectives of Open RAN Stack Developers, Network Maintenance, and Data Analysts, showcasing a significant reduction by a factor of 1000 in the workflow, an example is a commit to deploy leadtime. This results in enhanced business agility and flexibility for Open RAN deployments.

As we present our comprehensive showcase on the BubbleRAN OAM platform, we introduce the integration result between OAI FlexRIC with O-RAN OSC O-DU, leveraging the power of xApp to demonstrate a specific use case. This integration marks the initial step in an ongoing process toward running diverse use cases using components from various communities within the BubbleRAN cluster. Throughout this demo, our primary goal is to reveal the continuous evolution of integration, exploring the potential of BubbleRAN.



Paulo Duarte

**Demo:** E2E Orchestration in 5G Networks with Open-Source Components

**Affiliation:** Capgemini Engineering

**Abstract:** In the 5th Generation of Mobile Networks optimization of the network resources are crucial to improve the end-users Quality of Service, while lowering operating costs. On this work we explore the Radio Access Network monitoring using RIC's xAPP together with the Non-RT RIC for non-real-time resource management, and by implementing procedures and policy optimization in the RAN, using A1 interfaces for policy management. Our demonstration leverages the concepts and technologies within the O-RAN ecosystem, by using ONAP as Non-RT-RIC, RIC xApp, and A1 interfaces for policy management.



Eduardo Melão

**Demo:** OAI with OAM and RIC: a Demo of Remote Control, Automation, and xApp

**Affiliation:** CPQD

**Abstract:** The demo presents an integration between the OAI and the O-RAN OAM through O1. In this integration, it is possible to control the OAI parameters remotely using the OAM O1 interface. Furthermore, an automation of the architecture will be presented using Nephio orchestrator. The C2n core is presented as a 4G&5G solution, C2n is the CPQD packet core compatible with 3GPP Release 15. Lastly, we intend to demonstrate an xApp usage through the E2 interface between OAI and FlexRIC to perform Signaling Storm analysis and protection.

**Demo:** Combining Network Data Analytics Function and Machine Learning for Abnormal Traffic Detection in Beyond 5G

**Affiliation:** EURECOM

**Abstract:** The Network Data Analytics Function (NWDAF) is a key component of the 5G Core Network (CN) architecture whose role is to generate analytics and insights from the network data to accommodate end users and improve the network performance. NWDAF allows the collection, processing, and analysis of network data to enable a variety of applications, such as User Equipment (UE) mobility analytics and UE abnormal behaviour. Although defined by 3GPP, realizing these applications is still an open problem. To fill this gap: (i) we propose a microservices architecture of NWDAF to plug the 3GPP applications as microservices enabling greater flexibility and scalability of NWDAF; (ii) devise a Machine Learning (ML) algorithm, specifically an LSTM Auto-encoder whose role is to detect abnormal traffic events using real network data extracted from the Milano dataset; (iii) we integrate and test the abnormal traffic detection algorithm in the NWDAF based on OpenAirInterface (OAI) 5G CN and RAN.

**Demo:** 5G Labkit O-RAN based on OAI

**Affiliation:** Firecell

**Abstract:** Firecell Labkit is a lightweight indoor open source cellular network, packaged in a compact kit with a smartphone and SIM card, for development and tests.

Firecell Labkit is a perfect fit for enterprises, R&D labs and universities who want to demonstrate innovative use-cases with a real indoor private cellular network in their premises.

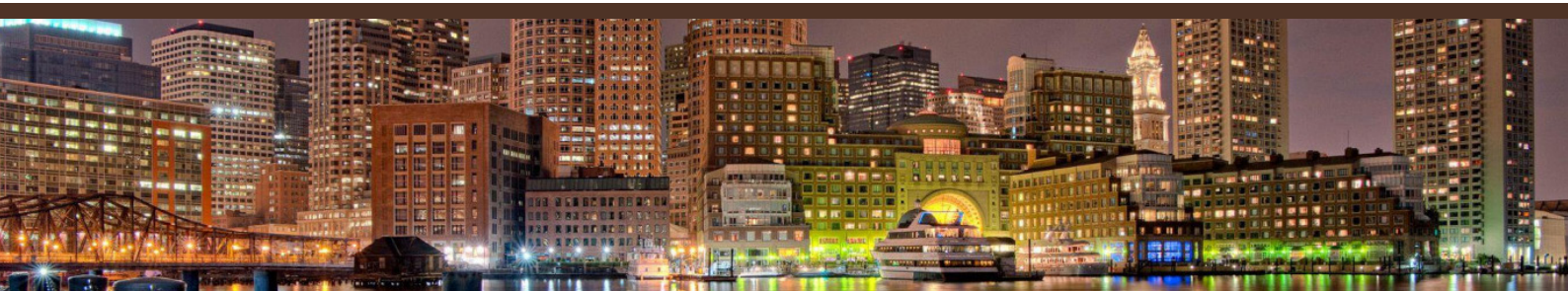
Firecell Labkit can be used to :

- Build and run demonstrations and proof of concepts using an indoor cellular network
- Wirelessly connect your smartphones, tablets, industrial routers, cameras and other devices within your lab
- Kick start your research on the cellular network protocols thanks to an all-in one setup
- Develop your own extensions or integrate third party software
- Inspect the security of the 5G protocols and develop your own enhancements
- Train your team or your students hands-on on an actual cellular network

**Demo:** Non-real-time Control of OpenAirInterface using the O-RAN O1-interface

**Affiliation:** Fraunhofer Heinrich Hertz Institute, Berlin

**Abstract:** In this demo, we will demonstrate our efforts in integrating the O-RAN O1 interface into OAI. We will demonstrate the architecture of our O1 implementation (including netconf, alarms/notifications, and PM data reporting), and present the status of the OAI interface. In particular, we will demonstrate, how ONAP can be used for non-real time control of OAI over the newly developed O1 interface.







**Demo:** Improving QoE using OSC nearRT-RIC and OAI 5G RAN through O-RAN E2-SM KPM and RC  
**Affiliation:** OpenAirInterface

Robert Schmidt

**Abstract:** We improve the Quality-of-Experience (QoE) of a user playing the online game slither.io in a 5G network through a near-RT RIC. We deploy an end-to-end 5G cellular network with the O-RAN SC RIC, OAI CU, OAI DU, and OAI 5GC. Because the online game is a delay-sensitive application, it is directly and noticeably affected when the cell has high load, becoming unresponsive and affecting the QoE negatively. In order to overcome this issue, we deploy our custom QoE xApp over the OSC RIC. We use the KPM SM to monitor the RAN packet delay. When the latency at the RLC buffer surpasses a threshold, we use the RC SM to create a new radio bearer in the E2 nodes. In this manner, traffic belonging to the game is scheduled preferentially, improving the QoE of the game.

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**Demo:** X5G - An Open, Programmable, Multi-vendor 5G O-RAN Testbed with NVIDIA ARC and OAI  
**Affiliation:** Northeastern University

Davide Villa

**Abstract:** In this demo, we present X5G: an open, programmable, and multi-vendor private 5G O-RAN testbed deployed at Northeastern University in Boston, MA. We demonstrate the first real deployment of the NVIDIA Aerial Research Cloud (ARC), using the Aerial SDK for the PHY layer, accelerated on Graphics Processing Unit (GPU), and integrated with higher layers from the OpenAirInterface (OAI) open-source project via the Small Cell Forum Functional Application Platform Interface (FAPI). Additionally, we highlight the integration with the O-RAN Software Community (OSC) RAN Intelligent Controller (RIC). We showcase testbed performance with up to 4 Commercial Off-the-Shelf (COTS) smartphones for each base station running iPerf and video streaming applications, measuring a cell rate higher than 500 Mbps in downlink and 45 Mbps in uplink.

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**Demo:** Colosseum: The Open RAN Digital Twin  
**Affiliation:** Northeastern University

Leonardo Bonati

**Abstract:** Colosseum is the world's largest Open RAN digital twin. It allows researchers and practitioners to experiment at scale on an O-RAN-compliant ecosystem with hardware-in-the-loop. The testbed allows users to reproduce realistic wireless environments and seamlessly instantiate software-defined 5G base stations through OpenAirInterface, as well as to control them with xApps/rApps deployed on RAN Intelligent Controllers, or with dApps deployed on the CU/DU directly and serve software-defined UEs with heterogeneous quality of service.

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**Demo:** Towards O-RAN experimentation in the upper mid band (FR3)  
**Affiliation:** NYU & Pi-Radio

pi-radio

Marco Mezzavilla

**Abstract:** The NYU+FIU+Pi-Radio team has been recently awarded a NTIA grant to develop testing and evaluation procedures for open and interoperable solutions of next-generation RAN components in the upper mid-band, known as FR3, with a focus on both shared and adversarial scenarios. The team will develop a software-defined radio platform for a multi-band FR3 radio unit that aims to enable FR3 development within the O-RAN framework. In this demo, the team will conduct the first OAI over-the-air experiment using their single-channel FR3 test board.

