Test Automation DevOps and CI/CD

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LFN 2020 April Virtual Technical Event
Part 1: VNF end-to-end testing with ONAP and OVP
## NFV Testing Automation Survey in EUAG

### Participants
- EUAG Group

### Response
- 5 participants, anonymous

### Design of survey
- 34 Questions

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<td>Before the introduction of NFV, investigate the test types and test contents of new equipment, equipment patches, resource pools and other network access tests.</td>
<td>Investigate the personnel and division of labor involved in the network access test, including the development of test specifications, test environment provision, test execution, and test result summary.</td>
<td>Investigate network access tests factors, including network access times, test costs, test stability, and others.</td>
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<td>Investigate test changes such as test organization, test cycle, and test frequency after the introduction of NFV.</td>
<td>After the introduction of NFV, investigate the automation requirements and the application of automation tools for various test phrase.</td>
<td>Research on the requirements and value as well as co-construction ideas of community open source certification platform.</td>
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Analysis and Summary of NFV Testing Automation Survey (1/3)

• Changes of NFV network element access test
  - Increased test types and frequency
    a) Resource pool tests and network element tests are usually conducted separately.
    b) Pairing tests are needed between resource pools and network elements.
  - Shorter upgrade cycle:
    Upgrade cycle is shortened from half-year to 2 ~ 3 weeks (1 ~ 2 months) compared to traditional physical network elements

• Limiting factors for NFV access test

• Optimization of NFV access test
  The functional testing and performance testing of Testbed/lab test are usually necessary before the new device or patch obtains the network access license.
  Specific optimization measures can include:
  - Establish common test resource pool, reuse hardware and virtual resources between different rounds of test;
  - Introduce test management system to optimize the resource use approval process.
  - Introduce automated tools and DevOps technology in different test stages.
  - Provide integrated standards for third-party test tools and test scripts.
Analysis and Summary of NFV Testing Automation Survey(2/3)

• **Status and requirements of test automation**
  - The life cycle test and the traditional business test are performed separately
  - Automation requirements priority
    • Test environment setup (highest)
    • Test execution (high)
    • Test design, test analysis, test scoring (medium)
  - Problems to be solved in life cycle test and business function test
    • Automatic configuration of network element (most urgent)
    • Automatic deployment, test scripts integration from different vendors, automatic control of the test process (urgent)
    • Test tools/test instruments integration from different vendors, traceability of test results (medium)

• **DevOps application status and cooperation mode**
  - Some operators have introduced DevOps tools, and all operators hope to achieve full-automatic closed loop, including
    a) Network element codes are automatically built and automatically integrated
    b) Network element life cycle and service test is performed automatically
    c) Network elements are automatically deployed and brought online to a test or production environment
  - The DevOps cooperation model between operators and VNF suppliers is VNF vendors provide VNF software packages and operators implement CI/CD in their own DevOps environment.
  - There is a requirements about how to load the VNF software package into the operator's DevOps environment automatically
• Significance of LFN OVP certification project for operators

The value of the LFN OVP certification program to operators is mainly reflected in:

- Build the automated test framework together, operators can reference the open source implementation of OVP test framework to support their network access test.
- Build test case executors together, operators can integrate existing test scripts and test tools with reference to test framework requirements, and leverage the capabilities of third-party tools to improve test efficiency.

For the enhancement of OVP automated test functions, the top priorities are:

- Topology design
- Test environment setup
- Test execution
- Test analysis
Objectives:
1. Common NFV automated test platform
2. Self-service certification NFV stores
3. Open ecosystem of 5G + AI and 5G + edge
NFV Testing Automation with OVP+ONAP

Function mapping with ONAP components
- Test Topology Design - ONAP SDC
- Test Environment Deploy - ONAP Orchestrator(SO, VF-C, APPC)
- Test Task Execution - ONAP VTP(VNFSDK, VVP)
- Test Result Certificate - OVP

NFV Testing Automation DevOps
Role-based VNF Testing Workflow

Step 1 Test topology design

Test Designer
Test designer either uses the existing test case models from VTP or creates new test cases models and uses them for creating test flows, finally upload them to VTP with NS ID tag.

Step 2 Test Case Model Definition and Development

Test Case Developer
Test developer implements the required test cases based model designed by test designer. And maintain it with VTP.

Step 3 Test Case Execution

1. **VTP Portal**
   - **Test NS/VNF**

2. **VTP Backend**
   - **Execute test cases**

3. **ONAP**
   - **Invoke ONAP orchestrator to deploy NS**

4. **Openstack**
   - **Deploy NS in Openstack**

5. **Report test result**

6. **Result Collecting**
   - **Upload NS test flow to VTP**

7. **Rating Certification System**
   - **Upload VNF passed the test to public repository**

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**SDC**

SDC Sync NS Topology with VFC (onboard to VF-C catalog)

**Execution Engine**

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Demo Scenario – Bidirectional Traffic Forwarding Test

**SUT:** Openwrt  
**Test Instrument:** Spirent virtual STCv

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**Step 1**  
Test Designer

**Step 2**  
Test Case Developer

- Try:
  - onap_setup_cloud_and_subscription()
  - job_id = onap_create_vnf() # onboard vnf, onboarding ns, create ns, instantiate ns
  - ns = onap_api(conf, onap.ns_instance_id, job_id, onap.tenant_id)
  - ns.get_vnfs_info()
  - testresult = onap_traffic_test(observer=conf['instrument']['instrument_name'], [instrument_mgr] [mmlt_address],
    - username = conf['instrument']['instrument_mgr'][username],
    - storl_mgmtp=ns_stcv_west_ip,
    - storl_testip=ns_stcv_west_test_port_ip,
    - storl_mgmtp=ns_stcv_east_test_port_ip,
    - storl_testip=ns_stcv_east_test_port_ip,
    - storl_leftip=ns_stcv_left_ip,
    - storl_rightip=ns_stcv_right_ip)

- except Exception as e:
  - logger.debug("------- Exception Happened -------")
  - print(s)
  - print(traceback.print_exc())
  - traceback.print_exc()
  - finally:
  - pass
  - onap.cleanup()
  - print ('Done')
**Future Plan**

**Goal:** Provide common test platform through the augment of ONAP components to support VNF/CNF/Service automated testing.

**Progress:** Has proposed the NFV Testing Automatic Requirements in ONAP Gulin Release. [https://wiki.onap.org/display/DW/Guilin+release++functional+requirements+proposed+list](https://wiki.onap.org/display/DW/Guilin+release++functional+requirements+proposed+list)

**Timeline:**

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<th>Jan. 2020</th>
<th>March</th>
<th>April</th>
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<td>Requirements subcommittee review</td>
<td>Requirements Solution analysis</td>
<td>Architecture subcommittee review and PTL discussion</td>
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<td>ONAP Gulin Release</td>
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Welcome to join above requirements discussion. More expertise for NE and test instrument integration (esp. LCM and configuration) is welcome. Contact Information: Lei Huang(ḥuangleiyjy@chinamobile.com) Yan Yang(yangyanyj@chinamobile.com)
Relationship with CNTT and OVP

VNF/CNF testing requirements ——》 CNTT and OVP
VNF/CNF testing tools ——》 OVP

VNF/CNF testing requirements
VNF/CNF testing tools
Automatic Testing Platform
Cloud Platform
Container Cloud Platform
Cloud Infrastructure Testing
Container Cloud Infrastructure Testing
NFVI testing requirements
NFVI testing tools
OVP
VNF/CNF testing requirements

VNF
CNF
VNF Testing
CNF Testing
Part 2: Open Discussion
Test Automation DevOps and CI/CD
DevOps represents a cultural shift that stresses collaboration between the business, developers, and IT professionals. Software test automation can enhance these connections and help organizations achieve desired SDLC acceleration.

Continuous testing is the most important phases of the DevOps toolchain
Automated testing is a prerequisite for Continuous testing
Typical CI/CD Scenario

This scenario is mainly applicable to development and testing of specific products within a single company.

- **R & D and testing completely closed loop**
- **Testing more refers to the company’s internal product testing**
• This scenario generally has two roles: software supplier and purchaser
• Testing more means that the purchaser conducts procurement tests and other tests for the products provided by the supplier

The OVP testing and certification process can be mapped to this scenario

1. Push software package/image
2. Pull latest package/image
3. Deploy and test
4. Notify deploy and test result
5. Deploy and test
6. Deploy and test
Joint CI/CD Pipeline Scenario

In NFV context, this scenario allows development, operations, security, and other teams in both the supplier and operator organizations to build confidence in the release through testing.

Support a joint agile VNF development and delivery process all the way through to production deployment and operation.
DevOps cooperation model between operators and VNF suppliers may have two options:

Option A: VNF vendors provide VNF software packages, and operators implement CI/CD in their own DevOps environment.

Option B: Operators open DevOps environment to VNF vendors, and VNF vendors implement CI/CD directly in the open DevOps environment.

Which option do you prefer?

If chose option A, How VNF is shipped to Operator?

- Operator-triggered
- Supplier-triggered
- Does the test function need to be shipped from suppliers to operators?
How to apply test frameworks in CI / CD? the integrated options and requirements for test framework?

Test framework can be used in continuous testing in different test environment

Integration Options and requirements for test framework in CI/CD:
• Test framework should provide flexible interface to support test execution, such as test case query, test case execution (single use case execution, batch execution of test suit ), test result collection, etc.
  a) CLI/RestAPI can be invoked directly by CI/CD toll chains, such as Jenkins
  b) For test framework which provides GUI, can be deployed by CI/CD tool chains, which can be used to monitor the test execution and download the customized test report
• Test framework should effectively cooperate with the test planning system to flexibly execute incremental, smoke or full-scale tests between different test iteration tests
• Other requirements?

What else is needed for continuous testing other than automated test execution?

• Requirements Traceability
• Test Data
• Change Impact Analysis
• Other?
If you have more expertise for automated testing, continuous testing, DevOps&CI/CD, or you are interested in any of the above aspects, welcome to discuss with us.

Contact Information: Yan Yang, email address: yangyanyj@chinamobile.com

Thank You!