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Redefining Virtual Network Function (VNF) Testing

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

Credits

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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

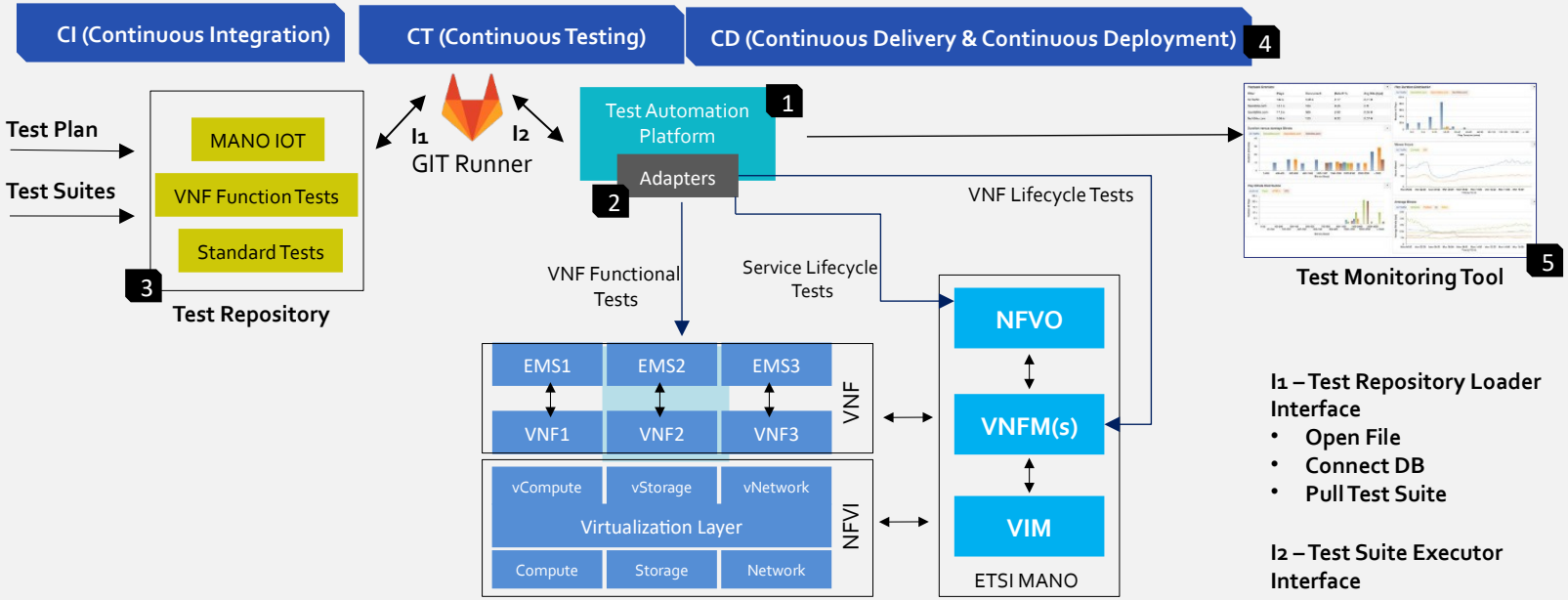
VNF Testing covers the entire SDN/NFV lifecycle management from concept, integration, launch, operation to retirement.
Creating an effective and portable VNF testing framework with end-to-end automation can help DSPs to overcome existing complexities.

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



Key Elements	1	2	3	4	5
	Portable and target independent test automation platform	Adaptors with zero-coding complexity for testers	Test cases adhering to ETSI standards	Automated CI/CT/CD setup to create agile and reliable testing process	Test monitoring tool to gather key insight for E2E testing

Key element - Portable and target independent test automation platform

1 Create a portable and target independent test automation platform

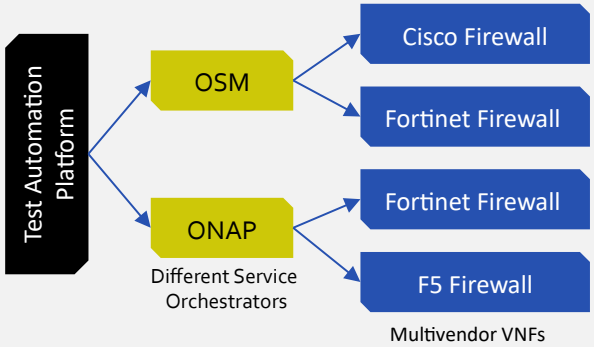
A portable test automation platform can fire test cases on different vendor VNFs using different service orchestrator

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**



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

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

Key element – Adaptors with zero-coding complexity for testers

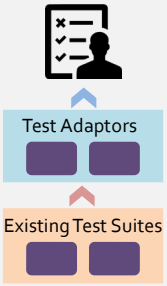
2 Build keyword driven test adaptors on top of existing test suites

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

Cucumber

Dovetail

Key element - Prebuilt test cases adhering to ETSI standards

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

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

GitLab

ANSIBLE

Jenkins

5 Test monitoring tool to gather key insights for E2E testing

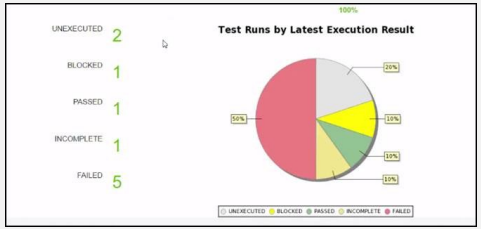
- Create a robust UI to monitor and handle all the basic functions of testing framework in a single window
- A report log file should be present for debugging purpose with detailed defect functionality

Test monitoring tool UI should support below tabs and functionalities

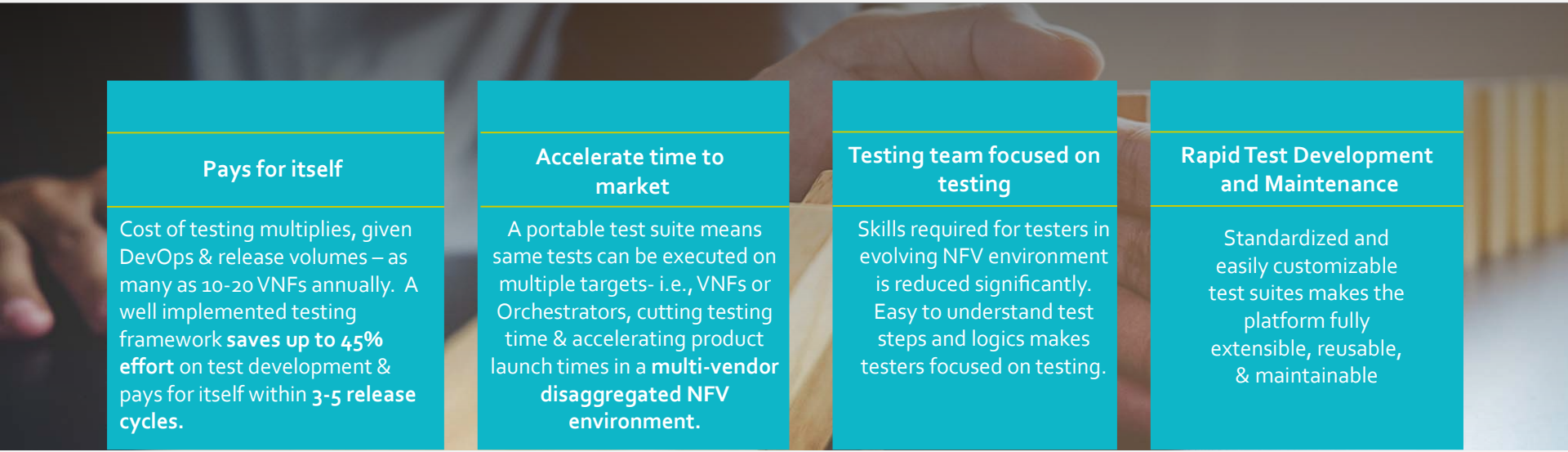
Test Plan

- 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

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THANK YOU!