SONIC Labs Technology Access Programme

Technical Document

Programme Themes

The overarching challenge for this Programme is to develop Open RAN energy efficiency solutions categorised under two themes namely.

1. RIC enabled Advanced Sleep Modes ("**Theme 1**")
2. Optimising CU/DU Power utilisation of server CPU cores ("**Theme 2**")

Theme 1: RIC-enabled Advanced Sleep Modes

The RAN Intelligent Controller (RIC) as a software-defined component controls and optimises Open RAN functions. Through the application of AI/ML techniques, it assesses, diagnoses and learns to optimise the performance and resource utilisation of radio network elements. Digital Catapult is looking for UK operating companies, small to medium businesses, as defined in Section 9.10, to develop solutions for rApps and xApps to run on Non-Real time and near real-time RIC platforms to achieve improvement in energy consumption by the radio access network.

Participating companies should have prior experience in developing applications and solutions that can be used for optimising wireless networks and should be interested in exploring innovative solutions and integrating their solutions in disaggregated Open RAN systems.

Theme 1 will enable the development of new prototype solutions (third-party RIC applications) with meaningful usage to the MNO community. This theme allows SMEs to explore energy efficiency solutions for Open RAN systems through the development of xApps and rApp applications.

To support Theme 1, Digital Catapult will provide access to SONIC Labs' in-house testing capabilities and a RIC tester which simulates O-RAN networking nodes including O-CU, O-DU and Near/Non-RT RIC to develop and trial energy efficiency solutions. The RIC tester will be leveraged to emulate the entire radio access network under different deployment scenarios including various traffic and mobility models.

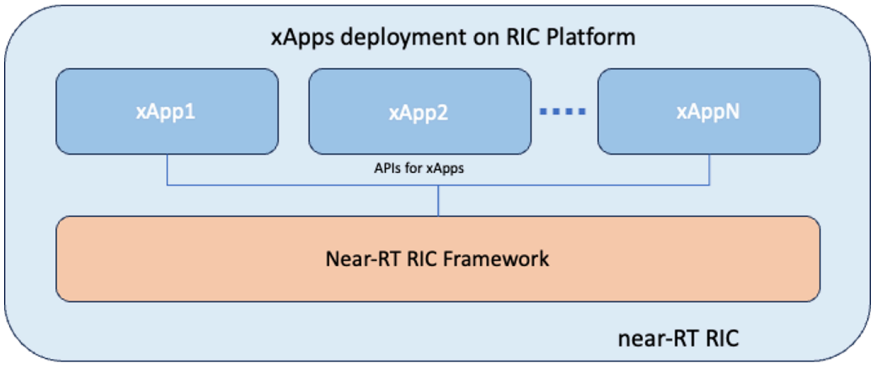

Fig [1]: Apps deployment on RIC platform

The MNO and private network provider community has identified Advanced Sleep Mode as a novel feature that requires further exploration to determine the feasibility of achieving intelligent energy saving by optimising the RAN sleep mode patterns through AI/ML enabled RIC-based actuation. This theme will explore solutions utilising any or all of the following three sleep modes of operation.

- Micro sleep power state with instantaneous (i.e. per symbol basis) transition time.
- Light sleep power state with transition times between 6 ms and 640 ms.
- Deep sleep power state with transition times between 50 ms to 10 sec.

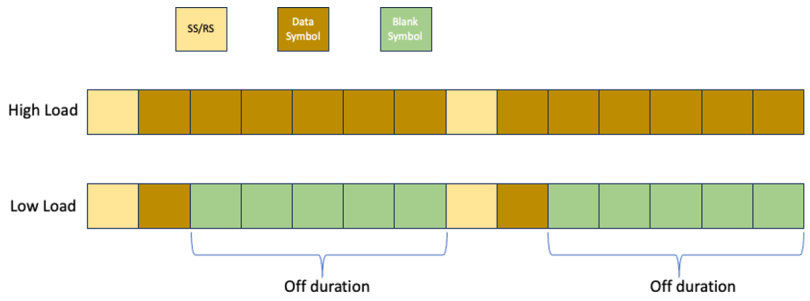

Fig [2]: Advanced sleep modes

Shortlisted SMEs will develop solutions for rApps and xApps to run on non-real and near real-time RIC platforms to achieve improvement in energy consumption by the radio access network. These applications will be tested with an emulated Open RAN deployment using a RIC tester to showcase the effectiveness of the application in achieving energy efficiency gains.

Theme 2: Optimising CU/DU Power utilisation of server CPU cores

The O-DU and O-CU consume significant processing power from a compute node. This theme will enable the optimization of O-DU and O-CU solutions for providing energy-efficient solutions to the MNOs and private network provider community. Digital Catapult is ideally looking for UK operating companies to provide, deploy and integrate O-CU/O-DU software solutions within an energy monitoring and optimisation test platform.

Participating companies should be interested in exploring innovative solutions and optimising their products' energy consumption using standardised testing methodologies such as those defined under ETSI (TS 103 786). The testing platform will provide feedback for optimising energy-saving gains by characterising: Uncore Frequency Scaling, Voltage-Frequency control states (P-states) and C-States.

To support this theme Digital Catapult will provide access to an energy consumption monitoring test platform presented in Figure [3]. O-DU and O-CU software will be deployed on a COTS server and integrated with an O-RU and Core network simulator and a Power Analyser. The O-RU simulator will simulate both UE and O-RU over fronthaul interfaces while the Core network simulator helps to provide end-to-end connectivity. The Power analyser will measure the AC power consumption for different load tests as defined by ETSI (TS 103 786).

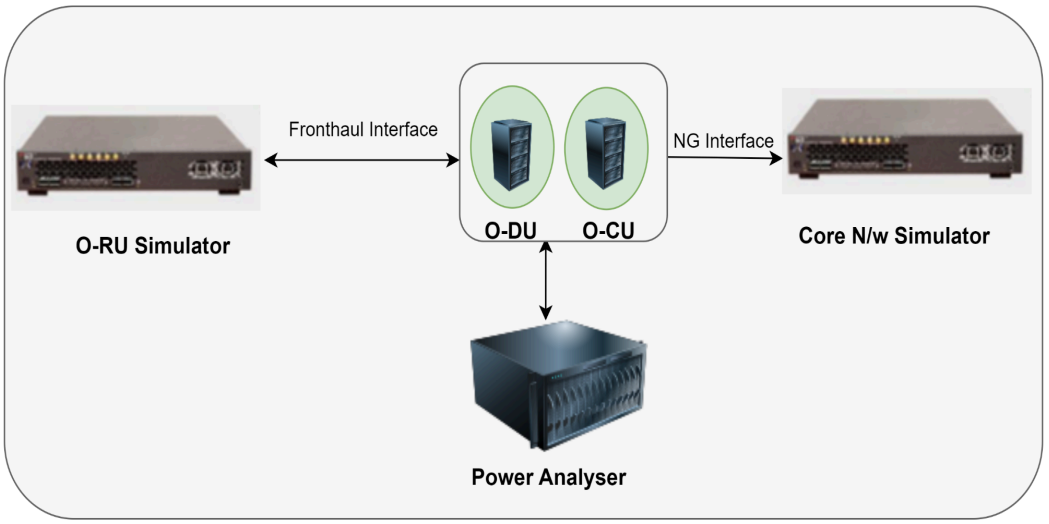

Fig [3]: Energy Consumption monitoring test platform

O-DU and O-CU will be tested under various combinations of path loss (Low, Medium and High) and load conditions (Low, Medium and High); with the power consumption monitored during the executions. The test platform will provide insights into energy consumption statistics leveraging the integrated Redfish and Power Analyzer. O-DU and O-CU software providers will be provided with the opportunity to incorporate the feedback from the test platform and optimise the product(s) implementation to showcase energy enhancements/gains.

Participants who are exploring and developing xApps and rApps for Theme 1 (Advanced Sleep Mode), would also commit to the following:

- Should aim to prove out with emulated CU/DU/RU, if supported by vendors, otherwise shall be proven with RIC tester which shall simulate CU/DU/RU/UE/Core
- Are expected to develop/enhance apps (xApps/rApps) during the TAP

Participants who are participating for Theme 2 (Optimising CU/DU Power utilisation of server CPU cores) and providing software for O-DU and O-CU, would also have the following commitments:

- Should provide support to integrate the O-DU and O-CU with the O-RU and Core Simulator in Energy consumption monitoring and test platform.
- Should utilise UE/RU Emulator with built-in channel emulation to generate ETSI traffic profiles for low, medium, and busy-hour levels.
- Should provide support for benchmarking Energy Consumption of the O-DU/O-CU under established and repeatable traffic conditions.
- Should provide support for Optimising energy-saving gains based on the characterisation tests using variations in Uncore Frequency Scaling technique, Voltage-Frequency control states (P-state), Traffic profiles and C-State

Product's Auxiliary Items

The start-ups/SMEs and O-DU and O-CU software providers participating in SONIC Labs will provide any auxiliary items necessary for the correct functioning and interfacing of the product in the programme. This includes items such as:

- Any installation manual or guide for the product.
- Accelerator cards for the O-DU deployment
- O-DU and O-CU software that can be deployed on COTS servers
- Software licences for O-DU and O-CU for the duration of the TAP programme

Technical Requirements

Theme 1 - Applicants developing xApps and rApps:

- Applicants must be able to demonstrate they have the technical capabilities to develop an xApp/rApp for an end-user.
- Applicants must have adequate technical resources to take part in development, integration, testing and porting processes as well as other resources to take part in knowledge sharing and dissemination activities.

Theme 2 - Applicants providing O-DU and O-CU software:

- Applicants must have adequate technical resources to take part in integration, testing and optimisation as well as other resources to take part in knowledge sharing and dissemination activities.

- O-DU and O-CU software will have a Technology Readiness Level (TRL) 7-9
- O-DU and O-CU software will be deployed and integrated with an energy consumption monitoring and test platform
- O-DU and O-CU software providers shall be able to incorporate the feedback from the test platform and incorporate, and implement it in the product to showcase energy gains