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TeraVM
TeraVM 5G SA CORE Test for TVM-vRAN SMF Wraparound Test

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Overview

The VIAVI TeraVM SMF wraparound test provides a comprehensive validation test suite for this critical component of the 5G SA Core, the Session Management Function.

SMF is the key node from control plane to user plane through N4/N11 interface. N4/N11 session management procedures are used to control the behavior and functionality of the UPF. The SMF can create, update and remove PDU sessions. It also performs the role of DHCP Server and IP address management systems as part of the decoupling of control plane functions from user plane in CUPS (Control and User Plane Separation).

SMF interacts with:

- AMF (N11) – receives session management requests

- UPF (N4) – instructs how packets are identified, forwarded, processed and marked

- PCF (N7) – requests policy information for subscriber

- UDM (N10) – checks subscription information

The SMF can be completely tested as a SUT (system under test) in isolation. The SMF interacts with AMF, UPF, PCF and UDM which are all newly developed elements for 5G. Therefore, protocol interoperability and performance issues for these new elements has the potential to cause network outages.

The SMF will run in a network with multiple vendors, a variety of virtual environments, with continuous integration and development (CI/CD) making releases in the network more frequent than ever before. VIAVI's leadership in 5G has enabled a first-to-market SMF tester that is designed to emulate the multiple-vendor environment with 3GPP conformant and non-conformant messages stressing the resilience of the Core at load.

Features

- First to market SMF wraparound test, compliant with Latest 3GPP standards
- Runs in lightweight VM on standard x86 hardware
- CI/CD Automation Integration
- Supports Open Source automation tools such as Jenkins
- Functional Testing
- Performance, Capacity Testing
- Negative Testing via Error insertion
- Flexible Impairment Generation
- NFV MANO Ready
- Lab to Field – Same test tools used in the field

SMF Wraparound Testing

One of the biggest time-to-market challenges facing NEMs and mobile operators as they launch 5G services is developing products against constantly changing and maturing 3GPP specs.

Consequently, as SMF functions are developed, it is important to remove the major obstacle of readily available 5G compatible network elements to test the node. In order to fully test the SMF, other elements of the 5G standalone Core network are required, namely the AMF, UPF, PCF, and UDM nodes.

TVM-vRAN SMF wraparound test emulates AMF, UPF, PCF and UDM according to the latest 3GPP Rel 15 specifications, allowing the interfaces to the SMF to be exposed and the SMF under test be bracket tested.
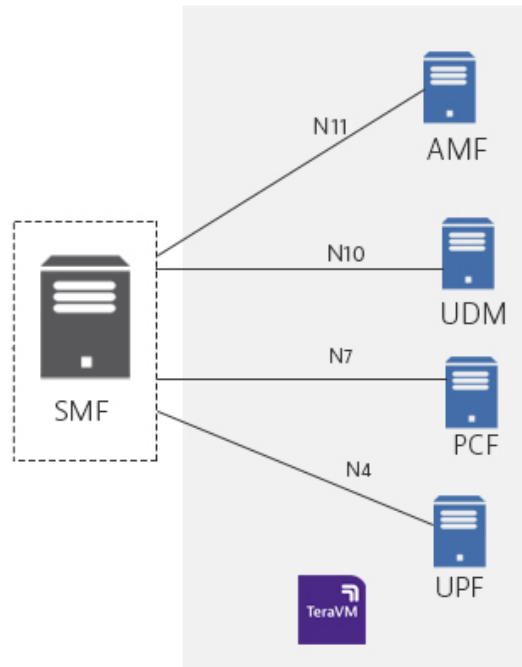
SMF Test Cases

Functional Test types available with SMF wraparound tester include:

• PDU Session Establishment Procedure

• PDU Session Release Procedure

• Multiple PDU Session per UE

• UE initiated PDU Session Modification (Adding new QoS Flow)

• NW initiated PDU Session Modification (Adding new QoS Flow)

• IPv4 and IPv6 address assignment

• UE initiated Service Request Procedure

• Paging procedure (NW initiated Service request)

• Xn based HO and Path Switch procedure

• N2 HO AMF anchored

• Emergency Service

KPI's to Validate SMF

An extensive range of Nsmf, Nudm, Npcf, N4 PFCP and SMF procedural KPI's are available for the 5G SA SMF tester including, but not limited to:

- Nsmf KPI's include SM Context Service create, update, release, retrieve, notify

- Nudm KPI's include UECM registration, response, request, subscribe

- Npcf KPI's include SMPolicy_Control create, update and release for both requests and associated responses

- SMF use case procedure KPI's including PDU sessions, QoS rules, NG N2 HO, Path Switch, Service Procedure, Paging, Session Activation Rate, Xn HO etc.

Benefits of TVM-vRAN SMF Wraparound Feature

- Proven – Has tested leading vendor SMF

- Robust Testing – The TVM-vRAN SMF tester allows engineers to insert errors on the N4, N7, N10 and N11 interface to check the robustness of the SMF design.

- Portability – 1U Server based system, easy to transport and setup (Lab/Field)

- Lightweight – Deploy and configure in real-time

- Deterministic Performance – Outcome is always consistent

- Time to Market – Frequent updates to most recent 3GPP Specifications

Error Insertion via N4, N7, N10, N11 Interface (Optional)

Use TVM-vRAN SMF wraparound test to introduce errors via the N4, N7, N10 and N11 interfaces and observe how the SMF reacts. For example, the following emulated error cases can be supported:

- PFCP Association Setup with erroneous Node ID

- PDU Session creation with invalid SUCI/SUPI and not supported DNN

- UE initiated PDU session modification with contradicting QoS Filter, QFI out of range

The above flexibility allows the customer to decide which impairments they would like emulated and tested. VIAVI works with its customers to regularly update new error insertion scenarios.

Automation and Scripting

The TVM-vRAN SMF wraparound tester comes with build-in management options, shell or a web client and provides APIs to control and operate the tester from external applications.

- SMF wraparound shell

- CLI (Command Line Interface) with readline/autocompletion support

- Fully scriptable

First to Market 3GPP Standards Test Alignment

VIAVI has the largest dedicated 4G and 5G R&D team of any test company focusing on gNB, Core Network test. We work closely with our key customers to ensure that our roadmap is aligned to market needs and that we deliver test capability first.

Specification and Configuration

The TVM-vRAN SMF wraparound test consists of the following virtual network function and interfaces:

Network Functions

- AMF (Access and Mobility Functions)

- PCF (Policy Control Function)

- UDM (User Data Management)

- UPF (User Plane Function)

Interfaces

- N4

- N7

- N10

- N11

The implemented features are according to the following 3GPP specifications:

- System Architecture for the 5G System

- Procedures for the 5G System

- Non-Access-Stratum (NAS) protocol for 5GS

- NR and NG-RAN Overall Description

- NG Application Protocol (NGAP)

- Study on New Radio Access Technology; Radio Access Architecture and Interfaces

- NG-RAN Architecture Description

- NG-U, Userplane interface (gNB – UPF)

Order Codes

SMF wraparound test is available with the following product codes:

Part Number	Description	Gbps	Support
48000/320	SMF Wraparound Test N4/7/10/11	100,000 TPS	SA320
48000/317	Error Insertion N1/N2-100K TPS	100,000 TPS	SA317

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