



Redefining Virtual Network Function (VNF) Testing

Creating an effective and portable VNF testing framework with end-to-end automation

Credits

Pratik Ravindra Tidke

Sumit Thakur

VNF Testing in DSP environment has become complex, costly and time consuming!

Testing activities consume more than 40% of time and effort

Testing challenges faced by DSPs in virtualized environment

Scope of testing has exploded

- Variety of NFV Infrastructure, multi-vendor VNFs and Disaggregated layers have dramatically increased the testing scope
- Unpredictable interoperability testing results with the explosion of NFV combinations
- Moving to virtualised environment has further increased testing scope with additional test scenarios to cover resource allocation, dynamic lifecycle management, multi-tenancy, etc

Complexity of testing is growing with evolving NFV ecosystem

- Ensure similar carrier grade performance in virtualised environment comprising of multi-vendor + Open Source + Home grown components
- Evolving NFV test designs to support **hybrid architecture**
- Monitoring & evaluating testing results to get a unified view of end to end testing

Frequency of testing has increased exponentially

- Frequent updates in the network services –frequent MANO & NFVI testing
- Testing and integrating more frequent patches and releases from different VNF vendors
- More frequent customization of existing test cases to suit specific vendor component

With these set of challenges, **testing activities** today consume more than **40%** of DSP's time and efforts in bringing new services online

In such a complex scenario getting multiple VNFs up and running can be complex, costly and time consuming, thereby defeating the overall purpose of network virtualization. To overcome these challenges DSPs need to radically change the existing testing methods and processes and shift to a new production model.

DSPs need to create a portable VNF testing framework to derive major business benefits

VNF Testing covers the entire SDN/NFV lifecycle management from concept, integration, launch, operation to retirement. Creating an effective and portable VNF testing framework with end-to-end automation can help DSPs to overcome existing complexities.

Major business drivers to create a portable VNF testing framework

Deliver releases
in a safe,
timely and
agile manner

Launch new
features with
stability and
without
breakages

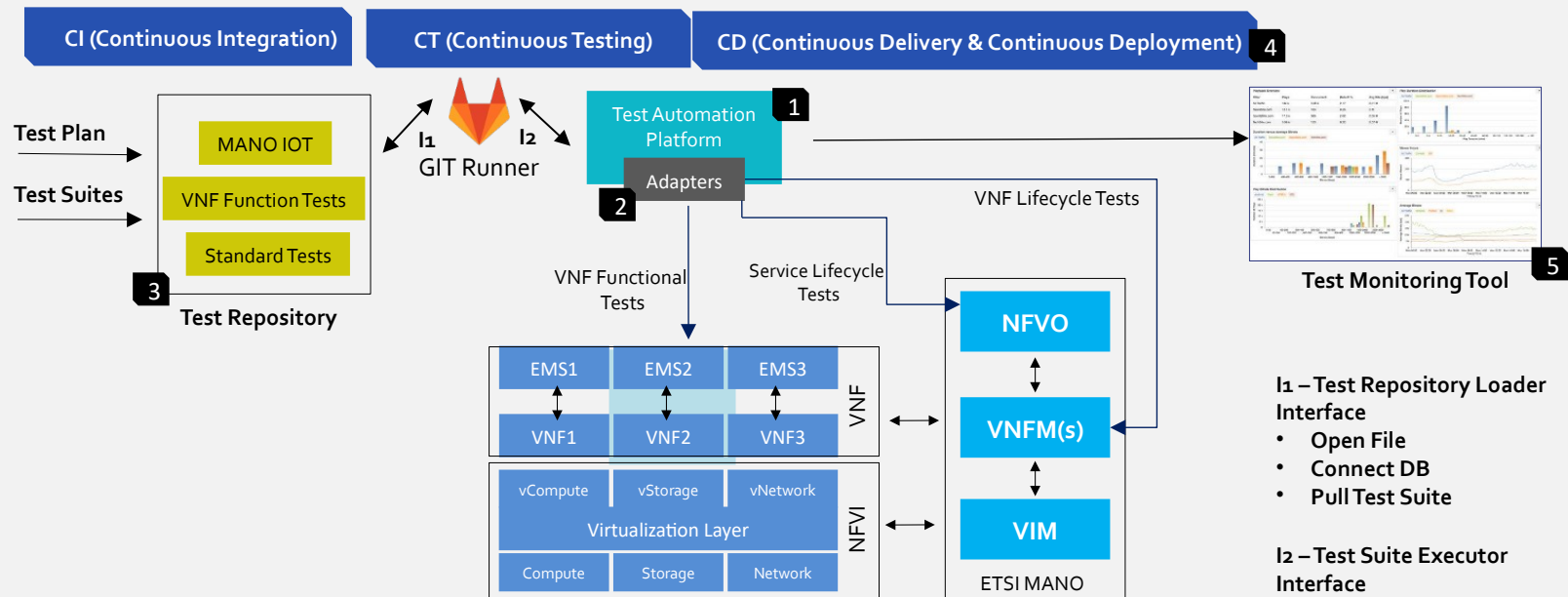
Launch
services that
are performant
even in a
heterogeneous
environment

Meet the
standards,
compliances
and
interoperability
with other
components

Ensure
portability
across
multiple
targets (NFVI
+ MANO)

This Insight focuses on key elements that can help DSPs in creating an effective and portable VNF testing framework to achieve the above mentioned business benefits.

Key elements to create effective VNF testing framework



- I1 – Test Repository Loader Interface**
- Open File
 - Connect DB
 - Pull Test Suite
- I2 – Test Suite Executor Interface**

Key Elements

1
Portable and target independent test automation platform

2
Adaptors with zero-coding complexity for testers

3
Test cases adhering to ETSI standards

4
Automated CI/CT/CD setup to create agile and reliable testing process

5
Test monitoring tool to gather key insight for E2E testing

Key element - Portable and target independent test automation platform

1 2 3 4 5

1

Create a portable and target independent test automation platform

A portable test automation platform can fire test cases on different vendor VNFs using different service orchestrator

1. Create a plug & play test modeling feature for specific vendor elements

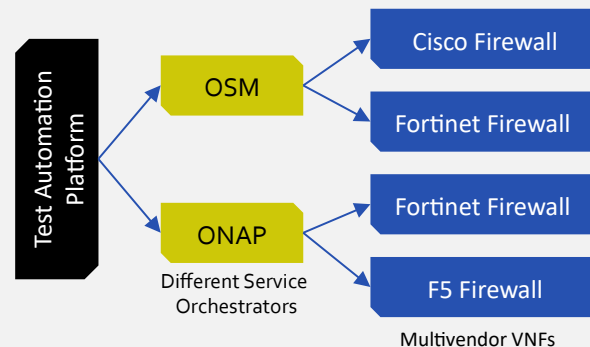
- Every service orchestrator has its own mandatory input list of parameters to fire test case
- Creating a plug & play feature requires customized parameter mapping for various vendor's network service orchestrators
- Various middleware tools like Jolt and Kong can be used for parameter mapping in JSON format

2. Create pre-built set of master test cases common for all the vendor specific VNFs

3. Test plan creation option should enable tester to add or remove test cases as per requirement

Advantages

- Fully extensible, reusable, portable test suites
- Once Built, can run on multiple targets – VNFs & MANO
- Can run multiple times – stability, reuse & extensibility of tests



Same set of generic test suit can be fired on multivendor VNFs using different service orchestrators

Key element – Adaptors with zero-coding complexity for testers

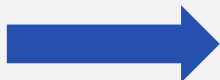
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2 Build keyword driven test adaptors on top of existing test suites

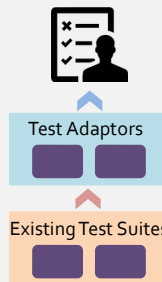
Challenges with current state of testing

Test Suites written in Python – Testers need coding skills

```
def read_config(file):
    try:
        with open(file) as f:
            config_file = json.load(f)
            print "Reading test setup configura
            global config_file
            return config_file
    except Exception as error:
        return (str(type(error).__name__):
        exit()
```



Using Keyword driven Test Adaptors



Leverage Test Adaptors – Testers don't need coding/Python skills

```
*** Test Adaptors ***
NS Creation ...
Read Test Setup Configuration ...
Set Configuration ...
Assert Authenticate To Orchestrator
Assert VNFD Create
Assert NSD Create
```

- NFV ecosystem is evolving rapidly that **requires frequent changes in test suites**
- Integration testing comprising of various vendor VNFs and MANO stack is highly complex
- Test steps & logic is not easy to understand for testers. Testers need coding skills that veers focus away from testing.

Overall this requires higher testing and coding skills resulting in higher cost to develop, maintain and customize test scripts

- Use keyword driven test framework with declarative test cases (test adaptors) on top of Python for easy customization
- Recommended tools to create keyword driven test framework – Robot, Cucumber, Selenium, Dovetail.

Salient features of test framework built with adaptors

- Framework can be integrated with any NFVI MANO stack
- Minimum changes required to core test suites
- Can be fired remotely on the NFVI stack from cloud
- Integrated with operational dashboard for minute insights
- Less manual intervention due to automation

Recommended tools



Robot



Dovetail

Key element - Prebuilt test cases adhering to ETSI standards

1 2 3 4 5

3 Build test suites compliant to standards specified by governing body such as ETSI

- Analyze different **NFVI + VNF testing standards** in the Industry
- Ensure compliance and conformance to these standards while defining the test suites

Use ETSI PLUGTEST for interoperability testing and lifecycle management of VNFs

This includes following:

Onboarding

Scaling & Update

Performance Monitoring

Instantiation

Fault Management

Service Function Chaining with Network Service Header

Adhering to below set of protocols defined by ETSI helps in standardized testing of different interfaces and components

ETSI SOL005 - used over the Os-Ma-NFVO reference point (between OSS/BSS & NFVO)

ETSI SOL003 - used over the Or-VNFM reference point (between NFVO & VNFM)

ETSI SOL 002 - used over the Ve-VNFM reference point (between VNFM & EMS or VNF)

These standards specifies a set of RESTful protocol specifications and data models fulfilling the requirements specified in ETSI for different interfaces in VNF ecosystem

Key element – Continuous testing & Test Monitoring Tool

1 2 3 4 5

4

Automated CI/CT/CD pipeline to create agile and reliable testing process

Ensure continuous testing with regular feedback

With the growing complexities in NFV ecosystem, it is crucial to develop a process of **testing early** and **testing often** thereby reducing the wait time for feedback.

Reduce human error factor with E2E automation

Testing of different NFV components, interactions between these components and testing their interfaces need to be **completely automated** to reduce any manual intervention

Recommended Tools



5

Test monitoring tool to gather key insights for E2E testing

- Create a robust UI to monitor and handle all the basic functions of testing framework in a single window
- A report log file should be present for debugging purpose with detailed defect functionality

Test monitoring tool UI should support below tabs and functionalities

Test Plan

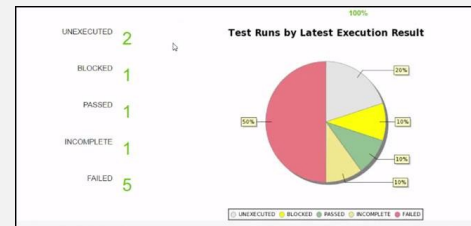
- Generic Test Plan
- Service Orchestrator
- Specific Test Plan
- Network Service
- Customized Test Plan

Test Suites

Test Design

Test Execution

Reports Tab



Business & operational benefits for DSPs implementing a portable VNF testing framework

Pays for itself

Cost of testing multiplies, given DevOps & release volumes – as many as 10-20 VNFs annually. A well implemented testing framework **saves up to 45% effort** on test development & pays for itself within **3-5 release cycles**.

Accelerate time to market

A portable test suite means same tests can be executed on multiple targets- i.e., VNFs or Orchestrators, cutting testing time & accelerating product launch times in a **multi-vendor disaggregated NFV environment**.

Testing team focused on testing

Skills required for testers in evolving NFV environment is reduced significantly. Easy to understand test steps and logics makes testers focused on testing.

Rapid Test Development and Maintenance

Standardized and easily customizable test suites makes the platform fully extensible, reusable, & maintainable

A holistic VNF testing framework is also crucial to **enhance customer satisfaction, leading to long term improvement of NPS.**

Faster product launch

Differentiated product delivery

Improved product quality

More reliable product customization

Get in touch

USA

Prodapt North America
Tualatin: 7565 SW Mohawk St.,
Phone: +1 503 636 3737

Dallas: 1333, Corporate Dr., Suite 101, Irving
Phone: +1 972 201 9009

New York: 1 Bridge Street, Irvington
Phone: +1 646 403 8161

CANADA

Prodapt Canada Inc.
Vancouver: 777, Hornby Street,
Suite 600, BC V6Z 1S4
Phone: +1 503 210 0107

UK

Prodapt (UK) Limited
Reading: Davidson House,
The Forbury, RG1 3EU
Phone: +44 (0) 11 8900 1068

EUROPE

Prodapt Solutions Europe
Amsterdam: Zekeringstraat 17A, 1014 BM
Phone: +31 (0) 20 4895711

Prodapt Consulting BV
Rijswijk: De Bruyn Kopsstraat 14
Phone: +31 (0) 70 4140722

Prodapt Germany GmbH
Münich: Briener Straße, 80333
Phone: +31 (0) 70 4140722

SOUTH AFRICA

Prodapt SA (Pty) Ltd.
Johannesburg: No. 3,
3rd Avenue, Rivonia
Phone: +27 (0) 11 259 4000

INDIA

Prodapt Solutions Pvt. Ltd.
Chennai: Prince Infocity II, OMR
Phone: +91 44 4903 3000

"Chennai One" SEZ, Thoraipakkam
Phone: +91 44 4230 2300

IIT Madras Research Park II,
3rd floor, Kanagam Road, Taramani

Bangalore: "CareerNet Campus"
2nd floor, No. 53, Devarabisana Halli,
Phone: +91 80 4655 7008

THANK YOU!