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Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Functional requirements 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 specifies functional requirements for NFV management and orchestration, and general guidelines and requirements for NFV management and orchestration interface design.

The scope of the present document does not cover the functional requirements on interfaces.

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 http://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-IFA 011: "Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; VNF Descriptor and Packaging 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.

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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 002: "Network Functions Virtualisation (NFV); Architectural Framework".

[i.2] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for main concepts in NFV".

[i.3] ETSI GS NFV 004: "Network Functions Virtualisation (NFV); Virtualisation Requirements".

[i.4] ETSI GS NFV-MAN 001: "Network Functions Virtualisation (NFV); Management and Orchestration".

[i.5] ETSI GS NFV-SWA 001: "Network Functions Virtualisation (NFV); Virtual Network Functions Architecture".

[i.6] ETSI GS NFV-REL 001: "Network Functions Virtualisation (NFV); Resiliency requirements".

[i.7] ETSI GS NFV-INF 001: "Network Functions Virtualisation (NFV); Infrastructure Overview".

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 [i.2] and the following apply:

NOTE: A term defined in the present document takes precedence over the definition of the same term, if any, in ETSI GS NFV 003 [i.2].

composite network service: network service containing at least one network service

NS healing: procedure that includes all virtualisation related corrective actions to repair a faulty Network Service (NS) instance including components/functionalities which make up the instance, and have been associated with this fault situation

NOTE 1: In a virtualised environment network service healing focuses only on the virtualised components/functionalities. In case of a NS consisting of virtualised and non-virtualised parts a procedure able to handle both parts is needed. This will be done in connection with components/functionalities that are located outside the virtualised environment.

NOTE 2: "Virtualisation related corrective actions" refers to action(s) toward virtualised resource(s) and associated NS instance.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS NFV 003 [i.2] and the following apply:

BSS	Business Support System
CP	Connection Point
DF	Deployment Flavour
EM	(Network) Element Manager
FB	Functional Block
FPGA	Field Programmable Gate Array
IP	Internet Protocol
LCM	LifeCycle Management
NFP	Network Forwarding Path
NSD	Network Service Descriptor
NUMA	Non Uniform Memory Access
OS	Operating System
OSS	Operation Support System
PCIe	Peripheral Component Interface express
PM	Performance Management
PNFD	Physical Network Function Descriptor
SAP	Service Access Point
URI	Uniform Resource Identifier
VL	Virtual Link
WIM	WAN Infrastructure Manager

4 General Description

4.1 Introduction

Network Functions Virtualisation (NFV) adds new capabilities to communications networks and requires a new set of management and orchestration functions to be added to the current model of operations, administration, maintenance and provisioning. The NFV Management and Orchestration (NFV-MANO) architectural framework has the role to manage the infrastructure and orchestrate the resources needed by the Network Services (NSs) and Virtualised Network Functions (VNFs).

In order to guide the development of the specification of the interfaces exposed between the NFV-MANO Functional Blocks (FBs), it is important to have a clear and consolidated set of functional requirements to be addressed by the NFV-MANO. The present document is providing functional requirements on NFV MANO e.g. VNF lifecycle management (LCM), NS LCM, virtualised resource management, etc.

The functional requirements specified in the present document are mainly derived from functional requirements identified in ETSI GS NFV 002 [i.1], ETSI GS NFV 003 [i.2], ETSI GS NFV 004 [i.3], ETSI GS NFV-MAN 001 [i.4], ETSI GS NFV-SWA 001 [i.5], ETSI GS NFV-REL 001 [i.6] and ETSI GS NFV-INF 001 [i.7] or derived from concepts defined in these documents.

4.2 Overview

In order to provide systematic functional requirements, the present document arranges the functional requirements by categorizing the requirements according to key operational functions of NFV-MANO, which are documented in ETSI GS NFV-MAN 001 [i.4].

Key operational function categories which are used to organize the requirements on NFV Orchestrator (NFVO), VNF Manager (VNFM) and Virtualised Infrastructure Manager (VIM) in the present document are listed below:

- Virtualised resource management.
- VNF LCM.
- NS LCM.
- VNF information management.
- NS information management.
- NFV performance management.
- NFV fault management.
- Security considerations.
- Software image management.
- NFV acceleration management.
- Multi-tenancy.

NOTE: This categorization groups related functional requirements together. Actual interface requirements derived from the functional requirements may be grouped differently, and/or individual interface requirements may be placed into a group that is different from the category of the related functional requirement.

5 General functional requirements

5.1 General functional requirements for virtualised resource management

The NFV-MANO architecture shall provide support to permit service providers to partially or fully virtualise the Network Functions (NFs) needed to create, deploy and operate the services they provide. In case of partial virtualisation, performance, management and operations of the non-virtualised NFs shall not be impacted.

The NFV-MANO architecture shall be able to support a NS composed of Physical Network Functions (PNFs) and VNFs implemented across multivendor environments.

The NFV-MANO architecture shall be able to manage NFV Infrastructure (NFVI) resources, in order to provide NSs and related VNFs and PNFs with the resources needed. Management of resources for PNFs shall be restricted to provisioning connectivity, e.g. necessary when a NS instance includes a PNF that needs to connect to a VNF.

The NFV-MANO architecture shall enable the NFVO and the VNFM to manage the virtualised resources needed for LCM of the VNFs. The NFV-MANO architecture shall enable deployments and implementations where:

- the NFVO is the only FB to manage the virtualised resources needed for the LCM of the VNF (**VNF-related Resource Management in indirect mode)**;
- the VNFM is the only FB to manage the virtualised resources needed for the LCM of the VNF **(VNF-related Resource Management in direct mode)**;
- the NFVO and the VNFM, both, manage the virtualised resources needed for the LCM of the VNF.

NOTE: This is a decision per VNFM whether it is the NFVO or the VNFM that manages the virtualised resources.

It is a deployment and implementation decision whether one option or both are deployed and implemented. All VNFs managed by one VNFM shall use the same option for virtualised resource management. The detailed requirements on the NFVO and the VNFM for each case are depicted in clauses 6.1 and 7.1.

In addition to managing the VNF-related virtualised resources as explained above, the NFV-MANO architecture shall enable the NFVO to manage the virtualised resources (i.e. network resources) that are needed for LCM of the NS(s).

Additionally, the NFV-MANO shall enable different models, per resource type, to facilitate availability of resources and to avoid resource contention. It shall be possible for the network operator, on a per NS basis, tenant basis or VNF basis, to select one of the following resource commitment models, or a combination of them:

- **Reservation** model, where resources are committed, but not allocated, to a particular consumer or consumer type. A reservation can have one of the following types (see details in clause A.2.8):

  1) reserving a set of resources considering particular virtualised resource configurations, i.e. reserving a number of virtualised containers, virtual networks, network ports and/or storage volumes;

  2) reserving virtualised resource capacity without considering particular resource configurations, i.e. reserving virtualised resource capacity of compute, storage and network resource types.

- **Quota/Allowance based** model, where the number of resources to be consumed by a particular consumer is limited to a defined amount or a percentage of resources; in this model, resources are committed upon demand from the consumer when a VNF or a NS is instantiated or scaled out, as long as those are within the limits established by the quota/allowance for that consumer or consumer type.

- **On demand**, where resources are committed when a VNF or a NS is instantiated or scaled out, as long as there are available resources for consumption.

The permitted allowance concept should be distinguished from the quota concept:

- Quota: enforced by the VIM. Quotas are usually used to prevent excessive resource consumption in the VIM by a given consumer.

- Permitted allowance: maintained at NFVO level. Permitted allowances might vary in granularity (VNFM, VNF, group of VNFs, NS, etc.) and are used to control resource consumption by VNFMs in relation to the granularity associated with the permitted allowance.

The detailed requirements on the affected FBs are depicted in clauses 6.1, 7.1 and 8.2.

5.2 General functional requirements for multi-tenancy

Multi-tenancy can be applied to all infrastructure and service resources which can be consumed from an NFV system and managed by NFV-MANO.

NOTE: The term "resource" as used in the present clause goes beyond the definition of NFV-resource as specified in the NFV Terminology document (ETSI GS NFV 003 [i.2]).

Figure 5.2-1 shows the entities relevant to multi-tenancy for any kind of resources.

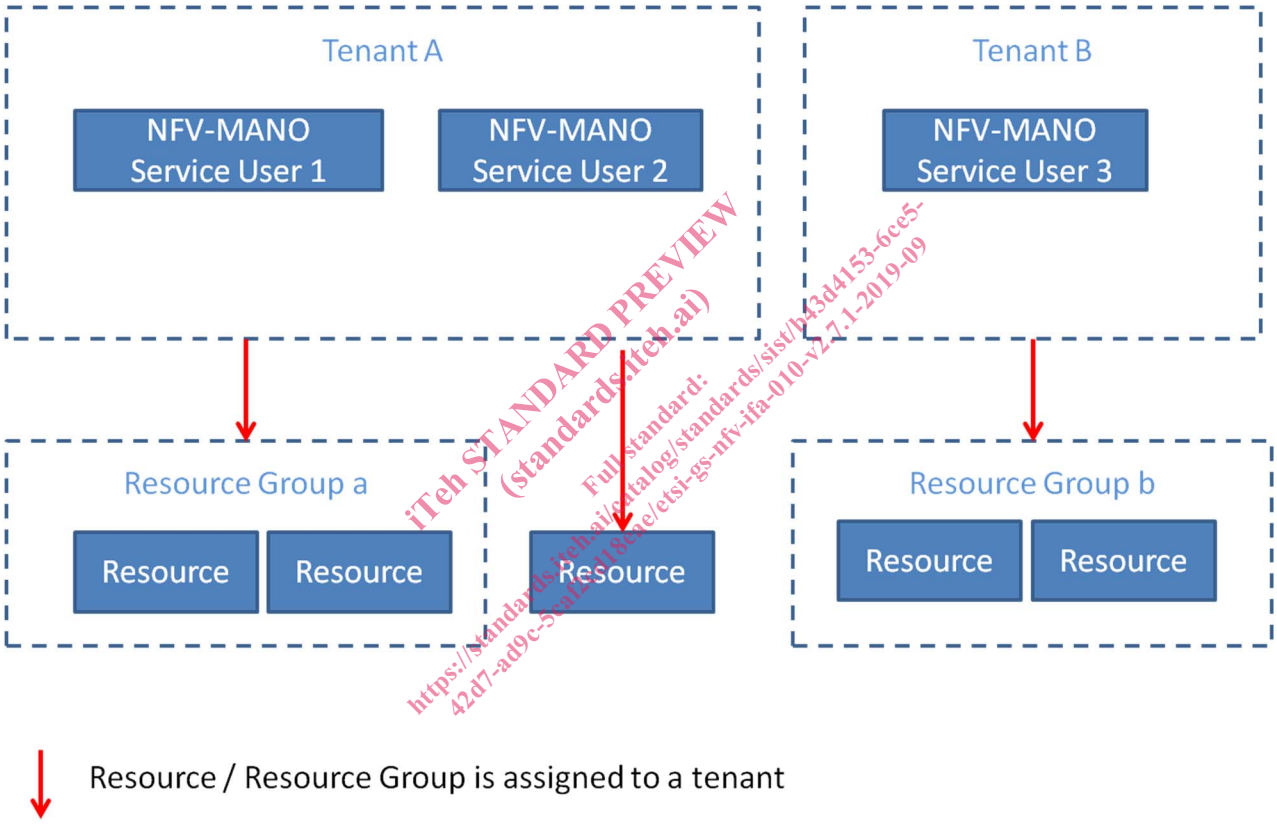

Figure 5.2-1: Entities relevant to multi-tenancy

Each FB may act as multiple tenants on the FBs from which it uses service or infrastructure resources. A service resource e.g. a VNF can be composed from multiple virtual resources from different tenants. Figure 5.2-2 shows an example how a VNFM may use tenants on the VIM.

EXAMPLE: The VNF (Resource Group a) is composed out of virtual resources from Resource Group c. The virtual resources in Resource Group c are assigned to Tenant C. Thus the VNFM has to identify as Tenant C to modify the virtual resources for VNF (Resource Group a). The VNF (Resource Group b) uses virtual resources assigned to Tenant D (Resource Group d) and Tenant E. Therefore the VNFM has to identify as Tenant D or Tenant E or both to modify the virtual resources for VNF (Resource Group b).

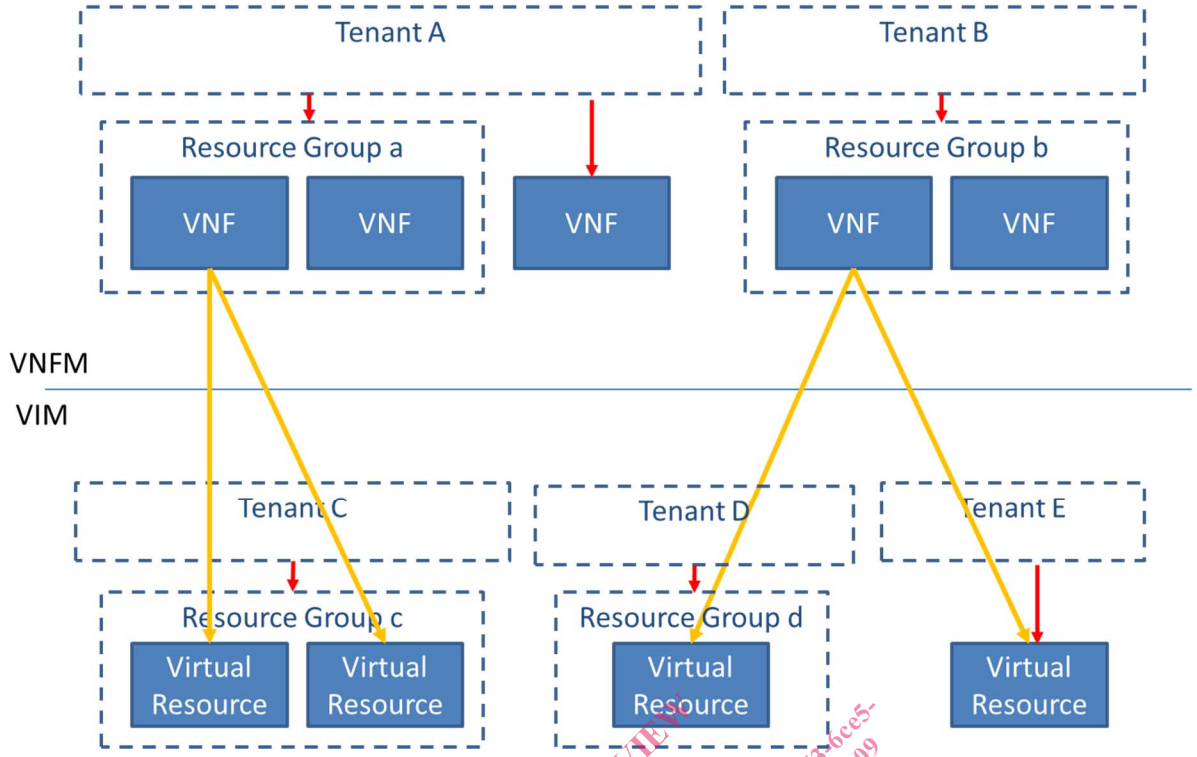

Figure 5.2-2: Example of how a VNFM may use tenants on a VIM

Since multi-tenancy exists for all kinds of service and infrastructure resources which can be used from an NFV-MANO service, tenants can be grouped based in the resources they use:

- A tenant to which virtual resources are assigned is referred to as an infrastructure tenant (Tenant C, D, E).
- A tenant to which VNFs are assigned is referred to as a VNF tenant (Tenant A, B).
- A tenant to which NSs are assigned is referred to as a NS tenant.

A resource group has different meaning for different resources which are being used:

- A resource group can be a "service resource group" containing VNFs, PNFs or NSs instances.
- A resource group can be an "infrastructure resource group" containing a set of virtual resources under the control of a VIM and belonging to a tenant.