



## **Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point**

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**Reference**

RGS/NFV-SOL011ed371

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# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Modal verbs terminology.....	6
1 Scope .....	7
2 References .....	7
2.1 Normative references .....	7
2.2 Informative references.....	7
3 Definition of terms, symbols and abbreviations.....	7
3.1 Terms.....	7
3.2 Symbols.....	7
3.3 Abbreviations .....	8
4 General aspects.....	8
4.1 Overview .....	8
4.2 Common data types.....	8
5 NSD Management interface .....	8
6 NS Lifecycle Management interface.....	9
7 NS Lifecycle Operation Granting interface.....	9
7.1 Description .....	9
7.2 API version.....	9
7.3 Resource structure and method .....	9
7.4 Sequence diagrams (informative).....	10
7.4.1 Flow of requesting a grant .....	10
7.5 Resources .....	10
7.5.1 Introduction.....	10
7.5.2 Resource: API versions.....	10
7.5.3 Resource: Grants.....	10
7.5.3.1 Description .....	10
7.5.3.2 Resource definition .....	11
7.5.3.3 Resource methods .....	11
7.5.3.3.1 POST .....	11
7.5.3.3.2 GET .....	12
7.5.3.3.3 PUT .....	12
7.5.3.3.4 PATCH.....	12
7.5.3.3.5 DELETE.....	12
7.5.4 Resource: Individual grant.....	12
7.5.4.1 Description .....	12
7.5.4.2 Resource definition .....	12
7.5.4.3 Resource methods .....	12
7.5.4.3.1 POST .....	12
7.5.4.3.2 GET .....	12
7.5.4.3.3 PUT .....	13
7.5.4.3.4 PATCH.....	13
7.5.4.3.5 DELETE.....	13
7.6 Data model .....	13
7.6.1 Introduction.....	13
7.6.2 Resource and notification data types .....	13
7.6.2.1 Introduction.....	13
7.6.2.2 Type: GrantNsLifecycleOperationRequest .....	13
7.6.2.3 Type: Grant .....	14
7.6.3 Referenced structured data types .....	14
7.6.4 Referenced simple data types and enumerations .....	14
7.6.4.1 Introduction.....	14

7.6.4.2	Simple data types .....	14
7.6.4.3	Enumeration: NsLcmOperation .....	15
8	NS Instance Usage Notification interface .....	15
8.1	Description .....	15
8.2	API version.....	15
8.3	Resource structure and method .....	15
8.4	Sequence diagrams (informative).....	16
8.4.1	Flow of managing subscriptions .....	16
8.4.2	Flow of sending notifications.....	18
8.5	Resources .....	19
8.5.1	Introduction.....	19
8.5.2	Resource: API versions.....	19
8.5.3	Resource: Subscriptions.....	19
8.5.3.1	Description .....	19
8.5.3.2	Resource definition .....	19
8.5.3.3	Resource methods .....	20
8.5.3.3.1	POST .....	20
8.5.3.3.2	GET .....	21
8.5.3.3.3	PUT .....	22
8.5.3.3.4	PATCH.....	22
8.5.3.3.5	DELETE.....	22
8.5.4	Resource: Individual subscription.....	23
8.5.4.1	Description .....	23
8.5.4.2	Resource definition .....	23
8.5.4.3	Resource methods .....	23
8.5.4.3.1	POST .....	23
8.5.4.3.2	GET .....	23
8.5.4.3.3	PUT .....	24
8.5.4.3.4	PATCH.....	24
8.5.4.3.5	DELETE.....	24
8.5.5	Resource: Notification endpoint .....	24
8.5.5.1	Description .....	24
8.5.5.2	Resource definition .....	24
8.5.5.3	Resource methods .....	25
8.5.5.3.1	POST .....	25
8.5.5.3.2	GET .....	25
8.5.5.3.3	PUT .....	26
8.5.5.3.4	PATCH.....	26
8.5.5.3.5	DELETE.....	26
8.6	Data model .....	26
8.6.1	Introduction.....	26
8.6.2	Resource and notification data types .....	26
8.6.2.1	Introduction.....	26
8.6.2.2	Type: NsInstanceUsageSubscriptionRequest.....	26
8.6.2.3	Type: NsInstanceUsageSubscription.....	26
8.6.2.4	Type: NsInstanceUsageNotification .....	27
8.6.3	Referenced structured data types .....	27
8.6.3.1	Type: NsInstanceUsageNotificationsFilter .....	27
8.6.4	Referenced simple data types and enumerations .....	28
8.6.4.1	Introduction.....	28
8.6.4.2	Simple data types .....	28
8.6.4.3	Enumeration: NsInstanceUsageStatusType .....	28
9	NS Performance Management interface.....	28
10	NS Fault Management interface.....	28
<b>Annex A (informative): Mapping operations to protocol elements.....</b>		<b>29</b>
A.1	Overview .....	29
A.2	NSD Management interface .....	29

A.3	NS lifecycle management interface.....	29
A.4	NS lifecycle operation granting interface.....	30
A.5	NS instance usage notification interface .....	30
A.6	NS performance management interface .....	30
A.7	NS fault management interface .....	31
<b>Annex B (informative):</b>	<b>Change History .....</b>	<b>32</b>
History .....		33

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# Foreword

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

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# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document specifies a set of RESTful protocol and data models fulfilling the requirements specified in ETSI GS NFV-IFA 030 [1] for the interfaces used over the Or-Or reference point.

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## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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 030: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Multiple Administrative Domain Aspect Interfaces Specification".
- [2] ETSI GS NFV-SOL 013: "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs".
- [3] ETSI GS NFV-SOL 005: "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfvo Reference Point".

### 2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI GR NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

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## 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] and ETSI GS NFV-IFA 030 [1] apply.

### 3.2 Symbols

Void.

## 3.3 Abbreviations

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

HTTP            HyperText Transfer Protocol

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# 4 General aspects

## 4.1 Overview

The present document defines the protocol and data model for the following interfaces, in the form of RESTful Application Programming Interface (APIs) specifications:

- NSD Management interface (as produced by the NFVO-N towards the NFVO-C).
- NS Lifecycle Management interface (as produced by the NFVO-N towards the NFVO-C).
- NS Lifecycle Operation Granting interface (as produced by the NFVO-N towards the NFVO-C).
- NS Instance Usage Notification interface (as produced by the NFVO-N towards the NFVO-C).
- NS Performance Management interface (as produced by the NFVO-N towards the NFVO-C).
- NS Fault Management interface (as produced by the NFVO-N towards the NFVO-C).

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 030 [1].

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 030 [1].

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

## 4.2 Common data types

The structured data types and simple data types defined in clause 7 of ETSI GS NFV-SOL 013 [2] shall apply in the present document.

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# 5 NSD Management interface

This interface allows the NFVO-C to invoke management operations of NSDs towards the NFVO-N.

The interface shall follow the provisions specified in the clause 5 of ETSI GS NFV-SOL 005 [3] for the NSD management interface, except that the producer is NFVO-N and the consumer is NFVO-C.

Only the "query NSD info" operation as defined in clause 5 of ETSI GS NFV-SOL 005 [3] is supported on the Or-Or reference point, i.e. only the "NS Descriptors" and "Individual NS Descriptor" resources with the GET method are supported for the present interface, and the API producer shall return a "405 Method Not Allowed" response for other methods requested on the "NS Descriptors" and "Individual NS Descriptor" resources, as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].



## 6 NS Lifecycle Management interface

This interface allows the NFVO-C to invoke NS lifecycle management operations of NS instances towards the NFVO-N, and to subscribe to notifications regarding NS lifecycle changes provided by the NFVO-N.

The interface shall follow the provisions specified in the clause 6 of ETSI GS NFV-SOL 005 [3] for the NS lifecycle management interface, except that the producer is NFVO-N and the consumer is NFVO-C.

The "update NS" as defined in clause 6 of ETSI GS NFV-SOL 005 [3] is not supported on the Or-Or reference point, i.e. the "Update NS task" resource and related methods are not supported for the present interface, and the API producer shall return a "404 Not Found" response for all methods requested on the "update NS" resource, as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

## 7 NS Lifecycle Operation Granting interface

### 7.1 Description

This interface allows the NFVO-N to obtain from the NFVO-C permission for an NS lifecycle operations. This interface also allows API version information retrieval.

The operations provided through this interface are:

- Grant NS Lifecycle Operation.

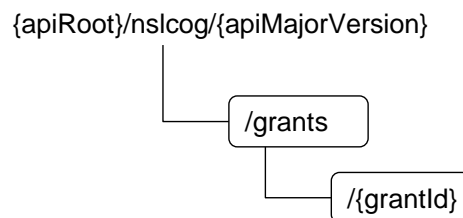
### 7.2 API version

For the NS lifecycle operation granting 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 0 (see clause 9.1 of ETSI GS NFV-SOL 013 [2] for a definition of the version fields). Consequently, the {apiMajorVersion} URI variable shall be set to "v1".

### 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 [2]. The string "nslcog" 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 NS lifecycle operation granting interface.



**Figure 7.3-1: Resource URI structure of the NS lifecycle operation granting interface**

Table 7.3-1 lists the individual resources defined, and the applicable HTTP methods.

The NFVO-C 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 NFVO-C shall also support the "API versions" resource as specified in clause 9.3.2 of ETSI GS NFV-SOL 013 [2].

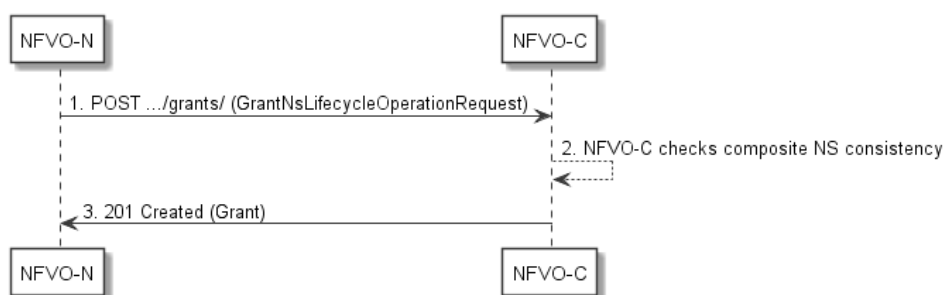
**Table 7.3-1: Resources and methods overview of the NS lifecycle operation granting interface**

Resource name	Resource URI	HTTP Method	Cat	Meaning
Grants	/grants	POST	M	Request a grant
Individual grant	/grants/{grantId}	GET	M	Read a grant

## 7.4 Sequence diagrams (informative)

### 7.4.1 Flow of requesting a grant

This clause describes a sequence for requesting a grant.

**Figure 7.4.1-1: Flow of requesting a grant**

The grant request procedure, as illustrated in figure 7.4.1-1, consists of the following steps:

- 1) The NFVO-N sends a POST request to the "Grants" resource, including one data structure of type "GrantNsLifecycleOperationRequest" in the payload body.
- 2) The NFVO-C checks whether the consistency of the composite NS is impacted by the nested NS lifecycle operation.
- 3) The NFVO-C returns a "201 Created" response with a "Grant" data structure in the body.

**Error handling:** In case of failure or rejection of the grant request, appropriate error information is provided in the response.

## 7.5 Resources

### 7.5.1 Introduction

This clause defines all the resources and methods provided by the NS lifecycle operation granting interface.

### 7.5.2 Resource: API versions

The "API versions" resources, as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [2], are part of the NS lifecycle operation granting interface.

### 7.5.3 Resource: Grants

#### 7.5.3.1 Description

This resource represents grants. The NFVO-N can use this resource to request a grant.

### 7.5.3.2 Resource definition

The resource URI is:

**{apiRoot}/nslcog/{apiMajorVersion}/grants**

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 [2]
apiMajorVersion	See clause 7.2

### 7.5.3.3 Resource methods

#### 7.5.3.3.1 POST

The POST method requests a grant for a particular NS lifecycle operation.

This method shall follow the provisions specified in the tables 7.5.3.3.1-1 and 7.5.3.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully processing this request, a new "Individual grant" resource shall be created.

**Table 7.5.3.3.1-1: URI query parameters supported by the POST method on this resource**

Name	Cardinality	Description
none supported		

**Table 7.5.3.3.1-2: Details of the POST request/response on this resource**

Request body	Data type	Cardinality	Description	
	GrantNsLifecycleOperationRequest	1	The NS lifecycle operation grant request parameters, as defined in clause 7.6.2.2.	
Response body	Data type	Cardinality	Response Codes	Description
	Grant		201 Created	<p>Shall be returned when the grant has been created successfully.</p> <p>A representation of the created "Individual grant" resource shall be returned in the response body.</p> <p>The HTTP response shall include a "Location" HTTP header that indicates the URI of the "Individual grant" resource just created.</p>
	ProblemDetails	1	403 Forbidden	<p>Shall be returned upon the following error: the grant request was rejected.</p> <p>A ProblemDetails structure shall be included in the response to provide more details about the rejection in the "details" attribute.</p>
ProblemDetails	See clause 6.4 of [2]		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 [2] may be returned.

### 7.5.3.3.2 GET

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 7.5.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 7.5.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 7.5.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

## 7.5.4 Resource: Individual grant

### 7.5.4.1 Description

This resource represents an individual grant.

### 7.5.4.2 Resource definition

The resource URI is:

**{apiRoot}/nslcg/{apiMajorVersion}/grants/{grantId}**

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 [2]
apiMajorVersion	See clause 7.2
grantId	Identifier of the grant. See note.
NOTE: This identifier can be retrieved from the "id" attribute in the payload body of the response to a POST request granting a new NS lifecycle operation.	

### 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 API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

#### 7.5.4.3.2 GET

The GET method reads a grant.

This method shall follow the provisions specified in the 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
	Grant	1	200 OK	Shall be returned when the grant has been read successfully.  A representation of the "Individual grant" resource shall be returned in the response body.
	ProblemDetails	See clause 6.4 of [2]	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 [2] may be returned.

### 7.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 7.5.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 7.5.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the API producer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

## 7.6 Data model

### 7.6.1 Introduction

This clause defines the request and response data structures of the NS lifecycle operation granting 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 resource representations and notifications.

#### 7.6.2.2 Type: GrantNsLifecycleOperationRequest

This type represents request parameters for the "grant NS lifecycle" operation. It shall comply with the provisions defined in table 7.6.2.2-1.

**Table 7.6.2.2-1: Definition of the GrantNsLifecycleOperationRequest data type**

Attribute name	Data type	Cardinality	Description
nsInstancelId	Identifier	1	Identifier of the NS instance which this grant request relates to.  See note 1.
nsdId	Identifier	1	Identifier of the NSD that defines the NS for which the lifecycle management operation is to be granted.
nsLcmOpOcclId	Identifier	1	The identifier of the NS lifecycle management operation occurrence associated to the GrantRequest.
lifecycleOperation	NsLcmOperation	1	Type of the lifecycle management operation for which the granting is requested.  See note 2.
additionalParams	KeyValuePairs	0..1	Additional parameters passed by NFVO-N, specific to the NS and the lifecycle management operation.
NOTE 1: Each NFVO-N instance manages its own namespace for NS instance identifiers.			
NOTE 2: The NS LCM operations InstantiateNS, CreateNsIdentifier, DeleteNsIdentifier, Get Operation Status and QueryNs can be executed by NFVO-N without requesting granting.			

### 7.6.2.3 Type: Grant

This type represents a grant. It shall comply with the provisions defined in table 7.6.2.3-1.

**Table 7.6.2.3-1: Definition of the Grant data type**

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of the grant.
nsInstancelId	Identifier	1	Identifier of the NS instance which this grant request relates to.
nsLcmOpOcclId	Identifier	1	Identifier of the NS lifecycle management operation occurrence associated to the GrantRequest.
additionalParams	KeyValuePairs	0..1	Additional parameters passed by NFVO-N, specific to the NS and the lifecycle management operation.
_links	Structure (inlined)	1	Links to resources related to this resource.
>self	Link	1	URI of this resource.
>nsLcmOpOcc	Link	1	Related NS lifecycle management operation occurrence.
>nsInstance	Link	1	Related NS instance.

## 7.6.3 Referenced structured data types

No particular referenced structured data types are defined for this interface.

## 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: NsLcmOperation

The enumeration NsLcmOperation shall comply with the provisions defined in table 7.6.4.3-1. It indicates the type of the NS lifecycle management operation for which the granting is requested.

**Table 7.6.4.3-1: Enumeration NsLcmOperation**

Enumeration value	Description
SCALE	Scale NS operation.
TERMINATE	Terminate NS operation.
HEAL	Heal NS operation.

---

## 8 NS Instance Usage Notification interface

### 8.1 Description

This interface allows the NFVO-N to receive notifications from the NFVO-C indicating that the NFVO-C has started or ceased to use an existing NS instance managed by the NFVO-N as a constituent nested NS of a composite NS managed by the NFVO-C. This interface also allows API version information retrieval.

The existing NS instance is "in use" by NFVO-C when it is associated to a composite NS instance managed by that NFVO-C. That is, the former NS instance is nested into the composite NS.

The existing NS instance is "not in use" by NFVO-C when it is not associated to a composite NS instance managed by that NFVO-C. That is, the NS instance is not nested into a composite NS managed by that NFVO-C.

The operations provided through this interface are:

- Subscribe.
- Query Subscription Information.
- Notify.
- Terminate Subscription.

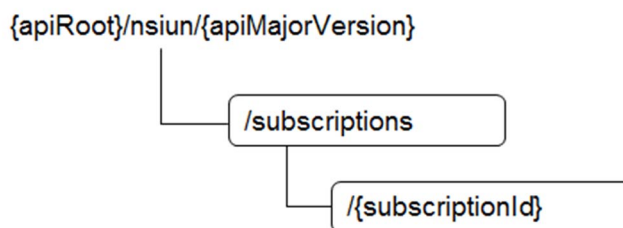
### 8.2 API version

For the NS instance usage notification 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 0 (see clause 9.1 of ETSI GS NFV-SOL 013 [2] for a definition of the version fields). Consequently, the {apiMajorVersion} URI variable shall be set to "v1".

### 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 [2]. The string "nsiun" 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 NS instance usage notification interface.



**Figure 8.3-1: Resource URI structure of the NS instance usage notification interface**

Table 8.3-1 lists the individual resources defined, and the applicable HTTP methods.

The NFVO-C 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 NFVO-C shall also support the "API versions" resource as specified in clause 9.3.2 of ETSI GS NFV-SOL 013 [2].

**Table 8.3-1: Resources and methods overview of the NS instance usage notification interface**

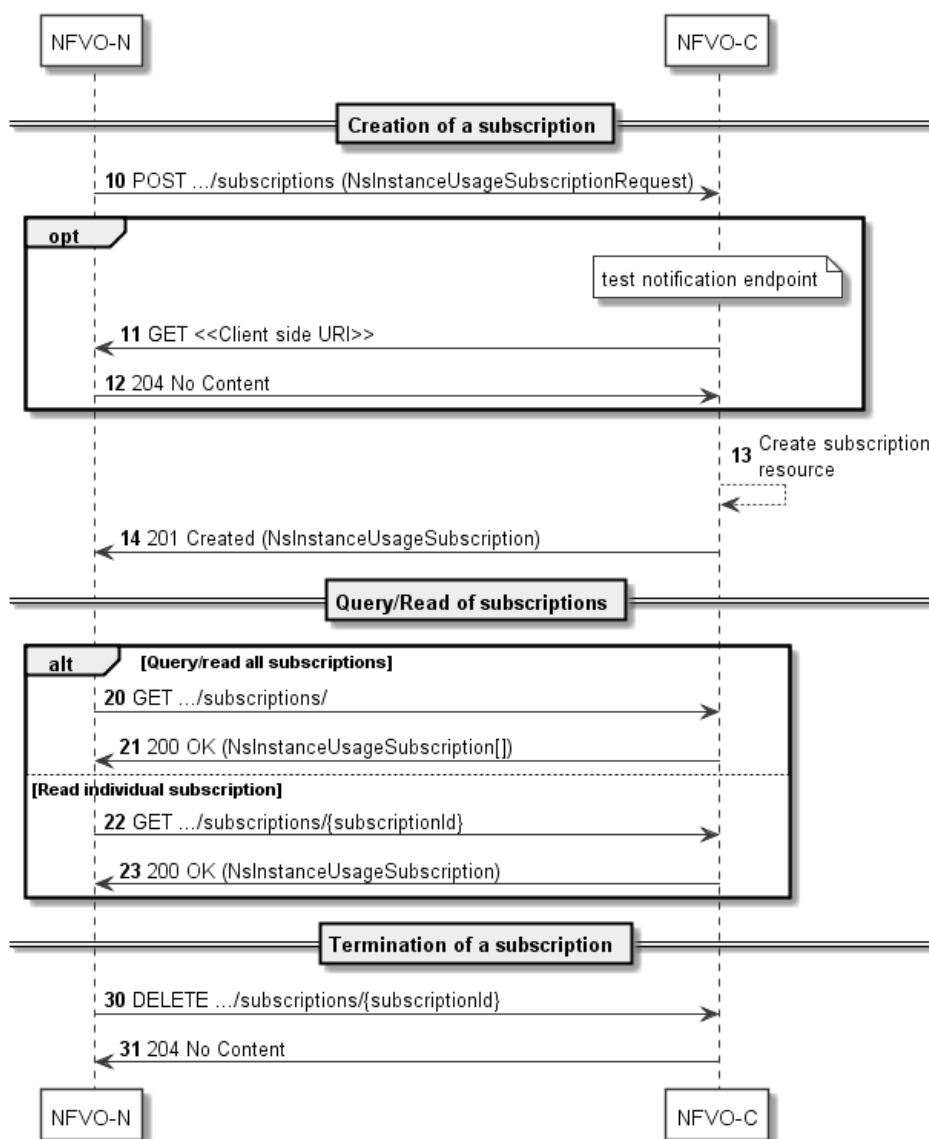
Resource name	Resource URI	HTTP Method	Cat	Meaning
Subscriptions	/subscriptions	POST	M	Subscribe to NS instance usage notifications.
		GET	M	Query multiple subscriptions.
Individual subscription	/subscriptions/{subscriptionId}	GET	M	Read an individual subscription resource.
		DELETE	M	Terminate a subscription.
Notification endpoint	(client-provided)	POST	See note	Notify about change in NS instance usage. See note.
		GET	See note	Test the notification endpoint. See note.
NOTE: The NFVO-C shall support invoking the HTTP methods defined for the "Notification endpoint" resource exposed by the NFVO-N. If the NFVO-N supports invoking the POST method on the "Subscriptions" resource towards the NFVO-C, it shall also support responding to the HTTP requests defined for the "Notification endpoint" resource.				

## 8.4 Sequence diagrams (informative)

### 8.4.1 Flow of managing subscriptions

This clause describes a sequence for creating, querying/reading and terminating subscriptions to notifications related to NS instance usage.





**Figure 8.4.1-1: Flow of managing subscriptions**

#### A) Procedure of subscription creation

The procedure of creating subscriptions consists of the following steps, as illustrated in figure 8.4.1-1:

**Precondition:** The notification endpoint URI is enabled.

- 10) The NFVO-N sends a POST request to the "subscriptions" resource including in the payload body a data structure of type "NsInstanceUsageSubscriptionRequest". This data structure contains filtering criteria and a client side URI to which the NFVO-C will subsequently send notifications about events that match the filter.
- 11) Optionally, to test the notification endpoint that was registered by the NFVO-N as part of the subscription, the NFVO-C sends a GET request to the notification endpoint URI.
- 12) In case of step 11), the NFVO-N returns a "204 No Content" response to indicate success.
- 13) The NFVO-C creates a new subscription for notifications related to NS instance usage, and a resource that represents this subscription.
- 14) The NFVO-C returns a "201 Created" response containing a data structure of type "NsInstanceUsageSubscription", representing the subscription resource created by the NFVO-C, and provides the URI of the newly-created resource in the "Location" HTTP header.

**Postcondition:** The subscription to notifications related to NS instance usage is available to the NFVO-N.

**Error handling:** The NFVO-C rejects a subscription if the subscription information is not valid: endpoint cannot be reached, subscription information is malformed, etc.

### B) Procedure of subscription query/read

The procedure of querying/reading subscriptions consists of the following steps, as illustrated in figure 8.4.1-1:

**Precondition:** Subscriptions have been created.

- 20) The NFVO-N can query information about its subscriptions by sending a GET request to the "subscriptions" resource.
- 21) In case of step 20), the NFVO-C returns a "200 OK" response that contains the list of representations of all existing subscriptions that were created by the NFVO-N.
- 22) The NFVO-N can 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 NFVO-C returns a "200 OK" response that contains a representation of that individual subscription.

**Postcondition:** The subscription information is available to the NFVO-N.

**Error handling:** The NFVO-C provides in the response message appropriate error information that reports an erroneous query request.

### C) Procedure of subscription termination

The procedure of terminating a subscription consists of the following steps, as illustrated in figure 8.4.1-1:

**Precondition:** The subscription to terminate exists.

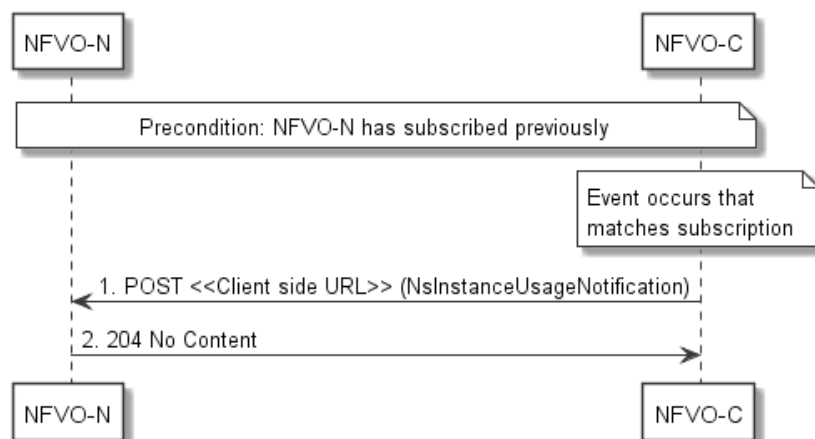
- 30) When the NFVO-N does not need the subscription anymore, it terminates the subscription by sending a DELETE request to the resource that represents the individual subscription.
- 31) The NFVO-C acknowledges the successful termination of the subscription by returning a "204 No Content" response.

**Postcondition:** The subscription to notifications related to NS instance usage is deleted and not available to the NFVO-N, and notifications associated to this subscription are not sent anymore by the NFVO-C.

**Error handling:** The NFVO-C provides in the response message appropriate error information that reports an erroneous termination request: the subscription to terminate does not exist, etc.

## 8.4.2 Flow of sending notifications

This clause describes the procedure for sending notifications related to NS instance usage.



**Figure 8.4.2-1: Flow of sending notifications**

The procedure consists of the following steps as illustrated in figure 8.4.2-1:

**Precondition:** The NFVO-N has subscribed previously for notifications related to NS instance usage and the NFVO-C has thus a related subscription.

- 1) If an event occurs that matches the filtering criteria which are part of the subscription, the NFVO-C generates an `NsInstanceUsageNotification` that includes information about the event, and sends it in the body of a POST request to the URI which the NFVO-N has registered as part of the subscription request.
- 2) The NFVO-N acknowledges the successful delivery of the notification by returning a "204 No Content" response.

**Postcondition:** The notification is available to the NFVO-N.

**Error handling:** If the NFVO-C does not receive the "204 No Content" response from the NFVO-N, it can retry sending the notification.

## 8.5 Resources

### 8.5.1 Introduction

This clause defines all the resources and methods provided by the NS instance usage notification interface.

### 8.5.2 Resource: API versions

The "API versions" resources as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [2] are part of the NS instance usage notification interface.

### 8.5.3 Resource: Subscriptions

#### 8.5.3.1 Description

This resource represents subscriptions. The client can use this resource to subscribe to notifications related to NS instance usage, and to query its subscriptions.

#### 8.5.3.2 Resource definition

The resource URI is:

**{apiRoot}/nsiun/{apiMajorVersion}/subscriptions**

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 [2]
apiMajorVersion	See clause 8.2

### 8.5.3.3 Resource methods

#### 8.5.3.3.1 POST

The POST method creates a new subscription.

This method shall follow the provisions specified in the 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 subscription" resource as defined in clause 8.5.4 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 NFVO-N, and might make sense only in very rare use cases. Consequently, the NFVO-C 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 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	
	NsInstanceUsageSubscriptionRequest	1	Details of the subscription to be created, as defined in clause 8.6.2.2.	
Response body	Data type	Cardinality	Response Codes	Description
	NsInstanceUsageSubscription	1	201 Created	<p>Shall be returned when the subscription has been created successfully.</p> <p>The response body shall contain a representation of the created "individual subscription" resource.</p> <p>The HTTP response shall include a "Location" HTTP header that points to the created "individual subscription" resource.</p>
	n/a		303 See Other	<p>Shall be returned if a subscription with the same callbackURI and the same filter already exists and the policy of the NFVO-C is to not create redundant subscriptions.</p> <p>The HTTP response shall include a "Location" HTTP header that contains the resource URI of the existing "individual subscription" resource.</p> <p>The response body shall be empty.</p>
ProblemDetails	See clause 6.4 of [2]	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 [2] may be returned.	

### 8.5.3.3.2 GET

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

This method shall follow the provisions specified in the 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	<p>Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [2].</p> <p>The NFVO-C shall support receiving this parameter as part of the URI query string. The NFVO-N may supply this parameter.</p> <p>All attribute names that appear in the NsInstanceUsageSubscription and in data types referenced from it shall be supported by the NFVO-C in the filter expression.</p>
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the NFVO-C if the NFVO-C supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] 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
	NsInstanceUsageSubscription	0..N	200 OK	<p>Shall be returned when the list of subscriptions has been queried successfully.</p> <p>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 NS instance usage notification subscriptions as defined in clause 8.6.2.3.</p> <p>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 [2].</p> <p>If the NFVO-C supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] 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 [2].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the NFVO-C supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [2].</p>
ProblemDetails	See clause 6.4 of [2]	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 [2] may be returned.	

### 8.5.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFVO-C shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 8.5.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFVO-C shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 8.5.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFVO-C shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

## 8.5.4 Resource: Individual subscription

### 8.5.4.1 Description

This resource represents an individual subscription. The client can use this resource to read and to terminate a subscription to notifications related to NS instance usage.

### 8.5.4.2 Resource definition

The resource URI is:

**{apiRoot}/nsium/{apiMajorVersion}/subscriptions/{subscriptionId}**

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 [2]
subscriptionId	Identifier of this subscription
apiMajorVersion	See clause 8.2

### 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 NFVO-C shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

#### 8.5.4.3.2 GET

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

This method shall follow the provisions specified in the 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
	NsInstanceUsageSubscription	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 [2]	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 [2] may be returned.

### 8.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFVO-C shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 8.5.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFVO-C shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 8.5.4.3.5 DELETE

The DELETE method terminates an individual subscription.

This method shall follow the provisions specified in the 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 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 8.5.4.3.5-1: 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 "individual subscription" resource has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [2]	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 [2] may be returned.

## 8.5.5 Resource: Notification endpoint

### 8.5.5.1 Description

This resource represents a notification endpoint. The NFVO-C can use this resource to send notifications related to NS instance usage to a subscribed NFVO-N, which has provided the URI of this resource during the subscription process.

### 8.5.5.2 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 8.5.5.2-1.

**Table 8.5.5.2-1: Resource URI variables for this resource**

Name	Definition
none supported	



### 8.5.5.3 Resource methods

#### 8.5.5.3.1 POST

The POST method delivers a notification from the NFVO-C to the NFVO-N.

This method shall follow the provisions specified in the tables 8.5.5.3.1-1 and 8.5.5.3.1-2 for URI query parameters, request and response data structures, and response codes.

**Table 8.5.5.3.1-1: URI query parameters supported by the POST method on this resource**

Name	Cardinality	Description
none supported		

**Table 8.5.5.3.1-2: Details of the POST request/response on this resource**

Request body	Data type	Cardinality	Description	
	NsInstanceUsageNotification	1	A notification about the change of usage of an NS instance as part of a composite NS managed by the server.	
Response body	Data type	Cardinality	Response Codes	Description
	n/a		204 No Content	Shall be returned when the notification was delivered successfully.
	ProblemDetails	See clause 6.4 of [2]	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 [2] may be returned.

#### 8.5.5.3.2 GET

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

This method shall follow the provisions specified in the 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
	n/a		204 No Content	Shall be returned when the notification was tested successfully. The response body shall be empty.
	ProblemDetails	See clause 6.4 of [2]	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 [2] may be returned.

### 8.5.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the NFVO-N shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 8.5.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the NFVO-N shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

### 8.5.5.3.5 DELETE

This method is not supported. When this method is requested on this resource, the NFVO-N shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

## 8.6 Data model

### 8.6.1 Introduction

This clause defines the request and response data structures of the NS instance usage notification 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: NsInstanceUsageSubscriptionRequest

This type represents a subscription request related to notifications about NS instance usage. It shall comply with the provisions defined in table 8.6.2.2-1.

**Table 8.6.2.2-1: Definition of the NsInstanceUsageSubscriptionRequest data type**

Attribute name	Data type	Cardinality	Description
filter	NsInstanceUsageNotificationsFilter	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 [2].  This attribute shall only be present if the subscriber requires authorization of notifications.

#### 8.6.2.3 Type: NsInstanceUsageSubscription

This type represents a subscription related to notifications about NS instance usage. It shall comply with the provisions defined in table 8.6.2.3-1.

**Table 8.6.2.3-1: Definition of the NsInstanceUsageSubscription data type**

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier that identifies the subscription.
filter	NsInstanceUsageNotificationsFilter	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: NsInstanceUsageNotification

This type represents an NS instance usage notification, which indicates the start or end of usage of an NS instance as a part of a composite NS managed by the NFVO-C. It shall comply with the provisions defined in table 8.6.2.4-1.

The notification shall be triggered by the NFVO-C when the usage of the NS instance has been changed.

**Table 8.6.2.4-1: Definition of the NsInstanceUsageNotification 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 "NsInstanceUsageNotification" 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.
nsInstanceId	Identifier	1	Identifier of the NS instance affected.
status	NsInstanceUsageStatusType	1	Indicates whether this notification reports about the start of the usage of an NS instance or about the end of the usage of an NS instance.
_links	NotificationLink	1	Links to resources related to this notification.

### 8.6.3 Referenced structured data types

#### 8.6.3.1 Type: NsInstanceUsageNotificationsFilter

This type represents a subscription filter related to notifications about NS instance usage. It shall comply with the provisions defined in table 8.6.3.1-1.

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 8.6.3.1-1: Definition of the NsInstanceUsageNotificationsFilter data type**

Attribute name	Data type	Cardinality	Description
notificationTypes	Enum (inlined)	0..N	Match particular notification types.  Permitted values: - NsInstanceUsageNotification  See note.
nsInstancelId	Identifier	0..N	If present, match NS instances with an instance identifier listed in this attribute.
status	NsInstanceUsageStatusType	0..1	If present, match a particular status of usage of an NS instance.
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

### 8.6.4.1 Introduction

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

### 8.6.4.2 Simple data types

No particular simple data types are defined for this interface, in addition to those defined in clause 4.2.

### 8.6.4.3 Enumeration: NsInstanceUsageStatusType

The enumeration NsInstanceUsageStatusType shall comply with the provisions defined in table 8.6.4.3-1.

**Table 8.6.4.3-1: Enumeration NsInstanceUsageStatusType**

Enumeration value	Description
START	Start of usage of the NS instance as part of a composite NS managed by NFVO-C.
END	End of usage of the NS instance as part of a composite NS managed by NFVO-C.

---

## 9 NS Performance Management interface

This interface allows providing performance management (measurement results collection and notifications) related to NSs. Performance information on a given NS instance is sent by the NFVO-N to the NFVO-C.

The interface shall follow the provisions specified in the clause 7 of ETSI GS NFV-SOL 005 [3] for the performance management interface, except that the producer is NFVO-N and the consumer is NFVO-C.

---

## 10 NS Fault Management interface

This interface allows the NFVO-C to subscribe to notifications regarding NS alarms provided by the NFVO-N.

The interface shall follow the provisions specified in the clause 8 of ETSI GS NFV-SOL 005 [3] for the fault management interface, except that the producer is NFVO-N and the consumer is NFVO-C.

## 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 030 [1] and the corresponding resources and HTTP methods defined in the present document.

### A.2 NSD Management interface

Table A.2-1 provides the mapping between the operations and corresponding resources and HTTP methods for the NSD management interface.

**Table A.2-1: Mapping for the NSD management interface**

ETSI GS NFV-IFA 030 [1] operation	HTTP method	Resource	Direction
Query NSD Info	GET	nsd/{apiMajorVersion}/ns_descriptors	NFVO-C → NFVO-N
	GET	nsd/{apiMajorVersion}/ns_descriptors/{nsdInfoId}	NFVO-C → NFVO-N

### A.3 NS lifecycle management interface

Table A.3-1 provides the mapping between the operations and corresponding resources and HTTP methods for the NS lifecycle management interface.

**Table A.3-1: Mapping for the NS lifecycle management interface**

ETSI GS NFV-IFA 030 [1] operation	HTTP method	Resource	Direction
Create NS Identifier	POST	nslcm/{apiMajorVersion}/ns_instances	NFVO-C → NFVO-N
Delete NS Identifier	DELETE	nslcm/{apiMajorVersion}/ns_instances/{nsInstanceld}	NFVO-C → NFVO-N
Instantiate NS	POST	nslcm/{apiMajorVersion}/ns_instances/{nsInstanceld}/instantiate	NFVO-C → NFVO-N
Terminate NS	POST	nslcm/{apiMajorVersion}/ns_instances/{nsInstanceld}/terminate	NFVO-C → NFVO-N
Scale NS	POST	nslcm/{apiMajorVersion}/ns_instances/{nsInstanceld}/scale	NFVO-C → NFVO-N
Heal NS	POST	nslcm/{apiMajorVersion}/ns_instances/{nsInstanceld}/heal	NFVO-C → NFVO-N
Query NS	GET	nslcm/{apiMajorVersion}/ns_instances	NFVO-C → NFVO-N
	GET	nslcm/{apiMajorVersion}/ns_instances/{nsInstanceld}	NFVO-C → NFVO-N
Get Operation Status	GET	nslcm/{apiMajorVersion}/ns_lcm_op_occs	NFVO-C → NFVO-N
	GET	nslcm/{apiMajorVersion}/ns_lcm_op_occs/{nsLcmOpOcclId}	NFVO-C → NFVO-N
Subscribe	POST	nslcm/{apiMajorVersion}/subscriptions	NFVO-C → NFVO-N
Terminate Subscription	DELETE	nslcm/{apiMajorVersion}/subscriptions/{subscriptionId}	NFVO-C → NFVO-N
Notify	POST	(provided by API consumer)	NFVO-N → NFVO-C
Query Subscription Information	GET	nslcm/{apiMajorVersion}/subscriptions	NFVO-C → NFVO-N
	GET	nslcm/{apiMajorVersion}/subscriptions/{subscriptionId}	NFVO-C → NFVO-N

## A.4 NS lifecycle operation granting interface

Table A.4-1 provides the mapping between the operations and corresponding resources and HTTP methods for the NS lifecycle operation granting interface.

**Table A.4-1: Mapping for the NS lifecycle operation granting interface**

ETSI GS NFV-IFA 030 [1] operation	HTTP method	Resource	Direction
Grant NS Lifecycle	POST	nslcog/{apiMajorVersion}/grants	NFVO-N → NFVO-C
	GET	nslcog/{apiMajorVersion}/grants/{grantId}	NFVO-N → NFVO-C

## A.5 NS instance usage notification interface

Table A.5-1 provides the mapping between the operations and corresponding resources and HTTP methods for the NS instance usage notification interface.

**Table A.5-1: Mapping for the NS instance usage notification interface**

ETSI GS NFV-IFA 030 [1] operation	HTTP method	Resource	Direction
Subscribe	POST	nsiun/{apiMajorVersion}/subscriptions	NFVO-N → NFVO-C
Terminate Subscription	DELETE	nsiun/{apiMajorVersion}/subscriptions/{subscriptionId}	NFVO-N → NFVO-C
Notify	POST	(provided by API consumer)	NFVO-C → NFVO-N
Query Subscription Information	GET	nsiun/{apiMajorVersion}/subscriptions	NFVO-N → NFVO-C
	GET	nsiun/{apiMajorVersion}/subscriptions/{subscriptionId}	NFVO-N → NFVO-C

## A.6 NS performance management interface

Table A.6-1 provides the mapping between the operations and corresponding resources and HTTP methods for the NS performance management interface.

**Table A.6-1: Mapping for the NS performance management interface**

ETSI GS NFV-IFA 030 [1] operation	HTTP method	Resource	Direction
Create PM Job	POST	nspm/{apiMajorVersion}/pm_jobs	NFVO-C → NFVO-N
Delete PM Job	DELETE	nspm/{apiMajorVersion}/pm_jobs/{pmJobId}	NFVO-C → NFVO-N
Query PM Job	GET	nspm/{apiMajorVersion}/pm_jobs	NFVO-C → NFVO-N
	GET	nspm/{apiMajorVersion}/pm_jobs/{pmJobId}	NFVO-C → NFVO-N
Create Threshold	POST	nspm/{apiMajorVersion}/thresholds	NFVO-C → NFVO-N
Delete Threshold	DELETE	nspm/{apiMajorVersion}/thresholds/{thresholdId}	NFVO-C → NFVO-N
Query Threshold	GET	nspm/{apiMajorVersion}/thresholds	NFVO-C → NFVO-N
	GET	nspm/{apiMajorVersion}/thresholds/{thresholdId}	NFVO-C → NFVO-N
Subscribe	n/a	see note	n/a
Query Subscription Information	n/a	see note	n/a
	n/a	see note	n/a
Terminate Subscription	n/a	see note	n/a
Notify	POST	(provided by API consumer)	NFVO-N → NFVO-C
NOTE:	In the NS Performance Management interface specified in the present document, delivery of notifications is controlled directly by the "Thresholds" and "PM jobs" resources.		

## A.7 NS fault management interface

Table A.7-1 provides the mapping between the operations and corresponding resources and HTTP methods for the NS fault management interface.

**Table A.7-1: Mapping for the NS fault management interface**

ETSI GS NFV-IFA 030 [1] operation	HTTP method	Resource	Direction
Get Alarm List	GET	nsfm/{apiMajorVersion}/alarms	NFVO-C → NFVO-N
	GET	nsfm/{apiMajorVersion}/alarms/{alarmId}	NFVO-C → NFVO-N
Acknowledge Alarm	PATCH	nsfm/{apiMajorVersion}/alarms/{alarmId}	NFVO-C → NFVO-N
Subscribe	POST	nsfm/{apiMajorVersion}/subscriptions	NFVO-C → NFVO-N
Query Subscription Information	GET	nsfm/{apiMajorVersion}/subscriptions	NFVO-C → NFVO-N
	GET	nsfm/{apiMajorVersion}/subscriptions/{subscriptionId}	NFVO-C → NFVO-N
Terminate Subscription	DELETE	nsfm/{apiMajorVersion}/subscriptions/{subscriptionId}	NFVO-C → NFVO-N
Notify	POST	(provided by API consumer)	NFVO-N → NFVO-C

## Annex B (informative): Change History

Date	Version	Information about changes
October 2018	0.0.1	Skeleton and scope
January 2019	0.0.2	Incorporate the following contributions: <ul style="list-style-type: none"> <li>- NFVSOL(18)000732r1_SOL011_Add_terms_and_the_overview_of_interface_Or-Or</li> <li>- NFVSOL(18)000733_SOL011_Add_the_description_of_NSD_management_in_the_interfac</li> <li>- NFVSOL(18)000734_SOL011_Add_the_description_of_NS_lifecycle_management_in_the</li> </ul>
April 2019	0.0.3	Incorporate the following contributions: <ul style="list-style-type: none"> <li>- NFVSOL(19)000110r1_SOL011_Add_the_description_of_performance_management_in_the_</li> <li>- NFVSOL(19)000111r1_SOL011_Add_the_description_of_fault_management_in_the_interf</li> <li>- NFVSOL(19)000113_SOL011_generic_part_of_NS_LCM_granting_interface</li> <li>- NFVSOL(19)000114_SOL011_resource_structure_of_NS_LCM_granting_interf</li> <li>- NFVSOL(19)000115r1_SOL011_sequence_diagram_of_NS_LCM_granting_int</li> <li>- NFVSOL(19)000116r1_SOL011_resource_definition_of_NS_LCM_granting_int</li> <li>- NFVSOL(19)000117r1_SOL011_data_type_definition_of_NS_LCM_granting_i</li> <li>- NFVSOL(19)000130r4_SOL011_NSD_management_resource_structure_and_method_of_the_i</li> <li>- NFVSOL(19)000200_SOL011_generic_part_of_NS_instance_usage_notify_int</li> <li>- NFVSOL(19)000201r1_SOL011_resource_structure_of_NS_instance_usage_n</li> <li>- NFVSOL(19)000202r1_SOL011_sequence_diagram_of_NS_instance_usage_notify_interfac</li> <li>- NFVSOL(19)000203r1_SOL011_resource_definition_of_NS_instance_usage_notify_inter</li> <li>- NFVSOL(19)000204_SOL011_data_type_of_NS_instance_usage_notify_interf</li> </ul>
October 2019	0.1.0	Incorporate the following contributions: <ul style="list-style-type: none"> <li>- NFVSOL(19)000308r1_SOL011_NS_lifecycle_management_resources_and_s</li> <li>- NFVSOL(19)000625_SOL011_Performance_management_interface_clause_f</li> <li>- NFVSOL(19)000626_SOL011_Fault_management_interface_clause_for_the_r</li> <li>- NFVSOL(19)000627_SOL011_clause_4_2_address_editor_s_note</li> <li>- NFVSOL(19)000628_SOL011_clause_7_4_1_address_editor_s_note</li> <li>- NFVSOL(19)000629r1_SOL011_clause_7_6_2_2_address_editor_s_note</li> </ul>
November 2019	0.2.0	Incorporate the following contributions: <ul style="list-style-type: none"> <li>- NFVSOL(19)000716_SOL011_Semi-Editorial_Corrections</li> <li>- NFVSOL(19)000730r1_SOL011_Annex_A_Mapping_operations_to_protocol_e</li> <li>- NFVSOL(19)000763r1_SOL011_Clause_5_Align_the_format_with_other_interf</li> <li>- NFVSOL(19)000764r2_SOL011_Clause_6_Address_the_Editor_s_Note</li> <li>- NFVSOL(19)000765r3_SOL011_Clause_7_align_the_grant_interface_design_with_SOL003</li> <li>- NFVSOL(19)000766_SOL011_Clause_8_Editorial_fix_for_api_version</li> </ul> with rapporteur's editorial changes
September 2022	3.6.2	Base line for Release 3 maintenance, created from v3.3.1



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## History

<b>Document history</b>		
V3.3.1	January 2020	Publication
V3.7.1	December 2022	Publication