



## Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; VNF Package specification

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## Foreword

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

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## 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 specifies the structure and format of a VNF package file and its constituents, fulfilling the requirements specified in ETSI GS NFV-IFA 011 [1] for a VNF package.

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## 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-IFA 011: "Network Functions Virtualisation (NFV); Management and Orchestration; VNF Packaging Specification".
- [2] TOSCA-Simple-Profile-YAML-v1.1-csprd01: "TOSCA Simple Profile in YAML Version 1.1".
- [3] IETF RFC 3339: "Date and Time on the Internet: Timestamps".
- [4] IANA register for Hash Function Textual Names.

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

- [5] IETF RFC 5652 (September 2009): "Cryptographic Message Syntax (CMS)".
- [6] IETF RFC 7468: "Textual Encodings of PKIX, PKCS, and CMS Structures".
- [7] IANA register for Media Types.

NOTE: Available at <https://www.iana.org/assignments/media-types/media-types.txt>.

- [8] Recommendation ITU-T X.509: "Information technology - Open Systems Interconnection - The Directory: Public-key and attribute certificate frameworks".

### 2.2 Informative references

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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] TOSCA-v1.0-os: "TOSCA Version 1.0".
- [i.2] TOSCA-Simple-Profile-YAML-v1.0-csprd02: "TOSCA Simple Profile in YAML Version 1.0".

- [i.3] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".
- [i.4] ETSI GS NFV-SOL 001: "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; NFV descriptors based on TOSCA specification".
- [i.5] ETSI NFV registry of non-MANO artifact sets.

NOTE: Available at <http://register.etsi.org/NFV>.

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI GS NFV 003 [i.3] and the following apply:

**non-MANO artifact:** artifact for use by functional blocks beyond NFV-MANO

**non-MANO artifact set:** set of related non-MANO artifacts which are intended to be used together

### 3.2 Abbreviations

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

ASCII	American Standard Code for Information Interchange
CA	Certificate Authority
CMS	Cryptographic Message Syntax
CSAR	Cloud Service ARchive
IANA	Internet Assigned Number Association
NFVI	NFV Infrastructure
NFVO	NFV Orchestrator
TOSCA	Topology and Orchestration Specification for Cloud Applications
URI	Universal Resource Identifier
UTF	Unicode Transformation Format
VNF	Virtualised Network Function
VNFC	VNF Component
VNFD	VNF Descriptor
YAML	YAML Ain't Markup Language

## 4 VNF package

### 4.1 TOSCA YAML Cloud Service Archive (CSAR) overview

#### 4.1.1 CSAR structure

TOSCA YAML CSAR file is an archive file using the ZIP file format whose structure complies with the TOSCA Simple Profile YAML v1.1 Specification [2]. The CSAR file may have one of the two following structures:

- CSAR containing a *TOSCA-Metadata* directory, which includes the *TOSCA.meta* metadata file providing an entry information for processing a CSAR file as defined in TOSCA v1.0 Specification [i.1].
- CSAR containing a single yaml (.yml or .yaml) file at the root of the archive. The yaml file is a TOSCA definition template that contains a metadata section with *template\_name* and *template\_version* metadata. This file is the CSAR Entry-Definitions file.

In addition, the CSAR file may optionally contain other directories with bespoke names and contents.

### 4.1.2 CSAR with TOSCA-Metadata directory

The TOSCA.meta metadata file includes *block\_0* with the *Entry-Definitions* keyword pointing to a TOSCA definitions YAML file used as entry for parsing the contents of the overall CSAR archive.

Any TOSCA definitions files besides the one denoted by the *Entry-Definitions* keyword can be found by processing respective *imports* statements in the entry definitions file (or in recursively imported files).

Any additional artifacts files (e.g. scripts, binaries, configuration files) can be either declared explicitly through blocks in the *TOSCA.meta* file as described in TOSCA v1.0 Specification [i.1] or pointed to by relative path names through artifact definitions in one of the TOSCA definitions files contained in the CSAR file.

In order to indicate that the simplified structure (i.e. not all files need to be declared explicitly) of TOSCA.meta file allowed by TOSCA Simple profile YAML 1.0 [i.2] is used, the *CSAR-Version* keyword listed in *block\_0* of the meta-file denotes the version 1.1 as described in the below example. Otherwise the *CSAR-Version* keyword denotes the version 1.0 and all files are declared explicitly.

EXAMPLE:

```
TOSCA-Meta-File-Version: 1.0
CSAR-Version: 1.1
Created-by: Onboarding portal
Entry-Definitions: Definitions/ MainServiceTemplate.yaml
```

END OF EXAMPLE.

### 4.1.3 CSAR zip without TOSCA-Metadata directory

The yaml file at the root of the archive is the *CSAR Entry-Definition* file. The *CSAR-Version* is defined by the *template\_version* metadata as can be seen in the below example.

EXAMPLE:

```
tosca_definitions_version: tosca_simple_yaml_1.1
metadata:
  template_name: MainServiceTemplate
  template_author: Onboarding portal
  template_version: 1.0
```

END OF EXAMPLE.

## 4.2 VNF package structure and format

The structure and format of a VNF package shall conform to the TOSCA Simple Profile YAML v1.1 Specification of the CSAR format [2].

NOTE: This implies that the VNF package can be structured according to any of the two options described in clause 4.1.

## 4.3 VNF package file contents

### 4.3.1 General

A VNF Package shall contain a main TOSCA definitions YAML file representing all or part of the VNFD, and additional files. It shall be structured according to one of the CSAR structure options described in clause 4.1.

NOTE: ETSI GS NFV-SOL 001 [i.4] specifies the structure and format of the VNFD based on TOSCA specifications.

If the option with a TOSCA-Metadata directory is used and the CSAR-Version parameter indicates version 1.0, all files that are contained in the archive shall be referenced from the TOSCA.meta file. If the CSAR-Version parameter indicates version 1.1, the files that are referenced and pointed to by relative path names through artifact definitions in one of the TOSCA definitions files (e.g. the VNFD) contained in the CSAR need not be declared in the TOSCA.meta file.

Examples of VNF package options are described in annex A.

### 4.3.2 VNF package manifest file

A CSAR VNF package shall have a manifest file. The manifest file shall have an extension .mf and the same name as the main TOSCA definitions YAML file and be located at the root of the archive (archive without TOSCA-Metadata directory) or in the location specified by the TOSCA.meta file (archive with a TOSCA-Metadata directory). In the latter case, the corresponding entry shall be named "Entry-Manifest".

The manifest file shall start with the VNF package metadata in the form of a name-value pairs. Each pair shall appear on a different line. The "name" and the "value" shall be separated by a colon and, optionally, one or more blanks. The name shall be one of those specified in table 4.3.2-1 and the values shall comply with the provisions specified in table 4.3.2-1.

**Table 4.3.2-1: List of valid names and values for VNF package metadata**

Name	Value
vnf_provider_id	A sequence of UTF-8 characters See note 1.
vnf_product_name	A sequence of UTF-8 characters See note 1.
vnf_release_date_time	String formatted according to IETF RFC 3339 [3].
vnf_package_version	A string See note 2.
NOTE 1: The value shall be identical to those specified in the VNFD.	
NOTE 2: The value shall be identical to the vnfVersion attribute specified in the VNFD.	

An example of valid manifest file metadata entries follows.

EXAMPLE:

```
metadata:
vnf_product_name: vMRF
vnf_provider_id: Acme
vnf_package_version: 1.0
vnf_release_date_time: 2017-01-01T10:00+03:00
```

END OF EXAMPLE.

If the VNF package refers to external files, the manifest file shall contain digests of individual files in the package, both local files contained in the package and external files referenced in the package.

If the VNF package does not refer to external files, the manifest files may contain digests of individual files contained in the package. If the manifest file does not include digests, the complete CSAR file shall be digitally signed by the VNF provider. A consumer of the VNF package verifies the digests in the manifest file by computing the actual digests and comparing them with the digests listed in the manifest file.

The manifest file, or alternatively, the signature of the CSAR file, is the key for decision regarding a VNF package integrity and validity in terms of its contained artifacts. The specification of the manifest file and specific algorithms used in digest creation and validation is described in the security related clause.

### 4.3.3 VNF package change history file

A CSAR VNF package shall have a humanly readable text file describing any change in the constituency of the VNF package. All the changes in the VNF package shall be versioned, tracked and inventoried in the change history file.



The VNF package change history file shall be named "ChangeLog.txt" and be located at the root of the archive (archive without TOSCA-Metadata directory) or in the location specified by the TOSCA.meta file (archive with a TOSCA-Metadata directory). In the latter case, the corresponding entry shall be named "Entry-Change-Log".

#### 4.3.4 VNF package testing files

To enable VNF package validation, a VNF Provider should include in a VNF package files containing necessary information (e.g. test description) in order to perform VNF testing. The contents of VNF testing information is outside the scope of the present document.

The VNF testing information shall be located in a directory named "Tests" located at the root of the archive (archive without TOSCA-Metadata directory) or in the location specified by the TOSCA.meta file (archive with a TOSCA-Metadata directory). In the latter case, the corresponding entry shall be named "Entry-Tests".

#### 4.3.5 VNF package licensing information

As required in ETSI GS NFV-IFA 011 [1] the VNF package shall contain license information for the released VNF. The license information shall include a single license term for the whole VNF. In addition the license information may also include license terms for each of the VNF package artifacts if different from the one of the released VNF.

The VNF licensing information shall be located in a directory named "Licenses" located at the root of the archive (archive without TOSCA-Metadata directory) or in the location specified by the TOSCA.meta file (archive with a TOSCA-Metadata directory). In the latter case, the corresponding entry shall be named "Entry-Licenses".

#### 4.3.6 Certificate file

If the manifest file is signed by the VNF provider (see option 1 in clause 5.1), the CSAR VNF package shall contain a certificate file if the certificate is not included in the signature container (see note) within the manifest file. In this case or if a single certificate is provided for the signature of multiple artifacts (see clause 5.4), the certificate file shall have an extension .cert and the same name as the main TOSCA definitions YAML file and be located at the root of the archive (archive without TOSCA-Metadata directory) or in the location specified by the TOSCA.meta file (archive with a TOSCA-Metadata directory). In the latter case, the corresponding entry shall be named "Entry-Certificate".

**NOTE:** Signature container refers to a structure in a standard format (e.g. CMS) which contains signature and additional data needed to process the signature (e.g. certificates, algorithms, etc.).

If the complete CSAR file is signed by the VNF provider (see option 2 in clause 5.1), the certificate file shall be contained in a zip file together with the CSAR file and the signature file if the certificate is not included in the signature file. The certificate file shall have an extension .cert and the same name as the CSAR file.

#### 4.3.7 Non-MANO artifact sets in a VNF package

As required in ETSI GS NFV-IFA 011 [1] the VNF package shall allow to store and identify non-MANO artifact sets in the VNF package file.

Every non-MANO artifact set shall be identified by a non-MANO artifact set identifier which shall be registered in the registry (specified in annex B). A non-MANO artifact set identifier shall be a string that consists of sub-strings which shall not contain characters other than the following: digits (0-9), lowercase ASCII characters (a-z), and the special characters underscore "\_" and dash "-". Sub-strings shall be separated by the dot "." character.

All files belonging to the same non-MANO artifact set shall share a common path prefix other than the root of the package.

Non-MANO artifact sets shall be declared in the manifest file. If the package contains at least one non-MANO artifact set, an entry named "non\_mano\_artifact\_sets:" shall be present in the package on its own line after the "metadata" section that is defined in clause 4.3.2. The section defined by the "non\_mano\_artifact\_sets" keyname shall have the following structure:

- Every non-MANO artifact set shall be declared on its own line, by a key name that is equal to the non-MANO artifact set identifier.

- Below the key name, all artifacts that belong to the non-MANO artifact set shall be listed, each on its own line, starting with key name "Source", followed by a colon (":") and, optionally, one or more blanks, and further followed by a file name with path for a file in the CSAR archive that is not contained in the root of this archive.

If the Manifest file provides the integrity assurance of the VNF package (option 1 in clause 5.1), these artifacts shall also appear in the list of blocks of name-value pairs specified in clause 5.3.

An example of the section that declares the non-MANO artifact sets in the package is provided below.

EXAMPLE:

```
non_mano_artifact_sets:
  foo_bar:
    Source: foobar/foo/foo.yaml
    Source: foobar/foo/foo.script
    Source: foobar/bar/descriptor.xml
  prv.happy-nfv.cool:
    Source: happy/cool/123.html
    Source: happy/cool/cool.json
    Source: happy/cool/hot/hot_or_cool.json
```

END OF EXAMPLE.

---

## 5 Adding security to TOSCA CSAR

### 5.1 VNF package authenticity and integrity

As specified in ETSI GS NFV-IFA 011 [1] a VNF package shall support a method for authenticity and integrity assurance.

In order to provide the public key based authenticity and integrity for the whole VNF package one of the two following options shall be followed:

**Option 1:** The VNF package shall contain a Digest (a.k.a. hash) for each of the components of the VNF package. The table of hashes is included in the manifest file, which is signed with the VNF provider private key. In addition, the VNF provider shall include a signing certificate that includes the VNF provider public key, following a pre-defined naming convention and located either at the root of the archive or in a predefined location (e.g. directory).

The certificate may also be included in the signature container, if the signature format allows that. For example, the CMS format allows to include the certificate in the same container as the signature.

**Option 2:** The complete CSAR file shall be digitally signed with the VNF provider private key. The VNF provider delivers one zip file consisting of the CSAR file, a signature file and a certificate file that includes the VNF provider public key. The certificate may also be included in the signature container, if the signature format allows that.

In option 2, the VNF package delivered would therefore be according to figure 5.1-1.