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Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; VNF Descriptor and Packaging 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 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.

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.

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

[1] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for main concepts in NFV".

[2] Hash Function Textual Names registry at IANA.

NOTE: Available at https://www.iana.org/assignments/hash-function-text-names.

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

[i.7] Assigned Internet Protocol Numbers.

NOTE: Available at https://www.iana.org/assignments/protocol-numbers/protocol-numbers.xhtml.

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

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GS NFV 003 [1] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS NFV 003 [1] and the following apply:

ARM	Advanced RISC Machine
CDN	Content Delivery Network
CP	Connection Point
CPD	Connection Point Descriptor
CPU	Central Processing Unit
DF	Deployment Flavour
DSL	Domain Specific Language
EM	Element Manager
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	Virtual 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

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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.

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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.

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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.

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(standards.iteh.ai)
Full standard:
https://standards.iteh.ai/catalog/standards/sist/4852d981-2b53-472c-8e79-91424572ee8e/etsi-gs-nfv-ifa-011-v2.6.1-2019-03

Table 5.1-1: List of roles

Role	Description
VNF Provider	The role providing the VNF. Actors that can play this role include, but are not limited to, vendor, integrator or in-house developer.
Supply Chain Specialist	Service provider function responsible for recommending or identifying VNFs required for desired services.
Service Designer	Service provider function responsible for defining and providing requirements (functional and non-functional) for required services. Also responsible for creating services to be deployed by the service provider.
Service Acceptance Specialist	Service provider function responsible to validate, certificate and on-board VNFs.
Service Deployment Manager	Service provider function responsible for managing the deployment (e.g. instantiation, update) of the VNFs and VLs validated by the Service Acceptance Specialist.

5.2 VNF Package bundling for distribution

A VNF is, from a delivery point of view a software application so most of the general principles and processes associated with the software development lifecycle apply. After a VNF provider completes the development and functional testing for the VNF it needs to bundle all the necessary binaries and corresponding metadata for distribution to potential customers.

Roles

#	Role
1	VNF Provider

Pre-conditions

#	Pre-conditions	Comment
1	Functional Testing was performed and the version of the VNF has been identified	

Post-conditions

#	Post-conditions	Comment
1	A versioned single file package	

Base Flow

#	Role	Action/Description
1	VNF Provider	Using their own software development lifecycle tools and procedures, retrieve all the software components associated with the version to be built. This includes but not limited to own developed code, configuration files as well as third party components with their code, license agreements as well as build scripts.
2	VNF Provider	Capture the release notes including clear description of the functionality the release delivers, any external dependencies, known bugs fixed relative to the prior releases as well as known issues in specific configurations.
3	VNF Provider	Bundle the release, sign the package and place it in a distribution repository.

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Full standard:
https://standards.iteh.ai/catalog/standards/sist/4852d981-2b63-472c-8e79-91442457 2e84/etsi-gs-nfv-ifa-011-v2.6.1-2019-03

5.3 VNF Package testing

The VNF Package testing encompasses steps to guarantee that the package adheres to the standard structure and contains the mandatory metadata required in order to be considered compliant with the industry format.

Roles

#	Role
1	VNF Provider

Pre-conditions

#	Pre-conditions	Comment
1	Versioned Package is signed and available for distribution	

Post-conditions

#	Post-conditions	Comment
1	Package is flagged as Validated	