ARI-5G™

TELECOM INFRA PROJECT®

UK DSIT Future RAN Competition (FRANC)

Accelerating RAN Intelligence in 5G

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Exhibit A

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Change Tracking

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09/05/2024	V1.0	Abdel Bagegni	Final version

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1. Executive Summary

The Accelerating RAN Intelligence in 5G (ARI-5G) Consortium, led by Telecom Infra Project (TIP) and in collaboration with Accelleran, Amdocs, Attocore, British Telecom (BT) and VIAVI Solutions, has successfully deployed, evaluated, and showcased four spectrum and energy management x/rApps use cases on a standards-based RIC platform. The project extends from TIP's ongoing efforts within the RAN Intelligence and Automation (RIA) subgroup and capitalizes on the subgroup's targeted use cases. Supported by funding from the UK government's Department for Science, Innovation, and Technology (DSIT), this project signifies a significant stride forward in advancing RAN intelligence within the 5G ecosystem.

The key value delivered by ARI-5G was to demonstrate four use cases across a live network and in a similarly configured OpenRAN network simulator (Viavi RIC Test) using Accelleran's dRAX RIC platform. The tested use cases include 1) Coverage and Capacity Optimization (CCO) by Amdocs, 2) Synchronization Signal Block (SSB) Beam-set Optimization also developed by Amdocs, 3) Energy Management developed by Accelleran, and 4) Interference Mitigation developed by VIAVI. The real network testing showed that the functional integration around the RIC is strong, and the principal function of the RIC can work in a practical, real-world deployment. The simulated testing showed that the algorithms could considerably improve coverage, capacity, and energy efficiency.

The results showed energy savings improvements of up to 60% on the energy management xApp, coverage improvements of 8% with the CCO xApp, 26% with traffic-appropriate beam selection on the mMIMO SSB xApp, and 50% improvement on the interference mitigation xApp. The project demonstrated the maturity of Open APIs for RAN data collection and RAN control, which allows third parties to develop RIC applications (xAPPs), allowing the much-needed supply chain resiliency for RAN optimization and management applications.

The project also delivered solutions covering one adjacent area of DSIT Future RAN Competition (FRANC), which was an organic outcome of the project. Amdocs developed CI/CD methods for deploying and upgrading xApps, while Accelleran built a

System for Energy Management (SEM) layer that served as a single interface for data collection and control of both the real and simulated networks. VIAVI demonstrated the importance of simulation in developing the RIC ecosystem. These contributions align well with FRANC's third and fourth areas: Software Platforms and Systems Integration.
The maturity of OpenRAN designs for 5G Standalone architecture with a Next Generation Core (NGC) was showcased and deployed at BT's outdoor lab - Adastral Park with Over-the-Air (OTA) testing.

2. Overview

ARI-5G is an industry-first public-private partnership initiative that successfully implemented a program where multiple parties built different functions of the disaggregated stack, including the RIC and RIC xApps/rAPPs, and proved that the OpenRAN architecture was achievable.

The focus was on the benefits of applying AI/ML for predictive and proactive energy and spectrum management. The project also demonstrated the maturity of open APIs/SDKs from RIC platforms that enabled third parties to develop RIC applications within the project's duration.

The project utilized a 5G Core Network (NGC) developed by Attocore. The OpenRAN network followed the O-RAN Alliance architecture with disaggregated RU (Benetel), CU (Accelleran), DU (Accelleran OEM), near-RT RIC (Accelleran), RIC Test simulator (VIAVI), and RIC Apps developed by VIAVI, Amdocs, and Accelleran.

The RIC Test simulator used in the project was set up to simulate a rich set of users and traffic patterns to feed diverse and rich data sets to the RIC xApps. A novel approach of ARI-5G was to configure the simulator to match the locations, antenna types, sites, and coverage characteristics of the outdoor sites. This allowed the project to compare certain aspects of the RIC application behaviours in each environment: real and simulated.

The ARI-5G consortium successfully demonstrated four software solutions that provide near-real-time solutions as xApps for spectrum management and energy efficiency applications in a 5G Stand-Alone (SA) network, as shown in Table 1.

FRANCE Solution Area	xAPP Delivered:	Solution Highlight
Spectrum and Energy	Coverage and Capacity (CCO)	Power reduction without impacts on QoS
Spectrum	Interference Management	Increased capacity due to interference reduction
Spectrum	mMIMO SSB configuration	Beam management to improve coverage based on traffic and network policy
Energy	Energy Management	Energy savings in single/multi-frequency sites

Table 1 Solution Highlights for FRANC Solution Areas

3. Use Cases Definition & Requirements

The use case requirements and definitions are taken from TIPs Radio Intelligence & Automation (RIA) subgroup which operators under TIPs OpenRAN Project Group. The subgroup is led by operators including British Telecom, Vodafone, Orange, Deutsch Telecom, AT&T, Rakuten and others. The subgroup goal is to enable MNOs and the OpenRAN ecosystem to collaborate on RAN use case development, testing, and deployment that leverage the strength of Data Science and AI/ML technologies and open interfaces based on industry standards. The ARI-5G use cases are highlighted in Figure 1.

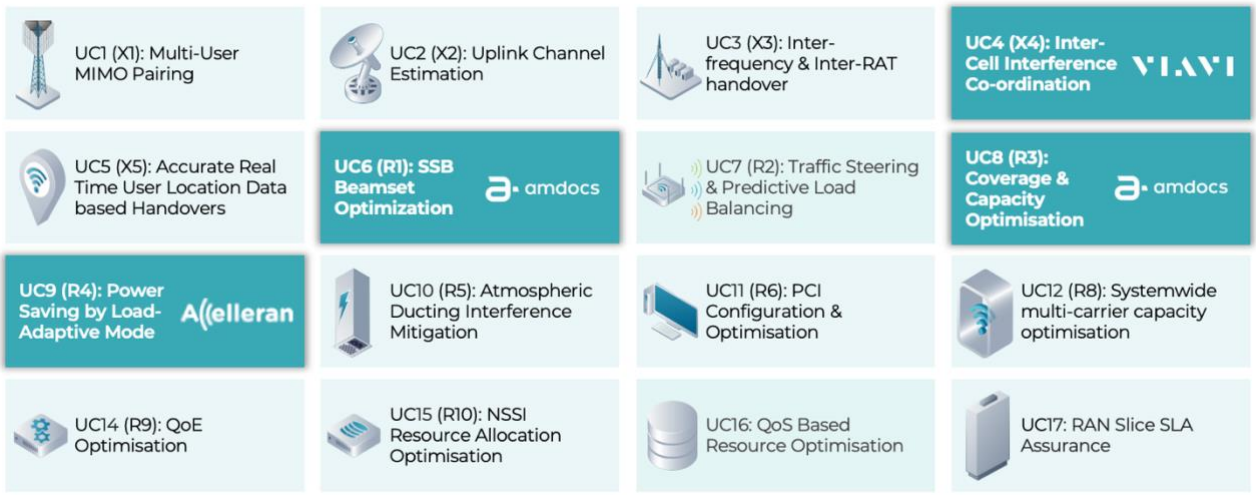

Figure 1 TIP OpenRAN RIA telco prioritised RIC use cases & ARI-5G points of focus

The RIA subgroups collaborate with the community to drive AI/ML use case productization and enable an OpenRAN ecosystem. They also leverage AI/ML and data science technologies to define the requirements of the use cases, initiate testing and MNO trials, and share results with the OpenRAN community.

4. Execution & Results

The testing took place in BT Labs at Adastral Park with two configurations: 1) a commercial-grade solution that included five Bentel radios, a CU (Centralized Unit), a DU (Distributed Unit), and an Accelleran RIC along with a 5G Core and management functions deployed at Adastral park (BT Lab), and 2) A VIAVI TeraVM RIC Tester connected to the Acclleran RIC at the same lab.

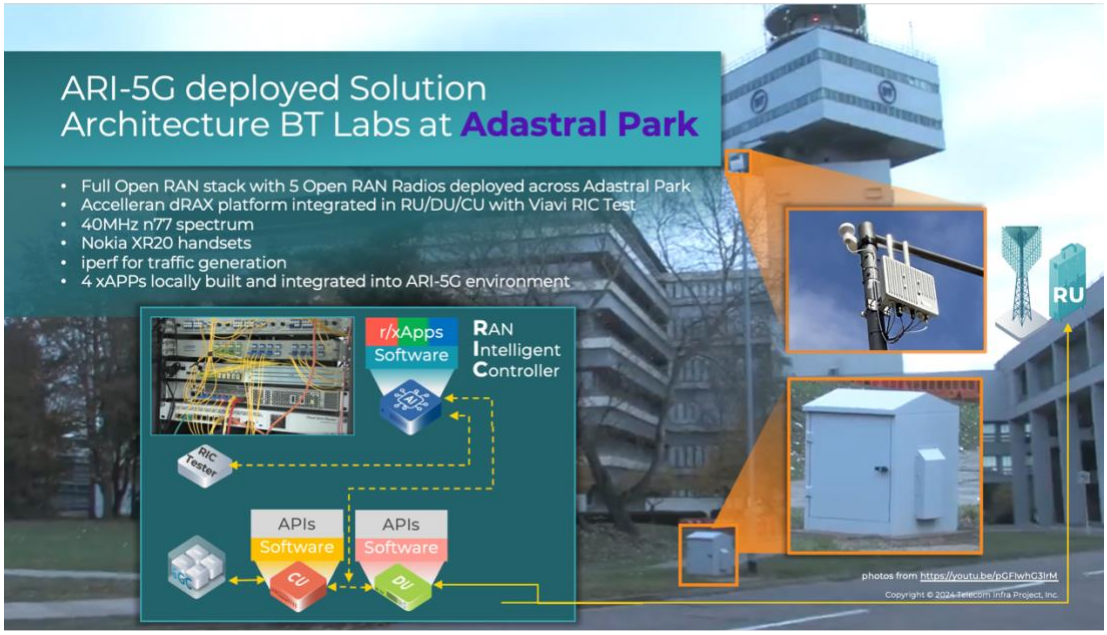

Figure 2 Solution Deployment at Adastral Park

The objective of the CCO xApp, developed by Amdocs, is to improve network coverage and capacity in a well-balanced way using Artificial Intelligence (AI) and Machine Learning (ML) algorithms. CCO automatically identifies weak coverage & interference problems, including over-propagating cells that cause interference. After problems are identified, root causes are analyzed, and optimized solutions are provided. The results showed 8% coverage improvements with the Over-The-Air (OTA) testing.

The mMIMO optimization xApp, also developed by Amdocs, focuses on optimizing coverage and capacity for the Grid-of-Beams (GoB) MIMO operation mode. The goal is to select the optimal SSB beam transmission configuration. The xApp was tested with the RIC tester and showed a coverage improvement of 26%.

Accelleran developed the Energy Management use case. It uses the KPI stats provided by the DU and CU to predict the cell traffic usage pattern and optimize cell coverage by gradually adjusting the power levels until it switches off the cells no longer in use. The testing resulted in 60% improvements in energy savings.

The Interference Management xApp, developed by VIAVI, focuses on inter-cell interference, where the downlink or uplink transmissions for a UE suffer interference

from the transmissions associated with another UE. By controlling the spectrum allocated to different UEs at risk of causing or experiencing interference, the aggregate interference is reduced, thus improving the service experience for the user. The testing results showed that active UEs increased by 50%.

5. Conclusion

With the support of UK DSIT, ARI-5G has created value for the industry beyond the exceptional contributions and results achieved by project partners, as outlined in this white paper.

The project execution of multiple use cases in ARI-5G had a positive impact within the RIC ecosystem not only because the project managed to verify the AI/ML algorithms of the x/rApps but was also tested in a real network that is similar to an operators' live network in many aspects. Two of the ARI-5G use cases (energy efficiency and mMIMO SSB use cases) were selected by the National Telecommunications and Information Administration NTIA/ITS to demo the use cases live. The forum brings together industry leaders and Open RAN innovators worldwide to share their valuable insights into the latest technology developments in global open networks.

The project findings and results were fed back to TIP's RIA subgroup. Through TIP's RIA community, the project findings and results are further analysed, and additional criteria are added to satisfy the new use cases and community requirements. Part of the RIA community activity is to provide feedback recommendations on specifications and interfaces to the O-RAN Alliance.

ARI-5G has firmly established the viability of integrating RIC platforms and RIC Apps on commercial-ready OpenRAN 5G networks in both simulated and deployed configurations; future projects can follow ARI-5G's blueprint and lessons learned for extending the scope and size of RIC applications and RIC platforms across a broader ecosystem of partners and solutions.