# TeraVM AI RSG
## VIAVI AI RAN Scenario Generator

The **VIAVI AI RAN Scenario Generator (AI RSG)** simulates real world RAN scenarios for training, testing and validating network optimization Apps. The AI RSG accurately simulates system-level RAN behaviors, creating a RAN Digital Twin (RDT) that mimics real network conditions and behaviors. This powerful solution can emulate various topologies, configurations and subscriber behaviors.
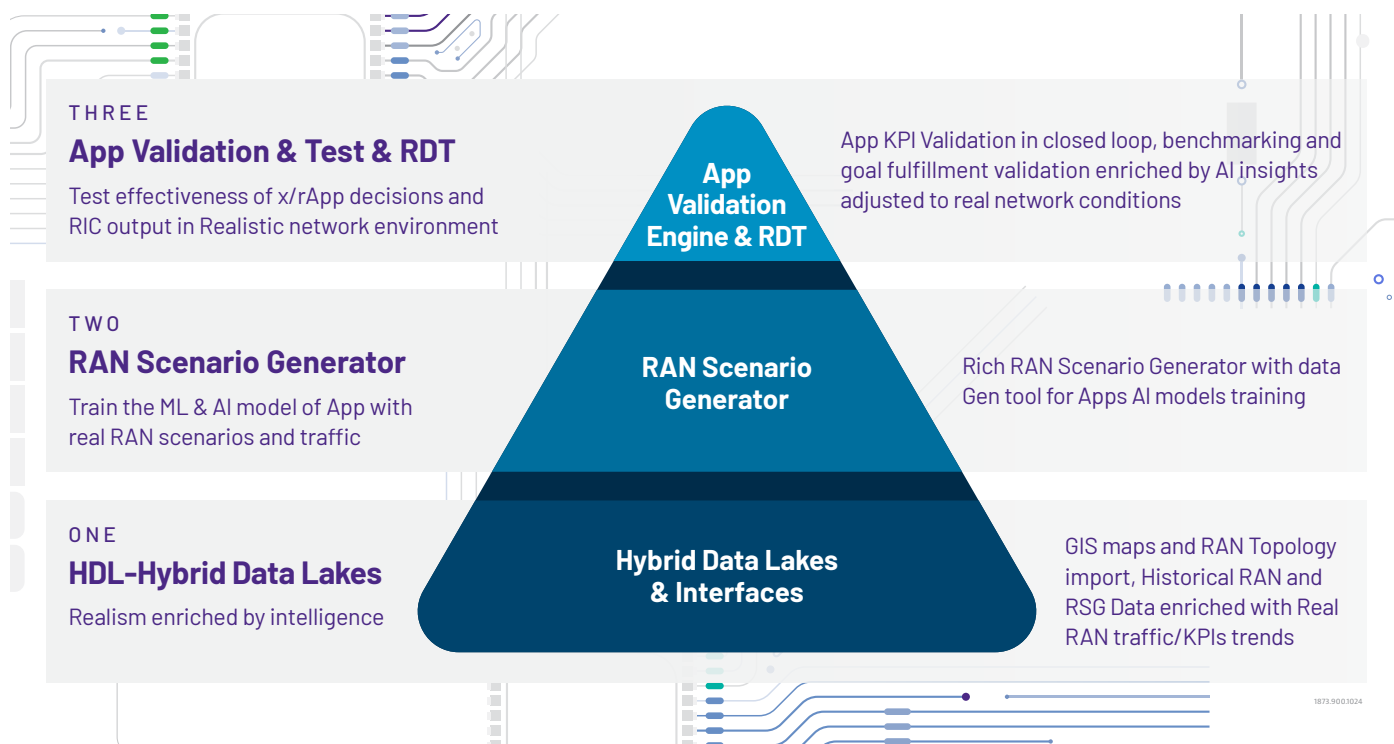
AI RSG can emulate various topologies and morphologies, configurations, mobility patterns and traffic profiles on both real and synthetic maps. Supporting 4G, 5G, emerging 6G and NTN networks, the AI RSG unlocks endless possibilities to train AI-driven app models utilizing advanced and complex technologies such as massive MIMO, making it essential for advanced network performance. AI RSG can serve as a "virtual sandbox playground" for greenfield app developers as well as for experienced RAN vendors and CSPs.

AI RSG can simulate up to tens of thousands of (UEs) and between 1,000 and 5,000 cells per reference server. It can be deployed in Docker containers with cloud environments or on dedicated servers.

Generate traffic demand profiles, enabling UEs to switch between idle and active states while dynamically utilizing varying amounts of Physical Resource Blocks (PRBs). Layer 1 radio conditions are modeled and fed into the Layer 2 scheduler, which assigns PRBs based on the Channel Quality Indicator (CQI).

## Key Benefits and Features

- **Open RAN Validation:** Benchmark Open RAN RIC (RAN Intelligent Controllers) in near-real time and non-real time scenarios.

- **Data Generation:** AI RSG produces RAN-specific datasets for training AI/ML models in intelligent applications such as SON, rApps and xApps.

- **Versatile Emulation:** Model diverse topologies, scenarios, UE types, mobility models, traffic profiles, GIS maps and topology import.

- **AI Driven Optimization:** Enhance network performance including massive MIMO technology.

- **Scale:** Emulate 10,000 UEs and up to 5,000 cells.

- **Lightweight VM Deployment:** Runs efficiently on container.

- **Cloud Compatibility:** Supports GCP, Azure, AWS.

- **Containerization:** Kubernetes and container-ready.

- **Realistic Network scenarios:** Configure UE type (Pedestrian, car, bus, drone, indoor etc.), Cell type (indoor, urban, rural), Frequency, Traffic profile.

- **Emulate Anomalies:** Introduce anomalies e.g. throughput 30% reduction in specific cells.

- **Realistic Network Twin:** Import real world maps with streets, buildings and network configurations.

**THREE**

**App Validation & Test & RDT**

Test effectiveness of x/rApp decisions and RIC output in Realistic network environment

**App Validation Engine & RDT**

App KPI Validation in closed loop, benchmarking and goal fulfillment validation enriched by AI insights adjusted to real network conditions

**TWO**

**RAN Scenario Generator**

Train the ML & AI model of App with real RAN scenarios and traffic

**RAN Scenario Generator**

Rich RAN Scenario Generator with data Gen tool for Apps AI models training

**ONE**

**HDL-Hybrid Data Lakes**

Realism enriched by intelligence

**Hybrid Data Lakes & Interfaces**

GIS maps and RAN Topology import, Historical RAN and RSG Data enriched with Real RAN traffic/KPIs trends

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## Unique Features

### Application Validation Engine (AVE)

AVE is an intelligent analytics layer providing AI based insight towards the app developer regarding Scoring, Benchmarking and app goal fulfilment over large periods of time and in large network instances. It gives graphical customizable User experience for the developer to understand the current app performance and to find room for improvements if required.

AI AVE ML Model uses Graph Neural Network modelling to accurately predict optimal network configuration for a certain app in a given RAN scenario to stress their application. Using this model AVE is able to predict the best case scenario of possible actions for a given network configuration for a specific App. As an example, feeding in a Manhattan City map the AI based AVE can predict the optimal set of actions to be run in this area in order to minimize the energy consumption without degrading the QoS. These actions can be compared to the actions and results of the App under test in order to alter and improve the app to strike the best possible result. In this way AI based AVE serves as a "Golden Standard" for apps to strive towards.

### Application Development Kit (ADK)

App twin ADK is a toolset in AI RSG allowing App developers to emulate App environments using Python developer library within AI RSG ecosystem, thus removing the need to integrate with the real NMS/RIC platform with complex interfaces. Instead, it allows to test the application features and performance within the AI RSG ecosystem in closed loop fashion in an iterative and agile approach.

## Supported Features

| Sample Procedures | | |
|---|---|---|
| Interface Testing (E2, A1, O1) | O-RAN WG3 Spec Compliance | UE Information |
| RIC Control Request | RIC Report Service | RIC Insert Service |
| RIC Control Service | RIC Policy Service | Call Process Outcome |
| RIC Subscription Request/Delete | On Demand Report | RIC Indication |
| E2 Node Configuration | L2 State Variables | Message Copy |
| RIC Reset/Removal | Radio Resource Allocation | E2 Node Info |
| Radio Access Control Request | Radio Bearer Control | UE List Assignment |

## KPI's to Validate Performance

TeraVM AI RSG offers KPIs for Cell, UE, QoS and mMIMO according to 3GPP Specs, O-RAN Alliance specs and VIAVI own proprietary KPIs. KPIs are generated in shared data tables, updated by relevant simulation models and exported via supported APIs/Interfaces toward the application/platform under test (r/x-app, SON, RIC, SMO etc.)

| Supported KPIs (sample) | | | |
|---|---|---|---|
| **Cell** | **UE** | **QoS** | **mMIMO** |
| Ave DL Thru'put | DL CQI | DL PRBs for Data Traffic | Beam Index |
| Dist of DL UE thru'put | Distance Travelled | No. of UL Transport Blocks | PRBs Available |
| Cell Frequency | Name UE Attached To | QoS Identifier | No. of Scheduled Layers |
| Energy Efficiency (b/j) | Neighbour Beam Id | No. of PDU Sessions | MIMO Beam Type |

## Order Codes

| Part Number | Description |
|---|---|
| TVM6235 | AI RSG Single User License |
| TVM6202 | AI RSG Data License (100 Nodes, 300 Cells, 2000 UEs, 200k Reports/s) |
| TVM6203 | AI RSG Advanced RF Model |

**VIAVI**

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