

Ng4T

From NFV-PLUGTESTS

NG40 ETSI VNF

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About ng4T

Overview

ng4T develops innovative solutions for verification of next Generation Mobile Communication Networks and Elements.

Equipment Manufacturers and Network Operators worldwide use ng4T-products to assure standard-conform behavior of interfaces, network nodes and services.

The NG40 is an inter-operability, functional, conformance and a leading edge load tester.

The NG40 is an integrated SW only tester, the only SW based Tester which supports iRAT (Inter Radio Access Technology) across 2G, 3G, 4G, VoLTE and WiFi.

The NG40 vTester fully integrates into NFV/SDN based Telco Cloud infrastructures.

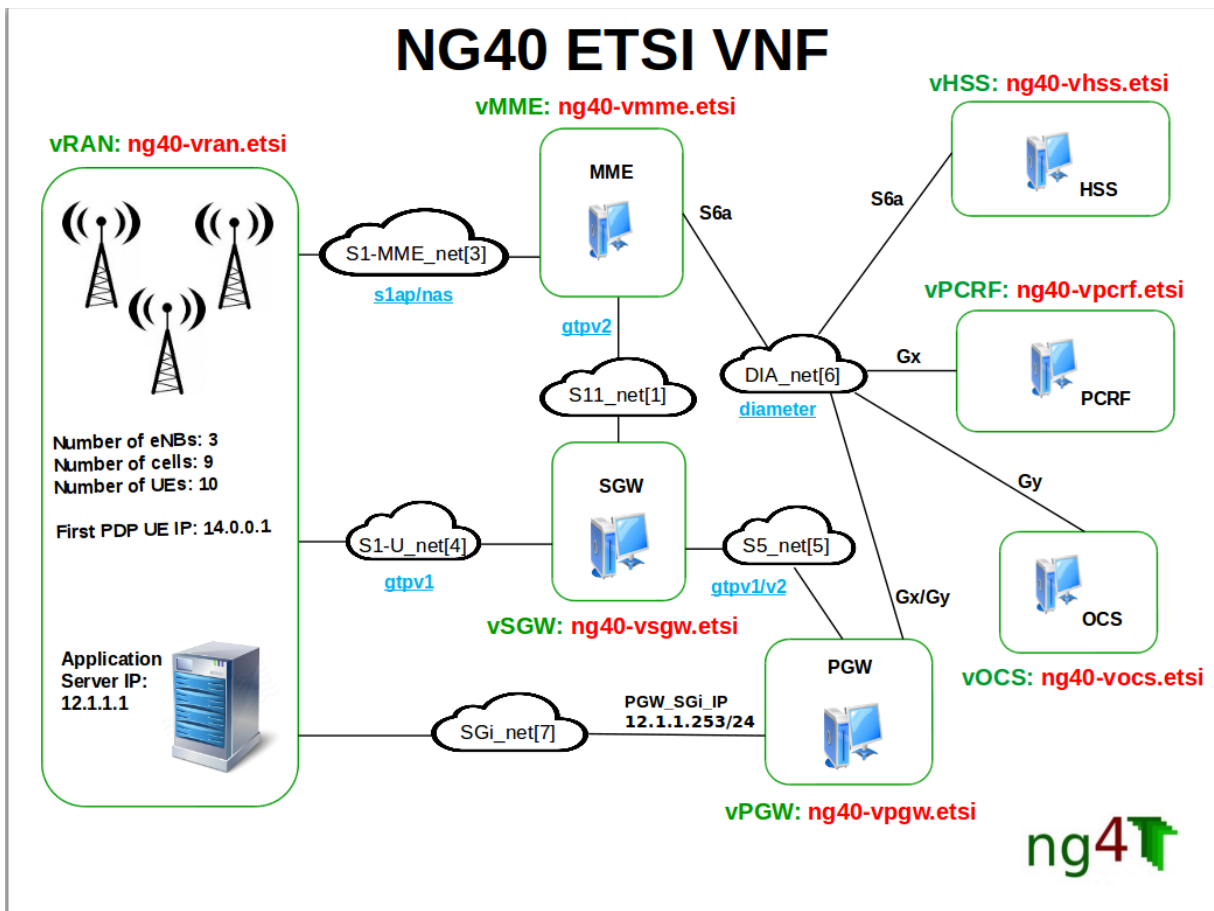
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preferred contact method is Slack

NG40-vTester

Functional Overview



Each NG40-vTester is implemented as one Virtualized Network Function (VNF).

The NG40-vTester available to plugtests participants does offer the following

Services

- virtual LTE Access Network (Cloud-RAN)
- virtual Mobility Management Entity (vMME)
- virtual Home Subscriber Server (vHSS)
- virtual Serving Gateway Function (vSGW)
- virtual Packet Gateway Function (vPGW)
- virtual Policy and Charging Rules Function (vPCRF)
- virtual Online Charging System (vOCS)

- The CORE Network is composed of separate nodes (splitted CORE architecture), while the Access Network combines eNBs + UEs at one emulation stack.

- The interfaces between the services are 3GPP compliant.

- Any service offered by the NG40-vTester can be replaced with a 3rd Party VNF.

- Up to 7 NG40-vTesters can be deployed breaking out all the 3GPP Interfaces in the above topology.

- This allows 3rd party Monitoring tools, Firewalls, Band management VNFs to be inserted on any wireline 3GPP interface.

Procedures and Features

1. RAN Emulation as active test case trigger

Features

- Integrated UE and eNB emulator with S1-MME/S1-U interface support
- Includes Application Server endpoint connected to SGi network of EPC
- Enables full end to end testing of an EPC service chain from Control and User Plane stack perspective.

Fundamentals

- ATTACH (EPS, EPS/IMSI Combined, Emergency, GUTI)
- DETACH/SERVICE REQUEST/S1-RELEASE/PAGING
- NAS PIGGYBACKED (Default+Dedicated bearer activation during ATTACH)

Security

- Authentication (XOR/Milenage)
- Ciphering (NULL, SNOW-3G, AES)
- NAS Integrity Protection

Bearer and Sessions

- up to 11 simultaneous bearer per UE
- Dedicated bearer creation/modification/deletion (UE/Network initiated)
- Default bearer creation/modification/deletion (UE/Network initiated)
- Session creation/deletion

Mobility

- Tracking Area Update
- Pathswitch
- Handover (with and w/o MME/SGW relocation)
- Idle mode PS Paging during DL data transfer
- User Plane
- Packet generator for S1-U + SGi interface
- IPv4/IPv6 Application + Transport

2. HSS as active responder**Features**

- HSS Emulation at S6a interface support as defined in 3GPP TS 29.272, clause 5
- Functional descriptions and message flows as described in 3GPP TS 23.401, clause 5.1.1.9 and 5.1.1.10
- 3GPP-specific Diameter codes and identifiers as defined in TS 29.230
- Diameter Base Protocol as defined in RFC 6733

General Procedures

- CER / CEA: Capabilities-Exchange-Request / Answer
- DWR / DWA: Device-Watchdog-Request / Answer

HSS S6a Procedures

- ULR/ULA: Update-Location-Request/Answer
- CLR/CLA: Cancel-Location-Request/Answer
- PUR/PUA: Purge-UE-Request/Answer
- IDR/IDA: Insert-Subscriber-Data-Request/Answer
- DSR/DSA: Delete-Subscriber-Data-Request/Answer
- AIR/AIA: Authentication-Information-Request/Answer
- RSR/RSA: Reset-Request/Answer
- NOR/NOA: Notify-Request/Answer

3. PCRF as passive responder**Features**

- PCRF nodal emulation at Gx-Interface
- Diameter Protocol acc. to 3GPP TS 23.203 and TS 29.212, Release 8+9+10+11+12
- Policy and charging control functions on the Gx interface
- Configurable subscriber and service profiles

Supported Procedures

- CCR/CCA: Credit-Control-Request/ Credit-Control-Answer
- RAR / RAA: Re-Authorization-Request / Re-Authorization-Answer
- CER / CEA: Capabilities-Exchange-Request / Capabilities-Exchange-Answer
- DWR / DWA: Device-Watchdog-Request / Device-Watchdog-Answer

4. OCS as passive responder

Basic Features

- OCS nodal emulation at Gy-Interface
- Diameter Base Protocol acc. to RFC 6733; Diameter Credit Control Application acc. to RFC 4006
- Charging Management acc. to 3GPP TS 32.240 Release 12 and TS 32.299 Release 12
- Online Charging System (OCS): Application and Interfaces acc. to 3GPP TS 32.296 Release 12
- Packet Switched (PS) Domain Charging Management acc. to TS 32.251; IMS Charging Management acc. to TS 32.260; Advice of Charge (AoS) Service acc. to TS 32.280
- Emulation of mobile subscriber credit control services
- Configurable subscriber profiles, credit pools and tariffs

Supported Procedures

- CCR / CCA: Credit-Control-Request (Rx) / Credit-Control-Answer (Tx)
- RAR / RAA: Re-Authentication-Request (Tx) / Re-Authentication-Answer (Rx)
- CER / CEA: Capabilities-Exchange-Request / Capabilities-Exchange-Answer
- DWR / DWA: Device-Watchdog-Request / Device-Watchdog-Answer

5. MME as a relay

Basic Features

- MME nodal emulation at S1-MME, S11, S6a interfaces
- GTPv2 simulation at S11 reference point acc. to 3GPP TS 29.274 Release 9 - 12

Supported Procedures

- Create Session Request / Response
- Delete Session Request / Response
- Modify Bearer Request / Response / Command / Failure Indication
- Delete Bearer Command / Failure Indication
- Bearer Resource Command / Failure Indication
- Downlink Data Notification / Notification Acknowledge / Notification Failure Indication
- Create Bearer Request / Response
- Update Bearer Request / Response
- Delete Bearer Request / Response
- PGW Restart Notification / Acknowledge

6. SGW as a relay

Basic Features

- SGW nodal emulation at S1-U, S11, S5 interfaces
- GTPv2 simulation at S11 reference point acc. to 3GPP TS 29.274 Release 9 - 12

Supported Procedures

- Create Session Request / Response
- Delete Session Request / Response
- Modify Bearer Request / Response / Command / Failure Indication
- Delete Bearer Command / Failure Indication
- Bearer Resource Command / Failure Indication
- Downlink Data Notification / Notification Acknowledge / Notification Failure Indication
- Create Bearer Request / Response
- Update Bearer Request / Response

- Delete Bearer Request / Response

7. PGW as a relay

Basic Features

- PGW Emulation at SGi, Gx/Gy, S5 Interfaces
- Diameter Protocol acc. to 3GPP TS 23.203 and TS 29.212, Release 8+9+10+11+12
- Policy and charging control functions on the Gx interface
- Configurable subscriber and service profiles
- Procedure generator for concurrent session management
- Simulation of policy or subscription changes in active sessions
- Initiate PGW-originated procedures:

- Credit Control Initial Request (CCR-I) for an idle transaction
- Credit Control Update Request (CCR-U) for an active transaction
- Credit Control Terminate Request (CCR-T) for an active transaction
- Event Trigger
- Indication of IP-CAN Service Establishment / Modification / Termination

Supported Procedures

- CCR/CCA: Credit-Control-Request/ Credit-Control-Answer
- RAR / RAA: Re-Authorization-Request / Re-Authorization-Answer
- CER / CEA: Capabilities-Exchange-Request / Capabilities-Exchange-Answer
- DWR / DWA: Device-Watchdog-Request / Device-Watchdog-Answer

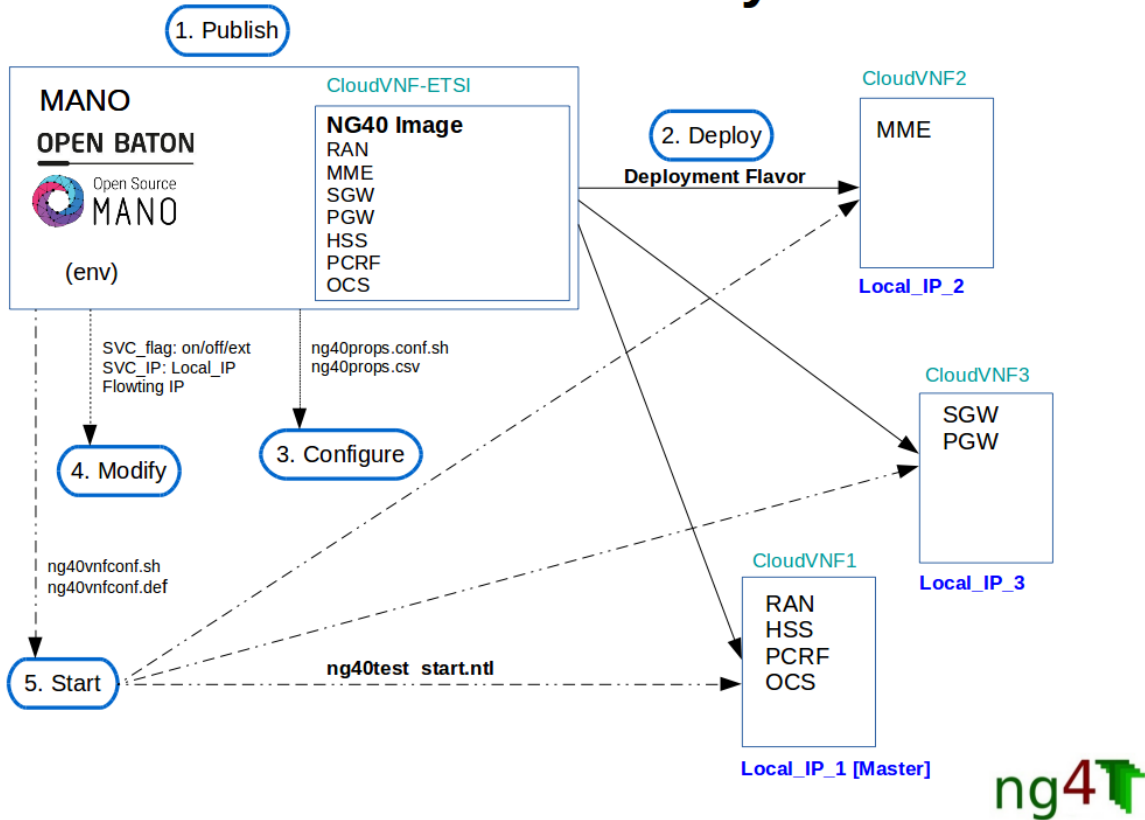
Flavour

- Based on Xenial Ubuntu Cloud image
- 2 vCPUs
- 4 GB RAM includes 512MB of huge pages
- 16 GB vDisk (includes or with extra 4GB swap)

These are the minimum requirements to run all the services for up to 10 subscribers in parallel in a single VM.

Life Cycle Managements

NG40 VNF Lifecycle



For management there are two methods:

Remote Shell

Using ng40test program with associated ng40 test list (.nfl) files:

Use:

```
ng40@TVM-RANtoCore-1:~$ ng40test --help
```

to get help and background information:

```
ng40test [-h|-?|-help|--help] [-t] [-c] <ng40testlistfile>
-h|-?|-help|--help: Print the help text and exit. Has to be the first parameter/option
-t: Translate commands into python, print and exit
-c: Execute testlist in classic mode. No translation to python and no python commands allowed.
```

testlist commands:

```
createshell <shellobjectname> <ng40serverIP> <ng40configpath> <username> [continue|shutdown|shutdownwait|<flags to pass to ng40shell>]
checkstate <shellobjectname> TC_RUNNING|TC_READYTORUN|TC_ABORTING|TC_STOPPING|TC_NULL exit|wait
testcase <shellobjectname> <testcasename> [[${<param1>=<value>}]*] <timeoutinseconds>
start <shellobjectname> <testcasename> [[${<param1>=<value>}]*]
stop <shellobjectname>
cancel <shellobjectname>
loop
until <loopcount>
wait <seconds>
waitselect <selectionlist> <timeout>
waitselectend
shutdown <shellobjectname>
cmd <shellobjectname> <command> [[<commandparameter>]*]
paraget <shellobjectname> <emulationname> <parameterid> <index>
paraset <shellobjectname> <emulationname> <parameterid> <index> <value>
set debug|verdictprint|<varname> <value>
setif <expression> <varname> <value>
load <shellobjectname> <callscenariofilename>
checkprocstate <shellobjectname> off|starting|start/run|running|stopping|stopped|fail|ending|end|scheduled
printverify <shellobjectname> [[<statisticname>]*]
printstatistics <shellobjectname> [[<statisticname>]*]
verdict <shellobjectname>
echo <text>* [stream=<output stream>]
remote <user@host> command [<arg>]* [exit|continue]
setlog [name=<logfile>] [folder=<logfilefolder>] [debuglevel=NO|INFO|DEBUG|DEBUG2|VERBOSE|OFF]
```

```

[screendebuglevel=NO|INFO|DEBUG|DEBUG2|VERBOSE|OFF] [screentime=OFF|ON] [filetime=ON|OFF]
include [-i] <filename>
varimport <filename>
csvimport <filename> [[[[<direction:columns|rows>] <startrow>] <startcol>] <rows>] <cols>]
parallel <parallelobjectname> <function> [<arg>]*
paralleltimer <parallelobjectname> <seconds> <function> [<arg>]*
paralleltimecancel <parallelobjectname>
parallelwait <parallelobjectname>*
parallelname <echo text>
stream <streamobjectname> <stream ip> <stream port>
streamclose <streamobjectname>
stattable <tableobjectname> <title>
stattableheader <tableobjectname> <header name>*
stattablecolumnwidth <tableobjectname> <width>*
stattablerowheader <tableobjectname> <row name>*
stattablerow <tableobjectname> <parameter description ([[<shell> <emulation>] or [<emulation>]<paramid> <paramindex>|)])>*
stattableverify <tableobjectname>
screen-update <interval> <timeout> <mode>
ui <uiobjectname> <streamobjectname>
uistatus <uiobjectname> <text>*

```

Rest API

Instead of using script and command line, MANOs can also try out our REST API.

- Rest-API Definition
- Rest-API based Results Manager
- Rest-API based Scenario Manager

Network use

The NG40 vTester requires a total of 8 virtual Ethernet devices.

One device is to be reserved for ssh to manage the VM.

Ethernet 1 to 7 is used as measurement interface according the table below.

Overview table

Net_ID	Network Reference Point	Network VNF Main Device	Subnet
Mgmt[0]	Management	ens3	DHCP, NAT 192.168.122.0/24
S11_net[1]	S11	ens4	192.168.17.0/24
Spare_net[2]	Spare	ens5	192.168.27.0/24
S1-MME_net[3]	S1-MME	ens6	192.168.37.0/24
S1-U_net[4]	S1-U	ens7	192.168.47.0/24
S5_net[5]	S5	ens8	192.168.57.0/24
DIA_net[6]	S6a, Gx, Gy	ens9	192.168.67.0/24
SGi_net[7]	SGi	ens10	192.168.77.0/24

Openstack Topology example

Project / Network / Network Topology

Network Topology



NG40-vTester Use Case examples

- vEPC bracket test with
 - NG40 vRAN over S1-MME, S1-U
 - NG40 vHSS over S6a to MME
 - NG40 vPCRF over Rx to PGW

Image Location

- FTP: 172.22.1.1
- Location: /NFVPLU3/VNFs/ng4T/

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