

O-RAN Software Community RIC xApp project perspective

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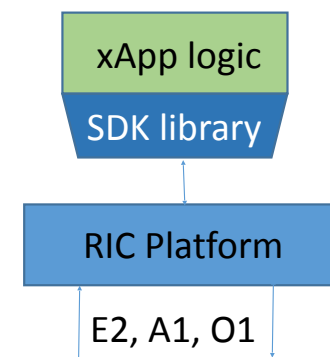
Open 5G Forum - short talk session
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RICAPP in O-RAN Software Community



- The RICAPP projects started with the RIC project
- xApps implemented since before formally approved E2AP, any E2SMs, the RIC architecture, or the RIC APIs.
 - xApps evolve with the RIC platform and evolve the platform itself: Common tasks and code can be moved to the RIC's SDK libraries.
 - xApps by different parties and using different E2 SMs ensure RIC platform stays E2SM agnostic
- **Demo xApps:** HelloWorld (HW) xApps in C++, go, and python demonstrate how to use different features in the RIC platform: E2, E2SM, SDL/R-NIB, A1, O1.
- **Use cases:** Combine xApps from different organizations.
 - UE-level traffic steering (TS) and anomaly detection (AD) using information collected using E2SM KPM (KPIMON)
 - Starting to explore ideas such as geo-location, network slicing, and new E2 SM RC
- While most of the open source xApps are simple for now, the best ideas may later evolve into commercial versions.



Building the RICAPP community



- HCL: Machine learning xApps for anomaly detection (AD) and throughput prediction (QP), and RIC performance benchmarking (Bouncer) as well as integration of the use case.
- Samsung: KPIMON xApp that implements E2 SM KPM, two demo xApps for go and python (hw-go, hw-python)
- AT&T: Metrics calculation (MC) and demo xApp for C++ (HW)
- ChinaMobile: Machine-learning xApp for load predictions (and others in the planning)
- UTFPR (University, Parana, Brazil): Traffic steering xApp (TS) originally developed by AT&T.
- Mavenir: RC xApp that implements subset of the new E2SM RC (Release E).

Release	A	B	C	D	E
Contributing organizations	2	2	3	5	6
xApps	4	6	7	10	11

In addition, Viavi has worked closely with the RICAPP team to develop a simulator to support the anomaly detection and traffic steering use case.

Finally, Facebook and VMWare will contribute to xAPP SDK repos under the RICAPP project.

Statements from the community

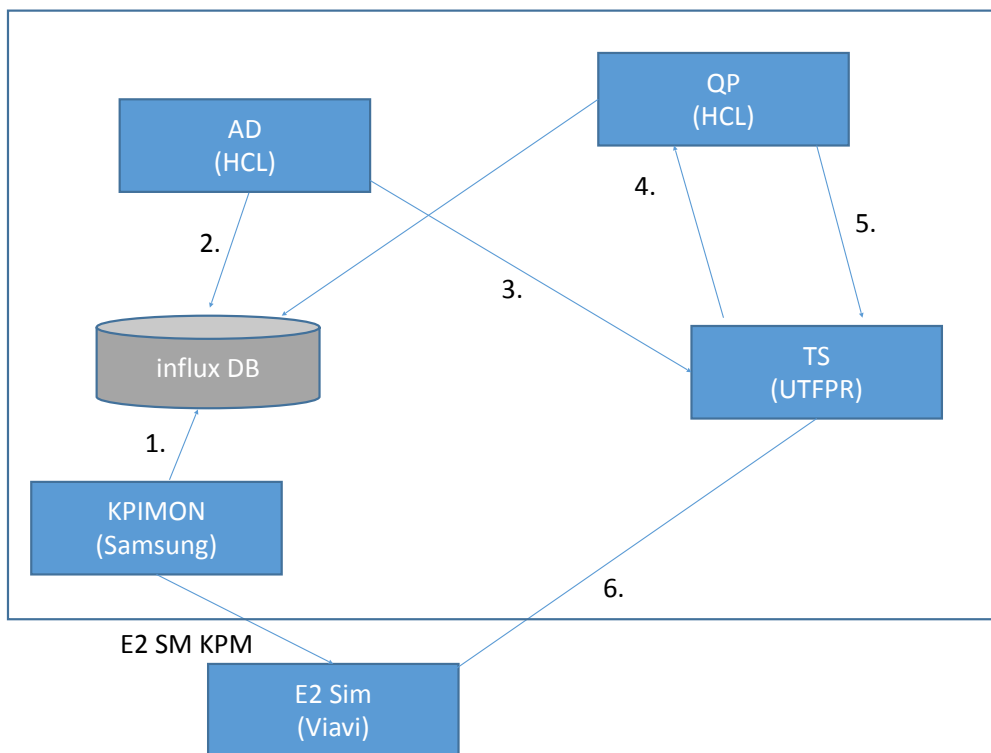


"Making the RAN intelligent and context-aware is critically important for network optimization and automation. The focus of Samsung's O-RAN SC contribution has been towards enhancing the A1-Enrichment Information (A1-EI) & xAPP Framework. Overall, we believe that strengthening the O-RAN AI/ML Framework will play a big role in making operators achieve *proactive closed-loop optimization and automation of RAN operations*." **Dr. Sunghyun Choi, Corporate SVP and Head of Advanced Communications Research Center of Samsung Research, Samsung Electronics.**

"The OSC RICAPP project provides me an opportunity to work on emerging technology and real-world problems, and collaborate with leading businesses in 5G technology", **Prof. Alexandre Huff, UTFPR**

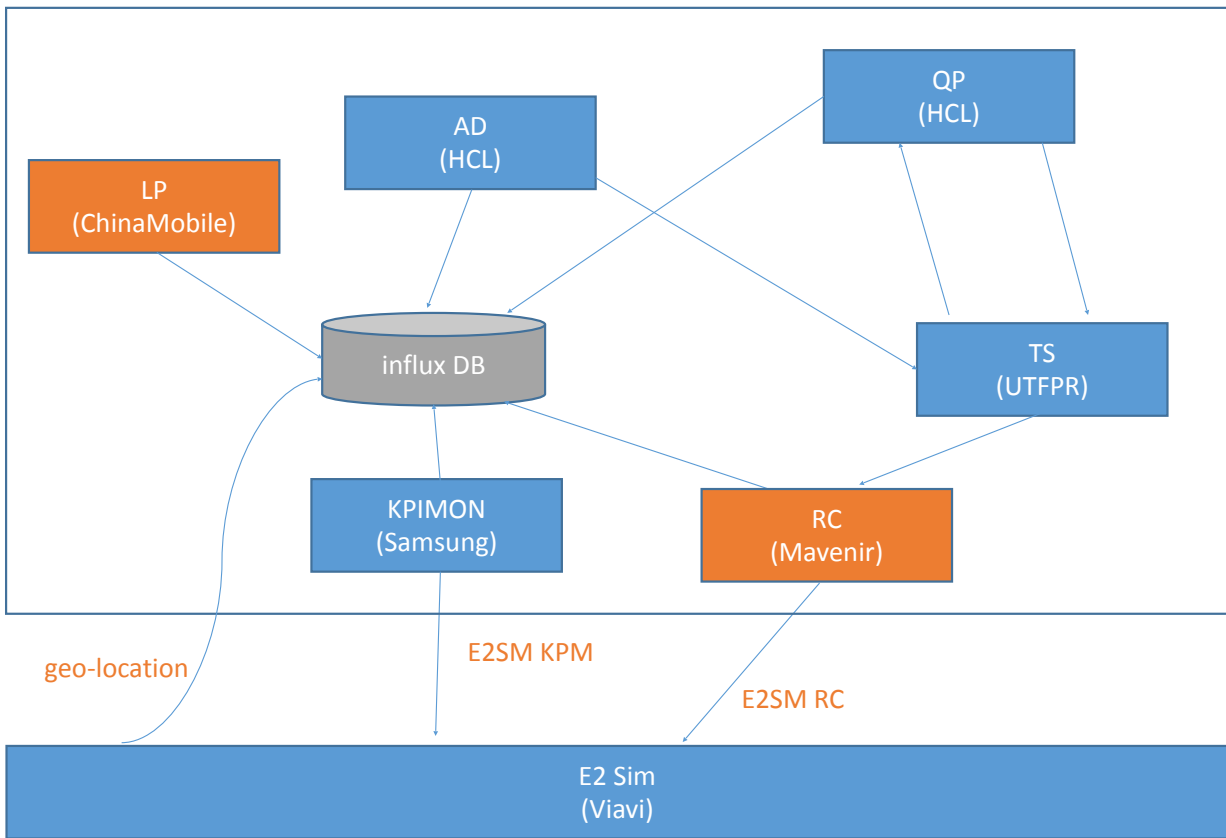
"RIC xApps requires a synthesis of many technologies like precision telemetry, fast data-based AI platform, AI/ML model driven decisions integrated to perform at highly optimized levels enabling intelligence at the edge providing for milli sec feedback loops. It is very exciting to work in this technology as *it will enable many new use cases that weren't possible before!*" **Ramesh Sriraman, contributor, HCL.**

RICAPP Release D use case



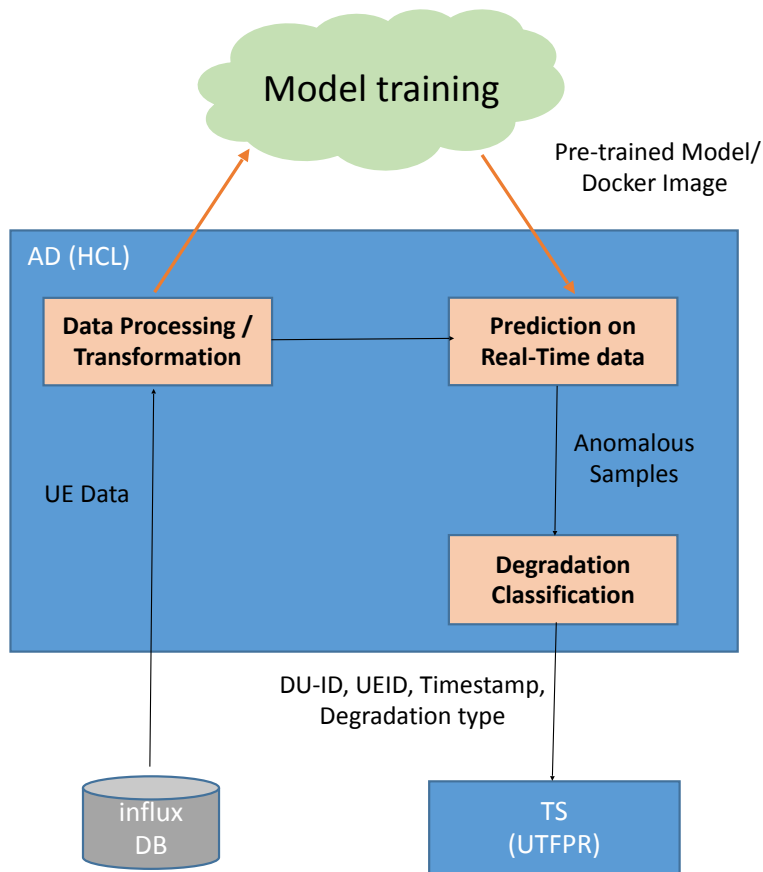
- Per UE handover control based on measurements, ML, and prediction.
- Combines anomaly detection (AD) with throughput prediction (QP) and traffic steering (TS).
- AD: Detect UE-level anomalies.
- QP: Predict UE throughput in a neighboring cell given cell utilization and UE signal strength.
- TS: Receives anomaly notifications, requests throughput predictions, and requests UE handover.
- Integration of KPIMON and Viavi E2 Tester delayed to E release.

Release E use case plan



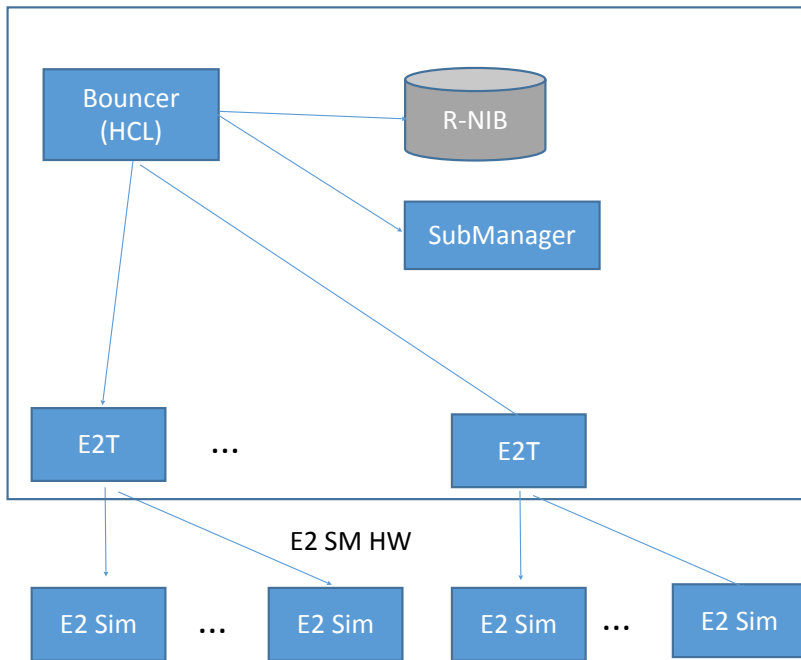
- Enrich use case with load prediction (LP xApp) and geo-location
- New xApp RC (RAN Control) implements a subset of the new E2SM RC
- Integration of KPIMON and closing of the control loop.
- Exploration of using load prediction and geo-location to improve anomaly detection and traffic steering use cases.

Anomaly Detection (AD) xApp - HCL



- ML-model trained off-line with data from Viavi simulator and packaged as a docker image.
- Isolation forest ML technique.
- Anomaly detection based on time series data.
- Multiple types of anomalies, e.g., throughput, signal strength.
- Continuous training and model update when needed.

Bouncer xApp – testing the limits of the RIC



- Bouncer xApp, in combination with the E2 Sim, tests the performance limits of the RIC platform.
 - How many E2 Nodes can connect to one RIC instance?
 - How many E2 subscriptions can be supported?
 - What is the end to end latency between an E2 REPORT and the matching E2 CONTROL at the E2 simulator?
 - What is the RIC throughput?
 - Where are the bottlenecks (resources, software, libraries, protocols)?
- Target: Profiling tool for any RIC implementation.



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