



GROUP SPECIFICATION

Network Functions Virtualisation (NFV) Release 5; 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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

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

The present document specifies methodologies of conformance test, including Test Descriptions for NFV implementations with interfaces specified in NFV specifications of the following:

- ETSI GS NFV-SOL 002 [2] for the *Ve-Vnfm* reference point;
- ETSI GS NFV-SOL 003 [1] for the *Or-Vnfm* reference point;
- ETSI GS NFV-SOL 005 [3] for the *Os-Ma-Nfvo* reference point;
- ETSI GS NFV-SOL 009 [7] for the management of NFV-MANO;
- ETSI GS NFV-SOL 011 [8] for the *Or-Or* reference point;
- ETSI GS NFV-SOL 012 [11] for the policy management interface; and
- ETSI GS NFV-SOL 025 [12] for the protocol and data models of Telco Cloud data analytics service.

Each ETSI NFV-SOL deliverable specifies a set of interfaces built on the RESTful approach and intended for use 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. See more details of the scope and means of conformance test specified in clause 4.1.2.

NOTE: The full set of functionalities supported by ETSI NFV Release 5 (V5.2.1) can be found in ETSI GS NFV-IFA 010 [i.5].

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 in the [ETSI docbox](#).

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 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point".
- [2] [ETSI GS NFV-SOL 002 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point".
- [3] [ETSI GS NFV-SOL 005 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; 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 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs".
- [6] [ETSI GS NFV-SOL 001 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; NFV descriptors based on TOSCA specification".
- [7] [ETSI GS NFV-SOL 009 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; RESTful protocols specification for the management of NFV-MANO".
- [8] [ETSI GS NFV-SOL 011 \(V4.5.1\)](#): "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point".
- [9] Void.
- [10] Void.
- [11] [ETSI GS NFV-SOL 012 \(V4.5.1\)](#): "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Policy Management Interface".
- [12] [ETSI GS NFV-SOL 025 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; Specification of protocol and data model solutions for Telco Cloud data analytics service".

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 may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

- [i.1] ETSI GR NFV-TST 007 (V3.1.1): "Network Functions Virtualisation (NFV) Release 3; Testing; Guidelines on Interoperability Testing for MANO".
- [i.2] [Robot Framework](#).
- [i.3] [Robot2doc tool](#).
- [i.4] Void.
- [i.5] [ETSI GS NFV-IFA 010 \(V5.2.1\)](#): "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Functional requirements specification".
- [i.6] ETSI Drafting Rules.

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
IUT	Implementation Under Test
LCM	Life Cycle Management
NFVI	NFV Infrastructure
NFVO	NFV Orchestrator
NS	Network Service
NSD	Network Service Descriptor
PNFD	PNF Descriptor
SUT	System Under Test
TD	Test Description
TLS	Transport Layer Security
VE	Virtual Element
VIM	Virtualised Infrastructure Manager
VNF	Virtual Network Function
VNFD	VNF Descriptor
VNFM	VNF Manager

4 Methodology

4.1 General

4.1.1 Introduction

The purpose of general conformance testing is to determine to what extent an implementation of a standard conforms to the 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 responses or related request operations from SUT and also verify notifications when appropriate.

4.1.2 Conformance of the NFV specifications

The conformance test including Test Descriptions (see clause 4.5 of the present document) is designed to test NFV implementations if those are following to the NFV specifications listed in clause 1 of the present document. The Test Descriptions tests the conformance of the exchanged HTTP payloads and the implementation of required actions for one or more of the available interfaces within a reference point.

The objectives of the "conformance" are the provisions described in each NFV specifications with typically use of "Verbal forms for the expression of provisions" specified in clause 3.2 of the ETSI Drafting Rules [i.6], i.e. "shall", "shall not" for Requirements, "should", "should not" for Recommendations, "may", "need not" for Permission, "can", "cannot" for Possibility and capability. Thus, all of the above types of listed provisions in the target NFV specifications are subject to conformance test with Test Descriptions of the present document, in terms of functionality (semantic checks) and the HTTP payloads (syntax checks).

NOTE: See also Annex L for special remarks on "conformance target provisions".

4.2 System Under Test (SUT)

The System Under Test (SUT) is identified by an implementation of the Function Under Test (FUT) that produces or consumes the API under test, e.g. in the case of the Or-vnfm reference point, the Function Under Test (FUT) may be either an NFVO implementation or a VNFM implementation.

The function shall be tested in isolation from other functional blocks in an NFV platform, to ensure that the outcomes of the conformance tests are not due to 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 for each protocol operation, including the conformant management of internal state.

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

EXAMPLE: To correctly execute an instantiation, a VNFM requires evaluation in a test environment that 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 include 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.

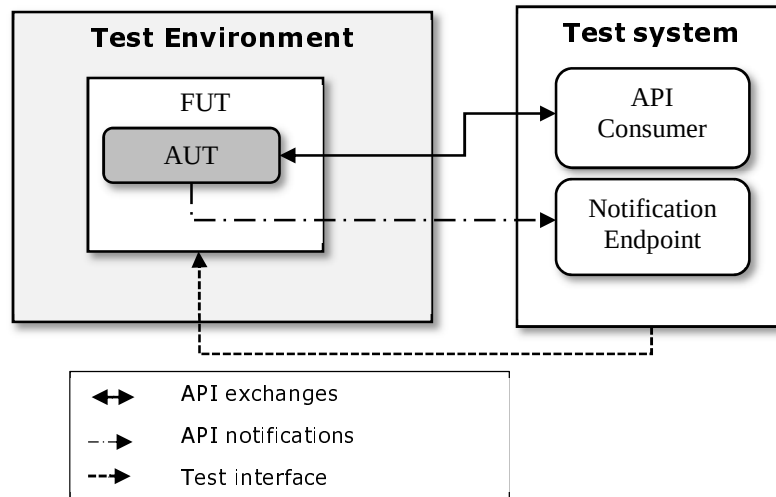


Figure 4.3.1-1: Generic SUT configuration

The test configurations specified in clause 4.3 fulfil the needs of the Test Descriptions specified in annexes D, E, F, G, H, I and J contained in the archive gs_nfv-tst010v050201p0.zip, which accompanies the present document, for the different FUTs and AUTs in the 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.

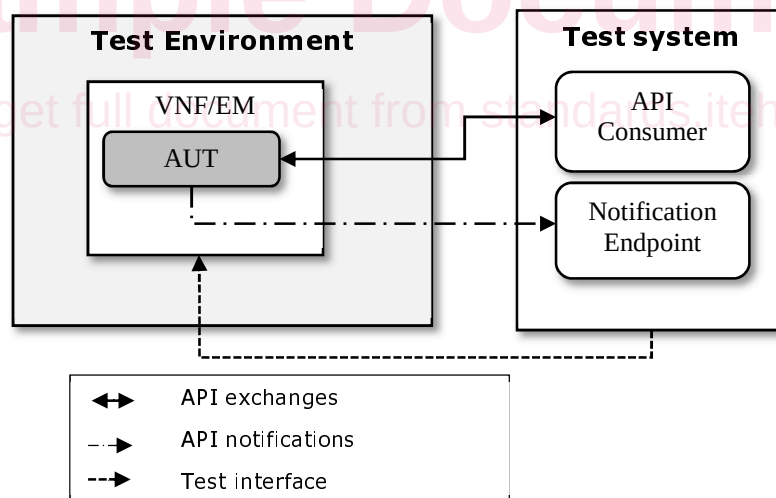


Figure 4.3.2-1: Configuration for tests of APIs with the FUTs as Producer run in a VNF/EM

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.

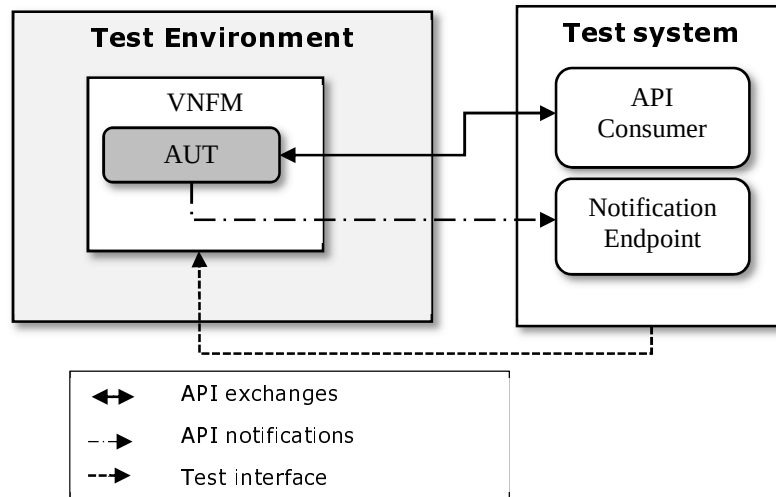


Figure 4.3.3-1: Configuration for tests of APIs with VNFM as Producer

4.3.4 Config_prod_NFVO

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

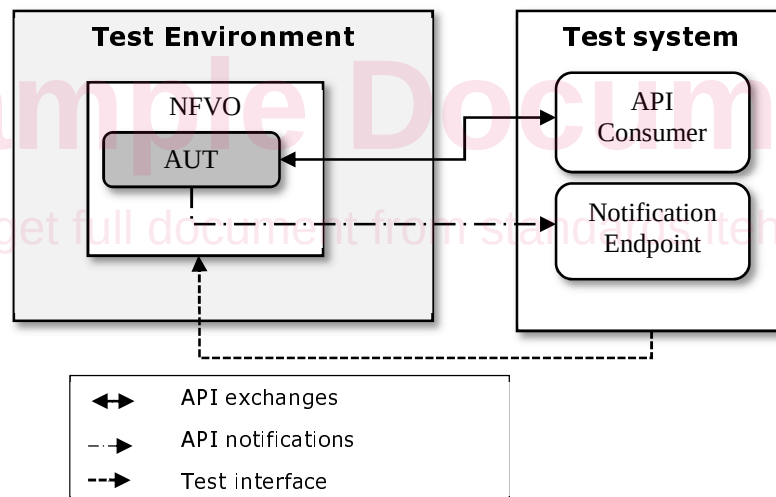


Figure 4.3.4-1: Configuration for tests of APIs with NFVO as Producer

4.3.5 Config_prod_VNFM_GRANT

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

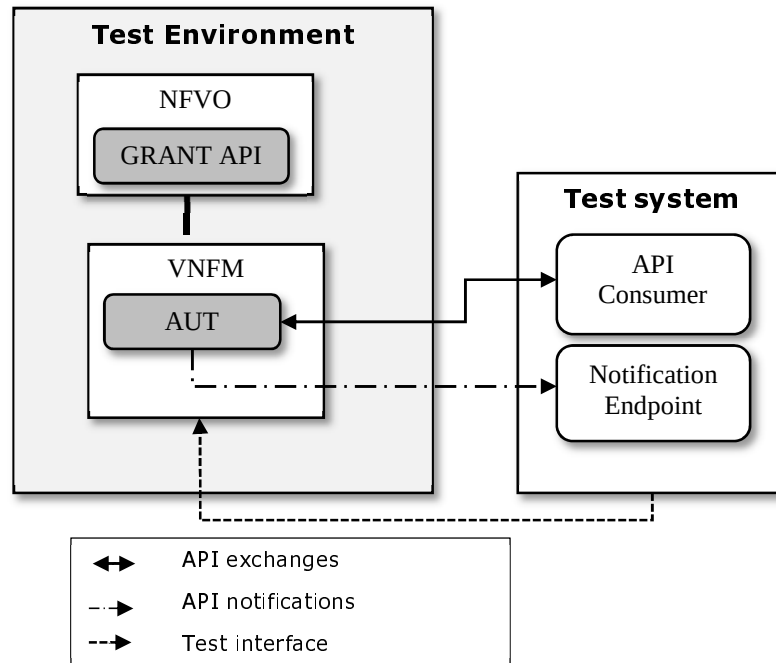


Figure 4.3.5-1: Configuration for tests of APIs with VNFM as Producer, where the VNFLifecycleOperationGranting API is required

4.3.6 Config_prod_Notif_Endpoint

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

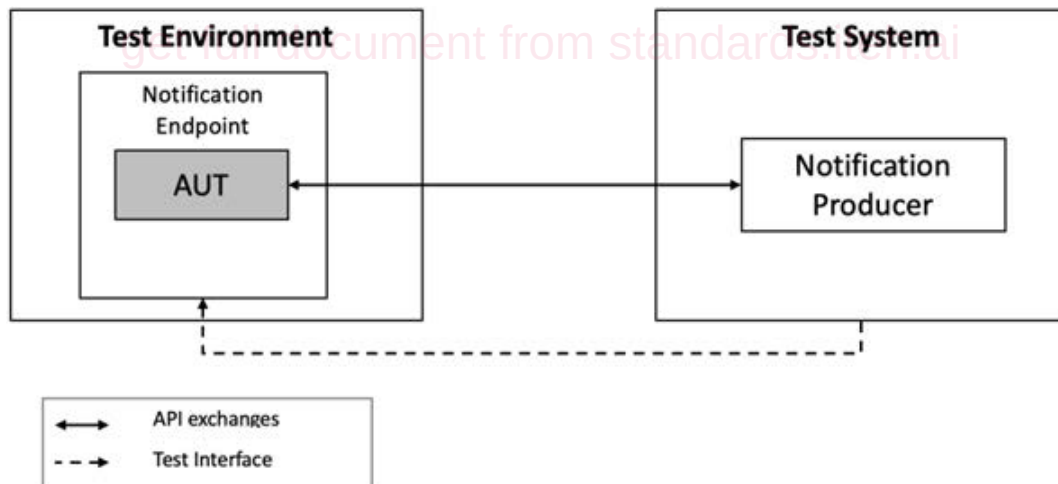


Figure 4.3.6-1: Configuration for tests of APIs where the Test System is an API Provider, and the AUT is a Notification endpoint

4.3.7 Config_prod_NFV-MANO

The configuration config_prod_NFV-MANO shall be implemented to test APIs produced by FUTs which implement NFV-MANO. The test environment for the virtual element is an NFV platform that provides NFVI.