

- (iii) Packaged this as a profile on the POWDER mobile and wireless testbed [7] as an artifact to enable open RAN research in a realistic wireless environment.

2 OVERVIEW

Figure 1 provides an overview of the Open RAN framework we have realized by combining software from the O-RAN Software Community and srsLTE. The figure also shows the specifics of our implementation efforts that will be showcased in the demonstration and which we describe in more detail below.

For the demonstration we will instantiate a version of the framework depicted in Figure 1 using equipment in the POWDER platform [7]. POWDER is an end-to-end platform for research on mobile wireless networks. It provides radios that are programmable down to the waveform, attached to a network that can be configured by the user, connected to a wide variety of compute, storage, and cloud resources.

Our demonstration will show the O-RAN RAN slicing use case in an over-the-air configuration on POWDER. Specifically, for this demo, UEs will be common-off-the-shelf (COTS) UEs or UEs realized with software-defined-radios (SDRs) and small form factor compute nodes, eNodeBs will be realized with SDRs and compute nodes in an edge compute cluster, and the evolved packet core (EPC) will run on general purpose compute nodes. *The POWDER platform is completely remotely accessible.* As such the demo will not require any special arrangements and will simply make use of the screen sharing functionality of virtual conferencing software. More importantly, that also implies that POWDER platform users can access the demonstrated functionality remotely.

3 DEMO DESCRIPTION

The demo involves RAN slicing using the O-RAN reference near-realtime RIC platform, a custom xApp and service model, and modified srsLTE software.

In particular, we have enhanced the srsLTE software to realize a slice-aware scheduler and have added an O-RAN E2 agent to srsLTE. As shown in Figure 1, E2 is a north-bound interface that connects the RIC with underlying radio equipment, such as eNodeBs and gNodeBs. The E2 agent implements the core E2 Application Protocol (E2AP) and has access to the internal RAN components in the eNodeB's stack to monitor and modify RAN parameters.

O-RAN service models are realized within the context of the E2AP protocol and expose various RAN related functionalities to the RIC and the xApps hosted by the RIC. xApps in turn realize the logic associated with managing or manipulating such RAN functionality. Our E2 agent provides an implementation of the standard O-RAN key performance measurements (KPM) service model [10] to provide key performance metrics. As shown in Figure 1, we have also implemented a custom 3GPP-like service model to expose our RAN slicing implementation as a set of abstractions and controls to xApps executing on the RIC. We also developed a custom xApp (NexRAN) in c++, using some of the xApp and RIC message router (RMR) framework libraries, that implements/consumes both the KPM service model and the RAN slicing service model. NexRAN exposes this functionality, via a RESTful API, to a RAN slicing manager. The slice manager can create slices, bind/unbind them to

multiple eNodeBs, bind/unbind UEs to those slices, and dynamically modify slice resource allocations.

We provide a POWDER profile that automatically deploys the O-RAN reference RIC on servers within the POWDER testbed, and preinstalls and configures the demo environment. Note that this means readers can run this demo themselves, by obtaining a POWDER account [12] and then instantiating an experiment with the O-RAN RAN slicing profile [3].

All software associated with our efforts are publicly available:

- (i) O-RAN RAN slicing POWDER profile [3], a POWDER specification that specifies the hardware and software resources needed to automatically instantiate the setup described in this writeup,
- (ii) srsLTE with O-RAN E2 and slice aware scheduler [6], i.e., a fork of the srsLTE code base with our enhancements,
- (iii) NexRAN xApp [2], the xApp that interacts with both the KPM and RAN slicing service models
- (iv) POWDER fork of e2 core repo with minor bugfixes [4],
- (v) POWDER fork of kpimon xApp with bugfixes [5].

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