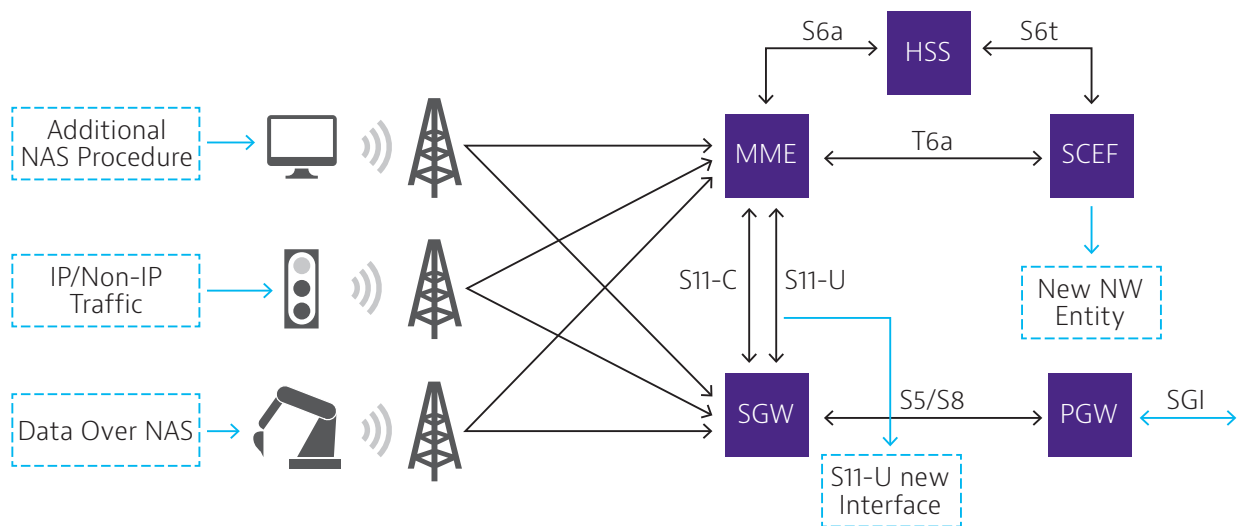# VIAVI
TeraVM-vRAN
Cellular IoT Module

2G to 5G Wireless Core Test Solutions

Overview

Cellular IoT (CIoT) devices provide an additional challenge for wireless networks. Despite the fact each IoT device generates relatively small amounts of data; their numbers are set to increase exponentially, stressing signalling nodes, such as the MME like never before. Couple this explosion with the EPS Optimization modifications on the Control Plane and Bearer Plane, data delivery options for IP and non-IP and deployment of new service nodes, IoT Emulation at scale is a must for testing new applications such as Smart Cites and MEC servers for Mission-Critical First Responder telemetry data.

As a key component of the VIAVI Solutions RANtoCore™ end-to-end IoT test platform, the TeraVM-vRAN CIoT test module emulates millions of IoT devices that support NB-IOT and CAT-M1 with options for IP, Non-IP and SMS delivery for testing of traditional EPC and cutting edge C-SGN and SCEF nodes. TeraVM-vRAN offers a variety of traffic models that allows the standards-based EPS Optimizations where a UE can attach without a PDN connection or deliver data over NAS or conventional LTE bearers. Create a test with a mix of NB-IOT, CAT-M1 and mobile-broadband data UEs to determine the bottlenecks, protect mission critical services and help plan for the next wireless core upgrade.


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

Use Cases

Validating EPC MME and S11-U to handle millions of IoT sessions

Emulate millions of CIoT devices that communicate with the backend IoT server with IP based application data. 3GPP EPS Optimizations are designed to transfer traffic over NAS signalling messages. However, this shifts the workload to the MME. TeraVM-vRAN enables load test of S11-U and the MME with real-world NAS traffic across the MME->SGW->PGW nodes, with millions of IoT Devices, where each Attach Request carries the required CIoT Optimization field. PDN Connectivity is piggybacked in attach requests and user-defined options exist for IPv4 or IPv6 and a used-defined APN. Once PDN connectivity is established and a UE receives the IP address, the user can configure how the UE generates application IP traffic via the NAS –ESM Data Transport message. Both UL and DL traffic is supported.
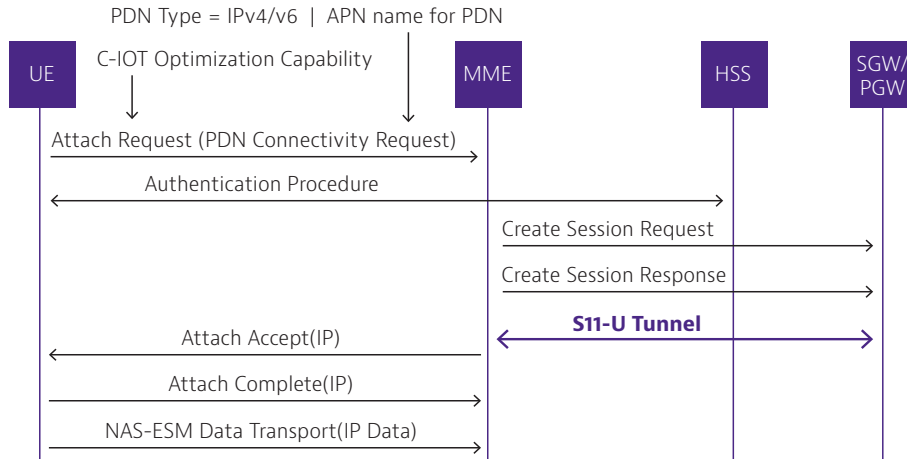
Verifying Seamless transition between states for millions of IoT devices

Like the previous use-case, CIoT optimization of UE idle-connected state transition is supported by TeraVM-vRAN. Transition between idle to connected state is optimised using a new Service Request Procedure called Control Plane Service Procedure. Users can configure timers to control a percentage of CIOT devices to/from idle to connected states. This procedure is specially designed to send a small amount of up-link data with Control Plane Service Request, without waiting for data bearer setup. UEs either continue in connected state or go idle and are configured to send or receive traffic using ESM-Data Transport message after successful state transition. TeraVM-vRAN generates various distributions of Control Plane Service Requests from millions of UEs.

ESM Data transport message can be encrypted by TeraVM-vRAN.
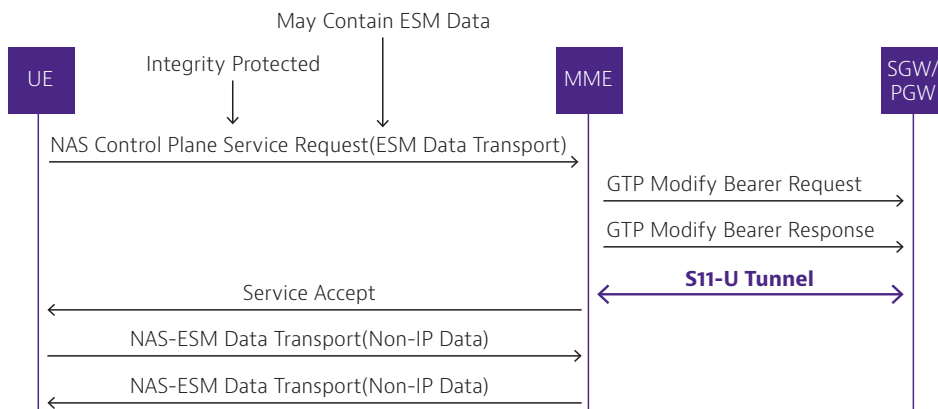
Testing ability to route Non-IP IoT traffic to proprietary nodes at scale

In CIoT Optimization for NB-IoT/CAT-M1, there is provision for UEs to send Non-IP data without PDN connectivity. TeraVM-vRAN will have the option for no IP allocation to UE during an Attach procedure. UE sessions will be maintained by MME and a new network node, SCEF, routes Non-IP traffic to proprietary nodes. In this case, TeraVM emulated user data is transferred over the NAS message.
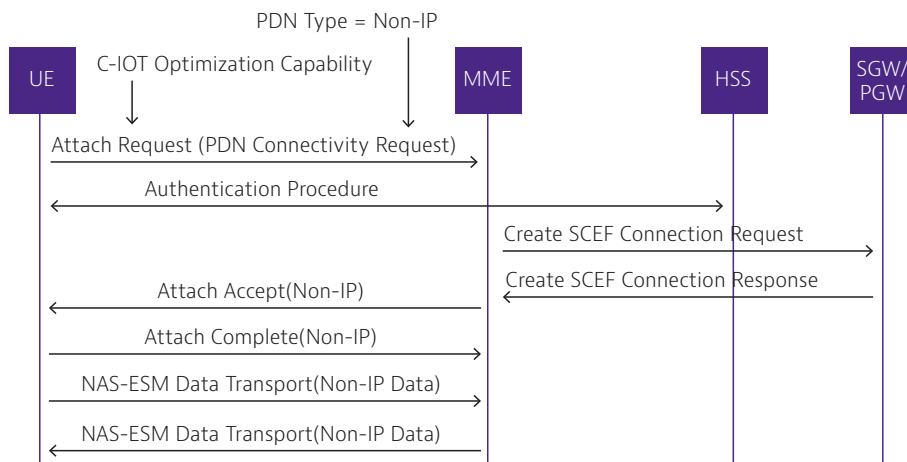
Non-IP traffic over NAS and SGi interfaces

In CIoT Optimization, there is additional provision for the UE to send Non-IP data with PDN connectivity. In this use case, data is transferred over the NAS message to MME and then it is forwarded to the SGW through a new interface called S11-U. Thereafter, the PGW sends non-IP traffic to proprietary nodes.
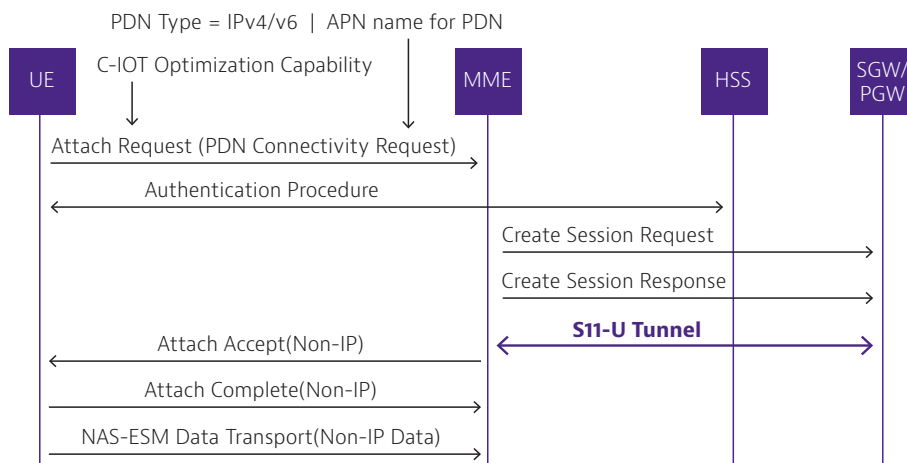
Benefits

- Part of end-to-end RANtoCore™ validation solution: Works in conjunction with TM500 to test eNB and/or emulates millions of UEs and thousands of eNBs to test the core.

- Flexibility to operate in standalone mode or as part of an end to end solution.

- Massive IoT Scalability

- Exceptional Price-Performance

- Prevent CapEx wastage through shared licenses across user-community.

- Future Proof Core Network Design

- Test edge to core for IoT,C-SGN or Network Slicing

- Cover 2G, 3G, 4G and 5G traffic scenarios from a single platform

- Automation: supports Orchestration and third party/in-house automation tools

Features

- Emulate over 16M IoT Devices with 180,000 TPS
- Generate repeatable, reliable traffic patterns with different flavours of IoT devices
- DMix of NB-IoT and non-IoT application traffic
- Rich set of traffic Metrics
- Fully Virtual – Runs in Lab, datacentre or cloud. Supports Openstack
- Compare and contrast Control Plane and User Plane Optimizations

Control Plane Optimization

- UE Attach without PDN connection for non IP traffic
- Control Plane Service Request
- Support for small data transfer over NAS
- Extended Discontinuous Reception (eDRX) Support for Sleeping Nodes
- Power Saving Mode (PSM) in UE

User Plane Optimization

- Data over S11-U Support
- Data over S11-U Support
- Non-IP PDN Support (NIDD)
- Connection Suspend procedure

Node Emulation

- IoT End Points
- eNodeB
- C-SGN
- HSS
- SCEF
- SMSC
- IoT Server

Supported Interfaces

- S1-MME
- S6t
- S11-U
- T6a
- T6b

Standards

- 3GPP TS 24.301
- 3GPP TS 23.401
- 3GPP TS 36.413
- GPP TR 23.720

System Specifications

- 4 Intel CPU v4 (or higher) and 128GB Memory per Virtual
- Machine
- ESXi 5.5+ or KVM Ubuntu 16.04.03 LTS
- Scales with multiple Virtual Machines

Licensing

TeraVM-vRAN requires an addition license for IoT support with options for 200, 200,000 or 1M IoT Devices with 400, 40,000 or 4M bearers respectively. Order Codes:

- TVM-vRAN-CIoT-200
- TVM-vRAN-CIoT-200K
- TVM-vRAN-CIoT-1M

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