



Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Functional requirements specification

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Reference

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Contents

Intellectual Property Rights	8
Foreword.....	8
Modal verbs terminology.....	8
1 Scope	9
2 References	9
2.1 Normative references	9
2.2 Informative references.....	9
3 Definition of terms, symbols and abbreviations.....	10
3.1 Terms.....	10
3.2 Symbols.....	11
3.3 Abbreviations	11
4 General Description.....	11
4.1 Introduction	11
4.2 Overview	11
5 General functional requirements	12
5.1 General functional requirements for virtualised resource management	12
5.2 General functional requirements for multi-tenancy.....	13
5.3 General requirements for the management of NFV-MANO functional entities.....	15
5.4 General functional requirements for management of connectivity for Multi-Site services.....	16
5.5 General requirements to support network slicing.....	16
5.6 General requirements to support software modification.....	17
5.6.1 General requirements for software modification	17
5.6.2 General requirements for the software modification of NFV-MANO functional entities	18
5.6.3 General requirements for changing the current VNF Package	18
5.6.4 General requirements for the software modification of NFVI components.....	18
5.6.4.1 Description	18
5.6.4.2 NFVI operation and maintenance constraints	19
5.7 General requirements to support service availability level.....	19
6 Functional requirements for NFVO	20
6.1 Functional requirements for virtualised resource management.....	20
6.1.1 Functional requirements for general virtualised resource management.....	20
6.1.2 Functional requirements for VNF-related resource management in indirect mode	21
6.1.3 Functional requirements for VNF-related resource management in direct mode	21
6.1.4 Functional requirements for NS-related resource management performed by the NFVO.....	22
6.1.5 Functional requirements for resource reservation management.....	22
6.1.6 Functional requirements for virtualised resource and NFVI capacity management	23
6.1.7 Functional requirements for virtualised resource performance management	24
6.1.8 Functional requirements for virtualised resource fault management	24
6.1.9 Functional requirements for virtualised resource information management.....	24
6.1.10 Functional requirements for Network Forwarding Path (NFP) management	25
6.1.11 Functional requirements for quota management.....	25
6.1.12 Functional requirements related to permitted allowance management	26
6.2 Functional requirements for VNF lifecycle management.....	26
6.2.1 Functional requirements for VNF lifecycle management	26
6.2.2 Functional requirements for VNF instantiation	27
6.2.3 Functional requirements for VNF scaling.....	27
6.2.4 Functional requirements for VNF termination.....	27
6.2.5 Functional requirements for VNF/VNFC Snapshots	27
6.2.6 Functional requirements for changing the current VNF Package	27
6.2.7 Functional requirements for change of the external VNF connectivity	28
6.3 Functional requirements for NS lifecycle management	28
6.3.1 Functional requirements for NS lifecycle management.....	28
6.3.2 Functional requirements for NS instantiation	28

6.3.3	Functional requirements for NS scaling.....	29
6.3.4	Functional requirements for NS updating	29
6.3.5	Functional requirements for NS termination.....	29
6.4	Functional requirements for VNF configuration management.....	30
6.5	Functional requirements for VNF information management.....	30
6.5.1	Functional requirements for VNF Package management	30
6.5.2	Functional requirements for VNF instance information management	30
6.6	Functional requirements for NS information management	31
6.6.1	Functional requirements for NSD management.....	31
6.6.2	Functional requirements for NS instance information management.....	31
6.6.3	Functional requirements for PNF Descriptor (PNFD) archive management	31
6.7	Functional requirements for NS performance management	32
6.8	Functional requirements for VNF fault management	32
6.8.1	Functional requirements for virtualisation-related fault management	32
6.9	Functional requirements for NS fault management.....	32
6.10	Functional requirements for infrastructure resource management	33
6.11	Functional requirements for security consideration	33
6.12	Functional requirements for software image management.....	33
6.13	Functional requirements for NFV acceleration management	33
6.14	Functional requirements for multi-tenancy	34
6.15	Functional requirements for compute host reservation management	34
6.16	Functional requirements for policy management	35
6.17	Functional requirements for management of network services in a multiple administrative domain environment.....	35
6.18	Functional requirements for management of connectivity for Multi-Site services.....	36
6.19	Functional requirements related to the support for network slicing	37
7	Functional requirements for VNFM.....	37
7.1	Functional requirements for virtualised resource management	37
7.1.1	Functional requirements for virtualised resource management	37
7.1.2	Functional requirements for VNF-related resource management in indirect mode	38
7.1.3	Functional requirements for VNF-related resource management in direct mode	38
7.1.4	Functional requirements for resource reservation management.....	39
7.1.5	Functional requirements for virtualised resource performance management	39
7.1.6	Functional requirements for virtualised resource fault management	39
7.1.7	Functional requirements for virtualised resource information management.....	39
7.1.8	Functional requirements for quota management.....	40
7.1.9	Functional requirements related to permitted allowance management	40
7.2	Functional requirements for VNF lifecycle management.....	40
7.2.1	Functional requirements for VNF lifecycle management	40
7.2.2	Functional requirements for VNF instantiation	41
7.2.3	Functional requirements for VNF scaling	41
7.2.4	Functional requirements for VNF termination.....	42
7.2.5	Functional requirements for changing the current VNF Package	42
7.2.6	Functional requirements for change of the external VNF connectivity	42
7.3	Functional requirements for VNF configuration management.....	42
7.4	Functional requirements for VNF information management.....	43
7.4.1	Functional requirements for VNF Package management	43
7.4.2	Functional requirements for VNF instance information management	43
7.5	Functional requirements for VNF performance management	43
7.6	Functional requirements for VNF fault management	44
7.6.1	Functional requirements for virtualised resource-related VNF fault management	44
7.6.2	Functional requirements for virtualisation-related fault management	44
7.7	Functional requirements for security consideration	44
7.8	Functional requirements for software image management.....	45
7.9	Functional requirements for NFV acceleration management	45
7.10	Functional requirements for multi-tenancy	45
7.11	Functional requirements for VNF indicator management	45
7.12	Functional requirements for policy management	46
7.13	Functional requirements for VNF/VNFC Snapshots.....	46
7.14	Functional requirements for management of connectivity for Multi-Site services.....	46

8	Functional requirements for VIM.....	47
8.1	General considerations	47
8.2	Functional requirements for virtualised resource management	47
8.2.1	Functional requirements for virtualised resource management	47
8.2.2	Functional requirements for resource reservation management.....	48
8.2.3	Functional requirements for virtualised resource and NFVI capacity management	48
8.2.4	Functional requirements for virtualised resource performance management	49
8.2.5	Functional requirements for virtualised resource fault management	49
8.2.6	Functional requirements for virtualised resource information management.....	49
8.2.7	Functional requirements for virtualised resource configuration management	50
8.2.8	Functional requirements for NFP management	50
8.2.9	Functional requirements for quota management.....	50
8.3	Functional requirements for infrastructure resource management	51
8.3.1	Functional requirements for infrastructure resource performance management.....	51
8.3.2	Functional requirements for infrastructure resource fault management.....	51
8.4	Functional requirements for security consideration	51
8.5	Functional requirements for software image management.....	51
8.6	Functional requirements for NFV acceleration management	52
8.7	Functional requirements for multi-tenancy	52
8.8	Functional requirements for compute host reservation management	52
8.9	Functional requirements for policy management	53
8.10	Functional requirements for virtualised resource Snapshots	53
8.11	Functional requirements for management of connectivity for Multi-Site services.....	53
9	Architectural level Requirements.....	53
9.1	General guidelines for NFV management and orchestration interface design	53
9.2	General requirements to NFV management and orchestration interface design	54
9.3	General requirements for NFV management and orchestration services	54
9.4	General requirements for multi-tenancy.....	55
10	Functional requirements for NFV-MANO as managed entities.....	55
10.1	Functional requirements for management of NFVO as a managed entity.....	55
10.2	Functional requirements for management of VNFM as a managed entity.....	55
10.3	Functional requirements for management of VIM as a managed entity.....	56
11	Functional requirements for WIM.....	56
11.1	General considerations	56
11.2	Functional requirements related to virtualised resource management.....	56
11.2.1	Functional requirements for virtualised resource management	56
11.2.2	Functional requirements for resource reservation management.....	56
11.2.3	Functional requirements for virtualised resource fault management	57
11.2.4	Functional requirements for virtualised resource information management.....	57
Annex A (informative): Resource management additional information.....		58
A.1	Quota based resource management	58
A.1.1	Overview	58
A.1.2	Summary of key aspects.....	58
A.1.3	Assignment of consumer identifiers	59
A.1.4	Setting of quotas.....	59
A.1.5	NFVO awareness of NFVI resource consumption	59
A.1.6	NFVI resource acquisition.....	59
A.1.7	Resource contention mitigation	60
A.1.8	Data centre resource utilization efficiency	60
A.1.9	Resource management evolution and interoperability.....	60
A.1.10	Co-existence of resource quota enforcement and resource management with reservation.....	60
A.2	Management of resource reservations	60
A.2.1	Introduction	60
A.2.2	Use cases	60
A.2.2.1	Use case for securing resources for several tenants	60
A.2.2.2	Use case for securing resources with detailed capabilities	61
A.2.2.3	Use case for securing resources during NS instantiation	61
A.2.2.4	Use case for securing resources during NS scaling	61

A.2.2.5	Use case for securing resources related to a scheduled event	61
A.2.3	Summary of key aspects	61
A.2.4	Resource reservation management by NFVO	62
A.2.5	Resource reservation handling by the VNFM	63
A.2.6	Resource reservation contention mitigation	63
A.2.7	Co-existence of reservation with quota	63
A.2.8	Resource reservation types	63
A.3	Management of permitted allowance	64
A.3.1	Introduction	64
A.3.2	Summary of key aspects	64
A.3.3	Setting of permitted allowance	64
A.3.4	Permitted allowance management by NFVO	65
A.3.5	Permitted allowance awareness by the VNFM	65
A.3.6	Permitted allowance contention mitigation	65
A.3.7	Co-existence of permitted allowance and resource quota enforcement	65
A.3.8	Co-existence of permitted allowance and resource management with reservation	65
Annex B (informative):	Virtualised resources capacity management	66
B.1	Introduction	66
B.2	Virtualised resources capacity information management by the VIM	66
B.2.1	Functionality	66
B.3	Virtualised resources capacity management by the NFVO	66
B.3.1	Functionality	66
Annex C (informative):	VNF management	68
C.1	Introduction	68
C.2	Use cases	68
C.2.1	Use case for stopping a VNF instance	68
C.2.1.1	Introduction	68
C.2.1.2	Steps	68
C.2.2	Use case for starting a VNF instance	69
C.2.2.1	Introduction	69
C.2.2.2	Steps	69
Annex D (informative):	Network service management additional information	70
D.1	Introduction	70
D.2	General use cases	70
D.2.1	Use case for creating an NS instance	70
D.2.1.1	Introduction	70
D.2.1.2	Trigger	71
D.2.1.3	Actors and roles	71
D.2.1.4	Pre-conditions	71
D.2.1.5	Post-conditions	71
D.2.1.6	Operational Flows	71
D.2.2	Use case NS scaling	72
D.2.2.1	Introduction	72
D.2.2.2	Trigger	72
D.2.2.3	Actors and roles	72
D.2.2.4	Pre-conditions	73
D.2.2.5	Post-conditions	73
D.2.2.6	Operational Flows	73
D.2.3	Use case: Re-instantiation of multiple NS instances with different priorities after NFVI failure	75
D.2.3.1	Introduction	75
D.2.3.2	Trigger	75
D.2.3.3	Actors and roles	75
D.2.3.4	Pre-conditions	76
D.2.3.5	Post-conditions	76

D.2.3.6	Operational Flows.....	77
D.2.4	Use case: Instantiation of NS in parallel to other LCM operations	78
D.2.4.1	Introduction.....	78
D.2.4.2	Trigger	79
D.2.4.3	Actors and roles	79
D.2.4.4	Pre-conditions	79
D.2.4.5	Post-conditions	79
D.2.4.6	Operational Flows.....	80
D.2.5	Use case: Resolve resource allocation conflict by pre-empting a lower priority NS instance that is up and running.....	82
D.2.5.1	Introduction.....	82
D.2.5.2	Trigger	82
D.2.5.3	Actors and roles	82
D.2.5.4	Pre-conditions	83
D.2.5.5	Post-conditions	83
D.2.5.6	Operational Flows.....	83
D.3	NS management supporting network slicing.....	85
D.3.1	Introduction	85
D.3.2	NS instance sharing between Network Slices and tenants	85
Annex E (informative): Policy management in NFV-MANO.....		87
E.1	Introduction	87
E.2	Scope of policies in NFV-MANO reference point.....	87
Annex F (informative): VNF Snapshots.....		88
F.1	Introduction	88
F.2	VNF Snapshot lifecycle.....	88
F.3	VNF/VNFC Snapshot procedures.....	89
F.3.1	Introduction	89
F.3.2	Create VNF Snapshot procedure	89
F.3.3	Query VNF Snapshot information procedure.....	93
F.3.4	Revert-To VNF Snapshot procedure	94
F.3.5	Delete VNF Snapshot information procedure	98
Annex G (informative): NFV-MANO and integration of management and connectivity for Multi-Site services.....		100
G.1	Introduction	100
G.2	Architecture options	100
G.2.1	Architecture option #A: WIM integration into NFV-MANO framework as specialized VIM	100
G.2.2	Architecture option #B: WIM integration as external entity to the NFV-MANO framework managing WIM functionality of OSS/BSS with Os-Ma-nfvo reference points	101
Annex H (informative): NFVI operation and maintenance		103
H.1	Procedures related to NFVI operation and maintenance	103
H.1.1	Introduction	103
H.1.2	VNFD-based transfer of NFVI operation and maintenance policies.....	104
H.1.3	NFVI operation and maintenance coordination for group impact	105
H.1.4	NFVI operation and maintenance coordination for virtualised resource impact	107
Annex I (informative): Authors & contributors.....		109
Annex J (informative): Change History		112
History		114

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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

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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.

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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".
- [i.8] ETSI GS NFV-PER 001: "Network Functions Virtualisation (NFV); NFV Performance & Portability Best Practises".
- [i.9] ETSI GR NFV-IFA 023: "Network Functions Virtualisation (NFV); Management and Orchestration; Report on Policy Management in Mano; Release 3".

- [i.10] ETSI GR NFV-TST 005: "Network Functions Virtualisation (NFV); Continuous Development and Integration; Report on use cases and recommendations for VNF Snapshot".
- [i.11] ETSI GR NFV-IFA 022: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on Management and Connectivity for Multi-Site Services".
- [i.12] ETSI GR NFV-EVE 012 (V3.1.1): "Network Functions Virtualisation (NFV) Release 3; Evolution and Ecosystem; Report on Network Slicing Support with ETSI NFV Architecture Framework".
- [i.13] ETSI GS NFV-IFA 013: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Os-Ma-Nfvo reference point - Interface and Information Model Specification".
- [i.14] ETSI GS NFV-IFA 005: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Or-Vi reference point - Interface and Information Model Specification".
- [i.15] ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".
- [i.16] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".
- [i.17] ETSI GS NFV-IFA 014: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Network Service Templates Specification".
- [i.18] ETSI GR NFV 001: "Network Functions Virtualisation (NFV); Use Cases".
- [i.19] ETSI GS NFV-IFA 011: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; VNF Descriptor and Packaging Specification".
- [i.20] ETSI GS NFV-REL 006: "Network Functions Virtualisation (NFV) Release 3; Reliability; Maintaining Service Availability and Continuity Upon Software Modification".

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

compute host: whole server entity, part of an NFVI, composed of a HW platform (processor, memory, I/O devices, internal disk) and a hypervisor running on it

NOTE: This definition is from ETSI GS NFV-PER 001 [i.8].

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 an 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.

service availability level: information provided to assist in the selection of virtualised resources to be allocated for the NS constituents in terms of availability

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 enable support for network slicing according to operator policies and SLAs, see clause 5.5.

The NFV-MANO architecture shall be able to support an 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 an 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 an 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 an NS is instantiated or scaled out, as long as there are available resources for consumption.

NFV-MANO shall be able to manage resources (service resources and infrastructure resources) taking in account priorities based on operator policies and SLAs.

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. NFV provides isolation between the infrastructure resources and/or isolation between the service resources allocated to different tenants. As described in ETSI GR NFV 001 [i.18], clause 6.6, the NFV infrastructure is responsible for providing appropriate isolation. NFV-MANO shall provide the necessary information to the NFVI to allow the appropriate isolation.

NOTE 1: 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]).

NOTE 2: NFV-MANO provides some capabilities to achieve such isolation, e.g. anti-affinity rules, resource-zones, etc. It is up to the Consumer to make proper use of these capabilities.

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