

TeraVM 无线场景仿真仪表

面向数字孪生
训练和测试无线优化应用

July 2024

VIAVI 3D 无线场景仿真仪 RAN Scenario Generator (RSG)

Train AI and Test AI

预测物理参数变化带来的影响



仿真 RAN 节点预测系统参数带来的影响



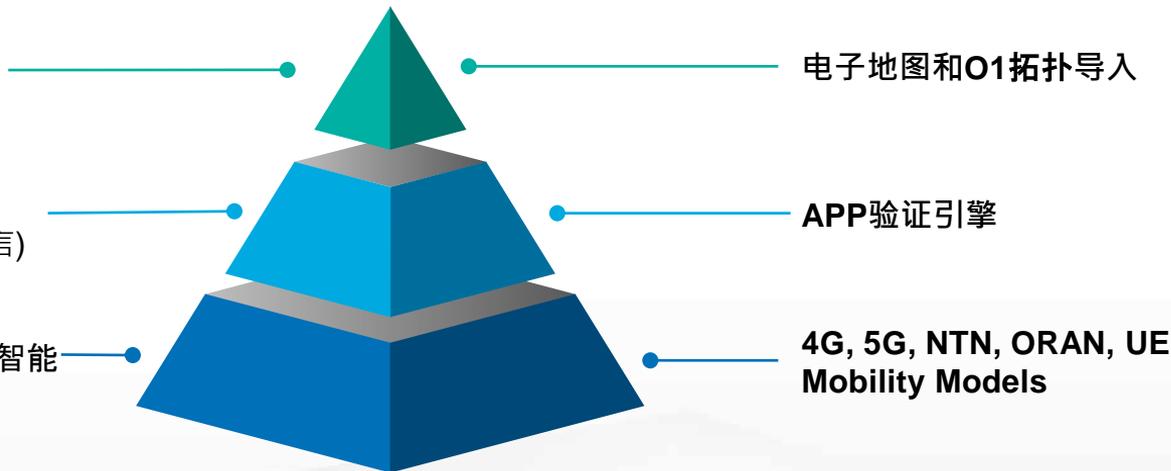
数字孪生
智能化真实场景仿真



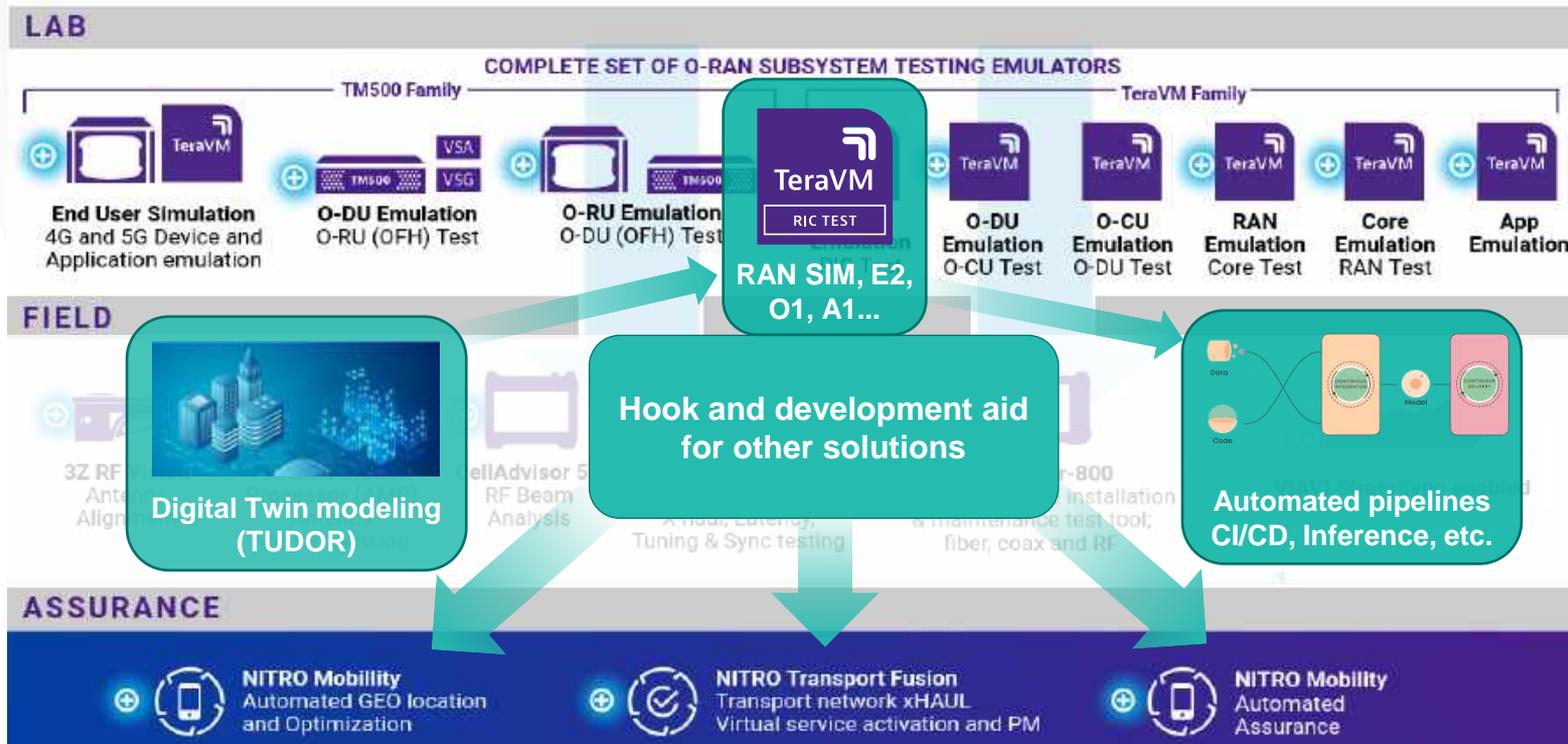
App Validation Engine
针对 AI 应用的测试 (机器语言)



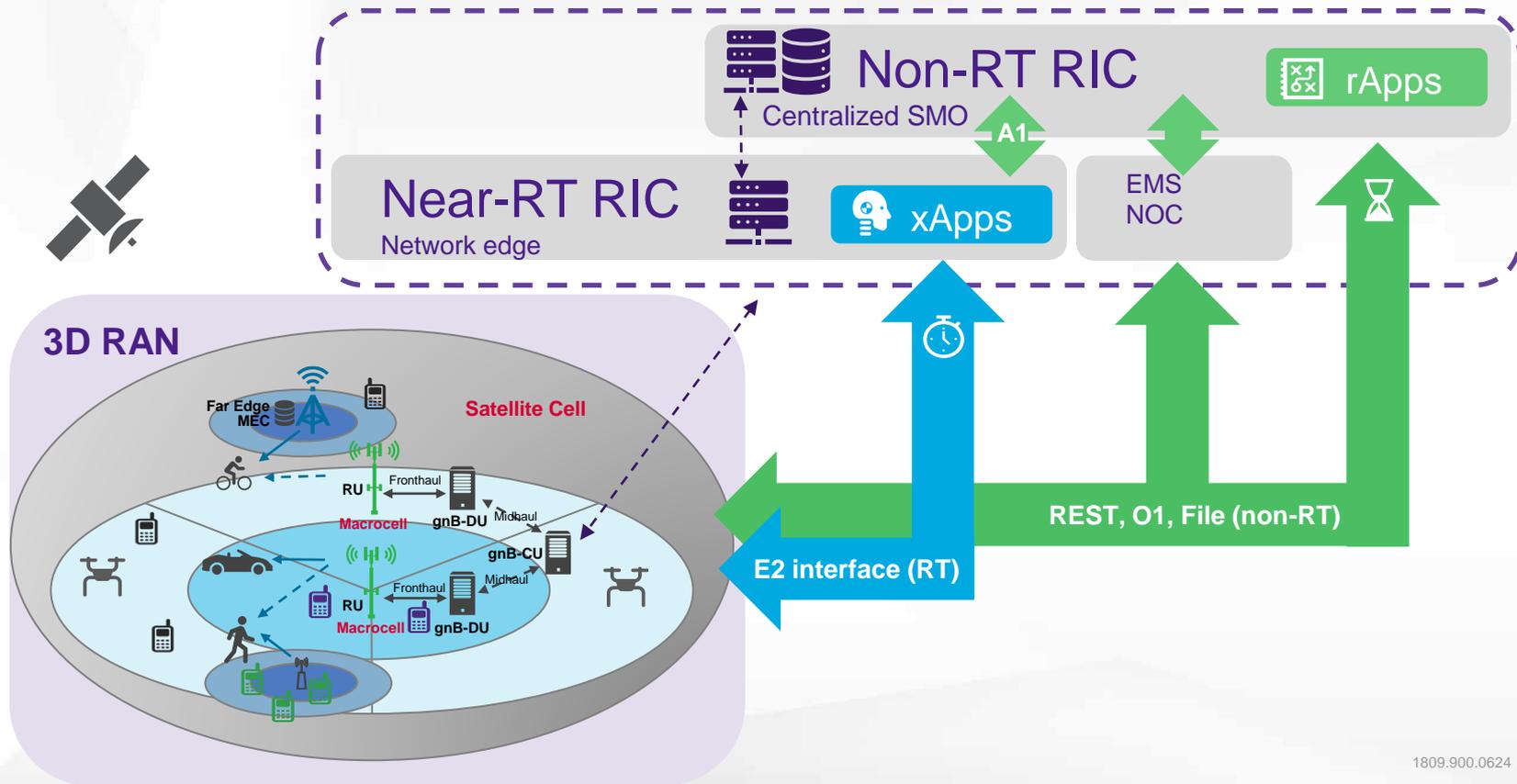
无线场景仿真器 RSG (人工智能训练)



RIC 测试确保从实验室到现场网络部署的顺利进行



面向基于AI RAN 优化为目的的 3D RAN 场景生成器 (RSG)

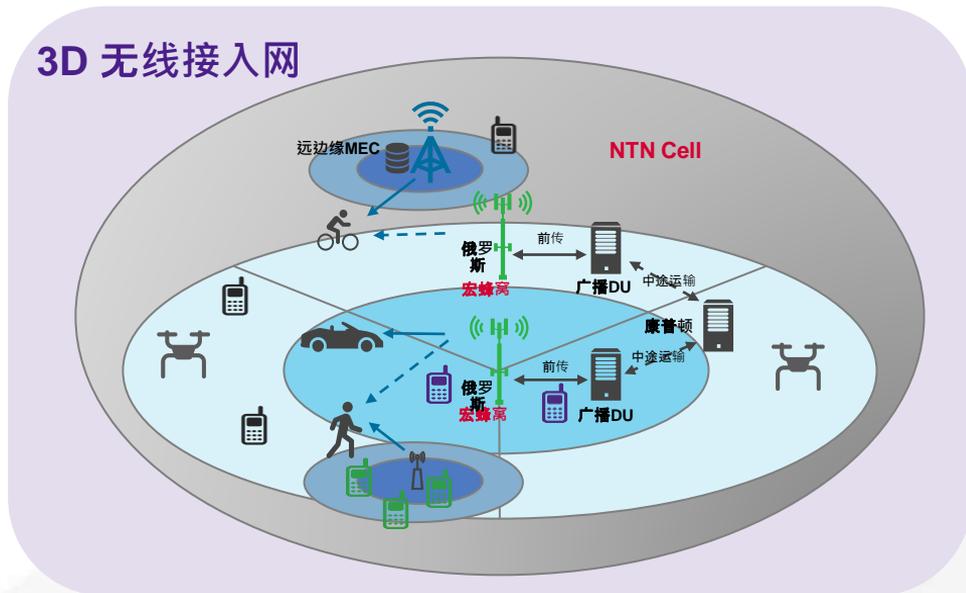


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3D RSG 概述

- KPI 报告：ORAN 和 3GPP KPI 测量报告
 - E2 (SM KPM 和 RC)、文件、REST API、O1
 - 每用户、每小区 1 毫秒至 30 分钟
- 拓扑：4G、NSA、5G SA、宏、O-RAN、3D (HAPS、卫星)
- 拓扑导入：基站坐标、高度、方位角、倾斜度、配置
- UE 移动性：静态 室内/室外、车辆、火车、行人、无人机

3D 无线接入网



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高级射频模型：

- 天线倾斜度/方位角/功率/增益/方向图
- 真实的商业天线模式
- RF环境：Uma/Umi/乡村/室内/室外
- 符合 TS 38.901 标准

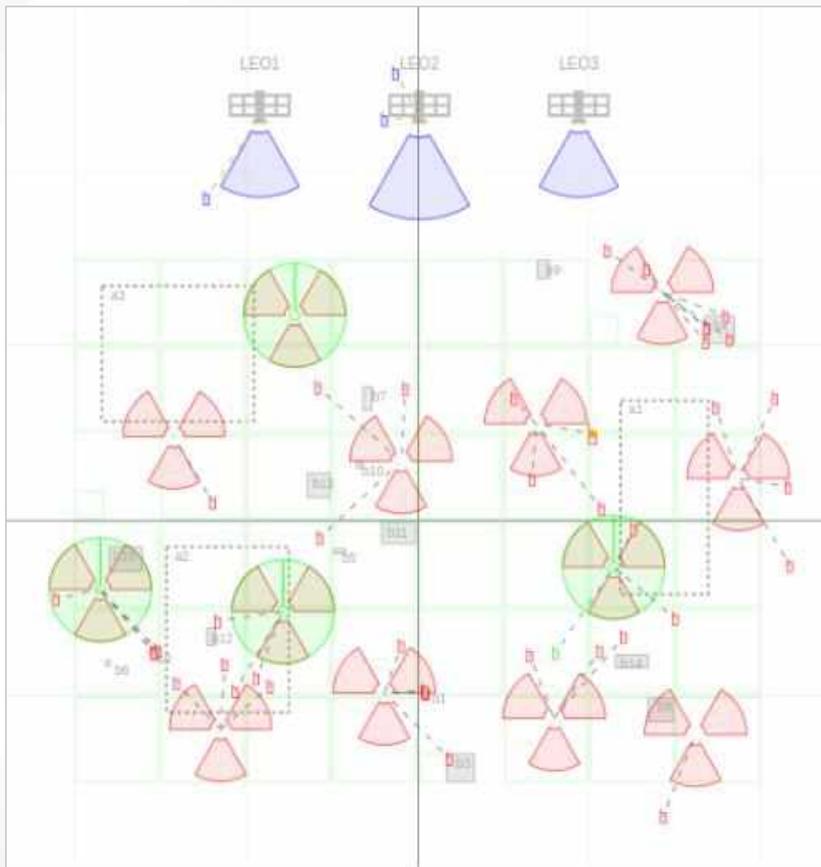
L1-3 建模：按 TTI 调度流量

- 现实的流量调度算法——循环调度、比例公平、QoS
- 快速衰落、LoS 和 nLoS
- MAC、PDCP、RLC、SDAP 层模拟
- 传输错误、重传、HARQ
- CQI 测量、MSC 选择
- LTE、NR、TDD、FDD
- RACH、小区重选、小区切换、RRC 状态转换、寻呼（连接模式移动性、空闲模式移动性）。
- 多个 PDU 会话、QoS 流和切片映射
- 切片资源重构
- 丰富的业务/流量类型：URLLC、eMTC 等。

容量和可扩展性：

- 低延迟、高容量模拟性能满足 RIC 测试的最高需求
- 可扩展用于 NWDAF 的大规模模拟

RSG 卫星支持



卫星小区 Satellite Cell

- LEO 和 GEO星座
- 小区频率设置——重叠、不重叠、半径、覆盖时间
- 蜂窝尺寸 – 标准和波束成形
- 基于功率和策略的切换 (A1至A6)
- Bent-Pipe 4G手机
- 长延迟信道模型
- 每个小区的 KPI – 频率、功率、利用率和吞吐量

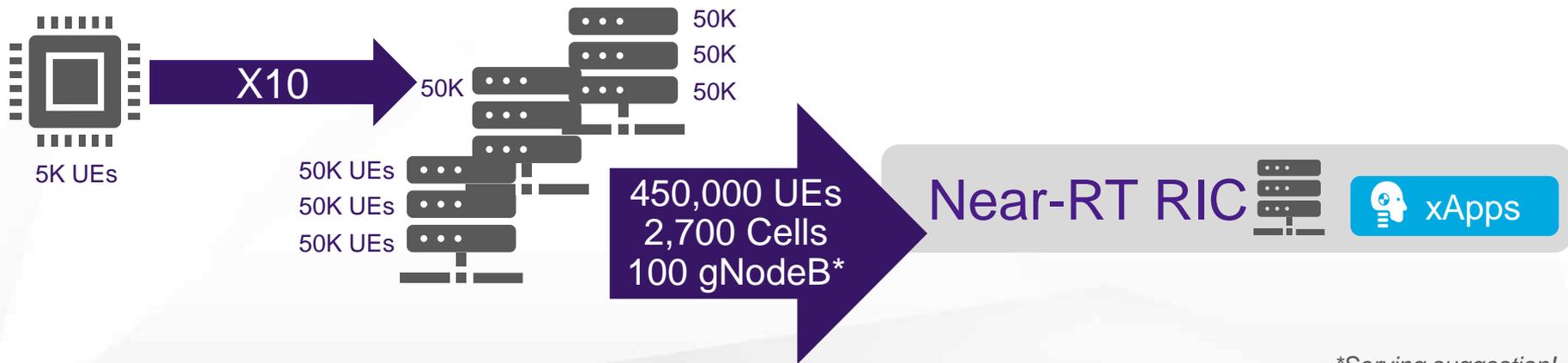
卫星模型

- 5G独立
- R17 NR 之前版本、R17 NR NB-IOT 和 CAT-M 手机
- Regen – Ariel DU 和 gNB
- 云干扰
- 波束跳跃

性能和可扩展性

Technology Overview

- E2 协议栈可以模拟 1,000's of E2 nodes per CPU core
- 1 RIC Test 实例可以通过运行 RSG 模拟高达 300 cells 和 5000 UEs
- 通过集群堆叠方式, 10 RIC 连接到同一个RIC, 可以提供高达 3,000 cells 和 50,000 UEs
 - 这种情况下, 单台Dell R630 server (28 cores) 可以模拟25,000个UE



**Serving suggestion!*

RIC Test 无线场景仿真: 模型方案驱动

如何模拟RAN

The screenshot displays the VIAMI RIC Test software interface, which is used for simulating RAN scenarios. The interface is divided into several sections:

- Left Panel:** A code editor showing a configuration script for a cell profile. The script includes fields for ID, title, header template, properties, name, title, example, description, type, band, technology, watch, bands, and areas. Below the code editor is a sidebar menu with options: RAN Scenario Generator, Global Settings, Scenario Generation, Cells Configuration, LTE Groups, Model Preview, and Interface Testing.
- Top Center:** Performance metrics are displayed: Energy Efficiency (271 Kbits/Joule) and Total Cell Power (1.24 kW).
- Top Right:** A table titled "Power Usage per Cell (PEE.AvgPower)" showing power usage for various cell IDs. The table has 5 columns and 3 rows of data.
- Bottom Center:** A "Cells Configuration" panel for "Profile B2". It includes fields for Name (B2), Technology (LTE-1900), and Area and sites (Any/30). Below this is a "Cells layout" table with columns for Cell number, Advanced RF model, Advanced traffic model, Tx Power (dBm), Height (meters), and Azimuth (degrees). The table contains one row for cell C1 with values: Isotropic-Rural, TDD, 23, and 33. A green button labeled "RUN SIMULATION" is overlaid on this panel.
- Right Panel:** A "Dynamic Graphics" section showing a line graph with multiple colored lines representing different data series over time.

架构驱动的UI

Dynamic Graphics

RUN SIMULATION

VIAVI – 促进行业高优先级用例 x/r 应用程序 (针对RIC)



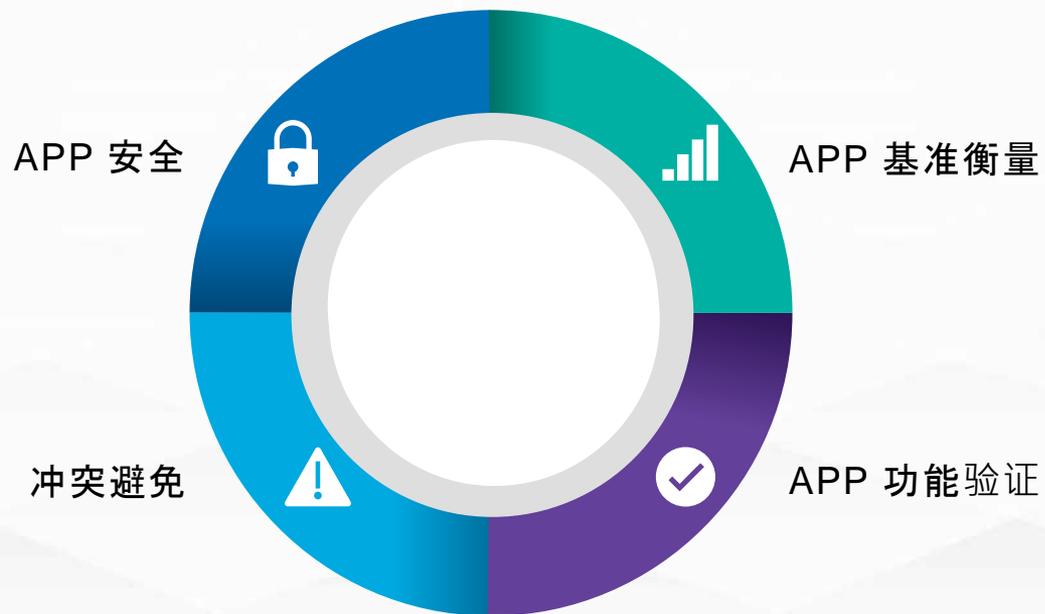
- NW Slice SLA Assurance (Including Traffic Steering and Anomaly Detection)
- Massive MIMO
- Energy Efficiency
- PCI collisions
- QoS / QoE Optimization ; Autonomous Vehicles Control (QoE)
- MLB / Traffic Steering
- Geolocation Integration (provide Geolocation data for x/r-App use cases)

Many more in the future...

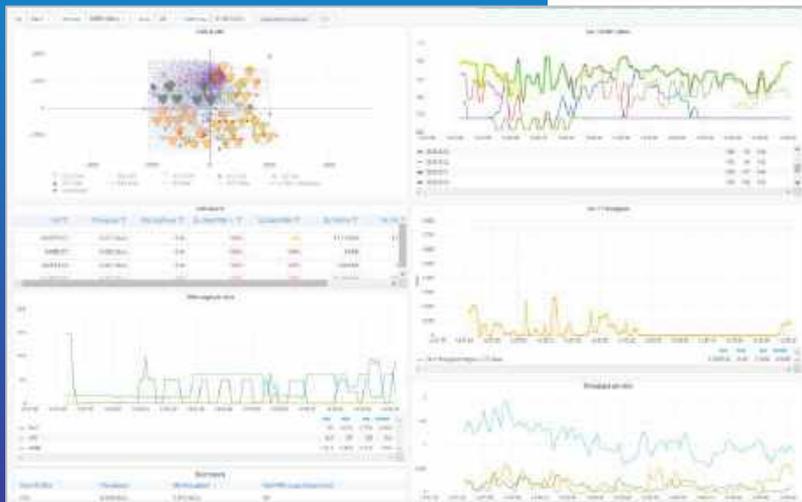
App Validation Engine

应用程序验证引擎

AVE - APP Validation Engine



AVE 特性



- 数据聚合和存储记录 (Influx DB 等)
- AVE 分析仪表盘 (之前/之后、操作、场景比较)
- 能够运行并行模拟并进行比较
- 基于 AI 的洞察：趋势检测、收敛/发散
- 基于 AI 的洞察：因果关系/相关性/基准分析和洞察
- 基于 AI 的分析：检测目标功能/控制 KPI
- 基于 AI 的洞察：冲突应用程序检测
- 基于 AI 的洞察：场景提示 (基于自我探索/GAN)

App Benchmarking (基准衡量)

场景 1

应用程序比较：哪个应用程序最适合您的 RIC 和网络拓扑？



场景 3 3

App 2 是否在相同场景中工作但影响不同的参数？

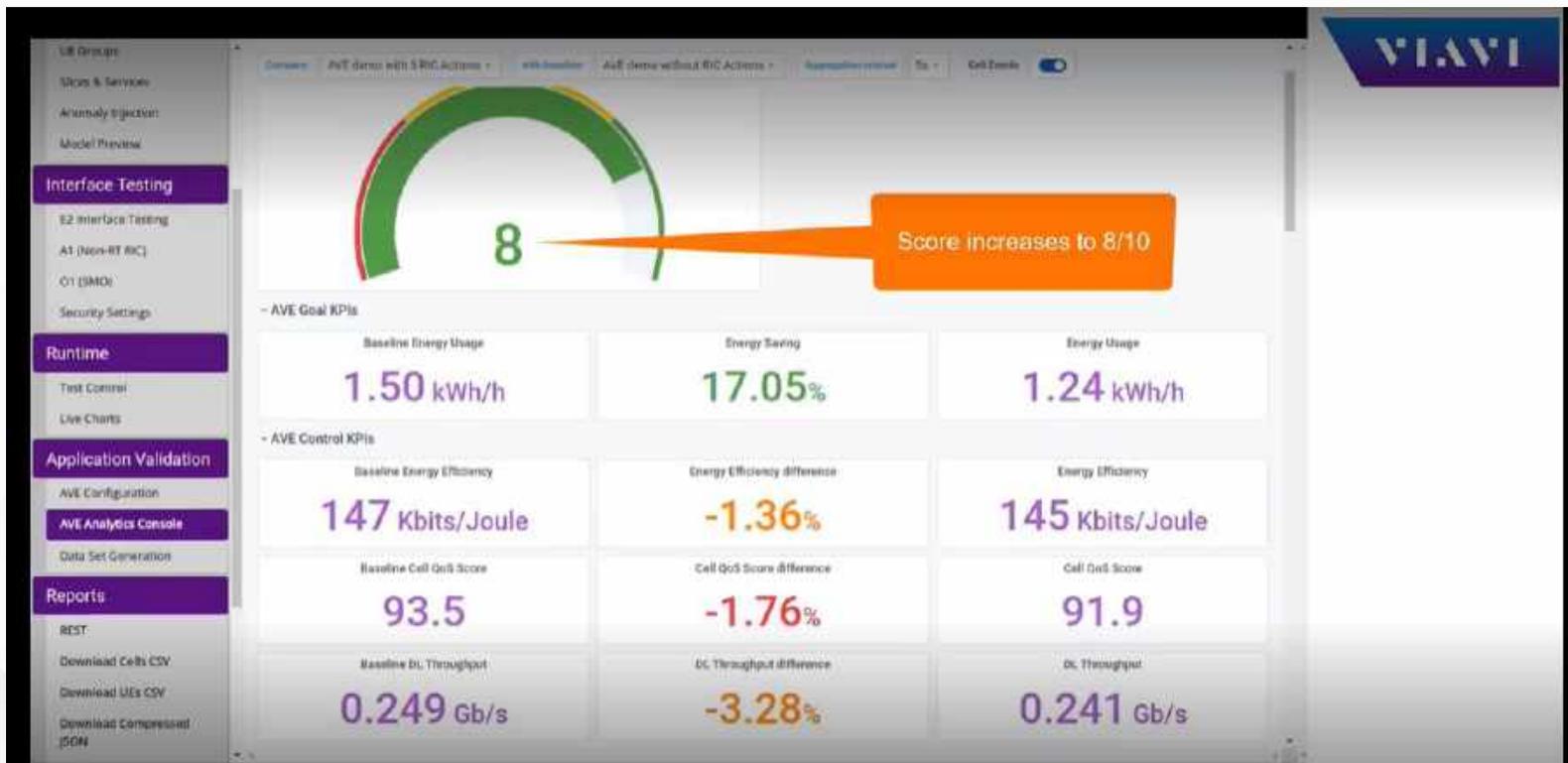


场景 2

App 2 是否也能在不同的 RAN 场景中工作？

该应用如何在不同的负载/覆盖范围内工作？

App Benchmarking (App 基准衡量)



Conflict Mitigation 缓解冲突

大数据、模式和趋势分析



Challenge:
如果两个应用程序同时在同一区域并行运行，那么就会发生冲突，哪一个会获胜？

在问题发生之前，这些冲突很难被发现。



Challenge:
两个应用独立运行，在不同时间影响覆盖范围。

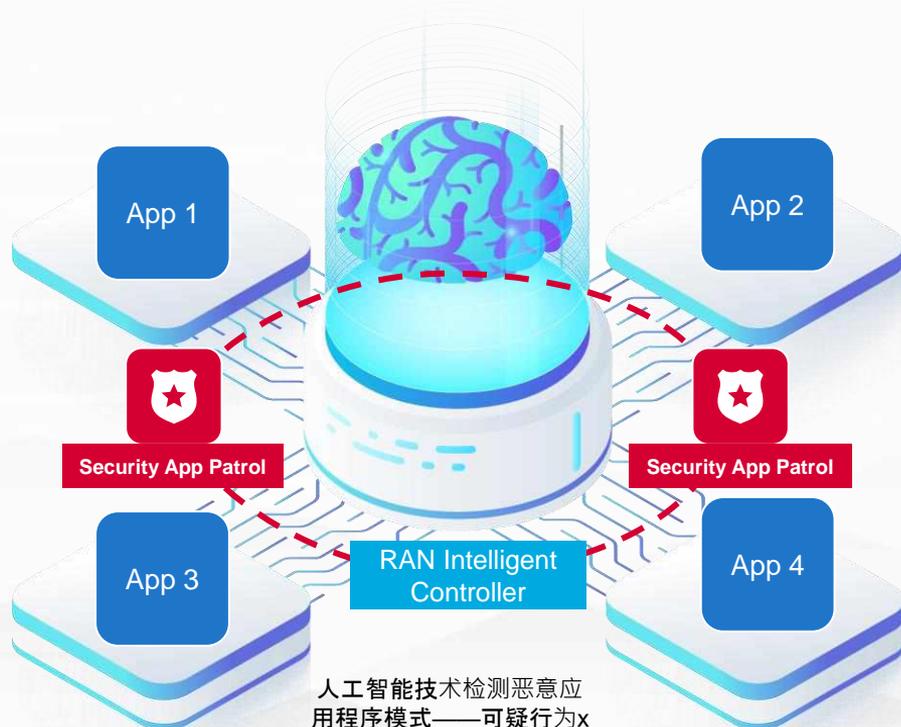
App 安全 (Security)

Challenge:

担心应用程序有后门，恶意软件可以访问包括用户数据在内的网络敏感数据。这个领域需要强有力的监管。

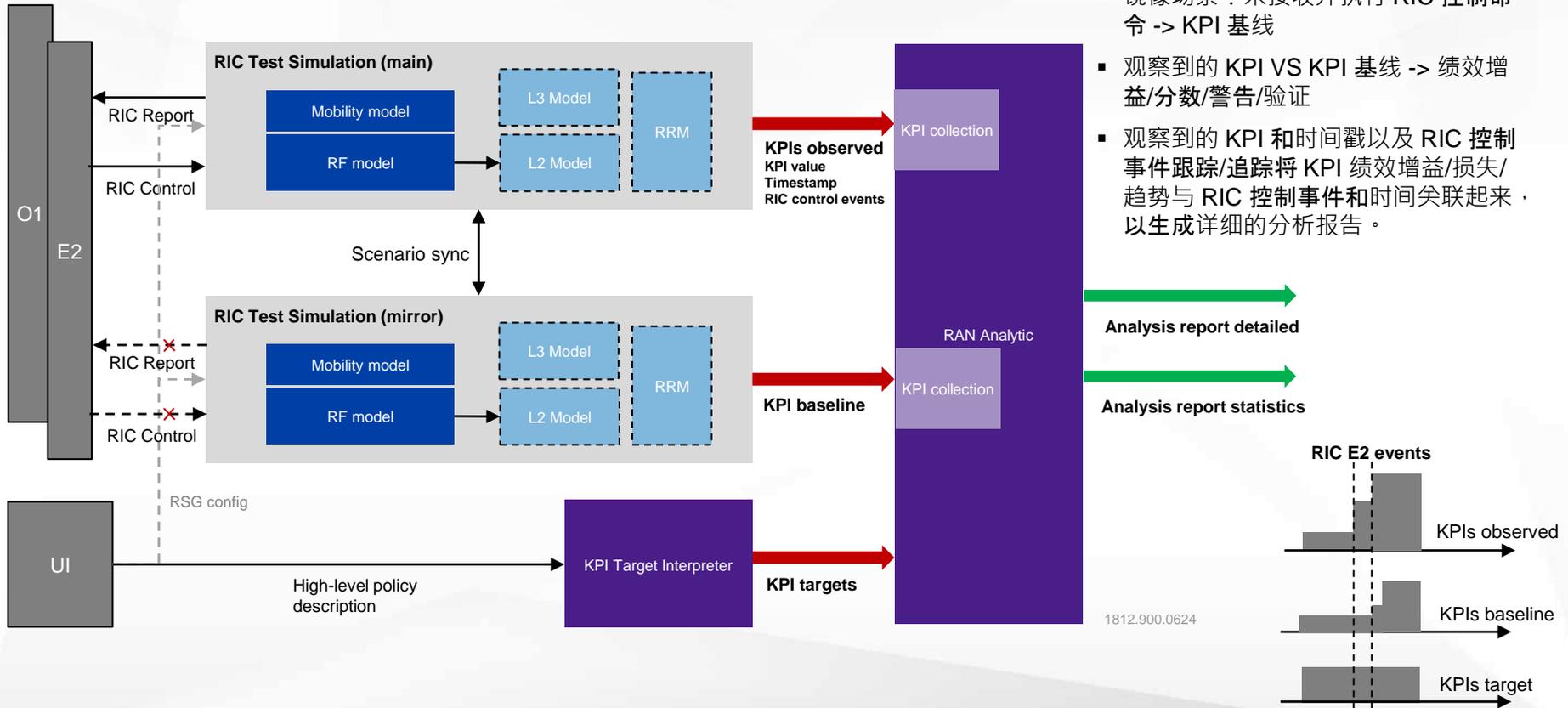


首先对哪些应用程序比其他应用程序更安全进行基准测试。



人工智能技术检测恶意应用程序模式——可疑行为x
需要仔细观察

APP Validation Engine - AVE

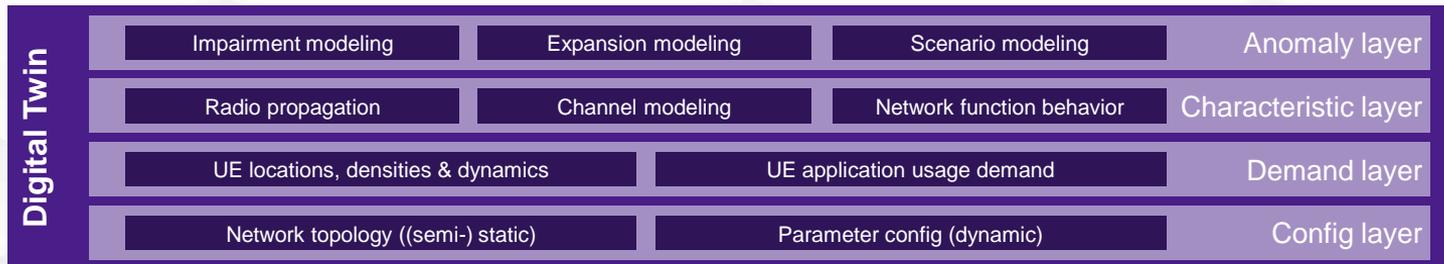
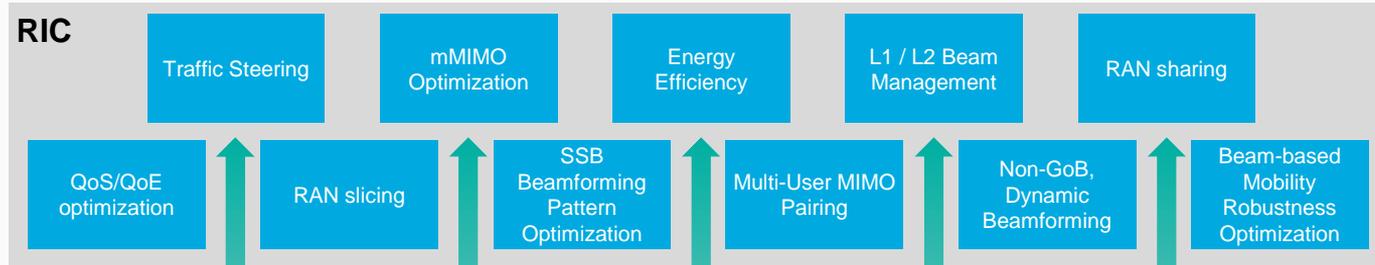


- 主要场景：接收并执行 RIC 控制命令 -> 观察到的 KPI
- 镜像场景：未接收并执行 RIC 控制命令 -> KPI 基线
- 观察到的 KPI VS KPI 基线 -> 绩效增益/分数/警告/验证
- 观察到的 KPI 和时间戳以及 RIC 控制事件跟踪/追踪将 KPI 绩效增益/损失/趋势与 RIC 控制事件和时间关联起来，以生成详细的分析报告。



RAN 数字孪生

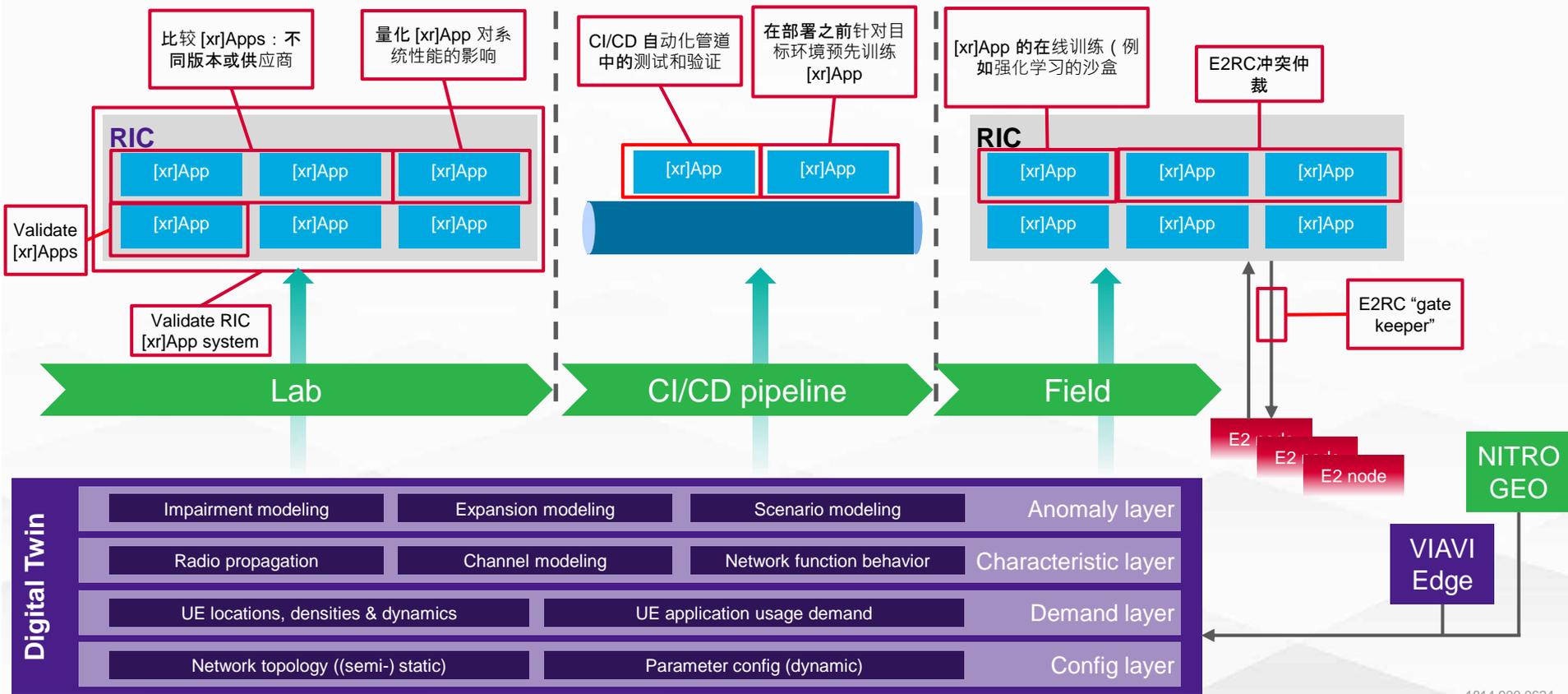
思考数字孪生能力的方法



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数字孪生的应用实例

实验室、CI/CD自动化交付和现场

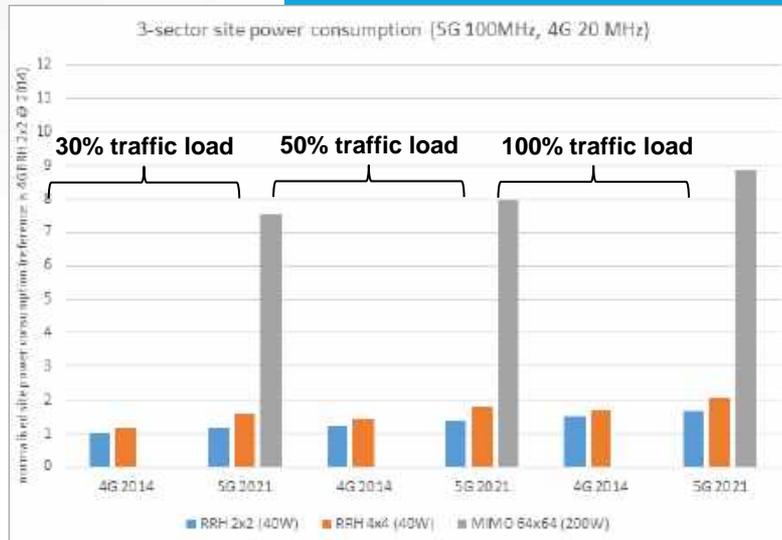


Energy Savings 节能场景

Energy Savings

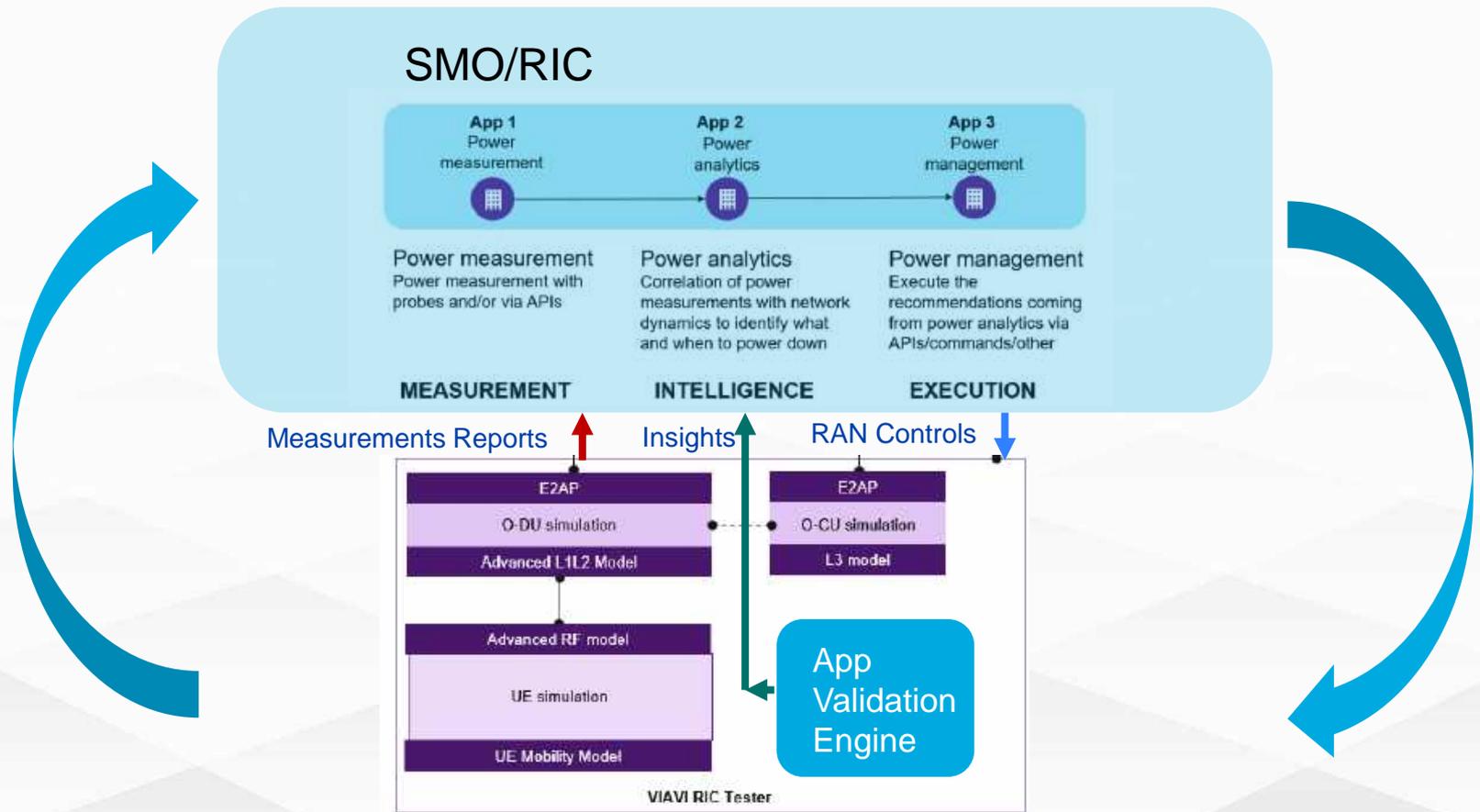
问题描述

- 5G 网络比 4G 消耗的电量更多 (Massive MIMO、100+ MHz 信道)
 - 例如, 具有 100 MHz 信道的 64x64 5G 站点消耗的电量是 4x4 4G 站点的五倍以上
- 电信公司寻求人工智能解决方案来降低功耗。他们需要从以下基本方面入手:
 - 现有的功率测量和监控系统
 - 可以评估和执行电源管理操作的智能方法和算法
- 策略
 - 关闭载波时, 载波的整个频率范围都会受到影响
 - 关闭 RF 信道时, 整个 tx/rx 阵列都会受到影响
 - 这些措施中的任何一项的持续时间都可能相当长、多个间隙甚至不确定 (关闭直到明确重新打开)



功耗可能会从目前 4G 网络中 RAN OPEX 的 15% 跃升至 5G 网络中 OPEX 的 50% 以上 (如果部署完整的 5G 功能)

VIAVI 建议的智能化节能 x/rApps 测试场景



节能通用应用实例

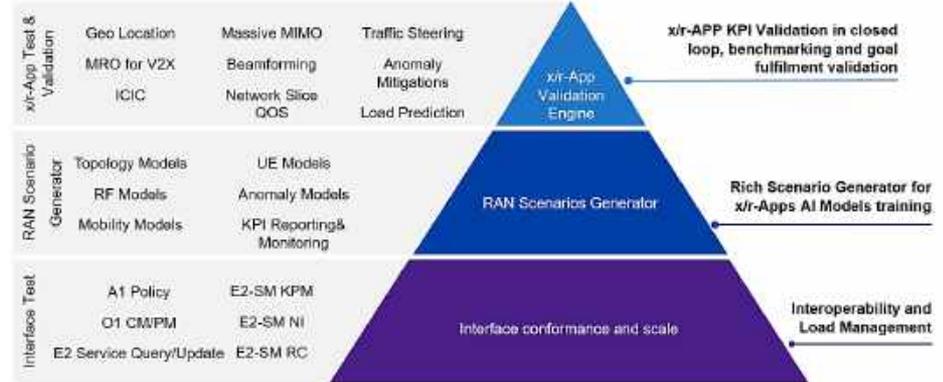
Network	Device	Test Case	Test Description
5G-LTE	Android	5G-LTE	5G-LTE
5G-LTE	Android	5G-LTE	5G-LTE
5G-LTE	Android	5G-LTE	5G-LTE

App智能调节节能和性能的平衡

多频、小区类型和移动模式的场景模拟

需要 O1接口配合, CM, PM

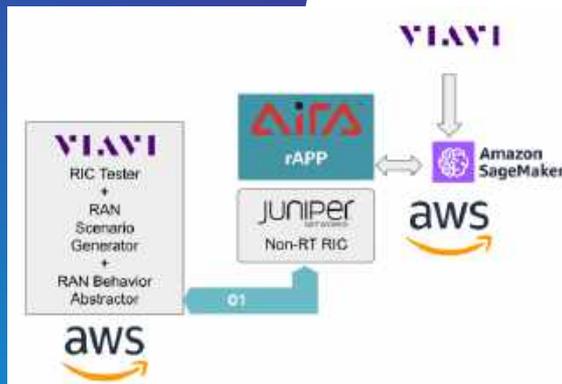
E2E RIC Test strategic pillars



E2E Comprehensive RIC Test Solution Suite from VIAVI

Many More in the Future ...

节能用例 真实客户 实例1

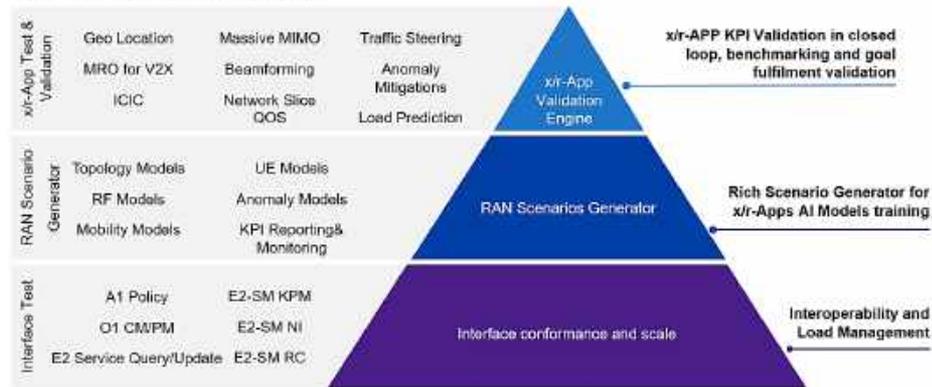


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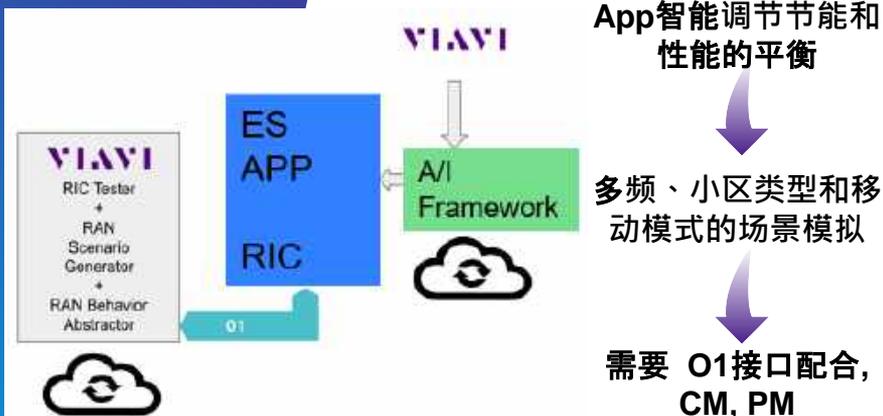
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E2E RIC Test strategic pillars

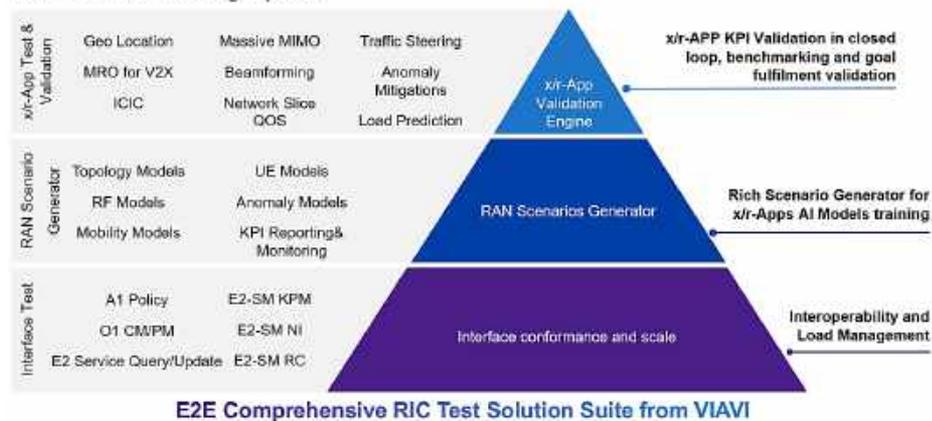


E2E Comprehensive RIC Test Solution Suite from VIAVI

节能用测试例逻辑架构



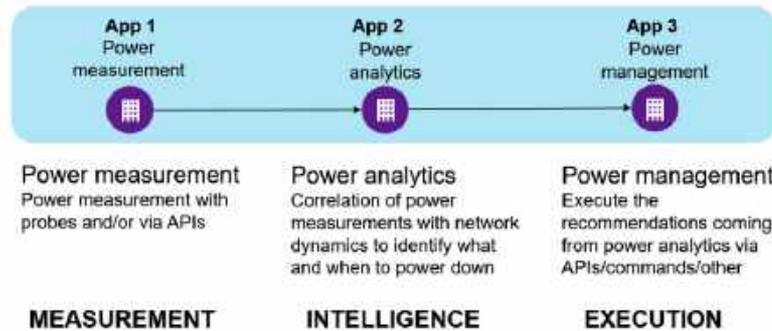
E2E RIC Test strategic pillars



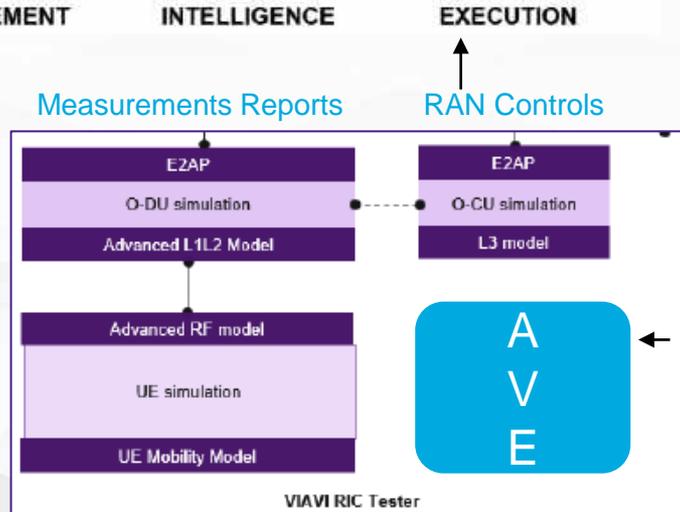
智能节能 x/r-apps 测试

TB.TotNbrDI	UE, Qos	Total number of downlink Transport Block (TBs) (**)	5.1.1.7.3
TB.TotNbrUI	UE, Qos	Total number of uplink Transport Block (TBs) (**)	5.1.1.7.8
PEE.Energy	Cell	Energy consumed (in kilowatt-hours,KhW)	5.1.1.19.3
Pee.AvgPower	Cell	Average power consumed over the measurement period (in watts, W)	5.1.1.19.2.1
MM.HoExeltraReg	Cell	Number of requested legacy handover executions (intra gNB)	5.1.1.6.2.1
VIAVI.Cell.Beam	nMIMO	Beam index in a mMIMO cell	VIAVI proprietary
VIAVI.PEE.EnergyEfficiency	Cell	Energy Efficiency in bits per joule	Not yet standardized by 3GPP

SMO/RIC



Insights



针对ORAN的智能 节能 (Energy Saving) X/R- apps 选项

- 关闭和打开部分天线元件 (TRX 控制) , 具有各种“睡眠深度 (模式) ”
- 关闭和打开整个 O-RU (高级睡眠模式) , 具有各种“睡眠深度 (模式) ”
- 在定义的时间间隔内关闭 , 时间到期后 O-RU 将完全激活
- 在未定义的时间间隔内关闭 , 需要“唤醒”命令才能使 O-RU 激活
- TRX 控制和高级睡眠模式控制
 - O-RU 报告支持睡眠模式的能力
 - 每个模式最多有四种特定的睡眠模式和唤醒时间 (一种模式的唤醒时间为零) ;
 - 允许的天线掩码和天线层掩码排列
 - O-DU 启用 TRX-CONTROL+ASM 功能
 - 受影响的端点将仅使用 mask-bit=1 数组元素 , 允许在命令持续时间内关闭 (进入睡眠状态) mask-bit=0 数组元素

TeraVM RIC Test ES

Energy parameters JSON Advanced

Parameters used to calculate the cell's instant power consumption as explained in [doi:10.1016/j.procs.2014.10.033](https://doi.org/10.1016/j.procs.2014.10.033)

$$C_{BS} = P_{D} T_F + C_{SIGN} + C_{DATA}$$

where

$$C_{SIGN} = P_{OCH} \cdot \Delta P_{BS} \cdot T_{SIGN}$$

$$C_{DATA} = \sum X_n \cdot P_{TX}(X_n, Y_n, Z_n) \cdot T_{SIGN}_n \cdot \Delta P_{BS}$$

Maximum TX Power (dBm) Maximum TX power possibly emitted by this cell, not counting antenna gain.

Max Energy Consumption (Watts) Energy consumed by the cell while fully loaded and at max TX power setting. This consumption is much higher than the effective TX power, depending on the cell's Spectral Efficiency. See ITU-R reports M.2410 and M.2412. Lowering load or reducing TX power reduces energy consumption proportionally.

Idle Energy Consumption (Watts) Energy consumed by the cell while powered with no active UEs. This varies a lot with technology, with 5G/NR cells requiring much less power in idle mode due to only sending one signal block every 20 ms, instead of the several CRSs per ms required by LTE. See [how 5G NR can reduce network Energy consumption](#)

Standby Energy Consumption (Watts) Energy consumed by the cell in standby/off mode.

配置界面：
现在可以在 RSG中配置小区的发射功率、最大功率、空闲态功率，以及待机功耗等



图标报告：提供总功耗、小区总功率和每个小区功率使用量等形式的能源使用信息

无线场景其他配置细节

UE Groups + Add item - Delete text All

Indoor-(ue) Pedestrian-(ue) Car-(e)

Indoor-(ue)

Global ID pattern (i) Indoor-(ue)

Description Indoor Users Randomly allocated in buildings 1-4

Services Used

Services used by each UE in the Group; this section enables the application of multiple services to a UE group including Slices, QoS, Throughput, GPRS, Average time between calls (seconds), and Average call duration. Test idle mode/call flow to a service slice within the UE Group. To emulate "idle mode" set the "Average time between calls" on any services to a value greater than zero. Idle mode requires the "RRC" Test idle mode.

Service Slice	QoS Identifier (5QI/QCI)	Target Service Throughput
eMBB	1: GBR, Conversational Voice	0.001

+ Add item

CA enabled false Capability for Carrier Aggregation. Requires license TMM-6222

Seed 0x7e5

UE height 1.5 Average UE height in meters

Initial distribution of UEs

UEs can be randomly assigned among locations in a comma-separated list. The list can include one or more of the following:

- Cell sites (*1)
- Random cells in a Cell Profile (*B13)
- Areas (*A2)
- Buildings (*12)

Note: Asterisks (*) can be used as wildcards; e.g. "3*" adds all areas to the list of locations.

Number of UEs	Location(s)
12	b*

+ Add item

Mobility model Indoor UEs

(no specific settings required)

1 slice: eMBB

3 组 UE

- Indoors:
 - 13 UEs
 - Static
 - Expected Throughput: 1Mbps
- Pedestrian:
 - 25 UEs
 - Moving: Manhattan path, 20m/s
 - ET: 1Mbps
- Car:
 - 150 UEs
 - Moving: Manhattan path, 3m/s
 - ET: 1Mbps

场景指标

PerMetric_Cell holds	
<input checked="" type="checkbox"/>	ORB_LEThpEI
<input checked="" type="checkbox"/>	ORB_LEThpEI
<input checked="" type="checkbox"/>	RRU_PDUloadEI
<input checked="" type="checkbox"/>	RRU_MaxLayer0Minio
<input checked="" type="checkbox"/>	CARR_AverageLayersCI
<input checked="" type="checkbox"/>	View_Cell_AverageBeamsCI
<input checked="" type="checkbox"/>	RRU_ConnMean
<input checked="" type="checkbox"/>	RRU_ConnMax
<input checked="" type="checkbox"/>	QoSFlow_TopPscPduVolumeCI
<input checked="" type="checkbox"/>	QoSFlow_TopPscPduVolumeCI
<input checked="" type="checkbox"/>	PEE_AvgPower
<input checked="" type="checkbox"/>	PEE_Energy
<input checked="" type="checkbox"/>	View_PEE_EnergyEfficiency
<input checked="" type="checkbox"/>	View_Radio_power
<input checked="" type="checkbox"/>	View_Radio_antennaType
<input checked="" type="checkbox"/>	View_Radio_azimuth
<input checked="" type="checkbox"/>	View_Geo_x
<input checked="" type="checkbox"/>	View_Geo_y
<input checked="" type="checkbox"/>	View_Geo_z
<input checked="" type="checkbox"/>	View_GridDist
<input checked="" type="checkbox"/>	View_QoS_Score
<input checked="" type="checkbox"/>	View_AirPci
<input checked="" type="checkbox"/>	View_NoCgi

通过 O1 接口报告的指标

O1 每 1 分钟报告一次，数据粒度：1 秒

- 模型：LSTM（1 层，256 个隐藏单元）使用 Adam 优化器进行训练
- 使用的指标：物理资源块 (PRB) 利用率
- 模型输入：5 分钟（300 个输入维度），提前预测 1 分钟。要预测 1 分钟（60 个样本），我们每次预测 1 个样本，然后使用新预测的输出生成下一个 PRB 利用率。然后我们重复此过程 60 次。
- 此迭代预测接下来的 60 秒，允许 ES-rApp 在流量过载前 60 秒提前决定开启

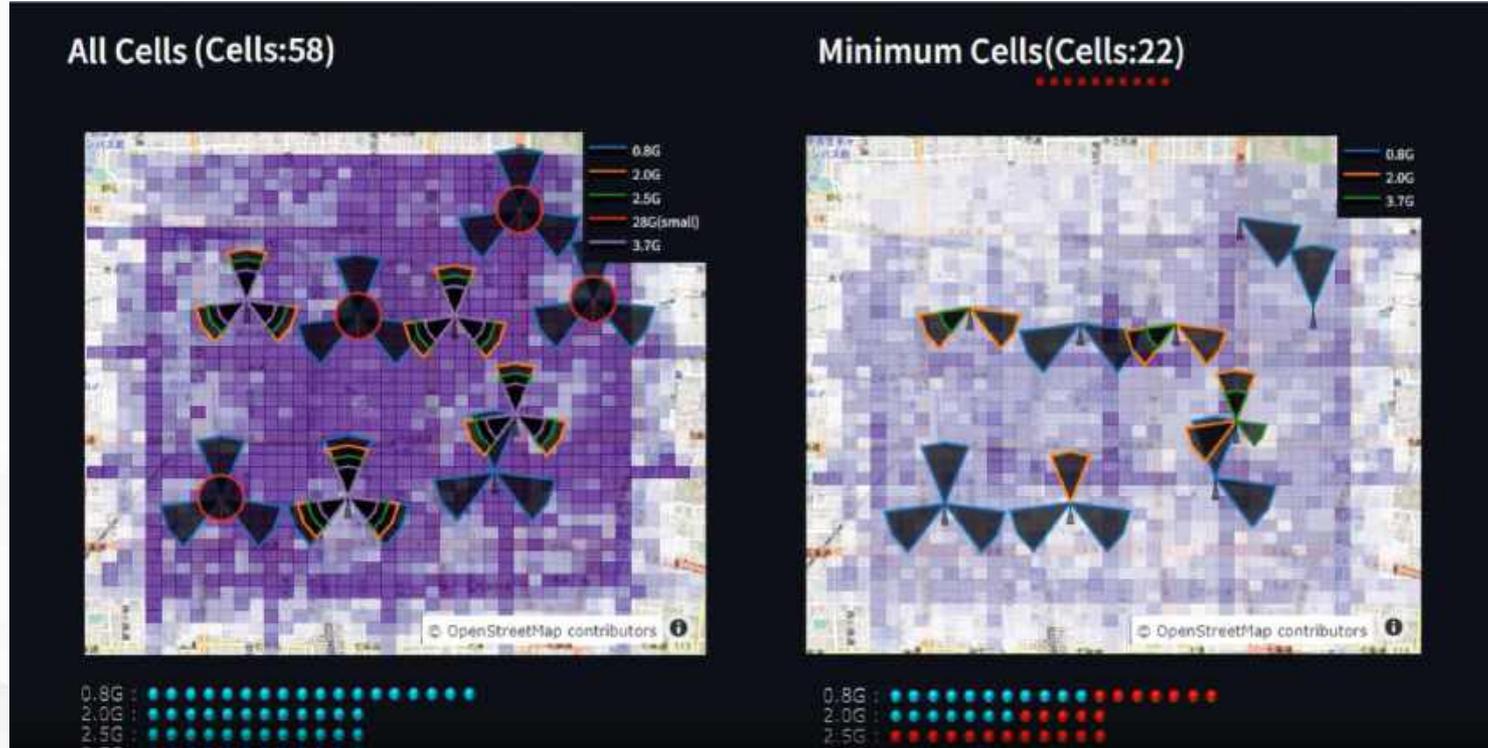
Energy Savings rApp

根据收到的 PRB 利用率和预测的利用率：

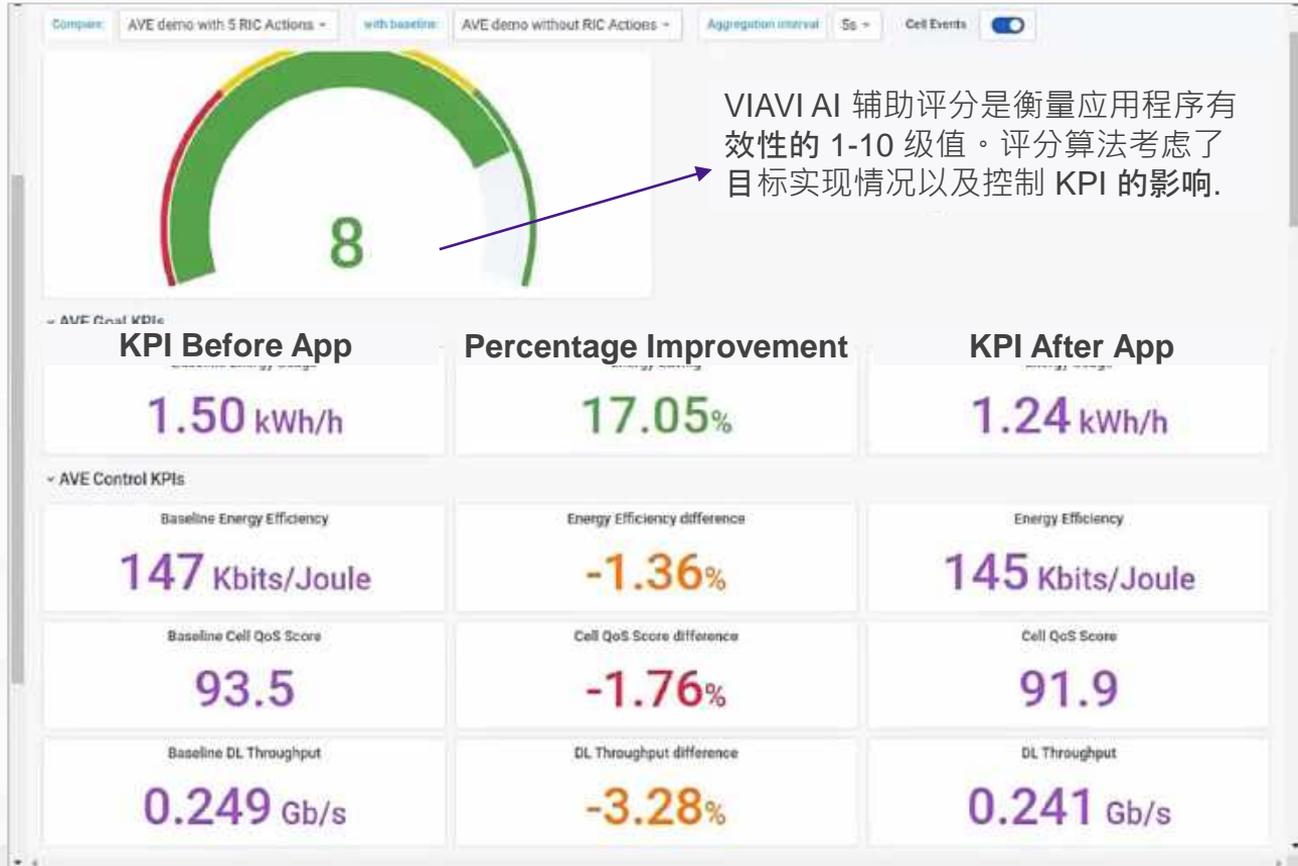
- 对于每个覆盖小区，如果当前和预测的 PRB 使用率较低：
 - 对于该覆盖小区覆盖范围内的每个容量小区：
 - 如果容量小区的当前和预测 PRB 使用率较低，且覆盖小区可以处理容量小区的流量：
 - 关闭容量小区
- 对于每个覆盖小区，如果当前或预测的 PRB 使用率较高：
 - 打开其覆盖范围内的所有容量小区

Threshold:
low - 5%, high - 80%

Before and After



VIAVI RIC Test- App Validation Engine (AVE)



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O1 Interface Support

- O1 允许 SMO 框架实时配置 RSG 对象
- 在 RIC 测试中，O1 接口可用于管理 RSG 中单元的配置 Managed Element-Single Root Element，其中包括以下托管元素：
 - GnbDuFunction-Single
 - GnbCuCpFunction-Single
 - GnbCuUpFunction-Single
 - REST and NETCONF Parameters Include:
 - GnbDuFunction-Single
 - NrCellDu", an array with NrCellDu-Single objects
 - NrCellDu-Single
 - NrSectorCarrier-Single
 - CommonBeamformingFunction-Single (Tilt, Azimuth)
 - RRMPolicyRatio-Single
 - GnbCuCpFunction-Single
 - NrCellCu-Single
 - NRCellRelation-Single
 - CESManagementFunction-Single
 - GNBRUFunction (Tilt Command)

O1 Energy Savings Command

- O1 接口支持 CESManagementFunction, 用于控制 Cell Energy Saving
- Energy Saving 由 CESManagementFunction 中的两个属性控制 :
 - energySavingControl - 将值设置为 toBeEnergySaving 将启动“软关闭”程序, 该程序将逐渐降低 cell 的 TX 功率 60 秒, 然后使其处于待机状态。
 - energySavingState - 将值设置为 isEnergySaving 将立即关闭 cell, 将值设置为 “isNotEnergySaving”将打开它。

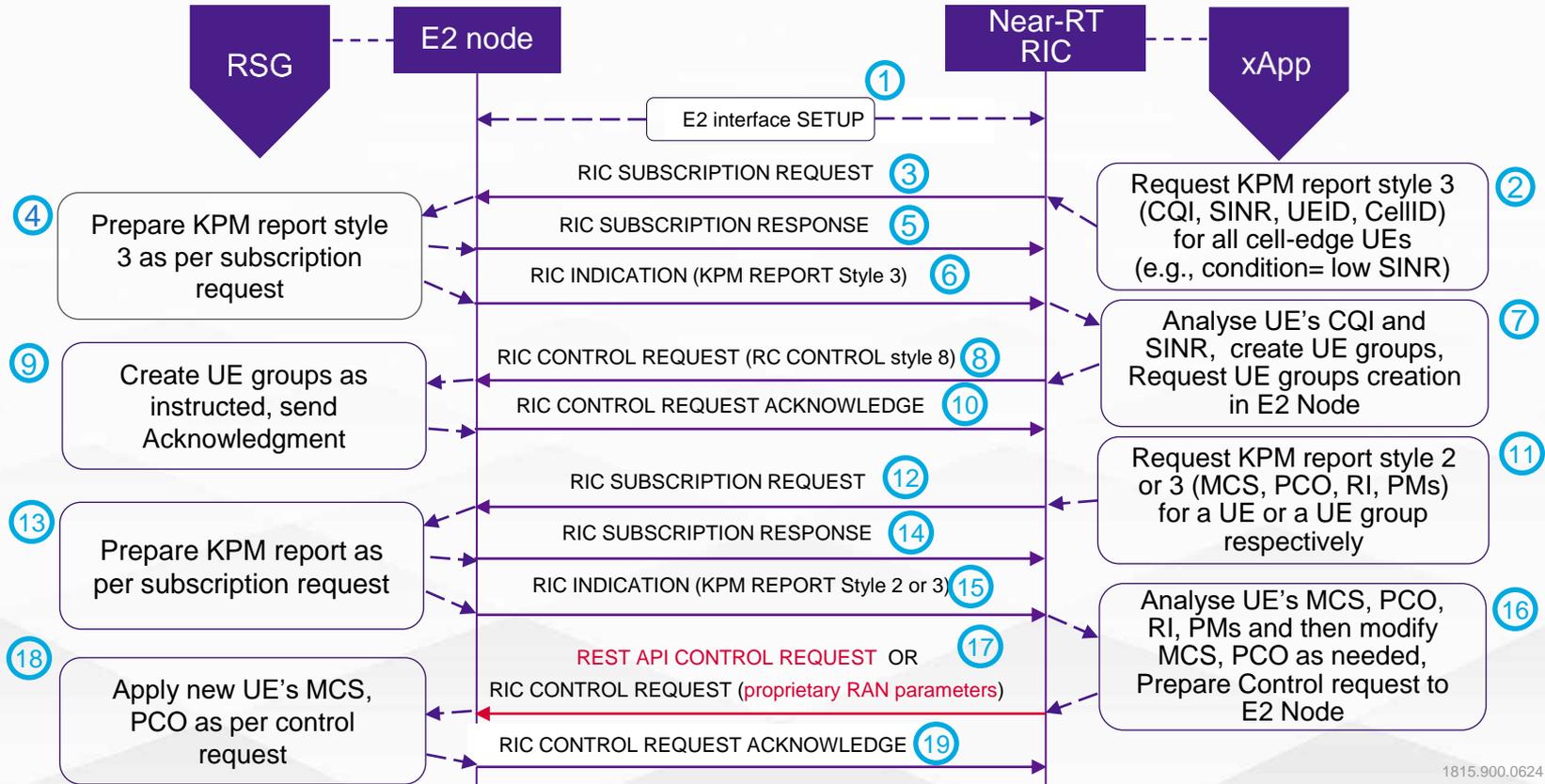
ID	PCI	TX power	DRB.UeThpDI Gb/s	RRU.PrbUsedDI	RRU.PrbAvail
S1/B13/C1	5	-1	0	0	75
S1/B13/C2	6	-1	0	0	75
S1/B13/C3	7	-1	0	0	75
S1/N77/C1	44	20	0	0	4914
S1/N77/C2	45	20	0	0	4914

Energy Saving rApp 验证测试例

NO	Test Case ID	O-RAN spec reference	Test Case description	Test Result
1	ESTC_1	O-RAN.WG2.Non-RT-RIC-ARCH-R003	Verify non-RT RIC able to make connection with RIC tester successfully.	Pass
2	ESTC_2	O-RAN:WS2:R1GAP	Verify if ESrApp is successfully onboard & deployed on non-RT RIC	Pass
3	ESTC_3	O-RAN:WS2:R1GAP	Verify ESrApp registration with non-RT RIC over R1 interface is successful	Pass
4	ESTC_4	O-RAN:WS2:R1GAP	Verify ESrApp CM & PM Service Discovery with non-RT RIC is successful	Pass
5	ESTC_5	O-RAN:WS2:R1GAP	Verify if Non-RT RIC is receiving CM data (Add details of API) from RIC Tester.	Pass
6	ESTC_6	O-RAN:WS2:R1GAP	Verify if ESrApp is receiving CM data (Add details of API).	Pass
7	ESTC_7	O-RAN:WS2:R1GAP	Verify if ESrApp is able to subscribe for PM data with non-RT RIC.	Pass
8	ESTC_8	O-RAN:WS2:R1GAP	Verify if non-RT RIC is receiving PM data from RIC Tester (Add details of API)	Pass
9	ESTC_9	O-RAN:WS2:R1GAP	Verify if ESrApp is receiving PM data (Add details of API)	Pass
10	ESTC_10	O-RAN.WG2.Use-Case-Requirements-R003- v07.00	Verify if ESrApp is able to calculate cell load data based on PM KPI	Pass
11	ESTC_11	O-RAN.WG2.Non-RT-RIC-ARCH-R003	Verify to collect 1 month test data for model training	Pass
12	ESTC_12	O-RAN.WG2.Use-Case-Requirements-R003- v07.00	Verify if ESrApp is able to identify the cells for which energy saving control to be triggered based on load condition	Pass
13	ESTC_13	O-RAN.WG2.Non-RT-RIC-ARCH-R003	Verify if ESrApp is able to control/update "energy saving control parameter" on RIC tester through non-RT RIC	Pass

下行功率优化

In RSG, xApp, and over E2 interface



1815.900.0624

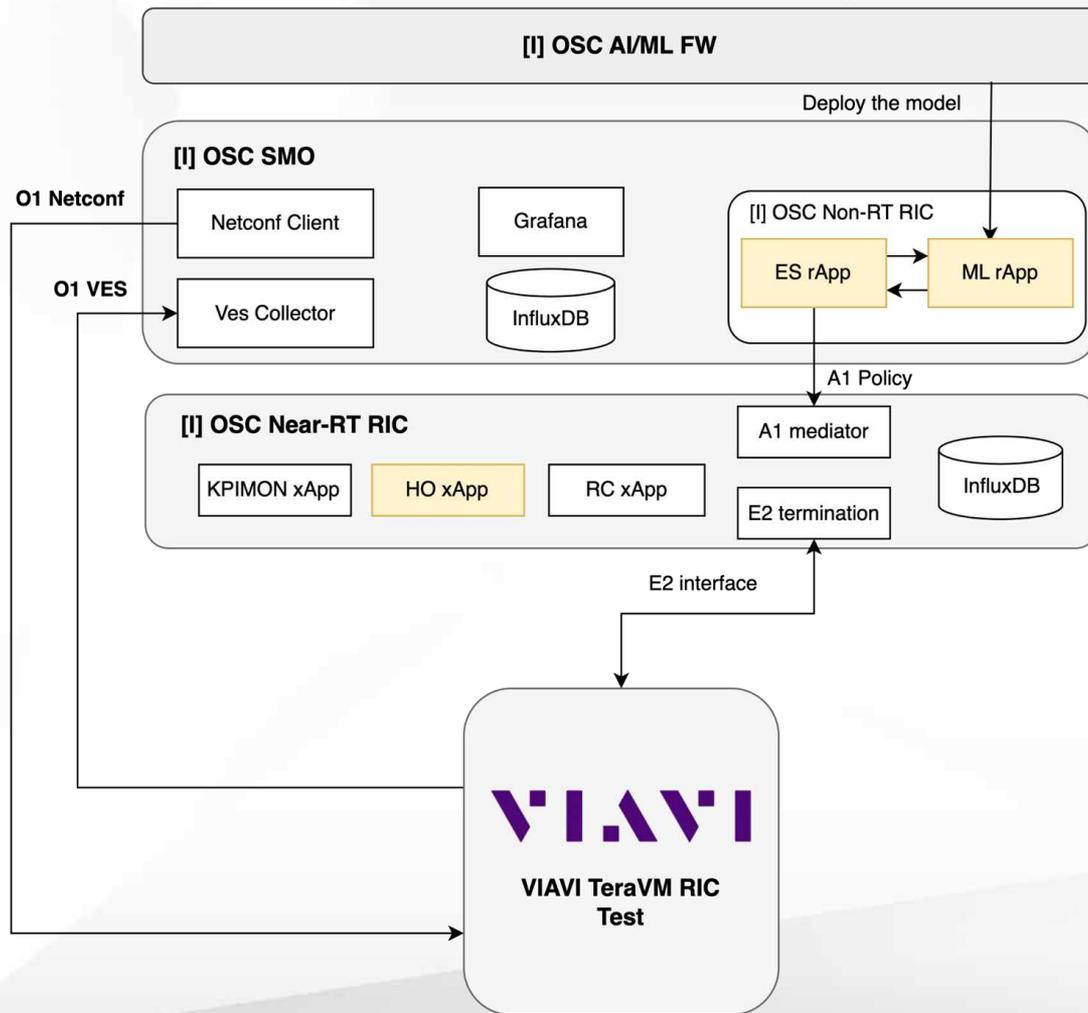


VIAVI Solutions

viavisolutions.com

BackUP Slides

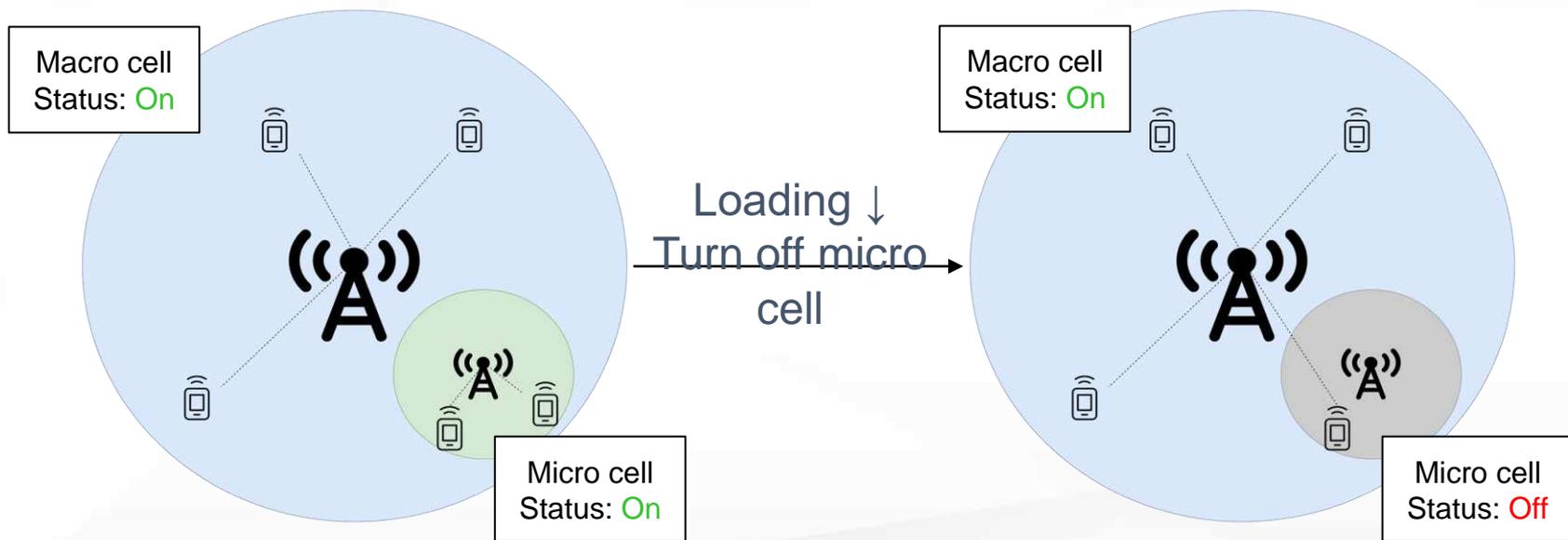
常用实际节能测试案例



- 使用 RIC 通用平台 + VIAVI RIC 测试的节能用例

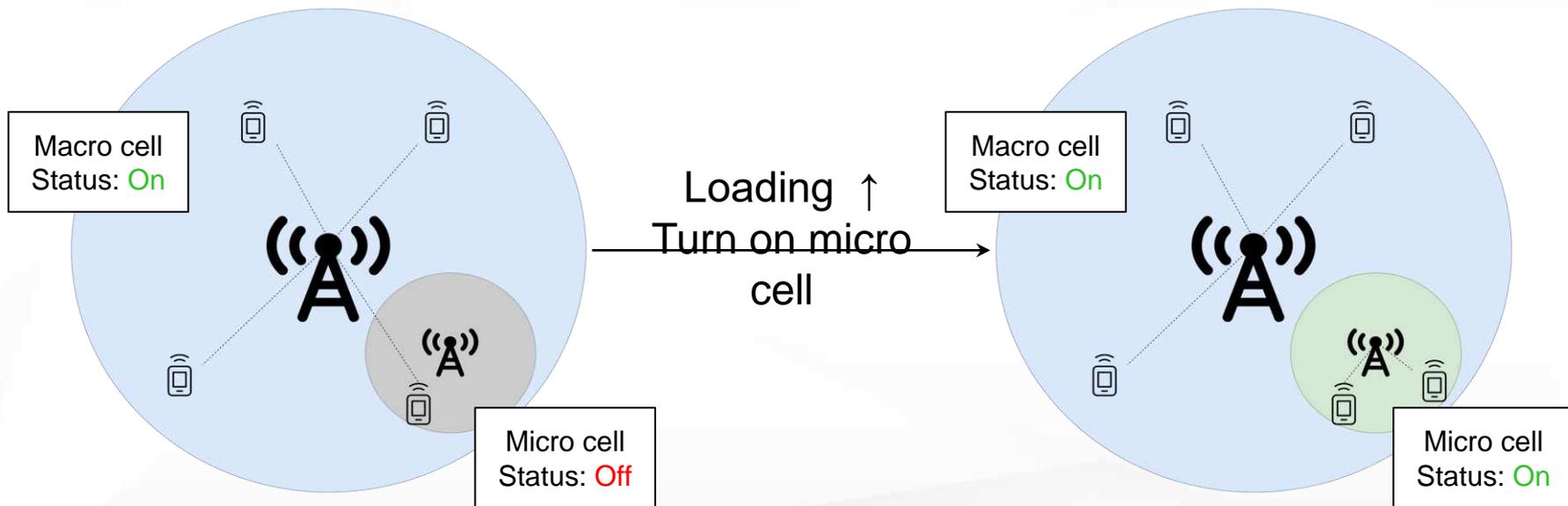
根据性能和容量门限开启和关闭小区

当小区负载低于一定门限(40%), 关闭micro cell

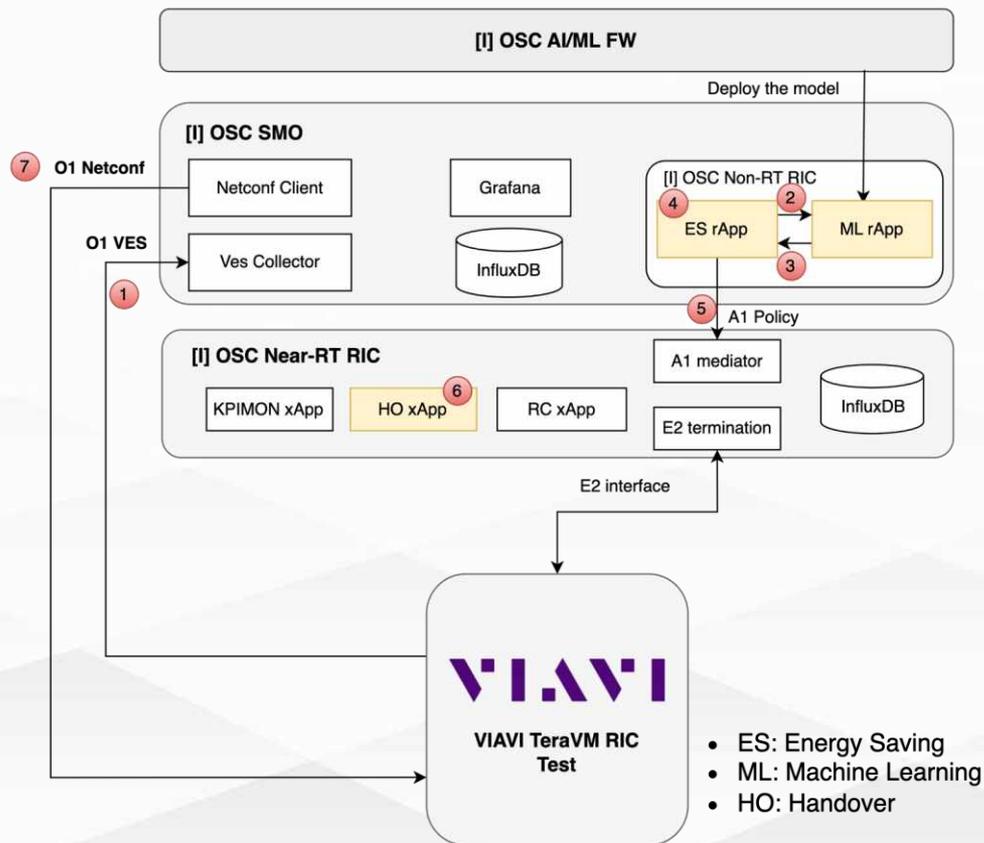


Cell Switch On/off VIAVI//Restricted

当小区负载高于一定门限 (40%), 开启micro cell.



交互流程



1. [O1 VES] 收集 RAN 数据
2. ES rApp 向 ML rApp 发送数据，请求预测流量负载
3. ML rApp 发送预测结果
4. ES rApp 决定是否开启或关闭小区。
5. [A1 策略] ES rApp 发送 UE 信息并请求 HO xApp 进行 UE 切换
6. [E2] HO xApp 将 UE 切换到邻小区
7. [O1 Netconf] ES rApp 打开/关闭小区

O1 RIC address

VIavi//Restricted

The image shows a web browser window displaying the 'O1 Interface Config' page. The 'VES collector address' field is highlighted with a red box and contains the URL 'http://192.168.8.6/evnt'. The 'Frequency' is set to 1 and 'Aggregation Granularity' is set to 10. A table of 'PerfMetric Cell fields' is visible, with several fields checked.

Field	Checked
DRB.UETpDI	<input checked="" type="checkbox"/>
DRB.UETpUI	<input checked="" type="checkbox"/>
RRU.PrbUsedDI	<input checked="" type="checkbox"/>
RRU.PrbUsedUI	<input checked="" type="checkbox"/>
RRU.PrbAvailDI	<input type="checkbox"/>
RRU.PrbAvailUI	<input type="checkbox"/>
RRU.PrbTotUI	<input type="checkbox"/>
RRU.PrbTotDI	<input type="checkbox"/>
RRU.MaxLayerDIMimo	<input type="checkbox"/>
CARR.AverageLayersDI	<input type="checkbox"/>
Viavi.Cell.AverageBeamsDI	<input type="checkbox"/>
RRC.ConnMean	<input checked="" type="checkbox"/>
RRC.ConnMax	<input type="checkbox"/>
QosFlow.TotPdcPduVolumeUI	<input type="checkbox"/>

The terminal window on the right shows a successful connection to the host 192.168.8.6. The user 'root' is logged in, and the system is Ubuntu 22.04.4 LTS. The terminal output includes system information and a confirmation message: '*** System restart Required ***'. The configuration file path is shown as '/conf'. The terminal also displays XML configuration data for the O1 interface.

```
root@smo-nearst-1:/home/ubuntu#
Microsoft Windows [Version 10.0.19045.4020]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Vinu\jash> ssh 192.168.8.6
The authenticity of host '192.168.8.6' can't be established.
ECDSA key fingerprint is SHA256:uBqapST4xkXU4tPQvEBHhFCWcQV1B3zy0UdR9gc.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.8.6' (ECDSA) to the list of known hosts.
ubuntu@192.168.8.6's password:
Welcome to Ubuntu 22.04.4 LTS (GNU/Linux 5.15.0-107-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Tue Jul 23 05:50:37 AM UTC 2024

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.
   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

 * Enhanced Security Maintenance for Applications is not enabled.
   12 updates can be applied immediately.
   To see these additional updates run: apt list --upgradable.
   14 additional security updates can be applied with ESM Apps.
   Learn more about enabling ESM Apps service at https://ubuntu.com/esm

*** System restart Required ***
Last login: Tue Jul 23 02:38:44 2024 from 192.168.8.9
ubuntu@smo-nearst-1:~$ sudo su
[sudo] password for ubuntu:
root@smo-nearst-1:/home/ubuntu# python3
Python 3.10.12 (main, Mar 22 2024, 16:58:05) [GCC 11.4.0] on linux
Type "help", "copyright", "credits" or "license()" for more information.
>>> from ncclient import manager
>>> from ncclient import import_manager
>>> smc = manager.connect(host='192.168.8.28', port='31948', timeout=5, username='root', password='viavi!', hostkey_verify=False)
>>> conf = <ncclient.xmlconf.XMLConfig object at 0x7f8c1c1c1c1c>
>>> <conf xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
... <ManagedElement xmlns:urn:3gpp:sa5:3gpp-common-managed-element>
... <id>193846</id>
... <GNBCellFunction xmlns:urn:3gpp:sa5:3gpp-nr-nm-gnbcucpfunction>
... <id>1</id>
... <NRCellID xmlns:urn:3gpp:sa5:3gpp-nr-nm-nr-cellid>
... <id>3</id>
... <CESManagementFunction xmlns:urn:3gpp:sa5:3gpp-nr-nm-cesmanagementfunction>
... <id>3</id>
... <attributes>
... <energySavingsState>IsNetEnergySavings</energySavingsState>
... <energySavingControl>toBeEnergySavings</energySavingControl>
... </attributes>
... </CESManagementFunction>
... </NRCellFunction>
... </GNBCellFunction>
... </ManagedElement>
... </conf>
...
>>> smc.edit_config(target="running", config=conf)
```