Exploration and Practice in Automated Testing

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# Requirements for Test Automation from EUAG Survey

<table>
<thead>
<tr>
<th>No</th>
<th>Requirements</th>
<th>priority</th>
<th>Requirements description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Test environment setup</td>
<td>highest</td>
<td>Leverage orchestration capability to deploy test environment automatically</td>
</tr>
<tr>
<td>2</td>
<td>Test environment configuration</td>
<td>highest</td>
<td>Automatic configuration of test environment, including SUT, test tools and other system</td>
</tr>
<tr>
<td>3</td>
<td>Test execution</td>
<td>high</td>
<td>Automatically execute test tasks/cases/scripts/steps</td>
</tr>
<tr>
<td>4</td>
<td>Test tools/scripts integration</td>
<td>high</td>
<td>Test tools/test instruments integration from different vendors</td>
</tr>
<tr>
<td>5</td>
<td>Test design</td>
<td>medium</td>
<td>Provide a quick test service(topology) design composed of tested VNF/CNF and test environment</td>
</tr>
<tr>
<td>6</td>
<td>Test analysis</td>
<td>medium</td>
<td>Automatic analysis and tracking of test results</td>
</tr>
<tr>
<td>7</td>
<td>Test scoring and badge</td>
<td>medium</td>
<td>Automatic authentication of test objects</td>
</tr>
<tr>
<td>8</td>
<td>Cross-organization joint DevOps</td>
<td>High</td>
<td>Implement joint DevOps pipeline between operator and provider to achieve agile delivery</td>
</tr>
</tbody>
</table>
Part 1: Exploration and Practice of Automated Testing in LFN
OVP VNF Compliance and Validation Testing with ONAP

TOSCA VNF Validation shown at 2019 ONS EU

Demo: TOSCA VNF Validation Testing

Testing Automation DevOps shown at 2020 ONES NA

Demo: Role-based VNF Testing Workflow

SUT: Open source VNF - OpenWrt
Test Instrument: Spirent virtual STCv
Test Management System in Testing Automation DevOps

Developing independent test management system to improve the usability of VTP test framework

Test statistics dashboard
Test case and specification management
Test Job Management
Test Result Show
Testing Automation Requirements in ONAP Gulin Release

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

https://wiki.onap.org/display/DW/Guilin+release+ +-+functional+requirements+proposed+list

**TimeLine:**

<table>
<thead>
<tr>
<th></th>
<th>Jan. 2020</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>......</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Requirements subcommittee review</td>
<td>Requirements solution analysis</td>
<td>Architecture subcommittee review and PTL discussion</td>
<td>ONAP Gulin Development</td>
<td>ONAP Gulin Integration Testing</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
## Delivery Status of Automated Testing Requirements

<table>
<thead>
<tr>
<th>No</th>
<th>Requirements</th>
<th>priority</th>
<th>Implementation status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Test environment setup</td>
<td>highest</td>
<td>Done</td>
<td>Test env with VNFs and virtual test tools/instruments have been verified</td>
</tr>
<tr>
<td>2</td>
<td>Test environment configuration</td>
<td>highest</td>
<td>Partial</td>
<td>The images of VNFs and virtual test tools/instruments is customized, and specific configurations are encapsulated.</td>
</tr>
<tr>
<td>3</td>
<td>Test execution</td>
<td>high</td>
<td>Done</td>
<td>Test framework can locate and execute test cases correctly</td>
</tr>
<tr>
<td>4</td>
<td>Test tools/scripts integration</td>
<td>high</td>
<td>Done</td>
<td>Integrated with virtual instruments (Spirent stcv)/robot</td>
</tr>
<tr>
<td>5</td>
<td>Test design</td>
<td>medium</td>
<td>Done</td>
<td>Test topology with VNFs and virtual test tools/instruments have been verified</td>
</tr>
<tr>
<td>6</td>
<td>Test analysis</td>
<td>medium</td>
<td>Done</td>
<td>Test results can be automatically recorded and presented</td>
</tr>
<tr>
<td>7</td>
<td>Test scoring and badge</td>
<td>medium</td>
<td>Partial</td>
<td>The VNFs which pass the test can be uploaded to VNF market. Test results need to be uploaded to OVP Portal automatically</td>
</tr>
</tbody>
</table>

### Requirement 8

**Cross-organization joint DevOps**

- Functions need to be improved to cover more SUT (PNF/CNF/NS/Service) testing and certification.
Part 2:  Exploration and Efforts of Automated Testing in ETSI NFV
The Transformation of Operation & Maintenance in 5G

Traditional network construction is divided into four stages: planning, construction, maintenance, and optimization. Each stage requires cross-organization coordination, approval, manual statistics, and signature confirmation.

At least 6 months is required for the traditional network service to be on-boarded to the production network. The service online cycle is long, the labor cost is high, and the operation and maintenance are mostly dependent on vendors.

New Requirements

- Rapid service deployment
- Improve the efficiency of network access testing
- Establish joint delivery pipelines
- Operation and maintenance self-control

New Means
Joint CI/CD Pipeline in NFV Context

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.

Establishing DevOps joint pipeline between NFV software provider and operator to achieve joint agile development and delivery is the trend of cooperation between provider and operator in future.

End-to-end continuous delivery, testing, deployment and online
# ETSI NFV TST006: CICD and DevOps Report

The GR proposes 4 recommended options for realizing cross-organizational joint DevOps.

<table>
<thead>
<tr>
<th>Options</th>
<th>How to deploy test code</th>
<th>How to execute test code</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Self-triggered Test VNFC</strong></td>
<td>Instantiation of VNFT in test mode including Test VNFC(s). Test VNFC implements the test function.</td>
<td>Test VNFC(s) automatically starts and executes the acceptance test code on deployment; Or the MANO interface should support the trigger of test execution.</td>
<td>The test execution is completely inside the test VNFC implemented by the vendor, and the VNF Operator cannot directly monitor the test results; The deployment of the VNF is divided into test mode and normal mode, which is distinguishing the SUT in real operating environment and the test environment, which may require additional processing.</td>
</tr>
<tr>
<td><strong>2. Self-triggered Test VNF</strong></td>
<td>Instantiation the Test NS consists of Test VNF(s) and VNFT; Test VNF implements the test function.</td>
<td>Test VNF(s) automatically starts and executes the acceptance test code on deployment; Or the MANO interface should support the trigger of test execution.</td>
<td>The test execution is completely inside the test VNF implemented by the vendor, and the VNF Operator cannot directly monitor the test result.</td>
</tr>
<tr>
<td><strong>3. Common test framework</strong></td>
<td>Obtain the test scripts from VNF package then kdeploy the in VNF operator’s common test framework</td>
<td>VNF Operator instruct the common test framework to start test executing.</td>
<td>Test code(scripts) and standardized test description files are provided by vendor, common test framework can parse the test description file so that it can support execution of different scripts, and parse the output of execution; the common test framework can decrease the complexity of test environment and decrease the cost of knowledge transfer.</td>
</tr>
<tr>
<td><strong>4. Vendor-specific test framework</strong></td>
<td>VNF operator needs to install the test framework and obtain the test scripts (according to information in VNFD), and deploy the test scripts in that framework.</td>
<td>Control test framework to start test executing according to vendor-provided instruction.</td>
<td>For different vendors need to install different test execution environments, which increases the complexity of the whole test environment and increases the cost of knowledge transfer.</td>
</tr>
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### ETSI NFV Release4 Feat-25 (Cross-organizational Continuous VNF Delivery)

Goal: Realize a joint DevOps pipeline to meet the requirements of cross-organizational VNF delivery by extending MANO related components, interfaces, process, etc.
Typical Scenario of Joint DevOps

In this scenario, the unified test system needs to be used to perform unified execution and result analysis of test cases from different vendors.

The models, processes, interfaces, components, etc. involved in the process of software delivery, test execution, test data collection, and test data feedback need to be standardized to quickly realize the agile delivery of DevOps across operators and vendors.
• Standardize the input and output information used for automatic test execution and result analysis.
• Ensure test controller performs unified and effective test control of test cases from different providers.

Test description templates e.g. VNF Package/NSD

Automatic test execution flow under the control of a unified test controller
Overview of joint DevOps Standard Progress

ETSI NFV-TST013  NFV Testing Test Case Description Template Specification

Standardized test case description form to ensure that the operator-side test controller performs unified and effective test control on test cases from different Vendors

NFV-TST NWI  Extension of TST006 ( CICD and DevOps )

Analyze the standard processes, components, feedback mechanisms and possible enhancements to existing MANOs that need to be defined in order to realize the common VNF delivery joint DevOps pipeline.

Feat25  Cross-organizational Continuous VNF Delivery
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
Feat25 focuses on Cross-organizational Continuous VNF Delivery

The following content needs to be standardized to realize Joint Pipeline:

- Structure of a VNF Package including automated testing functionality
- Interface specification between a VNF provider and a VNF Operator for VNF delivery
- Extensions to the MANO stack for automatic testing and test data collection
- The feedback on test data from the VNF operator to the VNF provider