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Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the management of NFV-MANO

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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 a set of RESTful protocols and data models fulfilling the requirements specified in ETSI GS NFV-IFA 031 [1] for the interfaces that enable the management of NFV-MANO functional entities.

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] ETSI GS NFV-IFA 031: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements and interfaces specification for management of NFV-MANO".

[2] Recommendation ITU-T X.733: "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".

[3] IETF RFC 7396: "JSON Merge Patch".

[4] ETSI GS NFV-SOL 013: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs".

[5] ETSI GS NFV-SEC 022: "Network Functions Virtualisation (NFV) Release 2; Security; Access Token Specification for API Access".

[6] IETF RFC 8447: "IANA Registry Updates for TLS and DTLS".

[7] Void.

[8] IETF RFC 5424: "The Syslog Protocol".

[9] ETSI GS NFV-SOL 002: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point".

[10] ETSI GS NFV-SOL 003: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point".

[11] ETSI GS NFV-SOL 005: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfvo Reference Point".

[12] ETSI GS NFV-SEC 012: "Network Functions Virtualisation (NFV) Release 3; Security; System architecture specification for execution of sensitive NFV components".

[13] ETSI GS NFV-SOL 011: "Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point".

[14] ETSI GS NFV-SOL 012: "Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Policy Management Interface".

[15] IETF RFC 9110: "HTTP Semantics".

[16] IETF RFC 5789: "PATCH Method for HTTP".

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.

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] ETSI GR NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[i.2] ETSI GS NFV-IFA 011: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; VNF Descriptor and Packaging Specification".

[i.3] ETSI GS NFV 006: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Architectural Framework Specification".

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

[i.5] ETSI GS NFV-IFA 005: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Or-Vi reference point - Interface and Information Model Specification".

[i.6] ETSI GS NFV-IFA 006: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification".

[i.7] ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".

[i.8] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[i.9] ETSI GS NFV-IFA 013: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Os-Ma-nfvo reference point - Interface and Information Model Specification".

[i.10] Recommendation ITU-T X.731: "Information technology - Open Systems Interconnection - Systems Management: State management function".

[i.11] IETF RFC 2228: "FTP Security Extensions".

[i.12] IETF RFC 4217: "Securing FTP with TLS".

[i.13] IANA: "Hypertext Transfer Protocol (HTTP) Status Code Registry".

[i.14] IETF RFC 5246: "The Transport Layer Security (TLS) Protocol Version 1.2".

[i.15] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[i.16] ETSI GS NFV-SOL 001: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV descriptors based on TOSCA specification".

[i.17] ETSI GS NFV-SOL 006: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV descriptors based on YANG Specification".

[i.18] ETSI GS NFV-IFA 032: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Interface and Information Model Specification for Multi-Site Connectivity Services".

[i.19] IETF RFC 7432: "BGP MPLS-Based Ethernet VPN".

[i.20] IETF RFC 4761: "Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling".

[i.21] IETF RFC 6624: "Layer 2 Virtual Private Networks Using BGP for Auto-Discovery and Signaling".

[i.22] IETF RFC 4762: "Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling".

[i.23] IETF RFC 6074: "Provisioning, Auto-Discovery, and Signaling in Layer 2 Virtual Private Networks (L2VPNs)".

[i.24] IETF RFC 4364: "BGP/MPLS IP Virtual Private Networks (VPNs)".

[i.25] IETF RFC 8214: "Virtual Private Wire Service Support in Ethernet VPN".

[i.26] NIST Special Publication 800-57 Part 3 Revision 1: "Recommendation for Key Management, Part 3: Application-Specific Key Management Guidance".

[i.27] 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.28] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3".

[i.29] ETSI GS NFV-IFA 036: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for container cluster management and orchestration specification".

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.1], ETSI GS NFV-IFA 031 [1] and the following apply:

NOTE: A term defined in the present document takes precedence over the definition of the same term, if any, in the documents listed above.

NFV-MANO management interfaces: interfaces for managing the NFV-MANO functional entities

NOTE: The protocols and data models of the NFV-MANO management interfaces are defined in the present document.

peer functional entity: functional entity from which interfaces are consumed by the producer NFV-MANO functional entity

NOTE: In the present document, "peer entity" is also used interchangeably.

producer NFV-MANO functional entity: NFV-MANO functional entity that produces the NFV-MANO management interfaces

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GR NFV 003 [i.1], ETSI GS NFV-IFA 031 [1] and the following apply:

BGP Border Gateway Protocol
EVPN Ethernet VPN

L2TP	Layer 2 Tunnelling Protocol
LDP	Label Distribution Protocol
MPLS	Multiprotocol Label Switching
VPLS	Virtual Private LAN Service
VPN	Virtual Private Network
VPWS	Virtual Private Wire Service

4 General aspects

4.1 Overview

The present document defines the protocol and data model for the interfaces used for the management of NFV-MANO functional entities, in the form of RESTful Application Programming Interface (API) specifications:

- NFV-MANO configuration and information management interface;
- NFV-MANO performance management interface;
- NFV-MANO fault management interface;
- NFV-MANO log management interface.

Table 4.1-1 lists the versions of the APIs defined in the present document.

Table 4.1-1: Versions of the APIs specified in the present document

API	API version
NFV-MANO configuration and information management interface	2.11.0
NFV-MANO performance management interface	2.0.0
NFV-MANO fault management interface	1.0.1
NFV-MANO log management interface	1.0.1

The interfaces are produced by the NFV-MANO functional entity, which acts as API producer, and can be consumed by an authorized external entity, which acts as API consumer. For more information, clause 4.2 of ETSI GS NFV-IFA 031 [1] defines the framework for the management of NFV-MANO.

The design of the protocol and data model for the above interfaces is based on the information model and requirements defined in ETSI GS NFV-IFA 031 [1]. In clause 4, general aspects such as common data types are specified that apply to multiple APIs produced by the NFV-MANO functional entity. In addition, the provisions in clauses 4, 5, 6, 8 and 9 of ETSI GS NFV-SOL 013 [4] define common aspects of RESTful NFV-MANO APIs, and shall apply for all APIs defined in the present document.

In the subsequent clauses, the protocol and data model for the individual interfaces are specified. Per interface, the resource structure with associated HTTP methods is defined and applicable flows are provided. Further, the resources and the data model are specified in detail.

Annex A provides the mapping of the combination of resources and methods defined in the present document to the operations defined in ETSI GS NFV-IFA 031 [1].

Even though the different interfaces defined in the present document are related, implementations shall not assume a particular order of messages that arrive via different interfaces.

4.2 NFV-MANO management concepts

4.2.1 Introduction

The framework for the management of NFV-MANO functional entities is specified in clause 4.2 of ETSI GS NFV-IFA 031 [1]. The framework is based on the definition and exposure of a set of management interfaces by the NFV-MANO functional entities. The data model and protocol specification of these interfaces is the scope of the present document.

4.2.2 NFV-MANO functional entity composition

4.2.2.1 NFV-MANO functional entity

An NFV-MANO functional entity represents a realization of a functional block part of the NFV-MANO architectural framework as specified in ETSI GS NFV 006 [i.3]. The following NFV-MANO functional blocks are identified:

- NFV Orchestrator (NFVO);
- VNF Manager (VNFM); and
- Virtualised Infrastructure Manager (VIM).

In addition, ETSI GS NFV-IFA 010 [i.4] defines the case of the WAN Infrastructure Manager (WIM) as part of the NFV-MANO framework.

To support the management and orchestration of OS containers in CIS clusters and the management of OS container software images, ETSI GS NFV-IFA 010 [i.4] also introduces the NFV-MANO function Container Infrastructure Service Management (CISM) and Container Image Registry (CIR). To support the management and orchestration of CIS clusters, ETSI GS NFV-IFA 010 [i.4] also introduces the NFV-MANO function CIS Cluster Management (CCM).

The functional requirements for the NFVO, VNFM, VIM, WIM, CIR, CISM and CCM are specified in ETSI GS NFV-IFA 010 [i.4]. The APIs specified in the present document allow an API consumer to manage an NFV-MANO functional entity and fulfil the configuration, monitoring and retrieval of relevant information enabling the maintenance and operation of the NFV-MANO by the service provider. In the present document, the NFV-MANO functional entity that is being managed is also referred as "producer NFV-MANO functional entity", in reference to the entity "producing" the set of NFV-MANO management interface.

An NFV-MANO functional entity is a managed object on which (not an exhaustive list):

- performance measurements related to resources used by the entity can be collected/reported;
- information about the entity can be collected;
- various parameters about the entity can be configured; and
- fault information about the entity can be notified and collected.

Figure 4.2.2.1-1 illustrates an example of the relationship between the different concepts introduced in the present and following clauses. A description of the example is available in clause 4.3 of ETSI GS NFV-IFA 031 [1].

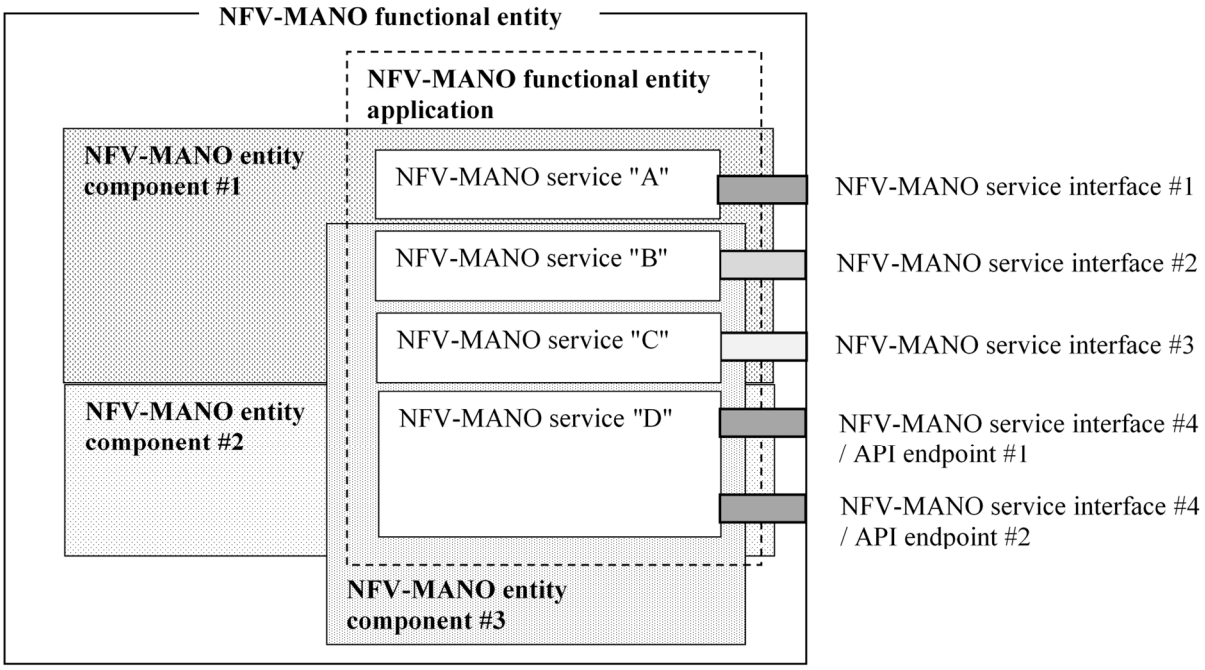

Figure 4.2.2.1-1: Example of relationship between NFV-MANO functional entity, NFV-MANO functional entity application, NFV-MANO service and NFV-MANO service interface (from ETSI GS NFV-IFA 031 [1])

4.2.2.2 NFV-MANO service

As specified in ETSI GS NFV-IFA 031 [1], an NFV-MANO functional entity provides NFV-MANO services. An NFV-MANO service corresponds to one or more capabilities offered by the NFV-MANO functional entity using a defined interface. The NFV-MANO service represents the "backend handler" of the corresponding interface.

EXAMPLE 1: The VNFM offers an NFV-MANO service for VNF lifecycle management. The NFVO offers an NFV-MANO service for NS lifecycle management.

The types of NFV-MANO services offered by an NFV-MANO functional entity are determined by the set of NFV-MANO service interfaces exposed by the producer NFV-MANO functional entity. The relationship of a type of NFV-MANO service and a type of NFV-MANO service interface is 1:1 (see clause 4.3 of ETSI GS NFV-IFA 031 [1]).

EXAMPLE 2: A VNFM that exposes the following set of interfaces: [VNF lifecycle management interface, VNF performance management interface, VNF fault management interface, and VNF indicator interface] is regarded to support the following set of NFV-MANO services: [VNF lifecycle management, VNF performance management, VNF fault management, and VNF indicator].

There can be dependencies among the set of NFV-MANO services offered by an NFV-MANO functional entity. Such dependencies impact the NFV-MANO management functionality that can be performed on the NFV-MANO services. Therefore, from the NFV-MANO management perspective, an NFV-MANO service is a managed object on the producer NFV-MANO functional entity, on which only:

- performance measurements can be collected/reported; and
- information about the service can be collected.

NOTE: The present document does not specify the implementation dependencies among NFV-MANO services, if any.

4.2.2.3 NFV-MANO service interface

An NFV-MANO service interface is an interface, associated to an NFV-MANO service, over which operations can be invoked and/or notifications issued (see ETSI GS NFV-IFA 031 [1]). The set of NFV-MANO service interfaces that can be produced by a given NFV-MANO functional entity is the set of interfaces specified in the respective information model (stage 2) and data model and protocol (stage 3) specifications.

EXAMPLE: The set of interfaces exposed by the VNFM are specified (at stage 3) in the ETSI GS NFV-SOL 002 [9] and ETSI GS NFV-SOL 003 [10], and include: VNF lifecycle management interface, VNF performance management interface, VNF fault management interface, and VNF indicator interface.

An NFV-MANO service interface is a managed object on the producer NFV-MANO functional entity, on which (not an exhaustive list):

- performance measurements can be collected/reported;
- information about the interface can be collected;
- various parameters about the interface can be configured; and
- the administrative and operational state can be changed.

4.2.2.4 NFV-MANO functional entity application and NFV-MANO functional entity components

For management purposes, an NFV-MANO functional entity is comprised of a set of NFV-MANO functional entity components and an NFV-MANO functional entity application.

Furthermore, an NFV-MANO functional entity can be decomposed into a set of NFV-MANO functional entity components to address functional requirements such as the implementation of the functionality exposed over the NFV-MANO service interfaces, which can in turn influence the dependency among the set of NFV-MANO services, and non-functional requirements such as scalability, resiliency, versioning, etc.

NOTE: It is out of scope of the present document how many NFV-MANO functional entity components and what sub-set of instances of NFV-MANO services is to be supported by an NFV-MANO functional entity component.

4.2.3 Peer functional entity and consumed NFV-MANO interfaces

The NFV-MANO architectural framework specifies a set of reference points in between the NFV-MANO functional blocks (i.e. the Or-Vi, Or-Vnfm and Vi-Vnfm reference points, hereafter referred to as "internal NFV-MANO reference points") and from the NFV-MANO functional blocks to other external entities (i.e. Nf-Vi, Ve-Vnfm-em/vnf, and Os-Ma-nfvo reference points, hereafter referred to as "external NFV-MANO reference points"). The reference points determine points of interaction in between the participating entities.

For the specific case of the "internal NFV-MANO reference points", an NFV-MANO functional entity can consume NFV-MANO services from another NFV-MANO functional entity.

EXAMPLE 1: The NFVO consumes NFV-MANO services from the VIM over the Or-Vi reference point, and NFV-MANO services from the VNFM over the Or-Vnfm reference point.

For the specific case of the "external NFV-MANO reference points", an NFV-MANO functional entity can consume interfaces from an external entity.

In both contexts (i.e. internal and external reference points interactions), for a given NFV-MANO functional entity exists a "peering" relationship towards another entity. To establish such a peering relationship and consume NFV-MANO services from the peer entity, the managed NFV-MANO functional entity needs to be made aware of such interaction availability.

EXAMPLE 2: Assuming a scenario with three NFV-MANO functional entities corresponding to one NFVO, one VNFM and one VIM, and the NFVO is the entity being managed (the target of management). In this scenario, the NFVO connects to and makes use of NFV-MANO services offered by the VNFM and the VIM. From NFVO's perspective, the VNFM and VIM are the peer NFV-MANO entities. Therefore, the NFVO, as a managed entity, holds information and configuration related to how to interact/communicate with the VNFM and VIM.

Part of the configuration and information of a peer functional entity concerns to the usage of the interfaces exposed by the peer functional entity. The consuming side of the interface, which is the responsibility of the NFV-MANO functional entity being managed is referred as "consumed interface". A consumed interface is also a managed object on the producer NFV-MANO functional entity, on which (not an exhaustive list):

- performance measurements can be collected/reported;
- information about the interface can be collected; and
- various parameters about the interface can be configured.

Figure 4.2.3-1 illustrates an example depicting an NFVO, a VNFM and two NFV-MANO management consumers who can manage the two entities using the produced NFV-MANO management interfaces. From the point of view of the consumer #1, who manages the NFVO, configuration and information with regards to the VNFM as a peer entity of the NFVO can be set, particularly in this example, information and configuration about the interfaces that can be consumed from the VNFM. Similarly, the consumer #2 can do the same with regards to NFVO, which is a peer NFV-MANO entity from the VNFM's perspective.

NOTE: For the sake of simplicity, the example and figure do not illustrate all resources involved in the management of the NFVO and the VNFM; in particular those involved in the configuration and information of the managed entities, the NFVO for the consumer #1, and the VNFM for the consumer #2.

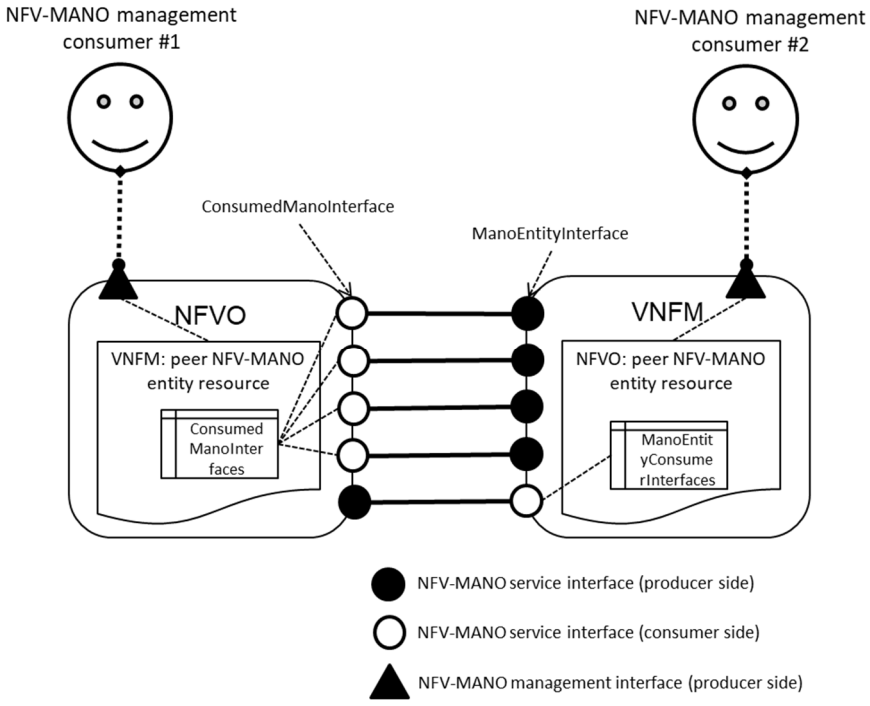

Figure 4.2.3-1: Example of peering between an NFVO and VNFM

4.2.4 Consumption of NFV-MANO management APIs

Clause 4.2 of ETSI GS NFV-IFA 031 [1] specifies the framework for the management of NFV-MANO. The present specification specifies the NFV-MANO management APIs. The APIs are produced by the NFV-MANO functional entity, which acts as API producer, and can be consumed by an authorized external entity, which acts as API consumer. A specific instance of NFV-MANO functional entity that exposes such an API is also referred as "producer NFV-MANO functional entity". An example of API consumer is an external entity to NFV-MANO, such as a "MANO monitor entity" within the OSS/BSS of the service provider (see clause 4.2.2 of ETSI GS NFV-IFA 031 [1]). Under proper security control other NFV-MANO functional entities may be allowed to act as an API consumer to consume certain NFV-MANO management services and functionality (see clause 4.2.3 of ETSI GS NFV-IFA 031 [1]).

4.3 Common data types

4.3.1 General

The data type definitions in clause 7.1 of ETSI GS NFV-SOL 013 [4] apply.

4.3.2 Structured data types

4.3.2.1 Introduction

This clause defines data structures that are referenced from data structures in multiple interfaces. In addition, the structured data types defined in clause 7.1 of ETSI GS NFV-SOL 013 [4] shall apply.

4.3.2.2 Type: ManoEntitySubscriptionFilter

This type represents subscription filter criteria to match NFV-MANO functional entities and their associated managed objects. It shall comply with the provisions defined in table 4.3.2.2-1.

Table 4.3.2.2-1: Definition of the ManoEntitySubscriptionFilter data type

Attribute name	Data type	Cardinality	Description
manoEntityId	Identifier	0..1	If present, match the NFV-MANO functional entity with an instance identifier listed in this attribute.
manoServiceIds	IdentifierInManoEntity	0..N	If present, match NFV-MANO services with an instance identifier listed in this attribute. See note 1.
manoServiceNames	String	0..N	If present, match NFV-MANO services with an NFV-MANO service name listed in this attribute. See note 1.
manoServiceInterfaceIds	IdentifierInManoEntity	0..N	If present, match NFV-MANO functional entity produced interfaces with an instance identifier listed in this attribute. See note 2.
manoServiceInterfaceNames	String	0..N	If present, match NFV-MANO functional entity produced interfaces with an instance Name listed in this attribute. See note 2.
consumedManoInterfaceIds	Identifier	0..N	If present, match NFV-MANO functional entity consumed interfaces with an instance identifier listed in this attribute. See note 3.
consumedManoInterfaceNames	String	0..N	If present, match NFV-MANO functional entity consumed interfaces with an instance Name listed in this attribute. See note 3.

Attribute name	Data type	Cardinality	Description
NOTE 1: The attributes "manoServiceIds" and "manoServiceNames" are alternatives to reference to NFV-MANO services in a filter. They should not be used together in the same filter instance, but one alternative should be chosen. NOTE 2: The attributes "manoServiceInterfaceIds" and "manoServiceInterfaceNames" are alternatives to reference to NFV-MANO functional entity produced interfaces in a filter. They should not be used both in the same filter instance, but one alternative should be chosen. NOTE 3: The attributes "consumedManoInterfaceIds" and "consumedManoInterfaceNames" are alternatives to reference to NFV-MANO functional entity consumed interfaces in a filter. They should not be used both in the same filter instance, but one alternative should be chosen.			

4.3.2.3 Type: ManoManagedObjectReference

This type represents the identifier to reference a managed object of a particular type. It shall comply with the provisions defined in table 4.3.2.3-1.

Table 4.3.2.3-1: Definition of the ManoManagedObjectReference data type

Attribute name	Data type	Cardinality	Description
type	Enum (inlined)	1	Indicates the type of managed object. Permitted values: • MANO_ENTITY • MANO_SERVICE • MANO_SERVICE_IF • CONSUMED_MANO_IF • MANO_ENTITY_COMPONENT See note.
objectId	Identifier	1	Identifier of the managed object. • If type="MANO_ENTITY", it corresponds to the value of the attribute "id" of the "ManoEntity" representing an NFV-MANO functional entity. • If type="MANO_SERVICE", it corresponds to the value of the attribute "id" of the "ManoEntity" representing the NFV-MANO functional entity that contains the "ManoService" sub-object. • If type="MANO_SERVICE_IF", it corresponds to the value of the attribute "id" of the "ManoServiceInterface" representing the NFV-MANO functional entity that contains the "ManoServiceInterface" sub-object. • If type="CONSUMED_MANO_IF", the value corresponds to the value of the attribute "id" of the "ConsumedManoInterfaceInfo" representing a consumed NFV-MANO service interface from a peer functional entity. • If type="MANO_ENTITY_COMPONENT", the value corresponds to the value of the attribute "id" of the "ManoEntity" representing the NFV-MANO functional entity that contains the "ManoEntityComponent" sub-object. See note.

Attribute name	Data type	Cardinality	Description
subObjectId	IdentifierInManoEntity	0..1	Identifier of the managed sub-object. It shall be present if type equals to "MANO_SERVICE" or "MANO_SERVICE_IF" or "MANO_ENTITY_COMPONENT". • If type="MANO_SERVICE", it corresponds to the value of the attribute "id" of the "ManoService" representing an individual NFV-MANO service. • If type="MANO_SERVICE_IF", it corresponds to the value of the attribute "id" of the "ManoServiceInterface" representing an individual NFV-MANO service interface. • If type="MANO_ENTITY_COMPONENT", it corresponds to the value of the attribute "id" of the "ManoEntityComponent" representing an NFV-MANO functional entity component. See note.
NOTE: The "MANO_ENTITY_COMPONENT" is only applicable if attribute "manoEntityComponents" in "ManoEntity" is supported by the API producer.			

4.3.3 Simple data types and enumerations

4.3.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in multiple interfaces.

4.3.3.2 Simple data types

Table 4.3.3.2-1 defines simple data types for reference from data type definitions in the present document. In addition, the simple data type definitions in clause 7.2.2 of ETSI GS NFV-SOL 013 [4] shall apply.

Table 4.3.3.2-1: Simple data types

Type name	Description
IdentifierInManoEntity	An identifier that is unique for the respective type within an NFV-MANO functional entity, but that need not be globally unique. Representation: string of variable length.
IdentifierLocal	An identifier that is unique within a limited local scope other than above listed identifiers, such as within a complex data structure or within a request-response pair. Representation: string of variable length.

4.3.3.3 Enumerations

The enumerations defined in clause 7.2.3 of ETSI GS NFV-SOL 013 [4] shall apply to be available for referencing from data type definitions in the present document.

5 NFV-MANO Configuration and Information Management interface

5.1 Description

This interface allows a consumer to configure the producer NFV-MANO functional entity. The interface also allows the consumer to query configuration data and other information from the producer NFV-MANO functional entity. In addition, the interface allows the consumer to request changing the state of the NFV-MANO functional entity application and its supported NFV-MANO services. Finally, the interface also allows the consumer to subscribe to notifications regarding changes of configuration data and other information, and changes in the state of the producer NFV-MANO functional entity application and its supported NFV-MANO services.

The NFV-MANO configuration and information management interface provided by an NFV-MANO functional entity supports the following operations:

- Modify Config;
- Query Config Info;
- Subscribe;
- Terminate Subscription;
- Notify;
- Query Subscription Information;
- Change State.

This interface allows API version information retrieval.

5.2 API version

For the NFV-MANO configuration and information management interface as specified in the present document, the MAJOR version field shall be 2, the MINOR version field shall be 11 and the PATCH version field shall be 0 (see clause 9.1 of ETSI GS NFV-SOL 013 [4] for a definition of the version fields). Consequently, the {apiMajorVersion} URI field shall be set to "v2".

5.3 Resource structure and method

All resource URIs of the API shall use the base URI specification defined in clause 4.1 of ETSI GS NFV-SOL 013 [4]. The string "nfvmanocim" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the above base URI.

Figure 5.3-1 shows the overall resource URI structure defined for the NFV-MANO configuration and information management interface.

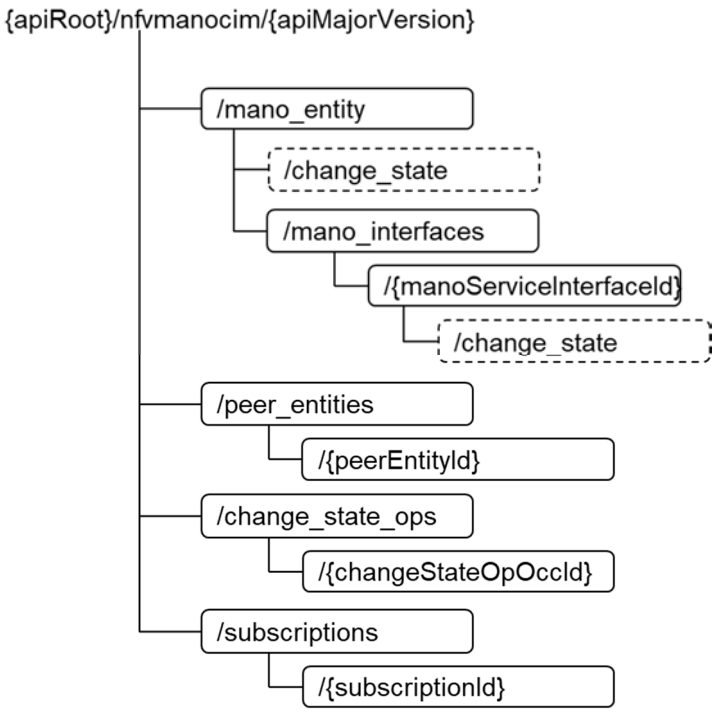

Figure 5.3-1: Resource URI structure of the NFV-MANO configuration and information management interface

Table 5.3-1 lists the individual resources defined, and the applicable HTTP methods.

The NFV-MANO functional entity shall support responding to requests for all HTTP methods on the resources in table 5.3-1 that are marked as "M" (mandatory) in the "Cat" column. The NFV-MANO functional entity shall support the "API versions" resources as specified in clause 9.3.2 of ETSI GS NFV-SOL 013 [4].

Table 5.3-1: Resources and methods overview of the NFV-MANO configuration and information management interface

Resource name	Resource URI	HTTP Method	Cat	Meaning
NFV-MANO entity	/mano_entity	GET	M	Read an NFV-MANO entity resource.
		PATCH	M	Modify NFV-MANO functional entity configuration and information.
Change NFV-MANO entity state task	/mano_entity/change_state	POST	M	Change the state of the NFV-MANO functional entity application.
NFV-MANO service interfaces	/mano_entity/mano_interfaces	GET	M	Query information of multiple NFV-MANO service interfaces of the NFV-MANO functional entity.
Individual NFV-MANO service interface	/mano_entity/mano_interfaces/{manoServiceInterfaceId}	GET	M	Read configuration and information of an NFV-MANO service interface.
		PATCH	M	Modify configuration and information of an NFV-MANO service interface.
Change interface state task	/mano_entity/mano_interfaces/{manoServiceInterfaceId}/change_state	POST	M	Change the state of the individual NFV-MANO service interface.
Peer entities	/peer_entities	POST	M	Create in the producer NFV-MANO functional entity a resource containing configuration and information with regards to a new peer functional entity resource.
		GET	M	Query information and configuration in the producer NFV-MANO functional entity with regards to multiple peer functional entities.

Resource name	Resource URI	HTTP Method	Cat	Meaning
Individual peer entity	/peer_entities/{peerEntityId}	GET	M	Read configuration and information in the producer NFV-MANO functional entity with regards to a peer functional entity.
		PATCH	M	Modify configuration and information of the producer NFV-MANO functional entity with regards of a peer functional entity.
		DELETE	M	Delete in the producer NFV-MANO functional entity a resource containing configuration and information with regards to related to an individual peer functional entity resource.
Change state operations	/change_state_ops	GET	M	Query multiple change state operation occurrences.
Individual change state operation	/change_state_ops/{changeStateOpOccId}	GET	M	Read an individual change state operation occurrence.
Subscriptions	/subscriptions	POST	M	Subscribe to configuration and information change notifications.
		GET	M	Query multiple subscriptions.
Individual subscription	/subscriptions/{subscriptionId}	GET	M	Read an individual subscription resource.
		DELETE	M	Terminate a subscription.
Notification endpoint	(client-provided)	POST	See note	Notify about configuration, information and state changes. See note.
		GET	See note	Test the notification endpoint. See note.
NOTE: The NFV-MANO functional entity shall support invoking the HTTP methods defined for the "Notification endpoint" resource exposed by the consumer. If the consumer supports invoking the POST method on the "Subscriptions" resource towards the NFV-MANO functional entity, it shall also support responding to the HTTP requests defined for the "Notification endpoint" resource.				

5.4 Sequence diagrams

5.4.1 Flow of the Read Config Info operation

This clause describes the sequence for reading configuration and information about an NFV-MANO functional entity.

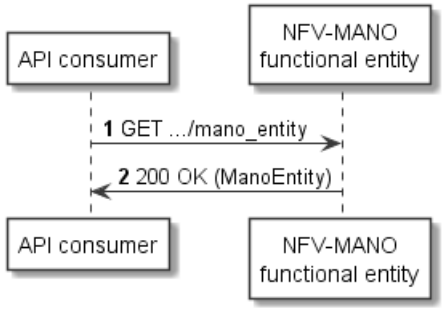

Figure 5.4.1-1: Flow of NFV-MANO entity read

NFV-MANO entity read, as illustrated in figure 5.4.1-1, consists of the following steps:

1) The API consumer sends a GET request to the "NFV-MANO entity" resource.

2) The NFV-MANO functional entity returns a "200 OK" response to the API consumer and includes one data structure of type "ManoEntity" in the message content.

Error handling: In case of failure, the NFV-MANO functional entity provides in the response appropriate error information.

5.4.2 Flow of the Modify Config operation

This clause describes the sequence for modifying configuration of an NFV-MANO functional entity.

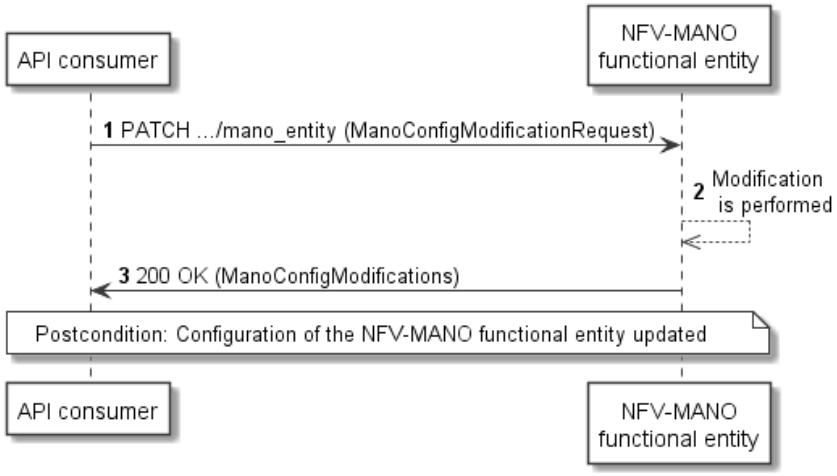

Figure 5.4.2-1: Flow of modification of NFV-MANO entity

NFV-MANO configuration modification, as illustrated in figure 5.4.2-1, consists of the following steps:

1) The API consumer sends a PATCH request to the "NFV-MANO entity" resource that is to be re-configured and includes in the message content a data structure of type "ManoConfigModificationRequest".

2) The NFV-MANO functional entity performs the modification.

3) The NFV-MANO functional entity returns a "200 OK" response and includes in the message content a data structure of type "ManoConfigModifications" to indicate the completion of the operation, and the performed changes.

Postcondition: Upon successful completion, configuration of the NFV-MANO functional entity is updated.

Error handling: If the updating/modification of the NFV-MANO functional entity configuration fails, the NFV-MANO functional entity provides in the response appropriate error information.

5.4.3 Flow of subscriptions management

This clause describes the procedure for creating, querying/reading and terminating subscriptions to notifications related to NFV-MANO configuration and information management.

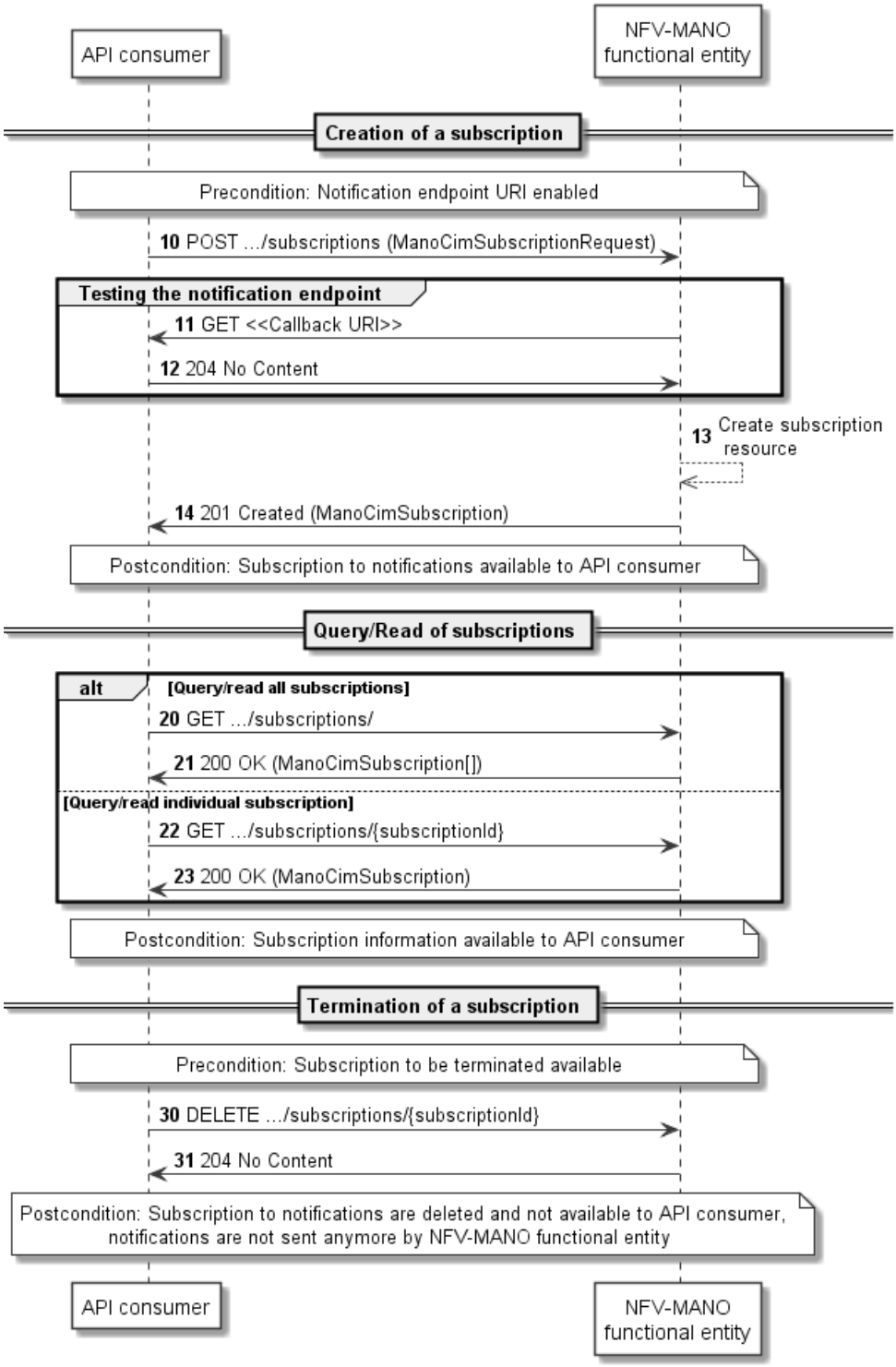

Figure 5.4.3-1: Flow of subscriptions management (create, query/read, terminate)

A) Procedure of creating subscriptions

The procedure of creating subscriptions consists of the following steps, as illustrated in figure 5.4.3-1:

Precondition: The notification endpoint URI is enabled.

10) The API consumer sends a POST request to the "Subscriptions" resource including in the message content a data structure of type "CimSubscriptionRequest". The data structure contains filtering criteria and a client side URI to which the NFV-MANO functional entity will subsequently send notifications about events that match the filter.

11) To test the notification endpoint that was registered by the API consumer as part of the subscription, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

12) The API consumer returns a "204 No Content" response to indicate success.

13) The NFV-MANO functional entity creates a new subscription to notifications related to NFV-MANO configuration and information changes, and a resource that represents this subscription.

14) The NFV-MANO functional entity returns a "201 Created" response containing a data structure of type "CimSubscription" representing the subscription resource just created by the NFV-MANO functional entity, and provides the URI of the newly created resource in the "Location" HTTP header.

Postcondition: The subscription to notifications related to NFV-MANO configuration and information changes is available to the API consumer.

Error handling: The NFV-MANO functional entity rejects a subscription if the subscription information is not valid: invalid notification endpoint, subscription information is malformed, etc.

B) Procedure of querying/reading subscriptions

The procedure of querying/reading subscriptions consists of the following steps, as illustrated in figure 5.4.3-1:

20) If needed, e.g. to recover from an error situation, the API consumer may query information about its subscriptions by sending a GET request to the resource representing the subscriptions.

21) In case of step 20), the NFV-MANO functional entity returns a "200 OK" response that contains zero or more representations of all existing subscriptions that were created by the API consumer.

22) If needed, e.g. to recover from an error situation, the API consumer may read information about a particular subscription by sending a GET request to the resource representing that individual subscription.

23) In case of step 22), the NFV-MANO functional entity returns a "200 OK" response that contains a representation of that individual subscription.

Postcondition: The subscription information is available to the API consumer.

Error handling: The NFV-MANO functional entity provides in the response message appropriate error information that reports an erroneous query request.

C) Procedure of terminating a subscription

The procedure of terminating a subscription consists of the following steps, as illustrated in figure 5.4.3-1:

Precondition: The subscription to be terminated is available.

30) If the API consumer does not need the subscription anymore, the subscription can be terminated by sending a DELETE request to the resource that represents the individual subscription to remove.

31) The NFV-MANO functional entity acknowledges the successful termination of the subscription by returning a "204 No Content" response.

Postcondition: The subscription to notifications related to NFV-MANO configuration and information changes is deleted and not available to the API consumer, and notifications associated to this subscription are not sent anymore by the NFV-MANO functional entity.

Error handling: The NFV-MANO functional entity provides in the response message appropriate error information that reports an erroneous termination request: the subscription to terminate is not available, etc.

5.4.4 Flow of sending notifications

This clause describes the procedure for sending notifications related to NFV-MANO configuration and information management.

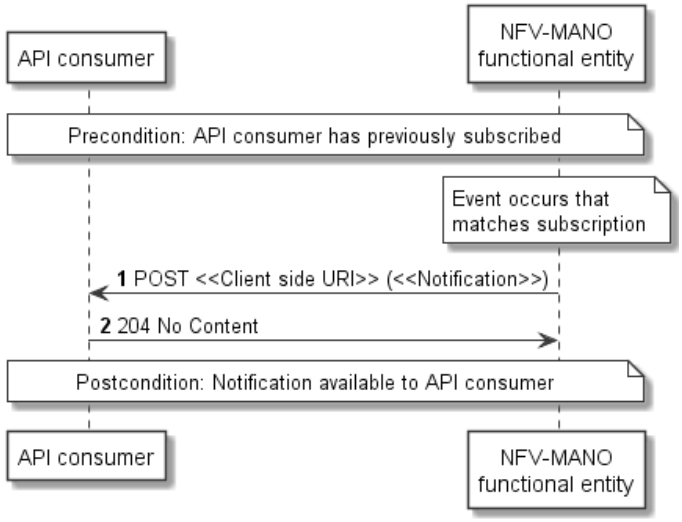

Figure 5.4.4-1: Flow of sending notifications

The procedure of sending notifications consists of the following steps, as illustrated in figure 5.4.4-1:

Precondition: The API consumer has subscribed previously to notifications related to NFV-MANO configuration and information management and the NFV-MANO functional entity has thus a related subscription.

1) If an event occurs that matches the filtering criteria which are part of the subscription, the NFV-MANO functional entity generates a notification that includes information about the event, and send it in the body of a POST request to the URI which the API consumer has registered as part of the subscription request.

NOTE: The variable <<Notification>> in the flow is a placeholder for the different types of notifications that can be sent by this API (see clauses 5.6.2.7 and 5.6.2.10).

2) The API consumer returns a "204 No Content" response to acknowledge the successful delivery of the notification.

Postcondition: The notification has been made available to the API consumer.

Error handling: If the NFV-MANO functional entity does not receive the "204 No Content" response from the API consumer, it can retry sending the notification.

5.4.5 Flow of changing the state of a managed entity

This clause describes the procedure for changing the operational state of the NFV-MANO functional entity application or NFV-MANO service interface (hereafter referred also as managed entity).

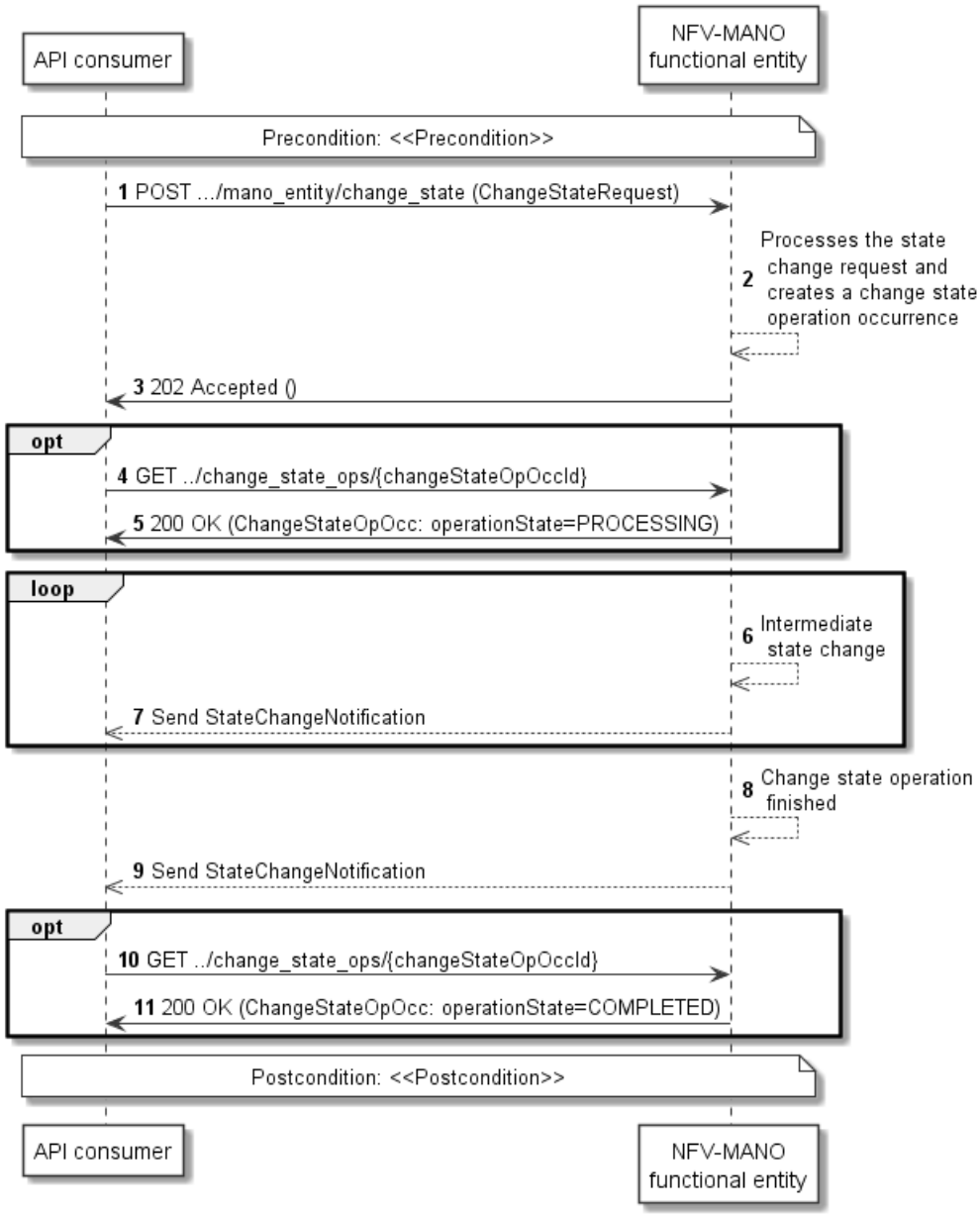

Figure 5.4.5-1: Flow of changing the state of a managed entity

The procedure of changing the state of the managed entity consists of the following steps, as illustrated in figure 5.4.5-1:

Precondition: The precondition depends on the actual state in which the managed entity is. The state transitions of a managed entity are specified in clause 5.7.

1) The API consumer sends a POST request to the "Change NFV-MANO entity state task" resource, and includes in the message content a data structure of type "ChangeStateRequest", which includes the specific operational state change.

2) The NFV-MANO functional entity processes the state change request and creates a "change state operation occurrence".

3) The NFV-MANO functional entity returns a "202 Accepted" response with an empty message content and a "Location" HTTP header that points to the new "change state operation occurrence" resource.

4) Optionally, the API consumer can poll the "change state operation occurrence" resource to obtain information about the ongoing change state operation by sending a GET request to the resource that represents the change state operation occurrence.

5) In case of step 4), the NFV-MANO functional entity returns to the API consumer information of the operation, such as the operation status, by providing in the message content a data structure of type "ChangeStateOpOcc".

6) Depending on the initial state of the managed entity and the state change request, some intermediate state change can take place.

7) In case of step 6), the NFV-MANO functional entity sends a "StateChangeNotification" to indicate the intermediate state change, with a "change state operation state equal to PROCESSING".

8) The NFV-MANO functional entity has completed the change of state.

9) The NFV-MANO functional entity sends a "StateChangeNotification" to indicate the completion of the change state operation with the success "change state operation state equal to COMPLETED".

10) Optionally, the API consumer can poll the "change state operation occurrence" resource to obtain information about the ongoing change state operation by sending a GET request to the resource that represents the change state operation occurrence.

11) In case of step 10), the NFV-MANO functional entity returns to the API consumer information of the operation, such as the operation status (in this flow, as COMPLETED), by providing in the message content a data structure of type "ChangeStateOpOcc".

Postcondition: The postcondition depends on the actual state in which the managed object is requested to transition to. The state transitions of an NFV-MANO functional entity application are specified in clause 5.7.

Error handling: If the state change of the managed entity fails, error information is provided in the notification message that reports the erroneous completion of the procedure, which is also available in the resource that represents the actual "change state operation occurrence".

5.4.6 Flow of managing information and configuration with regards to peer functional entity

This clause describes the procedures for managing the configuration and information in the producer NFV-MANO functional entity with regards to peer functional entities.

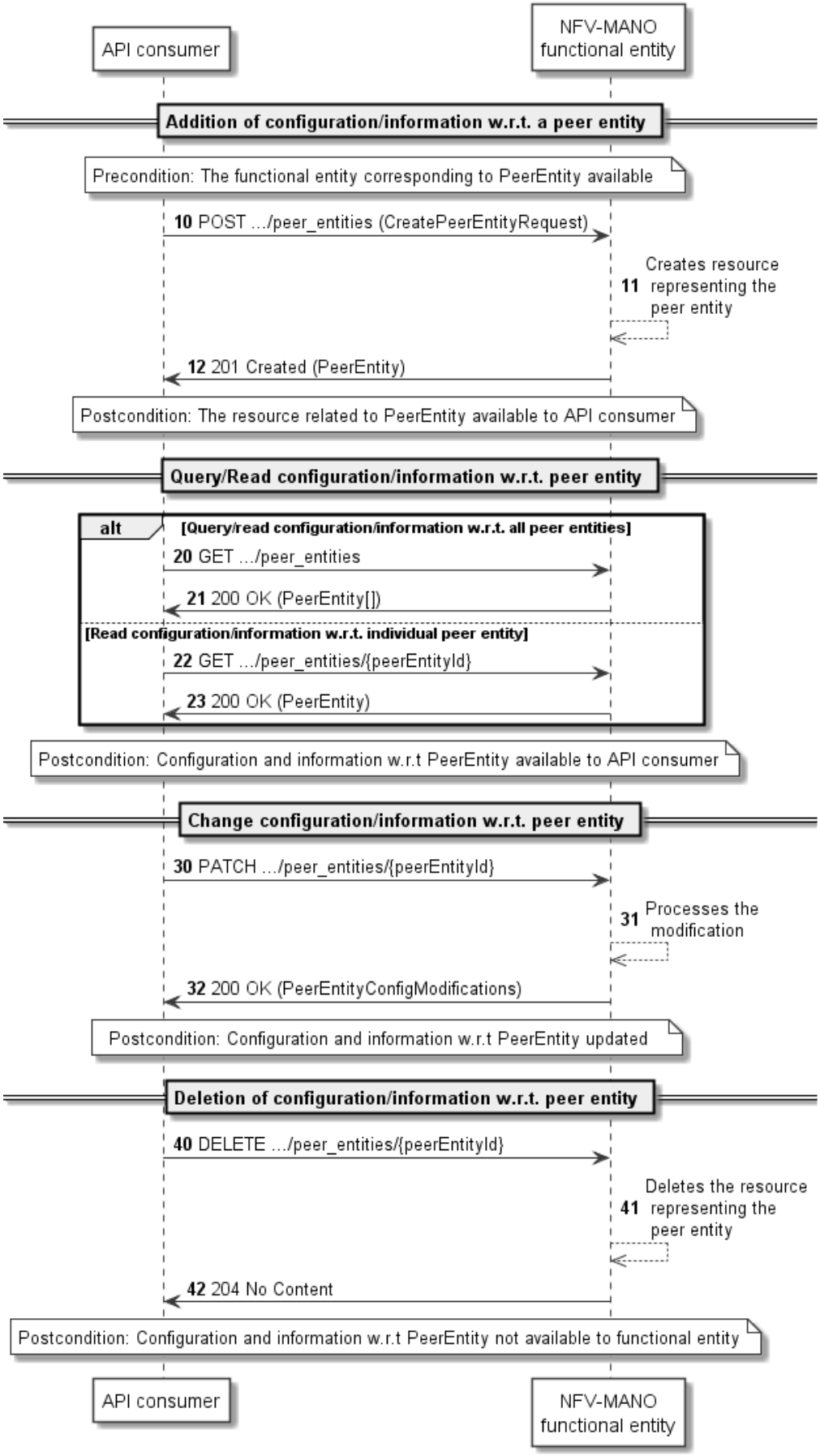

Figure 5.4.6-1: Flow of managing information and configuration with regards to peer functional entity

A) Procedure of adding a configuration/information with regards to a peer functional entity

The procedure of adding new information and configuration on the producer NFV-MANO functional entity with regards to a peer functional entity consists of the following steps, as illustrated in figure 5.4.6-1:

Precondition: The functional entity corresponding to the "peer entity" is available, i.e. it has been deployed and available.

10) The API consumer sends a POST request to the producer NFV-MANO functional entity to create a new peer entity resource, and includes in the message content a data structure of type "CreatePeerEntityRequest".

11) The NFV-MANO functional entity processes the request and creates a resource representing the "peer functional entity".

12) The NFV-MANO functional entity returns a "201 Created" response containing a data structure of type "PeerEntity" representing the resource just created by the NFV-MANO functional entity, and provides the URI of the newly created resource in the "Location" HTTP header.

Postcondition: The resource with the information and configuration related to the peer entity is available to the API consumer.

Error handling: The NFV-MANO functional entity rejects the creation if the information is not valid, such as: a resource corresponding to the peer functional entity already exists. In case of failure, appropriate error information is provided in the response.

B) Procedure of query/read configuration/information with regards to peer entities

The procedure of querying/reading the configuration and information in the producer NFV-MANO functional entity with regards to a peer entity consists of the following steps, as illustrated in figure 5.4.6-1:

20) If the API consumer intends to query all resources concerning peer functional entities, it sends a GET requests to the "Peer entities" resource.

21) In case of step 20), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes zero or more data structures of type "PeerEntity" in the message content.

22) If the API consumer intends to read information and configuration with regards to a particular peer functional entity, it sends a GET request to the "Individual peer entity" resource, addressed by the appropriate peer entity identifier in its resource URI.

23) In case of step 22), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes one data structure of type "PeerEntity" in the message content.

Postcondition: Upon successful completion, configuration and information with regards to the peer functional entities is available to the API consumer.

Error handling: In case of failure, appropriate error information is provided in the response.

C) Procedure of changing configuration/information with regards to a peer entity

The procedure of modifying the configuration and information in the producer NFV-MANO functional entity with regards to a peer entity consists of the following steps, as illustrated in figure 5.4.6-1:

30) The API consumer sends a PATCH request to the "Individual peer entity" resource that is to be operated and includes in the message content a data structure of type "PeerEntityConfigModificationRequest".

31) The NFV-MANO functional entity performs the modification.

32) The NFV-MANO functional entity returns a "200 OK" response and includes in the message content a data structure of type "PeerEntityConfigModifications" to indicate the completion of the operation, and the performed changes.

Postcondition: Upon successful completion, configuration and information with regards to the peer functional entity is updated.

Error handling: If the update/modification of the configuration and information with regards to the peer functional entity fails, the NFV-MANO functional entity provides in the response appropriate error information.

D) Procedure of deleting configuration/information with regards to a peer entity

The procedure of deleting the configuration and information in the producer NFV-MANO functional entity with regards to a peer entity consists of the following steps, as illustrated in figure 5.4.6-1:

40) If the API consumer intends to delete the configuration and information with regards to a particular peer functional entity, it sends a DELETE request to the "Individual peer NFV-MANO entity" resource, addressed by the appropriate individual peer entity identifier in its resource URI.

41) The NFV-MANO functional entity deletes the "Individual peer entity" resource.

42) The NFV-MANO functional entity returns a "204 No Content" response and an empty message content to the API consumer.

Postcondition: Upon successful completion, configuration and information with regards to the peer functional entity is not available in the producer NFV-MANO functional entity.

Error handling: In case of failure, appropriate error information is provided in the response.

5.5 Resources

5.5.1 Introduction

This clause defines all the resources and methods provided by the NFV-MANO configuration and information management interface.

5.5.2 Resource: API versions

The "API versions" resources as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [4] are part of the NFV-MANO configuration and information management interface.

5.5.3 Resource: NFV-MANO entity

5.5.3.1 Description

This resource represents an NFV-MANO functional entity. The client can use this resource to read and modify configuration and information data about the NFV-MANO functional entity.

5.5.3.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/mano_entity

This resource shall support the resource URI variables defined in table 5.5.3.2-1.

Table 5.5.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.

5.5.3.3 Resource methods

5.5.3.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.3.3.2 GET

The GET method retrieves information about an NFV-MANO functional entity by reading the NFV-MANO entity resource.

This method shall follow the provisions specified in tables 5.5.3.3.2-1 and 5.5.3.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.3.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	ManoEntity	1	200 OK	Shall be returned when configuration and information about the NFV-MANO functional entity has been read successfully. The response body shall contain a representation of the NFV-MANO functional entity, as defined in clause 5.6.2.2.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.3.3.4 PATCH

The PATCH method modifies the NFV-MANO entity resource.

Changes to the various configuration and information attributes are applied to the NFV-MANO functional entity, and are reflected in the representation of this resource.

This method shall follow the provisions specified in tables 5.5.3.3.4-1 and 5.5.3.3.4-2 for URI query parameters, request and response data structures, and response codes.

If the modification operation has successfully completed, the producer NFV-MANO functional entity shall update the representation of the "NFV-MANO entity" resource to reflect the result of the operation. If the modification operation is not successful, the producer NFV-MANO functional entity shall return to the API consumer information about the error as specified in table 5.5.3.3.4-2.

Table 5.5.3.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.3.3.4-2: Details of the PATCH request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	ManoConfigModificationRequest	1		Parameters for the NFV-MANO configuration and information modification, as defined in clause 5.6.2.3. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [3].
Response body	ManoConfigModifications	1	200 OK	Shall be returned when the modification of configuration on the NFV-MANO functional entity has been accepted and completed.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the "NFV-MANO entity" resource. Typically, this is due to the fact that another configuration and information modification is ongoing. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.4 Resource: Subscriptions

5.5.4.1 Description

This resource represents subscriptions. The client can use this resource to subscribe to notifications related to NFV-MANO configuration and information management, and to query its subscriptions.

5.5.4.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/subscriptions

This resource shall support the resource URI variables defined in table 5.5.4.2-1.

Table 5.5.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.

5.5.4.3 Resource methods

5.5.4.3.1 POST

The POST method creates a new subscription.

This method shall follow the provisions specified in tables 5.5.4.3.1-1 and 5.5.4.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual subscription" resource as defined in clause 5.5.5 shall have been created. This method shall not trigger any notification.

Creation of two "Individual subscription" resources with the same callbackURI and the same filter can result in performance degradation and will provide duplicates of notifications to the API consumer, and might make senses only in very rare use cases. Consequently, the NFV-MANO functional entity may either allow creating an "Individual subscription" resource if another "Individual subscription" resource with the same filter and callbackUri already exists (in which case it shall return the "201 Created" response code), or may decide to not create a duplicate "Individual subscription" resource (in which case it shall return a "303 See Other" response code referencing the existing "Individual subscription" resource with the same filter and callbackUri).

Table 5.5.4.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.4.3.1-2: Details of the POST request/response on this resource

Request body	**Data type**	**Cardinality**	**Description**	
	CimSubscriptionRequest	1	Details of the subscription to be created, as defined in clause 5.6.2.5.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	CimSubscription	1	201 Created	Shall be returned when the subscription has been created successfully. The response body shall contain a representation of the created "Individual subscription" resource. The HTTP response shall include a "Location" HTTP header that points to the created "Individual subscription" resource.
	n/a		303 See Other	Shall be returned when a subscription with the same callbackURI and the same filter already exists and the policy of NFV-MANO functional entity is to not create redundant subscriptions. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the existing "Individual subscription" resource. The response body shall be empty.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 5.5.6.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.4.3.2 GET

The GET method queries the list of active subscriptions of the API consumer that invokes the method. It can be used, e.g. for resynchronization after error situations.

This method shall follow the provisions specified in tables 5.5.4.3.2-1 and 5.5.4.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.4.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the CimSubscription and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 5.5.4.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	CimSubscription	0..N	200 OK	Shall be returned when the list of subscriptions has been queried successfully. The response body shall contain in an array the representations of all active subscriptions of the functional block that invokes the method, i.e. zero or more representations of NFV-MANO configuration and information management subscriptions as defined in clause 5.6.2.6. If the "filter" URI parameter was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clause 5.2.2 of ETSI GS NFV-SOL 013 [4]. If the NFV-MANO functional entity supports alternative #2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative #1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.5 Resource: Individual subscription

5.5.5.1 Description

This resource represents an individual subscription. The client can use this resource to read and to terminate a subscription to notifications related to NFV-MANO configuration and information management.

5.5.5.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 5.5.5.2-1.

Table 5.5.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.
subscriptionId	Identifier of this subscription. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new "Individual subscription" resource. It can also be retrieved from the "id" attribute in the message content of that response.	

5.5.5.3 Resource methods

5.5.5.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.5.3.2 GET

The GET method retrieves information about a subscription by reading an "Individual subscription" resource.

This method shall follow the provisions specified in tables 5.5.5.3.2-1 and 5.5.5.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.5.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.5.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	CimSubscription	1	200 OK	Shall be returned when information about an individual subscription has been read successfully. The response body shall contain a representation of the "Individual subscription" resource.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.5.3.5 DELETE

The DELETE method terminates an individual subscription.

This method shall follow the provisions specified in tables 5.5.5.3.5-1 and 5.5.5.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual subscription" resource shall not exist any longer. This means that no notifications for that subscription shall be sent to the formerly-subscribed API consumer.

NOTE: Due to race conditions, some notifications might still be received by the formerly-subscribed API consumer for a certain time period after the deletion.

Table 5.5.5.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.5.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a	1	204 No Content	Shall be returned when the "Individual subscription" resource has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.6 Resource: Notification endpoint

5.5.6.1 Description

This resource represents a notification endpoint. The API producer can use this resource to send notifications related to NFV-MANO configuration and information management to a subscribed API consumer, which has provided the URI of this resource during the subscription process.

5.5.6.2 Resource definition

The resource URI is provided by the client when creating the subscription.

This resource shall support the resource URI variables defined in table 5.5.6.2-1.

Table 5.5.6.2-1: Resource URI variables for this resource

Name	Definition
none supported	

5.5.6.3 Resource methods

5.5.6.3.1 POST

The POST method delivers a notification from the API producer to an API consumer. The API consumer shall have previously created an "Individual subscription" resource with a matching filter.

This method shall follow the provisions specified in tables 5.5.6.3.1-1 and 5.5.6.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.6.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Each notification request body shall include exactly one of the alternatives defined in table 5.5.6.3.1-2.

Table 5.5.6.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	InformationChangedNotification	1		A notification about configuration and information data changes of the NFV-MANO functional entity.
	ChangeStateNotification	1		A notification about state changes of the NFV-MANO functional entity and its managed objects.
Response body	n/a		204 No Content	Shall be returned when the notification has been delivered successfully.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.6.3.2 GET

The GET method allows the API producer to test the notification endpoint that is provided by the API consumer, e.g. during the subscription process.

This method shall follow the provisions specified in tables 5.5.6.3.2-1 and 5.5.6.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.6.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.6.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned to indicate that the notification endpoint has been tested successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.6.3.3 PUT

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.6.3.4 PATCH

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.6.3.5 DELETE

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.7 Resource: Change NFV-MANO entity state task

5.5.7.1 Description

This resource represents the "Change State" operation for the NFV-MANO functional entity application. The API consumer can use this resource to request changing the state of the NFV-MANO functional entity application.

5.5.7.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/mano_entity/change_state

This resource shall support the resource URI variables defined in table 5.5.7.2-1.

Table 5.5.7.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.

5.5.7.3 Resource methods

5.5.7.3.1 POST

The POST method requests to change the state of the NFV-MANO functional entity application.

This method shall follow the provisions specified in tables 5.5.7.3.1-1 and 5.5.7.3.1-2 for URI query parameters, request and response data structures, and response codes.

The steps and conditions that apply as the result of successfully executing this method are specified in clause 5.7.

Table 5.5.7.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.7.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	ChangeStateRequest	1		Parameters for the change state operation, as defined in clause 5.6.2.8.
Response body	n/a		202 Accepted	Shall be returned when the request has been accepted for processing. The response body shall be empty. The HTTP response shall include a "Location" HTTP header that contains the URI of the newly-created "Individual change state operation occurrence" resource corresponding to the operation.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the resource. Typically, this is due to the fact that the resource is in an incompatible state, or that another change state operation is ongoing. The response body shall contain a ProblemDetails structure, in which the "detail" attribute shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.7.3.2 GET

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.7.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.7.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.8 Resource: Change state operation occurrences

5.5.8.1 Description

This resource represents change state operation occurrences. The API consumer can use this resource to query status information about multiple change state operation occurrences.

5.5.8.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/change_state_ops

This resource shall support the resource URI variables defined in table 5.5.8.2-1.

Table 5.5.8.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.

5.5.8.3 Resource methods

5.5.8.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.8.3.2 GET

The API consumer can use the GET method to query status information about multiple change state operation occurrences.

This method shall follow the provisions specified in tables 5.5.8.3.2-1 and 5.5.8.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.8.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the ChangeStateOpOcc and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support this parameter.
fields	0..1	Complex attributes to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_fields	0..1	Complex attributes to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity shall support this parameter. The following attributes shall be excluded from the ChangeStateOpOcc structure in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: • operationParams.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 5.5.8.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	ChangeStateOpOcc	0..N	200 OK	Shall be returned when status information for zero or more "change state operation occurrences" has been queried successfully. The response body shall contain in an array the status information about zero or more "Individual change state operation occurrences", as defined in clause 5.6.2.9. If the "filter" URI parameter or one of the "all_fields", "fields" (if supported), "exclude_fields" (if supported) or "exclude_default" URI parameters was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clauses 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [4], respectively. If the NFV-MANO functional entity supports alternative #2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative #1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.8.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.8.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.8.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.9 Resource: Individual change state operation occurrence

5.5.9.1 Description

This resource represents a change state operation occurrence. The API consumer can use this resource to read status information about an "Individual change state operation occurrence".

5.5.9.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/change_state_ops/{changeStateOpOccId}

This resource shall support the resource URI variables defined in table 5.5.9.2-1.

Table 5.5.9.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.
changeStateOpOccId	Identifier of a change state operation occurrence. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request triggering a change of state.	

5.5.9.3 Resource methods

5.5.9.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.9.3.2 GET

The API consumer can use the GET method to retrieve status information about a change state operation occurrence by reading an "Individual change state operation occurrence" resource.

This method shall follow the provisions specified in tables 5.5.9.3.2-1 and 5.5.9.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.9.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.9.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	ChangeStateOpOcc	1	200 OK	Shall be returned when information about an "Individual change state operation occurrence" resource has been read successfully. The response body shall contain status information about a change state operation occurrence, as defined in clause 5.6.2.9.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.9.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.9.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.9.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.10 Resource: NFV-MANO service interfaces

5.5.10.1 Description

This resource represents NFV-MANO service interfaces of the producer NFV-MANO functional entity. The client can use this resource to query information about the NFV-MANO service interfaces of the NFV-MANO functional entity.

5.5.10.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces

This resource shall support the resource URI variables defined in table 5.5.10.2-1.

Table 5.5.10.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.

5.5.10.3 Resource methods

5.5.10.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.10.3.2 GET

The GET method queries information about multiple NFV-MANO service interfaces of the NFV-MANO functional entity.

This method shall follow the provisions specified in tables 5.5.10.3.2-1 and 5.5.10.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.10.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the ManoServiceInterface and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support this parameter.
fields	0..1	Complex attributes to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_fields	0..1	Complex attributes to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity shall support this parameter. The following attributes shall be excluded from the ManoServiceInterface structure in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: • none.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 5.5.10.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	ManoServiceInterface	0..N	200 OK	Shall be returned when information about zero or more NFV-MANO service interfaces has been queried successfully. The response body shall contain in an array the representations of zero or more NFV-MANO service interfaces, as defined in clause 5.6.2.11. If the "filter" URI parameter or one of the "all_fields", "fields" (if supported), "exclude_fields" (if supported) or "exclude_default" URI parameters was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clauses 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [4], respectively. If the NFV-MANO functional entity supports alternative #2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative #1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.10.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.10.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.10.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.11 Resource: Individual NFV-MANO service interface

5.5.11.1 Description

This resource represents an individual NFV-MANO service interface of the producer NFV-MANO functional entity. The client can use this resource to modify and read information about the NFV-MANO service interface.

5.5.11.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces/{manoServiceInterfaceId}

This resource shall support the resource URI variables defined in table 5.5.11.2-1.

Table 5.5.11.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.
manoServiceInterfaceId	Identifier of the individual NFV-MANO service interface. See note.
NOTE: This identifier can be retrieved from the "NFV-MANO service interfaces" resource.	

5.5.11.3 Resource methods

5.5.11.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.11.3.2 GET

The GET method retrieves information about an NFV-MANO service interface of the producer NFV-MANO functional entity by reading an "Individual NFV-MANO service interface" resource.

This method shall follow the provisions specified in tables 5.5.11.3.2-1 and 5.5.11.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.11.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.11.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	ManoServiceInterface	1	200 OK	Shall be returned when information about an individual NFV-MANO service interface has been read successfully. The response body shall contain a representation of the NFV-MANO service interface, as defined in clause 5.6.2.11.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.11.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.11.3.4 PATCH

This method is used to modify an "Individual NFV-MANO service interface" resource.

Changes to the configurable parameters of the corresponding NFV-MANO service interface are applied to the information managed by the producer NFV-MANO functional entity and reflected in the representation of this resource.

This method shall follow the provisions specified in tables 5.5.11.3.4-1 and 5.5.11.3.4-2 for URI query parameters, request and response data structures, and response codes.

If the modification operation has successfully completed, the producer NFV-MANO functional entity shall update the representation of the "Individual NFV-MANO service interface" resource to reflect the result of the operation. If the modification operation is not successful, the producer NFV-MANO functional entity shall return to the API consumer information about the error as specified in table 5.5.11.3.4-2.

Table 5.5.11.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.11.3.4-2: Details of the PATCH request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	ManoServiceInterfaceModification Request	1		Parameters for the modification of configuration parameters of the NFV-MANO service interface, as defined in clause 5.6.2.12. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [3].
Response body	ManoServiceInterfaceModifications	1	200 OK	Shall be returned when the request has been accepted and completed. The response body shall contain a representation of the attribute modifications for the "Individual NFV-MANO service interface" resource, as defined in clause 5.6.2.13.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the "Individual NFV-MANO service interface" resource. Typically, this is due to the fact that another operation is ongoing. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.11.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.12 Resource: Change interface state task

5.5.12.1 Description

This resource represents the "Change State" operation for an individual NFV-MANO service interface produced by the NFV-MANO functional entity. The API consumer can use this resource to request changing the state of the produced NFV-MANO service interface.

5.5.12.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces/{manoServiceInterfaceId}/change_state

This resource shall support the resource URI variables defined in table 5.5.12.2-1.

Table 5.5.12.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.
manoServiceInterfaceId	Identifier of the individual NFV-MANO service interface. See note.
NOTE: This identifier can be retrieved from the "NFV-MANO service interfaces" resource.	

5.5.12.3 Resource methods

5.5.12.3.1 POST

The POST method requests to change the state of the NFV-MANO service interface produced by the NFV-MANO functional entity.

This method shall follow the provisions specified in tables 5.5.12.3.1-1 and 5.5.12.3.1-2 for URI query parameters, request and response data structures, and response codes.

The steps and conditions that apply as the result of successfully executing this method are specified in clause 5.7.

Table 5.5.12.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.12.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	ChangeStateRequest	1		Parameters for the change state operation, as defined in clause 5.6.2.8.
Response body	n/a		202 Accepted	Shall be returned when the request has been accepted for processing. The response body shall be empty. The HTTP response shall include a "Location" HTTP header that contains the URI of the newly-created "Individual change state operation occurrence" resource corresponding to the operation.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the resource. Typically, this is due to the fact that the resource is in an incompatible state, or that another change state operation is ongoing. The response body shall contain a ProblemDetails structure, in which the "detail" attribute shall convey more information about the error.

	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.12.3.2 GET

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.12.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.12.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.12.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.13 Resource: Peer entities

5.5.13.1 Description

This resource represents peer functional entities, which can be either NFV-MANO functional entities or other external entities. The client can use this resource to create in the producer NFV-MANO functional entity individual peer entity resources containing configuration and information related to a peer functional entity, and to query in the producer information and configuration about peer entities.

A peer functional entity is a functional entity to which the producer NFV-MANO functional entity (i.e. the one exposing the present API endpoint) establishes a peering relationship to enable the communication and consumption of interfaces. In this sense, the producer NFV-MANO functional entity keeps information and configuration with regards to the peer functional entities via an individual peer entity resource.

5.5.13.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/peer_entities

This resource shall support the resource URI variables defined in table 5.5.13.2-1.

Table 5.5.13.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.

5.5.13.3 Resource methods

5.5.13.3.1 POST

The POST method creates in the producer NFV-MANO functional entity a new peer entity resource which contains configuration and information with regards to the peer functional entity.

This method shall follow the provisions specified in tables 5.5.13.3.1-1 and 5.5.13.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.13.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.13.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	CreatePeerEntityRequest	1		The peer entity creation parameters, as defined in clause 5.6.2.14.
Response body	PeerEntity	1	201 Created	Shall be returned when a new "Individual peer entity" resource has been created successfully. The response body shall contain a representation of the created resource with regards to a peer entity, as defined in clause 5.6.2.15. The HTTP response shall include a "Location" HTTP header that points to the created "Individual peer entity" resource.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.13.3.2 GET

The GET method queries information and configuration in the producer NFV-MANO functional entity with regards to multiple peer entities.

This method shall follow the provisions specified in tables 5.5.13.3.2-1 and 5.5.13.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.13.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity which acts as API producer shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the PeerEntity and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity which acts as API producer shall support this parameter.
fields	0..1	Complex attributes to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity which acts as API producer should support this parameter.
exclude_fields	0..1	Complex attributes to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity which acts as API producer should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity which acts as API producer shall support this parameter. The following attributes shall be excluded from the PeerEntity structure in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: • consumedManoInterfaces.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity which acts as API producer if the entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 5.5.13.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
	Data type	**Cardinality**	**Response Codes**	**Description**
Response body	PeerEntity	0..N	200 OK	Shall be returned when information about zero or more peer entities has been queried successfully. The response body shall contain in an array the resource representations of zero or more peer entities, as defined in clause 5.6.2.15. If the "filter" URI parameter or one of the "all_fields", "fields" (if supported), "exclude_fields" (if supported) or "exclude_default" URI parameters was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clauses 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [4], respectively. If the NFV-MANO functional entity supports alternative #2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].

	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative #1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.13.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.13.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.13.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.14 Resource: Individual peer entity

5.5.14.1 Description

This resource represents configuration and information in the producer NFV-MANO functional entity with regards to an individual peer functional entity. The client can use this resource to read and modify configuration and information in the producer NFV-MANO functional entity with regards to a peer functional entity.

The client can also use this resource to delete the configuration and information in the producer NFV-MANO functional entity with regards to a peer functional entity. By deleting the corresponding resource in the producer NFV-MANO functional entity representing a peer entity, the configuration and information with regards to such peer functional entity is deleted. Consequently, the peering relationship between the producer NFV-MANO functional entity and the peer entity is terminated, i.e. the producer NFV-MANO functional entity does not have the necessary information to communicate/interact with the peer entity.

5.5.14.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanocim/{apiMajorVersion}/peer_entities/{peerEntityId}

This resource shall support the resource URI variables defined in table 5.5.14.2-1.

Table 5.5.14.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 5.2.
peerEntityId	Identifier of the peer functional entity. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new "Individual peer entity" resource. It can also be retrieved from the "id" attribute in the message content of that response.	

5.5.14.3 Resource methods

5.5.14.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.14.3.2 GET

The GET method retrieves information and configuration hold in the producer NFV-MANO functional entity with regards to a peer entity by reading an individual peer entity resource.

This method shall follow the provisions specified in tables 5.5.14.3.2-1 and 5.5.14.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.14.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.14.3.2-2: Details of the GET request/response on this resource

Request body	**Data type**	**Cardinality**	**Description**	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	PeerEntity	1	200 OK	Shall be returned when information about an individual peer functional entity has been read successfully. The response body shall contain a resource representation of the peer functional entity, as defined in clause 5.6.2.15.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.14.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

5.5.14.3.4 PATCH

This method modifies configuration and information of the producer NFV-MANO functional entity with regards to a peer functional entity by updating the corresponding "Individual peer entity" resource.

Changes to the configurable parameters of the corresponding peer entity are applied to the information managed by the producer NFV-MANO functional entity and reflected in the representation of this resource.

This method shall follow the provisions specified in tables 5.5.14.3.4-1 and 5.5.14.3.4-2 for URI query parameters, request and response data structures, and response codes.

If the modification operation has successfully completed, the producer NFV-MANO functional entity shall update the representation of the "Individual peer entity" resource to reflect the result of the operation. If the modification operation is not successful, the producer NFV-MANO functional entity shall return to the API consumer information about the error as specified in table 5.5.14.3.4-2.

Table 5.5.14.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.14.3.4-2: Details of the PATCH request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	PeerEntityConfigModificationRequest	1		Parameters for the modification of configuration parameters of the peer functional entity, as defined in clause 5.6.2.16. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [3].
Response body	PeerEntityConfigModifications	1	200 OK	Shall be returned when the request has been accepted and completed. The response body shall contain a representation of the attribute modifications for the "Individual peer entity" resource, as defined in clause 5.6.2.17.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the "Individual peer entity" resource. Typically, this is due to the fact that another operation is ongoing. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.

	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.5.14.3.5 DELETE

This method deletes an individual peer entity resource. By deleting such a resource in the producer NFV-MANO functional entity representing a peer NFV-MANO entity, the configuration and information with regards to such peer entity is deleted. Consequently, the peering relationship between the producer NFV-MANO functional entity and the peer entity is terminated, i.e. the producer NFV-MANO functional entity does not have the necessary information to communicate/interact with the peer entity.

This method shall follow the provisions specified in tables 5.5.14.3.5-1 and 5.5.14.3.5-2 for URI query parameters, request and response data structures, and response codes.

As a result of successfully executing this method, the "Individual peer entity" resource shall not exist any longer.

Table 5.5.14.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.14.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the "Individual peer entity" resource has been deleted successfully. The response body shall be empty.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the peer entity resource. Typically, this is due to the fact that another operation is ongoing. The response body shall contain a ProblemDetails structure, in which the "detail" attribute shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

5.6 Data model

5.6.1 Introduction

This clause defines the request and response data structures of the NFV-MANO configuration and information management interface. If a request or response contains attributes not defined in the present document, a receiving functional block that does not understand these attributes shall not treat their presence as an error, and may choose to ignore them.

5.6.2 Resource and notification data types

5.6.2.1 Introduction

This clause defines the data structures to be used in resource representations and notifications.

5.6.2.2 Type: ManoEntity

This type represents an NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.2.2-1.

Table 5.6.2.2-1: Definition of the ManoEntity data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of the NFV-MANO functional entity. The identifier shall be set during the initial deployment of the NFV-MANO functional entity and its value allocated based on network operator policies. The value of this identifier shall be unique at least in the scope of the NFV-MANO deployment.
type	ManoEntityEnumType	1	Type of NFV-MANO functional entity.
name	String	1	Human-readable name of the NFV-MANO functional entity. This attribute can be modified with the PATCH method.
description	String	1	Human-readable description of the NFV-MANO functional entity. This attribute can be modified with the PATCH method.
provider	String	1	Information about the provider of the NFV-MANO functional entity. It typically includes the name of the provider.
softwareVersion	Version	1	The version of the software of the NFV-MANO functional entity.
softwareInfo	KeyValuePairs	0..1	Additional information about the software used to realize the NFV-MANO functional entity. For instance, the attribute can provide information about sourced software and corresponding release(s) used to build the entity's software.
manoEntityComponents	ManoEntityComponent	0..N	The deployed NFV-MANO functional entity components which realize the NFV-MANO functional entity. See note 5.
manoServices	ManoService	1..N	Information about the NFV-MANO services provided by the NFV-MANO functional entity.
manoConfigurableParams	ManoConfigurableParams	1	Information and current values of the configurable parameters. This attribute can be modified with the PATCH method.
manoApplicationState	Structure (inlined)	1	Information and current values of the NFV-MANO functional entity's application state.
>operationalState	OperationalStateEnumType	1	The operational state of the NFV-MANO functional entity application.
>administrativeState	AdministrativeStateEnumType	1	The administrative state of the NFV-MANO functional entity application.

Attribute name	Data type	Cardinality	Description
>usageState	UsageStateEnumType	1	The usage state of the NFV-MANO functional entity application.
nfvoSpecificInfo	NfvoSpecificInfo	0..1	The information specific to an NFVO entity. See notes 1 and 4.
vnfmSpecificInfo	VnfmSpecificInfo	0..1	The information specific to a VNFM entity. See notes 2 and 4.
vimSpecificInfo	VimSpecificInfo	0..1	The information specific to a VIM entity. See notes 3 and 4.
wimSpecificInfo	WimSpecificInfo	0..1	The information specific to a WIM entity. See notes 4 and 6.
cismSpecificInfo	CismSpecificInfo	0..1	The information specific to a CISM entity. See notes 4 and 7.
cirSpecificInfo	CirSpecificInfo	0..1	The information specific to a CIR entity. See notes 4 and 8.
ccmSpecificInfo	CcmSpecificInfo	0..1	The information specific to a CCM entity. See notes 4 and 9.
_links	Structure (inlined)	1	Links to resources related to this resource.
>self	Link	1	URI of this resource.
>manoServiceInterfaces	Link	1	Link to the "NFV-MANO service interfaces" resource.
>peerEntities	Link	1	Link to "Peer entities" resource.
>changeState	Link	1	Link to the "Change state" task resource.
>changeStateOpOccs	Link	1	Link to the "Change state operation occurrences" resource.
NOTE 1: It shall be present when "type" attribute is "NFVO", and it shall be absent in any other case. NOTE 2: It shall be present when "type" attribute is "VNFM", and it shall be absent in any other case. NOTE 3: It shall be present when "type" attribute is "VIM", and it shall be absent in any other case. NOTE 4: The information about the NFV-MANO services offered by a specific type of NFV-MANO functional entity is specified by the manoServices attribute. NOTE 5: It is optional for the API producer to support the "manoEntityComponents" attribute. NOTE 6: It shall be present when "type" attribute is "WIM", and it shall be absent in any other case. NOTE 7: It shall be present when "type" attribute is "CISM", and it shall be absent in any other case. NOTE 8: It shall be present when "type" attribute is "CIR", and it shall be absent in any other case. NOTE 9: It shall be present when "type" attribute is "CCM", and it shall be absent in any other case.			

5.6.2.3 Type: ManoConfigModificationRequest

This type represents attribute modifications for configuration parameters of an NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.2.3-1.

Table 5.6.2.3-1: Definition of the ManoConfigModificationRequest data type

Attribute name	Data type	Cardinality	Description
name	String	0..1	New value of the "name" attribute in "ManoEntity".
description	String	0..1	New value of the "description" attribute in "ManoEntity".
clockSyncs	map(ClockSyncInfo)	0..N	Modifications of the "clockSyncs" attribute in the "ManoEntityConfigurableParams". If present, these modifications shall be applied according to the rules of JSON Merge PATCH (see IETF RFC 7396 [3]).
defaultLogCompileBySizeValue	UnsignedInt	0..1	New value of the "defaultLogCompileBySizeValue" attribute in the "ManoEntityConfigurableParams".
defaultLogCompileByTimerValue	UnsignedInt	0..1	New value of the "defaultLogCompileByTimerValue" attribute in the "ManoEntityConfigurableParams".
manoServiceModifications	Structure (inlined)	0..N	New content of certain entries in the "manoServices" attribute array in the "ManoEntity", as defined below this table.
>id	IdentifierInManoEntity	1	Identifier of the NFV-MANO service to modify.

Attribute name	Data type	Cardinality	Description
>name	String	0..1	New value for the "name" attribute in the "ManoService". See note.
>description	String	0..1	New value for the "description" attribute in the "ManoService". See note.
NOTE: At least one of these attributes shall be provided if requesting a modification of the NFV-MANO service identified by "id".			

The following provisions shall apply when modifying an attribute that is an array of structured "manoServiceModifications".

Assumptions:

A) "oldList" is the array to be modified, "newList" is the array that contains the changes.

B) "oldEntry" is an entry in "oldList" and "newEntry" is an entry in "newList".

C) A "newEntry" has a "corresponding entry" if there exists an "oldEntry" that has the same content of "id" attribute as the "newEntry".

D) In any array of objects, the content of "id" is unique (i.e. there are no two entries with the same content of "id").

Provisions:

1) For each "newEntry" in "newList" that has a corresponding "oldEntry" in "oldList", the values of the sub-attributes of "oldEntry" shall be replaced by the value of the sub-attributes in the "newEntry".

2) If the "newEntry" in "newList" has no corresponding "oldEntry" in "oldList" (i.e. the "id" is not found), the modification operation will fail as a whole and an error message shall be raised.

5.6.2.4 Type: ManoConfigModifications

This type represents attribute modifications that were performed on the "NFV-MANO entity" resource of the producer NFV-MANO functional entity. The attributes that can be included consist of those requested to be modified explicitly in the "ManoConfigModificationRequest" data structure. It shall comply with the provisions defined in table 5.6.2.4-1.

Table 5.6.2.4-1: Definition of the ManoConfigModifications data type

Attribute name	Data type	Cardinality	Description
name	String	0..1	If present, this attribute signals modifications of the "name" attribute in "ManoEntity", as defined in clause 5.6.2.3.
description	String	0..1	If present, this attribute signals modifications of the "description" attribute in "ManoEntity", as defined in clause 5.6.2.3.
clockSyncs	map(ClockSyncInfo)	0..N	If present, this attribute signals modifications of the "clockSyncs" attribute in "ManoEntityConfigurableParams", as defined in clause 5.6.2.3.
defaultLogCompileBySizeValue	UnsignedInt	0..1	If present, this attribute signals modifications of the "defaultLogCompileBySizeValue" attribute in the "ManoEntityConfigurableParams".
defaultLogCompileByTimerValue	UnsignedInt	0..1	If present, this attribute signals modifications of the "defaultLogCompileByTimerValue" attribute in the "ManoEntityConfigurableParams".
manoServiceModifications	Structure (inlined)	0..N	If present, this attribute signals modifications of the "manoServices" attribute array in the "ManoEntity", as defined in clause 5.6.2.3.

Attribute name	Data type	Cardinality	Description
>id	IdentifierInManoEntity	1	Identifier of the NFV-MANO service that has been modified.
>name	String	0..1	If present, this attribute signals modification of the "name" attribute in the "ManoService".
>description	String	0..1	If present, this attribute signals modification of the "description" attribute in the "ManoService".

5.6.2.5 Type: CimSubscriptionRequest

This type represents a subscription request related to notifications about NFV-MANO configuration and information management changes. It shall comply with the provisions defined in table 5.6.2.5-1.

Table 5.6.2.5-1: Definition of the CimSubscriptionRequest data type

Attribute name	Data type	Cardinality	Description
filter	CimNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
authentication	SubscriptionAuthentication	0..1	Authentication parameters to configure the use of Authorization when sending notifications corresponding to this subscription, as defined in clause 8.3.4 of ETSI GS NFV-SOL 013 [4]. This attribute shall only be present if the subscriber requires authorization of notifications.

5.6.2.6 Type: CimSubscription

This type represents a subscription related to notifications about NFV-MANO configuration and information management changes. It shall comply with the provisions defined in table 5.6.2.6-1.

Table 5.6.2.6-1: Definition of the CimSubscription data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier that identifies the subscription.
filter	CimNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
_links	Structure (inlined)	1	Links to resources related to this resource.
>self	Link	1	URI of this resource.

5.6.2.7 Type: InformationChangedNotification

This type represents a notification that is sent when data about configuration and information of the NFV-MANO functional entity have been changed. It shall comply with the provisions defined in table 5.6.2.7-1.

The notification shall be triggered by the NFV-MANO functional entity when information has been changed.

Table 5.6.2.7-1: Definition of the InformationChangedNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "InformationChangedNotification" for this notification type.
subscriptionId	Identifier	1	Identifier of the subscription that this notification relates to.
timeStamp	DateTime	1	Date and time of the generation of the notification.
informationChangedTime	DateTime	1	Timestamp indicating when the information was changed.
manoEntityId	Identifier	1	Identifier of the MANO entity of which the information was changed.
changedInfo	KeyValuePairs	1	Data about the changed configuration and information of the NFV-MANO functional entity.
_links	Structure (inlined)	1	Links to resources related to this notification.
>subscription	NotificationLink	1	Link to the related subscription.
>objectInstance	NotificationLink	0..1	Link to the resource representing the object to which the notified changes applies. Shall be present if the object instance is accessible as a resource.

5.6.2.8 Type: ChangeStateRequest

This type represents request parameters for changing the state of a managed entity. It shall comply with the provisions defined in table 5.6.2.8-1.

NOTE: The ChangeStateRequest data type can be used for requesting state changes on different types of managed entities, such as the NFV-MANO functional entity application and NFV-MANO service interfaces, as indicated by the supported method request/response of a resource.

Table 5.6.2.8-1: Definition of the ChangeStateRequest data type

Attribute name	Data type	Cardinality	Description
operationalStateChange	Structure (inlined)	0..1	A change of operational state shall be present if the state change request refers to the operational state. See note 1.
>operationalStateAction	ChangeOperationalStateEnumType	1	The desired operation state to change the managed object to. In case of changing the state of an NFV-MANO service interface the value "RESTART" shall not be used.
>stopType	StopEnumType	0..1	It signals the type of stop. See note 2.
>gracefulStopTimeout	Integer	0..1	The time internal (in seconds) to wait for the entity to be taken out of service during graceful stop. See note 2.
administrativeStateChange	Structure (inlined)	0..1	A change of administrative state shall be present if the state change request refers to the administrative state. See note 1.
>administrativeStateAction	ChangeAdministrativeStateEnumType	1	The desired administrative state to change the managed object to.

NOTE 1: In the present document version, a request shall only include an operational state change (attribute "operationalStateChange") or an administrative state change request (attribute "administrativeStateChange"), but not both.

NOTE 2: The "stopType" shall only be provided when the "operationalStateAction" attribute is equal to "STOP" or "RESTART". The "gracefulStopTimeout" shall be absent when the "stopType" attribute is equal to "FORCEFUL", and may be provided otherwise.

5.6.2.9 Type: ChangeStateOpOcc

This type represents a Change state operation occurrence. It shall comply with the provisions defined in table 5.6.2.9-1.

Table 5.6.2.9-1: Definition of the ChangeStateOpOcc data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this change state operation occurrence.
operationState	ChangeStateOpOccStateEnumType	1	The state of the "change state operation occurrence".
stateEnteredTime	DateTime	1	Date-time when the current state was entered.
startTime	DateTime	1	Date-time of the start of the operation.
managedObjectRef	ManoManagedObjectReference	1	Reference of the managed object to which the change state operation occurrence relates. The value of the "type" attribute shall be "MANO_ENTITY" or "MANO_SERVICE_IF".
changeOperationalStateRequest	ChangeOperationalStateEnumType	0..1	The type of the change of operational state that was requested. Shall be present if the change of state operation triggered a change of operational state.
changeAdministrativeStateRequest	ChangeAdministrativeStateEnumType	0..1	The type of the change of administrative state that was requested. Shall be present if the change of state operation triggered a change of administrative state.
operationParams	Object	0..1	Input parameters of the change state operation. This attribute shall be formatted according to the request data type of the related change state operation. The following mapping between operationType and the data type of this attribute shall apply: • CHANGE_STATE: ChangeStateRequest This attribute shall be present if this data type is returned in a response to reading an individual resource, and may be present according to the chosen attribute selector parameter if this data type is returned in a response to a query of a container resource.

5.6.2.10 Type: ChangeStateNotification

This type represents a Change state operation occurrence. It shall comply with the provisions defined in table 5.6.2.10-1.

Table 5.6.2.10-1: Definition of the ChangeStateNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "ChangeStateNotification" for this notification type.
subscriptionId	Identifier	1	Identifier of the subscription that this notification relates to.
timestamp	DateTime	1	Date-time of the generation of the notification.
changeStateOpOccId	Identifier	1	Identifier of the change state operation occurrence associated to the notification.
stateChangedTime	DateTime	1	Timestamp indicating when the state on the managed object was changed.
changeStateOperationState	ChangeStateOpOccStateEnumType	1	The state of the "change state operation occurrence".
managedObjectRef	ManoManagedObjectReference	1	Reference of the managed object to which the state change notification relates. The value of the "type" attribute shall be "MANO_ENTITY" or "MANO_SERVICE_IF".
operationalState	OperationalStateEnumType	0..1	New operational state of the managed object. Shall only be present when there is a change in the operational state.
administrativeState	AdministrativeStateEnumType	0..1	New administrative state of the managed object. Shall only be present when there is a change in the administrative state.
_links	Structure (inlined)	1	Links to resources related to this notification.
>subscription	NotificationLink	1	Link to the related subscription.
>objectInstance	NotificationLink	1	Link to the resource representing the object to which the change state applies. Shall be present if the object instance is accessible as a resource.
>changeStateOpOcc	NotificationLink	1	Link to the change state operation occurrence that this notification is related to.

5.6.2.11 Type: ManoServiceInterface

This type represents an individual NFV-MANO service interface produced by an NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.2.11-1.

Table 5.6.2.11-1: Definition of the ManoServiceInterface data type

Attribute name	Data type	Cardinality	Description
id	IdentifierInManoEntity	1	Identifier of the NFV-MANO functional entity interface.
name	String	1	Human-readable name of the NFV-MANO functional entity interface. This attribute can be modified with the PATCH method.
type	String	1	Type of the NFV-MANO service interface produced by the NFV-MANO functional entity. Valid values are defined in clause 5.6.4.3.
standardVersion	Version	1	Version of the standard the interface is compliant to. See note 1.
providerSpecificApiVersion	Version	1	Provider-specific software API version.
apiVersion	Version	1	API version, in compliance with the version identifiers and parameters format specified in clause 9.1 of ETSI GS NFV-SOL 013 [4].
apiEndpoint	Structure (inlined)	1	Exposed API endpoint of the interface.
>apiRoot	Uri	0..1	Indicates the scheme ("http" or "https"), the host name and optional port, and an optional sequence of path segments that together represent a prefix path. Shall be present for ETSI NFV specified RESTful NFV-MANO APIs (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]). May be present otherwise. This attribute can be modified with the PATCH method.
>apiName	String	0..1	Indicates the interface name in an abbreviated form. Shall be present for ETSI NFV specified RESTful NFV-MANO APIs. The {apiName} of each interface is defined in the standard the interface is compliant to (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]). May be present otherwise.
>apiMajorVersion	String	0..1	Indicates the current major version of the API. Shall be present for ETSI NFV specified RESTful NFV-MANO APIs. The major version is defined in the standard the interface is compliant to (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]). May be present otherwise.
>apiUri	Uri	1	URL of the API endpoint. For ETSI NFV specified RESTful NFV-MANO APIs, the following prefix structure is used (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]): {apiRoot}/{apiName}/{apiMajorVersion} For APIs not specified by ETSI NFV as part of the RESTful NFV-MANO APIs, this attribute can be modified with the PATCH method. For RESTful NFV-MANO APIs specified by ETSI NFV, this attribute shall not be modified. Instead, changes are handled indirectly via patching of the "apiRoot" attribute's value.

Attribute name	Data type	Cardinality	Description
maxConcurrentIntOpNumber	Integer	0..1	Maximum number of concurrent operation requests supported on this interface. See note 2.
supportedOperations	Structure (inlined)	1..N	Information about supported operations of this interface.
>operationName	String	1	Name of the operation supported on the interface.
>maxConcurrentOpNumber	Integer	0..1	Maximum number of concurrent requests supported by the interface operation. See note 2.
interfaceState	Structure (inlined)	1	State of the NFV-MANO service interface.
>operationalState	InterfaceOperationalStateEnumType	1	The operational state of the NFV-MANO service interface.
>administrativeState	AdministrativeStateEnumType	1	The administrative state of the NFV-MANO service interface.
>usageState	UsageStateEnumType	1	The usage state of the NFV-MANO service interface.
securityInfo	ServerInterfaceSecurityInfo	0..1	Security related information. This attribute can be modified with the PATCH method. See note 3.
metadata	KeyValuePairs	0..1	Additional attributes that provide metadata describing the NFV-MANO service interface. These attributes can be created, modified or removed with the PATCH method.

NOTE 1: The information to be provided in this attribute shall relate to the specification and version of the specification. For instance: "ETSI GS NFV-SOL 003 (V2.4.1)".

NOTE 2: If this attribute is not present, the value of this parameter is undefined. Overload is handled by the error handling schemes defined by the applicable API specification.

NOTE 3: Due to the security sensitive information associated to the attribute, based on access control policies, the API consumer might have read only, write only, read/write, or no access at all to the attribute's value. In case the API consumer is not allowed to read the value of the security sensitive attribute, the attribute shall be omitted when the information is to be provided in a response message, and shall be provided otherwise. In case the API consumer is not allowed to modify the value of the security sensitive attribute, and the modification request includes new attribute values, the whole modification request shall be rejected, and proper error information returned.

5.6.2.12 Type: ManoServiceInterfaceModificationRequest

This type represents attribute modifications for configuration parameters of an NFV-MANO service interface of the producer NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.2.12-1.

Table 5.6.2.12-1: Definition of the ManoServiceInterfaceModificationRequest data type

Attribute name	Data type	Cardinality	Description
name	String	0..1	New value of the "name" attribute in "ManoServiceInterface". See note 1.
apiRoot	Uri	0..1	New value of the "apiRoot" attribute in "ManoServiceInterface". See note 2.
apiUri	Uri	0..1	New value of the "apiUri" attribute in "ManoServiceInterface". See note 2. Shall not be provided if a change of "apiRoot" is present in the request.
securityInfo	ServerInterfaceSecurityInfo	0..1	New value of the "securityInfo" attribute in "ManoServiceInterface". See note 3.
metadata	KeyValuePairs	0..1	Modifications of the "metadata" attribute in "ManoServiceInterface". If present, these modifications shall be applied according to the rules of JSON Merge PATCH (see IETF RFC 7396 [3]).

Attribute name	Data type	Cardinality	Description
NOTE 1: Changing the name does not change the corresponding standardized API name in the resource URI (refer to "{apiName}" defined in clause 4.1 of ETSI GS NFV-SOL 013 [4]). NOTE 2: The change of apiRoot or apiUri on an enabled and in use API may be service disruptive. Also, that change invalidates any related URI that might have been cached at API consumers. NOTE 3: Due to the security sensitive information associated to the attribute, based on access control policies, the API consumer might have read only, write only, read/write, or no access at all to the attribute's value. In case the API consumer is not allowed to modify the value of the security sensitive attribute, and the modification request includes new attribute values, the whole modification request shall be rejected, and proper error information returned.			

5.6.2.13 Type: ManoServiceInterfaceModifications

This type represents attribute modifications that were performed on an "Individual NFV-MANO service interface" resource. The attributes that can be included consist of those requested to be modified explicitly in the "ManoServiceInterfaceModificationRequest" data structure. If applicable, additional attributes of the "ManoServiceInterface" data structure that were modified implicitly shall also be provided. It shall comply with the provisions defined in table 5.6.2.13-1.

Table 5.6.2.13-1: Definition of the ManoServiceInterfaceModifications data type

Attribute name	Data type	Cardinality	Description
name	String	0..1	If present, this attribute signals modifications of the "name" attribute in "ManoServiceInterface", as defined in clause 5.6.2.11.
apiRoot	Uri	0..1	If present, this attribute signals modifications of the "apiRoot" attribute in "ManoServiceInterface", as defined in clause 5.6.2.11.
apiUri	Uri	0..1	If present, this attribute signals modifications of the "apiUri" attribute in "ManoServiceInterface", as defined in clause 5.6.2.11.
securityInfo	ServerInterfaceSecurityInfo	0..1	If present, this attribute signals modifications of the "securityInfo" attribute in "ManoServiceInterface", as defined in clause 5.6.2.11. See note.
metadata	KeyValuePairs	0..1	If present, this attribute signals modifications of the "metadata" attribute in "ManoServiceInterface", as defined in clause 5.6.2.11.
NOTE: Due to the security sensitive information associated to the attribute, based on access control policies, the API consumer might have read only, write only, read/write, or no access at all to the attribute's value. In case the API consumer is not allowed to read the value of the security sensitive attribute, the attribute shall be omitted when the information is to be provided in a response message.			

5.6.2.14 Type: CreatePeerEntityRequest

This type represents request parameters for the creation of a new peer entity resource. It shall comply with the provisions defined in table 5.6.2.14-1.

Table 5.6.2.14-1: Definition of the CreatePeerEntityRequest data type

Attribute name	Data type	Cardinality	Description
peerEntityId	Identifier	1	Identifier of the peer functional entity. See note.
name	String	1	Human-readable name of the peer functional entity.
type	PeerEntityEnumType	1	Type of the peer functional entity.
description	String	0..1	Human-readable description of the peer functional entity.
consumedManoInterfaces	map(ConsumedManoInterfaceInfo)	0..N	Initial information of the interface consumed by the NFV-MANO functional entity from the peer functional entity.
peerEntityState	Structure (inlined)	0..1	Current values of the state of the peer functional entity.
>operationalState	OperationalStateEnumType	1	The operation state of the peer functional entity's application.
>administrativeState	AdministrativeStateEnumType	1	The administrative state of the peer functional entity's application.
NOTE: The value of the "peerEntityId" attribute is the same as the value of the "id" attribute in the "ManoEntity" of the corresponding NFV-MANO functional entity that acts as peer entity, and shall follow the uniqueness requirements set out in clause 5.6.2.2 for the "id" attribute.			

5.6.2.15 Type: PeerEntity

This type represents an individual peer entity. It shall comply with the provisions defined in table 5.6.2.15-1.

NOTE: ETSI GS NFV-IFA 031 [1] defines an additional attribute named "apiDiscoveryEndpoint" in the PeerManoEntity. The modelling of this attribute is not specified in the present document version.

Table 5.6.2.15-1: Definition of the PeerEntity data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of the resource representing the peer functional entity. This identifier is allocated by the producer NFV-MANO functional entity.
peerEntityId	Identifier	1	Identifier of the peer functional entity. See note 1.
name	String	1	Human-readable name of the peer functional entity. This attribute can be modified with the PATCH method.
type	PeerEntityEnumType	1	Type of the peer functional entity.
description	String	0..1	Human-readable description of the peer functional entity. This attribute can be modified with the PATCH method.
consumedManoInterfaces	map(ConsumedManoInterfaceInfo)	0..N	Information of the interface consumed by the NFV-MANO functional entity from the peer functional entity. This attribute can be modified with the PATCH method. The keys of the map, each of which identifies information about a particular consumed NFV-MANO interface, are managed by the API consumer and referenced from other data structures via the "consumedManoInterfaceIds" attribute.

Attribute name	Data type	Cardinality	Description
vimConnectionInfos	map(VimConnectionInfo)	0..N	Map of VIM connection information. The VimConnectionInfo is specified in clause 4.4.1.6 of ETSI GS NFV-SOL 003 [10]. This attribute can be modified with the PATCH method. May be present only if the "type" attribute in the "PeerEntity" is either a "VIM", a "CISM" or a "CIR", and the NFV-MANO entity being configured is a "VNFM" or "NFVO" as indicated by the "type" attribute in the "ManoEntity". In case it is present, the value of the "vimId" in the "VimConnectionInfo" shall be equal to the value of "peerEntityId". In addition, the content of "interfaceInfo", "accessInfo" and "extra" (if applicable) of the "VimConnectionInfo" shall be provided by means in scope of the present document.
vnfmConfiguredVimConnectionInfoIds	Identifier	0..N	List of VIM connection information identifiers that identify the set of VIMs and associated VIM connection information that have been configured into the VNFM whose identifier is equal to the "peerEntityId". See note 2. Only applicable if the "type" attribute in the "ManoEntity" is "NFVO" and the "type" attribute in the "PeerEntity" is a "VNFM".
peerEntityState	Structure (inlined)	1	State of the peer functional entity as provided by the API consumer when creating the resource or when updating it with the PATCH method.
>operationalState	OperationalStateEnumType	1	The operational state of the peer functional entity's application.
>administrativeState	AdministrativeStateEnumType	1	The administrative state of the peer functional entity's application.

NOTE 1: The value of the "peerEntityId" attribute is the same as the value of the "id" attribute in the "ManoEntity" of the corresponding NFV-MANO functional entity that acts as peer entity, and shall follow the uniqueness requirements set out in clause 5.6.2.2 for the "id" attribute.
NOTE 2: With this information, the NFVO has available information about the set of VIMs and associated VIM connection information that have been configured into the VNFM.

5.6.2.16 Type: PeerEntityConfigModificationRequest

This type represents attribute modifications for configuration parameters of a peer entity. It shall comply with the provisions defined in table 5.6.2.16-1.

Table 5.6.2.16-1: Definition of the PeerEntityConfigModificationRequest data type

Attribute name	Data type	Cardinality	Description
name	String	0..1	New value of the "name" attribute in "PeerEntity".
description	String	0..1	New value of the "description" attribute in "PeerEntity", or "null" to remove the attribute.
consumedManoInterfaces	map(ConsumedManoInterfaceInfo)	0..N	Modification of the "consumedManoInterfaces" attribute in the "PeerEntity". If present, these modifications shall be applied according to the rules of JSON Merge PATCH (see IETF RFC 7396 [3]). See note.
vimConnectionInfos	map(VimConnectionInfo)	0..N	Modification of the "vimConnectionInfos" attribute in the "PeerEntity". If present, these modifications shall be applied according to the rules of JSON Merge PATCH (see IETF RFC 7396 [3]). See note.
operationalState	OperationalStateEnumType	0..1	New content of the "operationalState" attribute in the "peerEntityState" structure in the "PeerEntity".
administrativeState	AdministrativeStateEnumType	0..1	New content of the "administrativeState" attribute in the "peerEntityState" structure in the "PeerEntity".
NOTE: Due to the security sensitive information contained within the attribute (refer to "securityInfo" within the "ConsumedManoInterfaceInfo" and "accessInfo" within the "VimConnectionInfo"), based on access control policies, the API consumer might have read only, write only, read/write, or no access at all to the attribute's value. In case the API consumer is not allowed to modify the value of the security sensitive attribute, and the modification request includes new attribute values, the whole modification request shall be rejected, and proper error information returned.			

5.6.2.17 Type: PeerEntityConfigModifications

This type represents attribute modifications that were performed on an "Individual peer entity" resource. The attributes that can be included consist of those requested to be modified explicitly in the "PeerEntityConfigModificationRequest" data structure. If applicable, additional attributes of the "PeerEntity" data structure that were modified implicitly shall also be provided. It shall comply with the provisions defined in table 5.6.2.17-1.

Table 5.6.2.17-1: Definition of the PeerEntityConfigModifications data type

Attribute name	Data type	Cardinality	Description
name	String	0..1	If present, this attribute signals modifications of the "name" attribute in "PeerEntity", as defined in clause 5.6.2.15.
description	String	0..1	If present, this attribute signals modifications of the "description" attribute in "PeerEntity", as defined in clause 5.6.2.15.
consumedManoInterfaces	map(ConsumedManoInterfaceInfo)	0..N	If present, this attribute signals modifications of the "consumedManoInterfaces" attribute in "PeerEntity", as defined in clause 5.6.2.15. See note.
vimConnectionInfos	map(VimConnectionInfo)	0..N	If present, this attribute signals modifications of the "vimConnectionInfos" attribute in "PeerEntity", as defined in clause 5.6.2.15. See note.

Attribute name	Data type	Cardinality	Description
operationalState	OperationalStateEnumType	0..1	If present, this attribute signals modifications of the "operationalState" attribute in the "peerEntityState" structure in the "PeerEntity", as defined in clause 5.6.2.15.
administrativeState	AdministrativeStateEnumType	0..1	If present, this attribute signals modifications of the "administrativeState" attribute in the "peerEntityState" structure in the "PeerEntity", as defined in clause 5.6.2.15.
NOTE: Due to the security sensitive information contained within the attribute (refer to "securityInfo" within the "ConsumedManoInterfaceInfo" and "accessInfo" within the "VimConnectionInfo"), based on access control policies, the API consumer might have read only, write only, read/write, or no access at all to the attribute's value. In case the API consumer is not allowed to read the value of the security sensitive attribute, the attribute shall be omitted when the information is to be provided in a response message.			

5.6.3 Referenced structured data types

5.6.3.1 Introduction

This clause defines data structures that can be referenced from data structures defined in the previous clauses, but can neither be resource representations nor bound to any subscribe/notify mechanism.

5.6.3.2 Type: ManoEntityComponent

This type represents information of a deployed component realizing part of an NFV-MANO functional entity. It is optional for the API producer to support this type. If supported, this type shall comply with the provisions defined in table 5.6.3.2-1.

Table 5.6.3.2-1: Definition of the ManoEntityComponent data type

Attribute name	Data type	Cardinality	Description
id	IdentifierInManoEntity	1	Identifier of the NFV-MANO functional entity component.
manoServiceIds	IdentifierInManoEntity	0..N	References to the NFV-MANO services that depend on the NFV-MANO functional entity component. The identifier of the ManoService is referred. A service may depend on multiple components. Multiple services may depend on the same component.

5.6.3.3 Type: ManoService

This type represents information about an NFV-MANO service provided by the NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.3.3-1.

Table 5.6.3.3-1: Definition of the ManoService data type

Attribute name	Data type	Cardinality	Description
id	IdentifierInManoEntity	1	Identifier of the NFV-MANO service.
name	String	1	Human-readable name of the NFV-MANO service. This attribute can be modified with the PATCH method.
description	String	1	Human-readable description of the NFV-MANO service. This attribute can be modified with the PATCH method.
manoServiceInterfaceIds	IdentifierInManoEntity	1..N	Reference to the NFV-MANO interfaces associated to the NFV-MANO service. If cardinality is greater than one, the type of ManoServiceInterface (see clause 5.6.3.3) shall be the same. The identifier of the ManoServiceInterface is referred. See note.
_links	Structure (inlined)	1	Links to resources related to this resource.
>manoServiceInterfaces	Link	1..N	Link to the "individual NFV-MANO service interface" resources with information about the associated interfaces to the NFV-MANO service.
NOTE: A cardinality greater than one supports having different interface versions or apiEndpoints to be used for accessing the same instance of an NFV-MANO service.			

5.6.3.4 Type: NfvoSpecificInfo

This type represents information attributes specific to an NFVO entity, and that can be relevant to more than one NFV-MANO service offered by an NFVO entity. It shall comply with the provisions defined in table 5.6.3.4-1.

NOTE: The present document version does not specify the support for "maximum number of NS instances (attribute "maxNsInstanceNum")" as specified in clause 7.2.7.2 of ETSI GS NFV-IFA 031 [1].

Table 5.6.3.4-1: Definition of the NfvoSpecificInfo data type

Attribute name	Data type	Cardinality	Description
maxOnboardedNsdNum	Integer	0..1	Maximum number of NSDs that can be on-boarded on the NFVO. See note 2.
maxOnboardedVnfPkgNum	Integer	0..1	Maximum number of VNF Packages that can be on-boarded on the NFVO. See note 2.
supportedVnfdFormats	Structure (inlined)	1..N	Supported VNFD data formats.
>vnfdFormat	Enum (inlined)	1	Name of the VNFD format. Permitted values: TOSCA: The VNFD follows TOSCA definition, according to ETSI GS NFV-SOL 001 [i.16]. YANG: The VNFD follows YANG definition according to ETSI GS NFV-SOL 006 [i.17].
>standardVersion	Version	1	Name and version of the standard the VNFD is compliant to. See note 1.
supportedNsdFormats	Structure (inlined)	1..N	Supported NSD data formats.
>nsdFormat	Enum (inlined)	1	Name of the NSD format. Permitted values: TOSCA: The VNFD follows TOSCA definition, according to ETSI GS NFV-SOL 001 [i.16]. YANG: The VNFD follows YANG definition according to ETSI GS NFV-SOL 006 [i.17].
>standardVersion	Version	1	Name and version of the standard the NSD is compliant to. See note 1.
NOTE 1: The information to be provided in this attribute shall relate to the specification and version of the specification. For instance: "ETSI GS NFV-SOL 001 (V2.5.1)". NOTE 2: If this attribute is not present, the value of this parameter is undefined.			

5.6.3.5 Type: VnfmSpecificInfo

This type represents information attributes specific to a VNFM entity, and that can be relevant to more than one NFV-MANO service offered by a VNFM entity. It shall comply with the provisions defined in table 5.6.3.5-1.

NOTE: The present document version does not specify the support for "maximum number of VNF instances (attribute "maxVnfInstanceNum")" as specified in clause 7.2.8.2 of ETSI GS NFV-IFA 031 [1].

Table 5.6.3.5-1: Definition of the VnfmSpecificInfo data type

Attribute name	Data type	Cardinality	Description
resourceMgmtModeSupport	Enum (inlined)	1	The supported resource management modes of the VNFM. Permitted values: DIRECT: The VNFM supports direct mode only. INDIRECT: The VNFM supports indirect mode only. BOTH: The VNFM supports both direct and indirect mode.
managedVnfInstanceInfos	String	1..N	The kinds of VNF instances that can be managed, e.g. to determine the compatibility of a VNF with certain VNFM according to the `vnfmInfo` attribute in the VNFD (see table 7.1.2.2-1 in ETSI GS NFV-IFA 011 [i.2]).
supportedVnfdFormats	Structure (inlined)	1..N	Supported VNFD data formats.
>vnfdFormat	Enum (inlined)	1	Name of the VNFD format. Permitted values: TOSCA: The VNFD follows TOSCA definition, according to ETSI GS NFV-SOL 001 [i.16]. YANG: The VNFD follows YANG definition according to ETSI GS NFV-SOL 006 [i.17].
>standardVersion	Version	1	Name and version of the standard the VNFD is compliant to. See note.
NOTE: The information to be provided in this attribute shall relate to the specification and version of the specification. For instance: "ETSI GS NFV-SOL 001 (V2.5.1)".			

5.6.3.6 Type: VimSpecificInfo

This type represents information attributes specific to a VIM entity, and that can be relevant to more than one NFV-MANO service offered by a VIM entity. It shall comply with the provisions defined in table 5.6.3.6-1.

NOTE: The present document version does not specify the support for "maximum number of virtualised resources (attribute "maxVirtualResourceNum")" as specified in clause 7.2.9.2 of ETSI GS NFV-IFA 031 [1].

Table 5.6.3.6-1: Definition of the VimSpecificInfo data type

Attribute name	Data type	Cardinality	Description
imageContainerFormats	String	1..N	List of supported image container formats. Container format indicates whether a software image is in a file that also contains metadata about the actual software. Valid values are all values for "container_format" as defined in ETSI GS NFV-SOL 001 [i.16] and all values for "container-format" as defined in ETSI GS NFV-SOL 006 [i.17].
imageDiskFormats	String	1..N	List of supported image disk formats. The Disk format of a software image is the format of the underlying disk image. Valid values are all values for "disk_format" as defined in ETSI GS NFV-SOL 001 [i.16] and all values of "disk-format" as defined in ETSI GS NFV-SOL 006 [i.17].
imageSignatureVerification	Structure (inined)	1	Information about the supported mechanisms, algorithms, and protocols for verifying the signature of software images.
>additionalVerificationCapabilities	KeyValuePairs	0..1	List of additional image signature verification capabilities. The "key" in the KeyValuePairs determines the name of the capability, and the "value" shall indicate whether or not the capability is enabled. Examples of capabilities can include performing a validation of the image's signing certificate during the image signature verification.
>signatureVerificationAlgorithms	Structure (inlined)	1..N	List of algorithms for verifying the signature of software images that are supported by the VIM.
>>algorithm	String	1	The name of the algorithm. Permitted values are: "RSA", "DSA", "ECDSA".
>>keyLengths	String	1..N	List of supported key lengths of the algorithm. The key length indicates the number of bits, such as "256", "512", etc. See note.
>>additionalAlgParams	KeyValuePairs	0..1	Additional parameters specific to the signature verification algorithm.
imageDigestAlgorithms	Structure (inlined)	1..N	List of supported digest algorithms that can be used for digital signatures.
>algorithm	String	1	The name of the algorithm. Permitted values are: "SHA2", "SHA3".
>keyLengths	String	1..N	List of supported key lengths of the algorithm. The key length indicates the number of bits, such as "256", "512", etc. See note.
NOTE: Recommendations on appropriate algorithms and key lengths are given e.g. in NIST Special Publication 800-57 Part 3 Revision 1 [i.26] or in documents related to local legislation.			

5.6.3.7 Type: ManoEntityConfigurableParams

This type represents list of parameters that can be configured on the NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.3.7-1.

Table 5.6.3.7-1: Definition of the ManoEntityConfigurableParams data type

Attribute name	Data type	Cardinality	Description
clockSyncs	map(ClockSyncInfo)	1..N	Properties of the clock synchronization to be used by the NFV-MANO functional entity. The keys of the map, each of which identifies a particular ClockSyncInfo structure, are managed by the API consumer.
defaultLogCompileBySizeValue	UnsignedInt	1	Default value for the log compilation by size to be used.
defaultLogCompileByTimerValue	UnsignedInt	1	Default value for the log compilation by timer to be used.

5.6.3.8 Type: ConsumedManoInterfaceInfo

This type represents an interface consumed by the producer NFV-MANO functional entity from another peer functional entity. It shall comply with the provisions defined in table 5.6.3.8-1.

Table 5.6.3.8-1: Definition of the ConsumedManoInterfaceInfo data type

Attribute name	Data type	Cardinality	Description
name	String	1	Human-readable name of the NFV-MANO interface.
type	String	1	Type of the NFV-MANO service interface consumed by the NFV-MANO functional entity. Valid values are defined in clause 5.6.4.3.
standardVersion	Version	1	Version of the standard the interface is compliant to. See note 1.
apiVersion	Version	1	API version, in compliance with the version identifiers and parameters format specified in clause 9.1 of ETSI GS NFV-SOL 013 [4].
apiEndpoint	Structure (inlined)	1	Consumable API endpoint of the interface. It provides the information relevant about the protocol, host and port, and path where the interface API can be accessed.
>apiRoot	Uri	0..1	Indicates the scheme ("http" or "https"), the host name and optional port, and an optional sequence of path segments that together represent a prefix path. Shall be present for ETSI NFV specified RESTful NFV-MANO APIs (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]). May be present otherwise.
>apiName	String	0..1	Indicates the interface name in an abbreviated form. Shall be present for ETSI NFV specified RESTful NFV-MANO APIs. The {apiName} of each interface is defined in the standard the interface is compliant to (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]). May be present otherwise.
>apiMajorVersion	String	0..1	Indicates the current major version of the API. Shall be present for ETSI NFV specified RESTful NFV-MANO APIs. The major version is defined in the standard the interface is compliant to (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]). May be present otherwise.

Attribute name	Data type	Cardinality	Description
>apiUri	Uri	1	URL of the API endpoint. For ETSI NFV specified RESTful NFV-MANO APIs, the following prefix structure is used (see also clause 4.1 of ETSI GS NFV-SOL 013 [4]): {apiRoot}/{apiName}/{apiMajorVersion}.
securityInfo	ClientInterfaceSecurityInfo	0..1	Security related information including credentials information if needed for consuming the API. See note 2.
NOTE 1: The information to be provided in this attribute shall relate to the specification and its version. For instance: "ETSI GS NFV-SOL 003 (V2.4.1)". NOTE 2: Due to the security sensitive information associated to the attribute, based on access control policies, the API consumer might have read only, write only, read/write, or no access at all to the attribute's value. In case the API consumer is not allowed to read the value of the security sensitive attribute, the attribute shall be omitted when the information is to be provided in a response message, and shall be provided otherwise. In case the API consumer is not allowed to modify the value of the security sensitive attribute, and the modification request includes new attribute values, the whole modification request shall be rejected, and proper error information returned.			

5.6.3.9 Type: CimNotificationsFilter

This type represents a subscription filter related to notifications about NFV-MANO configuration and information management. It shall comply with the provisions defined in table 5.6.3.9-1.

At a particular nesting level in the filter structure, the following applies: All attributes shall match in order for the filter to match (logical "and" between different filter attributes). If an attribute is an array, the attribute shall match if at least one of the values in the array matches (logical "or" between the values of one filter attribute).

Table 5.6.3.9-1: Definition of the CimNotificationsFilter data type

Attribute name	Data type	Cardinality	Description
manoEntitySubscription Filter	ManoEntitySubscriptionFilter	0..1	Filter criteria to select the NFV-MANO functional entity and its associated managed objects.
notificationTypes	Enum (inlined)	0..N	Match particular notification types. Permitted values: • InformationChangedNotification • ChangeStateNotification See note.
NOTE: The permitted values of the "notificationTypes" attribute are spelled exactly as the names of the notification types to facilitate automated code generation systems.			

5.6.3.10 Type: ClockSyncInfo

This type represents parameters for connecting to an NTP server. It shall comply with the provisions defined in table 5.6.3.10-1.

Table 5.6.3.10-1: Definition of the ClockSyncInfo data type

Attribute name	Data type	Cardinality	Description
type	Enum (inlined)	1	Type of clock synchronization. Permitted values: • NTP: For Network Time Protocol (NTP) based clock synchronization. • OTHER: For other types of clock synchronization.
ntpServerInfo	Structure (inlined)	0..1	Information for the NTP based clock synchronization. Shall be present if type = "NTP".
>ipAddress	IpAddress	0..1	IP address of the NTP server. See note.

Attribute name	Data type	Cardinality	Description
>hostname	String	0..1	Indicates the hostname of the NTP server. See note.
otherClockSyncParams	KeyValuePairs	0..1	Information for the other types of clock synchronization. May be present if type = "OTHER".
NOTE: Either ipAddress or hostname shall be set, but not both at the same time.			

5.6.3.11 Type: ServerInterfaceSecurityInfo

This type represents security related information of an NFV-MANO service interface produced by an NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.3.11-1.

Table 5.6.3.11-1: Definition of the ServerInterfaceSecurityInfo data type

Attribute name	Data type	Cardinality	Description
authType	Enum (inlined)	1..N	Type of API request authorization to be used by the API producer. The support of authorization methods for the API producer is specified in clause 8.3.6 of ETSI GS NFV-SOL 013 [4]. Permitted values: • TLS_TUNNEL: Using TLS tunnel, as defined by TLS 1.2 in IETF RFC 5246 [i.14]. • TLS_TUNNEL_13: Using TLS tunnel, as defined by TLS 1.3 in IETF RFC 8446 [i.28]. • OAUTH2: Using access token, as defined by the OAuth 2.0 specification in IETF RFC 6749 [i.15].
oauthServerInfo	Structure (inlined)	1	OAuth 2.0 authorization server information and configuration.
>dynamicDiscovery	Structure (inlined)	0..1	Configuration data used when performing dynamic discovery of the authorization server identifier. See note.
>>webFingerHost	Uri	1	Server where the WebFinger service is hosted. When used, the request to the WebFinger resource shall conform as specified in clause 5.1.3 of ETSI GS NFV-SEC 022 [5].
>providedConfiguration	Structure (inlined)	1	Configuration data used to setup the authorization server identifier. See note.
>>authServerId	Uri	1	Authorization server identifier as defined in ETSI GS NFV-SEC 022 [5].
>tlsCipherSuites	String	1..N	List of cipher suites that shall be declared as supported by the API producer when performing the SSL or TLS negotiation with the authorization server. Valid values of cipher suites are defined in IETF RFC 8447 [6].
tlsTunnelInfo	Structure (inlined)	0..1	Information and configuration related to the use of TLS tunnel. Shall be present if authType contains "TLS_TUNNEL".
>tlsTunnelCipherSuites	String	1..N	List of cipher suites that shall be declared as supported by the API producer when performing the SSL or TLS negotiation with the API client. Valid values of cipher suites are defined in IETF RFC 8447 [6].
NOTE: Provided configuration of the OAuth 2.0 authorization server information and configuration shall be supported, and dynamic configuration may be supported.			

5.6.3.12 Type: ClientInterfaceSecurityInfo

This type represents security related information for accessing an NFV-MANO service interface produced by an NFV-MANO functional entity. It shall comply with the provisions defined in table 5.6.3.12-1.

Table 5.6.3.12-1: Definition of the ClientInterfaceSecurityInfo data type

Attribute name	Data type	Cardinality	Description
authType	Enum (inlined)	1..N	Type of API request authorization to be used by the API consumer accessing the API. The support of authorization methods for the API consumer is specified in clause 8.3.6 of ETSI GS NFV-SOL 013 [4]. Permitted values: • TLS_TUNNEL: Using TLS tunnel, as defined by TLS 1.2 in IETF RFC 5246 [i.14]. • TLS_TUNNEL_13: Using TLS tunnel, as defined by TLS 1.3 in IETF RFC 8446 [i.28]. • OAUTH2: Using access token, as defined by the OAuth 2.0 specification in IETF RFC 6749 [i.15].
oauthServerInfo	Structure (inlined)	1	OAuth 2.0 authorization server information and configuration.
>dynamicDiscovery	Structure (inlined)	0..1	Configuration data used when performing dynamic discovery of the authorization server identifier. See note.
>>webFingerHost	Uri	1	Server where the WebFinger service is hosted. When used, the request to the WebFinger resource shall conform as specified in clause 5.1.3 of ETSI GS NFV-SEC 022 [5].
>providedConfiguration	Structure (inlined)	1	Configuration data used to setup the authorization server identifier. See note.
>>authServerId	Uri	1	Authorization server identifier as defined in ETSI GS NFV-SEC 022 [5].
>tlsCipherSuites	String	1..N	List of cipher suites that shall be declared as supported by the API consumer when performing the SSL or TLS negotiation with the authorization server. Valid values of cipher suites are defined in IETF RFC 8447 [6].
tlsTunnelInfo	Structure (inlined)	0..1	Information and configuration related to the use of TLS tunnel. Shall be present if authType contains "TLS_TUNNEL".
>tlsTunnelCipherSuites	String	1..N	List of cipher suites that shall be declared as supported by the API consumer when performing the SSL or TLS negotiation with the API producer. Valid values of cipher suites are defined in IETF RFC 8447 [6].
NOTE: Provided configuration of the OAuth 2.0 authorization server information and configuration shall be supported, and dynamic configuration may be supported.			

5.6.3.13 Type: WimSpecificInfo

This type represents information attributes specific to a WIM entity, and that can be relevant to more than one NFV-MANO service offered by a WIM entity. It shall comply with the provisions defined in table 5.6.3.13-1.

NOTE: The present document version does not specify the support for a) "list of protocols of particular layers used to realize an MSNC that are supported by the WIM (attribute "msncLayerProtocolSupport")" as specific in clause 7.2.14.2 of ETSI GS NFV-IFA 031 [1].

Table 5.6.3.13-1: Definition of the WimSpecificInfo data type

Attribute name	Data type	Cardinality	Description
maxMscsNums	Structure (inlined)	1..N	Maximum number of MSCS that the WIM can manage.
>numMscs	Integer	1	Maximum number of MSCS.
>criteriaNumMscs	KeyValuePairs	0..1	Reference criteria for derivation/computation of the referred maximum number of MSCS in attribute "numMscs". Shall be provided if specific criteria has been taken into account for deriving the referred number.
maxMsncNum	Structure (inlined)	1..N	Maximum number of MSNC that the WIM can manage.
>numMsnc	Integer	1	Maximum number of MSNC.
>criteriaNumMsnc	KeyValuePairs	0..1	Reference criteria for derivation/computation of the referred maximum number of MSNC in attribute "numMsnc". Shall be provided if specific criteria has been taken into account for deriving the referred number.
mscsLayerProtocolSupport	Enum (inlined)	1..N	List of protocols of particular layers used to realize an MSCS that are supported by the WIM. Permitted values are as listed below: - EVPN_BGP_MPLS: L2 MSCS realized by BGP MPLS-based Ethernet VPN (EVPN) as specified in IETF RFC 7432 [i.19]. - EVPN_VPWS: L2 MSCS realized by EVPN Virtual Private Wire Service (VPWS) as specified in IETF RFC 8214 [i.25]. - VPLS_BGP: L2 MSCS realized by Virtual Private LAN Service (VPLS) using BGP as specified in IETF RFC 4761 [i.20] and IETF RFC 6624 [i.21]. - VPLS_LDP_L2TP: L2 MSCS realized by VPLS using Label Distribution Protocol (LDP) Layer 2 Tunnelling Protocol (L2TP) as specified in IETF RFC 4762 [i.22] and IETF RFC 6074 [i.23]. - VPWS_LDP_L2TP: L2 MSCS realized by VPWS using LDP L2TP as specified in IETF RFC 6074 [i.23]. - BGP_IP_VPN: L3 MSCS realized by BGP/MPLS based IP VPN as specified in IETF RFC 4364 [i.24].

5.6.3.14 Type: CismSpecificInfo

This type represents information attributes specific to a CISM entity, and that can be relevant to more than one NFV-MANO service offered by a CISM entity. It shall comply with the provisions defined in table 5.6.3.14-1.

NOTE: No attributes are specified in the present document version. The definition of attributes is left for future specification.

Table 5.6.3.14-1: Definition of the CismSpecificInfo data type

Attribute name	Data type	Cardinality	Description
None			

5.6.3.15 Type: CirSpecificInfo

This type represents information attributes specific to a CIR entity, and that can be relevant to more than one NFV-MANO service offered by a CIR entity. It shall comply with the provisions defined in table 5.6.3.15-1.

Table 5.6.3.15-1: Definition of the CirSpecificInfo data type

Attribute name	Data type	Cardinality	Description
osContainerImageFormats	String	1..N	List of supported OS container image formats. Valid values are all values for "container_format" as defined in ETSI GS NFV-SOL 001 [i.16] and all values for "container-format" as defined in ETSI GS NFV-SOL 006 [i.17].
imageSignatureVerification	Structure (inlined)	1	Information about the supported mechanisms, algorithms, and protocols for verifying the signature of software images.
>signatureVerificationAlgorithms	Structure (inlined)	1..N	List of algorithms for verifying the signature of software images that are supported by the CIR.
>>algorithm	String	1	The name of the algorithm. Permitted values are: "RSA", "DSA", "ECDSA".
>>keyLengths	String	1..N	List of supported key lengths of the algorithm. The key length indicates the number of bits, such as "256", "512", etc. See note.
>>additionalAlgParams	KeyValuePairs	0..1	Additional parameters specific to the signature verification algorithm.
imageDigestAlgorithms	Structure (inlined)	1..N	List of supported digest algorithms that can be used for digital signatures.
>algorithm	String	1	The name of the algorithm. Permitted values are: "SHA2", "SHA3".
>keyLengths	String	1..N	List of supported key lengths of the algorithm. The key length indicates the number of bits, such as "256", "512", etc. See note.
NOTE: Recommendations on appropriate algorithms and key lengths are given e.g. in NIST Special Publication 800-57 Part 3 Revision 1 [i.26] or in documents related to local legislation.			

5.6.3.16 Type: CcmSpecificInfo

This type represents information attributes specific to a CCM entity, and that can be relevant to more than one NFV-MANO service offered by a CCM entity. It shall comply with the provisions defined in table 5.6.3.16-1.

NOTE: The present document version does not specify the support for "supported CIS Cluster Descriptors (CCD) data formats (attribute "supportedCcdFormat")" as specified in clause 7.2.18 of ETSI GS NFV-IFA 031 [1] pending on the development of other related protocol and data models specifications for CIS cluster management.

Table 5.6.3.16-1: Definition of the CcmSpecificInfo data type

Attribute name	Data type	Cardinality	Description
clusterResourceMgmtModes	Enum (inlined)	1..N	The supported cluster resource management modes. Available modes include: virtual and bare-metal resources, and for both types, on-demand (i.e. CCM requests to corresponding infrastructure managers to build necessary pools of resources) or pooled (i.e. CCM manages resources from pre-allocated resource pools). Multiple values can be specified. See note. Permitted values: VIRTUAL-ON-DEMAND: virtual resources on demand. VIRTUAL-POOLED: virtual resources from a pre-allocated resource pool. BARE-METAL-ON-DEMAND: bare-metal resources on demand. BARE-METAL-POOLED: bare-metal resources from a pre-allocated resource pool.
NOTE: Hybrid CIS clusters include both physical and virtual CIS cluster nodes and can be supported by a combination of relevant "clusterResourceMgmtModes".			

5.6.4 Referenced simple data types and enumerations

5.6.4.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

5.6.4.2 Simple data types

No particular simple data types are defined for this interface, in addition to those defined in clause 4.2.3.

5.6.4.3 Type: ManoServiceInterfaceTypeShortName

For the RESTful NFV-MANO APIs, valid values are all values for "apiName" as defined in ETSI GS NFV-SOL 002 [9], ETSI GS NFV-SOL 003 [10], ETSI GS NFV-SOL 005 [11], ETSI GS NFV-SOL 011 [13] and ETSI GS NFV-SOL 012 [14].

For the NFV-MANO service interfaces for which no API is specified by ETSI NFV, valid values are defined in table 5.6.4.3-1.

NOTE: The table is expected to be updated, by removing the corresponding listed entries, once the interfaces are specified as a RESTful NFV-MANO API.

Table 5.6.4.3-1: String values for types of NFV-MANO service interfaces

Acronym string value	Description
"sim"	Represents the "Software Image Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vcrm"	Represents the "Virtualised Compute Resources Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vcrim"	Represents the "Virtualised Compute Resources Information Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vcrcam"	Represents the "Virtualised Compute Resources Capacity Management" interface produced by a VIM (refer to IFA005).
"vcrcn"	Represents the "Virtualised Compute Resources Change Notification" interface produced by a VIM (refer to IFA005 and IFA006).

Acronym string value	Description
"vcfm"	Represents the "Virtualised Compute Flavour Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vnrm"	Represents the "Virtualised Network Resources Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vnrim"	Represents the "Virtualised Network Resources Information Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vnrcam"	Represents the "Virtualised Network Resources Capacity Management" interface produced by a VIM (refer to IFA005).
"vnrcn"	Represents the "Virtualised Network Resources Change Notification" interface produced by a VIM (refer to IFA005 and IFA006).
"nfpm"	Represents the "Network Forwarding Path Management" interface produced by a VIM (refer to IFA005).
"vsrm"	Represents the "Virtualised Storage Resources Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vsrim"	Represents the "Virtualised Storage Resources Information Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vsrcam"	Represents the "Virtualised Storage Resources Capacity Management" interface produced by a VIM (refer to IFA005).
"vsrcn"	Represents the "Virtualised Storage Resources Change Notification" interface produced by a VIM (refer to IFA005 and IFA006).
"vrpm"	Represents the "Virtualised Resources Performance Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vrfm"	Represents the "Virtualised Resources Fault Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vcrmm"	Represents the "Virtualised Compute Resources Reservation Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vnrmm"	Represents the "Virtualised Network Resources Reservation Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vsrmm"	Represents the "Virtualised Storage Resources Reservation Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vrrcn"	Represents the "Virtualised Resources Reservation Change Notification" interface produced by a VIM (refer to IFA005 and IFA006).
"vcrqm"	Represents the "Virtualised Compute Resources Quota Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vnrqm"	Represents the "Virtualised Network Resources Quota Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vsrqm"	Represents the "Virtualised Storage Resources Quota Management" interface produced by a VIM (refer to IFA005 and IFA006).
"vrqcn"	Represents the "Virtualised Resources Quota Change Notification" interface produced by a VIM (refer to IFA005 and IFA006).
"chrm"	Represents the "Compute Host Reservation Management" interface produced by a VIM (refer to IFA005).
"chcam"	Represents the "Compute Host Capacity Management" interface produced by a VIM (refer to IFA005).
"vnfspkgm"	Represents the "VNF Snapshot Package Management" interface produced by a VNFM (refer to IFA007 and IFA013). This value is deprecated and it can be removed in subsequent versions of the present document. ETSI GS NFV-SOL 005 [11] has specified to use the string "vnfsnapshotpkgm" as "apiName".
"vcrm_ind"	Represents the indirect "Virtualised Compute Resources Management" interface produced by an NFVO (refer to IFA007).
"vcrim_ind"	Represents the indirect "Virtualised Compute Resources Information Management" interface produced by an NFVO (refer to IFA007).
"vcrcn_ind"	Represents the indirect "Virtualised Compute Resources Change Notification" interface produced by an NFVO (refer to IFA007).
"vsrm_ind"	Represents the indirect "Virtualised Storage Resources Management" interface produced by an NFVO (refer to IFA007).
"vsrim_ind"	Represents the indirect "Virtualised Storage Resources Information Management" interface produced by an NFVO (refer to IFA007).
"vsrcn_ind"	Represents the indirect "Virtualised Storage Resources Change Notification" interface produced by an NFVO (refer to IFA007).
"vnrm_ind"	Represents the indirect "Virtualised Network Resources Management" interface produced by an NFVO (refer to IFA007).
"vnrim_ind"	Represents the indirect "Virtualised Network Resources Information Management" interface produced by an NFVO (refer to IFA007).

Acronym string value	Description
"vnrcn_ind"	Represents the indirect "Virtualised Network Resources Change Notification" interface produced by an NFVO (refer to IFA007).
"vcrrm_ind"	Represents the indirect "Virtualised Compute Resources Reservation Management" interface produced by an NFVO (refer to IFA007).
"vsrrm_ind"	Represents the indirect "Virtualised Storage Resources Reservation Management" interface produced by an NFVO (refer to IFA007).
"vnrrm_ind"	Represents the indirect "Virtualised Network Resources Reservation Management" interface produced by an NFVO (refer to IFA007).
"vrrcn_ind"	Represents the indirect "Virtualised Resources Reservation Change Notification" interface produced by an NFVO (refer to IFA007).
"vrpm_ind"	Represents the indirect "Virtualised Resources Performance Management" interface produced by an NFVO (refer to IFA007).
"vrfm_ind"	Represents the indirect "Virtualised Resources Fault Management" interface produced by an NFVO (refer to IFA007).
"vcrqm_ind"	Represents the indirect "Virtualised Resources Compute Quota Management" interface produced by an NFVO (refer to IFA007).
"vsrqm_ind"	Represents the indirect "Virtualised Storage Resources Quota Management" interface produced by an NFVO (refer to IFA007).
"vnrqm_ind"	Represents the indirect "Virtualised Network Resources Quota Management" interface produced by an NFVO (refer to IFA007).
"vrqcn_ind"	Represents the indirect "Virtualised Resources Quota Change Notification" interface produced by an NFVO (refer to IFA007).
"lcmcoord"	Represents the "LCM Coordination" interface produced by an EM and OSS (refer to IFA008 and IFA013).
"mscsm"	Represents the "MSCS Management" interface produced by a WIM (refer to IFA032).
"mscscapm"	Represents the "(MSCS) Capacity Management" interface produced by a WIM (refer to IFA032).
"mscsfm"	Represents the "(MSCS) Fault Management" interface produced by a WIM (refer to IFA032).
"mscspm"	Represents the "(MSCS) Performance Management" interface produced by a WIM (refer to IFA032).
"cismwkldm"	Represents the "OS container workload management" service interface produced by a CISM (refer to IFA040).
"cismcompm"	Represents the "OS container compute management" service interface produced by a CISM (refer to IFA040).
"cismstrgm"	Represents the "OS container storage management" service interface produced by a CISM (refer to IFA040).
"cismnetwm"	Represents the "OS container network management" service interface produced by a CISM (refer to IFA040).
"cismcfgm"	Represents the "OS container configuration management" service interface produced by a CISM (refer to IFA040).
"cismcisim"	Represents the "CIS instance management" service interface produced by a CISM (refer to IFA036).
"cismcismccom"	Represents the "CIS MCCO management" service interface produced by a CISM (refer to IFA036).
"cirimgm"	Represents the "OS container image management" service interface produced by a CIR (refer to IFA040).
"ccmcisclcm"	Represents the "CIS cluster lifecycle management" service interface produced by a CCM (refer to IFA036).
"ccmciscfm"	Represents the "CIS cluster fault management" service interface produced by a CCM (refer to IFA036).
"ccmciscpm"	Represents the "CIS cluster performance management" service interface produced by a CCM (refer to IFA036).
"ccmciscm"	Represents the "CIS cluster configuration management" service interface produced by a CCM (refer to IFA036).
"ccmciscsm"	Represents the "CIS cluster security management" service interface produced by a CCM (refer to IFA036).
NOTE: "IFA005", "IFA006", "IFA007", "IFA008", "IFA013", "IFA032", "IFA040" are used as a shorthand for the specifications ETSI GS NFV-IFA 005 [i.5], ETSI GS NFV-IFA 006 [i.6], ETSI GS NFV-IFA 007 [i.7], ETSI GS NFV-IFA 008 [i.8], ETSI GS NFV-IFA 013 [i.9], ETSI GS NFV-IFA 032 [i.18], ETSI GS NFV-IFA 040 [i.27] and ETSI GS NFV-IFA 036 [i.29] respectively.	

5.6.4.4 Enumeration: OperationalStateEnumType

The enumeration OperationalStateEnumType defines values representing the operational state of an NFV-MANO functional application type of managed entity.

The OperationalStateEnumType shall comply with the provisions defined in table 5.6.4.4-1.

Table 5.6.4.4-1: Enumeration OperationalStateEnumType

Enumeration value	Description
STARTED	The managed entity is operational.
STOPPED	The managed entity is not operational.
STOPPING	The managed entity is in the transition to stop.
STARTING	The managed entity is in the transition to start and become operational.
RESTARTING	The managed entity is in the transition to stop and start again.

5.6.4.5 Enumeration: AdministrativeStateEnumType

The enumeration AdministrativeStateEnumType defines values representing the administrative state of a managed entity.

The AdministrativeStateEnumType shall comply with the provisions defined in table 5.6.4.5-1.

Table 5.6.4.5-1: Enumeration AdministrativeStateEnumType

Enumeration value	Description
LOCKED	The managed entity is administratively prohibited to be used.
UNLOCKED	The managed entity is administratively allowed to be used.
LOCKING	The managed entity is in the transition to be locked.

5.6.4.6 Enumeration: UsageStateEnumType

The enumeration UsageStateEnumType defines values representing the usage state of a managed entity.

The UsageStateEnumType shall comply with the provisions defined in table 5.6.4.6-1.

Table 5.6.4.6-1: Enumeration UsageStateEnumType

Enumeration value	Description
IN_USE	The managed entity is currently being used.
NOT_IN_USE	The managed entity is currently not being used.

5.6.4.7 Enumeration: ChangeOperationalStateEnumType

The enumeration ChangeOperationalStateEnumType defines permitted values for the change state operation.

The ChangeOperationalStateEnumType shall comply with the provisions defined in table 5.6.4.7-1.

Table 5.6.4.7-1: Enumeration ChangeOperationalStateEnumType

Enumeration value	Description
START	To start the managed entity.
STOP	To stop the managed entity.
RESTART	To stop and start again the managed entity.

5.6.4.8 Enumeration: ChangeAdministrativeStateEnumType

The enumeration ChangeAdministrativeStateEnumType defines permitted values for the change of administrative state operation.

The ChangeAdministrativeStateEnumType shall comply with the provisions defined in table 5.6.4.8-1.

Table 5.6.4.8-1: Enumeration ChangeAdministrativeStateEnumType

Enumeration value	Description
LOCK	To lock the managed entity.
UNLOCK	To unlock the managed entity.

5.6.4.9 Enumeration: InterfaceOperationalStateEnumType

The enumeration InterfaceOperationalStateEnumType defines values representing the operational state of an NFV-MANO service interface type of managed entity.

The InterfaceOperationalStateEnumType shall comply with the provisions defined in table 5.6.4.9-1.

Table 5.6.4.9-1: Enumeration InterfaceOperationalStateEnumType

Enumeration value	Description
STARTED	The managed entity is operational.
STOPPED	The managed entity is not operational.
STOPPING	The managed entity is in the transition to stop.
STARTING	The managed entity is in the transition to start and become operational.

5.6.4.10 Enumeration: StopEnumType

The enumeration ChangeStateOpOccStateEnumType defines permitted values for the change state operation. It shall comply with the provisions defined in table 5.6.4.10-1.

Table 5.6.4.10-1: Enumeration ChangeStateOpOccStateEnumType

Enumeration value	Description
GRACEFUL	To stop the managed entity immediately after accepting the request.
FORCEFUL	To stop the managed entity attempting to gracefully discharge the entity from service.

5.6.4.11 Enumeration: ChangeStateOpOccStateEnumType

The enumeration ChangeStateOpOccStateEnumType defines permitted values for the change state operation. It shall comply with the provisions defined in table 5.6.4.11-1.

Table 5.6.4.11-1: Enumeration ChangeStateOpOccStateEnumType

Enumeration value	Description
PROCESSING	The change state operation is currently in execution.
COMPLETED	The change state operation has been completed successfully.
FAILED	The change state operation has failed.

5.6.4.12 Enumeration: ManoEntityEnumType

The enumeration ManoEntityEnumType defines the permitted values to represent NFV-MANO functional entities. It shall comply with the provisions defined in table 5.6.4.12-1.

Table 5.6.4.12-1: Enumeration ManoEntityEnumType

Enumeration value	Description
NFVO	The NFV-MANO functional entity is an NFVO.
VNFM	The NFV-MANO functional entity is a VNFM.
VIM	The NFV-MANO functional entity is a VIM.
WIM	The NFV-MANO functional entity is a WIM.
CISM	The NFV-MANO functional entity is a CISM.
CIR	The NFV-MANO functional entity is a CIR.
CCM	The NFV-MANO functional entity is a CCM.

5.6.4.13 Enumeration: PeerEntityEnumType

The enumeration PeerEntityEnumType defines the permitted values to represent peer functional entities. It shall comply with the provisions defined in table 5.6.4.13-1.

Table 5.6.4.13-1: Enumeration PeerEntityEnumType

Enumeration value	Description
NFVO	The peer functional entity is an NFVO.
VNFM	The peer functional entity is a VNFM.
VIM	The peer functional entity is a VIM.
WIM	The peer functional entity is a WIM.
CISM	The peer functional entity is a CISM.
CIR	The peer functional entity is a CIR.
CCM	The peer functional entity is a CCM.
EM	The peer functional entity is an EM.
OSS	The peer functional entity is an OSS/BSS.

5.7 States and state transitions of an NFV-MANO functional entity

5.7.1 Introduction

The state of an NFV-MANO functional entity application and its provided NFV-MANO service interfaces (all referred hereafter as "managed entities") shall be managed via the NFV-MANO configuration and information management interface.

The complete state of the managed entities is determined based on three aspects:

- operability;
- administration; and
- usage.

The state of an NFV-MANO service interface type of managed entity shall not affect its ability to respond to management operations. In other words, the NFV-MANO service interface managed entity shall be able to respond to NFV-MANO management operations specified in the present document even when the managed entity is in a non-operational state.

In the case of managing the state of an NFV-MANO functional entity application, two cases are possible with respect to the status of the NFV-MANO functional entity:

A) The NFV-MANO functional entity application state is not bound (coupled) to the system's state of the NFV-MANO functional entity.

B) The NFV-MANO functional entity application state is bound (coupled) to the system's state of the NFV-MANO functional entity.

In case of A), the NFV-MANO functional entity shall be able to respond to NFV-MANO management operations specified in the present document even when the NFV-MANO functional entity application type of managed entity is in a non-operational state, i.e. the NFV-MANO functional entity application is in the states "stopped", "restarting" or "stopping".

In case of B), the NFV-MANO functional entity will typically not be able to respond to NFV-MANO management operations specified in the present document when the NFV-MANO functional entity application type of managed entity is in a non-operational state, i.e. the NFV-MANO functional entity application is in the state "stopped", "starting", "restarting" or "stopping". In the particular case that the NFV-MANO functional entity application is "stopped" because the NFV-MANO functional entity system is "down", the NFV-MANO functional entity application may reach the operational state "started", by other means not specified in the present document.

5.7.2 States overview

5.7.2.1 Operational state

The operability of the managed entity (NFV-MANO functional entity application and NFV-MANO service interfaces) is described by the operational state, which determines whether the entity is or not "working". For a given managed entity, the operational state shall be single-valued, readable and writable (i.e. it can be modified). The operational state has four possible values:

- started: the managed entity is operational;
- starting: the managed entity is in the transition to start and become operational;
- restarting: the managed entity is in the transition to stop and start again in order to become operational;
- stopping: the managed entity is in the transition to stop and become not operational;
- stopped: the managed entity is not operational.

NOTE: Similar meanings as defined in Recommendation ITU-T X.731 [i.10] are: a) the "started" state in the present document is referred as "enabled", and b) the "stopped" state is referred as "disabled". However, the operational state attribute in the Recommendation ITU-T X.731 [i.10] is single-valued and read-only, whereas in the present document, the operational state can be modified by using "Change NFV-MANO entity state task" and "change interface state task" resources.

The entry state for an NFV-MANO functional entity application shall be "started". The entry state for an NFV-MANO service interface shall either be "started" or "stopped". These state entry cases are represented by the transitions from the "solid circle" to "started" and "stopped" in figure 5.7.3.1-1.

In the "stopping" state, the managed entity is not expected to handle API requests.

The state of the NFV-MANO service interfaces is bound to the state of the NFV-MANO functional entity application. In particular, when the NFV-MANO functional entity application is in the "stopping" and "stopped" states, so are the NFV-MANO service interfaces of the NFV-MANO functional entity.

5.7.2.2 Administrative state

The administrative state determines the capability whether the managed entity is permitted to be used. For a given managed entity, the administrative state shall be single-valued, readable and writable (i.e. it can be modified). The administrative state has three possible values:

- unlocked: the managed entity is administratively permitted to be used. This state corresponds to the meaning as defined in Recommendation ITU-T X.731 [i.10];
- locking: the managed entity is administratively permitted to be used only for handling service on existing managed objects. This state corresponds to the meaning as defined for the state "shutting down" in the Recommendation ITU-T X.731 [i.10];

NOTE: The description of "shutting down" in the Recommendation ITU-T X.731 [i.10] indicates that "usage is administratively limited to current instances of use". Based on this description, the correspondence in between the "shutting down" and the "locking" state is established.

- locked: the managed entity is administratively prohibited to be used. This state corresponds to the meaning as defined in Recommendation ITU-T X.731 [i.10].

In the locking state, the managed entity shall not accept the activation of new managed objects handled by the corresponding NFV-MANO services of the NFV-MANO functional entity application.

EXAMPLE: Assuming the case where a VNFM is being used for managing two VNF instances, in the:

- unlocked state: the VNFM is allowed to handle requests for creating new VNF instances, or creating new subscriptions for the existing VNF instances, or creating new PM jobs for the existing VNF instances, etc.;
- locking state: the VNFM is not allowed to handle requests for creating new VNF instances, or creating other managed objects for the existing VNF instances;
- locked state: the VNFM is completely discharged from service and is not allowed to handle requests for creating new VNF instances.

END of EXAMPLE

5.7.2.3 Usage state

The usage state determines whether or not the managed entity is actively in use at a specific instant. For a given managed entity, the usage state shall be single-valued and readable. The usage state has two possible values:

- "not in use": the managed entity is not currently in use. This means that the managed entity is not holding any associated managed object;
- "in use": the managed entity is currently in use. A managed entity is "in use" when it maintains, or manages associated managed objects.

From an NFV-MANO state management perspective, the usage state cannot be operated, and it depends on the actual service that the NFV-MANO functional entity and its NFV-MANO services provide. However, by setting the administrative state into "locked", it can be controlled that a managed entity that is "not in use" does not suddenly become "in use".

EXAMPLE: Assuming the case where a VNFM supporting the NFV-MANO service of "VNF LCM", in the:

- "not in use" state: the VNFM does not have any VNF instance being managed;
- "in use" state: the VNFM has one or more VNF instances being managed.

END of EXAMPLE

5.7.3 State operations

5.7.3.1 Operational state changes and interface operations

The changes of operational state of a managed entity that shall be supported by the NFV-MANO functional entity are:

- start: to start the managed entity. If successful, the end operational state shall be "started";
- stop: to stop the managed entity and change its state to "stopping". The stop can be done gracefully or forcefully depending on the operation's input parameterization. If successful, the end operational state shall be "stopped";
- restart: to stop and start again the managed entity. The restart can be done gracefully or forcefully depending on the operation's input parameterization. If successful, the end operational state shall be "started".

Figure 5.7.3.1-1 illustrates the operational state transitions triggered by the change state operations. The entry state is represented by the transitions from the "solid circle" to "started" and "stopped" in figure 5.7.3.1-1 (see provisions in clause 5.7.2.1).

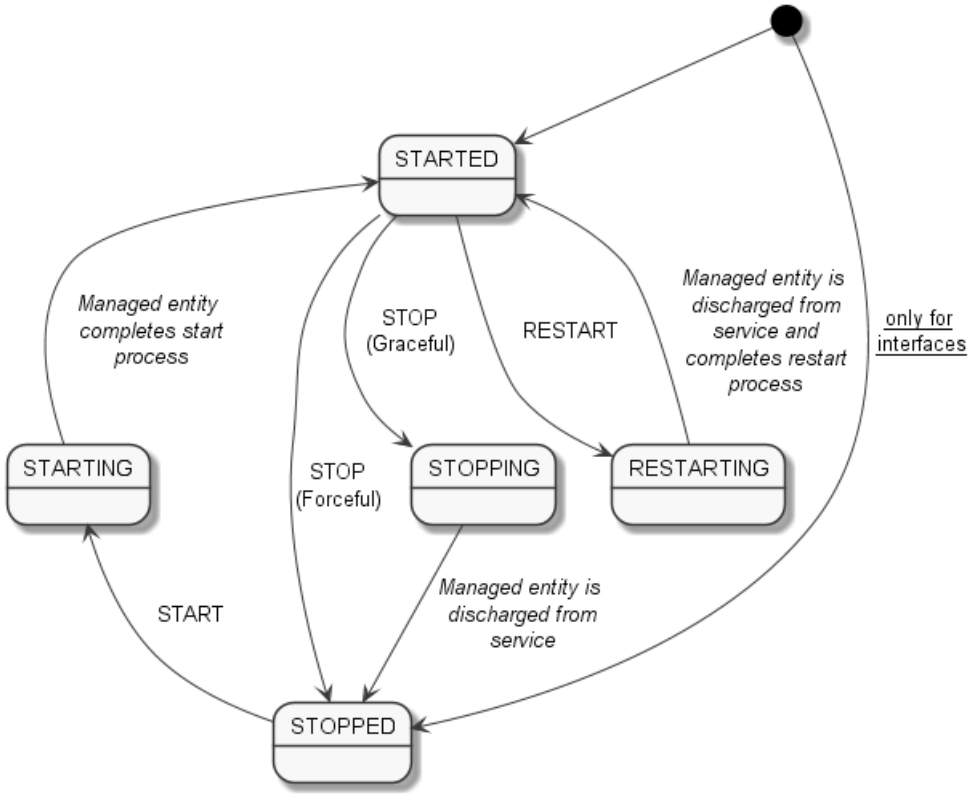

Figure 5.7.3.1-1: Operational state diagram

5.7.3.2 Administrative state changes and interface operations

The changes of administrative state of a managed entity that shall be supported by the NFV-MANO functional entity are:

- lock: to lock the managed entity. In case the managed entity is "in use", the managed entity will first transition to the state "locking". If successful, and after the managed entity is discharged from service, the end administrative state shall be "locked";
- unlock: to unlock the managed entity. If successful, the end administrative state shall be "unlocked".

Figure 5.7.3.2-1 illustrates the administrative state transitions triggered by the change state operations.

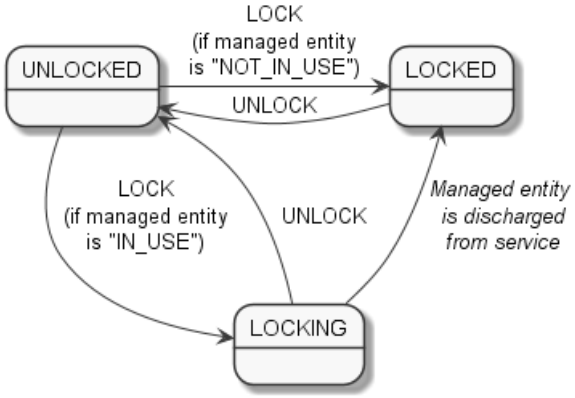

Figure 5.7.3.2-1: Administrative state diagram

6 NFV-MANO Performance Management interface

6.1 Description

This interface enables an NFV-MANO functional entity to provide to the API consumer performance information (measurement results collection and notifications) related to the NFV-MANO functional entity. Collection and reporting of performance information is controlled via PM jobs. A PM job groups details of performance collection and reporting information.

When new performance information is available, the API consumer is notified using the notification PerformanceInformationAvailableNotification.

The operations provided through this interface are:

- Create PM Job
- Query PM Job
- Delete PM Job
- Create Threshold
- Query Threshold
- Delete Threshold
- Notify

6.2 API version

For the NFV-MANO performance management interface as specified in the present document, the MAJOR version field shall be 2, the MINOR version field shall be 0 and the PATCH version field shall be 0 (see clause 9.1 of ETSI GS NFV-SOL 013 [4] for a definition of the version fields). Consequently, the {apiMajorVersion} URI variable shall be set to "v2".

NOTE: In the present document, there were no changes to the clauses defining the NFV-MANO performance management interface that are visible at interface level compared to the previous version of the present document; hence, the MAJOR/MINOR/PATCH version fields are kept the same.

6.3 Resource structure and methods

All resource URIs of the API shall use the base URI specification defined in clause 4.1 of ETSI GS NFV-SOL 013 [4].

The string "nfvmanopm" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the above base URI.

Figure 6.3-1 shows the overall resource URI structure defined for the performance management API.

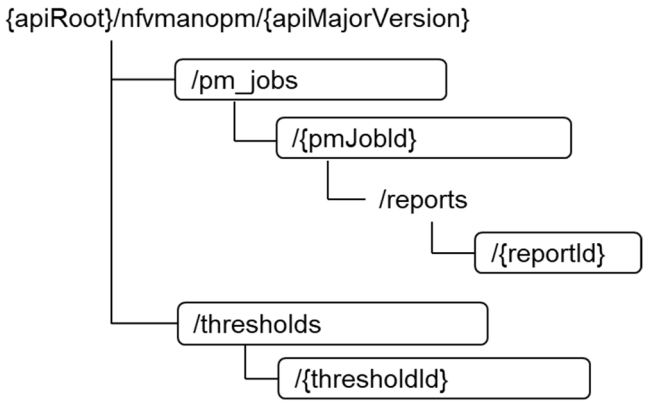

Figure 6.3-1: Resource URI structure of the NFV-MANO performance management interface

Table 6.3-1 lists the individual resources defined, and the applicable HTTP methods.

The NFV-MANO functional entity shall support responding to requests for all HTTP methods on the resources in table 6.3-1 that are marked as "M" (mandatory) in the "Cat" column. The NFV-MANO functional entity shall also support the "API versions" resources as specified in clause 9.3.2 of ETSI GS NFV-SOL 013 [4].

Table 6.3-1: Resources and methods overview of the NFV-MANO performance management interface

Resource name	Resource URI	HTTP Method	Cat	Meaning
PM jobs	/pm_jobs	POST	M	Create a PM job.
		GET	M	Query PM jobs.
Individual PM job	/pm_jobs/{pmJobId}	GET	M	Read a single PM job.
		PATCH	M	Update PM job callback.
		DELETE	M	Delete a PM job.
Individual performance report	/pm_jobs/{pmJobId}/reports/{reportId}	GET	M	Read an individual performance report.
Thresholds	/thresholds	POST	M	Create a threshold.
		GET	M	Query thresholds.
Individual threshold	/thresholds/{thresholdId}	GET	M	Query a single threshold.
		PATCH	M	Update threshold callback.
		DELETE	M	Delete a threshold.
Notification endpoint	(client-defined)	POST	See note	Notify about PM related events. See note.
		GET	See note	Test the notification endpoint. See note.
NOTE: The NFV-MANO functional entity shall support invoking the HTTP methods defined for the "Notification endpoint" resource exposed by the API consumer. If the API consumer supports invoking the POST method on the "PM jobs" or "Thresholds" resource towards the NFV-MANO functional entity, it shall also support responding to the HTTP requests defined for the "Notification endpoint" resource.				

6.4 Sequence diagrams

6.4.1 Flow of creating a PM job

This clause describes a sequence for creating a performance management jobs.

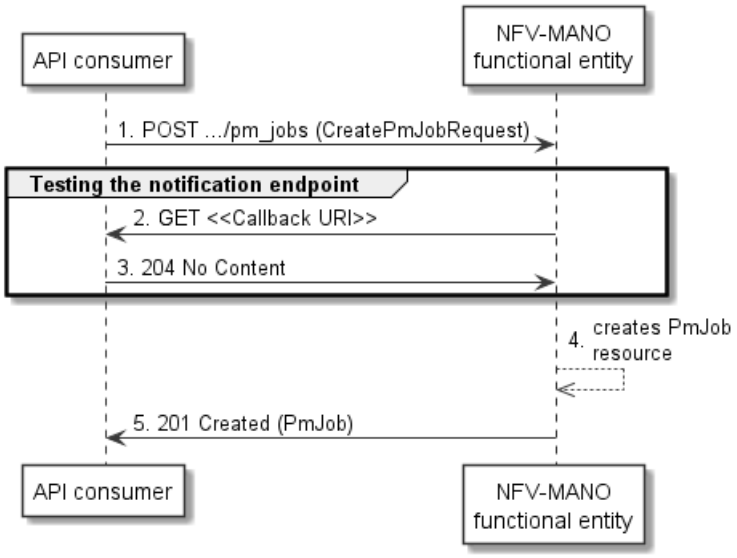

Figure 6.4.1-1: Flow of PM job creation

PM job creation, as illustrated in figure 6.4.1-1, consists of the following steps:

1) If the API consumer intends to create a PM job, it sends a POST request to the "PM jobs" resource, including one data structure of type "CreatePmJobRequest" in the message content.

2) To test the notification endpoint, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

3) The API consumer returns a "204 No Content" response to indicate success.

4) The NFV-MANO functional entity creates a PM job instance.

5) The NFV-MANO functional entity returns a "201 Created" response to the API consumer, and includes in the message content a representation of the PM job just created.

Error handling: In case of failure, including an invalid notification endpoint, appropriate error information is provided in the response.

6.4.1a Flow of updating the callback URI of a PM job

This clause describes a sequence for updating the callback Uri in a PM job.

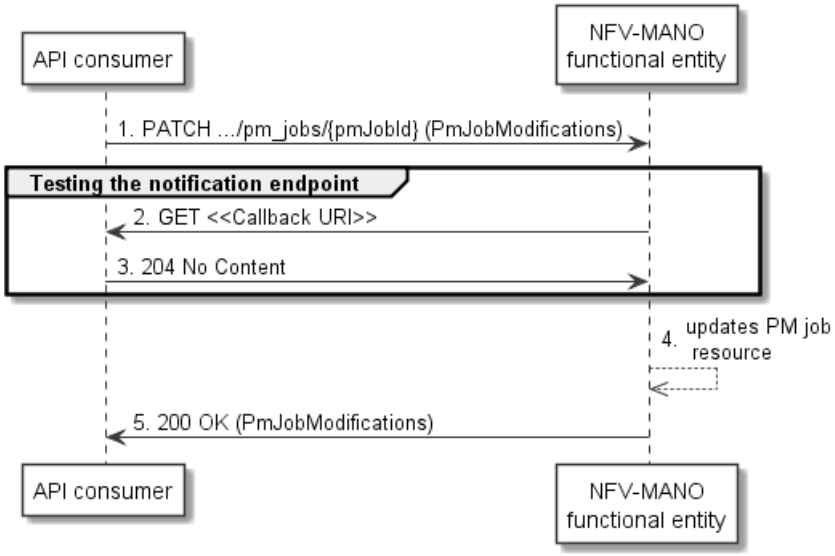

Figure 6.4.1a-1: Flow of PM job callback URI update

PM job callback URI update, as illustrated in figure 6.4.1a-1, consists of the following steps:

1) If the API consumer intends to update the callback URI in a PM job, it sends a PATCH request to the "Individual PM job" resource, including a data structure of type "PmJobModifications" in the message content.

2) To test the notification endpoint that is addressed by the new callback URI, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

3) The API consumer returns a "204 No Content" response to indicate success.

4) The NFV-MANO fimctional entity updates the callback URI of the "Individual PM job" resource.

5) The NFV-MANO functional entity returns a "200 OK" response to the API consumer and includes in the message content a data structure of type "PmJobModifications" to indicate the performed modifications.

Error handling: In case of failure, including an invalid notification endpoint, appropriate error information is provided in the response.

6.4.2 Flow of querying/reading PM jobs

This clause describes a sequence for querying/reading performance management jobs.

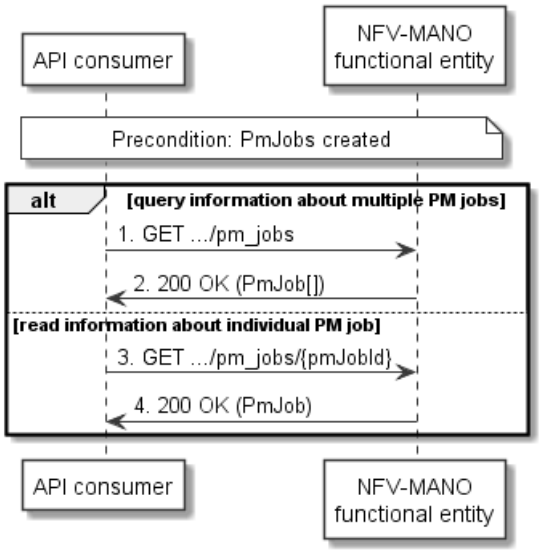

Figure 6.4.2-1: Flow of PM jobs query/read

PM jobs query/read, as illustrated in figure 6.4.2-1, consists of the following steps:

Precondition: PM jobs have been created.

1) If the API consumer intends to query all PM jobs, it sends a GET request to the "PM jobs" resource.

2) In case of step 1), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes zero or more data structures of type "PmJob" in the message content.

3) If the API consumer intends to read information about a particular PM job, it sends a GET request to the "Individual PM job" resource, addressed by the appropriate PM job identifier in its resource URI.

4) In case of step 3), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes one data structure of type "PmJob" in the message content.

Error handling: In case of failure, appropriate error information is provided in the response.

6.4.3 Flow of deleting a PM job

This clause describes a sequence for deleting a performance management job.

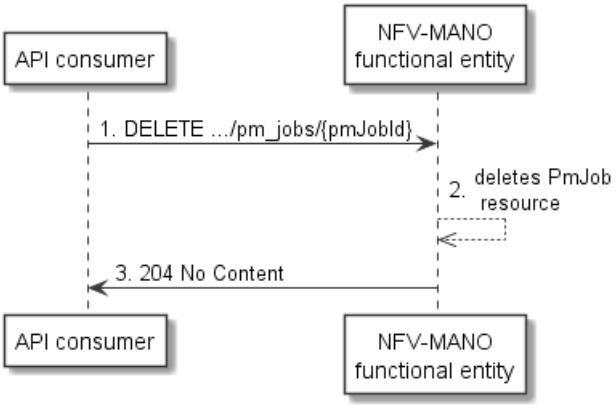

Figure 6.4.3-1: Flow of PM job deletion

PM job deletion, as illustrated in figure 6.4.3-1, consists of the following steps:

1) If the API consumer intends to delete a PM job, it sends a DELETE request to the "Individual PM job" resource, addressed by the appropriate PM job identifier in its resource URI.

2) The NFV-MANO functional entity deletes the "Individual PM job" resource.

3) The NFV-MANO functional entity returns a response with a "204 No Content" response code and an empty message content to the API consumer.

Error handling: In case of failure, appropriate error information is provided in the response.

6.4.4 Flow of obtaining performance reports

This clause describes a sequence for obtaining performance reports.

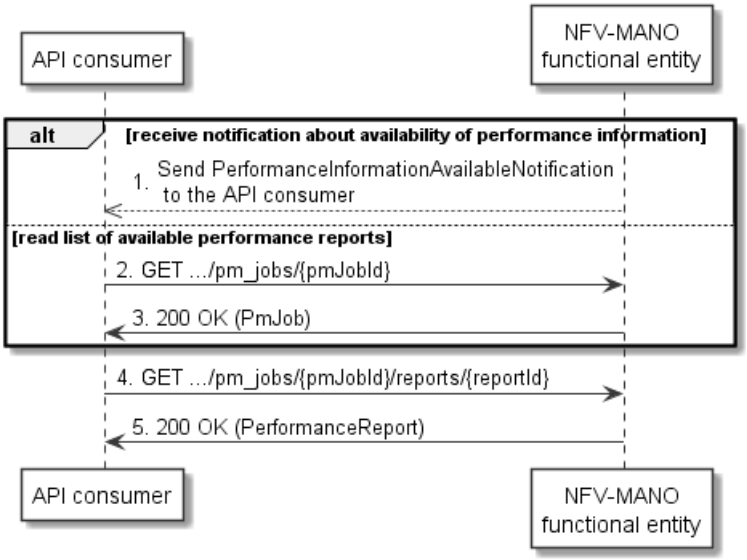

Figure 6.4.4-1: Flow of obtaining performance reports

Obtaining a performance report, as illustrated in figure 6.4.4-1, consists of the following steps:

1) The NFV-MANO functional entity sends to the API consumer a "PerformanceInformationAvailableNotification" (see clause 6.6.2.5) that indicates the availability of a new performance report, including a link from which the report can be obtained.

2) Alternatively, the API consumer sends a GET request to the "Individual PM job" resource, to obtain a representation of the PM job resource including information about performance reports that are available for this PM job, including their URIs.

3) In case of step 2), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes a data structure of type "PmJob" in the message content.

4) The API consumer sends to the NFV-MANO functional entity a GET request to the URI obtained either in step 1) or step 3), in order to read a performance report resource.

5) The NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes a data structure of type "PerformanceReport" in the message content.

6.4.5 Flow of creating a threshold

This clause describes a sequence for creating a performance management threshold.

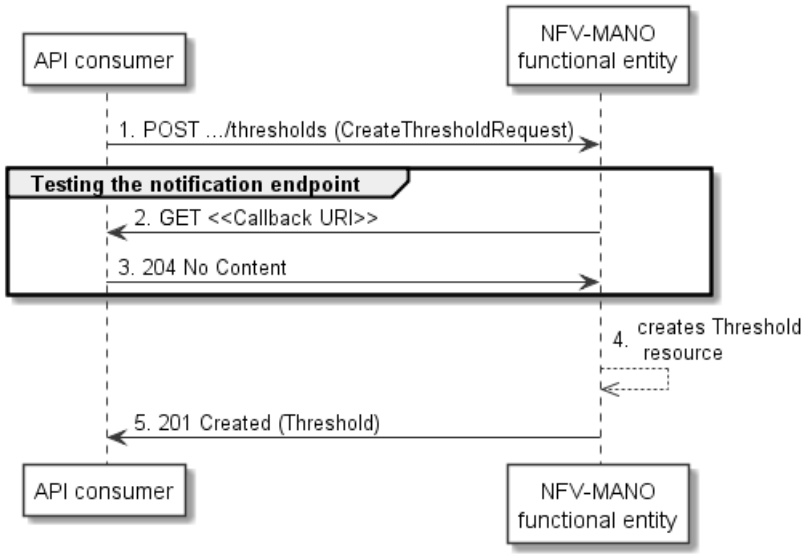

Figure 6.4.5-1: Flow of threshold creation

Threshold creation, as illustrated in figure 6.4.5-1, consists of the following steps:

1) If the API consumer intends to create a threshold, it sends a POST request to the "Thresholds" resource, including a data structure of type "CreateThresholdRequest" in the message content.

2) To test the notification endpoint, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

3) The API consumer returns a "204 No Content" response to indicate success.

4) The NFV-MANO functional entity creates a threshold resource.

5) The NFV-MANO functional entity returns a "201 Created" response to the API consumer, and includes in the message content a representation of the threshold just created.

Error handling: In case of failure, including an invalid notification endpoint, appropriate error information is provided in the response.

6.4.5a Flow of updating the callback URI of a threshold

This clause describes a sequence for updating the callback Uri in a performance management threshold.

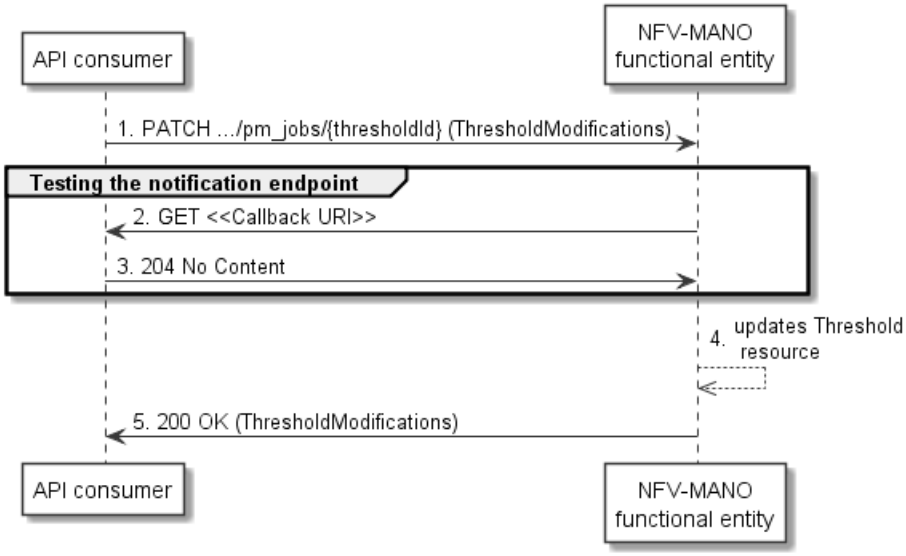

Figure 6.4.5a-1: Flow of threshold callback URI update

Threshold callback URI update, as illustrated in figure 6.4.5a-1, consists of the following steps:

1) If the API consumer intends to update the callback URI in a threshold, it sends a PATCH request to the "Individual threshold" resource, including a data structure of type "ThresholdModifications" in the message content.

2) To test the notification endpoint that is addressed by the new callback URI, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

3) The API consumer returns a "204 No Content" response to indicate success.

4) The NFV-MANO functional entity updates the callback URI of the "Individual threshold" resource.

5) The NFV-MANO functional entity returns a "200 OK" response to the API consumer and includes in the message content a data structure of type "ThresholdModifications" to indicate the performed modifications.

Error handling: In case of failure, including an invalid notification endpoint, appropriate error information is provided in the response.

6.4.6 Flow of querying/reading thresholds

This clause describes a sequence for querying/reading performance management thresholds.

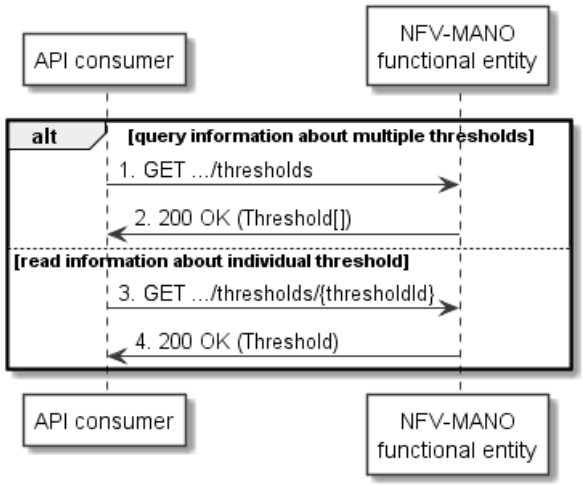

Figure 6.4.6-1: Flow of thresholds query/read

Threshold query/read, as illustrated in figure 6.4.6-1, consists of the following steps:

1) If the API consumer intends to query all thresholds, it sends a GET request to the "Thresholds" resource.

2) In case of step 1), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes zero or more data structures of type "Threshold" in the message content.

3) If the API consumer intends to read information about a particular threshold, it sends a GET request to the "Individual threshold" resource addressed by the appropriate threshold identifier in its resource URI.

4) In case of step 3), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes a data structure of type "Threshold" in the message content.

Error handling: In case of failure, appropriate error information is provided in the response.

6.4.7 Flow of deleting thresholds

This clause describes a sequence for deleting performance management thresholds.

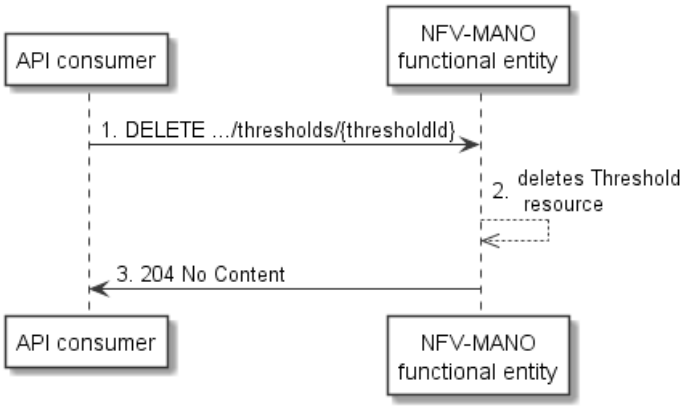

Figure 6.4.7-1: Flow of threshold deletion

Threshold deletion, as illustrated in figure 6.4.7-1, consists of the following steps:

1) If the API consumer intends to delete a particular threshold, it sends a DELETE request to the "Individual threshold" resource, addressed by the appropriate threshold identifier in its resource URI.

2) The NFV-MANO functional entity deletes the "Individual threshold" resource.

3) The NFV-MANO functional entity returns a "204 No Content" response code to the API consumer. The response body will be empty.

Error handling: In case of failure, appropriate error information is provided in the response.

6.4.8 Void

6.4.9 Flow of sending notifications

This clause describes the procedure for sending notifications related to NFV-MANO performance management.

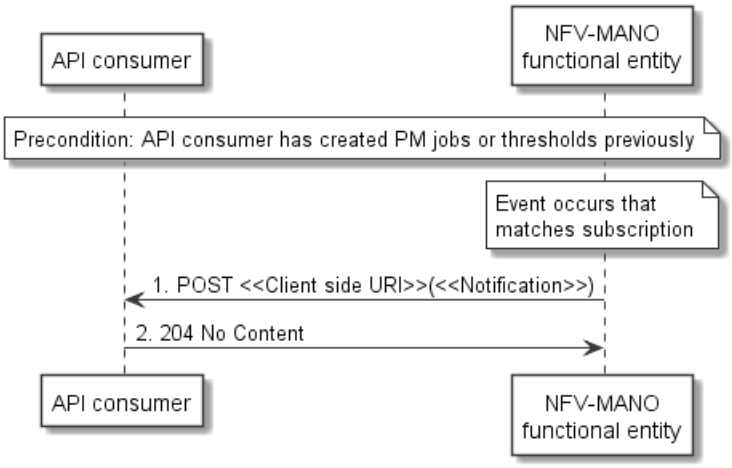

Figure 6.4.9-1: Flow of sending notifications

The procedure consists of the following steps as illustrated in figure 6.4.9-1:

Precondition: The API consumer has previously created thresholds and or PM jobs which trigger notifications related to NFV-MANO functional entity performance management.

1) If an event occurs that indicates a threshold crossing or availability of performance information in a PM job, the NFV-MANO functional entity generates a notification that includes information about the event, and sends it in the body of a POST request to the URI which the API consumer has registered as part of creating the threshold or PM job. The variable <<Notification>> in the flow is a placeholder for the different types of notifications that can be sent by this API.

2) The API consumer acknowledges the successful delivery of the notification by returning a "204 No Content" response.

Error handling: If the NFV-MANO functional entity does not receive the "204 No Content" response from the API consumer, it can retry sending the notification.

6.5 Resources

6.5.1 Introduction

This clause defines all the resources and methods provided by the NFV-MANO performance management interface.

6.5.2 Resource: API versions

The "API versions" resources as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [4] are part of the NFV-MANO performance management interface.

6.5.3 Resource: PM jobs

6.5.3.1 Description

This resource represents PM jobs. The client can use this resource to create and query PM jobs.

6.5.3.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanopm/{apiMajorVersion}/pm_jobs

This resource shall support the resource URI variables defined in table 6.5.3.2-1.

Table 6.5.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 6.2.

6.5.3.3 Resource methods

6.5.3.3.1 POST

The POST method creates a PM job.

This method shall follow the provisions specified in tables 6.5.3.3.1-1 and 6.5.3.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual PM job" resource as defined in clause 6.5.4 shall have been created.

Table 6.5.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.3.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	CreatePmJobRequest	1	PM job creation request.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	PmJob	1	201 Created	Shall be returned when the PM job has been created successfully. The response body shall contain a representation of the created "Individual PM job" resource, as defined in clause 6.6.2.7. The HTTP response shall include a "Location" HTTP header that points to the created "Individual PM job" resource.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 6.5.10.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.3.3.2 GET

The client can use this method to retrieve information about PM jobs.

This method shall follow the provisions specified in tables 6.5.3.3.2-1 and 6.5.3.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the PmJob and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity shall support this parameter.
fields	0..1	Complex attributes to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_fields	0..1	Complex attributes to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity shall support this parameter. The following attributes shall be excluded from the PmJob structure in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: • reports.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 6.5.3.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	PmJob	0..N	200 OK	Shall be returned when information about zero or more PM jobs has been queried successfully. The response body shall contain in an array the representations of zero or more PM jobs, as defined in clause 6.6.2.7. If the "filter" URI parameter or one of the "all_fields", "fields" (if supported), "exclude_fields" (if supported) or "exclude_default" URI parameters was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clauses 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [4], respectively. If the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.4 Resource: Individual PM job

6.5.4.1 Description

This resource represents an individual PM job. The client can use this resource to delete and read the underlying PM job.

6.5.4.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanopm/{apiMajorVersion}/pm_jobs/{pmJobId}

This resource shall support the resource URI variables defined in table 6.5.4.2-1.

Table 6.5.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 6.2.
pmJobId	Identifier of the PM job. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new PM job resource. It can also be retrieved from the "id" attribute in the message content of that response.	

6.5.4.3 Resource methods

6.5.4.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.4.3.2 GET

The client can use this method for reading an individual PM job.

This method shall follow the provisions specified in tables 6.5.4.3.2-1 and 6.5.4.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.4.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.4.3.2-2: Details of the GET request/response on this resource

Request body	**Data type**	**Cardinality**	**Description**	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	PmJob	1	200 OK	Shall be returned when information about an individual PM job has been read successfully. The response body shall contain a representation of the "Individual PM job" resource, as defined in clause 6.6.2.7.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.4.3.4 PATCH

This method allows to modify an "individual PM job" resource.

This method shall follow the provisions specified in tables 6.5.4.3.4-1 and 6.5.4.3.4-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.4.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.4.3.4-2: Details of the PATCH request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	PmJobModifications	1	Parameters for the PM job modification. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [3].	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	PmJobModifications	1	200 OK	Shall be returned when the request has been processed successfully. The response body shall contain a data structure of type "PmJobModifications".
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 6.5.10.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.4.3.5 DELETE

This method terminates an individual PM job.

This method shall follow the provisions specified in tables 6.5.4.3.5-1 and 6.5.4.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual PM job" resource shall not exist any longer.

Table 6.5.4.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.4.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the PM job has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.5 Resource: Individual performance report

6.5.5.1 Description

This resource represents an individual performance report that was collected by a PM job. The client can use this resource to read the performance report. The URI of this report can be obtained from a PerformanceInformationAvailableNotification (see clause 6.6.2.5) or from the representation of the "Individual PM job" resource.

It is determined by means outside the scope of the present document, such as configuration or policy, how long an individual performance report is available.

6.5.5.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanopm/{apiMajorVersion}/pm_jobs/{pmJobId}/reports/{reportId}

This resource shall support the resource URI variables defined in table 6.5.5.2-1.

Table 6.5.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 6.2.
pmJobId	Identifier of the PM job.
reportId	Identifier of the performance report.

6.5.5.3 Resource methods

6.5.5.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.5.3.2 GET

The client can use this method for reading an individual performance report.

This method shall follow the provisions specified in tables 6.5.5.3.2-1 and 6.5.5.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.5.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.5.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	PerformanceReport	1	200 OK	Shall be returned when information of an individual performance report has been read successfully. The response body shall contain a representation of the "Individual performance report" resource, as defined in clause 6.6.2.10.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.5.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.6 Resource: Thresholds

6.5.6.1 Description

This resource represents thresholds. The client can use this resource to create and query thresholds.

6.5.6.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanopm/{apiMajorVersion}/thresholds

This resource shall support the resource URI variables defined in table 6.5.6.2-1.

Table 6.5.6.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 6.2.

6.5.6.3 Resource methods

6.5.6.3.1 POST

The POST method can be used by the client to create a threshold.

This method shall follow the provisions specified in tables 6.5.6.3.1-1 and 6.5.6.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual threshold" resource as defined in clause 6.5.7 shall have been created.

Table 6.5.6.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.6.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	CreateThresholdRequest	1	Request parameters to create a threshold.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	Threshold	1	201 Created	Shall be returned when a threshold has been created successfully. The response body shall contain a representation of the created "Individual threshold" resource, as defined in clause 6.6.2.9. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the created "Individual threshold" resource.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 6.5.10.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.6.3.2 GET

The client can use this method to query information about thresholds.

This method shall follow the provisions specified in tables 6.5.6.3.2-1 and 6.5.6.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.6.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the Threshold data type and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

NOTE: There are no attribute selectors defined for this resource as the threshold attributes with cardinality 0..1 or 0..N are not structurally complex in nature.

Table 6.5.6.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	Threshold	0..N	200 OK	Shall be returned when information about zero or more thresholds has been queried successfully. The response body shall contain in an array the representations of zero or more thresholds, as defined in clause 6.6.2.9. If the "filter" URI parameter was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clause 5.2.2 of ETSI GS NFV-SOL 013 [4]. If the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.6.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.6.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.6.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.7 Resource: Individual threshold

6.5.7.1 Description

This resource represents an individual threshold.

6.5.7.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanopm/{apiMajorVersion}/thresholds/{thresholdId}

This resource shall support the resource URI variables defined in table 6.5.7.2-1.

Table 6.5.7.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 6.2.
thresholdId	Identifier of the threshold. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new threshold resource. It can also be retrieved from the "id" attribute in the message content of that response.	

6.5.7.3 Resource methods

6.5.7.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.7.3.2 GET

The client can use this method for reading an individual threshold

This method shall follow the provisions specified in tables 6.5.7.3.2-1 and 6.5.7.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.7.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.7.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	Threshold	1	200 OK	Shall be returned when information about an individual threshold has been read successfully. The response body shall contain a representation of the threshold, as defined in clause 6.6.2.9.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.7.3.4 PATCH

This method allows to modify an "Individual threshold" resource.

This method shall follow the provisions specified in tables 6.5.7.3.4-1 and 6.5.7.3.4-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.7.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.7.3.4-2: Details of the PATCH request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	ThresholdModifications	1		Parameters for the threshold modification. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [3].
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	ThresholdModifications	1	200 OK	Shall be returned when the request has been processed successfully. The response body shall contain a data structure of type "ThresholdModifications".
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 6.5.10.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.7.3.5 DELETE

This method allows to delete a threshold.

This method shall follow the provisions specified in tables 6.5.7.3.5-1 and 6.5.7.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual threshold" resource shall not exist any longer.

Table 6.5.7.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.7.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the threshold has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.8 Void

6.5.9 Void

6.5.10 Resource: Notification endpoint

6.5.10.1 Description

This resource represents a notification endpoint for NFV-MANO performance management.

The API producer can use this resource to send notifications related to performance management events to an API consumer, which has provided the URI of this resource during the PM job or threshold creation process.

6.5.10.2 Resource definition

The resource URI is provided by the client when creating the subscription.

This resource shall support the resource URI variables defined in table 6.5.10.2-1.

Table 6.5.10.2-1: Resource URI variables for this resource

Name	Definition
n/a	

6.5.10.3 Resource methods

6.5.10.3.1 POST

The POST method delivers a notification regarding a performance management event from the API producer to an API consumer. The API consumer shall have previously created an "Individual PM job resource" or "Individual threshold resource".

This method shall follow the provisions specified in tables 6.5.10.3.1-1 and 6.5.10.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.10.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Each notification request body shall include exactly one of the alternatives defined in table 6.5.10.3.1-2.

Table 6.5.10.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	PerformanceInformationAvailableNotification	1	Notification about performance information availability	
	ThresholdCrossedNotification	1	Notification about threshold crossing	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the notification has been delivered successfully.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.10.3.2 GET

The GET method allows the server to test the notification endpoint that is provided by the client, e.g. during creation of the PM job or threshold.

This method shall follow the provisions specified in tables 6.5.10.3.2-1 and 6.5.10.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 6.5.10.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 6.5.10.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned to indicate that the notification endpoint has been tested successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

6.5.10.3.3 PUT

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.10.3.4 PATCH

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.5.10.3.5 DELETE

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

6.6 Data model

6.6.1 Introduction

This clause defines the request and response data structures of the NFV-MANO performance management interface. If a request or response contains attributes not defined in the present document, a receiving functional block that does not understand these attributes shall not treat their presence as an error and may choose to ignore them.

6.6.2 Resource and notification data types

6.6.2.1 Introduction

This clause defines the data structures to be used in resource representations and notifications.

6.6.2.2 Void

6.6.2.3 Void

6.6.2.4 Type: ThresholdCrossedNotification

This type represents a notification that is sent when a threshold has been crossed. It shall comply with the provisions defined in table 6.6.2.4-1.

NOTE: The timing of sending this notification is determined by the capability of the producing entity to evaluate the threshold crossing condition.

The notification shall be triggered by the NFV-MANO functional entity when a threshold has been crossed.

Table 6.6.2.4-1: Definition of the ThresholdCrossedNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "ThresholdCrossedNotification" for this notification type.
timeStamp	DateTime	1	Date and time of the generation of the notification.
thresholdId	Identifier	1	Identifier of the threshold which has been crossed.
crossingDirection	CrossingDirectionType	1	An indication of whether the threshold was crossed in upward or downward direction.
objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
objectInstanceId	Identifier	1	Identifier of the measured object instance. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1].
subObjectInstanceId	IdentifierInManoEntity	0..1	Identifier of the sub-object of the measured object to which the measurement applies. Shall be present if this is required in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type. Shall be absent otherwise.
performanceMetric	String	1	Performance metric associated with the threshold. This attribute shall contain the related "Measurement Name" value as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1].
performanceValue	(any type)	1	Value of the metric that resulted in threshold crossing. The type of this attribute shall correspond to the related "Measurement Unit" as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1].
context	KeyValuePairs	0..1	Measurement context information related to the measured value. The set of applicable keys is defined per measurement in clause 8.4 of ETSI GS NFV-IFA 031 [1].
_links	Structure (inlined)	1	Links to resources related to this notification.
>objectInstance	NotificationLink	0..1	Link to the resource representing the measured object instance to which the notified change applies. Shall be present if the measured object instance information is accessible as a resource.
>threshold	NotificationLink	1	Link to the resource that represents the threshold that was crossed.

6.6.2.5 Type: PerformanceInformationAvailableNotification

This notification informs the receiver that performance information is available. It shall comply with the provisions defined in table 6.6.2.5-1.

The notification shall be triggered by the NFV-MANO functional entity when new performance information collected by a PM job is available. The periodicity of triggering this notification is influenced by the "reportingPeriod" attribute in the "PmJobCriteria" data structure as defined in clause 6.6.3.3.

Table 6.6.2.5-1: Definition of the PerformanceInformationAvailableNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "PerformanceInformationAvailableNotification" for this notification type.
timeStamp	DateTime	1	Date and time of the generation of the notification.
pmJobId	Identifier	1	Identifier of the PM job for which performance information is available.
objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
objectInstanceId	Identifier	1	Identifier of the measured object instance. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1].
subObjectInstanceId	IdentifierInManoEntity	0..1	Identifier of the sub-object of the measured object instance for which the measurements have been taken. Shall be present if the related PM job has been set up to measure a sub-object instance of the measured object instance and a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type. Shall be absent otherwise.
_links	Structure (inlined)	1	Links to resources related to this notification.
>objectInstance	NotificationLink	0..1	Link to the resource representing the measured object instance to which the notification applies. Shall be present if the measured object instance information is accessible as a resource.
>pmJob	NotificationLink	1	Link to the resource that represents the PM job for which performance information is available.
>performanceReport	NotificationLink	1	Link from which the available performance information of data type "PerformanceReport" (see clause 6.6.2.10) can be obtained. This link should point to an "Individual performance report" resource as defined in clause 6.5.5.

6.6.2.6 Type: CreatePmJobRequest

This type represents a request to create a PM job. It shall comply with the provisions defined in table 6.6.2.6-1.

Table 6.6.2.6-1: Definition of the CreatePmJobRequest data type

Attribute name	Data type	Cardinality	Description
objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
objectInstanceIds	Identifier	1..N	Identifiers of the measured object instance for which performance information is requested to be collected. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1]. If more than one identifier is provided, values shall all refer to measured object instances of the same type, for which the same criteria is then applicable.

Attribute name	Data type	Cardinality	Description
subObjectInstanceIds	IdentifierInManoEntity	0..N	Identifiers of the sub-object instances of the measured object instance for which performance information is requested to be collected. May be present if a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type. If this attribute is present, the cardinality of the "objectInstanceIds" attribute shall be 1. If this attribute is absent and a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type, measurements will be taken for all sub-object instances of the measured object instance.
criteria	PmJobCriteria	1	Criteria of the collection of performance information.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
authentication	SubscriptionAuthentication	0..1	Authentication parameters to configure the use of Authorization when sending notifications corresponding to this PM job, as defined in clause 8.3.4 of ETSI GS NFV-SOL 013 [4]. This attribute shall only be present if the API consumer requires authorization of notifications.

6.6.2.7 Type: PmJob

This type represents a PM job. It shall comply with the provisions defined in table 6.6.2.7-1.

Table 6.6.2.7-1: Definition of the PmJob data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this PM job.
objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
objectInstanceIds	Identifier	1..N	Identifiers of the measured object instance for which performance information is collected. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1].
subObjectInstanceIds	IdentifierInManoEntity	0..N	Identifiers of the sub-object instances of the measured object instance for which performance information is requested to be collected. May be present if a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type. If this attribute is present, the cardinality of the "objectInstanceIds" attribute shall be 1. If this attribute is absent and a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type, measurements will be taken for all sub-object instances of the measured object instance.
criteria	PmJobCriteria	1	Criteria of the collection of performance information.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
reports	Structure (inlined)	0..N	Information about available reports collected by this PM job.
>href	Uri	1	The Uri where the report can be obtained.
>readyTime	DateTime	1	The time when the report was made available.
>expiryTime	DateTime	0..1	The time when the report will expire.
>fileSize	UnsigendInt	0..1	The size of the report file in bytes, if known.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.

Attribute name	Data type	Cardinality	Description
>objects	Link	0..N	Links to resources representing the measured object instances for which performance information is collected. Shall be present if the measured object instance information is accessible as a resource.

6.6.2.8 Type: CreateThresholdRequest

This type represents a request to create a threshold. It shall comply with the provisions defined in table 6.6.2.8-1.

Table 6.6.2.8-1: Definition of the CreateThresholdRequest data type

Attribute name	Data type	Cardinality	Description
objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
objectInstanceId	Identifier	1	Identifier of the measured object instance associated with this threshold. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1].
subjObjectInstanceIds	IdentifierInManoEntity	0..N	Identifiers of the sub-object instances of the measured object instance associated with this threshold. May be present if a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type. If this attribute is absent and a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type, thresholds will be set for all sub-object instances of the measured object instance.
criteria	ThresholdCriteria	1	Criteria that define this threshold.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
authentication	SubscriptionAuthentication	0..1	Authentication parameters to configure the use of Authorization when sending notifications corresponding to this threshold, as defined in clause 8.3.4 of ETSI GS NFV-SOL 013 [4]. This attribute shall only be present if the API consumer requires authorization of notifications.

6.6.2.9 Type: Threshold

This type represents a threshold. It shall comply with the provisions defined in table 6.6.2.9-1.

Table 6.6.2.9-1: Definition of the Threshold data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this threshold resource.
objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
objectInstanceId	Identifier	1	Identifier of the measured object instance associated with the threshold. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1].

Attribute name	Data type	Cardinality	Description
subjObjectInstanceIds	IdentifierInManoEntity	0..N	Identifiers of the sub-object instances of the measured object instance associated with this threshold. May be present if a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type. If this attribute is absent and a sub-object is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type, thresholds are set for all sub-object instances of the measured object instance.
criteria	ThresholdCriteria	1	Criteria that define this threshold.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.
>object	Link	0..1	Link to a resource representing the measured object instance for which performance information is collected. Shall be present if the measured object instance information is accessible as a resource.

6.6.2.10 Type: PerformanceReport

This type defines the format of a performance report provided by the NFV-MANO functional entity to the API consumer as a result of collecting performance information as part of a PM job. The type shall comply with the provisions defined in table 6.6.2.10-1.

Table 6.6.2.10-1: Definition of the PerformanceReport data type

Attribute name	Data type	Cardinality	Description
entries	Structure (inlined)	1..N	List of performance information entries. Each performance report entry is for a given metric of a given object (i.e. measured object instance) corresponding to the related measured object types, but can include multiple collected values.
>objectType	String	1	Type of measured object. The applicable measured object type for a measurement is defined in clause 8.2 of ETSI GS NFV-IFA 031 [1].
>objectInstanceId	ManoManagedObjectReference	1	The object instance (i.e. measured object instance) for which the performance metric is reported. This attribute shall contain the identifier of the instance of the measure object according to their type. See also definitions in clause 8.2 of ETSI GS NFV-IFA 031 [1].
>subObjectInstanceId	IdentifierInManoEntity	0..1	Identifier of the sub-object instance of the measured object instance for which the performance metric is reported. Shall be present if this is required in clause 8.2 of ETSI GS NFV-IFA 031 [1] for the related measured object type.
>performanceMetric	String	1	Name of the metric collected. This attribute shall contain the related "Measurement Name" value as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1].
>performanceValues	Structure (inlined)	1..N	List of performance values with associated timestamp.
>>timeStamp	DateTime	1	Time stamp indicating when the data was collected.

Attribute name	Data type	Cardinality	Description
>>value	(any type)	1	Value of the metric collected. The type of this attribute shall correspond to the related "Measurement Unit" as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1].
>>context	KeyValuePairs	0..1	Measurement context information related to the measured value. The set of applicable keys is defined per measurement in clause 8.4 of ETSI GS NFV-IFA 031 [1].

6.6.2.11 Type: PmJobModifications

This type represents modifications to a PM job. It shall comply with the provisions defined in table 6.6.2.11-1.

Table 6.6.2.11-1: Definition of the PmJobModifications data type

Attribute name	Data type	Cardinality	Description
callbackUri	Uri	0..1	New value of the "callbackUri" attribute. The value "null" is not permitted. See note.
authentication	SubscriptionAuthentication	0..1	New value of the "authentication" attribute, or "null" to remove the attribute. If present in a request body, these modifications shall be applied according to the rules of JSON Merge PATCH (see IETF RFC 7396 [3]). This attribute shall not be present in response bodies. See note.
NOTE: At least one of the attributes defined in this type shall be present in request bodies.			

6.6.2.12 Type: ThresholdModifications

This type represents modifications to a threshold. It shall comply with the provisions defined in table 6.6.2.12-1.

Table 6.6.2.12-1: Definition of the ThresholdModifications data type

Attribute name	Data type	Cardinality	Description
callbackUri	Uri	0..1	New value of the "callbackUri" attribute. The value "null" is not permitted. See note.
authentication	SubscriptionAuthentication	0..1	New value of the "authentication" attribute, or "null" to remove the attribute. If present in a request body, these modifications shall be applied according to the rules of JSON Merge PATCH (see IETF RFC 7396 [3]). This attribute shall not be present in response bodies. See note.
NOTE: At least one of the attributes defined in this type shall be present in request bodies.			

6.6.3 Referenced structured data types

6.6.3.1 Introduction

This clause defines data structures that can be referenced from data structures defined in the previous clauses, but can neither be resource representations nor bound to any subscribe/notify mechanism.

6.6.3.2 Void

6.6.3.3 Type: PmJobCriteria

This type represents collection criteria for PM jobs. It shall comply with the provisions defined in table 6.6.3.3-1.

Table 6.6.3.3-1: Definition of the PmJobCriteria data type

Attribute name	Data type	Cardinality	Description
performanceMetric	String	0..N	This defines the types of performance metrics for the specified measured object(s). This attribute's value shall contain the related "Measurement Name" values as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1]. At least one of the two attributes (performance metric or group) shall be present.
performanceMetricGroup	String	0..N	Group of performance metrics. A metric group is a pre-defined list of metrics, known to the producer that it can decompose to individual metrics. This attribute's value shall contain the related "Measurement Group" values as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1]. At least one of the two attributes (performance metric or group) shall be present.
collectionPeriod	UnsignedInt	1	Specifies the periodicity at which the producer will collect performance information. The unit shall be seconds. See notes 1 and 2.
reportingPeriod	UnsignedInt	1	Specifies the periodicity at which the producer will report to the API consumer. about performance information. The unit shall be seconds. See notes 1 and 2.
reportingBoundary	DateTime	0..1	Identifies a time boundary after which the reporting will stop. The boundary shall allow a single reporting as well as periodic reporting up to the boundary.
NOTE 1: At the end of each reportingPeriod, the producer will inform the API consumer about availability of the performance data collected for each completed collection period during this reportingPeriod. The reportingPeriod should be equal to or a multiple of the collectionPeriod. In the latter case, the performance data for the collection periods within one reporting period are reported together. NOTE 2: In particular when choosing short collection and reporting periods, the number of PM jobs that can be supported depends on the capability of the producing entity.			

6.6.3.4 Type: ThresholdCriteria

This type represents criteria that define a threshold. It shall comply with the provisions defined in table 6.6.3.4-1.

Table 6.6.3.4-1: Definition of the ThresholdCriteria data type

Attribute name	Data type	Cardinality	Description
performanceMetric	String	1	Defines the performance metric associated with the threshold. This attribute's value shall contain the related "Measurement Name" values as defined in clause 8.4 of ETSI GS NFV-IFA 031 [1].
thresholdType	Enum (inlined)	1	Type of threshold. This attribute determines which other attributes are present in the data structure. Permitted values: • SIMPLE: Single-valued static threshold See note 1.
simpleThresholdDetails	Structure (inlined)	0..1	Details of a simple threshold. Shall be present if thresholdType="SIMPLE".
>thresholdValue	Number	1	The threshold value. Shall be represented as a floating point number.
>hysteresis	Number	1	The hysteresis of the threshold. Shall be represented as a non-negative floating point number. A notification with crossing direction "UP" will be generated if the measured value reaches or exceeds "thresholdValue" + "hysteresis". A notification with crossing direction "DOWN" will be generated if the measured value reaches or undercuts "thresholdValue" - "hysteresis". See note 2.
NOTE 1: In the present document, simple thresholds are defined. The definition of additional threshold types is left for future specification. NOTE 2: The hysteresis is defined to prevent storms of threshold crossing notifications. When processing a request to create a threshold, implementations should enforce a suitable minimum value for this attribute (e.g. override the value or reject the request).			

6.6.4 Referenced simple data types and enumerations

6.6.4.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.6.4.2 Simple data types

No particular simple data types are defined for this interface, in addition to those defined in clause 4.2.3.

6.6.4.3 Enumeration: CrossingDirectionType

The enumeration CrossingDirectionType shall comply with the provisions defined in table 6.6.4.3-1.

Table 6.6.4.3-1: Enumeration CrossingDirectionType

Enumeration value	Description
UP	The threshold was crossed in upward direction.
DOWN	The threshold was crossed in downward direction.

7 NFV-MANO Fault Management interface

7.1 Description

This interface allows the consumer to subscribe to notifications regarding alarms provided by the producer NFV-MANO functional entity, and API version information retrieval. The consumer receives information through alarm notifications when a failure is detected by the producer NFV-MANO functional entity. The granularity of failures include:

- Communication failures with other peering functional entities.
- Failures affecting a specific interface produced by the producer NFV-MANO functional entity, e.g. VNF lifecycle management interface produced by a VNFM.
- Malfunctioning of the NFV-MANO functional entity due to failures on resources supporting the execution of the entity, e.g. CPU, memory, reported as event type relevant to resources (see Recommendation ITU-T X.733 [2]).

The operations provided through this interface are:

- Get Alarm List
- Acknowledge Alarm
- Subscribe
- Query Subscription Information
- Terminate Subscription
- Notify

7.2 API version

For the NFV-MANO fault management interface as specified in the present document, the MAJOR version field shall be 1, the MINOR version field shall be 0 and the PATCH version field shall be 1 (see clause 9.1 of ETSI GS NFV-SOL 013 [4] for a definition of the version fields). Consequently, the {apiMajorVersion} URI variable shall be set to "v1".

NOTE: In the present document, there were no changes to the clauses defining the NFV-MANO fault management interface that are visible at interface level compared to the previous version of the present document; hence, the MAJOR/MINOR/PATCH version fields are kept the same.

7.3 Resource structure and method

All resource URIs of the API shall use the base URI specification defined in clause 4.1 of ETSI GS NFV-SOL 013 [4]. The string "nfvmanofm" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the above base URI.

Figure 7.3-1 shows the overall resource URI structure defined for the NFV-MANO fault management interface.

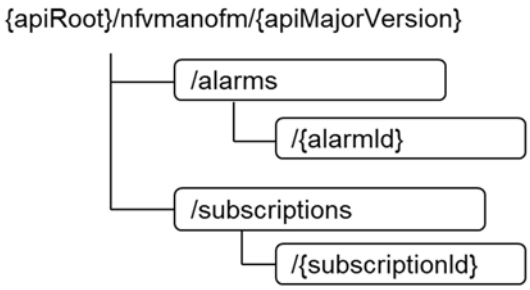

Figure 7.3-1: Resource URI structure of the NFV-MANO fault management interface

Table 7.3-1 lists the individual resources defined, and the applicable HTTP methods.

The NFV-MANO functional entity shall support responding to requests for all HTTP methods on the resources in table 7.3-1 that are marked as "M" (mandatory) in the "Cat" column. The NFV-MANO functional entity shall also support the "API versions" resources as specified in clause 9.3.2 of ETSI GS NFV-SOL 013 [4].

Table 7.3-1: Resources and methods overview of the NFV-MANO fault management interface

Resource name	Resource URI	HTTP Method	Cat	Meaning
Alarms	/alarms	GET	M	Query alarms related to NFV-MANO functional entity.
Individual alarm	/alarms/{alarmId}	GET	M	Read individual alarm.
		PATCH	M	Acknowledge individual alarm.
Subscriptions	/subscriptions	POST	M	Subscribe to NFV-MANO functional entity alarms.
		GET	M	Query multiple subscriptions.
Individual subscription	/subscriptions/{subscriptionId}	GET	M	Read an individual subscription.
		DELETE	M	Terminate a subscription.
Notification endpoint	(client-provided)	POST	See note	Notify about NFV-MANO functional entity alarms. See note.
		GET	See note	Test the notification endpoint. See note.
NOTE: The NFV-MANO functional entity shall support invoking the HTTP methods defined for the "Notification endpoint" resource exposed by the consumer. If the consumer supports invoking the POST method on the "Subscription" resource towards the NFV-MANO functional entity, it shall also support responding to the HTTP requests defined for the "Notification endpoint" resource.				

7.4 Sequence diagrams

7.4.1 Flow of the Get Alarm List operation

This clause describes a sequence flow for querying one or multiple alarms.

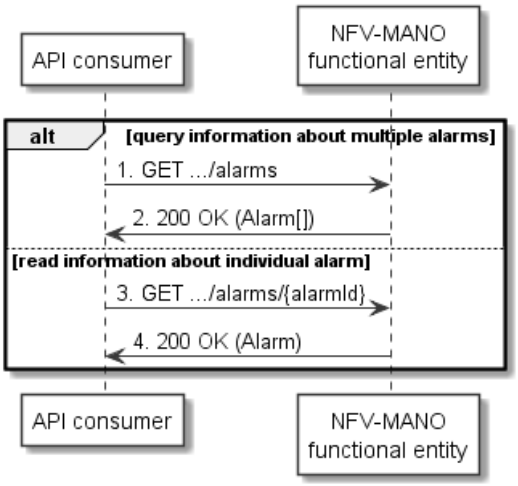

Figure 7.4.1-1: Flow of alarm query/read

Alarm query, as illustrated in figure 7.4.1-1, consists of the following steps:

1) If the API consumer intends to query all alarms, it sends a GET request to the "Alarms" resource.

2) The NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes zero or more data structures of type "Alarm" in the message content.

3) If the API consumer intends to read a particular alarm, it sends a GET request to the "Individual alarm" resource, addressed by the appropriate alarm identifier in its resource URI.

4) The NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes a data structure of type "Alarm" in the message content.

Error handling: In case of failure, appropriate error information is provided in the response.

7.4.2 Flow of acknowledging alarm

This clause describes the procedure to acknowledge an individual alarm.

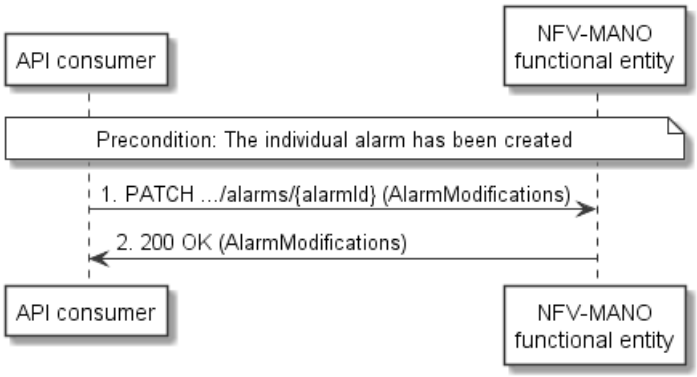

Figure 7.4.2-1: Flow of acknowledging alarm

Precondition: The resource representing the individual alarm has been created.

Acknowledge alarm, as illustrated in figure 7.4.2-1, consists of the following steps:

1) The API consumer sends a PATCH request to the individual alarm.

2) The NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes a data structure of type "AlarmModifications" in the message content.

Error handling: In case of failure, appropriate error information is provided in the response.

7.4.3 Flow of managing subscriptions

This clause describes the procedure for creating, reading and terminating subscriptions to notifications related to NFV-MANO fault management.

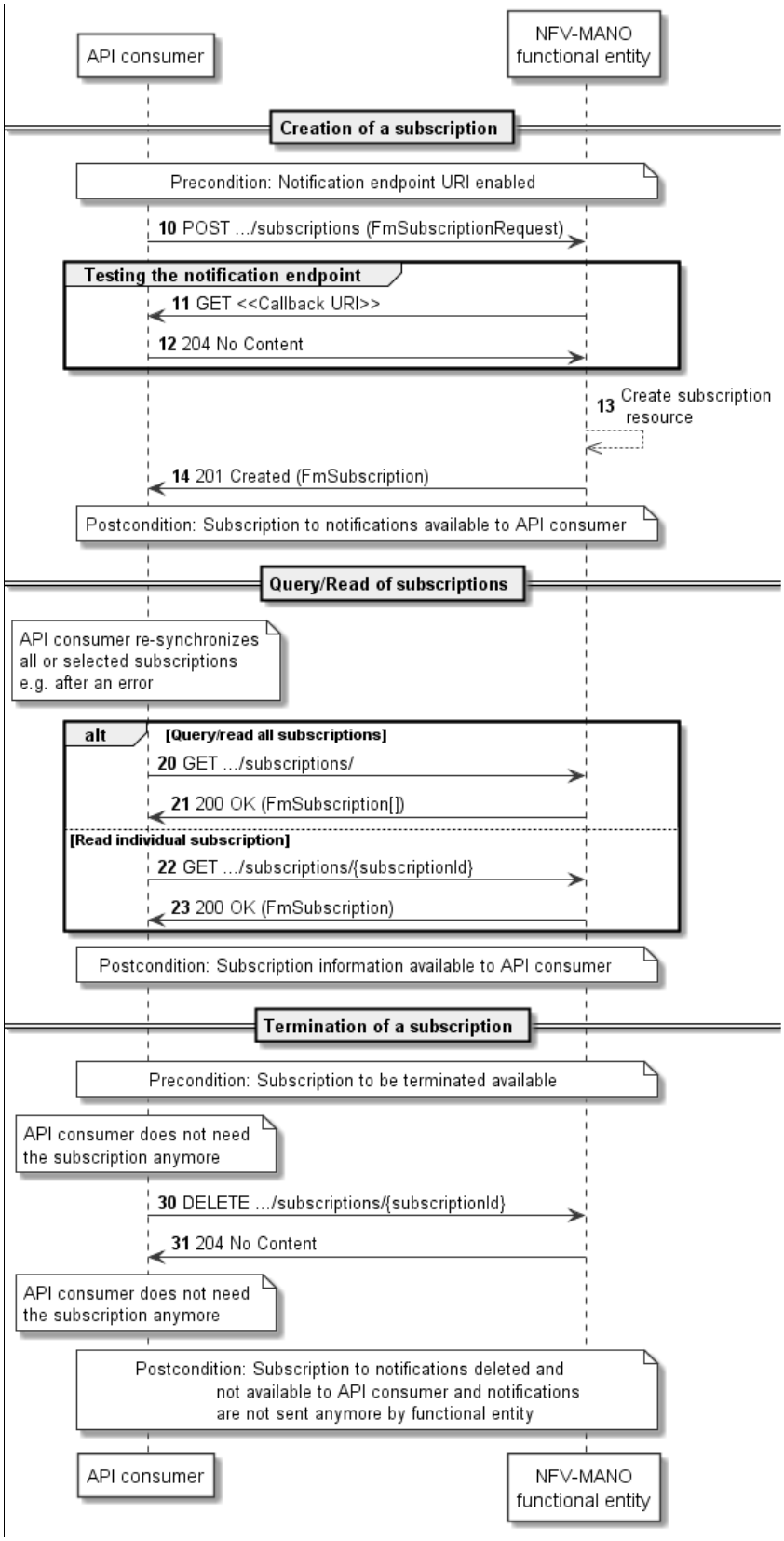

Figure 7.4.3-1: Flow of managing subscriptions

A) Procedure of creating subscriptions

The procedure of creating subscriptions consists of the following steps as illustrated in figure 7.4.3-1:

Precondition: The notification endpoint URI is enabled.

10) The API consumer sends a POST request to the "Subscriptions" resource including in the message content a data structure of type "FmSubscriptionRequest". This data structure contains filtering criteria and a client side URI to which the NFV-MANO functional entity will subsequently send notifications about events that match the filter.

11) To test the notification endpoint that was registered by the API consumer as part of the subscription, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

12) The API consumer returns a "204 No Content" response to indicate success.

13) The NFV-MANO functional entity creates a new subscription for notifications related to NFV-MANO functional entity fault management, and a resource that represents this subscription.

14) The NFV-MANO functional entity returns a "201 Created" response containing a data structure of type "FmSubscription", representing the subscription resource just created by the NFV-MANO functional entity, and provides the URI of the newly-created resource in the "Location" HTTP header.

Postcondition: The subscription to notifications related to NFV-MANO fault management is available to the API consumer.

Error handling: The NFV-MANO functional entity rejects a subscription if the subscription information is not valid: invalid notification endpoint, subscription information is malformed, etc.

B) Procedure of querying/reading subscriptions

The procedure of querying/reading subscriptions consists of the following steps, as illustrated in figure 7.4.3-1:

20) Optionally, for example when trying to recover from an error situation, the API consumer may query information about its subscriptions by sending a GET request to the "Subscriptions" resource.

21) In that case, the NFV-MANO functional entity returns a "200 OK" response that contains the list of representations of all existing subscriptions that were created by the API consumer.

22) Optionally, for example when trying to recover from an error situation, the API consumer may read information about a particular subscription by sending a GET request to the resource representing that individual subscription.

23) In that case, the NFV-MANO functional entity returns a "200 OK" response that contains a representation of that individual subscription.

Postcondition: The subscription information is available to the API consumer.

Error handling: The NFV-MANO functional entity provides in the response message appropriate error information that reports an erroneous query request.

C) Procedure of terminating a subscription

The procedure of terminating a subscription consists of the following steps, as illustrated in figure 7.4.3-1:

Precondition: The subscription to be terminated is available.

30) When the API consumer does not need the subscription anymore, it terminates the subscription by sending a DELETE request to the resource that represents the individual subscription.

31) The NFV-MANO functional entity acknowledges the successful termination of the subscription by returning a "204 No Content" response.

Postcondition: The subscription to notifications related to NFV-MANO fault management is deleted and not available to the API consumer, and notifications associated to this subscription are not sent anymore by the NFV-MANO functional entity.

Error handling: The NFV-MANO functional entity provides in the response message appropriate error information that reports an erroneous termination request: the subscription to terminate is not available, etc.

7.4.4 Flow of sending notifications

This clause describes the procedure for sending notifications related to NFV-MANO fault management.

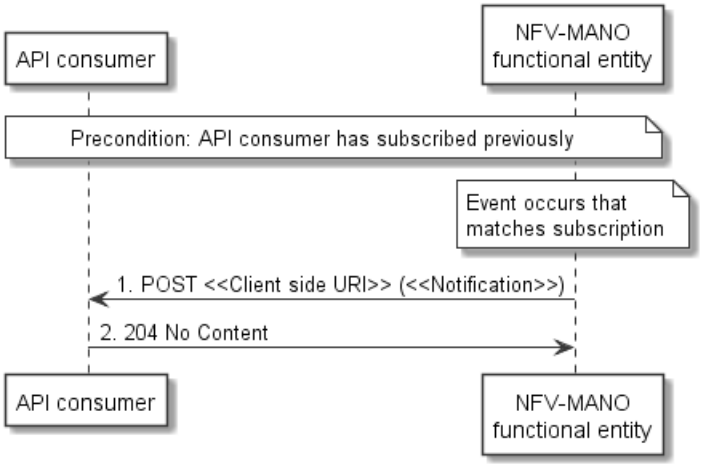

Figure 7.4.4-1: Flow of sending notifications

Precondition: The consumer has subscribed previously for notifications related to NFV-MANO functional entity fault management.

The procedure consists of the following steps as illustrated in figure 7.4.4-1:

1) If an event occurs that matches the filtering criteria which are part of the subscription, the NFV-MANO functional entity generates a notification that includes information about the event, and sends it in the body of a POST request to the URI which the API consumer has registered as part of the subscription request. The variable <<Notification>> in the flow is a placeholder for the different types of notifications that can be sent by this API (see clauses 7.6.2.5, 7.6.2.6 and 7.6.2.7).

2) The API consumer acknowledges the successful delivery of the notification by returning a "204 No Content" response.

Error handling: If the NFV-MANO functional entity does not receive the "204 No Content" response from the API consumer, it can retry sending the notification.

7.5 Resources

7.5.1 Introduction

This clause defines all the resources and methods provided by the NFV-MANO fault management interface.

7.5.2 Resource: API versions

The "API versions" resources as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [4] are part of the NFV-MANO fault management interface.

7.5.3 Resource: Alarms

7.5.3.1 Description

This resource represents a list of alarms related to NFV-MANO functional entity.

7.5.3.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanofm/{apiMajorVersion}/alarms

This resource shall support the resource URI variables defined in table 7.5.3.2-1.

Table 7.5.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 7.2.

7.5.3.3 Resource methods

7.5.3.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.3.3.2 GET

The client can use this method to retrieve information about the alarm list.

This method shall follow the provisions specified in tables 7.5.3.3.2-1 and 7.5.3.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. The following attribute names shall be supported by the NFV-MANO functional entity in the attribute-based filtering expression: id, managedObjectId, eventType, perceivedSeverity, probableCause.
next_opaque_marker	0..1	Marker to obtain the next page of a paged resource. Shall be supported by the NFV-MANO functional entity if the entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

NOTE: There are no attribute selectors defined for this resource as the Alarm attributes with cardinality 0..1 or 0..N are not structurally complex in nature.

Table 7.5.3.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	Alarm	0..N	200 OK	Shall be returned when information about zero or more alarms has been queried successfully. The response body shall contain in an array the representations of zero or more alarms as defined in clause 7.6.2.4. If the "filter" URI parameter was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clause 5.2.2 of ETSI GS NFV-SOL 013 [4]. If the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.4 Resource: Individual alarm

7.5.4.1 Description

This resource represents an individual alarm.

7.5.4.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanofm/{apiMajorVersion}/alarms/{alarmId}

This resource shall support the resource URI variables defined in table 7.5.4.2-1.

Table 7.5.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 7.2.
alarmId	Identifier of the alarm. See note.
NOTE: This identifier can be retrieved from the "id" attribute of the "alarm" attribute in the AlarmNotification or AlarmClearedNotification. It can also be retrieved from the "id" attribute of the applicable array element in the message content of the response to a GET request to the "Alarms" resource.	

7.5.4.3 Resource methods

7.5.4.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.4.3.2 GET

The client can use this method to read an individual alarm.

This method shall follow the provisions specified in tables 7.5.4.3.2-1 and 7.5.4.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.4.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 7.5.4.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	Alarm	1	200	Shall be returned when information about an individual alarm has been read successfully. The response body shall contain a representation of the individual alarm.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.4.3.4 PATCH

This method modifies an "Individual alarm" resource.

This method shall follow the provisions specified in tables 7.5.4.3.4-1 and 7.5.4.3.4-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.4.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 7.5.4.3.4-2: Details of the PATCH request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	AlarmModifications	1		The parameter for the alarm modification, as defined in clause 7.6.2.8. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [3].
Response body	AlarmModifications	1	200 OK	Shall be returned when the request has been accepted and completed. The response body shall contain attribute modifications for an "Individual alarm" resource (see clause 7.6.2.4).
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the "Individual alarm" resource. Typically, this is due to the fact that the alarm is already in the state that is requested to be set (such as trying to acknowledge an already-acknowledged alarm). The response body shall contain a ProblemDetails structure, in which the "detail" attribute shall convey more information about the error.
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.5 Resource: Subscriptions

7.5.5.1 Description

This resource represents subscriptions. The client can use this resource to subscribe to notifications related to NFV-MANO functional entity alarms and to query its subscriptions.

7.5.5.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanofm/{apiMajorVersion}/subscriptions

This resource shall support the resource URI variables defined in table 7.5.5.2-1.

Table 7.5.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 7.2.

7.5.5.3 Resource methods

7.5.5.3.1 POST

The POST method creates a new subscription.

This method shall follow the provisions specified in tables 7.5.5.3.1-1 and 7.5.5.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual subscription" resource as defined in clause 7.5.6 shall have been created. This method shall not trigger any notification.

Creation of two "Individual subscription" resources with the same callbackURI and the same filter can result in performance degradation and will provide duplicates of notifications to the API consumer, and might make sense only in very rare use cases. Consequently, the NFV-MANO functional entity may either allow creating a new "Individual subscription" resource if another "Individual subscription" resource with the same filter and callbackUri already exists (in which case it shall return the "201 Created" response code), or may decide to not create a duplicate "Individual subscription" resource (in which case it shall return a "303 See Other" response code referencing the existing "Individual subscription" resource with the same filter and callbackUri).

Table 7.5.5.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Remarks
none supported		

Table 7.5.5.3.1-2: Details of the POST request/response on this resource

Request body	**Data type**	**Cardinality**	**Description**	
	FmSubscriptionRequest	1	Details of the subscription to be created, as defined in clause 7.6.2.2.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	FmSubscription	1	201 Created	Shall be returned when the subscription has been created successfully. The response body shall contain a representation of the created "Individual subscription" resource. The HTTP response shall include a "Location" HTTP header that points to the created "Individual subscription" resource.
	n/a		303 See Other	Shall be returned when a subscription with the same callbackURI and the same filter already exists and the policy of the NFV-MANO functional entity is to not create redundant subscriptions. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the existing "Individual subscription" resource. The response body shall be empty.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 7.5.7.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.5.3.2 GET

The client can use this method to retrieve the list of active subscriptions for NFV-MANO functional entity alarms subscribed by the client. It can be used e.g. for resynchronization after error situations.

This method shall follow the provisions specified in tables 7.5.5.3.2-1 and 7.5.5.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.5.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Remarks
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the FmSubscription and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
next_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 7.5.5.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	FmSubscription	0..N	200 OK	Shall be returned when the list of subscriptions has been queried successfully. The response body shall contain in an array the representations of all active subscriptions of the functional block that invokes the method, i.e. zero or more representations of FM subscriptions as defined in clause 7.6.2.3. If the "filter" URI parameter was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clause 5.2.2 of ETSI GS NFV-SOL 013 [4]. If the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error. Response too big. If the NFV-MANO functional entity supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.5.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.6 Resource: Individual subscription

7.5.6.1 Description

This resource represents an individual subscription for NFV-MANO functional entity alarms. The client can use this resource to read and to terminate a subscription to notifications related to NFV-MANO fault management.

7.5.6.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanofm/{apiMajorVersion}/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 7.5.6.2-1.

Table 7.5.6.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 7.2.
subscriptionId	Identifier of this subscription. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new "Individual subscription" resource. It can also be retrieved from the "id" attribute in the message content of that response.	

7.5.6.3 Resource methods

7.5.6.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.6.3.2 GET

The client can use this method for reading an individual subscription for NFV-MANO functional entity alarms subscribed by the client.

This method shall follow the provisions specified in tables 7.5.6.3.2-1 and 7.5.6.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.6.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 7.5.6.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	FmSubscription	1	200 OK	Shall be returned when information about an individual subscription has been read successfully. The response body shall contain a representation of the "Individual subscription" resource.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.6.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.6.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.6.3.5 DELETE

This method terminates an individual subscription.

This method shall follow the provisions specified in tables 7.5.6.3.5-1 and 7.5.6.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual subscription" resource shall not exist any longer. This means that no notifications for that subscription shall be sent to the formerly-subscribed API consumer.

NOTE: Due to race conditions, some notifications might still be received by the formerly-subscribed API consumer for a certain time period after the deletion.

Table 7.5.6.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 7.5.6.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the "Individual subscription" resource has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.7 Resource: Notification endpoint

7.5.7.1 Description

This resource represents a notification endpoint for NFV-MANO functional entity alarms.

The API producer can use this resource to send notifications related to NFV-MANO functional entity alarms or about a rebuilt alarm list to a subscribed API consumer, which has provided the URI of this resource during the subscription process.

7.5.7.2 Resource definition

The resource URI is provided by the client when creating the subscription.

This resource shall support the resource URI variables defined in table 7.5.7.2-1.

Table 7.5.7.2-1: Resource URI variables for this resource

Name	Definition
n/a	

7.5.7.3 Resource methods

7.5.7.3.1 POST

The POST method notifies an NFV-MANO functional entity alarm or that the alarm list has been rebuilt. The API consumer shall have previously created an "Individual subscription" resource with a matching filter.

This method shall follow the provisions specified in tables 7.5.7.3.1-1 and 7.5.7.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.7.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Each notification request body shall include exactly one of the alternatives defined in table 7.5.7.3.1-2.

Table 7.5.7.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Response Codes	Description
Request body	AlarmNotification	1		Information of an NFV-MANO functional entity alarm.
	AlarmClearedNotification	1		Information of the clearance of an NFV-MANO functional entity alarm.
	AlarmListRebuiltNotification	1		Information that the alarm list has been rebuilt by the NFV-MANO functional entity.
Response body	n/a		204 No Content	Shall be returned when the notification has been delivered successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.7.3.2 GET

The GET method allows the server to test the notification endpoint that is provided by the client, e.g. during subscription.

This method shall follow the provisions specified in tables 7.5.7.3.2-1 and 7.5.7.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 7.5.7.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 7.5.7.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned to indicate that the notification endpoint has been tested successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

7.5.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.7.3.4 PATCH

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.5.7.3.5 DELETE

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

7.6 Data model

7.6.1 Introduction

This clause defines the request and response data structures of the NFV-MANO fault management interface. If a request or response contains attributes not defined in the present document, a receiving functional block that does not understand these attributes shall not treat their presence as an error, and may choose to ignore them.

7.6.2 Resource and notification data types

7.6.2.1 Introduction

This clause defines the data structures to be used in the resource representations and notifications for the NFV-MANO fault management interface.

7.6.2.2 Type: FmSubscriptionRequest

This type represents a subscription request related to notifications about NFV-MANO functional entity faults. It shall comply with the provisions defined in table 7.6.2.2-1.

Table 7.6.2.2-1: Definition of the FmSubscriptionRequest data type

Attribute name	Data type	Cardinality	Description
filter	FmNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
authentication	SubscriptionAuthentication	0..1	Authentication parameters to configure the use of Authorization when sending notifications corresponding to this subscription, as defined in clause 8.3.4 of ETSI GS NFV-SOL 013 [4]. This attribute shall only be present if the subscriber requires authorization of notifications.

7.6.2.3 Type: FmSubscription

This type represents a subscription related to notifications about NFV-MANO functional entity faults. It shall comply with the provisions defined in table 7.6.2.3-1.

Table 7.6.2.3-1: Definition of the FmSubscription data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this subscription resource.
filter	FmNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.

7.6.2.4 Type: Alarm

The alarm data type encapsulates information about an alarm. It shall comply with the provisions defined in table 7.6.2.4-1.

Table 7.6.2.4-1: Definition of the Alarm data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this Alarm information element.
managedObjectId	Identifier	1	Identifier of the affected NFV-MANO functional entity.
associatedFaultyInstanceId	ManoManagedObjectReference	0..1	The constituent of the NFV-MANO functional entity (i.e. component (if supported), service, interface) to which the fault is associated. Shall be provided if known.
alarmRaisedTime	DateTime	1	Time stamp indicating when the alarm is raised by the managed object.
alarmChangedTime	DateTime	0..1	Time stamp indicating when the alarm was last changed. It shall be present if the alarm has been updated.
alarmClearedTime	DateTime	0..1	Time stamp indicating when the alarm was cleared. It shall be present if the alarm has been cleared.
ackState	Enum (inlined)	1	Acknowledgement state of the alarm. Permitted values: • UNACKNOWLEDGED. • ACKNOWLEDGED.
perceivedSeverity	PerceivedSeverityType	1	Perceived severity of the managed object failure.
eventTime	DateTime	1	Time stamp indicating when the fault was observed.
eventType	EventType	1	Type of event.
faultType	String	0..1	Additional information to clarify the type of the fault.
probableCause	String	1	Information about the probable cause of the fault.
isRootCause	Boolean	1	Attribute indicating if this fault is the root for other correlated alarms. If TRUE, then the alarms listed in the attribute CorrelatedAlarmIds are caused by this fault.
correlatedAlarmIds	Identifier	0..N	List of identifiers of other alarms correlated to this fault.
faultDetails	String	0..N	Provides additional information about the fault.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.
>objectInstance	Link	0..1	Link to the resource representing the NFV-MANO functional entity to which the notified alarm is correlated. Shall be present if the NFV-MANO functional entity information is accessible as a resource.

7.6.2.5 Type: AlarmNotification

This type represents an alarm notification about NFV-MANO functional entity faults. It shall comply with the provisions defined in table 7.6.2.5-1.

This notification shall be triggered by the NFV-MANO functional entity when:

- An alarm has been created.
- An alarm has been updated, e.g. if the severity of the alarm has changed.

Table 7.6.2.5-1: Definition of the AlarmNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "AlarmNotification" for this notification type.
subscriptionId	Identifier	1	Identifier of the subscription that this notification relates to.
timeStamp	DateTime	1	Date-time of the generation of the notification.
alarm	Alarm	1	Information about an alarm including AlarmId, affected identifier of NFV-MANO functional entity, and FaultDetails.
_links	Structure (inlined)	1	Links to resources related to this notification.
>subscription	NotificationLink	1	Link to the related subscription.

7.6.2.6 Type: AlarmClearedNotification

This type represents an alarm cleared notification about NFV-MANO functional entity faults. It shall comply with the provisions defined in table 7.6.2.6-1.

The notification shall be triggered by the NFV-MANO functional entity when an alarm has been cleared.

Table 7.6.2.6-1: Definition of the AlarmClearedNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "AlarmClearedNotification" for this notification type.
subscriptionId	Identifier	1	Identifier of the subscription that this notification relates to.
timeStamp	DateTime	1	Date-time of the generation of the notification.
alarmId	Identifier	1	Alarm identifier.
alarmClearedTime	DateTime	1	The time stamp indicating when the alarm was cleared.
_links	Structure (inlined)	1	Links to resources related to this notification.
>subscription	NotificationLink	1	Link to the related subscription.
>alarm	NotificationLink	1	Link to the resource that represents the related alarm.

7.6.2.7 Type: AlarmListRebuiltNotification

This type represents a notification that the alarm list has been rebuilt, e.g. if the NFV-MANO functional entity detects its storage holding the alarm list is corrupted. It shall comply with the provisions defined in table 7.6.2.7-1.

The notification shall be triggered by the NFV-MANO functional entity when the alarm list has been rebuilt.

Table 7.6.2.7-1: Definition of the AlarmListRebuiltNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "AlarmListRebuiltNotification" for this notification type.
subscriptionId	Identifier	1	Identifier of the subscription that this notification relates to.
timeStamp	DateTime	1	Date-time of the generation of the notification.
_links	Structure (inlined)	1	Links to resources related to this notification.
>subscription	NotificationLink	1	Link to the related subscription.
>alarms	NotificationLink	1	Link to the alarm list, i.e. the "Alarms" resource.

7.6.2.8 Type: AlarmModifications

This type represents attribute modifications for an "Individual alarm" resource, i.e. modifications to a resource representation based on the "Alarm" data type. The attributes of "Alarm" that can be modified according to the provisions in clause 7.6.2.4 are included in the "AlarmModifications" data type.

The "AlarmModifications" data type shall comply with the provisions defined in table 7.6.2.8-1.

Table 7.6.2.8-1: Definition of the AlarmModifications data type

Attribute name	Data type	Cardinality	Description
ackState	Enum (inlined)	1	New value of the "ackState" attribute in "Alarm". Permitted values: • ACKNOWLEDGED.

7.6.3 Referenced structured data types

7.6.3.1 Introduction

This clause defines data structures that can be referenced from data structures defined in the previous clauses, but can neither be resource representations nor bound to any subscribe/notify mechanism.

7.6.3.2 Type: FmNotificationsFilter

This type represents a subscription filter related to notifications about NFV-MANO functional entity faults. It shall comply with the provisions defined in table 7.6.3.2-1.

At a particular nesting level in the filter structure, the following applies: All attributes shall match in order for the filter to match (logical "and" between different filter attributes). If an attribute is an array, the attribute shall match if at least one of the values in the array matches (logical "or" between the values of one filter attribute).

Table 7.6.3.2-1: Definition of the FmNotificationsFilter data type

Attribute name	Data type	Cardinality	Description
notificationTypes	Enum (inlined)	0..N	Match particular notification types. Permitted values: • AlarmNotification • AlarmClearedNotification • AlarmListRebuiltNotification See note.
perceivedSeverities	PerceivedSeverityType	0..N	Match NFV-MANO functional entity alarms with a perceived severity listed in this attribute.
eventTypes	EventType	0..N	Match NFV-MANO functional entity alarms with an event type listed in this attribute.
probableCauses	String	0..N	Match NFV-MANO functional entity alarms with a probable cause listed in this attribute.
NOTE: The permitted values of the "notificationTypes" attribute are spelled exactly as the names of the notification types to facilitate automated code generation systems.			

7.6.4 Referenced simple data types and enumerations

7.6.4.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

7.6.4.2 Simple data types

No particular simple data types are defined for this interface, in addition to those defined in clause 4.2.

7.6.4.3 Enumeration: PerceivedSeverityType

The enumeration PerceivedSeverityType shall comply with the provisions defined in table 7.6.4.3-1. It indicates the relative level of urgency for operator attention.

Table 7.6.4.3-1: Enumeration PerceivedSeverityType

Enumeration value	Description
CRITICAL	The Critical severity level indicates that a service affecting condition has occurred and an immediate corrective action is required. Such a severity can be reported, for example, when a managed object becomes totally out of service and its capability needs to be restored (Recommendation ITU-T X.733 [2]).
MAJOR	The Major severity level indicates that a service affecting condition has developed and an urgent corrective action is required. Such a severity can be reported, for example, when there is a severe degradation in the capability of the managed object and its full capability needs to be restored (Recommendation ITU-T X.733 [2]).
MINOR	The Minor severity level indicates the existence of a non-service affecting fault condition and that corrective action should be taken in order to prevent a more serious (for example, service affecting) fault. Such a severity can be reported, for example, when the detected alarm condition is not currently degrading the capacity of the managed object (Recommendation ITU-T X.733 [2]).
WARNING	The Warning severity level indicates the detection of a potential or impending service affecting fault, before any significant effects have been felt. Action should be taken to further diagnose (if necessary) and correct the problem in order to prevent it from becoming a more serious service affecting fault (Recommendation ITU-T X.733 [2]).
INDETERMINATE	The Indeterminate severity level indicates that the severity level cannot be determined (Recommendation ITU-T X.733 [2]).
CLEARED	The Cleared severity level indicates the clearing of one or more previously reported alarms. This alarm clears all alarms for this managed object that have the same Alarm type, Probable cause and Specific problems (if given) (Recommendation ITU-T X.733 [2]).

7.6.4.4 Enumeration: EventType

The enumeration EventType represents those types of events that trigger an alarm. It shall comply with the provisions defined in table 7.6.4.4-1.

Table 7.6.4.4-1: Enumeration EventType

Enumeration value	Description
COMMUNICATIONS_ALARM	An alarm of this type is associated with the procedure and/or process required conveying information from one point to another (Recommendation ITU-T X.733 [2]).
PROCESSING_ERROR_ALARM	An alarm of this type is associated with a software or processing fault (Recommendation ITU-T X.733 [2]).
ENVIRONMENTAL_ALARM	An alarm of this type is associated with a condition related to an enclosure in which the equipment resides (Recommendation ITU-T X.733 [2]).
QOS_ALARM	An alarm of this type is associated with degradation in the quality of a service (Recommendation ITU-T X.733 [2]).
EQUIPMENT_ALARM	An alarm of this type is associated with an equipment fault (Recommendation ITU-T X.733 [2]).

8 NFV-MANO Log Management interface

8.1 Description

This interface enables an API consumer to manage logging jobs on the producer NFV-MANO functional entity, and it enables corresponding log reporting. A logging job represents the filtering criteria for processing and creating log reports from the logs generated by the underlying system of the NFV-MANO functional entity. The interface does not provide the means to "control and manage" the underlying log system of the NFV-MANO functional entity.

NOTE 1: The logging sources of the underlying log system are assumed to be active, in particular those that deliver logging data corresponding to the types and filtering criteria of logging jobs. It is not specified in the present document how the configuration of the log system is performed.

The interface also enables the API consumer to subscribe to and notify about events related to the availability of the log reports.

The interface enables managing different types of filtered logs, which can be grouped, at large, into two categories:

- Messaging logs: logs of messages exchanged on an interface between NFV-MANO functional entities, and between NFV-MANO functional entities and external entities. This includes logging of the input and output message parameters of interfaces exposed by the functional entities, e.g. input and output messages when an NFVO functional entity queries the InstantiateVnf operation of the VNF LCM interface.

- Provider-specific logs: provider-specific logs of NFV-MANO functional entity. In this case, it is assumed that such logs may have security restrictions in place, e.g. be encrypted, so that only a certain organization can have access to the content in the log.

The operations provided through this interface are:

- Create Logging Job;

- Stop Logging Job;

- Query Logging Job;

- Subscribe;

- Terminate Subscription;

- Notify;

- Query Subscription Information.

NOTE 2: The CreateLoggingJob and StopLoggingJob operations can be used to create and terminate a specific logging job for messaging logs or provider-specific logs. The NFV-MANO functional entity may also have pre-configured logging jobs.

8.2 API version

For the NFV-MANO log management interface as specified in the present document, the MAJOR version field shall be 1, the MINOR version field shall be 0 and the PATCH version field shall be 1 (see clause 9.1 of ETSI GS NFV-SOL 013 [4] for a definition of the version fields). Consequently, the {apiMajorVersion} URI variable shall be set to "v1".

NOTE: In the present document, there were no changes to the clauses defining the NFV-MANO log management interface that are visible at interface level compared to the previous version of the present document; hence, the MAJOR/MINOR/PATCH version fields are kept the same.

8.3 Resource structure and method

All resource URIs of the API shall use the base URI specification defined in clause 4.1 of ETSI GS NFV-SOL 013 [4].

The string "nfvmanologm" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the above base URI.

Figure 8.3-1 shows the overall resource URI structure defined for the performance management API.

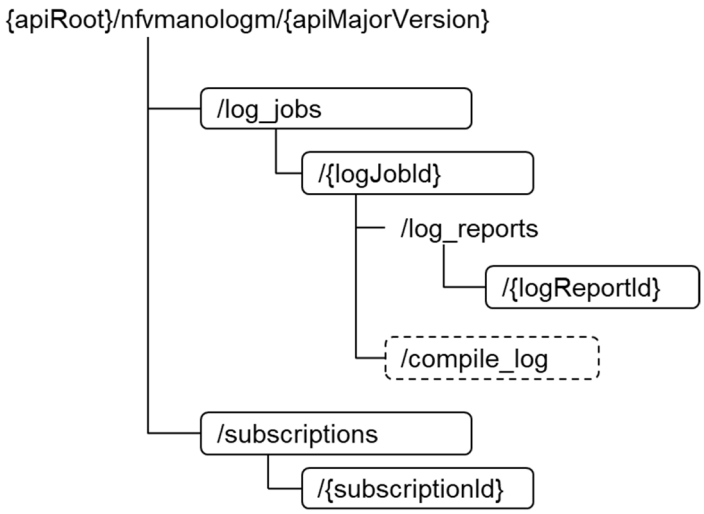

Figure 8.3-1: Resource URI structure of the NFV-MANO log management interface

Table 8.3-1 lists the individual resources defined, and the applicable HTTP methods.

The NFV-MANO functional entity shall support responding to requests for all HTTP methods on the resources in table 8.3-1 that are marked as "M" (mandatory) in the "Cat" column. The NFV-MANO functional entity shall also support the "API versions" resources as specified in clause 8.3.2 of ETSI GS NFV-SOL 013 [4].

Table 8.3-1: Resources and methods overview of the NFV-MANO log management interface

Resource name	Resource URI	HTTP Method	Cat	Meaning
Logging jobs	/log_jobs	POST	M	Create a logging job.
		GET	M	Query logging jobs.
Individual logging job	/log_jobs/{logJobId}	GET	M	Read a single logging job.
		DELETE	M	Delete a logging job.
Compile log task	/log_jobs/{logJobId}/compile_log	POST	M	On-demand compilation of the log data into a file.
Individual log report	/log_jobs/{logJobId}/log_reports/{logReportId}	GET	M	Read an individual log report.
Subscriptions	/subscriptions	POST	M	Subscribe to log management notifications.
		GET	M	Query log management related subscriptions.
Individual subscription	/subscriptions/{subscriptionId}	GET	M	Read a single log management related subscription.
		DELETE	M	Terminate a subscription.
Notification endpoint	(client-defined)	POST	See note	Notify about log management related events. See note.
		GET	See note	Test the notification endpoint. See note.
NOTE: The NFV-MANO functional entity shall support invoking the HTTP methods defined for the "Notification endpoint" resource exposed by the API consumer. If the API consumer supports invoking the POST method on the "Subscriptions" resource towards the NFV-MANO functional entity, it shall also support responding to the HTTP requests defined for the "Notification endpoint" resource.				

8.4 Sequence diagrams

8.4.1 Flow of creating a logging job

This clause describes a sequence for creating a logging job.

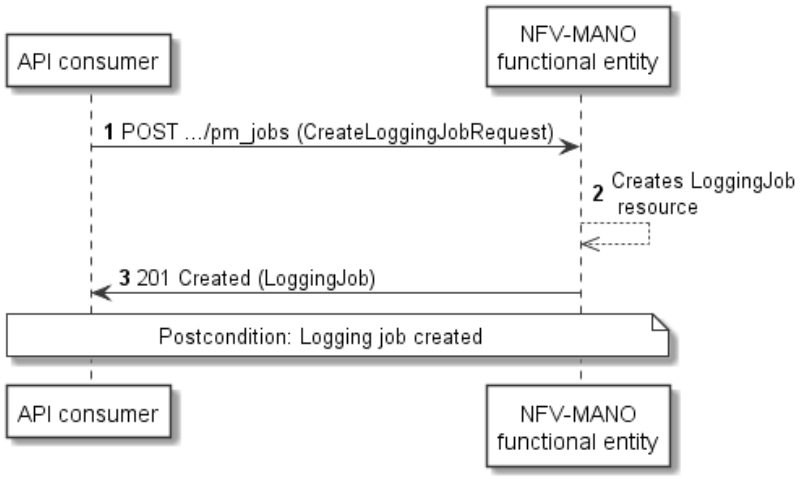

Figure 8.4.1-1: Flow of logging job creation

Logging job creation, as illustrated in figure 8.4.1-1, consists of the following steps:

1) If the API consumer intends to create a logging job, it sends a POST request to the "Logging jobs" resource, including one data structure of type "CreateLoggingJobRequest" in the message content.

2) The NFV-MANO functional entity creates a logging job instance.

3) The NFV-MANO functional entity returns a "201 Created" response to the API consumer, and includes in the message content a representation of the logging job just created.

Postcondition: Upon successful completion, the logging job has been created.

Error handling: In case of failure, appropriate error information is provided in the response.

8.4.2 Flow of querying/reading logging jobs

This clause describes a sequence for querying/reading logging jobs.

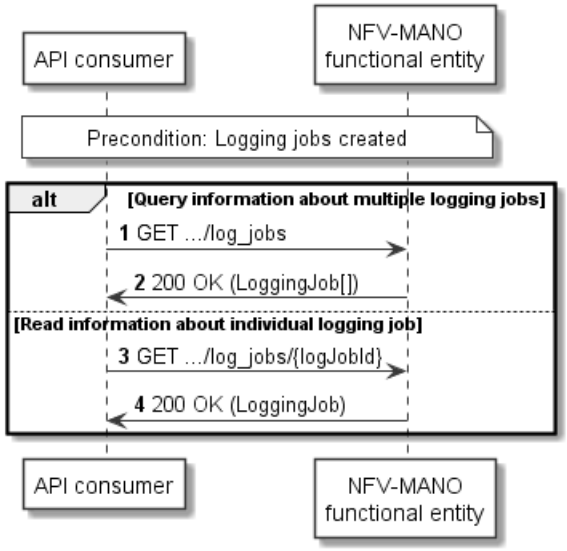

Figure 8.4.2-1: Flow of logging jobs query/read

Logging jobs query/read, as illustrated in figure 8.4.2-1, consists of the following steps:

Precondition: Logging jobs have been created.

1) If the API consumer intends to query all logging jobs, it sends a GET request to the "Logging jobs" resource.

2) In case of step 1), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes zero or more data structures of type "LoggingJob" in the message content.

3) If the API consumer intends to read information about a particular logging job, it sends a GET request to the "Individual logging job" resource, addressed by the appropriate logging job identifier in its resource URI.

4) In case of step 3), the NFV-MANO functional entity returns a "200 OK" response to the API consumer, and includes one data structure of type "LoggingJob" in the message content.

Error handling: In case of failure, appropriate error information is provided in the response.

8.4.3 Flow of deleting a logging job

This clause describes a sequence for deleting a logging management job.

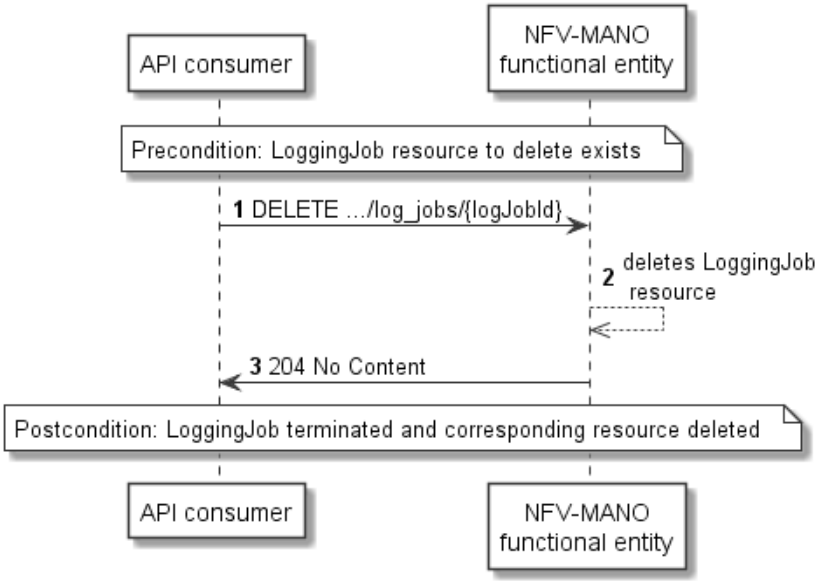

Figure 8.4.3-1: Flow of logging job deletion

Logging job deletion, as illustrated in figure 8.4.3-1, consists of the following steps:

Precondition: The logging job resource to delete exists.

1) If the API consumer intends to delete a logging job, it sends a DELETE request to the "Individual logging job" resource, addressed by the appropriate logging job identifier in its resource URI.

2) The NFV-MANO functional entity deletes the logging job resource.

3) The NFV-MANO functional entity returns a response with a "204 No Content" response code and an empty message content to the API consumer.

Postcondition: The logging job has been terminated and the corresponding logging job resource deleted.

Error handling: In case of failure, appropriate error information is provided in the response.

8.4.4 Flow of obtaining log reports

This clause describes the procedure for obtaining log reports.

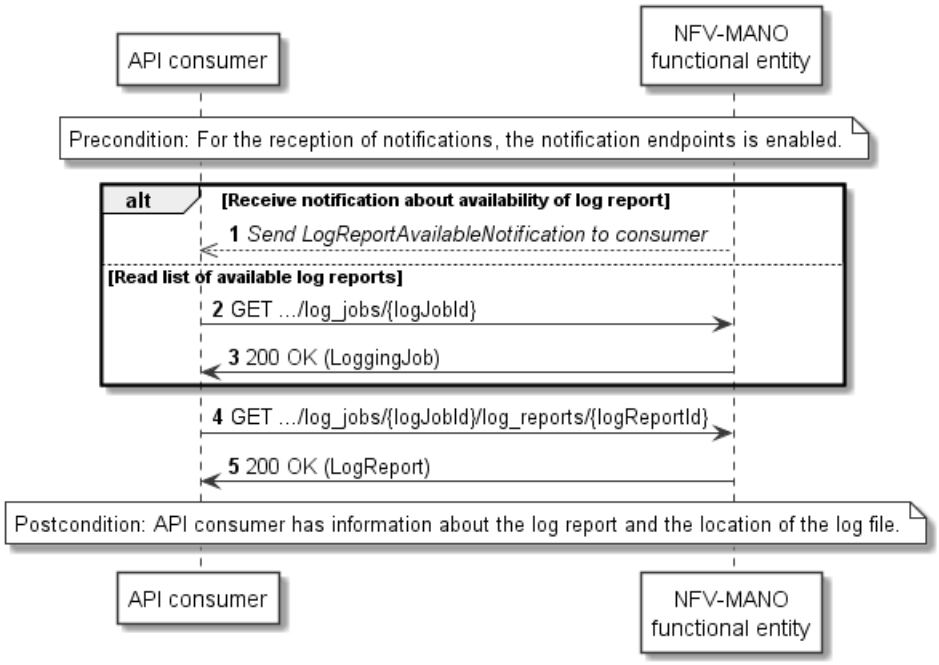

Figure 8.4.4-1: Flow of obtaining log reports

The procedure of obtaining log reports consists of the following steps as illustrated in figure 8.4.4-1:

Precondition: For the reception of notifications, the notification endpoint URI shall be enabled.

1) The NFV-MANO functional entity sends to the API consumer a LogReportAvailableNotification that indicates the availability of a new log report, including a link from which the log report can be obtained.

2) Alternatively, the API consumer sends a GET request to the "Individual logging job" resource to obtain a representation of the resource with information about the log reports that are available for this logging job, including their URIs.

3) In case of step 2), the NFV-MANO functional entity returns a "200 OK" response to the API consumer and includes a data structure of type "LoggingJob" in the message content with the information about the log reports that are available for this logging job, including their URIs.

4) The API consumer sends to the NFV-MANO functional entity a GET request to the URI obtained either in step 1) or step 3) in order to read an "Individual log report" resource.

5) The NFV-MANO functional entity returns a "200 OK" response to the API consumer and includes a data structure of type "LogReport" in the message content.

Postcondition: The API consumer has information about the log report and the location for obtaining the log file.

Error handling: The NFV-MANO functional entity provides in the response messages appropriate error information that reports an erroneous query request.

8.4.5 Flow of managing subscriptions

This clause describes the procedure for creating, reading and terminating subscriptions to notifications related to NFV-MANO log management.

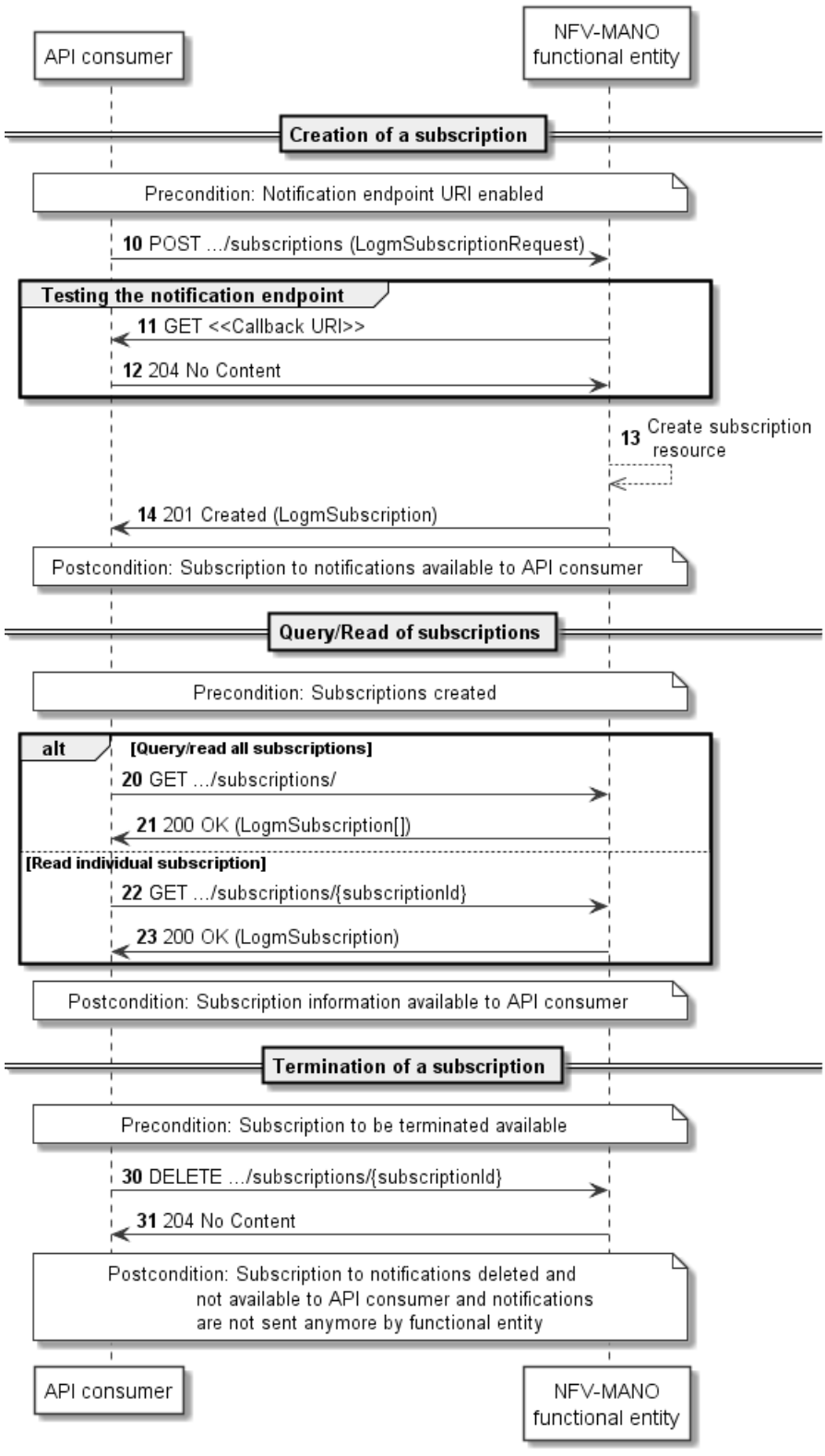

Figure 8.4.5-1: Flow of managing subscriptions

A) Procedure of creating subscriptions

The procedure of creating subscriptions consists of the following steps as illustrated in figure 8.4.5-1:

Precondition: The notification endpoint URI is enabled.

10) The API consumer sends a POST request to the "Subscriptions" resource including in the message content a data structure of type "LogmSubscriptionRequest". This data structure contains filtering criteria and a client side URI to which the NFV-MANO functional entity will subsequently send notifications about events that match the filter.

11) To test the notification endpoint that was registered by the API consumer as part of the subscription, the NFV-MANO functional entity sends a GET request to the notification endpoint URI.

12) The API consumer returns a "204 No Content" response to indicate success.

13) The NFV-MANO functional entity creates a new subscription for notifications related to NFV-MANO log management, and a resource that represents this subscription.

14) The NFV-MANO functional entity returns a "201 Created" response containing a data structure of type "LogmSubscription", representing the subscription resource just created by the NFV-MANO functional entity, and provides the URI of the newly-created resource in the "Location" HTTP header.

Postcondition: The subscription to notifications related to NFV-MANO log management is available to the API consumer.

Error handling: The NFV-MANO functional entity rejects a subscription if the subscription information is not valid: invalid notification endpoint, subscription information is malformed, etc.

B) Procedure of querying/reading subscriptions

The procedure of querying/reading subscriptions consists of the following steps, as illustrated in figure 8.4.5-1:

Precondition: Subscriptions have been created.

20) Optionally, for example when trying to recover from an error situation, the API consumer may query information about its subscriptions by sending a GET request to the "Subscriptions" resource.

21) In case of step 20), the NFV-MANO functional entity returns a "200 OK" response that contains the list of representations of all existing subscriptions that were created by the API consumer.

22) Optionally, for example when trying to recover from an error situation, the API consumer may read information about a particular subscription by sending a GET request to the resource representing that individual subscription.

23) In case of step 22), the NFV-MANO functional entity returns a "200 OK" response that contains a representation of that individual subscription.

Postcondition: The subscription information is available to the API consumer.

Error handling: The NFV-MANO functional entity provides in the response message appropriate error information that reports an erroneous query request.

C) Procedure of terminating a subscription

The procedure of terminating a subscription consists of the following steps, as illustrated in figure 8.4.5-1:

Precondition: The subscription to be terminated is available.

30) When the API consumer does not need the subscription anymore, it terminates the subscription by sending a DELETE request to the resource that represents the individual subscription.

31) The NFV-MANO functional entity acknowledges the successful termination of the subscription by returning a "204 No Content" response.

Postcondition: The subscription to notifications related to NFV-MANO log management is deleted and not available to the API consumer, and notifications associated to this subscription are not sent anymore by the NFV-MANO functional entity.

Error handling: The NFV-MANO functional entity provides in the response message appropriate error information that reports an erroneous termination request: the subscription to terminate is not available, etc.

8.4.6 Flow of sending notifications

This clause describes the procedure for sending notifications related to NFV-MANO log management.

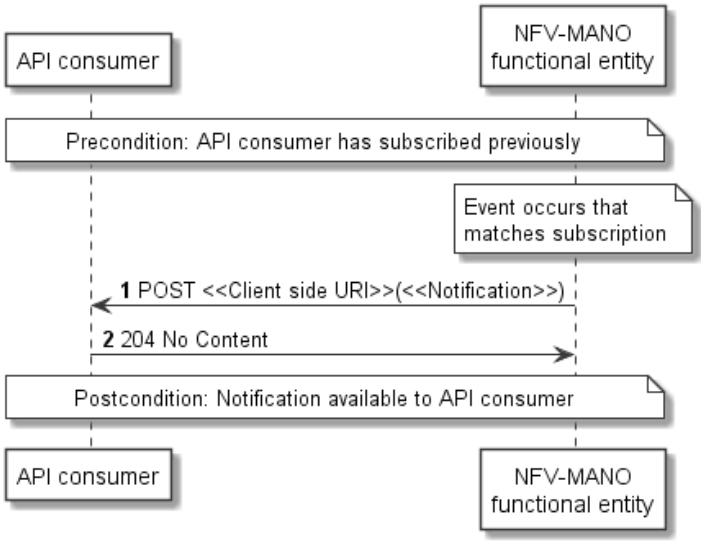

Figure 8.4.6-1: Flow of sending notifications

The procedure consists of the following steps as illustrated in figure 8.4.6-1:

Precondition: The API consumer has subscribed previously for notifications related to NFV-MANO log management and the NFV-MANO functional entity has thus a related subscription.

1) If an event occurs that matches the filtering criteria which are part of the subscription, the NFV-MANO functional entity generates a notification that includes information about the event, and sends it in the body of a POST request to the URI which the API consumer has registered as part of the subscription request. The variable <<Notification>> in the flow is a placeholder for the different types of notifications that can be sent by this API.

2) The API consumer acknowledges the successful delivery of the notification by returning a "204 No Content" response.

Postcondition: The notification is available to the API consumer.

Error handling: If the NFV-MANO functional entity does not receive the "204 No Content" response from the API consumer, it can retry sending the notification.

8.4.7 Flow of on-demand request to compile log data into file

This clause describes the procedure for performing the on-demand compilation of log data into a file. The procedure can be synchronous or asynchronous depending on whether the NFV-MANO functional entity can compile the log data and create the log report immediately.

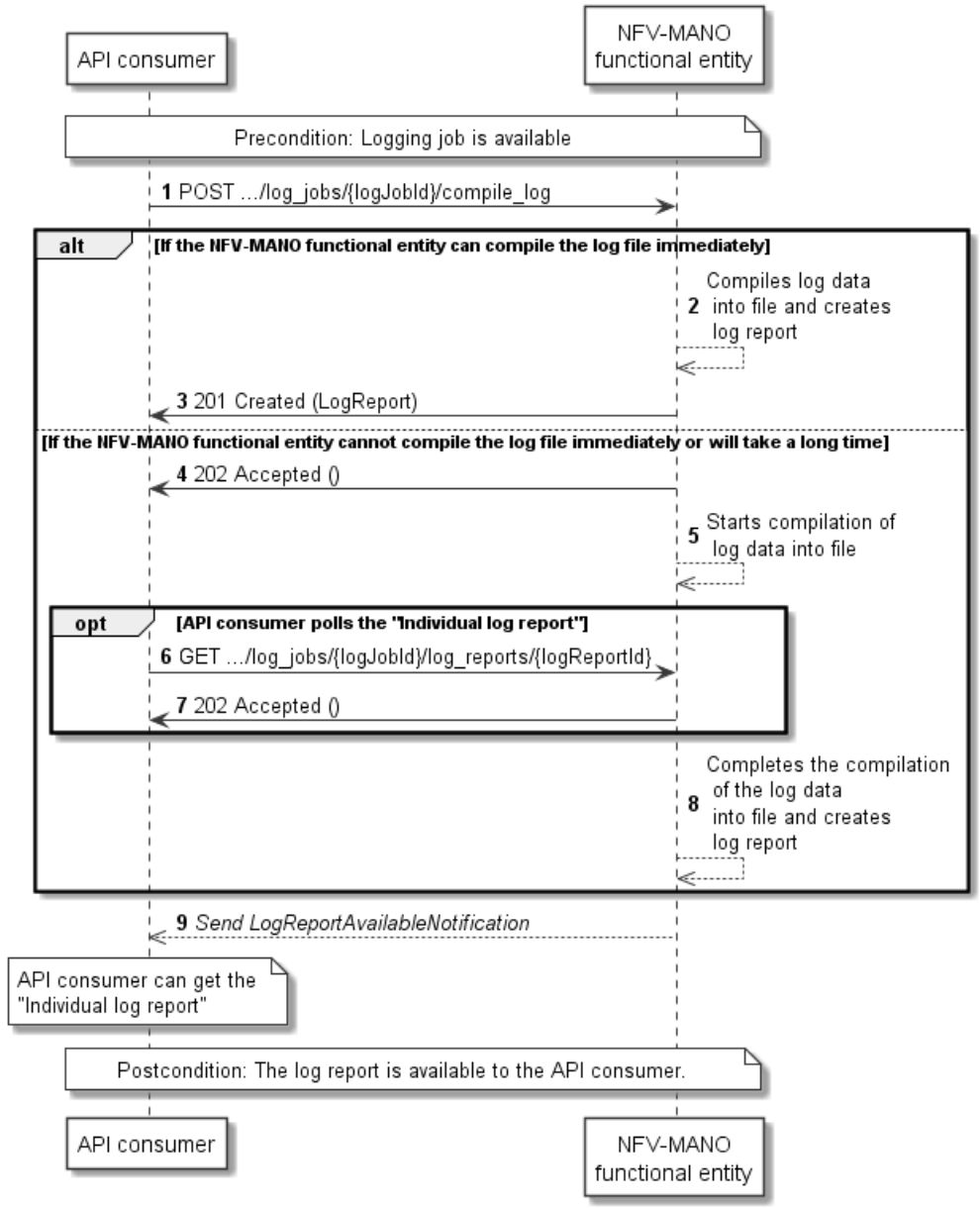

Figure 8.4.7-1: Flow of on-demand request to compile log data into file

The procedure consists of the following steps as illustrated in figure 8.4.7-1:

Precondition: The logging job is available.

1) The API consumers sends a POST request to the "compile log task" resource, and includes in the message content a data structure of type "CompileLogFileRequest".

2) If the NFV-MANO functional entity can process the compile log file request and compile the log file immediately, it compiles such a file and generates the associated log report (synchronous mode).

3) In case of 2), the NFV-MANO functional entity returns a "201 Created" response to indicate the completion of the operation, and includes in the message content a data structure of type "LogReport".

4) Alternatively to step 2), if the NFV-MANO functional entity cannot compile the log file immediately or the NFV-MANO functional entity knows that the compilation will take some time, the NFV-MANO functional entity returns to the API consumer a "202 Accepted" response with an empty body and a "Location" HTTP header that indicates the URI of the "Individual log report" resource that will be created once the compilation is completed (asynchronous mode).

5) The NFV-MANO functional entity starts the compilation of the log data into a file.

6) Optionally, the API consumer can send a GET request to the NFV-MANO functional entity using the URI in the "Location" header that was returned in step 4).

7) As there is no result of the compilation of the log file and consequently the "Individual log report" resource is still in the process of being created, the NFV-MANO functional entity returns a "202 Accepted" response with an empty body.

8) The NFV-MANO functional entity completes the compilation of the log data into the log file and generates the associated log report.

9) The NFV-MANO functional entity sends to the API consumer a LogReportAvailableNotification to indicate the availability of the log report resource.

NOTE 1: Due to possible race conditions, the "201 Created" response and the LogReportAvailableNotification can arrive in any order at the API consumer.

NOTE 2: In synchronous case, the API consumer can get the "Individual log report" from the response body or as defined in clause 8.4.4. In asynchronous case, the "Individual log report" can be obtained with the procedure defined in clause 8.4.4.

Postcondition: The log report is available to the API consumer.

Error handling: If the compilation of the log file and reporting fails, the NFV-MANO functional entity provides in the response appropriate error information.

8.5 Resources

8.5.1 Introduction

This clause defines all the resources and methods provided by the NFV-MANO log management interface.

8.5.2 Resource: API versions

The "API versions" resources as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [4] are part of the NFV-MANO log management interface.

8.5.3 Resource: Logging jobs

8.5.3.1 Description

This resource represents logging jobs. The API consumer can use this resource to create and query logging jobs.

8.5.3.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanologm/{apiMajorVersion}/log_jobs

This resource shall support the resource URI variables defined in table 8.5.3.2-1.

Table 8.5.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 8.2.

8.5.3.3 Resource methods

8.5.3.3.1 POST

The POST method creates a logging job.

This method shall follow the provisions specified in tables 8.5.3.3.1-1 and 8.5.3.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual logging job" resource as defined in clause 8.5.4 shall have been created.

Table 8.5.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.3.3.1-2: Details of the POST request/response on this resource

Request body	**Data type**	**Cardinality**	**Description**	
	CreateLoggingJobRequest	1	Logging job creation request.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LoggingJob	1	201 Created	Shall be returned when the logging job has been created successfully. The response body shall contain a representation of the created "Individual Logging job" resource, as defined in clause 8.6.2.6. The HTTP response shall include a "Location" HTTP header that points to the created "Individual logging job" resource.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.3.3.2 GET

The API consumer can use this method to retrieve information about logging jobs.

This method shall follow the provisions specified in tables 8.5.3.3.2-1 and 8.5.3.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the LoggingJob and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity shall support this parameter.
fields	0..1	Complex attributes to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.

Name	Cardinality	Description
exclude_fields	0..1	Complex attributes to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [4] for details. The NFV-MANO functional entity shall support this parameter. The following attributes shall be excluded from the LoggingJob structure in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: • logReports.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 8.5.3.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LoggingJob	0..N	200 OK	Shall be returned when information about zero or more logging jobs has been queried successfully. The response body shall contain in an array the representations of zero or more logging jobs, as defined in clause 8.6.2.6. If the "filter" URI parameter or one of the "all_fields", "fields" (if supported), "exclude_fields" (if supported) or "exclude_default" URI parameters was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clauses 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [4], respectively. If the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.4 Resource: Individual logging job

8.5.4.1 Description

This resource represents an individual logging job. The API consumer can use this resource to delete and read the underlying logging job.

8.5.4.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanologm/{apiMajorVersion}/log_jobs/{logJobId}

This resource shall support the resource URI variables defined in table 8.5.4.2-1.

Table 8.5.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 8.2.
logJobId	Identifier of the logging job. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new "Individual logging job" resource. It can also be retrieved from the "id" attribute in the message content of that response.	

8.5.4.3 Resource methods

8.5.4.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.4.3.2 GET

The API consumer can use this method for reading an individual logging job.

This method shall follow the provisions specified in tables 8.5.4.3.2-1 and 8.5.4.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.4.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.4.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LoggingJob	1	200 OK	Shall be returned when information about an individual logging job has been read successfully. The response body shall contain a representation of the "Individual logging job" resource, as defined in clause 8.6.2.6.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.4.3.5 DELETE

This method terminates an individual logging job.

This method shall follow the provisions specified in tables 8.5.4.3.5-1 and 8.5.4.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual logging job" resource shall not exist any longer.

Table 8.5.4.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.4.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the logging job has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.5 Resource: Individual log report

8.5.5.1 Description

This resource represents an individual log report. The API consumer can use this resource to read information about a log report.

The log report provides metadata information about a log and location information of the log file from where it can be obtained.

NOTE: The present document does not specify the mechanism how to retrieve the log files.

8.5.5.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanologm/{apiMajorVersion}/log_jobs/{logJobId}/log_reports/{logReportId}

This resource shall support the resource URI variables defined in table 8.5.5.2-1.

Table 8.5.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 8.2.
logJobId	Identifier of the logging job. See note 1.
logReportId	Identifier of the log report. See note 2.
NOTE 1: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new logging job resource. It can also be retrieved from the "id" attribute in the message content of that response. NOTE 2: This identifier can be retrieved from: a) the "logReportsIds" attribute of the applicable element in the message content of the response to a GET request to a logging job (see clause 8.6.2.6), and b) the "logReport" attribute available from a LogReportAvailableNotification.	

8.5.5.3 Resource methods

8.5.5.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.5.3.2 GET

The API consumer can use this method for reading an individual log report.

This method shall follow the provisions specified in tables 8.5.5.3.2-1 and 8.5.5.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.5.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.5.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LogReport	1	200 OK	Shall be returned when information of an individual log report has been read successfully. The response body shall contain a representation of the "Individual log report" resource, as defined in clause 8.6.2.7.
	n/a		202 Accepted	Shall be returned if the creation of the log report is ongoing and no log report is available yet (applicable in asynchronous mode of the "Compile log task" resource). The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.5.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.6 Resource: Compile log task

8.5.6.1 Description

This resource represents the "Compile log" operation. The API consumer can use this resource to request compiling the logged data, collected via a logging job, into a file and creating the associated log report.

As the result of successfully processing this request, a new "Individual log report" resource shall be created. Two modes of operation, synchronous or asynchronous, can take place depending on whether the NFV-MANO functional entity can compile the log data and create the log report immediately. In the synchronous case, which is indicated by responding with "201 Created", the resource shall be created before the "201 Created" response is returned. In the asynchronous case, which is indicated by responding with "202 Accepted", the resource may be created after the response is returned.

8.5.6.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanologm/{apiMajorVersion}/log_jobs/{logJobId}/compile_log

This resource shall support the resource URI variables defined in table 8.5.6.2-1.

Table 8.5.6.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 8.2.
logJobId	Identifier of the logging job. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new logging job resource. It can also be retrieved from the "id" attribute in the message content of that response.	

8.5.6.3 Resource methods

8.5.6.3.1 POST

The POST method requests to compile the logged data into a file and create an associated log report.

This method shall follow the provisions specified in tables 8.5.6.3.1-1 and 8.5.6.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.6.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.6.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	CompileLogRequest	1	Log compilation request.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LogReport	1	201 Created	Shall be returned for a successful compilation of the log data and creation of the associated log report (synchronous mode). The response body shall contain a representation of the log report resource, as defined in clause 8.6.2.7. The HTTP response shall include a "Location" HTTP header that indicate the URI of the "Individual log report" resource just created.
	n/a		202 Accepted	Shall be returned when the request has been accepted for processing, and it is expected to take some time to compile the log file and create the associated log report (asynchronous mode). The response body shall be empty. The HTTP response shall include a "Location" HTTP header that indicates the URI of the "Individual log report" resource that will be created once the log file compilation is completed.
	n/a		303 See other	Shall be returned when a log data compilation and report creation is already ongoing, or a log report has just been created, for the specified logging job at the time of processing the request. The response body shall be empty. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the log report resource just created, or to be created by the ongoing compilation and report creation.
	ProblemDetails	1	422 Unprocessable Content	The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically, in case of this task resource, the response code 422 shall also be returned if the "objectInstanceId" value provided in the message content of the request does not correspond to an object instance for which log data is being collected by the logging job represented by this resource. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.6.3.2 GET

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.6.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.6.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.6.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.7 Resource: Subscriptions

8.5.7.1 Description

This resource represents subscriptions. The client can use this resource to subscribe to notifications related to NFV-MANO log management and to query its subscriptions.

8.5.7.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanologm/{apiMajorVersion}/subscriptions

This resource shall support the resource URI variables defined in table 8.5.7.2-1.

Table 8.5.7.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 6.4 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 8.2.

8.5.7.3 Resource methods

8.5.7.3.1 POST

The POST method creates a new subscription.

This method shall follow the provisions specified in tables 8.5.7.3.1-1 and 8.5.7.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual subscription" resource as defined in clause 8.5.8 shall have been created. This method shall not trigger any notification.

Creation of two "Individual subscription" resources with the same callbackURI and the same filter can result in performance degradation and will provide duplicates of notifications to the API consumer, and might make sense only in very rare use cases. Consequently, the NFV-MANO functional entity may either allow creating a new "Individual subscription" resource if another "Individual subscription" resource with the same filter and callbackUri already exists (in which case it shall return the "201 Created" response code), or may decide to not create a duplicate "Individual subscription" resource (in which case it shall return a "303 See Other" response code referencing the existing "Individual subscription" resource with the same filter and callbackUri).

Table 8.5.7.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.7.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	LogmSubscriptionRequest	1	Details of the subscription to be created.	
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LogmSubscription	1	201 Created	Shall be returned when the subscription has been created successfully. A representation of the created "Individual subscription" resource shall be returned in the response body, as defined in clause 8.6.2.3. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the created "Individual subscription" resource.
	n/a		303 See Other	Shall be returned when a subscription with the same callbackURI and the same filter already exists and the policy of the NFV-MANO functional entity is to not create redundant subscriptions. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the existing "Individual subscription" resource. The response body shall be empty.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [4], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the API producer has tested the Notification endpoint as described in clause 8.5.9.3.2 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.7.3.2 GET

The API consumer can use this method to query the list of active subscriptions to log management notifications subscribed by the API consumer.

This method shall follow the provisions specified in tables 8.5.7.3.2-1 and 8.5.7.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.7.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [4]. The NFV-MANO functional entity shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the LogmSubscription and in data types referenced from it shall be supported by the NFV-MANO functional entity in the filter expression.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFV-MANO functional entity if the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource.

Table 8.5.7.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LogmSubscription	0..N	200 OK	Shall be returned when the list of subscriptions has been queried successfully. The response body shall contain in an array the representations of all active subscriptions of the functional block that invokes the method, i.e. zero or more representations of log management subscriptions as defined in clause 8.6.2.3. If the "filter" URI parameter was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clause 5.2.2 of ETSI GS NFV-SOL 013 [4]. If the NFV-MANO functional entity supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the NFV-MANO functional entity supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [4] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [4].
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.7.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.7.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.8 Resource: Individual subscription

8.5.8.1 Description

This resource represents an individual subscription for notifications about log management related events.

The API consumer can use this resource to read and to terminate a subscription to notifications related to NFV-MANO log management.

8.5.8.2 Resource definition

The resource URI is:

{apiRoot}/nfvmanologm/{apiMajorVersion}/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 8.5.8.2-1.

Table 8.5.8.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 6.4 of ETSI GS NFV-SOL 013 [4].
apiMajorVersion	See clause 8.2.
subscriptionId	Identifier of the subscription. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new "Individual subscription" resource. It can also be retrieved from the "id" attribute in the message content of that response.	

8.5.8.3 Resource methods

8.5.8.3.1 POST

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.8.3.2 GET

The API consumer can use this method for reading an individual subscription about log management notifications subscribed by the API consumer.

This method shall follow the provisions specified in tables 8.5.8.3.2-1 and 8.5.8.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.8.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.8.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	LogmSubscription	1	200 OK	Shall be returned when the subscription has been read successfully. The response body shall contain a representation of the "Individual subscription" resource, as defined in clause 8.6.2.3.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.8.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.8.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFV-MANO functional entity shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.8.3.5 DELETE

This method terminates an individual subscription.

This method shall follow the provisions specified in tables 8.5.8.3.5-1 and 8.5.8.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual subscription" resource shall not exist any longer. This means that no notifications for that subscription shall be sent to the formerly-subscribed API consumer.

NOTE: Due to race conditions, some notifications might still be received by the formerly-subscribed API consumer for a certain time period after the deletion.

Table 8.5.8.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.8.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	n/a		204 No Content	Shall be returned when the "Individual subscription" resource has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.9 Resource: Notification endpoint

8.5.9.1 Description

This resource represents a notification endpoint for NFV-MANO log management.

The API producer can use this resource to send notifications related to log management events to a subscribed API consumer, which has provided the URI of this resource during the subscription process.

8.5.9.2 Resource definition

The resource URI is provided by the client when creating the subscription.

This resource shall support the resource URI variables defined in table 8.5.9.2-1.

Table 8.5.9.2-1: Resource URI variables for this resource

Name	Definition
n/a	

8.5.9.3 Resource methods

8.5.9.3.1 POST

The POST method delivers a notification regarding a log management event from the API producer to the API consumer. The API consumer shall have previously created an "Individual subscription" resource with a matching filter.

This method shall follow the provisions specified in tables 8.5.9.3.1-1 and 8.5.9.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.9.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.9.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	LogReportAvailableNotification	1	Notification about the availability of a log report.	
Response body	Data type	Cardinality	Response Codes	Description
	n/a		204 No Content	Shall be returned when the notification has been delivered successfully.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.9.3.2 GET

The GET method allows the API producer to test the notification endpoint that is provided by the API consumer, e.g. during subscription.

This method shall follow the provisions specified in tables 8.5.9.3.2-1 and 8.5.9.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 8.5.9.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 8.5.9.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	Data type	Cardinality	Response Codes	Description
	n/a		204 No Content	Shall be returned to indicate that the notification endpoint has been tested successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [4]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4] may be returned.

8.5.9.3.3 PUT

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.9.3.4 PATCH

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.5.9.3.5 DELETE

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [4].

8.6 Data model

8.6.1 Introduction

This clause defines the request and response data structures of the NFV-MANO log management interface. If a request or response contains attributes not defined in the present document, a receiving functional block that does not understand these attributes shall not treat their presence as an error, and may choose to ignore them.

8.6.2 Resource and notification data types

8.6.2.1 Introduction

This clause defines the data structures to be used in resource representations and notifications.

8.6.2.2 Type: LogmSubscriptionRequest

This type represents a subscription request. It shall comply with the provisions defined in table 8.6.2.2-1.

Table 8.6.2.2-1: Definition of the LogmSubscriptionRequest data type

Attribute name	Data type	Cardinality	Description
filter	LogmNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
authentication	SubscriptionAuthentication	0..1	Authentication parameters to configure the use of Authorization when sending notifications corresponding to this subscription, as defined in clause 8.3.4 of ETSI GS NFV-SOL 013 [4]. This attribute shall only be present if the subscriber requires authorization of notifications.

8.6.2.3 Type: LogmSubscription

This type represents a subscription. It shall comply with the provisions defined in table 8.6.2.3-1.

Table 8.6.2.3-1: Definition of the LogmSubscription data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier that identifies the subscription.
filter	LogmNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
_links	Structure (inlined)	1	Links to resources related to this resource.
>self	Link	1	URI of this resource.

8.6.2.4 Type: LogReportAvailableNotification

This notification informs the receiver that the log report of the NFV-MANO functional entity is available. It shall comply with the provisions defined in table 8.6.2.4-1.

The notification shall be triggered by the NFV-MANO functional entity when log information has been collected by the logging job and the log report is available.

Table 8.6.2.4-1: Definition of the LogReportAvailableNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "LogReportAvailableNotification" for this notification type.
subscriptionId	Identifier	1	Identifier of the subscription that this notification relates to.
timeStamp	DateTime	1	Date and time of the generation of the notification.
objectInstanceId	ManoManagedObjectReference	1	Identifier that identifies the object instance for which the log report is available. This attribute shall contain the identifier of the logged object according to their type.
_links	Structure (inlined)	1	Links to resources related to this notification.
>subscription	NotificationLink	1	Link to the related subscription.
>objectInstance	NotificationLink	0..1	Link to the resource representing the measured object instance to which the notified change applies. Shall be present if the measured object instance information is accessible as a resource.
>LoggingJob	NotificationLink	1	Link to the resource that represents the logging job for which the log report is available.
>logReports	NotificationLink	1..N	Link from which the available log report can be obtained. Due to the relationship of the logging job compilation and the logging information availability reporting, more than one logReport notification link can be provided.

8.6.2.5 Type: CreateLoggingJobRequest

This type represents a request to create a logging job. It shall comply with the provisions defined in table 8.6.2.5-1.

Table 8.6.2.5-1: Definition of the CreateLoggingJobRequest data type

Attribute name	Data type	Cardinality	Description
objectInstanceIds	ManoManagedObjectReference	1..N	Identifiers of the object instance for which logging information is requested to be collected. This attribute shall contain the identifier of the instance of the object to be logged according to their type. If more than one identifier is provided, values shall all refer to object instances of the same type, for which the same criteria is then applicable.
jobCriteria	LoggingJobCriteria	1	Criteria of the collection of logging information.
jobConfig	LoggingJobConfig	1	Configuration about the logging job.

8.6.2.6 Type: LoggingJob

This type represents a logging job. It shall comply with the provisions defined in table 8.6.2.6-1.

Table 8.6.2.6-1: Definition of the LoggingJob data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this logging job.
objectInstanceIds	ManoManagedObjectReference	1..N	Identifiers of the object instance for which logging information is collected. This attribute shall contain the identifier of the instance of the object that is logged according to their type.
jobCriteria	LoggingJobCriteria	1	Criteria of the collection of logging information.
jobConfig	LoggingJobConfig	1	Configuration about the logging job.
logReports	Structure (inlined)	0..N	Information about available log reports created by the logging job.
>logReportId	Identifier	1	Identifier of the available log report.
>logReportLoc	Link	1	Link to the available log report.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.
>objects	Link	0..N	Links to resources representing the object instances that are logged. Shall be present if the logged object instance information is accessible as a resource.

8.6.2.7 Type: LogReport

This type represents a log report, which provides information about a compiled log and how to obtain it. It shall comply with the provisions defined in table 8.6.2.7-1.

Table 8.6.2.7-1: Definition of the LogReport data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this log report.
objectInstanceId	ManoManagedObjectReference	1	Identifiers of the object instance for which logging information is collected. This attribute shall contain the identifier of the instance of the object that is logged according to their type.
compilationTrigger	Enum (inlined)	1	The trigger for the compilation of the log file. Permitted values: • ON_DEMAND: created based on explicit request by a client. • AUTOMATIC: created according to the logging job compilation configuration.
readyTime	DateTime	1	The time when the report and log file was made available.
expiryTime	DateTime	0..1	The time when the report and log file will expire.
fileSize	UnsignedInt	0..1	The size of the compiled log file in bytes, if known.
fileFormat	String	1	The encoding used by the file.
fileLocationInfo	Structure (inlined)	1	Location and address information of the compiled log file. The consumer can use this information to obtain the compiled log file.

Attribute name	Data type	Cardinality	Description
>protocol	Enum (inlined)	1	Protocol over which the compiled log file can be retrieved. Permitted values: • HTTPS: transmission over HTTP Secure (HTTPS). • SFTP: transmission over SSH file transfer protocol (SFTP). • SCP: transmission over secure copy protocol (SCP). • FTPS: transmission over file transfer protocol secure (FTPS), as specified in IETF RFC 2228 [i.11], using explicit mode as specified in IETF RFC 4217 [i.12]. If FTPS is supported, "private" protection level shall be used. HTTPS shall be supported, and other protocols may be supported.
>fileEndpoint	Uri	1	The host name (or IP address), optionally a port number (if the host with the compile log file uses a non-standard port number as per the supported transmission protocol), a valid file directory path, and the file name of the compiled log file, or a valid URL.
securityAndIntegrityInfo	Structure (inlined)	1	Security and integrity information for the compilation of the log files.
>algorithm	String	1	Algorithm used to generate the hash of the compiled log file. Only SHA-256 and SHA-512 shall be used.
>hash	String	1	The hexadecimal value of the hash of the compiled log file. The hash shall be computed from the encrypted compiled log file, in case the encryption applies.
>encryptionPublicKey	String	0..1	Public key used for the encryption of the compiled log file. Shall be present if the compiled log file is encrypted.
>cipherAlgorithm	String	0..1	The cryptographic algorithm used for the encryption. Shall be present if the compiled log file is encrypted. Valid values are: "AES-CBC-128", "AES-GCM-128", "AES-CBC-256", and "AES-GCM-256", as specified in clause 6.5 of ETSI GS NFV-SEC 012 [12].
>logFileSignature	String	1	Signature to the compiled log file generated with the NFV-MANO functional entity's private key, which is used to ensure the authenticity of the compiled log file. The signature shall be applied according to the "encryptAndSignOrder" of the "LoggingJobConfig". See note.
>signingCertificate	String	1	X.509 certificate with the NFV-MANO functional entity's public key used for verifying the log report and compiled log file signatures.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.
>object	Link	0..1	Link to resource representing the object instance that is logged, which is identified by the corresponding objectInstanceId attribute's value. Shall be present if the logged object instance information is accessible as a resource.

NOTE: It is not specified in the present document how the NFV-MANO functional entity's private key is provided to the NFV-MANO functional entity.

8.6.2.8 Type: CompileLogRequest

This type represents a request to compile the logged data associated to an object instance. It shall comply with the provisions defined in table 8.6.2.8-1.

Table 8.6.2.8-1: Definition of the CompileLogRequest data type

Attribute name	Data type	Cardinality	Description
objectInstanceId	ManoManagedObjectReference	0..1	Identifier of the object instance for which logging information is requested to be compiled. The provided value shall correspond to an object instance for which log data is being collected as specified in the corresponding "LoggingJob". If not present, the compile log request is requested for all managed object instances associated to the logging job.

8.6.3 Referenced structured data types

8.6.3.1 Introduction

This clause defines data structures that can be referenced from data structures defined in the previous clauses, but can neither be resource representations nor bound to any subscribe/notify mechanism.

8.6.3.2 Type: LoggingJobCriteria

This type represents collection criteria for logging jobs. It shall comply with the provisions defined in table 8.6.3.2-1.

Table 8.6.3.2-1: Definition of the LoggingJobCriteria data type

Attribute name	Data type	Cardinality	Description
loggingType	Enum (inlined)	1	Type of logging. This defines the types of logged information to collect. Permitted values: • MESSAGES: logged NFV-MANO service interface messages. • SERVICES: logged messages about processes pertaining to NFV-MANO services. • SYSTEM: logged messages about the NFV-MANO functional entity's system enabled by the provider. See note.
messagesLogDetail	LoggingJobMessagesCriteria	0..1	Values for the collection of logged NFV-MANO service interface messages. Shall be present if loggingType="MESSAGES".
servicesLogDetail	LoggingJobServicesCriteria	0..1	Values for the collection of logged NFV-MANO service messages. Shall be present if loggingType="SERVICES".
systemLogDetail	LoggingJobSystemCriteria	0..1	Values for the collection of logged messages about the NFV-MANO functional entity's system. Shall be present if loggingType="SYSTEM".
NOTE: The value of the loggingType has dependency on the object that is requested to be logged (refer to the CreateLoggingJobRequest): a) the logging of messages is only applicable to ManoServiceInterface and ConsumedManoInterface objects.			

8.6.3.3 Type: LoggingJobMessagesCriteria

This type represents criteria for logging jobs to collect logged messages on NFV-MANO service interfaces. It shall comply with the provisions defined in table 8.6.3.3-1.

Table 8.6.3.3-1: Definition of the LoggingJobMessagesCriteria data type

Attribute name	Data type	Cardinality	Description
direction	Enum (inlined)	1	The direction of the interface messages to match. Permitted values: • IN: input messages into the interface. • OUT: output messages from the interface. • ALL: both input and output messages into/from the interface.
matchingPatterns	Structure (inline)	0..N	Patterns to be matched in the interface message. If provided, only messages that match all the values provided in the sub-attributes shall be logged. An API consumer can provide more than one "matchingPattern" if combinations of patterns are to be considered to match diverse sets of interface messages. See note.
>srcIpAddress	IpAddress	0..1	IP address to match the source IP address of request messages to log. The API producer shall support this attribute.
>requestMethod	String	0..1	HTTP request method to be matched. To match, the HTTP request method of the message shall be the same as the value of this attribute. Valid values are specified in IETF RFC 9110 [15] and IETF RFC 5789 [16]. The API producer shall support this attribute.
>requestUriPattern	String	0..1	Substring to be matched in the request URI. To match, the request URI shall include the value of this attribute as a substring. This is typically used to match messages which associate to RESTful resources, or to a specific API (e.g. by using the "apiName" of the API). The API producer shall support this attribute.
>dstIpAddress	IpAddress	0..1	IP address to match the destination IP address of response messages to log. The API producer shall support this attribute.
>responseCodes	String	0..N	HTTP response codes or patterns to match. A list of all valid HTTP response codes and their specification documents can be obtained from the HTTP status code registry [i.13]. In addition, if supported, the following patterns may be used (case-insensitive): • "1XX": for matching any kind of informational response. • "2XX": for matching any kind of success response. • "3XX": for matching any kind redirection response. • "4XX": for matching any kind of client error response. • "5XX": for matching any kind of server error response. The API producer shall support this attribute.

Attribute name	Data type	Cardinality	Description
>headerField	String	0..1	Name of the header field to be matched. The header field name shall be one of the supported fields in a request message as defined in clause 4.2.2 of ETSI GS NFV-SOL 013 [4] or in a response message as defined in clause 4.2.3 of ETSI GS NFV-SOL 013 [4], in accordance with the "direction" criteria input. The API producer may support this attribute.
>headerValue	String	0..1	Value in the header to be matched. To match, the value in the header field indicated by "headerField" shall be the same as in this attribute. Shall be provided if a "headerField" is provided. The API producer may support this attribute.
>bodyValues	String	0..N	A list of strings to be matched in the body part of the interface message (e.g. the body of an HTTP message). If provided, only messages with text in the body part containing all the values from the list shall match the filter. In addition to a matching filter for the body of the message, a corresponding "headerField" filter shall also be provided, with "headerField" set to "Content-Type", to restrict matching to appropriate textual payloads such as "application/json" or "text/plain". The API producer may support this attribute.
NOTE: If a matching pattern is present, at least one of the "srcIpAddress", "dstIpAddress", "requestMethod", "requestUriPattern" or "responseCodes" shall be provided.			

Examples on the usage of the LoggingJobMessagesCriteria follow:

EXAMPLE 1: A logging job messages criteria in which input and output messages are requested to be logged according to specific matching criteria: for all incoming messages with: a) a "POST" request with the "/vnflcm/v1" in the URI originated from the source IP address "10.0.0.1", and b) all outgoing messages with response codes in the ranges of "4XX" and "5XX", associated to the request URI matched pattern and source IP address "10.0.0.1", will be logged:

```
{
     "direction" : "ALL",
     "matchingPatterns" : [ {
         "srcIpAddress" : "10.0.0.1",
         "requestMethod" : "POST",
         "requestUriPattern" : "/vnflcm/v1" }, {
         "responseCodes" : [ "4XX", "5XX" ] } ]
}
```

END OF EXAMPLE 1

EXAMPLE 2: A logging job messages criteria in which all input and output messages are requested to be matched, and as a result, all messages will be logged:

```
{
     "direction" : "ALL",
}
```

END OF EXAMPLE 2

8.6.3.4 Type: LoggingJobServicesCriteria

This type represents criteria for logging jobs to collect logged messages about processes pertaining to NFV-MANO services. It shall comply with the provisions defined in table 8.6.3.4-1.

Table 8.6.3.4-1: Definition of the LoggingJobServicesCriteria data type

Attribute name	Data type	Cardinality	Description
logGarbageCollection	Boolean	0..1	Indicates to collect logged information about garbage collection processes associated to NFV-MANO services. See note.
NOTE: In the present version of the present document, only one attribute, i.e. "logGarbageCollection", is available.			

8.6.3.5 Type: LoggingJobSystemCriteria

This type represents criteria for logging jobs to collect logged system events of the NFV-MANO functional entity. It shall comply with the provisions defined in table 8.6.3.5-1.

Table 8.6.3.5-1: Definition of the LoggingJobSystemCriteria data type

Attribute name	Data type	Cardinality	Description
systemLogs	KeyValuePairs	1	Values for the provider enabled system logs. See note.
severityLevelScheme	String	0..1	Identifies a severity level scheme. The default value is "rfc5424", which represents the set of values specified in the clause 6.2.1, table 2 of IETF RFC 5424 [8]. Other values may be used to signal different schemes.
severityLevel	Number	1	The severity level, which determines the severity of the system messages to collect. The NFV-MANO functional entity shall collect system log messages, as indicated by the "systemLogs" attribute, with severity levels lower (i.e. more severe) or equal to the value provided by this present attribute.
NOTE: The set of properties and values for this attribute are assumed to be known to the consumer by means defined outside of the present document.			

8.6.3.6 Type: LoggingJobConfig

This type represents configuration data for a logging job. It shall comply with the provisions defined in table 8.6.3.6-1.

NOTE: The present document version does not specify the support for "log compilation and reporting based on events" as specified in clause 6.6.2.2 of ETSI GS NFV-IFA 031 [1].

Table 8.6.3.6-1: Definition of the LoggingJobConfig data type

Attribute name	Data type	Cardinality	Description
startTime	DateTime	0..1	Specifies the time for the logging job to be started. If not provided, the logging job is requested to start immediately.
endTime	DateTime	0..1	Specifies the time after which the logging job will stop. Shall only be provided if the logging job is requested to stop at a specific time.
reportingCondition	Structure (inlined)	1	Specifies the condition under which the producer will report to the consumer about the compiled log data.

Attribute name	Data type	Cardinality	Description
>reportingType	Enum (inlined)	1	Specifies the type of reporting condition. Permitted values: • REPORTING_ON_COMPILATION: the producer shall notify the consumer once the compilation of the collected logging data into a file is completed and a new log report is available. • NO_REPORTING: no reporting is requested (the consumer can query the logging jobs to know about the availability of new log reports).
>minimumReportingPeriod	UnsignedInt	0..1	Specifies the minimum periodicity at which the producer will report to the consumer about the collected log information, in seconds. See note 1.
compileBySizeValue	UnsignedInt	0..1	An indicative size threshold for compiling the collected log data, in bytes. It is used when the compilation is based on the size of the collected log data. If not present, a default value as specified with the "defaultLogCompileBySizeValue" configuration in the "ManoEntityConfigurableParams" shall be used. See note 2 and note 3.
compileByTimerValue	UnsignedInt	0..1	The periodicity threshold for compiling the filtered log, in seconds. It is used when the compilation is based on a timer (e.g. every 24 hours). If not present, a default value as specified with the "defaultLogCompileByTimerValue" configuration in the "ManoEntityConfigurableParams" shall be used See note 2.
securityConf	Structure (inlined)	1	Configuration about the security aspects of the logging job.
>logFileEncryption	Structure (inline)	0..1	Information about the encryption of the compiled log files. Shall be present if the log file is requested to be encrypted.
>>encryptionCertificate	String	1	X.509 certificate with the public key to use for the encryption of the compiled log file.
>>cipherAlgorithm	String	1..N	Cryptographic algorithm to be used for the encryption of the compiled log file. More than one algorithm can be provided from higher (lower array index) to lower (higher array index) precedence. Valid values are: "AES-CBC-128", "AES-GCM-128", "AES-CBC-256", and "AES-GCM-256", as specified in clause 6.5 of ETSI GS NFV-SEC 012 [12].
>>encryptAndSignOrder	String	0..1	Indication about the order in signing and encrypting the compiled log file. Valid values are: "encryptFirst", to apply the order "first encrypt, then sign", and "signFirst" for the order "first sign, then encrypt". Default value is "encryptFirst".
>logTransferSecurity	Structure (inline)	1	Information about the security measures for retrieving/accessing the compiled log files.
>>publicKey	String	0..1	The public key of the API consumer used for the client authentication with the file server. Shall be provided if required by the type of transfer protocol. May be omitted if the key has been provided to the API producer by other means, or if it has already been provided in some previous CreateLoggingJobRequest issued by the same API consumer, whose public key has not changed.

NOTE 1: The minimumReportingPeriod is used to throttle possible flooding of reports by providing a lower limit on the gap between two log availability notification to be emitted by the same logging job.

NOTE 2: More than one logCompilingCondition is possible to provide a combination of different conditions for the compilation. This covers use cases when the compilation of the log can be based on, e.g. a timer value and a size value, whichever first condition is met first. For instance, compile a log every 3 600 seconds, or whenever during the 3 600 seconds period the log grows in size to 1 000 000 bytes.

NOTE 3: The value is indicative, as the actual size of the compiled log files might not match the provided compileBySizeValue due to possible deviations in the tracking of the size of the log data by the API producer, and the size of individual logged data entries when these are collected.

An example about the usage of the compileBySizeValue and compileByTimerValue, and their possible combination follows. Figure 8.6.3.6-1 illustrates the example.

EXAMPLE: In this example, three different log data compilation configurations are considered:

- Config #1: it requests compilation only based on size, which is indicated by the compileBySizeValue#1.
- Config #2: it requests compilation only based on a timer, which is indicated by the compileByTimerValue#1.
- Config #3: it requests compilation based both on size and timing, which is indicated by the compileByTimerValue#1 and compileBySizeValue#2.

For simple illustrative purposes, the example does assume that collection of the log data for the compilation starts at the same time, i.e. t0 is considered the starting point. In addition, the example does not take into account the cases when a default size or time compilation value is applicable.

Under these conditions:

- Log file compilation events according to config #1 take place only when the size of the log data to compile in the file reaches value indicated by the compileBySizeValue#3, i.e. at t3 and t9.
- Log file compilation events according to config #2 take place based on the value of the compileByTimerValue#1, thus at the times t1, t2, t5, t8, and t10.
- Log file compilation events according to config #3 take place both when either the timing value indicated by the compileBySizeTimer#1 or the size value indicated by the compileBySizeValue#2. Therefore, in this case, the compilation takes place at times t1, t2, t4, t5, t6, t7, t8 and t10. The behaviour in between t2 and t8 is of particular relevance for this combined compilation case: at t4, the size of the log data to compile reaches the size value indicated by the compileBySizeValue#2, thus a compilation takes place; the next matching compilation condition matches when the compileByTimerValue#1 is reached, i.e. at t5. In a similar behaviour, next compilation events happen at t6, t7 and t8.

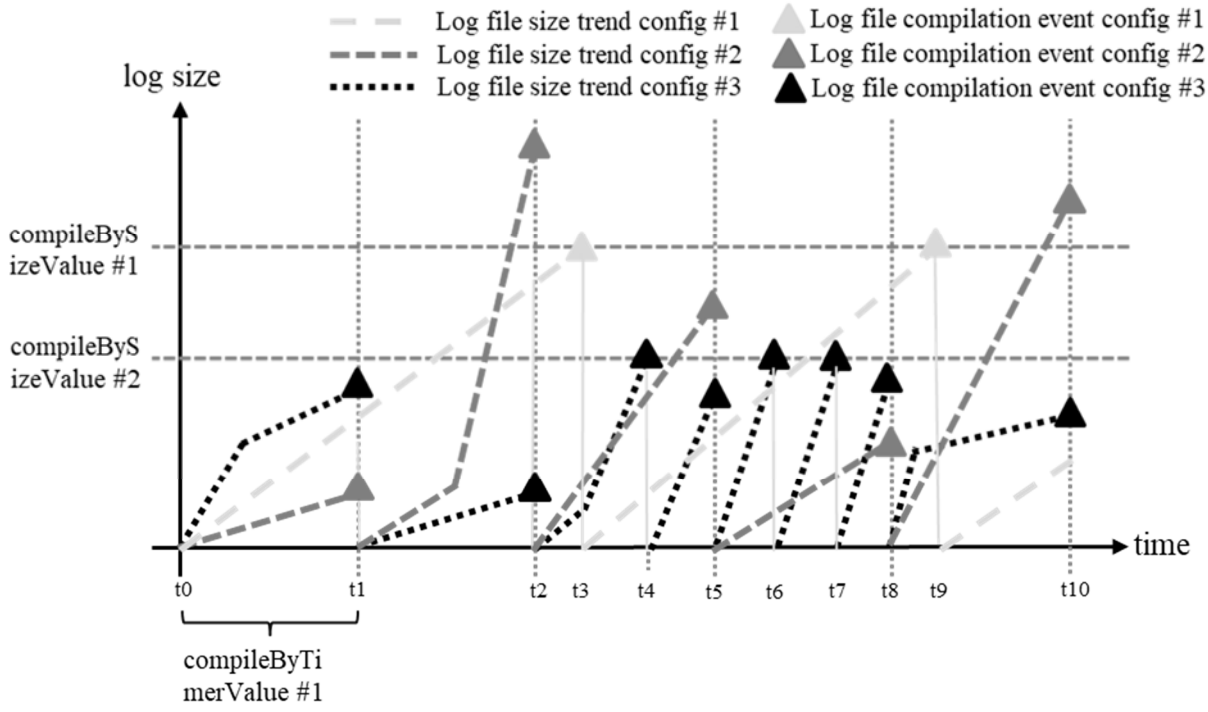

Figure 8.6.3.6-1: Example of combining different compiling conditions

END OF EXAMPLE

8.6.3.7 Type: LogmNotificationsFilter

This type represents a filter that can be used to subscribe for notifications related to log management events. It shall comply with the provisions defined in table 8.6.3.7-1.

At a particular nesting level in the filter structure, the following applies: All attributes shall match in order for the filter to match (logical "and" between different filter attributes). If an attribute is an array, the attribute shall match if at least one of the values in the array matches (logical "or" between the values of one filter attribute).

Table 8.6.3.7-1: Definition of the LogmNotificationsFilter data type

Attribute name	Data type	Cardinality	Description
objectInstanceFilter	ManoEntitySubscriptionFilter	0..1	Filter criteria to select object instance about which to notify.
notificationTypes	Enum (inlined)	0..N	Match particular notification types. Permitted values: • LogReportAvailableNotification See note.
NOTE: The permitted values of the "notificationTypes" attribute are spelled exactly as the names of the notification types to facilitate automated code generation systems.			

8.6.4 Referenced simple data types and enumerations

None.

Annex A (informative): Mapping operations to protocol elements

A.1 Overview

This annex provides the mapping between operations as defined in ETSI GS NFV-IFA 031 [1] and the corresponding resources and HTTP methods defined in the present document.

A.2 NFV-MANO configuration and information management interface

Table A.2-1 provides the mapping in between the operations and corresponding resources and HTTP methods for the NFV-MANO configuration and information management interface.

Table A.2-1: Mapping for the NFV-MANO configuration and information management interface

ETSI GS NFV-IFA 031 [1] operation	HTTP method	Resource	Direction
Modify Config	PATCH	nfvmanocim/{apiMajorVersion}/mano_entity	API consumer → NFV-MANO functional entity
	PATCH	nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces/{manoServiceInterfaceId}	API consumer → NFV-MANO functional entity
	PATCH	nfvmanocim/{apiMajorVersion}/peer_entities/{peerEntityId}	API consumer → NFV-MANO functional entity
Query Config Info	GET	nfvmanocim/{apiMajorVersion}/mano_entity	API consumer → NFV-MANO functional entity
	GET	nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces	API consumer → NFV-MANO functional entity
	GET	nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces/{manoServiceInterfaceId}	API consumer → NFV-MANO functional entity
	GET	nfvmanocim/{apiMajorVersion}/peer_entities	API consumer → NFV-MANO functional entity
	GET	nfvmanocim/{apiMajorVersion}/peer_entities/{peerEntityId}	API consumer → NFV-MANO functional entity
Change State	POST	nfvmanocim/{apiMajorVersion}/mano_entity/change_state	API consumer → NFV-MANO functional entity
	POST	nfvmanocim/{apiMajorVersion}/mano_entity/mano_interfaces/{manoServiceInterfaceId}/change_state	API consumer → NFV-MANO functional entity
Subscribe	POST	nfvmanocim/{apiMajorVersion}/subscriptions	API consumer → NFV-MANO functional entity
Terminate subscription	DELETE	nfvmanocim/{apiMajorVersion}/subscriptions/{subscriptionId}	API consumer → NFV-MANO functional entity
Notify	POST	(client-provided)	NFV-MANO functional entity → API consumer
Query Subscription Information	GET	nfvmanocim/{apiMajorVersion}/subscriptions	API consumer → NFV-MANO functional entity
	GET	nfvmanocim/{apiMajorVersion}/subscriptions/{subscriptionId}	API consumer → NFV-MANO functional entity

A.3 NFV-MANO performance management interface

Table A.3-1 provides the mapping in between the operations and corresponding resources and HTTP methods for the NFV-MANO performance management interface.

Table A.3-1: Mapping for the NFV-MANO performance management interface

ETSI GS NFV-IFA 031 [1] operation	HTTP method	Resource	Direction
Create PM Job	POST	nfvmanopm/{apiMajorVersion}/pm_jobs	API consumer → NFV-MANO functional entity
Delete PM Job	DELETE	nfvmanopm/{apiMajorVersion}/pm_jobs/{pmJobId}	API consumer → NFV-MANO functional entity
Query PM Job	GET	nfvmanopm/{apiMajorVersion}/pm_jobs/	API consumer → NFV-MANO functional entity
	GET	nfvmanopm/{apiMajorVersion}/pm_jobs/{pmJobId}	API consumer → NFV-MANO functional entity
Create Threshold	POST	nfvmanopm/{apiMajorVersion}/thresholds	API consumer → NFV-MANO functional entity
Delete Thresholds	DELETE	nfvmanopm/{apiMajorVersion}/thresholds/{thresholdId}	API consumer → NFV-MANO functional entity
Query Thresholds	GET	nfvmanopm/{apiMajorVersion}/thresholds	API consumer → NFV-MANO functional entity
	GET	nfvmanopm/{apiMajorVersion}/thresholds/{thresholdId}	API consumer → NFV-MANO functional entity
Subscribe	n/a	See note.	
Terminate Subscription	n/a	See note.	
Notify	POST	(client-provided)	NFV-MANO functional entity → API consumer
Query Subscription Information	n/a	See note.	
	n/a	See note.	
NOTE: In the VNF Performance Management interface, support for subscriptions has been dropped in version 3.5.1 of the present document in favour of controlling the delivery of notifications directly by the "Thresholds" and "PM jobs" resources.			

A.4 NFV-MANO fault management interface

Table A.4-1 provides the mapping in between the operations and corresponding resources and HTTP methods for the NFV-MANO fault management interface.

Table A.4-1: Mapping for the NFV-MANO fault management interface

ETSI GS NFV-IFA 031 [1] operation	HTTP method	Resource	Direction
Subscribe	POST	nfvmanofm/{apiMajorVersion}/subscriptions	API consumer → NFV-MANO functional entity
Terminate Subscription	DELETE	nfvmanofm/{apiMajorVersion}/subscriptions/{subscriptionId}	API consumer → NFV-MANO functional entity
Notify	POST	(client-provided)	NFV-MANO functional entity → API consumer
Get Alarm List	GET	nfvmanofm/{apiMajorVersion}/alarm/	API consumer → NFV-MANO functional entity
Query Subscription Information	GET	nfvmanofm/{apiMajorVersion}/subscriptions	API consumer → NFV-MANO functional entity
	GET	nfvmanofm/{apiMajorVersion}/subscriptions/{subscriptionId}	API consumer → NFV-MANO functional entity
Acknowledge alarms	PATCH	nfvmanofm/{apiMajorVersion}/alarm/{alarmId}	API consumer → NFV-MANO functional entity

A.5 NFV-MANO log management interface

Table A.5-1 provides the mapping in between the operations and corresponding resources and HTTP methods for the NFV-MANO log management interface.

Table A.5-1: Mapping for the NFV-MANO log management interface

ETSI GS NFV-IFA 031 [1] operation	HTTP method	Resource	Direction
Create Logging Job	POST	nfvmanologm/{apiMajorVersion}/log_jobs	NFV-MANO functional entity → API consumer
Stop Logging Job	DELETE	nfvmanologm/{apiMajorVersion}/log_jobs/{logJobId}	API consumer → NFV-MANO functional entity
Query Logging Job	GET	nfvmanologm/{apiMajorVersion}/log_jobs	API consumer → NFV-MANO functional entity
	GET	nfvmanologm/{apiMajorVersion}/log_jobs/{logJobId}	API consumer → NFV-MANO functional entity
Subscribe	POST	nfvmanologm/{apiMajorVersion}/subscriptions	API consumer → NFV-MANO functional entity
Terminate Subscription	DELETE	nfvmanologm/{apiMajorVersion}/subscriptions/{subscriptionId}	API consumer → NFV-MANO functional entity
Notify	POST	(client-provided)	NFV-MANO functional entity → API consumer
Query Subscription Information	GET	nfvmanologm/{apiMajorVersion}/subscriptions	API consumer → NFV-MANO functional entity
	GET	nfvmanologm/{apiMajorVersion}/subscriptions/{subscriptionId}	API consumer → NFV-MANO functional entity

Annex B (informative): Change History

Date	Version	Information about changes
October 2018	0.0.1	Skeleton and scope based on NFVSOL(18)000570 and NFVSOL(18)000571 approved at SOL#79.
November 2018	0.1.0	Implementation of contributions approved at SOL#83 and post EA: - NFVSOL(18)000641r1, NFVSOL(18)000642r1, NFVSOL(18)000643r3, NFVSOL(18)000644r2, NFVSOL(18)000650r2, NFVSOL(18)000651r2, NFVSOL(18)000652r2, NFVSOL(18)000653r2, NFVSOL(18)000654r3. Rapporteur changes: - Added reference IETF RFC 7396 as introduced by contribution NFVSOL(18)000653r2.
December 2018	0.2.0	Implementation of contributions approved at SOL#84 and SOL#85-F2F: - NFVSOL(18)000714r1, NFVSOL(18)000701, NFVSOL(18)000702r1, NFVSOL(18)000703r1, NFVSOL(18)000704r2, NFVSOL(18)000705r1, NFVSOL(18)000710, NFVSOL(18)000711r1, NFVSOL(18)000712r1, NFVSOL(18)000713r1. Rapporteur corrections: - Table 6.5.7.3.2-2: change clause reference, 6.6.2.9 instead of 6.5.2.9. - Clause 6.4.4: change clause reference 6.6.2.5 instead of 6.5.10. - Clauses 5.4.3, 6.4.8, 7.4.3 and 9.4.5: change "to terminate is available" to "to be terminated is available".
January 2019	0.3.0	Implementation of contributions approved at SOL#85-EA, SOL#86-EA, and SOL#87: - NFVSOL(18)000721, NFVSOL(18)000716r1, NFVSOL(19)000017. Rapporteur actions: - Corrected few editorials. - Added reference [i.2] to NFV-IFA011.
February 2019	0.4.0	Implementation of contributions approved at SOL#88-EA, SOL#89, SOL#91-EA, and SOL#92: - NFVSOL(19)000029, NFVSOL(19)000031, NFVSOL(19)000028, NFVSOL(19)000072r2, NFVSOL(19)000100r1. Rapporteur actions: - Corrected few editorials. - Updated few references to "clause a.b.c.d" to the actual available clause number. - Aligned the spec draft to latest EditHelp! template (February 2019): updates in the "Important Notice" and addition of the clause 3.2 Symbols. - Deleted editor's notes in few places as content is now available: Table 5.5.4.3.2-2, Table 5.5.4.3.1-2, Table 5.5.3.3.2-2, Table 5.5.3.3.4-2, and Table 9.5.5.3.1-2.
April 2019	0.5.0	Implementation of contributions approved at SOL#93-EA, SOL#94-EA and SOL#95: - NFVSOL(19)000148, NFVSOL(19)000180, NFVSOL(19)000181r3, NFVSOL(19)000184r2, NFVSOL(19)000153r3, NFVSOL(19)000179r1, NFVSOL(19)000099r3. Rapporteur actions: - Updated the clause number in clause 4 due to the insertion of clause 4.2. - Added missing references for ETSI GS NFV-MAN 001 and Recommendation ITU-T X.731 in clause 2.2. - Updated the references numbering. - Updated clause numbering in clauses 5.6.2.x and references to these clauses due to the insertion of ManoConfigModifications as clause 5.6.2.4. - Updated clause numbering in clauses 5.6.3.x and references to these clauses due to the move of the ManoEntityInterface to clause 5.6.2.11.
May 2019	0.6.0	Implementation of contributions approved at SOL#101-F2F Sophia Antipolis: - NFVSOL(19)000281r1, NFVSOL(19)000282r2, NFVSOL(19)000283, NFVSOL(19)000284, NFVSOL(19)000285r1, NFVSOL(19)000286r1, NFVSOL(19)000151r2, NFVSOL(19)000287r1. Rapporteur actions: - Updated several clauses numbering, and their references.

Date	Version	Information about changes
June 2019	0.7.0	Implementation of contributions approved at SOL#102-F2F Sophia Antipolis: - NFVSOL(19)000349r2, NFVSOL(19)000351r1, NFVSOL(19)000352r1, NFVSOL(19)000375, NFVSOL(19)000350r3, NFVSOL(19)000356r3. Rapporteur actions: - Updated several clauses numbering, and their references. - New references added for IETF RFC 5246, IETF RFC 6749 and ETSI GS NFV-SEC 022 as indicated by contribution NFVSOL(19)000356r3. - Deletion of editor's note in clause 9.6.2.5 about LoggingJobConfig, which is contributed as per implemented contribution NFVSOL(19)000351r1.
August 2019	0.8.0	Implementation of contributions approved at SOL#107: NFVSOL(19)000505, NFVSOL(19)000455r1. NFVSOL(19)000456r1, NFVSOL(19)000499. Implementation of contributions approved in SOL009-EA1: - NFVSOL(19)000429, NFVSOL(19)000445, NFVSOL(19)000444, NFVSOL(19)000447, NFVSOL(19)000476, NFVSOL(19)000474r1, NFVSOL(19)000399r2, NFVSOL(19)000433r1, NFVSOL(19)000435r1, NFVSOL(19)000437r1, NFVSOL(19)000439r2, NFVSOL(19)000441r3, NFVSOL(19)000443r1, NFVSOL(19)000446r1, NFVSOL(19)000450r1, NFVSOL(19)000469r2, NFVSOL(19)000471. Implementation of contributions approved in SOL009-EA2: - NFVSOL(19)000436r3, NFVSOL(19)000440r2, NFVSOL(19)000452r2, NFVSOL(19)000500r2, NFVSOL(19)000489r3, NFVSOL(19)000438r5. Implementation of contributions approved in SOL#108: - NFVSOL(19)000401r2, NFVSOL(19)000400r4, NFVSOL(19)000432r5, NFVSOL(19)000442r2, NFVSOL(19)000502r1, NFVSOL(19)000521. Rapporteur actions: - Updated several clauses numbering, and their references. - Emptied clause 8 of state management after merging the clause 8.7 content into clause 5.7. - Applied SOL015 API documentation convention such as: 1) using the "apiMajorVersion" in the resource definitions and tree representations, 2) updating the resource tree figures to indicate the task resources, 3) the steps in the flows to differentiate in between messages, notifications and internal entity steps. - Multiple changes of "wrt" to "with regards to". - Typos and small editorials. - Added clause 8.6.4 "Referenced simple data types and enumerations" in the log management API, to keep consistency with other API clauses structure. - Delete empty Annexes B and Y. - Clause 5.6.2.2: deletion of the editor's note about the "usage stage" as per approval of the contribution NFVSOL(19)000441r3. - Added new references as required by the approved contributions, including: IETF RFC 8447, IETF RFC 2228, IETF RFC 4217, IETF RFC 7231, HTTP status codes registry by IANA, IETF RFC 5424, IFA005/006/007/008/013, SOL005 and SEC012. The references of SOL002/003 were moved from the informative to the normative clause as per normative usage of them. - Correction when applying the NFVSOL(19)000450r1: clause 5.5.3.3.4, the description needs to refer to the "NFV-MANO entity" resource.
September 27, 2019	0.8.0a	Implementation of CR in NFV(19)000224 approved at NFV#27: Internal version produced by ETSI Secretariat after NFV Approval. This version implements the CR in NFV(19)000224 which was approved during the NFV#27 Closing Plenary together with v0.8.0.
July 2020	3.3.2	Implementation of CRs approved at EA#129, SOL#135 and EA#135_round2: - BWC: NFVSOL(19)000682: SOL009ed341 mirror of 679 adding error response for failed notification endpoint test - NBWC: NFVSOL(19)000686r1: SOL009ed341 fixing the PM interface wrt subscriptions - BWC: NFVSOL(20)000373: SOL009ed341 mirror of 349 adding PM job id to notification - NBWC: NFVSOL(20)000324r1: SOL009ed341 mirror of 208r1 introducing maps
February 2021	3.3.3	Implementation of CRs approved at SOL#151: - BWC: NFVSOL(20)000681: SOL009ed341 Resolve miscellaneous inconsistencies - BWC: NFVSOL(20)000682: SOL009ed341 Fixing notifications optionality in flows
March 2021	3.3.4	Implementation of CRs approved at SOL#165: - BWC: NFVSOL(21)000153: SOL009ed351 Release alignment with FEAT10 multi-site connectivity - BWC: NFVSOL(21)000154: SOL009ed351 Release alignments about specified interfaces

Date	Version	Information about changes
April 2021	3.3.5	Implementation of CRs approved at EA#168: - BWC: NFVSOL(21)000235: SOL009ed351 Updating API versions
October 2021	4.0.1	Implementation of CRs approved at SOL#183: - BWC: NFVSOL(21)000512: SOL009ed431 Rel. 4 mirror of 494
January 2022	4.0.2	Re-base the draft with published v3.5.1. Implementation of CRs approved during EA#189: - BWC: NFVSOL(21)000605: SOL009ed431 Rel. 4 mirror of 584 Minor improvements Implementation of CRs approved during SOL#192: - BWC: NFVSOL(21)000656: SOL009ed431 Rel. 4 Mirror of 640r1 Resolution of VimSpecificInfo related editor's note
February 2022	4.0.3	Implementation of CRs approved during SOL#195: - BWC: NFVSOL(22)000038r1 SOL009ed431 Replacing MAN001 for NFV006 references - BWC: NFVSOL(22)000041 SOL009ed431 PeerEntityEnumType fix
April 2022	4.0.4	Implementation of CRs approved during SOL#201: - BWC: NFVSOL(22)000123 SOL009ed431 Adding CISM into NFV-MANO mgmt. interfaces
May/June 2022	4.0.5	Implementation of CRs approved during SOL#204: - BWC: NFVSOL(22)000201 SOL009ed431 Resolution of CismSpecificInfo related editor's note Implementation of CRs approved during SOL#205: - BWC: NFVSOL(22)000202 SOL009ed431 Updating API versions Implementation of CRs approved during SOL#208: - BWC: NFVSOL(22)000292r1 SOL009ed431 API version jump
October 2022	4.3.2	Implementation of CRs approved during SOL#220: - BWC: NFVSOL(22)000409 SOL009ed441 Adding CIR into NFV-MANO mgmt. interfaces - BWC: NFVSOL(22)000410 SOL009ed441 Mirror of 373r2 Handling of obsoletion of IETF RFCs
November 2022	4.3.3	Implementation of CRs approved during SOL#229: - BWC: NFVSOL(22)000490 SOL009ed441 VimConnectionInfo alignments
January 2023	4.3.4	Implementation of CRs approved during SOL#231: - BWC: NFVSOL(22)000522 SOL009ed441 Resolution of CirSpecificInfo related editor's note Implementation of CRs approved during SOL#232: - BWC: NFVSOL(23)000006 SOL009ed441 Update IETF references and Bugfixes Implementation of CRs approved during SOL#233: - BWC: NFVSOL(23)000009r1 SOL009ed441 Adding CCM into NFV-MANO mgmt. interfaces
February 2023	4.3.5	Implementation of CRs approved during SOL#234: - BWC: NFVSOL(23)000032 SOL009ed441 Editor's note in clause 5.6.3.16 - BWC: NFVSOL(23)000033: SOL009ed441 Updating API versions

History

Document history		
V4.3.1	July 2022	Publication
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