ETSI GS NFV-IFA 011 V4.5.1 (2023-09)

Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; VNF Descriptor and Packaging Specification

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Reference
RGS/NFV-IFA011ed451

Keywords
management, MANO, NFV, orchestration,
virtualisation

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Contents

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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 provides requirements for the structure and format of a VNF Package to describe the VNF properties and associated resource requirements in an interoperable template.

The focus is on VNF packaging, meta-model descriptors (e.g. VNFD) and package integrity and security considerations.

The present document also specifies requirements for the structure and contents of VNF Snapshot Package.

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] Void.

[2] Hash Function Textual Names registry at IANA.

[3] ISO/IEC 9899: "Information Technology -- Programming languages -- C".

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.

[i.1] ETSI GS NFV-IFA 002: "Network Functions Virtualisation (NFV); Acceleration Technologies; VNF Interfaces Specification".

[i.2] ETSI GS NFV-IFA 006: "Network Functions Virtualisation (NFV); Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification".

[i.3] ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV); Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".

[i.4] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[i.5] ISO/IEC 9646-7: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".

[i.6] Void.

[i.7] IANA: "Protocol Numbers".

[i.8] ETSI GS NFV-IFA 014: "Network Functions Virtualisation (NFV); Management and Orchestration; Network Service Templates Specification".

[i.9] IETF RFC 4090: "Fast Reroute Extensions to RSVP-TE for LSP Tunnels".

[i.10] Void.

[i.11] ETSI GR NFV 003: "Network Functions Virtualisation (NFV); Terminology for main concepts in NFV".

[i.12] ETSI GS NFV-IFA 040: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification".

[i.13] ETSI GS NFV-IFA 010: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Functional requirements specification".

[i.14] IETF RFC 5280: "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GR NFV 003 [i.11] and the following apply:

deployable module: set of optional VDUs, specified in the VNFD for a particular VNF deployment flavour, which are used to create VNFC instances only if selected by the consumer in a VNF lifecycle management operation

NOTE: This definition is from ETSI GS NFV-IFA 010 [i.13].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GR NFV 003 [i.11] and the following apply:

ARM	Advanced RISC Machine
CDN	Content Delivery Network
CMF	Certificate Management Function
CP	Connection Point
CPD	Connection Point Descriptor
CPU	Central Processing Unit
CSR	Certificate Signing Request
DF	Deployment Flavour
DNS	Domain Name System
DSL	Domain Specific Language
EM	Element Manager
FQDN	Fully Qualified Domain Name
GS	Group Specification
IFA	Infrastructure and Architecture Working Group
IP	Internet Protocol
ISG	Industry Specification Group
LAN	Local Area Network
LCM	Life Cycle Management

MAC	Media Access Control
MPLS	MultiProtocol Label Switching
NFV	Network Functions Virtualisation
NFVI	Network Functions Virtualisation Infrastructure
NFVO	Network Functions Virtualisation Orchestrator
NS	Network Service
PM	Performance Management
QA	Quality Assurance
QoS	Quality of Service
RAM	Random Access Memory
RDMA	Remote Direct Memory Access
SAL	Service Availability Level
SW	Software
UML	Unified Modelling Language
URL	Uniform Resource Locator
VDU	Virtualisation Deployment Unit
VIM	Virtualised Infrastructure Manager
VL	Virtual Link
VLD	Virtual Link Descriptor
VM	Virtual Machine
VNF	Virtualised Network Function
VNFC	Virtualised Network Function Component
VNFD	Virtualised Network Function Descriptor
VNFM	Virtualised Network Function Manager

4 General description

4.1 Introduction

The present document develops specifications for packaging of VNFs to be delivered to service providers, focusing on the holistic end-to-end view of the VNF Package lifecycle, from design to runtime, capturing development as well as operational views. The present document provides an analysis of end-to-end VNF Package lifecycle management operations based on use-cases and NFV Architectural Framework functional blocks.

A VNF Package contains all of the required files and meta-data descriptors required to validate and instantiate a VNF.

Standardized meta-data descriptors are required to:

- describe the NFV infrastructure resource requirements for a VNF in a service provider environment;
- describe design constraints and other dependencies in order for the VNF to successfully install, instantiate and terminate; and
- describe VNF operational behaviour including VNF lifecycle events (e.g. scaling, upgrading).

Standardized packaging and validation of VNFs is required to:

- provide a consistent, documented method for VNF providers to package VNFs;
- harmonize the service provider on-boarding process for VNFs coming from different VNF providers;
- ensure integrity, trust and auditability of a VNF Package;
- allow for a flexible and extensible VNF packaging structure that accommodates a wide variety of NFV infrastructure scenarios; and
- allow the packaged VNF-related meta-data to be interpreted and the packaged VNF to be instantiated in a wide variety of orchestration systems irrespective of technology choice or infrastructure environment.

4.2 Objectives

The present document delivers:

- A description of a set of use cases involving the handling of VNF Packages.
- A set of functional requirements to be fulfilled when packaging a VNF.
- A specification of the information elements and attributes applicable to the VNFD.

4.3 Conventions

The attributes of the VNFD and associated information elements are described in the tables provided in clause 7. Each table has 5 columns, with the following significance:

- The "Attribute" column provides the attribute name.
- The "Qualifier" column indicates whether the support of the attribute is mandatory, optional or conditional.
- The "Cardinality" column contains the minimum and maximum cardinality of this information element (e.g. 1, 2, 0..N, 1..N). A cardinality range starting with 0 indicates that the attribute need not always be included.
- The "Content" column provides information on the type of the attribute values. It can be the name of an Information Element, a primitive type (Identifier, DateTime, etc.) or a generic UML type (String, Integer, etc.). If a cell in the "Content" column is marked as "Not specified", this means that the specification of the type is left to the data model design stage.
- The "Description column" provides a brief explanatory description and additional constraints.

The following notations, defined in ISO/IEC 9646-7 [i.5], are used for the qualifier column:

- M mandatory - the attribute shall be supported.
- O optional - the attribute may, but need not to, be supported.
- CM conditional mandatory - the attribute shall be supported under certain conditions. If the specified conditions are met then the attribute shall be supported. These conditions are specified in the Description column.
- CO conditional optional - the attribute may, but need not to, be supported under certain conditions. These conditions are specified in the Description column.

A Mandatory qualifier would imply that NFVO/VNFM shall understand/parse the particular element but the presence (inclusion in an occurrence of a VNFD) of the element is dictated by Cardinality. The lower bound of "1.." cardinality would imply that the attribute shall be present in the VNFD.

The following notations are used for the content column of information elements, input parameters, notifications, etc.:

- Parameters are of type "Identifier" when referring to an identifier of an actual object.
- For a "true" identifier identifying an object (information element or structure) the content type "Identifier" and the description "Identifier of this <object_name> <notification/information element/…>" is used.

EXAMPLE: Identifier "resourceId" of the "NetworkSubnet information element" shall have the description "Identifier of this NetworkSubnet information element".

- Object(s) are referenced by their identifier using the syntax "Identifier (Reference to <object_name1> [, <object_name2>…][, or <object_nameN>])".
- Names for attributes and parameters of type Identifier shall be of the following pattern: <name>Id.

4.4 Levels of NFV Entities

For NFV management, there are four levels of entities, i.e.:

- Descriptors - general type definitions for entities such as VNFs and VLs, e.g. VNFD and VLD.
- Descriptor objects - an instance of a descriptor, e.g. an instance of a VNFD (not an instance of a VNF instantiated according to this VNFD):
  - A descriptor object may provide (among other things) value ranges and default values for the attributes in the associated NFV entity class.
  - In the present document, the creation of subclasses of generic descriptors (e.g. VNFD_x as a subclass of VNFD) has been avoided, since this approach would create a proliferation of descriptor classes.
- NFV Entity Classes - these are classes that represent various NFV entities such as VNF and VL. There is one-to-one mapping between a descriptor object and an NFV entity class. An example of an NFV Entity Class is CDN Cache VNF.
- NFV Entity Instances - these are instances of a given NFV entity class. An NFV entity instance is used to represent the current state and attribute values for a given NFV entity. Each NFV entity instance is bound by the associated descriptor object, e.g. value ranges and default values for attributes. An example of an NFV Entity Instance is a CDN Cache VNF instance.

Each level puts constraints on the subsequent levels.

Information in a lower level does not appear in a higher level, e.g. NFV entity instance information does not appear in the associated NFV entity class, descriptor object or descriptor.

For example:

- A VNFD has parameters such as virtualisationDeploymentUnit, intVirtualLinkDesc, extConnectionPointDesc and deploymentFlavour. These same parameters apply to every type of VNF.
- For a given type of VNF (e.g. a firewall), one would create an instance of the VNFD and populate the various VNFD parameters with values specific to the given type of firewall: specific VDU instances describing the resource requirements for this VNFD instance, VLD instances describing the various types of VL needed, specific Deployment Flavour (DF), etc.
- Next, one defines the class for the given VNF firewall. The class includes the attributes that are seen across the given reference point.
- Finally, one can instantiate one or more VNF firewall by populating the various attributes in the VNF class with actual values.

5 VNF Packaging use-cases (informative)

5.1 General

The following use cases describe the steps involving the VNF Package as it transitions from the VNF Provider to the Service Provider. They 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 packaging format.

All the use cases presented in this clause are informative.

For the purpose of the use cases, the roles identified in table 5.1-1 have been identified.