Demo: A dense vRAN deployment to challenge computing

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Abstract

Several computer architectures were offered by the industry for implementing virtualized Radio Access Networks (vRAN). Assessing these solutions requires to challenge them in complete full-stack setups at scale. In this demo, we will show how we implement a deployment of several O-RAN Distributed Units (O-DU) on three different systems to observe and compare their respective behavior and performance.

CCS Concepts

• **Networks** → **Middle boxes / network appliances**; **Mobile networks**; **Network experimentation**; • **Hardware** → Platform power issues; *Board- and system-level test*.

Keywords

Mobile networks, Network appliances, Network experimentation, Network virtualization

ACM Reference Format:
Romain Beurdouche and Raymond Knopp. 2026. Demo: A dense vRAN deployment to challenge computing. In *20th ACM Workshop on Wireless Network Testbeds, Experimental evaluation & Characterization (WiNTECH '26), October 26–30, 2026, Austin, TX, USA*. ACM, New York, NY, USA, 1 page. https://doi.org/10.1145/3831662.3844795

1 Context

Several silicon industrials offered competing solutions for implementing O-DUs from the O-RAN standard architecture. O-DUs are network components that include especially the upper part of the physical layer of the RAN protocol stack. It includes demanding computing blocks such as channel coding, precoding or channel estimation. It is also the first network component in the RAN up from the cell that can be virtualized on top of a shared edge infrastructure. The industry offers systems relying on combinations of general-purpose processors and Hardware Accelerators (HA) to implement this component. Several such systems enable to implement an O-DU with the OpenAirInterface RAN software stack. For instance, two systems from AMD, the first one relying on an EPYC Zen5 processor and the second one on a combination of an EPYC Zen4c processor and an RFSoC and a third system from Intel relying on a Sapphire Rapids Edge Enhanced processor embedding an accelerator for vRAN baseband processing [1].

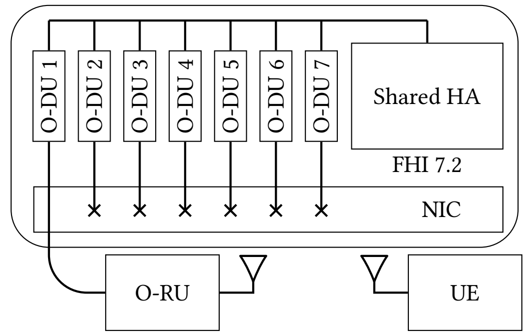

Figure 1: Schematic of the intended vRAN deployment

Evaluating the performance and fitness for given use-cases of different computer architectures is key to the design of future generations of mobile networks. Solutions should be at some point evaluated in operational conditions, with full-stack operation and in conditions in which computer architectures make a difference, in intensive usage conditions. A framework enabling end-to-end experiments with several O-DUs sharing compute would enable these evaluations on existing and future computer architectures for vRANs. Such a framework is what we want to show in this demo.

2 Demo Content

In this demo, we will implement a deployment of several 5G small-cell O-DUs on the three systems that we introduced above. We will show that this deployment enables us to make relevant observations on the behavior of networks on the three systems under load. This is a protocol with which we already carried out several studies on computer architectures from the industry [1, 2].

We implement between 3 and 7 O-DUs with the OpenAirInterface software stack on the different systems as illustrated in Figure 1. Each O-DU implements a 100MHz 4T4R small-cell. The setup we present requires limited radio appliances. Only one O-DU instance connects to a real radio device in order to monitor the end-to-end behavior of a network on the system. Traffic is emulated on the other O-DUs in order that they create the typical load of an O-DU on the system. The O-DUs share the system including the host processor, the Network Interface Card (NIC) and the HA. The sharing of resources and the behavior it induces are key concerns in this setup. Sharing the NICs and HAs is achieved with Single-Root I/O Virtualization (SR-IOV). We monitor the behavior of physical layer processing, especially the tail latencies and real-time compliance.

References

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WiNTECH '26, Austin, TX, USA

ACM ISBN 979-8-4007-2879-2/26/10
https://doi.org/10.1145/3831662.3844795