



Comprehensive O-RAN Stack Validation

A Cloud-based Solution with ABoT & AMCOP

Aarna Networks and Rebaca have developed a comprehensive O-RAN stack validation solution allowing users to overcome common O-RAN challenges, customize a validation stack, and enable interoperability testing.

Overview

The O-RAN Alliance has enabled an ecosystem of disaggregated, multi-vendor RAN solutions. However, this has necessitated interoperability among various stake holders for specification compliance. Added to this, the RAN components need to integrate with the backhaul 4G or 5G Core network. This comprises a combination of NFs deployed across distributed networks using different deployment models. An automated, ready-made test suite that can exhaustively validate and do benchmarking of functional, conformance, and performance use cases is a “must have.”

Rebaca Technologies ABoT integrated with the Aarna Networks AMCOP SMO (Service Management and Orchestration) offers a comprehensive environment to emulate any O-RAN and 4G/5G network functions. The solution can trigger and verify different use cases. Each use case can be represented in a Domain Specific Language, which can describe the different scenarios. The representation of these use cases in a Domain Specific Language helps to generate the resultant test cases according to the 3GPP and O-RAN specifications. The solution also includes ABoT Analytics which analyzes the test execution results to provide report generation, log/pcap analysis, KPI correlation, release maturity reports, and bug tracking. This represents a “zero touch” model for deployment and commissioning.

Background

The Control Plane, Data plane, and Management Plane test cases for O-RAN need to be defined and automated according to requirements specified in the O-RAN specifications for Interoperability testing. Requirements for C-Plane, U-Plane, and M-Plane interoperability are as follows.

(<https://www.o-ran.org/specifications>)

- ▶ F1/E1 Specific requirements: 3GPP Specification 38.401
- ▶ O-RAN Stack Interoperability Test Specification 5.0
- ▶ E2 & RIC Specific Requirements ORAN WG3.E2TS.v01.00.05
- ▶ M-Plane, O1- Specific Requirements ORAN WG8-IOT-v04.00

The overall specifications for M-Plane are described in the following documents with O1, Netconf server & SMO support:

- ▶ O-RAN Management Plane Specification 10.0
- ▶ O-RAN.WG4.MP.0-v10.00
- ▶ O-RAN O1 Interface specification for O-CU-UP and O-CU-CP 4.0
- ▶ O-RAN.WG5.O-CU-O1.0-v04.00
- ▶ O-RAN O1 Interface specification for O-CU-UP and O-CU-CP - YANG Models 4.0
- ▶ O-RAN.WG5.O-DU-O1.0-v05.00-YANGs
- ▶ O-RAN O1 Interface specification for O-DU - Configuration Tables 5.0
- ▶ O-RAN.WG5.O-DU-O1.0-v05.00-AnnexD
- ▶ O-RAN O1 Interface specification for O-DU - YANG Models 5.0
- ▶ O-RAN.WG5.O-DU-O1.0-v05.00-YANGs

Challenge

O-RAN testing involves pulling different components (SMO, RU, DU, CU, and RIC) from various sources. This activity is time-consuming and expensive and makes it challenging to validate interoperability. What's more, users today need more ability to generate test cases and make them work in automated CI/CD multi-vendor O-cloud environments. Examples of real-time use cases where manual testing is a bottleneck are:

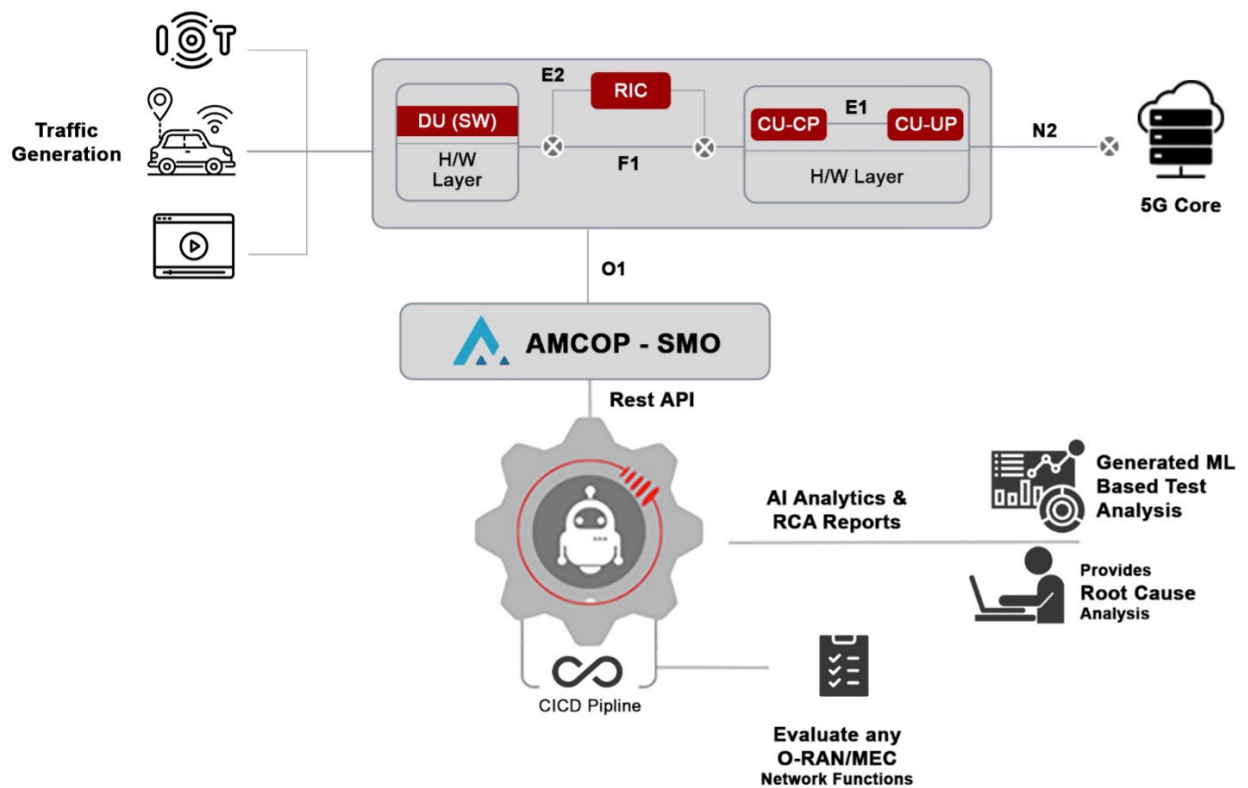
- ▶ Rapid generation of the test cases that can be used to validate interoperability
- ▶ Execution and analysis in a repeatable, multi-vendor CI/CD environment
- ▶ End-to-end test cases in multi-vendor environments with standardized 3GPP and O-RAN interfaces

Solution

Comprehensive O-RAN Stack Validation allows users to customize a validation stack by mixing and matching components and quickly enables interoperability testing. Specifically, the solution comprises the following components:

1. DU, CU, RIC simulators
2. Open source O-RAN SMO
3. RU simulator from O-RAN-SC
4. Open source Kubernetes O-Cloud
5. Comprehensive test suite for all the 3GPP and O-RAN interfaces
6. Automated analysis of test execution data and report generation

This integration replicates a multi-vendor O-Cloud environment and executes test cases as specified in the O-RAN specifications.



Market Readiness

The solution is a market-ready validation stack that facilitates multi-vendor testing of the O-RAN stack.

Sample test cases:

- ▶ F1 Startup Cells and Activation
- ▶ UE Initial Access with data flow
- ▶ NSA mode of operation in split RAN
- ▶ Intra / Inter gNB Handovers
- ▶ RRC state transition use cases & reestablishment
- ▶ Multiple TNLAs Procedures
- ▶ Bearer context management procedures
- ▶ UE context management procedures
- ▶ Warning message transfer procedures
- ▶ RIC integration use cases: E2 Setup, Subscription, Subscription Delete, Indication, KPM/NI model support, etc.
- ▶ SMO related procedures: SMO discovery, alarm/ event management, cell activation, fault management, monitoring, performance/configuration management, etc.
- ▶ and many more...

Sample Business Use Cases:

- ▶ The orchestration, validation and debugging/analyzing capabilities can be used in a multi-vendor O-RAN initiative for validation, e2e analysis, debugging and KPI monitoring
- ▶ The solution can facilitate end-to-end dynamic network slicing with different resolution of video traffic and analyze the video KPIs like bandwidth, latency, and jitter
- ▶ The missing NF simulation capabilities with end-to-end test packages can be used to validate DUTs under different scenarios with various of load/traffic conditions
- ▶ The E2 interface validation support can be used for vendor specific RIC clients for different xApp model executions & validation

High-level Benefits for SIs, OEMs & Operators:

SIs: Provides a zero touch “pay as you go” 5G/O-RAN validation platform to test interoperability scenarios seamlessly at the pre-deployment phase with multi-vendor NFs across different distributed networks.

OEMs: Facilitates wraparound testing encompassing the OEM's DUTs and validate the DUTs performance against different scenarios for different deployment models like MEC/Edge.

Operators: Enables continuous end-to-end integration testing with a highly scalable test framework. It helps the operators to build their customized ready-to-use test suites, automates the testing cycle, and scales testing — all in cost-effective manner.

Summary

The solution creates an opportunity to accelerate the process of automated O-RAN validation with test cases that scale rapidly. Test cases for standards-compliant interfaces like F1, E1, E2, and O1 are used to manage the rapidly growing test cases to reduce deployment cycles for operator deployments of O-RAN solutions. Users customize a validation stack by mixing and matching components and validating interoperability in a multi-vendor CI/CD environment. This process ensures 3GPP and O-RAN compliance and includes debugging test execution artifacts and analytics reports.

Solution

<https://www.aarnanetworks.com/about-us#contact>

<https://www.rebaca.com/contact-us>