ETSI GS NFV-TST 010 V2.8.1 (2021-11)

Network Functions Virtualisation (NFV) Release 2; Testing; API Conformance Testing 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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Introduction

The interoperability among the functional entities which supports the requirements and functionalities specified in ETSI NFV deliverables is one of the key and most important aspect to develop and deploy the NFV environment. In order to achieve such interoperability, ETSI GR NFV-TST 007 [i.1] specifies the methodologies and test scenario for the testing of interoperability mainly based on the ETSI NFV IFA specification series which specifies the reference point/interface and functional requirements. At the same time, the validation of the NFV specification compliance of each functional entities is also key aspects to be ensured for the interoperability, in particular protocol solution/API level. Therefore, the present document specifies the API conformance testing.

1 Scope

Scope of API conformance is the functionality test in an automated way for ETSI NFV APIs.

The goal of the present document is to specify the methodologies of conformance test including Test Descriptions for NFV implementations with interfaces specified in the following NFV specifications: ETSI GS NFV-SOL 002 [2] for the *Ve-Vnfm* reference point, ETSI GS NFV-SOL 003 [1] for the *Or-Vnfm* reference point and ETSI GS NFV-SOL 005 [3] for the *Os-ma-nfvo* reference point.

Each ETSI NFV SOL deliverable specifies a set of interfaces built on the RESTful approach and meant to be used over the HTTP protocol. The aim of the present document is to define the methodologies and the procedures with Test Descriptions to test conformance of the exchanged HTTP payloads and the implementation of required actions for one or more of the available interfaces within a reference point.

Since the targets of the testing are functionality (semantic checks) and the HTTP payloads (syntax checks), methodologies, including test suite(s) and/or any technologies from any organizations (in particular open source initiatives) that can improve or help the (automated) test execution are also considered as being in the scope of the present document.

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-SOL 003 (V2.8.1): "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point".

[2] ETSI GS NFV-SOL 002 (V2.8.1): "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point".

[3] ETSI GS NFV-SOL 005 (V2.8.1): "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfvo Reference Point".

[4] ETSI GS NFV-TST 002 (V1.1.1): "Network Functions Virtualisation (NFV); Testing Methodology; Report on NFV Interoperability Testing Methodology".

[5] ETSI GS NFV-SOL 013 (V2.8.1): "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs".

[6] ETSI GS NFV-SOL 001 (V2.8.1): "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; NFV descriptors based on TOSCA specification".

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.

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

[i.1] ETSI GR NFV-TST 007 (V2.5.1): "Network Functions Virtualisation (NFV) Release 2; Testing; Guidelines on Interoperability Testing for MANO".

[i.2] Robot Framework.

NOTE: Available at http://robotframework.org.

[i.3] Robot2doc tool.

NOTE: Available at https://forge.etsi.org/rep/forge-tools/robot2doc.

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

Test Description (TD): set of information required to define/run the API conformance test and to realize the verdict for the API conformance test

3.2 Symbols

Void.

3.3 Abbreviations

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

API	Application Programming Interface
AUT	API Under Test
EM	Element Manager
FUT	Function Under Test
HTTP	Hyper Text Transfer Protocol
IFA	Interfaces and Architecture
IUT	Implementation Under Test
JSON	JavaScript Object Notation
LCM	Life Cycle Management
MANO	MANagement and Orchestration
NFV	Network Functions Virtualisation
NFVI	NFV Infrastructure
NFVO	NFV Orchestrator
NS	Network Service
NSD	Network Service Descriptor
OCC	OCCurrence
PM	Performance Management
PNF	Physical Network Function

PNFD	PNF Descriptor
SOL	SOLutions
SUT	System Under Test
TD	Test Description
TLS	Transport Layer Security
URI	Uniform Resource Identifier
VE	Virtual Element
VIM	Virtualised Infrastructure Manager
VNF	Virtual Network Function
VNFD	VNF Descriptor
VNFM	VNF Manager

4 Methodology

4.1 General

The purpose of general conformance testing is to determine to what extent a single implementation of a particular standard conforms to the individual requirements of that standard. Concepts from ETSI GS NFV-TST 002 [4] are used in the present document.

The important factors which characterize conformance testing are as follows:

- the System or Implementation Under Test (SUT or IUT) defines the boundaries (open interfaces) for testing;
- the conformance test system is a specialized tool (system) built for the purpose of testing and on which specific test scripts can be run;
- the SUT comes from a single supplier (or, at least, a single product line);
- the tests are executed by a dedicated test system that has full control of the SUT and the ability to observe all communications from the SUT;
- the tests are performed at open standardized interfaces that are not (usually) accessible to a normal user (i.e. they are specified at the protocol level);
- the tests are specified at the detailed protocol level and are not usually based on functionality as experienced by a user;
- the tests verify response or related request operation from SUT, also verify notifications when appropriate.

4.2 System Under Test (SUT)

The system under test is identified by an implementation of the function under test producing or consuming the API under test e.g. in the case of the Or-vnfm reference point the function under test may be either a NFVO implementation or a VNFM implementation.

The function shall be tested in isolation with respect to other functional blocks in a NFV platform, to guarantee that the outcomes of the conformance tests are not result of interoperability issues with other components.

4.3 Test configurations

4.3.1 General

In accordance with clause 1, the scope of the present document is to define a testing methodology and test suite for both the conformant protocol exchange (i.e. valid serialization and order of messages) and the initialization or execution of the functionalities mandated for each protocol operation, including the conformant management of internal state.

In order to enable the FUT to correctly execute the operations mandated the FUT shall be tested while being executed in a test environment (TSTENV) which provides all the functional elements needed for the correct outcome of the operation.

NOTE: For example, to correctly execute an instantiation a VNFM requires evaluation in a test environment which provides a VIM and NFVI plus the NFVO to grant the operation.

The test system shall provide the implementation of an API Consumer and a Notification Endpoint for the API Under Test (AUT). Moreover, the test configuration may contain observation interfaces between the Test System and the FUT or any other functional block which is part of the test environment. The specification of the mentioned observation interfaces is out of the scope of the present document.

Stimuli to the FUT shall be injected by the Test System via the AUT only.

Conformance checks on the status and outcome of the operations triggered by the protocol shall be verified by the Test System by means of:

- read operations issued via the AUT; or
- reception of notifications on the Notification Endpoint exposed by the test system; or
- other test interfaces to support triggers or verifications.

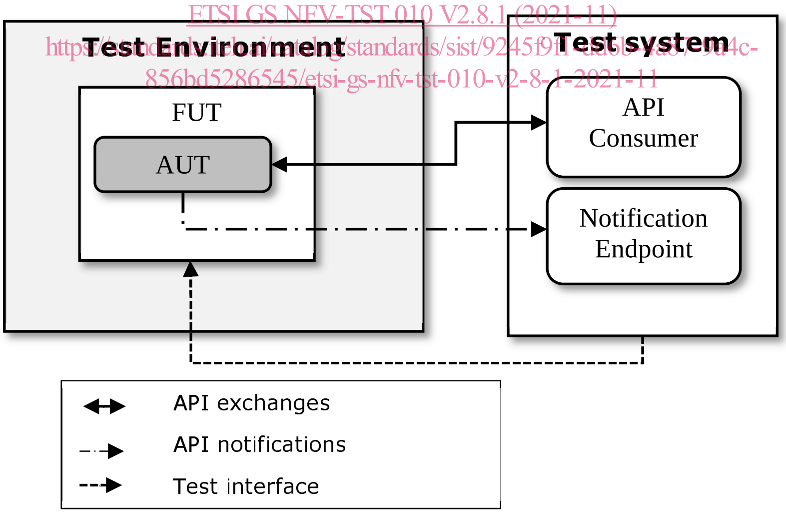

Figure 4.3.1-1: Generic SUT configuration

The test configurations specified in clause 4.3 fulfil the needs of Test Descriptions specified in annexes D, E and F contained in archive gs_nfv-tst010v020801p0.zip which accompanies the present document for the different FUTs and AUTs in scope of the present document.

4.3.2 Config_prod_VE

The configuration config_prod_VE shall be implemented to test APIs which are produced by FUTs in a VNF or EM. The test environment of the VNF/EM is the NFVI where the test is executed.

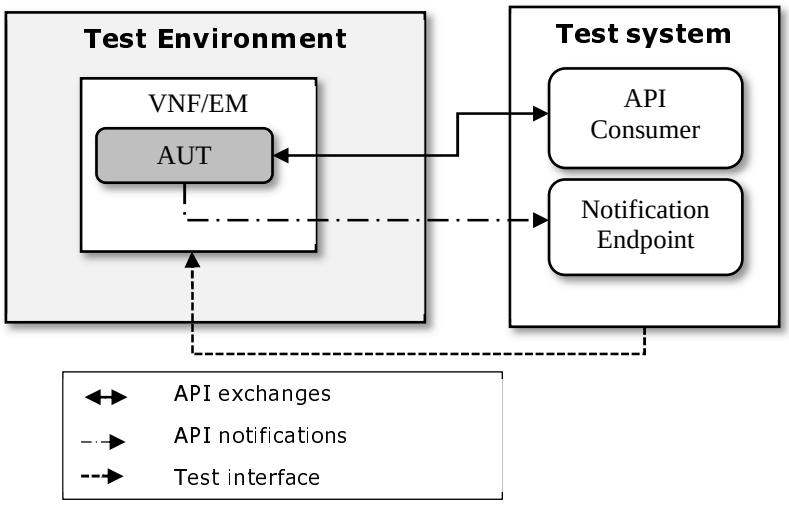

Figure 4.3.2-1: Configuration for tests of APIs with the FUTs as Producer run in a VNF/EM

4.3.3 Config_prod_VNFM

The configuration config_prod_VNFM shall be implemented to test APIs produced by FUTs which implement a VNFM. The test environment of the virtual element is the NFVI where the VE is executed.

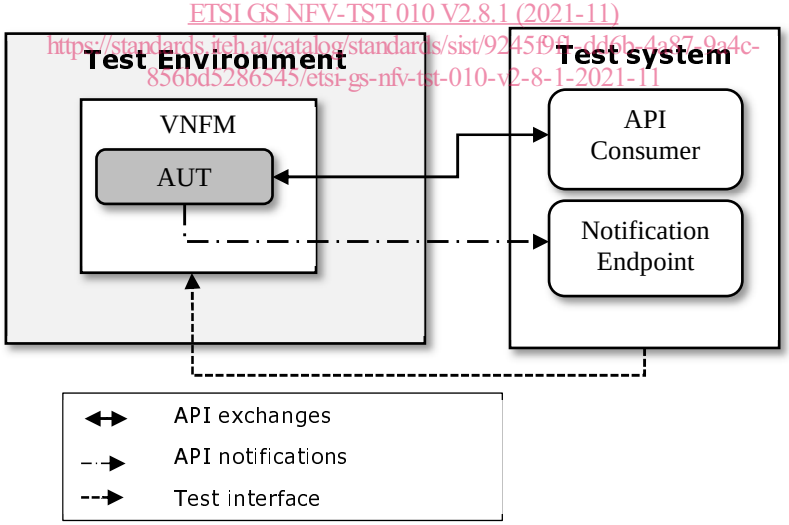

Figure 4.3.3-1: Configuration for tests of APIs with VNFM as Producer

4.3.4 Config_prod_NFVO

The configuration config_prod_NFVO shall be implemented to test APIs produced by FUTs which implement a NFVO. The test environment of the virtual element is an NFV platform providing VNFM, VIM and NFVI.

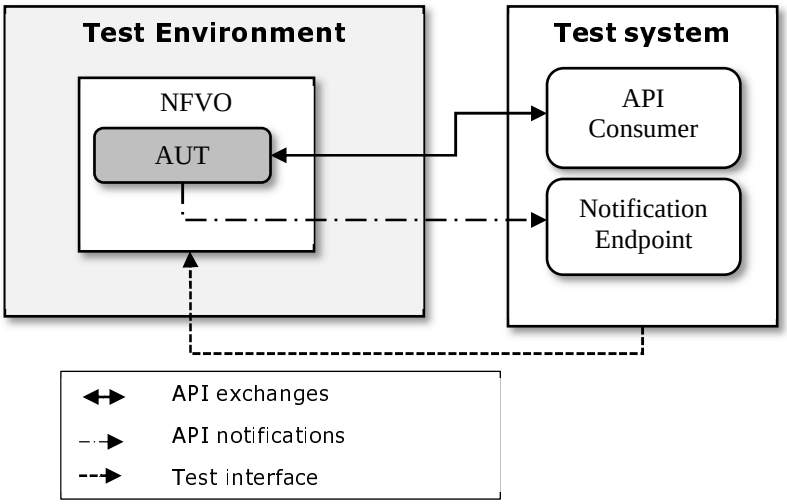

Figure 4.3.4-1: Configuration for tests of APIs with NFVO as Producer

4.3.5 Config_prod_VNFM_GRANT

The configuration config_prod_VNFM_GRANT shall be implemented to test APIs produced by FUTs which implement a VNFM for VNF LCM test cases where an Operation Grant is needed. The test environment of the virtual element is composed by the NFVI where the VE is executed and a NFVO component exposing the VNF Lifecyle Operation Granting API.

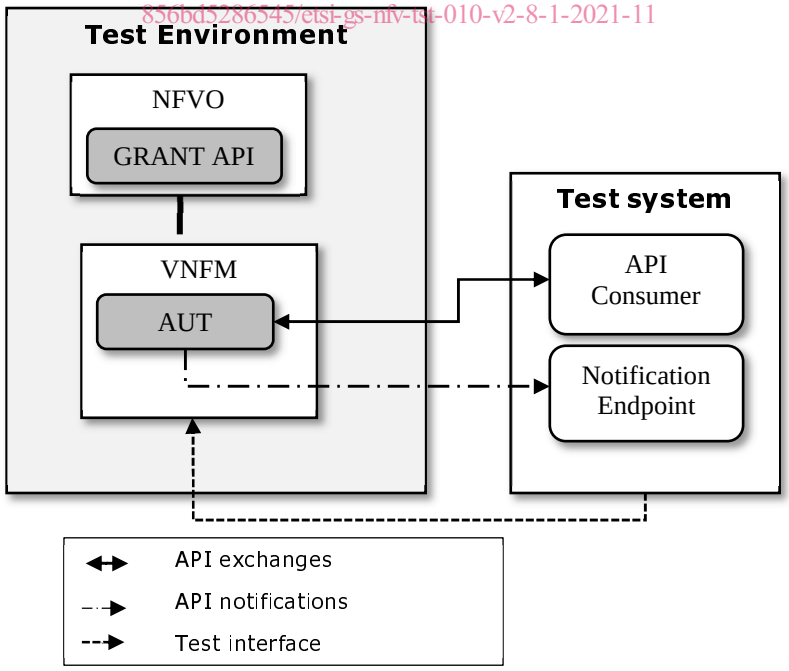

Figure 4.3.5-1: Configuration for tests of APIs with VNFM as Producer, where the VNFLifecycleOperationGranting API is required

4.3.6 Config_prod_Notif_Endpoint

The configuration config_prod_Notif_Endpoint shall be implemented to test any notification endpoint. The test environment of the virtual element is an NFV platform providing an API Provider.

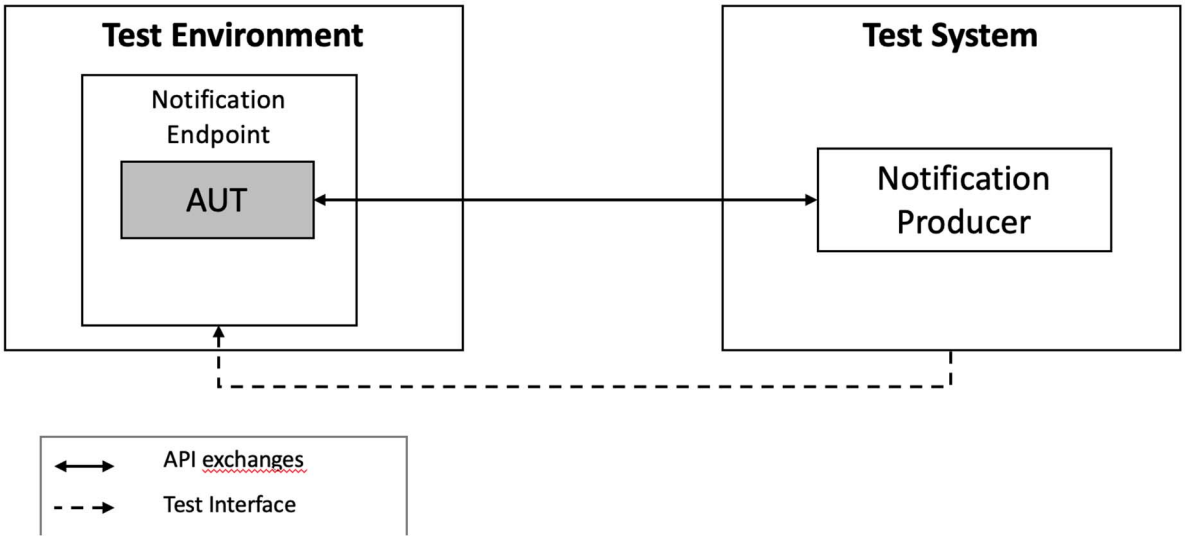

Figure 4.3.6-1: Configuration for tests of APIs where the Test System is an API Provider, and the AUT is a Notification endpoint

4.4 Void

Void.

4.5 Generic Test Description

4.5.1 General

The machine readable language used for the test case implementations is the Robot Framework [i.2].

The Robot code for all test cases is available at: https://forge.etsi.org/rep/nfv/api-tests/tree/2.8.1 and in the accompanying Docx Annexes, which contain the tabular representations of the test descriptions. The primary source for the Test Descriptions is the online repository at ETSI Forge.

A compliant NFV MANO API Conformance test systems shall implement the Test Descriptions as documented in the ETSI Forge repository and in the accompanying annexes which follow the requirements set in the following clauses.

Together with the normative test descriptions, informative implementation of the tests steps is made available as well in the form of "Keywords in Robot Framework" to facilitate adoption of the present work.

Within the Robot Framework files present in the online repository, the test descriptions (which are normative) and test steps implementations (which are informative) can be identified by the heading under which they are grouped, as follows:

- the normative tests descriptions are grouped under the "`*** Test Cases ***`" heading, while
- the informative test steps implementations are grouped under the "`*** Keywords ***`" heading.

NOTE: The text for the headings needs to conform to the Robot Framework language syntax.