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Network Functions Virtualisation (NFV); Testing; Test Case Description Template Specification

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Network Functions Virtualisation (NFV).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document is based on the requirement of establishing a test case description convention between operators and providers in DevOps automated testing. It proposes a test case description template, to be used for standardizing the input and output information exchanged for test execution and result analysis.

The standardized test case description template in the present document aims at determining a standardized machine-readable format to for (but not restricted to):

1) Test case description information

2) Test case input information

3) Test case script designation information

4) Test case output information

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI GS NFV-TST 010: "Network Function Virtualisation (NFV) Release 2; Testing; API Conformance Testing Specification".

[2] ETSI GS NFV-SOL 001: "Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; NFV descriptors based on TOSCA specification".

[3] ETSI GS NFV-SOL 004: "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; VNF Package and PNFD Archive specification".

[4] ETSI GS NFV-SOL 006: "Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; NFV descriptors based on YANG Specification".

[5] ETSI GS NFV-SOL 007: "Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; Network Service Descriptor File Structure Specification".

[6] ETSI GS NFV-TST 009: "Network Functions Virtualisation (NFV) Release 3; Testing; Specification of Networking Benchmarks and Measurement Methods for NFVI".

[7] ETSI GS NFV-SOL 014: "Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; YAML data model specification for descriptor-based virtualised resource management".

[8] "YAML Ain't Markup Language (YAML™) Version 1.2", 3rd Edition. Oren Ben-Kiki, Clark Evans, Ingy döt Net.

NOTE: Available at http://www.yaml.org/spec/1.2/spec.html.

[9] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

NOTE: Available at https://tools.ietf.org/html/rfc8259.

[10] JSON Schema.

NOTE: Available at https://json-schema.org/.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purpose of the present document, the following terms apply:

configuration: element of test case to describe information like network topology and the specific structure of the test environment

pre-test conditions: element of test case to describe the dependent conditions before the test sequence is performed in which the SUT/Test Function should be ready for executing the test and in which the test related parameters/measurements are defined

reference function: reference implementation of NFV functional components in the test environment

NOTE: The NFV functional components which are neither SUT nor Test Function in the test environment are Reference Function, the actual entity of Reference Function depends on the specific SUT.

test environment: environment which provides all the functional elements needed for the testing execution on SUT, consists of test functions, reference functions

test function: entity that will be controlled (for example, by test controller) for test execution and monitored to obtain measurements for test results in the test environment

test PNF: physical instrument as test function in the test environment

test sequence: element of test case which contains a series of test steps listed in sequence to describe the operation of each step like controlling or checking the SUT/Test Function

test system: specialized tool (system) built for the purpose of testing that has the abilities including test case management and execution, control and communication with SUT during testing, observation and measurement of test result

test verdict: element of test case that is used to describe how to record the test result according to the checking step's result in test sequence. For functionality or API testing, test verdict describes how the result is deemed as passed or failed; for benchmark testing, test verdict describes which values should be recorded

test VNF: virtual instrument as test function in the test environment

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Programming Interface
HTML	Hyper Text Markup Language
JSON	JavaScript Object Notation
MANO	Management and Orchestration
NFV	Network Function Virtualization
NFVI	Network Function Virtualization Infrastructure
NFVO	NFV Orchestrator
NS	Network Service
SUT	System Under Test
URL	Uniform Resource Locator
VIM	Virtual Infrastructure Manager
VM	Virtual Machine
VNF	Virtual Network Function
VNFM	VNF Manager
vFW	virtual Firewall
XML	Extensible Markup Language
YAML	YAML Ain't Markup Language

4 Test Case Description use-cases (informative)

4.1 General

The following use cases describe the steps involved in NFV automatic testing, the relevant information may be referred in the Test Case Description file. The use cases capture the generic processes as well as the actions required to be performed by actors playing different roles in order to identify the requirements for the standard Test Case Description format. All the use cases presented in this clause are informative.

For the purpose of the use cases, the roles identified in table 4.1-1 have been identified.

Table 4.1-1: List of roles

Role	Description
Test Case Description Provider	Provide the Test Case Description file according to corresponding automated test.
Test Case Description Consumer	System that parses the Test Case Description file and use the information obtained from the test description file to automatically execute the test. (For example, it could be a test framework.)

4.2 Test Case Description composition

Test cases are designed for SUT (in the present document are functional components of the NFV architecture), and automated tests are implemented. The standardized Test Case Description defined in the present document provides key information to describe the test, information about deployment automation, information about automated test execution, and information about test result collection. The Test Case Description composition encompasses steps to describe that the content in Test Case Description will be specified by which role.

Table 4.2-1: Roles

#	Role
1	Test Case Description Provider

Table 4.2-2: Pre-conditions

#	Pre-conditions	Comment
1	Test case has been designed; automated test has been implemented	

Table 4.2-3: Post-conditions

#	Post-conditions	Comment
1	A Test Case Description file for corresponding test case	

Table 4.2-4: Base Flow

#	Role	Action/Description
1	Test Case Description provider	According to the automated test, with the standard format, specify the information including: • key information to describe the test; • information about deployment automation; • information about automated test execution; • information about test result collection.

4.3 Test case selection

By parsing the key description information of the test case provided in the test description files, the Test Case Description Consumer may have the capability to select test cases according to the actual test task.

Table 4.3-1: Roles

#	Role
1	Test Case Description Consumer

Table 4.3-2: Pre-conditions

#	Pre-conditions	Comment
1	Test Case Description composition is done	

Table 4.3-3: Post-conditions

#	Post-conditions	Comment
1	The test cases to be executed have been selected	

Table 4.3-4: Base Flow

#	Role	Action/Description
1	Test Case Description Consumer	Obtain Test Case Description files.
2	Test Case Description Consumer	Parse the key description information of the test case.
3	Test Case Description Consumer	Select the test cases to be executed.

4.4 Automated test deployment

Automated test is closely related to the execution environment. SUT, Test Functions and Reference Functions may need to be deployed automatically before the test execution. Considering the functional components of the NFV architecture as different type of software, there are kinds of deployment automation solutions.

Typical examples of those solutions are:

- Setting up virtual machines by delivering VM images
- Managing VNF deployments via OpenStack Heat or according to ETSI GS NFV-SOL 001 [2], ETSI GS NFV-SOL 004 [3], ETSI GS NFV-SOL 006 [4] and ETSI GS NFV-SOL 007 [5]
- Managing container deployments via Kubernetes®
- Installing application software on top of an operating system

When SUT is a VNF under test, the relevant test functions are VNFs too, the deployment will be that VNFs are instantiated through NFV MANO. In this case, Test Case Description file may need to specify the resource file information required for deployment operation: VNF package, and other required parameters depending on demands.

NOTE: Other situations for non-VNF SUTs are FFS.

Table 4.4-1: Roles

#	Role
1	Test Case Description Consumer

Table 4.4-2: Pre-conditions

#	Pre-conditions	Comment
1	The test cases have been selected to be run	

Table 4.4-3: Post-conditions

#	Post-conditions	Comment
1	The SUT/Test Function/Reference Function involved in the automated test have been deployed	

Table 4.4-4: Base Flow

#	Role	Action/Description
1	Test Case Description Consumer	Obtain Test Case Description files.
2	Test Case Description Consumer	Map the related parameters to the corresponding values in actual environment.
3	Test Case Description Consumer	With the parameter values, perform the deployment operation via execute automation scripts.

4.5 Automated test execution

If the role that implements the automated test and the role that executes the automated test are not hosted by the same organization, a method is needed between these 2 roles to provide the information about how to execute automated testing.

The test case description file may contain such information, so that the Test Case Description consumer can use the information to execute the test via parsing the machine-readable test case description file.

During this process, the Test Case Description consumer may need to know:

- By which type of operation the test is performed (e.g. by running a command, by executing a test script or by call an API).
- The details about the exact operation.
- On which system the operation is done.

- The relevant files for execution (e.g. the test script file).
- The parameters related to actual environment (mapping these parameters to the corresponding values in actual environment).
- The parameters specified for values related to test steps (may have default values, but also capable to specify the customized values when execute the test).

Table 4.5-1: Roles

#	Role
1	Test Case Description Consumer

Table 4.5-2: Pre-conditions

#	Pre-conditions	Comment
1	The SUT/Test Function/Reference Function involved in the automated test have been deployed	

Table 4.5-3: Post-conditions

#	Post-conditions	Comment
1	The automated test execution has finished	

Table 4.5-4: Base Flow

#	Role	Action/Description
1	Test Case Description Consumer	Obtain the test case description files.
2	Test Case Description Consumer	Parse and confirm the exact operation to execute the test, fetch or find the related files.
3	Test Case Description Consumer	Map the related parameters to the corresponding values in the actual environment.
4	Test Case Description Consumer	Specify the values related to test steps as parameters of test execution. (Optional)
5	Test Case Description Consumer	Execute the automated test.

4.6 Test result collection

The result of automated test execution may be presented differently depending on the implementation. For example, it may be printed directly in the output, or saved as files with format like JSON, XML, HTML, text. Test results presented in different forms increase complexity in the collection of test results.

The test case description file may provide information to describe how the test results are collected, such as by saving the printed information directly, by fetching information through the API, or by obtaining files with specified path/location. Then the Test Case Description Consumer can use the information above to collect test results.

Table 4.6-1: Roles

#	Role
1	Test Case Description Consumer

Table 4.6-2: Pre-conditions

#	Pre-conditions	Comment
1	Test case description file contains information that can be parsed by Test Case Description Consumer about when to collect results (collection start/stop) and how to collect results	
2	The automated test execution is ready to begin	

Table 4.6-3: Post-conditions

#	Post-conditions	Comment
1	Test result has been collected	

Table 4.6-4: Base Flow

#	Role	Action/Description
1	Test Case Description Consumer	Parse the test description file and confirm how to collect the test result.
2	Test Case Description Consumer	Collect test results based on the information parsed from the file.

5 Requirements for Test case description template

5.1 Generic Requirements

Table 5.1-1 specifies generic requirements applicable to the standardised test case description file.

Table 5.1-1: Generic requirements for test case description file

Numbering	Requirement Description
TEST_CASE_DESC.GEN.001	The test case description file shall contain the key information to describe the test, information about deployment automation, information about automated test execution, information about test result collection.

5.2 Requirements for test case description information

Table 5.2-1 specifies requirements applicable to the test case description information.

Table 5.2-1: Requirements for test case description information

Numbering	Requirement Description
TEST_CASE_DESC.TD.001	The test description shall support a way to identify uniquely the test.
TEST_CASE_DESC.TD.002	The test description shall include the type of testing for test case selection.
TEST_CASE_DESC.TD.003	The test description shall include the information about SUT for test case selection.
TEST_CASE_DESC.TD.004	The test description shall include machine readable key information of test case for test case selection.
TEST_CASE_DESC.TD.005	The test description shall include human readable key information of test case for understanding.
TEST_CASE_DESC.TD.006	The test description shall include the information to describe the pre-conditions and post-conditions of test case.
TEST_CASE_DESC.TD.007	The test description shall include the information to describe main steps of test case.