VIAVI Solutions

Application Note

VIAVI
TeraVM-vRAN
Wireless Core Validation

Verifying Mobile Subscriber Quality of Experience

Next generation wireless technology is enabling the possibility of connected driverless cars, virtual and augmented reality, remote robotic surgery, smart city infrastructure, wearables, plus many more. It won't just stop there, technologies will be further extended with a whole host of applications we're yet to realise are possible. However, with the growth in mission critical services and applications, we've also witnessed the onslaught of cybersecurity attacks.

To address these new requirements, the industry is preparing to disaggregate the Radio Access Network (RAN) and the Core network to bring processing functions and resources closer to the edge and user, with the aim of greatly reduced latency and for increased traffic load. New topologies such as Control and User Plane Separation (CUPS), MEC and Network Slicing are yet to be proven. Regardless of network design choice, there are still enormous pressures with unrelenting demand for connections (IoT) and bandwidth (HD Video). Security is an overarching requirement for all.

The VIAVI RANtoCore™ platform offers end to end testing from Radio Access to Edge to Core.

Combine the TeraVM™ and *TM500™ to enable successful commercial wireless deployments and guarantee the highest standards in customer experience, in a safe and secure environment.

*Further TM500 information available at viavisolutions.com/wirelessvalidation

Next-Generation Packet Core

Where 4G called for a transition to a flat, all IP core network with open interfaces, 5G decouples control and user plane, with the goal for higher throughput, lower latency, simplified mobility between networks and efficient use of network resources.

Mobile operators need a flexible test solution to plan for a number of potential deployment architectures to compare and contrast network designs in order to deliver an optimum user experience and migrate to an efficient, intelligent core.

The VIAVI RANtoCore™ platform offers end to end testing from Radio Access to Edge to Core.

TeraVM-vRAN: Validating Network Performance

TeraVM-vRAN is a proven 3G/4G/5G Core test solution for network equipment vendors and operators worldwide. As a key component of the VIAVI RANtoCore™, TeraVM-vRAN offers a range of use-cases to qualify the functionality and performance of the core network. These include:

- ✓ Evolved Packet Core Validation
- ✓ 3G, 4G & 5G User Plane Performance
- ✓ Packet Gateway Validation
- ✓ MME/HSS Subscriber Validation
- ✓ I-RAT Handover
- ✓ Security Gateway Testing
- ✓ IoT Emulation at Scale
- ✓ MEC applications
- ✓ End to End Network Slicing
- ✓ Signalling Only Call Flows
- ✓ IMS Performance Validation

Uncovering performance limitations and failures require subjecting the EPC network to realistic, high-load scenarios to validate the quality of experience expected by today's subscriber.

Scale with Realism

TeraVM-vRAN uses standard x86 hardware, which delivers significant cost savings to the user. TeraVM has the unique advantage of scalability on both the signalling and data planes to tens of millions of bearers with 100's of Gigabits/s of real application traffic, offering application realism and price performance that is second to none.

Emulating Real Subscriber Behaviour

TeraVM-vRAN's stateful emulation of UEs and broad coverage of 3GPP interfaces such as S1, X2, IuCS, IuPS enables the user to accurately simulate UE applications and mobility behavior for Intra-LTE and Inter-RAT scenarios.

Wireless Core vEPC Validation

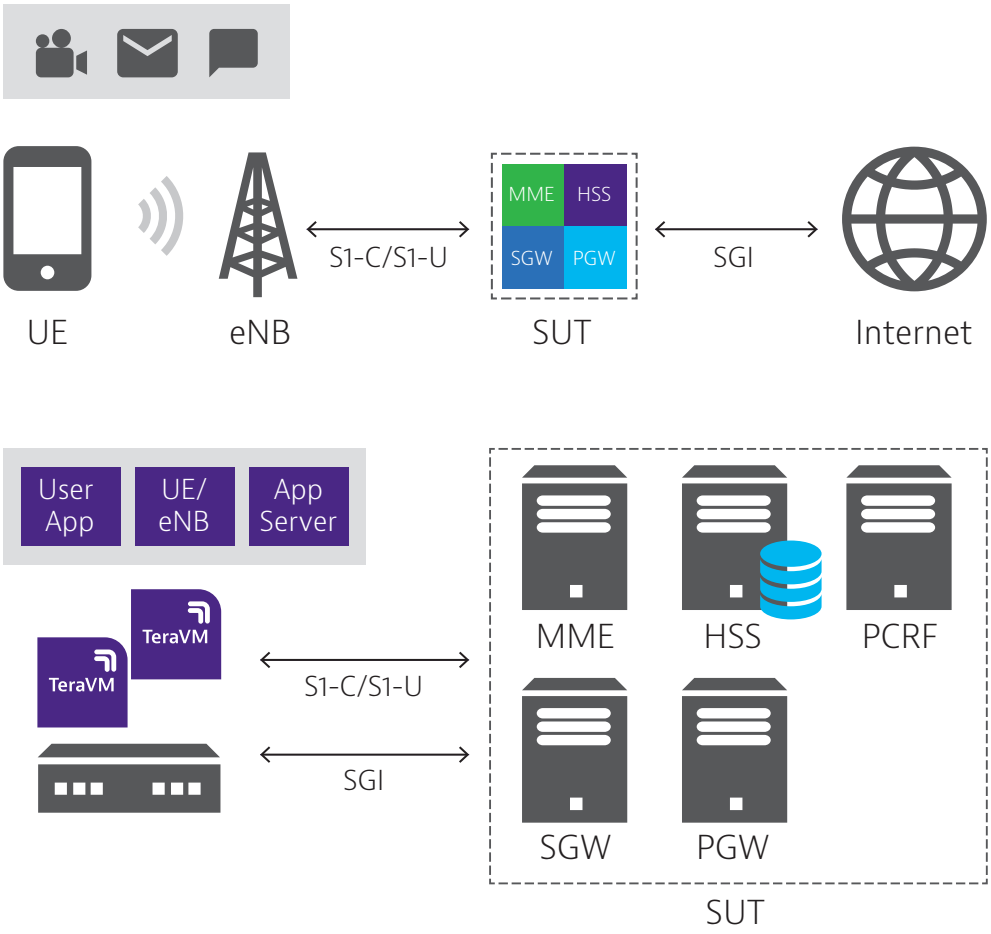
The TeraVM-vRAN virtualized platform makes it an ideal solution for validating physical mobile cores, but more importantly virtualized mobile core components. TeraVMvRAN is Openstack ready, ideal for virtual Evolved Packet Core (vEPC) testing.

CHALLENGE:
Emulate 1 million IoT devices per Km2

Use Cases

EPC/vEPC Performance Validation

TeraVM-vRAN emulates 2G/3G/4G/5G Radio Access Network at scale with 10's of millions of UEs and bearers generating 100's of Gigabits of application traffic to test next generation EPC. Gigabit handsets, bandwidth hungry applications and adoption of WiFi-offload generate an ever-increasing traffic load on the CORE that requires a more flexible design. Test scale-out and failover options of vEPC using TeraVM. Rack and stack x86 appliances to drive unprecedented levels of traffic across the Core. TeraVM offers a rich set of metrics at packet and application QoE levels to guarantee service and application performance in a repeatable and scriptable test environment.

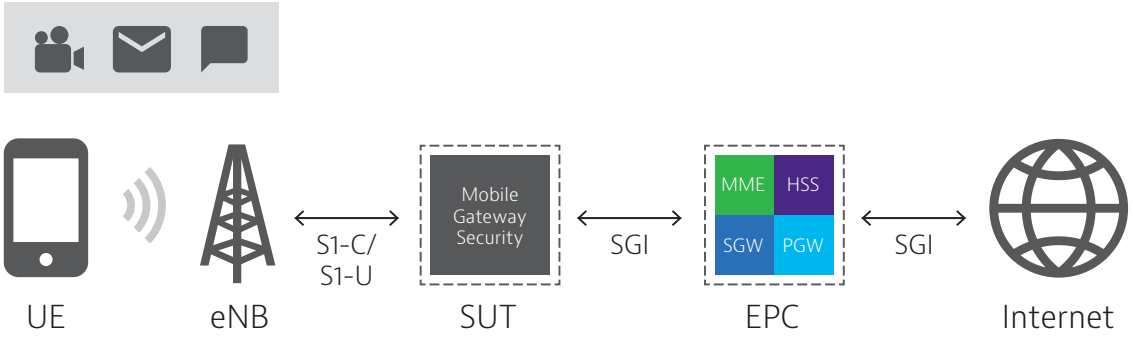


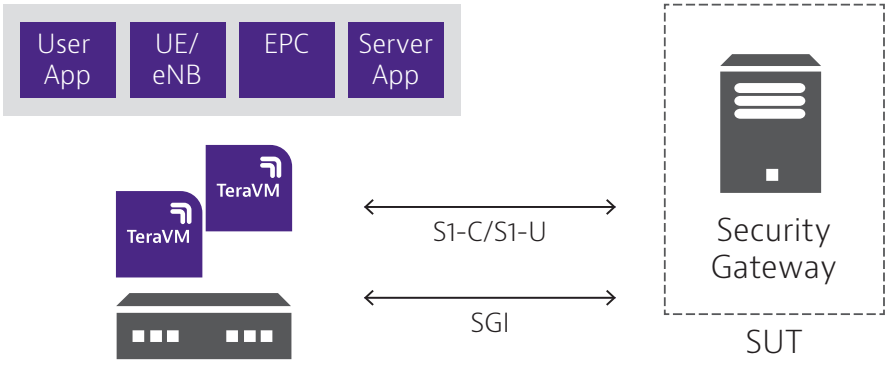
CHALLENGE:
Millisecond Latency Applications

Mobile Secure Gateway Validation

Secure Backhaul is key for shared networks, multi-tenant server farms and application security. The addition of the Mobile Security Gateway into the edge and core introduces an additional bottleneck that needs to be engineered for predicted traffic growth for MEC and 5G network expansions.

TeraVM emulates thousands of eNodeBs with IPSec security associations to the Security Gateway, offering options for IKEv1/2, Authentication, Rekeying and more. Validate end-to-end network performance of real-world applications over IPSec tunnels to simultaneously optimize performance and protect traffic



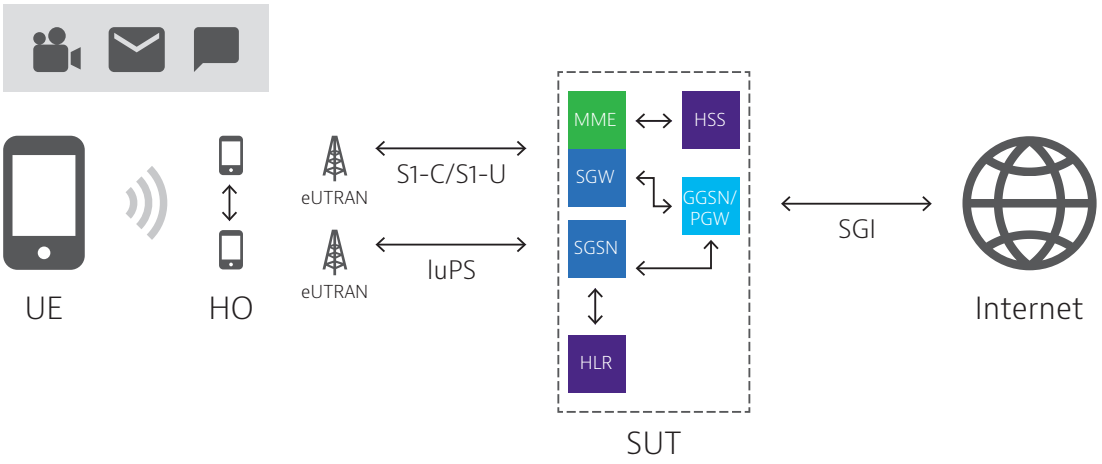


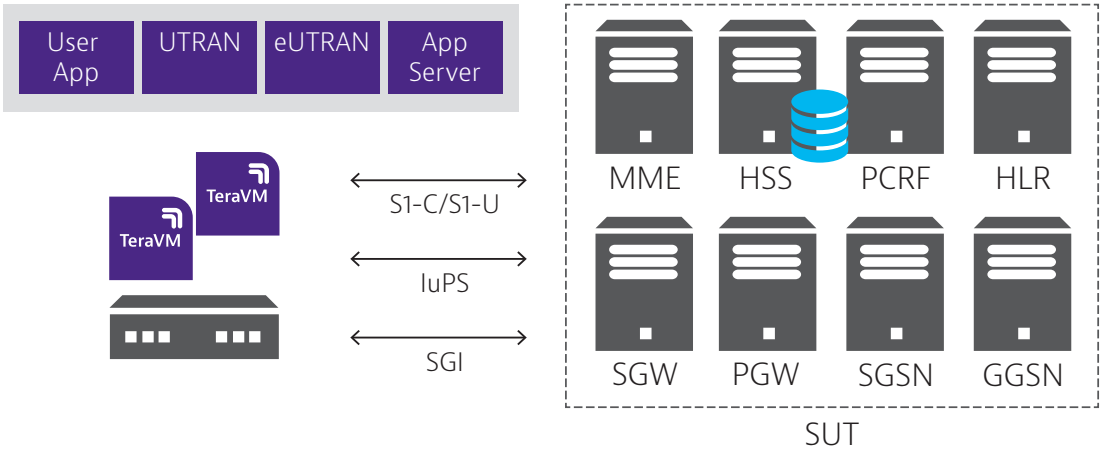
CHALLENGE:
Efficient Secure Backhaul for MEC & 5G Traffic Workloads

4G/3G/2G Handover

TeraVM enables I-RAT Verification with 2G, 3G and 4G emulation with support for CSFB and SRVCC. Test both signalling and media options with the I-RAT mobility package. In addition, load the ePDG with voice over WiFi to LTE to WiFi mobility scenario and see how many calls originating on the cellular network can be handed over to Wi-Fi mid-call.

5G mobility options will be available soon.

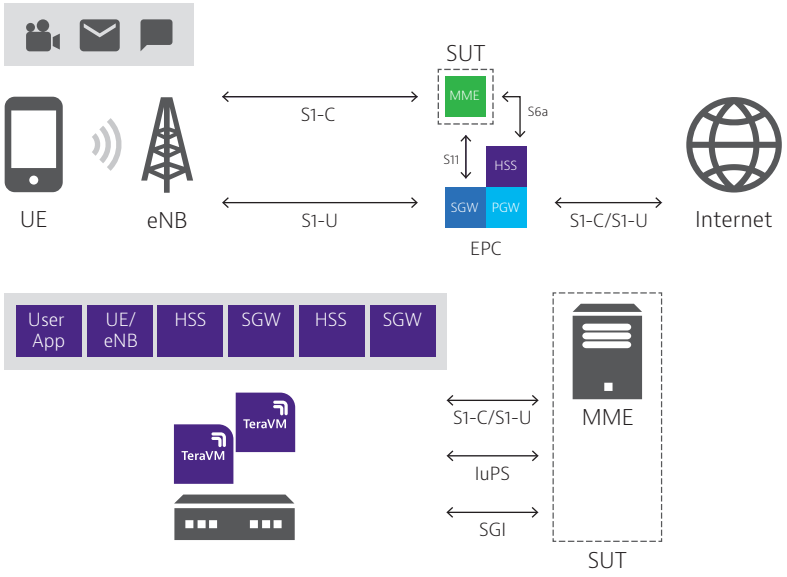




MME/HSS Subscriber Validation

With the advances Mobile Edge Computing and deployment of Cellular IoT, signalling testing is becoming more and more critical. TeraVM-vRAN can isolate and surround the MME for functional and load test scenarios. As the gateways go virtual and migrate to the edge of the network, TeraVM will guarantee the robustness of centralized signalling elements.

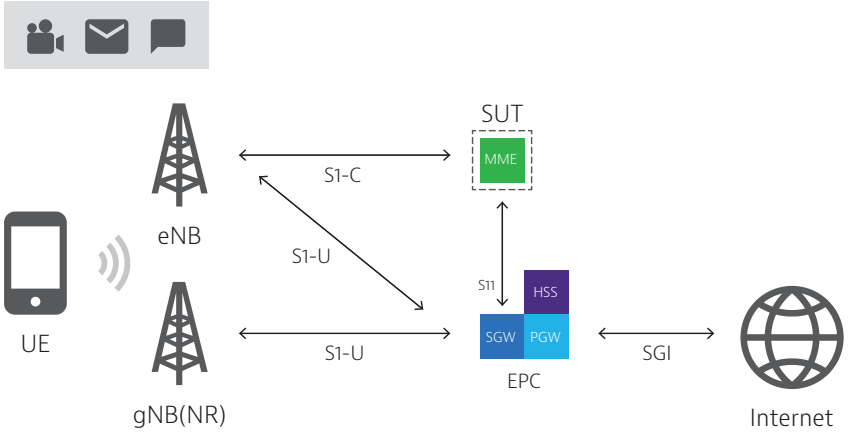
In addition, TeraVM can add emulation of millions of IoT devices to measure the impact on the capacity of the MME and the S11-U interface to the SGW.



Determine Impact of 5G Dual Connectivity on the Core

The addition of Non-Standalone New Radio (NR) offers the path of least resistance for 5G deployments but will necessitate EPC upgrades, in particular when operators offer mobility services. A network with a mix of E-UTRAN Dual Connectivity (EN-DC) capable and LTE-only handsets requires traffic modelling to test the gradual expansion of 5G. TeraVM-vRAN emulates a mix of EN-DC and LTE UEs to create different ratios of subscriber traffic profiles to measure the impact on the core network. Add increasing ratios of 5G NR and double the number of bearers & traffic to test if the core performs as required. In addition, as NR coverage grows, TVM-vRAN offers key mobility tests. As the UE migrates out of NR to LTE coverage, it measures the impact to applications such as Over-the-Top video.

By assessing how many path-switch events the MME can process, TVM-vRAN measures the influence of slowing response times to NR bearer activation and deactivation as the subscriber base moves in and out of 5G coverage.



TeraVM-vRAN Solution Benefits

Usability

- HTML5 user interface
- REST APIs for Automation and Orchestration (MANO)
- Supports OpenStack

Price Performance

- Uniquely scale on both application layer throughput and bearer/UE connections for most realistic emulation.
- Packaged for device, functional and load testing
- Subscription pricing options.

Portability

- License sharing across geo-locations – optimal use of test assets.
- Fully virtual for EPC and vEPC testing
- Run anywhere: lab, datacentre, cloud

Broadest Coverage

- Combine TeraVM with TM500 for end-to-end testing from RAN to EDGE to CORE
- Superior coverage of 2G, 3G, 4G RAN, 5G NSA interfaces on a single x86 server
- 5GC ready with UE enabled secure tunnel endpoints
- Error Insertion package – Ignore, Delay, Re-order, Reject or Duplicate key signalling messages.
- CIoT optional emulation package for NB-IoT and CAT-M1, covering connection and connectionless, IP and Non-IP.

x86 (1u) Server Specifications

Example 1: S1U Load System Specifications

- 2M UEs, 3000 eNBs, 30 Gbps Throughput, Attach Rate 3000/s
- CPU: Intel Xeon E5–2697 v4 2.3 GHz, 45M Cache, 9.60 GT/s
- Memory: RDIMM, 2400 MT/s, Dual Rank, x8 Data Width
- I/O: Intel X520 DP 10 Gb DA/SFP+ Server Adapter, Low Profile 2 SR
- ESXi 5.5 or later, KVM, Ubuntu 16.04.03 LTS and Openstack

Example 2: S1-MME Performance

- 4M UEs, 10,000 eNBs,, Attach Rate 10,000/s
- CPU: Intel Xeon E5–2697 v4 2.3 GHz, 45M Cache, 9.60 GT/s
- Memory: RDIMM, 2400 MT/s, Dual Rank, x8 Data Width
- I/O: Intel X520 DP 10 Gb DA/SFP+ Server Adapter, Low Profile 2 SR
- ESXi 5.5 or later, KVM, Ubuntu 16.04.03 LTS and Openstack

Interface Support (With Regular Updates for Signaling Compatibility)

- User Plane Nodes and Interfaces: SGW, PGW. S1-U, S11-U, Gi, SGi.
- GTPv2: S2b, S3, S4, S5/S8, S10, S11, S16, Sv, N26
- NAS (Backhaul): A, Gb, IuCS, IuPS, IuH, S1
- Diameter, HSS, PCRF, OCS: Cx, Gx, Gy, S6a, S6d, S13, Rx, Sh, SWx
- Coming soon: T6a, T6b, S6t
- 4G-RAN: X2
- SRVCC: SGs
- Untrusted non-3GPP Access: SWu
- MAP: C, F, Gr, Gf
- 3GPP TS36.413 V15.1.0 (2018–03)
- 3GPP TS24.301 V15.3.0 (2018–06)

TeraVM-vRAN is an application emulation and security performance solution, delivering comprehensive test coverage for application services, wired and wireless networks. TeraVM is offered as a virtualized solution enabling the flexibility to run anywhere – lab, datacenter and the cloud, with consistent performance coverage, ensuring that highly optimized networks and services can be delivered with minimal risk.

Visit www.viavisolutions.com/wirelessvalidation for more details on TeraVM-vRAN Mobile Core validation.

VIAVI Solutions

To reach the VIAVI office nearest you, visit viavisolutions.com/contact

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