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# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In drafting the TS/TR, pay particular attention to the use of modal auxiliary verbs! TRs shall not contain any normative provisions.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document specifies the stage 2 and stage 3 of generic management services for mobile network.

# 2 References

- The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] Void

[3] 3GPP TS 28.541: "Management and orchestration ; 5G Network Resource Model (NRM); Stage 2 and stage3".

[4] ITU-T Recommendation X.733 (02/92): "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".

[5] 3GPP TS 28.531: "Management and orchestration ; Provisioning; ".

[6] 3GPP TS 28.554: "Management and orchestration ; 5G end to end Key Performance Indicators (KPI)".

[7] Void

[8] Void

[9] Void

[10] Void

[11] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[12] Void

[13] 3GPP TS 28.533: "Management and orchestration; Architecture framework"

[14] Void

[15] 3GPP TS 32.158: "Management and orchestration; Design rules for REpresentational State Transfer (REST) Solution Sets (SS)".

[16] Void

[17] Void

[18] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[19] 3GPP TS 32.401: "Telecommunication management; Perfomance Measurement (PM); Concept and requirements".

[20] ISO 8601:2004: "Data elements and interchange formats – Information interchange – Representation of dates and times".

[21] Void.

[22] Void.

[23] Void.

[24] Void.

[25] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects ".

[26] W3C REC-xmlschema-0-20010502: "XML Schema Part 0: Primer".

[27] W3C REC-xmlschema-1-20010502: "XML Schema Part 1: Structures".

[28] W3C REC-xmlschema-2-20010502: "XML Schema Part 2: Datatypes".

[29] W3C REC-xml-names-19990114: "Namespaces in XML".

[30] Void.

[31] 3GPP TS 32.111-2: " Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)".

[32] IETF RFC 6241 "Network Configuration Protocol (NETCONF)".

[33] 3GPP TS 32.160 " Management and orchestration; Management service template ".

[34] IETF RFC 7950 "The YANG 1.1 Data Modeling Language".

[35] Void

[36] IETF RFC 6902: "JavaScript Object Notation (JSON) Patch".

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

[38] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".

[39] 3GPP TS 32.423: "Telecommunication management; Subscriber and equipment trace; Trace data definition and management".

[40] IETF RFC 6455: "The WebSocket Protocol".

[41] IETF RFC 793: "Transmission Control Protocol".

[42] 3GPP TS 28.550: "Management and orchestration; Performance assurance".

[43] Void

[44] 3GPP TS 28.623: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Solution Set (SS) definitions".

[45] Text Attribution: Creator: ONAP, under Creative Commons Attribution 4.0 International License, https://creativecommons.org/licenses/by/4.0/, URI to access the text: <https://github.com/onap/vnfrqts-requirements/blob/05f26fac2b941513a7d0e856b99fd8c61d688299/docs/Chapter8/ves7_1spec.rst#resource-structure>.

[46] Void

[47] 3GPP TS 32.404: "Performance Management (PM); Performance measurements; Definitions and template".

[48] Void

[49] IETF RFC 8040: "RESTCONF protocol".

[50] IETF RFC 7951: " JSON Encoding of Data Modeled with YANG".

[51] IETF RFC 6243: "With-defaults Capability for NETCONF".

[52] IETF RFC 3339: " Date and Time on the Internet: Timestamps".

[53] 3GPP SA5 FORGE OpenAPI definitions: <https://forge.3gpp.org/rep/sa5>

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**Matching-Criteria-Attributes:** See its definition in [31].

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

FS Fault Supervision

MnS Management Service

# 4 Overview

The generic management services concept follows the management service concepts as defined in TS 28.533 [13].

# 5 Void

# 6 Void

# 7 Void

# 8 Void

# 9 Void

# 10 Void

# 11 Management services – Stage 2

## 11.1 Generic provisioning management service

### 11.1.0 Introduction

This clause provides the stage 2 definitions of Create, Read, Update and Delete (CRUD) operations for managing managed objects. According to clause 4.2.2 of TS 28.533 [13], these CRUD operations are the MnS component type A. The operations specified in this clause in combination with a NRM (MnS component type B) constitute a MnS, as defined in clause 4.3 of TS 28.533 [13] providing generic provisioning services for supported NRM (MnS component type B) of all MnS.

In addition, notifications to report changes related to managed objects and their attributes are specified.

### 11.1.1 Operations and notifications

#### 11.1.1.1 createMOI operation

##### 11.1.1.1.1 Description

This operation is invoked by MnS consumer to request the MnS producer to create a Managed Object instance in the MIB maintained by MnS producer. This operation will create only one Managed Object instance.

The MnS consumer supplies the values of all attributes that are supported, i.e. a) attributes whose Support Qualifier is M and b) attributes whose Support Qualifier is O. The special cases are:

1) If the attribute has a default value specified. In such case, if the MnS consumer supplies a value, the supplied value is used; otherwise, the default value is used.

2) If the attribute is specified as capable of carrying a null value or carrying no information. In such case, if the Generic Provisioning MnS consumer supplies a (non-null) value, the supplied value is used; otherwise, the null value is used.

3) If the attribute does not have a default value specified and is specified as incapable of carrying null value and incapable of carrying no information, if there is a MnS producer defined default value, then that value will be used.

##### 11.1.1.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| managedObjectClass | M | class | This parameter specifies the class of the new managed object instance. |
| managedObjectInstance | M | DN | This parameter specifies the instance of the managed object that is to be created and registered. This is a full DN according to TS 32.300 [5]. |
| attributeListIn | M | LIST OF SEQUENCE< attribute name, attribute value> | This parameter may have a null value. When this parameter is supplied, it contains a list of name/value pairs specifying attribute identifiers and their values to be assigned to the new managed object. These values override the values for the corresponding attributes derived from the default value set specified in the definition of the managed object's class. |

##### 11.1.1.1.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | S | Matching Information / Legal Values | Comment |
| attributeListOut | M | LIST OF SEQUENCE< attribute name, attribute value> | This list of name/value pairs contains the attributes of the new managed object and the actual value assigned to each. |
| status | M | ENUM (OperationSucceeded, OperationFailed) |  |

##### 11.1.1.1.4 Results

In case of success, the ManagedEntity instance has been created with the supplied DN. In case of failure, indication of the failure is provided in the Output parameters.

#### 11.1.1.2 getMOIAttributes operation

##### 11.1.1.2.1 Definition

This operation is invoked by MnS consumer to request the retrieval of management information (Managed Object attribute names and values) from the MIB maintained by MnS producer. One or several Managed Objects may be retrieved - based on the containment hierarchy.

A SS may choose to split this operation in several operations (e.g. operations to get "handlers" or "iterators" to Managed Objects fulfilling the scope/filter criteria and other operations to retrieve attribute names/values from these "handlers").

##### 11.1.1.2.2 Input Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | S | Information Type | Comment |
| baseObjectInstance | M | DN | This parameter specifies the base object instance.  If the "scope" parameter is absent, then either only the base object or the complete subtree below and including the base object shall be selected. The default behaviour is protocol specific. |
| scope | M | n/a | This parameter specifies the scope. It is a structured parameter and consists of the sub-parameters "scopeType" and "scopeLevel". The scope describes which object instances are selected with respect to a base object instance. The base object instance needs to be specified using a dedicated attribute. |
| > scopeType | M | ENUM {  BASE\_ONLY,  BASE\_ALL  } | If the optional "scopeLevel" parameter is not supported or absent, allowed values of "scopeType" are "BASE\_ONLY" and "BASE\_ALL".  The value "BASE\_ONLY" indicates only the base object is selected.  The value "BASE\_ALL" indicates the base object and all of its subordinate objects (incl. the leaf objects) are selected.  This parameter is redundant and can be omitted when confirming only the protocol specific default behaviour. |
|  |  | ENUM {  BASE\_NTH\_LEVEL,  BASE\_SUBTREE  } | If the "scopeLevel" parameter is supported and present, allowed values of "scopeType" are "BASE\_NTH\_LEVEL" and "BASE\_SUBTREE".  The value "BASE\_NTH\_LEVEL" indicates all objects on the level, which is specified by the "scopeLevel" parameter, below the base object are selected. The base object is at "scopeLevel" zero.  The value "BASE\_SUBTREE" indicates the base object and all of its subordinate objects down to and including the objects on the level, which is specified by the "scopeLevel" parameter, are selected. The base object is at "scopeLevel" zero. |
| > scopeLevel | O | Integer | See definition of "scopeType" parameter. |
| filter | O | See Comment. | This parameter defines filter criteria to be applied to the objects selected by the "baseObjectInstance", "scope" and "scopeLevel" parameters.  The actual syntax and capabilities of the filter is SS specific. However, each SS should support a filter consisting of one or several assertions that may be grouped using the logical operators AND, OR and NOT.  Each assertion is a logical expression of attribute existence, attribute value comparison ("equal to X, less than Y" etc.) and MO Class. |
| attributeListIn | O | LIST OF attribute name. | This parameter identifies the attributes to be returned by this operation. If the parmeter is absent or empty all attributes shall be returned. |

##### 11.1.1.2.3 Output Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | S | Matching Information | Comment |
| managedObjectClass | M | ManagedEntity class | For each returned MO: The class of the MO. |
| managedObjectInstance | M | ManagedEntity DN | For each returned MO: The name of the MO. This is a full DN according to TS 32.300 [5]. |
| attributeListOut | M | LIST OF SEQUENCE< attribute name, attribute value > | For each returned MO: A list of name/value pairs for MO. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | An operation may fail because of a specified or unspecified reason. |

##### 11.1.1.2.4 Results

In case of success, all of the ManagedEntity instances selected for retrieval are returned. In case of failure, a specified or unspecified reason may be provided in the Output parameters.

#### 11.1.1.3 modifyMOIAttributes operation

##### 11.1.1.3.1 Description

This operation is invoked by MnS consumer to request the modification of one or more Managed Object instances from MnS producer. Attributes of one or several Managed Objects may be modified.

##### 11.1.1.3.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| baseObjectInstance | M | DN | The MO instance that is to be used as the starting point for the selection of managed objects to which the filter (when supplied) is to be applied. This is a full DN according to TS 32.300 [5]. |
| scopeType | M | See corresponding parameter in getMOIAttributes. | See corresponding parameter in getMOIAttributes. |
| scopeLevel | O | See corresponding parameter in getMOIAttributes. | See corresponding parameter in getMOIAttributes. |
| filter | O | See comment. | See corresponding parameter in getMOIAttributes. |
| modificationList | M | LIST OF SEQUENCE <attribute identifier, [attribute values], ENUM( replace, add values, remove values, set to default)>  See Comment for when attribute values are require and when they are optional. | This parameter contains a set of attribute modification specifications, each of which contains:  1). attribute identifier: the identifier of the attribute whose value(s) is (are) to be modified.  2). attribute value: the value(s) to be used in the modification of the attribute. The use of this parameter is defined by the modify operator. This parameter is optional when the set to default modify operator is specified and if supplied, shall be ignored.  3). modify operator: the way in which the attribute values(s) (if supplied) is(are) to be applied to the attribute. The possible operators are:  a) replace: the attribute value(s) specified shall be used to replace the current values(s) of the attribute;  b) add values: the attribute values(s) specified shall be added to the current value(s) of the attribute. This operator shall only be applied to a set-valued attribute and shall perform a set union (in the mathematical sense) between the current values(s) of the attribute and the attribute value(s) specified. Value(s) specified in the attribute value parameter which is(are) already in the current values of the attribute shall not cause an error to be returned.  c) remove values: the attribute value(s) specified shall be removed from the current values(s) of the attribute. This operator shall only be applied to a set-valued attribute and shall perform a set difference (in the mathematical sense) between the current value(s) of the attribute and the attribute values(s) specified. Value(s) specified in the attribute value parameter which is(are) not in the current value(s) of the attribute shall not cause an error to be returned;    d) set to default: when this operator is applied to a single-valued attribute, the value of the attribute shall be set to its default value. When this operator is applied to a set–valued attribute, the value(s) of the attribute shall be set to their default value(s) and only as many values as defined by the default shall be assigned. If there is no default value defined, an error shall be returned.  Note: Set is used here in the mathematical sense so that a set-valued attribute is an unordered set of unique values.  The modify operator is optional, and if it is not specified, the replace operator shall be assumed.  The modificationList parameter contains a single set of attribute modification specifications and this same set is applied to each MO instance to be modified. |

##### 11.1.1.3.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | S | Matching Information / Legal Values | Comment |
| modificationListOut | M | LIST OF SEQUENCE< ManagedEntity DN, ManagedEntity class, LIST OF SEQUENCE< attribute name, attribute value >> | This parameter will provide for each managed object instance the full DN of the managed object instance, the managedObjectClass, and a list of name/value pairs with the values of all the attributes of the modified managed object instance after modification. The form of this information is SS dependant and may be provided in one or many data structures. |
| status | M | ENUM (OperationSucceeded, OperationFailed, OperationPartiallySucceeded) | An operation may fail because of a specified or unspecified reason and no attributes have been updated. The operation is only successful if all specified attributes of all selected objects are actually modified. Otherwise, the operation is partially successful. |

In lieu of a synchronization parameter, best effort synchronization will apply; that is, all managed objects selected for this operation will perform the operation if possible regardless of whether some managed objects fail to perform it.

##### 11.1.1.3.4 Results

In case of success, all of the ManagedEntity instances selected for modification are modified. In case of failure, a specified or unspecified reason may be provided in the Output parameters.

#### 11.1.1.4 deleteMOI operation

##### 11.1.1.4.1 Description

This operation is invoked by MnS consumer to request the deletion of one or more Managed Object instances in the MIB maintained by the MnS producer.

##### 11.1.1.4.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| baseObjectInstance | M | DN | The MO instance that is to be used as the starting point for the selection of managed objects to which the filter (when supplied) is to be applied. This is a full DN according to TS 32.300 [5]. |
| scopeType | O | See corresponding parameter in getMOIAttributes. | See corresponding parameter in getMOIAttributes. |
| scopeLevel | O | See corresponding parameter in getMOIAttributes. | See corresponding parameter in getMOIAttributes. |
| filter | O | See comment. | See corresponding parameter in getMOIAttributes. |

##### 11.1.1.4.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | S | Matching Information / Legal Values | Comment |
| deletionList | M | LIST OF SEQUENCE< ManagedEntity DN, ManagedEntity class name> | If the base object alone is specified, then this parameter is optional; otherwise it contains a list of managedObjectInstance/managedObjectClass pairs identifying the managed objects deleted. |
| status | M | ENUM (OperationSucceeded, OperationFailed, OperationPartiallySucceeded) | An operation may fail because of a specified or unspecified reason. The operation is partially successful if some, but not all, objects selected to be deleted are actually deleted. |

In lieu of a synchronization parameter, best effort synchronization will apply; that is, all managed objects selected for this operation will perform the operation if possible regardless of whether some managed objects fail to perform it.

##### 11.1.1.4.4 Results

In case of success, all of the ManagedEntity instances selected for deletion are deleted. In case of failure, a specified or unspecified reason may be provided in the Output parameters.

#### 11.1.1.5 Void

#### 11.1.1.6 Void

#### 11.1.1.7 Notification notifyMOICreation

##### 11.1.1.7.1 Definition

This notification notifies the subscribed consumers that a new Managed Object Instance has been created.

##### 11.1.1.7.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| objectClass | M | ManagedEntity.objectClass | It specifies the class name of the IOC. A network event has occurred in an instance of this class. |
| objectInstance | M | ManagedEntity.objectInstance | It specifies a new instance of the above IOC in which the network event related to by carrying the Distinguished Name (DN) for the instance. |
| notificationId | M | This is an identifier for the notification, which may be used to correlate notifications. | The identifier of the notification shall be chosen to be unique across all notifications of a particular managed object instance throughout the time that correlation is significant, it uniquely identifies the notification from other notifications generated by the subject MOI. |
| notificationType | M | It specifies the type of provisioning management services related notifications. The value “notifyMOICreation” shall be carried. | It specifies the type of notification. |
| eventTime | M | It indicates the MOICreation event time. | The semantics of Generalised Time specified by RFC 3339 [52] shall be used here. |
| systemDN | M | It shall carry the DN of management service providers. | - |
| correlatedNotifications | CM | It specifies a set of notifications that are correlated to the subject notification. | The condition is that the MnS producer support the correlation of notifications |
| additionalText | O | It can contain further information in text on the event of the ManagedEntity(s). | - |
| sourceIndicator | O | ENUM(  Resource\_operation,  Management\_operation,  SON\_operation,Unknown) | This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values:  1. resource operation: The notification was generated in response to an internal operation of the resource;  2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object;  3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. .  4. unknown: It is not possible to determine the source of the operation.  Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON\_operation for sourceIndicator might be sent. |
| attributeList | O | LIST OF SEQUENCE <AttributeName, AttributeValue> | The attributes (name/value pairs) of the created MOI. |

##### 11.1.1.7.3 Triggering event

###### 11.1.1.7.3.1 From-state

stateBeforeObjectCreation.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateBeforeObjectCreation | The number of instances of the IOC ManagedEntity is equal to N. |

###### 11.1.1.7.3.2 To-state

stateAfterObjectCreation.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateAfterObjectCreation | The number of instances of the IOC ManagedEntity is equal to N + 1. |

#### 11.1.1.8 Notification notifyMOIDeletion

##### 11.1.1.8.1 Definition

This notification notifies the subscribed consumers that an existing Managed Object Instance has been deleted.

##### 11.1.1.8.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| objectClass | M | ManagedEntity.objectClass | It specifies the class name of the IOC. A network event has occurred in an instance of this class. |
| objectInstance | M | ManagedEntity.objectInstance | It specifies an existing instance of the above IOC in which the network event related to by carrying the Distinguished Name (DN) for the instance. |
| notificationId | M | This is an identifier for the notification, which may be used to correlate notifications. | The identifier of the notification shall be chosen to be unique across all notifications of a particular managed object throughout the time that correlation is significant, it uniquely identifies the notification from other notifications generated by the subject MOI. |
| notificationType | M | It specifies the type of provisioning management services related notifications. The value “notifyMOIDeletion” shall be carried. | It specifies the type of notification. |
| eventTime | M | It indicates the MOIDeletion event time. | The semantics of Generalised Time specified by RFC 3339 [52] ITU-T[17] shall be used here. |
| systemDN | M | It shall carry the DN of management service providers. | - |
| correlatedNotifications | CM | It specifies a set of notifications that are correlated to the subject notification. | The condition is that the MnS producer support the correlation of notifications |
| additionalText | O | It can contain further information in text on the event of the ManagedEntity(s). | - |
| sourceIndicator | O | ENUM(  Resource\_operation,  Management\_operation,  SON\_operation,Unknown) | This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values:  1. resource operation: The notification was generated in response to an internal operation of the resource;  2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object;  3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. .  4. unknown: It is not possible to determine the source of the operation.  Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON\_operation for sourceIndicator might be sent. |
| attributeList | O | LIST OF SEQUENCE <AttributeName, AttributeValue> | The attributes (name/value pairs) of the deleted MOI. |

##### 11.1.1.8.3 Triggering event

###### 11.1.1.8.3.1 From-state

stateBeforeObjectDeletion.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateBeforeObjectDeletion | The number of instances of the IOC ManagedEntity is equal to N. |

###### 11.1.1.8.3.2 To-state

stateAfterObjectDeletion.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateAfterObjectDeletion | The number of instances of the IOC ManagedEntity is equal to N - 1. |

#### 11.1.1.9 Notification notifyMOIAttributeValueChanges

##### 11.1.1.9.1 Definition

This notification notifies the subscribed MnS consumers that changes of one or several attributes of a Managed Object Instance in the NRM.

##### 11.1.1.9.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| objectClass | M | ManagedEntity.objectClass | It specifies the class name of the IOC. A network event has occurred in an instance of this class. |
| objectInstance | M | ManagedEntity.objectInstance | It specifies the existing instance of the above IOC in which the network event related to by carrying the Distinguished Name (DN) for the instance. |
| notificationId | M | This is an identifier for the notification, which may be used to correlate notifications. | The identifier of the notification shall be chosen to be unique across all notifications of a particular managed object throughout the time that correlation is significant, it uniquely identifies the notification from other notifications generated by the subject Information Object. |
| notificationType | M | It specifies the type of provisioning management services related notifications. The value “notifyMOIAttributeValueChange” shall be carried. | It specifies the type of notification. |
| eventTime | M | It indicates the MOIAttributeValueChange event time. | The semantics of Generalised Time specified by RFC 3339 [52] shall be used here. |
| systemDN | M | It shall carry the DN of management service providers. | - |
| correlatedNotifications | CM | It specifies a set of notifications that are correlated to the subject notification. | The condition is that the MnS producer support the correlation of notifications |
| additionalText | O | It can contain further information in text on the event of the ManagedEntity(s). | - |
| sourceIndicator | O | ENUM(  Resource\_operation,  Management\_operation,  SON\_operation,Unknown) | This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values:  1. resource operation: The notification was generated in response to an internal operation of the resource;  2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object;  3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. .  4. unknown: It is not possible to determine the source of the operation.  Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON\_operation for sourceIndicator might be sent. |
| attributeValueChange | M | LIST OF SEQUENCE <AttributeName, NewAttributeValue,  CHOICE [NULL, OldAttributeValue]> | The changed attributes (name/value pairs) of the MOI (with both new and, optionally, old values). |

##### 11.1.1.9.3 Triggering event

###### 11.1.1.9.3.1 From-state

stateBeforeAttributeValueChange.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateBeforeAttributeValueChange | The subject attribute has a value at time T1. |

###### 11.1.1.9.3.2 To-state

stateAfterAttributeValueChange.

|  |  |  |
| --- | --- | --- |
| Assertion Name | Definition | |
| stateAfterAttributeValueChange | | The subject attribute has been changed to a value other than the value at time T1. |

#### 11.1.1.10 Notification notifyEvent

##### 11.1.1.10.1 Definition

This notification notifies the MnS consumer, who has a subscription receiving this type of notification, that certain network events has occurred with potential service impact, for example, system restart and system redundancy shift (backup).

This notification definition is generic in the sense that the specific types of network event are not defined.

##### 11.1.1.10.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| objectClass | M | ManagedEntity.objectClass | -- |
| objectInstance | M | ManagedEntity.objectInstance | -- |
| notificationId | M | It carries the identifier for the subject notification. | See Note 1. |
| eventTime | M | It indicates the time of the event. | The semantics of Generalised Time specified by RFC 3339 [52] shall be used here. |
| systemDN | M | It carries the DN of producer of the notification. | -- |
| notificationType | M | "notifyEvent" | -- |
| specificProblem | M | It indicates a problem detected. | -- |
| additionalText | O | It carries additional information. | -- |
| additionalInformation | O | It carries additional information. | -- |
| NOTE 1: If consumer receives notifications from one producer, consumer can use the notificationId and the objectInstance to uniquely identify all received notifications.  If consumer receives notifications from multiple producers and notifications of each objectInstance are reported to at most by one producer, consumer can use the notificationId and objectInstance to uniquely identify all received notifications.  If consumer receives notifications from multiple producers and notifications of one or more objectInstance(s) are reported byo two or more producers, consumer can use the notificationId together with objectInstance and the identity of producer (systemDN), to uniquely identify all received notifications. If the information systemDN is absent, consumer needs other means, which are outside the scope of this TS, to determine the identity of producer.  How notificationId of notifications are re-used to correlate notifications is outside of the scope of this specification. | | | |

#### 11.1.1.11 Notification notifyMOIChanges

##### 11.1.1.11.1 Definition

This notification reports NRM updates to subscribed MnS consumers. It can report multiple NRM updates that happen at the same time. All possible NRM updates can be reported:

- Creation and deletion of an object.

- Creation and deletion of an attribute, attribute field, attribute element and attribute field element.

- Replacement of an attribute value, attribute field value, attribute element and attribute field element.

The MnS producer decides whether to send notifications of type notifyMOICreation, notifyMOIDeletion or notifyMOIAttributesValueChange, or a single notifyMOIChanges reporting all changes in a single notification. The MnS producer should take subscription information into account when deciding the notification types to be sent, and not try to send notifications that the MnS consumer did not subscribe to.

The notification header includes a notificationId. This identifier shall not be used in the parameter correlatedNotifications potentially carried in other notifications. The notificationId in mOIChanges shall be used instead. This is because the latter notification id is associated to a single MOI only, whereas the former notification id can be associated to changes of multiple MOIs. The correlatedNotifications associates to a single MOI one or more notification ids identifying notifications reporting events for that MOI.

In this clause the following definitions apply.

data type: Constraint on an attribute value.

simple type: Data type constraining an attribute value to a scalar.

complex type: Data type of a structured and/or multi-valued attribute.

attribute: Information element of an object composed of an attribute name and an attribute value.

attribute name: Name of an attribute.

attribute value: Value of an attribute. The value is defined by a simple type or a complex type.

attribute field: Attribute contained in an attribute. Attribute fields can contain attribute fields.

attribute field name: Name of an attribute field.

attribute field value: Value of an attribute field. The value is defined by a simple type or a complex type.

simple attribute: Attribute whose value is a simple type.

complex attribute: Attribute whose value is a complex type.

structured attribute: Attribute whose value contains one or more attribute fields. A structured attribute is a kind of a complex attribute.

multi-valued attribute: Attribute with multiplicity > 1. A multi-valued attribute is a kind of a complex attribute.

attribute element: A single value of a multi-valued attribute.

attribute field element: A single value of a multi-valued attribute field.

##### 11.1.1.11.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| objectClass | M | See clause 11.1.1.7.2 | Identifies the classe name of a common ancestor object of the objects for which changes are reported. A MnS producer may set this parameter always to the class name of the parent of the local root object in the MIB. |
| objectInstance | M | See clause 11.1.1.7.2 | Identifies the instance of a common ancestor object of the objects for which changes are reported. A MnS producer may set this parameter always to the instance of the parent of the local root object in the MIB. |
| notificationId | M | See clause 11.1.1.7.2 | See clause 11.1.1.7.2 |
| notificationType | M | const string “notifyMOIChanges” | See clause 11.1.1.7.2 |
| eventTime | M | See clause 11.1.1.7.2 | See clause 11.1.1.7.2 |
| systemDN | M | See clause 11.1.1.7.2 | See clause 11.1.1.7.2 |
| moiChanges | M | SEQUENCE OF SET {  notificationId (M),  correlatedNotifications (O),  additionalText (O),  sourceIndicator (O),  op (M),  path (M),  value (M) ,  oldValue (O)  } | This parameter describes the reported NRM updates. It is a list of items; each item reports a single NRM update. The "notificationId" identifies an item.  The NRM update itself is described by the parameters "op", "path", "value" and "oldValue". The parameters "correlatedNotifications", "additionalText" and "sourceIndicator " provide context information.  The parameter "op" specifies the type of operation reporting the NRM update. Valid values are "add", "remove" and "replace". The operation describes what has conceptually happened to the NRM on the MnS producer. The operation applied to the NRM by the MnS producer and causing the reported NRM update can be different.  "add" shall be used for reporting the creation of an object, attribute, attribute field or multi-value attribute element.  "remove" shall be used for reporting the deletion of an object, attribute, attribute field or multi-value attribute element.  "replace" shall be used for reporting the replacement of an existing attribute value, attribute field value or multi-value attribute element.  The "path" and "objectInstance" identify the object, attribute, attribute field or multi-value attribute element, that was created, deleted or replaced.  If an object creation is reported with "add", the "value" shall carry a complete representation of the created object. If an object deletion is reported with "remove", the "value" shall be absent. It may optionally carry a complete representation of the deleted object.  If an attribute, attribute field or multi-value attribute element creation is reported with "add", the "value" shall carry the value of the created attribute, attribute field or multi-value attribute element.  If an attribute, attribute field or multi-value attribute element deletion is reported with "remove", the "value" shall be absent. It may optionally carry the old value of the deleted attribute, attribute field or multi-value attribute element.  If the replacement of an attribute, attribute field or multi-value attribute element value is reported with "replace", the "value" shall carry the new value of the attribute, attribute field or multi-value attribute element. The "oldValue" may optionally carry the old value of the attribute, attribute field or multi-value attribute element before the replacement.  If multiple objects are created, the creation of parent objects shall be reported before the creation of the child objects. Vice versa, when the deletion of multiple objects is reported, the deletion of child objects shall be reported before the deletion of the parent objects. |

### 11.1.2 Managed Information

#### 11.1.2.1 ManagedEntity << ProxyClass>>

##### 11.1.2.1.1 Definition

The ProxyClass ManagedEntity represents the role that can be played by an instance of an IOC defined in NRMs, e.g. Generic NRM, NR and NG-RAN NRM, or 5GC NRM. ManagedEntity is used in the specification of provisioning operations and notifications to represent an instance of an IOC defined in these NRMs.

## 11.2 Generic fault supervision management service

### 11.2.1 Operations and notifications

#### 11.2.1.1 Fault supervision data report

##### 11.2.1.1.1 subscribe

###### 11.2.1.1.1.1 Definition

A MnS consumer invokes this operation to establish subscription to receive network events via notifications, under the filter constraint specified in this operation.

###### 11.2.1.1.1.2 Input parameters

| Parameter Name | S | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| consumerReference | M | NtfSubscriber.ntfManagerReference | It specifies the reference of the authorized MnS consumer to which notifications shall be sent. |
| timeTick | O | NtfSubscription.ntfTimeTick | It specifies the value of a timer held for the subject management service consumer.  The value is in unit of whole minute.  A special infinite value is assumed when parameter is absent or present but equal to zero. |
| filter | O | This attribute represents the filter of a subscription. | It specifies a filter constraint that MnS producer shall use to filter notification of the alarms.  If this parameter is absent, then no filter constraint shall be applied. |

###### 11.2.1.1.1.3 Output parameters

| Parameter Name | S | Matching Information /  Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| subscriptionId | M | NtfSubscription.ntfSubscriptionId. | It holds an unambiguous identity of this subscription. |
| status | M | ENUM (OperationSucceeded, OperationFailedExistingSubscription, OperationFailed) | If subscriptionCreated is true, status = OperationSuceeded.  If operation\_failed\_existing\_subscription is true, status = OperationFailedExistingSubscription  If operation\_failed is true, status = OperationFailed. |

###### 11.2.1.1.1.4 Pre-condition

notificationCategoriesNotAllSubscribed OR notificationCategoriesParameterAbsentAndNotAllSubscribed.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| notificationCategoriesNotAllSubscribed | At least one notificationCategory identified in the notificationCategories input parameter is supported by management service producer and is not a member of the ntfNotificationCategorySet attribute of an NtfSubscription which is involved in a subscription relationship with the NtfSubscriber identified by the managerReference input parameter. |
| notificationCategoriesParameterAbsentAndNotAllSubscribed | The notificationCategories input parameter is absent and at least one notificationCategory supported by management service producer is not a member of the ntfNotificationCategorySet attribute of an ntfSsubscription which is involved in a subscription relationship with the NtfSubscriber identified by the managerReference input parameter. |

###### 11.2.1.1.1.5 Post-condition

subscriberPossiblyCreated AND subscriptionCreated.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| subscriberPossiblyCreated | An NtfSubscriber with an ntfManagerReference attribute equal to the value of the managerReference input parameter is involved in a subscriptionRegistration relationship. |
| subscriptionCreated | An NtfSubscription has been created according to the following rules:  - ntfSubscriptionState attribute value has been set to "notSuspended";  - ntfTimeTick attribute value has been set to the value of the timeTick input parameter if This value was higher or equal to 15, or set to 15 if this parameter value was between 1 and 15, or set to a special infinite value if the parameter value was lower or equal to 0 or if parameter was absent;  - ntfTimeTickTimer has been reset with the value of timeTick attribute;  - ntfFilter attribute value has been set to the value of the filter input parameter if present;  - NtfSubscription is involved in a subscription relationship with the NtfSubscriber identified by the managerReference input parameter;  - attribute ntfNotificationCategorySet of NtfSubscription contains EITHER the notification categories identified by the notificationCategories input parameter that were not already contained in the ntfNotificationCategorySet attribute of other NtfSubscription of the same NtfSubscriber identified by the managerReference input parameter OR if notificationCategories input parameter is absent, all notification categories supported by management service producer that were not already contained in the ntfNotificationCategorySet attribute of other subscriptions of the same NtfSubscriber identified by the managerReference input parameter. |

###### 11.2.1.1.1.6 Exceptions

|  |  |
| --- | --- |
| Name | Definition |
| operation\_failed\_existing\_subscription | **Condition:** (notificationCategoriesNotAllSubscribed OR notificationCategoriesParameterAbsentAndNotAllSubscribed) not true  **Returned Information:** The output parameter status  **Exit state:** Entry State |
| operation\_failed | **Condition:** Post-condition is false  **Returned Information:** The output parameter status  **Exit state:** Entry State |

##### 11.2.1.1.2 unsubscribe

###### 11.2.1.1.2.1 Definition

A MnS consumer invokes this operation to cancel subscriptions. The MnS consumer can cancel one subscription made with a consumerReference by providing the corresponding subscriptionId or all subscriptions made with the same consumerReference by leaving the subscriptionId parameter absent.

###### 11.2.1.1.2.2 Input parameters

| Parameter Name | S | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| consumerReference | M | DN | It specifies the reference of the MnS consumer to which notifications shall be sent. |
| subscriptionId | O | A unique identifier that is SS dependent. | It holds a subscriptionId carried as the output parameter in the subscribe operation. |

###### 11.2.1.1.2.3 Output parameters

| Parameter Name | S | Matching Information /  Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If (subscriptionDeleted OR allSubscriptionDeleted) is true, status = OperationSucceeded.  If operation\_failed is true, status = OperationFailed. |

###### 11.2.1.1.2.4 Pre-condition

validSubscriptionId&ManagerReference OR SubscriptionIdAbsent&ValidManagerReference.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| validSubscriptionId&ManagerReference | The NtfSubscription identified by subscriptionId input parameter is involved in a subscription relationship with the NtfSubscriber identified by the managerReference input parameter. |
| subscriptionIdAbsent&ValidManagerReference | The subscriptionId input parameter is absent and the NtfSubscriber identified by the managerReference input parameter exists. |

###### 11.2.1.1.2.5 Post-condition

subscriptionDeleted OR allSubscriptionDeleted.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| subscriptionDeleted | The NtfSubscription identified by subscriptionId input parameter is no more involved in a subscription relationship with the NtfSubscriber identified by the managerReference input parameter and has been deleted. If this NtfSubscriber has no more NtfSubscription, it is deleted as well. |
| allSubscriptionDeleted | "In the case subscriptionId input parameter was absent, the NtfSubscriber identified by the managerReference input parameter is no more involved in any subscription relationship and is deleted, the corresponding NtfSubscription have been deleted as well. |

###### 11.2.1.1.2.6 Exceptions

|  |  |
| --- | --- |
| Name | Definition |
| operation\_failed | **Condition:** Pre-condition is false or post-condition is false  **Returned Information:** The output parameter status  **Exit state:** Entry State |

##### 11.2.1.1.3 getAlarmList

###### 11.2.1.1.3.1 Definition

A MnS consumer invokes this operation to request the MnS producer to provide either the complete list of AlarmInformation instances in the AlarmList or only a part of this list (partial alarm alignment).

The parameters baseObjectClass and baseObjectInstance are used to identify the part of the alarm list to be returned. If they are absent, then the complete alarm list shall be provided (full alarm alignment). If they identify a particular class instance, then only a) the AlarmInformation instances related to this class instance and b) the AlarmInformation instances related to the subordinate class instances of this class instance shall be provided (partial alarm alignment). An instance-a is said to be subordinate to instance-b if the DN of the latter is part of the DN of the former.

There are two modes of operation. One mode is synchronous. In this mode, the list of AlarmInformation instances in AlarmList is returned synchronously with the operation. The other mode is asynchronous. In this mode, the list of AlarmInformation instances is returned via alarm notifications. In asynchronous mode of operation, the only information returned synchronously is the status of the operation. A method allowing to abort an ongoing alarm alignment process shall be available in the asynchronous mode. The mode of operation to be used is determined by means outside the scope of specification. To use asynchronous mode, the authorized consumer needs to have established a subscription via the subscribe operation.

###### 11.2.1.1.3.2 Input parameters

| Parameter Name | S | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| alarmAckState | O | ENUM (all alarms, all active alarms, all active and acknowledged alarms, all active and unacknowledged, all Cleared and unacknowledged alarms, all unacknowledged) | It carries a constraint. The FaultSupervision MnS producer shall apply it on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList. |
| baseObjectClass | O, see note 1 | This parameter is either absent or carries the object class of a certain class. | See how this attribute is used to support full alarm alignment and partial alarm alignment in 11.2.1.1.3.1.  See note 2. |
| baseObjectInstance | O, see note 1 | This parameter is either absent or carries the DN of a certain class instance. | See how this attribute is used to support full alarm alignment and partial alarm alignment in 11.2.1.1.3.1.  See note 2. |
| filter | O | N/A | It carries a filter constraint.  If the filter is present, the MnS producer shall apply it on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList.  If the filter is not present, all of the AlarmInformation instances included by the scope are selected. |
| NOTE 1: If the notification notifyAlarmListRebuilt supports indicating that only a part of the alarm list has been rebuilt then the operation getAlarmList shall support partial alarm alignment.  NOTE 2: The legal values of the parameters baseObjectClass and baseObjectInstance are restricted to those carried by the parameters baseObjectClass and baseObjectInstance in the recent notifyAlarmListRebuilt notifications. The timeline for "recent" is vendor-specific. | | | |

###### 11.2.1.1.3.3 Output parameters

Table 11.2.1.1.3.3-1: Output parameters for the operation getAlarmList

| Parameter Name | S | Matching Information /  Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| alarmInformationList | M | List of AlarmInformation. | It carries the requested AlarmInformation instances.  Case when synchronous mode of operation is used:  (a) The MnS producer shall apply the constraints expressed in alarmAckState and filter to AlarmInformation instances when constructing this output parameter.  Case when asynchronous mode of operation is used (i.e. this output parameter is conveyed via notifications):  (a) If the filter parameter is present, theMnS producer shall apply the constraint when constructing this output parameter. Furthermore, if the alarmAckState constraint is present, the MnS producer shall apply that constraint as well. The filter constraint, if any, that is currently active in the notification channel is not used for the construction of this output parameter.  (b) If the filter parameter is absent, the MnS producer shall apply the filter constraint currently active in the notification channel when constructing this output parameter. If the alarmAckState constraint is present, the MnS producer shall apply that constraint as well. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If all the AlarmInformation are returned, status = OperationSucceeded.  If operation is failed, status = OperationFailed. |

The following table defines an item of alarmInformationList.

Table 11.2.1.1.3.3-2: Definition of an item of alarmInformationList

| **Parameter name** | **S** | **Matching information** | **Comment** |
| --- | --- | --- | --- |
| objectClass,  objectInstance | M | MonitoredEntity.objectClass,  MonitoredEntity.objectInstance | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation. |
| notificationId | M | AlarmInformation.notificationId |  |
| notificationType | M | "notifyNewAlarm"  or  "notifyChangedAlarm"  or  "notifyClearedAlarm" | The parameter carries  - notifyNewAlarm in case the alarm has not yet changed and has not yet been cleared.  - notifyChangedAlarm in case the alarm has changed but has not yet been cleared.  - notifyClearedAlarm in case the alarm has been cleared but not yet acknowledged. |
| eventTime | O | AlarmInformation.alarmRaisedTime or  AlarmInformation.alarmChangedTime or  AlarmInformation.alarmClearedTime | The parameter carries the  - alarmRaisedTime in case notificationType carries notifyNewAlarm  - alarmChangedTime in case notificationType carries notifyChangedAlarm  - alarmClearedTime in case notificationType carries notifyClearedAlarm |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| [objectClass],  [objectInstance] | n/a | MonitoredEntity.objectClass,  MonitoredEntity.objectInstance | Parmeter identical to the first parameter in this list, shown here to clarify all elements of AlarmInformation are present |
| [notificationId] | n/a | AlarmInformation.notificationId | Parmeter identical to the second parameter in this list, shown here to clarify all elements of AlarmInformation are present |
| alarmRaisedTime | M | AlarmInformation.alarmRaisedTime |  |
| alarmChangedTime | O | AlarmInformation.alarmChangedTime | not applicable if the severity of related alarm was not changed |
| alarmClearedTime | M | AlarmInformation.alarmClearedTime | not applicable if related alarm was not cleared |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| specificProblem | O | AlarmInformation.specificProblem |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity |  |
| backedUpStatus | O | AlarmInformation.backedUpStatus | not applicable if related alarm is a security alarm |
| backUpObject | O | MonitoredEntity.objectInstance | The MonitoredEntity is identified by relation-BackUpObject-AlarmInformation.  Not applicable if related alarm is a security alarm |
| trendIndication | O | AlarmInformation.trendIndication | not applicable if related alarm is a security alarm |
| thresholdInfo | O | AlarmInformation.thresholdInfo | not applicable if related alarm is a security alarm |
| correlatedNotifications | O | The set of CorrelatedNotification instances related to this AlarmInformation. |  |
| stateChangeDefinition | O | AlarmInformation.stateChange | not applicable if related alarm is a security alarm |
| monitoredAttributes | O | AlarmInformation.monitoredAttributes | not applicable if related alarm is a security alarm |
| proposedRepairActions | O | AlarmInformation.proposedRepairActions | not applicable if related alarm is a security alarm |
| additionalText | O | AlarmInformation.additionalText |  |
| additionalInformation | O | AlarmInformation.additionalInformation |  |
| rootCauseIndicator | O | AlarmInformation.rootCauseIndicator |  |
| ackTime | M | AlarmInformation.ackTime | not applicable if related alarm was not acknowledged nor unacknowledged  The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmClearedTime and ackTime) shall be "best effort".  Reason: A Management System is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data). |
| ackUserId | M | AlarmInformation.ackUserId | not applicable if related alarm was not acknowledged nor unacknowledged |
| ackSystemId | O | AlarmInformation.ackSystemId | not applicable if related alarm was not acknowledged nor unacknowledged |
| ackState | M | AlarmInformation.ackState | not applicable if related alarm was not acknowledged nor unacknowledged |
| clearUserId | O | AlarmInformation.clearUserId | not applicable if related alarm was not cleared |
| clearSystemId | O | AlarmInformation.clearSystemId | not applicable if related alarm was not cleared |
| serviceUser | M | AlarmInformation.serviceUser | not applicable if related alarm is not a security alarm |
| serviceProvider | M | AlarmInformation.serviceProvider | not applicable if related alarm is not a security alarm |
| securityAlarmDetector | M | AlarmInformation.securityAlarmDetector | not applicable if related alarm is not a security alarm |
| comments | M | The set of Comment instances related to this AlarmInformation. | Not applicable if the related alarm has no related comments |

###### 11.2.1.1.3.4 Exceptions and constraints

| Exception Name | Definition |
| --- | --- |
| operation\_failed | **Condition:** Operation is failed  **Returned Information:** The output parameter status  **Exit state:** Entry State |

##### 11.2.1.1.4 notifyNewAlarm

###### 11.2.1.1.4.1 Definition

This notification is generated by the MnS producer when a new AlarmInformation is added to the AlarmList. The notification parameters depend on the alarmType and are different for non-security and security alarms.

###### 11.2.1.1.4.2 Input parameters

The notifyNewAlarm notification is defined by Table 11.2.1.1.4.2-1, if the alarmType is equal to "Communications Alarm", "Processing Error Alarm", "Environmental Alarm". "Quality Of Service Alarm" or "Equipment Alarm".

Table 11.2.1.1.4.2-1: Input parameters for notifications related to non-security alarms

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| objectInstance | M | MonitoredEntity.objectInstance | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| notificationId | M | -- |  |
| notificationType | M | "notifyNewAlarm" |  |
| eventTime | M | AlarmInformation.alarmRaisedTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity |  |
| specificProblem | O | AlarmInformation.specificProblem |  |
| backedUpStatus | O | AlarmInformation.backedUpStatus |  |
| backUpObject | O | MonitoredEntity.objectInstance  It carries the DN of the back up object. | The object is identified by relation-BackUpObject-AlarmInformation of the new AlarmInformation. |
| trendIndication | O | AlarmInformation.trendIndication |  |
| thresholdInfo | O | AlarmInformation.thresholdInfo |  |
| correlatedNotifications | O | The CorrelatedNotification instances related to this AlarmInformation. |  |
| stateChangeDefinition | O | AlarmInformation.stateChangeDefinition |  |
| monitoredAttributes | O | AlarmInformation.monitoredAttributes |  |
| proposedRepairActions | O | AlarmInformaton.proposedRepairActions |  |
| additionalText | O | AlarmInformation.additionalText |  |
| additionalInformation | O | AlarmInformation.additionalInformation |  |
| rootCauseIndicator | O | AlarmInformation.rootCauseIndicator |  |

###### 11.2.1.1.4.2a Input parameters for notifications related to security alarms

The notifyNewAlarm notification is defined by Table 11.2.1.1.4.2a-1, if the alarmType is equal to "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation" or "Time Domain Violation".

Table 11.2.1.1.4.2a-1: Input parameters for notifications related to security alarms

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| objectInstance | M | MonitoredEntity.objectInstance | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation. |
| notificationId | M | -- |  |
| notificationType | M | "notifyNewAlarm" |  |
| eventTime | M | AlarmInformation.alarmRaisedTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity |  |
| correlatedNotifications | O | The set of CorrelatedNotification related to this AlarmInformation. |  |
| additionalText | O | AlarmInformation.additionalText |  |
| additionalInformation | O | AlarmInformation.additionalInformation |  |
| rootCauseIndicator | O | AlarmIngormation.rootCauseIndicator |  |
| serviceUser | M | AlarmInformation.securityServiceUser | This may contain no information if the identify of the service-user (requesting the service) is not known. |
| serviceProvider | M | AlarmInformation.securityServiceProvider | This shall always identify the service-provider receiving a service request, from serviceUser, that provokes the security alarm. |
| securityAlarmDetector | M | AlarmInformation.securityAlarmDetector | This may contain no information if the detector of the security alarm is the serviceProvider. |

###### 11.2.1.1.4.3 Triggering event

11.2.1.1.4.3.1 From-state

noMatchedAlarm.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| noMatchedAlarm | AlarmList does not contain an AlarmInformation that has the following properties:  Its matching-criteria-attributes values are identical to that of the newly generated network alarm and it is involved in relation-AlarmObject-AlarmInformation with the same MonitoredEntity as the one identified by the newly generated network alarm. |

11.2.1.1.4.3.2 To-state

newAlarmInAlarmList.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| newAlarmInAlarmList | AlarmList contains an AlarmInformation holding information conveyed by the newly generated network alarm. This AlarmInformation is involved in relation-AlarmObject-AlarmInformation with the same MonitoredEntity as the one identified by the newly generated network alarm.  The following attributes of the AlarmInformation shall be populated with information in the newly generated alarm:  notificationId, alarmRaisedTime, alarmId, alarmType, , probableCause, perceivedSeverity.  The following attributes of the same AlarmInformation shall be populated with information of the newly generated alarm if the information is present (in the newly generated alarm) and if the attribute is supported:  specificProblem, backedUpStatus, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation. |

##### 11.2.1.1.5 notifyChangedAlarm

###### 11.2.1.1.5.1 Definition

This notification is generated by the MnS producer when the perceivedSeverity of an existing AlarmInformation changes (except to the value "CLEARED").

11.2.1.1.5.2 Input parameters

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation. |
| objectInstance | M | MonitoredEntity.objectInstance | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation. |
| notificationId | M | -- |  |
| notificationType | M | "notifyChangedAlarm" |  |
| eventTime | M | AlarmInformation.alarmChangedTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity |  |

###### 11.2.1.1.5.3 Triggering event

11.2.1.1.5.3.1 From-state

alarmMatched AND alarmNotCleared AND alarmChanged.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmMatched | The matching-criteria-attributes of the newly generated network alarm has values that are identical (matches) with ones in one AlarmInformation in AlarmList. |
| alarmNotCleared | The perceivedSeverity of the newly generated network alarm is not Cleared. |
| alarmChanged | The perceivedSeverity of the newly generated network alarm and of the matched AlarmInformation are different. |

11.2.1.1.5.3.2 To-state

informationUpdate.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| informationUpdate | The AlarmInformation identified in alarmMatched in from-state has been updated according to the following rules:  - notificationId is updated;  - alarmChangedTime is updated;  - perceivedSeverity is updated;  - ackTime, ackUserId and ackSystemId are updated to contain no information;  - ackState is updated to "unacknowledged"; |

##### 11.2.1.1.6 notifyAlarmListRebuilt

###### 11.2.1.1.6.1 Definition

This notification is generated by the MnS producer when the AlarmList has been completely or partially rebuilt.

###### 11.2.1.1.6.2 Input parameters

| Parameter Name | S | Legal type | Comment |
| --- | --- | --- | --- |
| objectClass | M | -- | Identifies, together with the objectInstance parameter, the part of the alarm list that has been rebuilt.  If this paramter specifies the class of the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may have been rebuilt.  If this parameter specifies some class represented by MonitoredEntity, then a subset of the AlarmInformation instances in the AlarmList may have been rebuilt. |
| objectInstance | M | -- | Identifies, together with the objetClass parameter, the part of the alarm list that has been rebuilt.  If this parameter is equal to the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may have been rebuilt.  If this parameter is equal to some instance represented by MonitoredEntity, then only AlarmInformation related to this instance and its descendants may have been rebuilt.. |
| notificationId | M | -- | -- |
| notificationType | M | "notifyAlarmListRebuilt" |  |
| eventTime | M | -- | The time when the alarm list has been rebuilt. |
| systemDN | M | -- | It identifies the DN of MnS producer. |
| reason | M | "System-NE communication error", "System restarts", "indeterminate". Other values can be added. | The reason why the system has rebuilt the AlarmList. This may carry different reasons than that carried by the immediate previous notifyPotentialFaultyAlarmList. |
| alarmListAlignmentRequirement | O | "alignmentRequired", "alignmentNotRequired". | It carries an enumeration of "alignmentRequired" and "alignmentNotRequired". |

###### 11.2.1.1.6.3 Triggering event

11.2.1.1.6.3.1 From-state

alarmListRebuilt\_0 OR alarmListRebuilt\_1.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmListRebuilt\_0 | MnS producer has cold-started, initialized, re-initialized or rebooted and it has initiated procedure to rebuild its AlarmList. |
| alarmListRebuilt\_1 | MnS producer loses confidence in part or whole of its AlarmList. MnS producer has initiated procedure to repair its AlarmList. |

11.2.1.1.6.3.2 To-state

alarmListRebuilt\_2.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmListRebuilt\_2 | MnS producer rebuilds the whole or part of AlarmList. |

##### 11.2.1.1.7 notifyCorrelatedNotificationChanged

###### 11.2.1.1.7.1 Definition

This notification is generated by the MnS producer when the set of CorrelatedNotification is created, updated or deleted.

###### 11.2.1.1.7.2 Input parameters

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation. |
| objectInstance | M | MonitoredEntity.objectInstance | The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation. |
| notificationId | M | -- |  |
| notificationType | M | "notifyCorrelatedNotificationChanged" |  |
| eventTime | M | It carries the time when the CorrelatedNotification is created, updated or deleted. |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| correlatedNotifications | M | The CorrelatedNotification instances related to this AlarmInformation. |  |
| rootCauseIndicator | O | AlarmInformation.rootCauseIndicator |  |

###### 11.2.1.1.7.3 Triggering event

11.2.1.1.7.3.1 From-state

newAlarmCorrelationInfoIsAvailable AND alarmInformationExists.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| newAlarmCorrelationInfoIsAvailable | New alarm correlation information is available but not yet conveyed to any consumer. |
| alarmInformationExists | The AlarmInformation is in AlarmList. |

11.2.1.1.7.3.2 To-state

alarmCorrelatedInfoUpdated.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmCorrelatedInfoUpdated | The set of CorrelatedNotification network slice instances is created, updated or deleted. |

##### 11.2.1.1.8 getAlarmCount

###### 11.2.1.1.8.1 Definition

A MnS consumer invokes this operation to get the number of alarms in the alarm list. The alarms are counted separately for each perceived severity level. An input parameter allows to control which alarms are counted.

###### 11.2.1.1.8.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | S | Information Type | Comment |
| filter | O | N/A | It carries a filter constraint. The operation shall apply it when counting the AlarmInformation instances in AlarmList.  Case when synchronous mode of operation is used for getAlarmList:  (a) If this parameter is present, the operation shall count the AlarmInformation instances which satisfy both (a) this filter constraint and (b) the condition set by input parameter alarmAckState.  (b) If this parameter is absent, the operation shall count all AlarmInformation instances that satisfy the condition set by input parameter alarmAckState.  Case when asynchronous mode of operation is used for getAlarmList:  (a) If this parameter is present, the operation shall count all AlarmInformation instances that satisfy this filter constraint and the condition set by input parameter alarmAckState.  (b) If this parameter is absent, the operation shall count AlarmInformation instances that satisfy (a) the filter constraint currently active in the notification channel established between the authorized MnS consumer and the MnS produce and (b) the condition set by input parameter alarmAckState. |
| alarmAckState | O | ENUM (all alarms, all active alarms, all active and acknowledged alarms, all active and unacknowledged, all cleared and unacknowledged alarms, all unacknowledged) | It carries a constraint. The operation shall apply it on AlarmInformation instances in AlarmList when counting. |

###### 11.2.1.1.8.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | S | Matching Information | Comment |
| criticalCount, majorCount, minorCount, warningCount, indeterminateCount, clearedCount | M | N/A | They carry the number of AlarmInformation in AlarmList that has the following properties.  Case when synchronous mode of operation is used:  (a) The operation shall apply the constraints expressed in alarmAckState and filter to AlarmInformation instances when counting.  Case when asynchronous mode of operation is used (i.e. this output parameter is conveyed via notifications):  (a) If the filter parameter is present, the operation shall apply the constraint when counting. Furthermore, if the alarmAckState constraint is present, the operation shall apply that constraint as well. The filter constraint, if any, that is currently active in the notification channel is not used for the counting.  (b) If the filter parameter is absent, the operation shall apply the filter constraint currently active in the notification channel when counting. If the alarmAckState constraint is present, the operation shall apply that constraint as well. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If allAlarmInformationCounted is true, status = OperationSucceeded.  If operation\_failed is true, status = OperationFailed. |

###### 11.2.1.1.8.4 Pre-condition

There are no pre-conditions.

###### 11.2.1.1.8.5 Post-condition

allAlarmInformationCounted.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| allAlarmInformationCounted | All AlarmInformation that satisfy the constraints expressed in input parameters filter and alarmAckState and are present in the AlarmList at the moment of this operation invocation are counted and the result returned.  All AlarmInformation in AlarmList remains unchanged as the result of this operation. |

###### 11.2.1.1.8.6 Exceptions

|  |  |
| --- | --- |
| Name | Definition |
| operation\_failed | **Condition:** the pre-condition is false or the post-condition is true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |
| filter\_complexity\_limit | **Condition:** Operation not performed because the filter parameter is too complex.  **Returned Information**: The output parameter status.  **Exit state:** Entry state. |

##### 11.2.1.1.9 setComment

###### 11.2.1.1.9.1 Definition

A MnS consumer invokes this operation to set a comment in one or more AlarmInformation instances in AlarmList.

###### 11.2.1.1.9.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | S | Information Type | Comment |
| alarmInformationReferenceList | M | List of AlarmInformation.alarmId | It carries one or more identifiers identifying AlarmInformation instances in the AlarmList. |
| commentUserId | M | Comment.commentUserId | The Comment is identified by the relation-AlarmInformation-Comment. |
| commentSystemId | O | Comment.commentSystemId | The Comment is identified by the relation-AlarmInformation-Comment. |
| commentText | M | Comment.commentText | The Comment is identified by the relation-AlarmInformation-Comment. |

###### 11.2.1.1.9.3 Output Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | S | Matching Information | Comment |
| badAlarmInformationReferenceList | M | List of pair of AlarmInformation.alarmId and the failure reason. | If allUpdated is true, it contains no information.  If someUpdated is true, then it contains identifications of AlarmInformation that are not present in AlarmList or that they are present, but AlarmInformation.comments has not changed, in contrast to authorized consumer's request. |
| status | M | ENUM( Operation succeeded, Operation failed, Operation partially failed) | If allUpdated is true, then status = OperationSucceeded.  If someUpdated is true, then status = OperationPartiallyFailed.  If exception operationFailed is raised, then status = OperationFailed. |

#### 11.2.1.2 Fault supervision data control

##### 11.2.1.2.1 acknowledgeAlarms

###### 11.2.1.2.1.1 Definition

The MnS consumer invokes this operation to acknowledge one or more alarms.

When this operation is not supported, the MnS producer shall support acknowledging alarms.

###### 11.2.1.2.1.2 Input parameters

| Parameter Name | S | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| alarmInformationAnd SeverityReferenceList | M | SET OF SEQUENCE {  AlarmInformation.alarmId (M)  AlarmInformation.perceivedSeverity (O)  } | It identifies the alarms to be acknowledged. If an alarm id is qualified with an optional perceived severity, the alarm shall be acknowledged only when the perceived severity in the alarm list matches the perceived severity provided in the operation request. |
| ackUserId | M | AlarmInformation.ackUserId | The identifier of the user acknowledgeding the alarm. |
| ackSystemId | O | AlarmInformation.ackSystemId | The identifier of the system where the acknowledgement request was originated. |

###### 11.2.1.2.1.3 Output parameters

| Parameter Name | S | Matching Information /  Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| badAlarmInformationReferenceList | M | SET OF SEQUENCE {  AlarmInformation.alarmId (M)  errorReason (M)  }  errorReason ::= ENUM {  UnknownAlarmId,  AcknowledgmentFailed,  WrongPerceivedSeverity  } | If all alarms are acknowledged, it contains no information.  If only some alarms are acknowledged, then it contains identifications of AlarmInformation that are  (a) present in input parameter AlarmInformationReferenceList but absent in the AlarmList (errorReason = UnknownAlarmId; or  (b) present in input parameter AlarmInformationReferenceList and present in the AlarmList but the Acknowledgement Information (see note below table) has not changed despite the consumer's request (errorReason = AcknowledgmentFailed); or  (c) present in input parameter AlarmInformationReferenceList and present in the AlarmList but the perceivedSeverity to be acknowledged has changed and/or is different in the Alarm List (ErrorReason = WrongPerceivedSeverity), applicable only if perceivedSeverity is provided. |
| status | M | ENUM {  OperationSucceeded,  OperationPartiallySucceeded,  OperationFailed  } | If all alarms acknowledged, then  status = OperationSucceeded.  If some alarms are acknowledged, then status = OperationPartiallySuceeded.  If operation failed is true, then  status = OperationFailed. |

NOTE: Acknowledgement Information is defined as the information contained in AlarmInformation.ackTime, AlarmInformation.ackUserId, AlarmInformaton.ackSystemId, AlarmInformation.ackState.

###### 11.2.1.2.1.4 Exceptions and constraints

| Exception Name | Definition |
| --- | --- |
| operation\_failed | **Condition:** Operation is failed  **Returned Information:** The output parameter status  **Exit state:** Entry State |

##### 11.2.1.2.2 unacknowledgeAlarms

###### 11.2.1.2.2.1 Definition

The MnS consumer invokes this operation to remove acknowledgement information kept in one or more AlarmInformation instances.

###### 11.2.1.2.2.2 Input parameters

| Parameter Name | S | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| alarmInformationReferenceList | M | List of AlarmInformation.alarmId | It carries one or more identifiers identifying AlarmInformation in AlarmList. |
| ackUserId | M | AlarmInformation.ackUserId | The identifier of the user unacknowledgeding the alarm. |
| ackSystemId | O | AlarmInformation.ackSystemId | The identifier of the system where the acknowledgement request was originated. |

###### 11.2.1.2.2.3 Output parameters

| Parameter Name | S | Matching Information /  Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| badAlarmInformationReferenceList | M | SET OF SEQUENCE {  AlarmInformation.alarmId (M)  errorReason (M)  }  errorReason ::= ENUM {  UnknownAlarmId,  AcknowledgmentFailed,  WrongPerceivedSeverity,  } | If all alarms are acknowledged, it contains no information.  If only some alarms are acknowledged, then it contains identifications of AlarmInformation that are  (a) present in input parameter AlarmInformationReferenceList but absent in the AlarmList (errorReason = UnknownAlarmId; or  (b) present in input parameter AlarmInformationReferenceList and present in the AlarmList but the Acknowledgement Information (see note below table) has not changed despite the consumer's request (errorReason = AcknowledgmentFailed); or  (c) present in input parameter AlarmInformationReferenceList and present in the AlarmList but the perceivedSeverity to be acknowledged has changed and/or is different in the Alarm List (ErrorReason = WrongPerceivedSeverity), applicable only if perceivedSeverity is provided. |
| status | M | ENUM {  OperationSucceeded,  OperationPartiallySucceeded,  OperationFailed | If all alarms acknowledged, then  status = OperationSucceeded.  If some alarms are acknowledged, then  status = OperationPartiallySuceeded.  If operation failed is true, then  status = OperationFailed. |

NOTE: Acknowledgement Information is defined as the information contained in AlarmInformation.ackTime, AlarmInformation.ackUserId, AlarmInformaton.ackSystemId, AlarmInformation.ackState.

###### 11.2.1.2.2.4 Exceptions and constraints

| Exception Name | Definition |
| --- | --- |
| Operation\_failed | **Condition:** Operation is failed  **Returned Information:** The output parameter status  **Exit state:** Entry State |

##### 11.2.1.2.3 clearAlarms

###### 11.2.1.2.3.1 Definition

The authorized consumer invokes this operation to clear one or more AlarmInformation instances in AlarmList. For example, this operation can be used to support the manual clearing of the ADMC (automatic detection and manual clearing, see also TS 32.111-1 [3]) alarms.

###### 11.2.1.2.3.2 Input parameters

| Parameter Name | S | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| alarmInformationReferenceList | M | List of AlarmInformation.alarmId | It carries one or more identifiers identifying AlarmInformation instances in the AlarmList. |
| clearUserId | M | AlarmInformation.clearUserId | It identities the user clearing the alarm. |
| clearSystemId | O | AlarmInformation.clearSystemId | It identifies the authorized consumer. It may be absent implying that consumer does not wish this information be known to the MnS producer. |

###### 11.2.1.2.3.3 Output parameters

| Parameter Name | S | Matching Information /  Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| badAlarmInformationReferenceList | M | List of pair of AlarmInformation.alarmId and the failure reason. | If all alarms are cleared, it contains no information.  If some alarms are cleared, then it contains identifications of AlarmInformation that are not present in AlarmList or that are present in AlarmList but remain unchanged, in contrast to consumer's request. |
| status | M | ENUM( OperationSucceeded, OperationFailed, OperationPartiallySucceeded) | If all alarms are cleared, then status = OperationSucceeded.  If some alarms are cleared, then status = OperationPartiallySucceeded.  If operation is failed, then status = OperationFailed. |

###### 11.2.1.2.3.4 Exceptions and constraints

| Exception Name | Definition |
| --- | --- |
| operation\_failed | **Condition:** Operation is failed  **Returned Information:** The output parameter status  **Exit state:** Entry State |

##### 11.2.1.2.4 notifyClearedAlarm

###### 11.2.1.2.4.1 Definition

This notification is generated by the MnS producer when the perceivedSeverity of an existing AlarmInformation changes to "CLEARED".

###### 11.2.1.2.4.2 Input parameters

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass |  |
| objectInstance | M | MonitoredEntity.objectInstance |  |
| notificationId | M | -- |  |
| notificationType | M | "notifyClearedAlarm" |  |
| eventTime | M | AlarmInformation.alarmClearedTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probablaCause |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity | Value shall be "CLEARED" |
| correlatedNotifications | O | The CorrelatedNotification instances related to this AlarmInformation. | This parameter contains references to other AlarmInformation instances whose perceivedSeverity levels are cleared as well. In this way, the perceivedSeverity level of multiple AlarmInformation instances can be cleared by one notification. |
| clearUserId | O | AlarmInformation.clearUserId | This parameter shall be present and contain valid information if the AlarmInformation is cleared by a clearAlarms operation request. |
| clearSystemId | O | AlarmInformation.clearSystemId | This parameter is present if clearUserId is present and if AlarmInformation.clearSystemId contains valid information. |

###### 11.2.1.2.4.3 Triggering event

11.2.1.2.4.3.1 From-state

alarmMatchedAndCleared OR clearedByProvider.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmMatchedAndCleared | The matching-criteria-attributes of the newly generated network alarm have values that are identical (matched) with ones in one AlarmInformation in AlarmList and the perceivedSeverity of the matched AlarmInformation is not Cleared  AND  The perceivedSeverity of the newly generated network alarm is cleared. |
| clearedByProvider | Reception of a valid clearAlarms operation that identifies the subject AlarmInformation instances. This triggering event shall occur regardless of the perceivedSeverity state of the identified AlarmInformation instances. |

11.2.1.2.4.3.2 To-state

alarmInformationCleared\_1 OR alarmInformationCleared\_2.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmInformationCleared\_1 | Case if From-state is alarmMatchedAndCleared:  The following attributes of the subject AlarmInformation are updated:  notificationId, perceivedSeverity (updated to Cleared), alarmClearedTime. |
| alarmInformationCleared\_2 | Case if From-state is clearedByProvider:  The following attributes of the subject AlarmInformation are updated:  notificationId, alarmClearedTime, perceivedSeverity (updated to CLEARED), alarmClearedUserId, alarmClearedSystemId. |

##### 11.2.1.2.5 notifyAckStateChanged

###### 11.2.1.2.5.1 Definition

This notification is generated by the MnS producer when a the acknowledgement state of an alarm changes from "UNACKNOWLEDGED" to "ACKNOWLEDGED" or back from "ACKNOWLEDGED" to "UNACKNOWLEDGED".

###### 11.2.1.2.5.2 Input parameters

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass |  |
| objectInstance | M | MonitoredEntity.objectInstance |  |
| notificationId | M | -- |  |
| notificationType | M | "notifyAckStateChanged" |  |
| eventTime | M | AlarmInformation.ackTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| perceivedSeverity | M | AlarmInformation.perceivedSeverity |  |
| ackState | M | AlarmInformation.ackState |  |
| ackUserId | M | AlarmInformation.ackUserId | The identifier of the user who acknowledged or unacknowledged the alarm. |
| ackSystemId | O | AlarmInformation.ackSystemId | The identifier of the system where the acknowledgement or unacknowledgement request was originated. |

###### 11.2.1.2.5.3 Triggering event

11.2.1.2.5.3.1 From-state

ackedByConsumer OR ackedByProvider AND alarmInformationExists.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| ackedByConsumer | Reception of an acknowledgeAlarms operation and a subsequent operation success return. |
| ackedByProvider | Reception of a local (non-standard) acknowlegeAlarms equivalent operation and a subsequent operation success return. |
| alarmInformationExists | The AlarmInformation exists in AlarmList. |

11.2.1.2.5.3.2 To-state

alarmAckStateHasChanged.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmAckStateHasChanged | The AlarmInformation.ackState of the AlarmInformation identified by from-state assertion alarmInformationExists have been updated. Specifically, the following attributes of the subject AlarmInformation are updated:  -- notificationId, ackTime, ackUserId, ackState, ackSystemId. |

##### 11.2.1.2.6 notifyComments

###### 11.2.1.2.6.1 Definition

This notification is generated by the MnS producer when a Comment instance is added to an AlarmInformation instance in the AlarmList.

A MnS producer shall support this notification if it supports the operation setComment.

###### 11.2.1.2.6.2 Input parameters

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass |  |
| objectInstance | M | MonitoredEntity.objectInstance |  |
| notificationId | M | -- |  |
| notificationType | M | "notifyComments" |  |
| eventTime | M | Comment.commentTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| perceived Severity | M | AlarmInformation.perceivedSeverity |  |
| comments | M | The Comment instances related to this AlarmInformation. |  |

###### 11.2.1.2.6.3 Trigger event

11.2.1.2.6.3.1 From-state

commentSetByServiceConsumer OR commentSetInternallyByServiceprovider commentedByServiceprovider AND alarmInformationExists.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| commentSetByServiceConsumer | Reception of a successful setComment operation from the service consumer. |
| commentSetInternallyByServiceprovider | Setting of the comment internally by the service producer based on local events. |
| alarmInformationExists | The AlarmInformation is in AlarmList. |

11.2.1.2.6.3.2 To-state

commentInserted.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| commentInserted | One Comment has been created and it is involved in a relationship with the AlarmInformation identified by from-state assertion alarmInformationExists. The following attributes of the newly created Comment instance shall be populated:  commentTime, commentText, commentUserId and commentSystemId. |

##### 11.2.1.2.7 notifyPotentialFaultyAlarmList

###### 11.2.1.2.7.1 Definition

This notification is generated by the MnS producer when the MnS producer looses confidence in the integrity of its alarm list.

The MnS producer may then rebuilt the faulty alarm list. When the alarm List is rebuilt or confidence in the existing alarm list is re-established the MnS producer may generate a notifyAlarmListRebuilt notification.

The parameters objectClass and objectInstance are used to specify if the complete alarm list is unreliable or only parts thereof.

The MnS consumer behaviour, on reception of this notifyPotentialFaultyAlarmList notification, is not specified. The authorized consumer behaviour is considered not essential for the specification of the interface itself. However, the following are recommended actions the uthorized consumer should take, in case it receives this notification.

1) The uthorized consumer should not perform any task requiring the integrity of the AlarmInformation identified as faulty or unreliable by the subject notification.

2) The uthorized consumer should not invoke operations that require integrity of the AlarmList such as getAlarmList., acknolwedgeAlarms operations.

###### 11.2.1.2.7.2 Input parameters

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | It identifies the class of the instance identified by systemDN or the class of MonitoredEntity. | Identifies, together with the objectInstance parameter, the part of the alarm list that is not reliable.  If this paramter specifies the class of the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may not be reliable.  If this parameter specifies some class represented by MonitoredEntity, then a subset of the AlarmInformation instances in the AlarmList is not reliable. |
| objectInstance | M | It identifies the instance identified by systemDN or an instance of MonitoredEntity. | Identifies, together with the objetClass parameter, the part of the alarm list that may not be reliable.  If this parameter is equal to the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may not be reliable.  If this parameter is equal to some instance represented by MonitoredEntity, then only AlarmInformation related to this instance and its descendants may not be reliable. |
| notificationId | M | -- |  |
| notificationType | M | "notifyPotentialFaultyAlarmList" |  |
| eventTime | M | -- | Time when the MnS producer lost confidence in the integrity of the alarm list |
| systemDN | M | -- |  |
| reason | M | "serviceprovider-NE communication error", " serviceprovider restarts", "indeterminate". Other values can be added. | Reason why the MnS producer has to rebuild its AlarmList. |

###### 11.2.1.2.7.3 Trigger event

11.2.1.2.7.3.1 From-state

faultyAlarmListDetected.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| faultyAlarmListDetected | MnS producer detects faults in part or whole of its AlarmList. |

11.2.1.2.7.3.2 To-state

faultyAlarmList

|  |  |
| --- | --- |
| Assertion Name | Definition |
| faultyAlarmList | MnS producer initiates the AlarmList rebuild process. |

##### 11.2.1.2.8 notifyChangedAlarmGeneral

###### 11.2.1.2.8.1 Definition

This notification is generated by the MnS producer when one or more of the following attributes of an AlarmInformation instance in the AlarmList changes its value: perceivedSeverity, backedUpStatus, backUpObject, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation, serviceUser, serviceProvider or securityAlarmDetector. From the attributes listed above, only those that changed value shall be included in the notification.

The notification parameters depend on the alarmType and are different for non-security and security alarms.

###### 11.2.1.2.8.2 Input parameters for notifications related to non-security alarms

The notifyChangedAlarmGeneral notification is defined by Table 11.2.1.2.8.2-1, if the alarmType is equal to "Communications Alarm", "Processing Error Alarm", "Environmental Alarm",, "Quality Of Service Alarm" or "Equipment Alarm".

Table 11.2.1.2.8.2-1: Input parameters for notifications related to non-security alarms

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass |  |
| objectInstance | M | MonitoredEntity.objectInstance |  |
| notificationId | M | -- |  |
| notificationType | M | "notifyChangedAlarmGeneral" |  |
| eventTime | M | AlarmInformation.alarmChangedTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| specificProblem | O | AlarmInformation.specificProblem |  |
| perceivedSeverity | O | AlarmInformation.perceivedSeverity |  |
| backedUpStatus | O | AlarmInformation.backedUpStatus |  |
| backUpObject | O | MonitoredEntity.objectInstance | The DN of the back up object. The object is identified by relation-BackUpObject-AlarmInformation of the new AlarmInformation. |
| trendIndication | O | AlarmInformation.trendIndication |  |
| thresholdInfo | O | AlarmInformation.thresholdInfo |  |
| correlatedNotifications | O | Set of CorrelatedNotification related to this AlarmInformation. |  |
| stateChangeDefinition | O | AlarmInformation.stateChange |  |
| monitoredAttributes | O | AlarmInformation.monitoredAttributes |  |
| proposedRepairActions | O | AlarmInformaton.proposedRepairActions |  |
| additionalText | O | AlarmInformation.additionalText |  |
| additionalInformation | O | AlarmInformation.additionalInformation |  |
| rootCauseIndicator | O | alarmInformation.rootCauseIndicator |  |
| changedAlarmAttributes | O | LIST OF SEQUENCE <AttributeName, OldAttributeValue> | The changed alarm attributes (name/value pairs) (with old values). |

###### 11.2.1.2.8.3 Input parameters for notifications related to security alarm

The notifyChangedAlarmGeneral notification is defined by Table 11.2.1.1.4.2a-1, if the alarmType is equal to "Integrity Violation", "Operational Violation", "Physical Violation", "Security Service or Mechanism Violation" or "Time Domain Violation".

Table 11.2.1.2.8.3-1: Input parameters for notifications related to security alarms

| Parameter Name | S | Matching Information/ Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| objectClass | M | MonitoredEntity.objectClass |  |
| objectInstance | M | MonitoredEntity.objectInstance |  |
| notificationId | M | -- |  |
| notificationType | M | "notifyChangedAlarmGeneral". |  |
| eventTime | M | AlarmInformation.alarmChangedTime |  |
| systemDN | M | -- |  |
| alarmId | M | AlarmInformation.alarmId |  |
| alarmType | M | AlarmInformation.alarmType |  |
| probableCause | M | AlarmInformation.probableCause |  |
| perceivedSeverity | O | AlarmInformation.perceivedSeverity |  |
| correlatedNotifications | O | Set of CorrelatedNotification related to this AlarmInformation. |  |
| additionalText | O | AlarmInformation.additionalText |  |
| additionalInformation | O | AlarmInformation.additionalInformation |  |
| rootCauseIndicator | O | alarmInformation.rootCauseIndicator |  |
| serviceUser | M | AlarmInformation.serviceUser | This may contain no information if the identify of the service-user (requesting the service) is not known. |
| serviceProvider | M | AlarmInformation.serviceProvider | This shall always identify the service-provider receiving a service request, from serviceUser, that provokes the security alarm. |
| securityAlarmDetector | M | AlarmInformation.securityAlarmDetector | This may contain no information if the detector of the security alarm is the serviceProvider. |
| changedAlarmAttributes | O | LIST OF SEQUENCE <AttributeName, OldAttributeValue> | The changed alarm attributes (name/value pairs) (with old values). |

###### 11.2.1.2.8.4 Trigger event

11.2.1.2.8.4.1 From-state

alarmMatched AND alarmNotCleared AND alarmChanged.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| alarmMatched | The matching-criteria-attributes of the newly generated network alarm has values that are identical (matches) with ones in one AlarmInformation in AlarmList. |
| alarmChanged | One or more of perceivedSeverity, backedUpStatus, backUpObject, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation, serviceUser, serviceProvider or securityAlarmDetector of the newly generated network alarm and of the matched AlarmInformation are different. |

11.2.1.2.8.4.2 To-state

informationUpdate.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| informationUpdate | The AlarmInformation identified in alarmMatched in from-state has been updated according to the following rules: perceivedSeverity, backedUpStatus, backUpObject, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation, serviceUser, serviceProvider or securityAlarmDetector is updated;  notificationId is updated;  alarmChangedTime is updated;  ackTime, ackUserId and ackSystemId are updated to contain no information;  ackState is updated to "unacknowledged"; |

### 11.2.2 Managed information

#### 11.2.2.1 Alarm information, alarm state change and Information Object Classes

##### 11.2.2.1.1 Imported information entities and local labels

None.

##### 11.2.2.1.2 Class diagram

###### 11.2.2.1.2.1 Introduction

This clause introduces the fault supervision related classes (i.e. IOCs, SupportIOCs). The intent is to identify the information required for the Fault management service implementation of its operations and notification emission. This clause provides the overview of all support object classes in UML. Subsequent clauses provide more detailed specification of various aspects of these support object classes.

###### 11.2.2.1.2.2 Attributes and relationships



##### 11.2.2.1.3 Information Object Class Definitions

###### 11.2.2.1.3.1 AlarmInformation

11.2.2.1.3.1.1 Definition

AlarmInformation contains information about alarm conditions of an alarmed MonitoredEntity.

A MnS producer is related to at most one AlarmList. The MnS producer assigns an identifier, called alarmId, to each AlarmInformation in the AlarmList. An alarmId unambiguously identifies one AlarmInformation in the AlarmList.

11.2.2.1.3.1.2 Attribute

|  |  |
| --- | --- |
| **Attribute name** | **S** |
| alarmId | M |
| objectClass/objectInstance (attribute related to role) | M |
| notificationId | M |
| alarmRaisedTime | M |
| alarmChangedTime | O |
| alarmClearedTime | M |
| alarmType | M |
| probableCause | M |
| specificProblem | O |
| perceivedSeverity | M |
| backedUpStatus | O |
| backUpObject (attribute related to role) | O |
| trendIndication | O |
| thresholdInfo | O |
| correlatedNotifications (attribute related to role) | O |
| stateChangeDefinition | O |
| monitoredAttributes | O |
| proposedRepairActions | O |
| additionalText | O |
| additionalInformation | O(see note 3) |
| rootCauseIndicator | O |
| ackTime | M |
| ackUserId | M |
| ackSystemId | O |
| ackState | M |
| clearUserId | O (see note 1) |
| clearSystemId | O (see note 1) |
| serviceUser | O (see note 2) |
| serviceProvider | O (see note 2) |
| securityAlarmDetector | O (see note 2) |
| NOTE 1: These attributes and qualifiers are applicable only if the management service producer supports clearAlarms() (they are absent if clearAlarms() is not supported).  NOTE 2: These attributes are supported if the management service producer emits notifyNewAlarm that carries security alarm information.  NOTE 3: This attribute is optionally populated whenever vendor specific attributes are needed. | |

11.2.2.1.3.1.3 State diagram

Alarms have states. The alarm state information is captured in AlarmInformation in AlarmList.

The solid circle icon represents the Start State. The double circle icon represents the End State. In this state, the alarm is Cleared and acknowledged. The AlarmInformation shall not be accessible via the Service interface and is removed from the AlarmList.

Note the state diagram uses " X / Y ^ Z " to label the arc that indicates state transition. The meanings of X, Y and Z are:

- X identifies the triggering event;

- Y identifies the action of FaultSupervision MnS producer because of the triggering event;

- Z is the notification to be emitted by FaultSupervision MnS producer because of the triggering event.

Note that acknowledgeAlarm^notifyAckStateChanged and the unacknowledgeAlarm^notifyAckStateChanged refer to cases when the request of the management service consumer is successful for the AlarmInformation concerned. They do not refer to the cases when the request is a failure since in the failure cases, no state transition would occur.

Note that, to reduce cluttering to the diagram, the setComment^notifyComment is not included in the figure . One transition should be applied from unack&unclear to itself. Similarly, another transition should be applied from ack&unclear to itself. Another one is from unack&clear to itself.

"PS" used in the state diagram stands for "perceived severity".

Figure 11.2.2.1.3.1.3-1 is used if it supports ^notifyChangedAlarm and Figure 11.2.2.1.3.1.3-2 is used if it does not support ^notifyChangedAlarm.

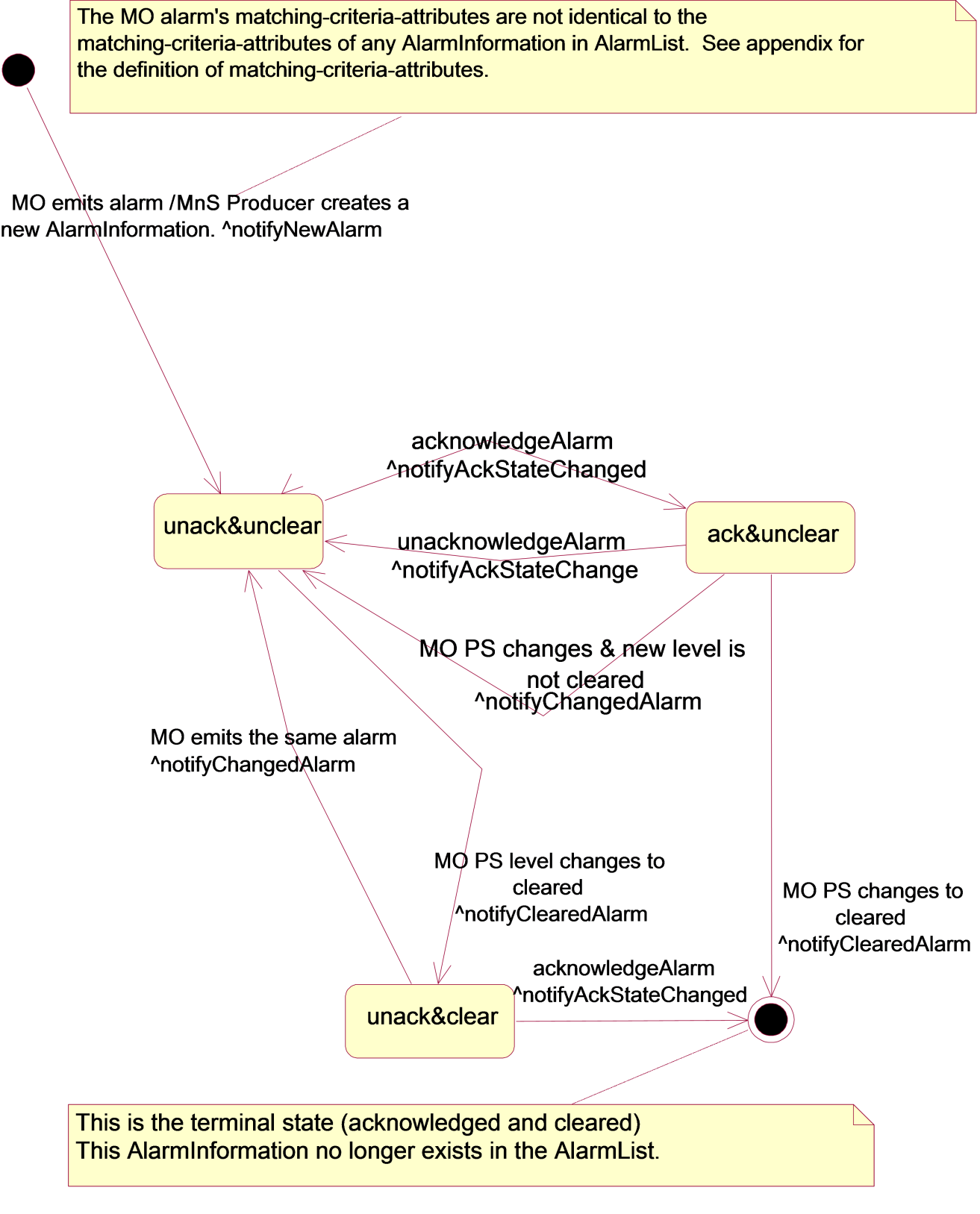


Figure 11.2.2.1.3.1.3-1 notifyChangedAlarm supported

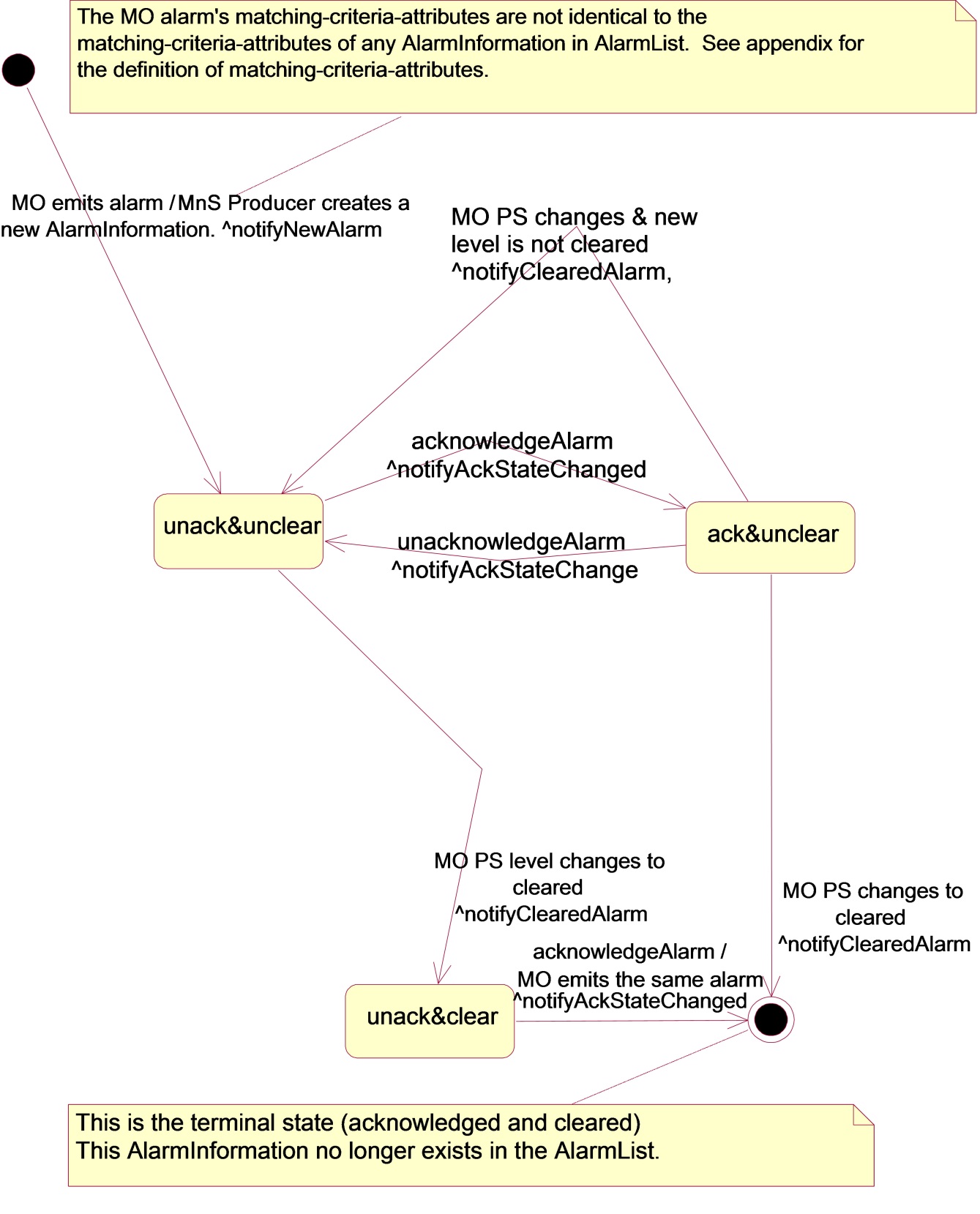


Figure 11.2.2.1.3.1.3-2 notifyChangedAlarm not supported

###### 11.2.2.1.3.2 AlarmList

11.2.2.1.3.2.1 Definition

The MnS producer maintains an AlarmList that contains currently active alarms (i.e. AlarmInformation whose perceivedSeverity is not Cleared) and alarms that are Cleared but not yet acknowledged.

11.2.2.1.3.2.2 Attribute

There is no additional attribute defined for this class besides those inherited.

###### 11.2.2.1.3.3 FSMnSProducer

11.2.2.1.3.3.1 Definition

FSMnSProducer is the representation of the entity who provides the fault supervision management service(s) and contains the AlarmList.

11.2.2.1.3.3.2 Attribute

There is no additional attribute defined for this class besides those inherited.

11.2.2.1.3.3.3 Notification Table

| **Name** | **S** | **Notes** |
| --- | --- | --- |
| notifyAlarmListRebuilt | M |  |
| notifyPotentialFaultyAlarmList | O | . |

###### 11.2.2.1.3.4 Comment

11.2.2.1.3.4.1 Definition

Comment contains commentary and associated information such as the time when the commentary is made.

11.2.2.1.3.4.2 Attribute

|  |  |
| --- | --- |
| **Attribute Name** | **S** |
| commentTime | M |
| commentUserId | M |
| commentSystemId | O |
| commentText | M |

###### 11.2.2.1.3.5 CorrelatedNotification

11.2.2.1.3.5.1 Definition

The sourceObjectInstance attribute of CorrelatedNotification identifies one MonitoredEntity. For the MonitoredEntity identified, a set of notification identifiers is also identified. One or more CorrelatedNotification instances can be related to an AlarmInformation. In this case, the information of the AlarmInformation is said to be correlated to information carried in the notifications identified by the CorrelatedNotification instances. See further definition of correlated notification in ITU-T Recommendation X.733 [4], clause 8.1.2.9.

The notification identified by the CorrelatedNotification, as defined in ITU-T and used here, can carry all types of information and is not restricted to carrying alarm information only. For example, a notification, identified by the CorrelatedNotification, can indicate a managed instance attribute value change. In this case, the information of the AlarmInformation is said to be correlated to the managed instance attribute value change event.

The meaning of correlation is dependent on the type of notification itself. See the comment column of the correlatedNotification input parameter for each type of notification, such as notifyNewAlarm.

Notification carries AlarmInformation. The AlarmInformation instances referred to by the correlatedNotification may or may not exist in the AlarmList. For example, the AlarmInformation carried by the identified notification may have been acknowledged and Cleared and therefore, no longer exist in the AlarmList.

11.2.2.1.3.5.2 Attribute

|  |  |
| --- | --- |
| **Attribute Name** | **S** |
| sourceObjectInstance | M |
| notificationIdSet | M |

###### 11.2.2.1.3.6 MonitoredEntity

11.2.2.1.3.6.1 Definition

It represents classes that can have an alarmed state. The types of classes that can have alarmed state are:

a) All classes whose Notification Tables include alarm notifications.

b) VSE subclass of 3GPP defined classes and VSE defined classes that can have alarmed state.

The objectClass and objectInstance of this class identifies an instance of this class. The AlarmInformation uses this information in two places. In one place, the information is used to identify the instance that is in alarmed state. In another place, the information is used to identify an instance that can be used as the back up network resource for the instance that is in alarmed state.

11.2.2.1.3.6.2 Attribute

There is no attribute for this class.

##### 11.2.2.1.4 Information relationships definition

###### 11.2.2.1.4.1 relation-FSMnSProducer-AlarmList (M)

11.2.2.1.4.1.1 Definition

This represents the relationship between FSMnSProducer and AlarmList.

11.2.2.1.4.1.2 Role

There is no role defined for this relationship.

11.2.2.1.4.1.3 Constraint

There is no constraint for this relationship.

###### 11.2.2.1.4.2 relation-AlarmList-AlarmInformation (M)

11.2.2.1.4.2.1 Definition

This represents the relationship between AlarmList and AlarmInformation.

11.2.2.1.4.2.2 Role

|  |  |
| --- | --- |
| **Name** | **Definition** |
| identifyAlarmInformation | It represents a capability to obtain the information contained in AlarmInformation. |

11.2.2.1.4.2.3 Constraint

|  |  |
| --- | --- |
| **Name** | **Definition** |
| inv\_ hasAlarmInformation1 | No AlarmInformation playing the role of theAlarmInformation shall have its perceivedSeverity = "cleared" and its ackState = "acknowledged". |
| inv\_ hasAlarmInformation2 | The alarmId of all AlarmInformation instances playing the role of theAlarmInformation are distinct. |

###### 11.2.2.1.4.3 relation-AlarmInformation-Comment (M)

11.2.2.1.4.3.1 Definition

This represents the relationship between AlarmInformation and Comment.

11.2.2.1.4.3.2 Role

|  |  |
| --- | --- |
| **Name** | **Definition** |
| comment | It represents a capability to obtain the information contained in Comment. |

11.2.2.1.4.3.3 Constraint

There is no constraint.

###### 11.2.2.1.4.4 relation-AlarmInformation-CorrelatedNotification (M)

11.2.2.1.4.4.1 Definition

This represents the relationship between AlarmInformation and CorrelatedNotification.

11.2.2.1.4.4.2 Role

|  |  |
| --- | --- |
| **Name** | **Definition** |
| correlatedNotification | It represents a capability to obtain the information contained in CorrelatedNotification. |

11.2.1.4.4.3 Constraint

There is no constraint.

###### 11.2.2.1.4.5 relation-AlarmedObject-AlarmInformation (M)

11.2.2.1.4.5.1 Definition

This represents the relationship between MonitoredEntity and AlarmInformation.

11.2.2.1.4.5.2 Role

|  |  |
| --- | --- |
| **Name** | **Definition** |
| objectClass/objectInstance | It represents the capability to obtain the identification, in terms of objectClass and objectInstance, of alarmed network resource. |

11.2.2.1.4.5.3 Constraint

|  |  |
| --- | --- |
| **Name** | **Definition** |
| inv\_relation-AI-ME | All AlarmInformation involved in this relationship with the same MonitoredEntity shall have at least one different value in the following attributes: alarmType, probableCause and specificProblem. |

###### 11.2.2.1.4.6 relation-backUpObject-AlarmInformation (O)

11.2.2.1.4.6.1 Definition

The relationship represents the relationship between AlarmInformation and the backUpObject.

11.2.2.1.4.6.2 Role

|  |  |
| --- | --- |
| **Name** | **Definition** |
| backUpObject | It represents a capability to obtain the identification, in terms of objectClass and objectInstance, of the backUpObject. |

11.2.2.1.4.6.3 Constraint

|  |  |
| --- | --- |
| **Name** | **Definition** |
| inv\_identifyBackUpObject | This relationship is present if and only if the AlarmInformation.backedUpStatus attribute is present and is indicating true. |

##### 11.2.2.1.5 Information attribute definition

###### 11.2.2.1.5.1 Definition and legal values

| **Name** | **Definition** | **Legal Values** |
| --- | --- | --- |
| alarmId | It identifies one AlarmInformation in the AlarmList. |  |
| notificationId | It identifies the notification that carries the AlarmInformation. |  |
| alarmRaisedTime | It indicates the date and time when the alarm is first raised by the alarmed resource. | All values indicating valid date and time. |
| alarmChangedTime | It indicates the last date and time when the AlarmInformation is changed by the alarmed resource. Changes to AlarmInformation caused by invocations of the management service consumer would not change this date and time. | All values indicating valid date and time. |
| alarmClearedTime | It indicates the date and time when the alarm is cleared. | All values indicating valid date and time. |
| alarmType | It indicates the type of alarm.  Communications Alarm:  An alarm of this type is associated with the procedure and/or process required conveying information from one point to another (ITU-T Recommendation X.733 [4]).  Processing Error Alarm:  An alarm of this type is associated with a software or processing fault (ITU T Recommendation X.733 [4]).  Environmental Alarm:  An alarm of this type is associated with a condition related to an enclosure in which the equipment resides (ITU-T Recommendation X.733 [4]).  Quality of Service Alarm:  An alarm of this type is associated with degradation in the quality of a service (ITU T Recommendation X.733 [4]).  Equipment Alarm:  An alarm of this type is associated with an equipment fault (ITU-T Recommendation X.733 [4]).  Integrity Violation:  An indication that information may have been illegally modified, inserted or deleted.  Operational Violation:  An indication that the provision of the requested service was not possible due to the unavailability, malfunction or incorrect invocation of the service.  Physical Violation:  An indication that a physical resource has been violated in a way that suggests a security attack.  Security Service or Mechanism Violation:  An indication that a security attack has been detected by a security service or mechanism.  Time Domain Violation: An indication that an event has occurred at an unexpected or prohibited time. |  |
| probableCause | It qualifies alarm and provides further information than alarmType. Probable causes are ouside the scope of the present document. |  |
| specificProblem | It provides further refinement to the probableCause. This attribute value shall be single-valued and of simple type such as integer or string. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.2. | Provided by vendor. |
| perceivedSeverity | It indicates the relative level of urgency for operator attention. | Critical, Major, Minor, Warning, Indeterminate, Cleared: see ITU-T Recommendation X.733 [4]. The present document does not recommend the use of indeterminate. |
| backedUpStatus | It indicates if an object (the MonitoredEntity) has a back up. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.4. | All values that carry the semantics of backedUpStatus defined by ITU-T X.733 [4] clause 8.1.2.4. |
| trendIndication | It indicates if some observed condition is getting better, worse, or not changing. | "Less severe", "no change", "more severe": see definition in ITU-T Recommendation X.733 [4] clause 8.1.2.6. |
| thresholdInfo | It indicates the crossed threshold information such as:  - The identifier of the monitored attribute whose value has crossed a threshold,  - The threshold settings,  - The observed value that have crossed a threshold, etc.  See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.7. See also for information in TS 32.401 [19] clause 5.6. |  |
| stateChangeDefinition | It indicates attribute value changes associated with the alarm for state attributes of the monitored entity (state transitions). The change is reported with the name of the state attribute, the new value and an optional old value. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.10. |  |
| monitoredAttributes | It indicates attributes of the monitored entity and their values at the time the alarm occurred that are of interest for the alarm report. How these attributes are chosen is outside of the scope of the present document. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.11. |  |
| proposedRepairActions | Used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4] |  |
| additionalText | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]. | N/A |
| additionalInformation | This attribute when present allows the inclusion of a set of vendor specific alarm information in the alarm.  A specific condition for this optional population is when an alarm presented by the Management System (e.g. via the user interface) has different values of perceived severity, and / or alarm type, compared with the values presented to the Itf-N.  Any other uses of additional information on the alarm and its semantics are outside the scope of the present document | The additional information field is a list of one or more information parts.  The present document allows the support of two such information parts to carry  - vendor defined perceived severity  - vendor defined alarm type  using defined identification.  Other vendor specific information parts are allowed by using vendor specific identifications. |
| rootCauseIndicator | It indicates that this AlarmInformation is the root cause of the events captured by the notifications whose identifiers are in the related CorrelatedNotification instances. | boolean |
| ackTime | It identifies the time when the alarm has been acknowledged or unacknowledged the last time, i.e. it registers the time when ackState changes. | All values that indicate valid time that are later than that carried in alarmRaisedTime. |
| ackUserId | It identifies the last user who has changed the acknowledgement state. | It can be used to identify the human operator such as "John Smith" or it can identify a group, such as "Team Six", or it can contain no information such as "". |
| ackSystemId | It identifies the system that last changed the ackState of an alarm, i.e. acknowledged or unacknowledged the alarm. | It can be used to identify the system, such as "system 6" or it can contain no information such as "". |
| ackState | It identifies the acknowledgement state of an alarm. | Acknowledged: the alarm has been acknowledged.  Unacknowledged: the alarm has been unacknowledged or the alarm has never been acknowledged. |
| commentTime | It carries the time when the comment has been added to the alarm. |  |
| commentText | It carries the textual comment. |  |
| commentUserId | It carries the identification of the user who made the comment. |  |
| commentSystemId | It carries the identification of the system (Management System) from which the comment is made. That system supports the user that made the comment. |  |
| clearUserId | It carries the identity of the user who invokes the clearAlarms operation. | It can be used to identify the human operator such as "John Smith" or it can identify a group, such as "Team Six", or it can contain no information such as "". |
| clearSystemId | It carries the identity of the system in consuming the fault management service. That management service consumer supports the user who invokes the clearAlarms(). | It can be used to identify the system, such as "system 6" or it can contain no information such as "". |
| serviceUser | It identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm. | This attribute may carry no information if the server user is not identifiable. |
| serviceProvider | It identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm. |  |
| securityAlarmDetector | It carries the identity of the detector of the security alarm. | This attribute may carry no information if the security alarm detector is not identifiable. |
| sourceObjectInstance | It identifies one MonitoredEntity. | All values that carry the semantics of DN. |
| notificationIdSet | It carries one or more notification identifiers. |  |

###### 11.2.2.1.5.2 Constraints

|  |  |
| --- | --- |
| **Name** | **Definition** |
| inv\_alarmChangedTime | Time indicated shall be later than that carried in alarmRaisedTime. |
| inv\_alarmClearedTime | Time indicated shall be later than that carried in alarmRaisedTime. |
| inv\_ackTime | Time indicated shall be later than that carried in alarmRaisedTime. |
| inv\_notificationId | NotificationIds shall be chosen to be unique across all notifications of a particular Managed Object throughout the time that alarm correlation is significant. The algorithm by which alarm correlation is accomplished is outside the scope of the present document. |

#### 11.2.2.2 Subscription information, subscription state and Information Object Classes

##### 11.2.2.2.1 Imported information entities and local labels

None.

##### 11.2.2.2.2 Class Diagram

###### 11.2.2.2.2.1 Attributes and relationships

This clause depicts the set of Support IOCs that encapsulate information within the notification IRP. The intent is to identify the information required for the notification IRP implementation of its operations and notification emission. This clause provides the overview of all Support IOCs in UML. Subsequent clauses provide more detailed specification of various aspects of these Support IOCs.



###### 11.2.2.2.2.2 Inheritance

This clause depicts the inheritance relationships that exist between Support IOCs.



##### 11.2.2.2.3 Information object classes definition

###### 11.2.2.2.3.1 NtfSubscriber

11.2.2.2.3.1.1 Definition

This Support IOC represents a Subscriber from a notification perspective: a subscriber is fully identified by a management service consumer reference. A management service consumer using multiple management service consumer reference attributes to subscribe will result in multiple NtfSubscriber instances.

11.2.2.2.3.1.2 Attributes

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Support Qualifier | Read Qualifier | Write Qualifier |
| ntfConsumerReference | M | M | M |

###### 11.2.2.2.3.2 NtfSubscription

11.2.2.2.3.2.1 Definition

This Support IOC represents a subscription that has been requested by a management service consumer and created.

11.2.2.2.3.2.2 Attributes

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Support Qualifier | Read Qualifier | Write Qualifier |
| ntfSubscriptionId | M | M | - |
| ntfSubscriptionState | M | M | M |
| ntfTimeTick | M | M | M |
| ntfTimeTickTimer | M | - | - |
| ntfNotificationCategorySet | M | M | M |
| ntfFilter | M | M | M |

11.2.2.2.3.2.3 Void

###### 11.2.2.2.3.3 NotificationIRP

11.2.2.2.3.3.1 Definition

This Support IOC represents a notification IRP. It inherits from Support IOC ManagedGenericIRP.

##### 11.2.2.2.4 Information relationship definitions

###### 11.2.2.2.4.1 relation-ntfSubscriber-ntfSubscription (M)

11.2.2.2.4.1.1 Definition

This relationship defines the relationship between a NtfSubscriber and its current subscriptions.

11.2.2.2.4.1.2 Roles

|  |  |
| --- | --- |
| Name | Definition |
| theNtfSubscriber | This role represents the one who has subscribed. It can be played by instances of Support IOC NtfSubscriber |
| theNtfSubscription | This role represents the subscriptions which were made and not unsubscribed. It can be played by instances of Support IOC NtfSubscription |

11.2.2.2.4.1.3 Constraints

|  |  |
| --- | --- |
| Name | Definition |
| inv\_notificationCategoriesAllDistinct | The notification categories contained in the ntfNotificationCategorySet attribute of NtfSubscription playing the role theNtfSubscription are all distinct from each other. |

###### 11.2.2.2.4.2 relation-ntfIRP-ntfSubscriber (M)

11.2.2.2.4.2.1 Definition

This relationship defines the relationship between the NotificationIRP and the current subscribers of notifications.

11.2.2.2.4.2.2 Roles

|  |  |
| --- | --- |
| Name | Definition |
| theNtfSubscriber | This role represents the entities to which IRPAgent will notify events. It is played by instances of Support IOC NtfSubscriber |
| theNotificationIRP | This role represents the NotificationIRP to which an IRPManager has subscribed. It is played by instances of Support IOC NotificationIRP |

11.2.2.2.4.2.3 Constraints

|  |  |
| --- | --- |
| Name | Definition |
| inv\_uniqueManagerReference | All NtfSubscriber involved in the subscriptionRegistration relationship are distinguished from each other by their ntfManagerReference Attribute. |

##### 11.2.2.2.5 Information attribute definitions

###### 11.2.2.2.5.0 Introduction

This clause defines the semantics of the Attributes used in Support IOCs.

###### 11.2.2.2.5.1 Definitions and legal values

| Attribute Name | Definition | Legal Values |
| --- | --- | --- |
| ntfSubscriptionId | It identifies uniquely a subscription | N/A |
| ntfSubscriptionState | It indicates the activation state of a subscription | "suspended": the subscription is suspended  "notSuspended": the subscription is active |
| ntfTimeTick | This attribute represents the initial value of ntfTimeTickTimer. It is in unit of whole minute. This value defines a time window within which management service consumer intends to invoke getSubscriptionStatus (or subscribe) operation to confirm its subscription. A special value indicates infinity which is such that timer will never expire and management service producer needs other means to decide when to delete resources allocated to the management service consumer | Integer greater or equal to 15, OR special infinite value |
| ntfTimeTickTimer | This attribute represents the current value of a timer | integer greater or equal to zero |
| ntfNotificationCategorySet | This attribute represents a set of notification categories (see also Definition of notification category in clause 3.1) |  |
| ntfFilter | This attribute represents the filter of a subscription. The filter can be applied to parameters of notification header (see Notificationmaanagement service producer interface) and to parameters of notifications defined as filterable to  IManagement service producer shall notifymanagement service consumer if the event satisfies the filter constraint. |  |
| ntfConsumerReference | This attribute contains the reference of a consumer. It uniquely identifies a subscriber |  |

###### 11.2.2.2.5.2 Constraints

- "ntfTimeTickTimer is lower.

## 11.3 Performance assurance

### 11.3.1 Operations and notifications

#### 11.3.1.1 Void

#### 11.3.1.2 Void

#### 11.3.1.3 Notification notifyThresholdCrossing

##### 11.3.1.3.1 Definition

A MnS producer sends this notification to subscribed MnS consumers when a "ThresholdMonitor" (TS 28.622 [11]) on that MnS producer detects the threshold crossing of a monitored performance metric.

##### 11.3.1.3.2 Notification information

| **Parameter Name** | **S** | **Information Type** | **Comment** |
| --- | --- | --- | --- |
| objectClass | M | ManagedEntity.objectClass | Class of the managed object, where the threshold crossing occurred. |
| objectInstance | M | ManagedEntity.objectInstance | Instance of the managed object, where the threshold crossing occurred. |
| notificationId | M | -- |  |
| notificationType | M | "notifyThresholdCrossing" |  |
| eventTime | M | -- | Time when the threshold crossing occurred. |
| systemDN | M | MnSAgent.objectInstance |  |
| observedPerfMetricName | M | ThresholdMonitor.thresholdInfoList[11].\  performanceMetrics[y] | Name of the performance metric that has crossed the threshold. |
| observedPerfMetricValue | M | -- | Value of the performance metric, that has crossed the threshold, when the threshold crossing was observed |
| observedPerfMetricDirection | M | -- | Direction ("UP" or "DOWN") of the performance metric, when the threshold crossing was observed |
| thresholdValue | M | ThresholdMonitor.thresholdInfoList[11].\  thresholdvalue | Threshold value of the triggered threshold |
| hysteresis | O | ThresholdMonitor.thresholdInfoList[11].\  hysteresis | Hysteresis of the triggered threshold |
| monitorGranularityPeriod | M | ThresholdMonitor.monitorGranularityPeriod | Granularity period of the threshold monitor |
| additionalText | O | -- | Vendor specific information |

### 11.3.2 Managed information

#### 11.3.2.1 Performance data file

##### 11.3.2.1.1 Void

##### 11.3.2.1.2 Performance data file content description

Table 11.3.2.1.2-1 provides the content definition of a performance data file.

Table 11.3.2.1.2-1: Performance data file content description

| File content item | Description |
| --- | --- |
| measDataFile | Top-level tag indicating the file contains performance metrics. Each file includes a header ("measFileHeader"), a collection of information elements with produced performance metrics and associated meta data ("measData") and a footer ("measFileFooter"). |
| measFileHeader | File header including the file format version, information about the sending node (DN, type and vendor) and a time stamp indicating the begin of the first granularity period contained in the file ("collectionBeginTime"). |
| measData | Information element containing the DN of the common root of the measured object instances ("measObjRootDn ") included in that information element, followed by a list of information elements containing the produced performance metrics and associated meta data ("measInfo"). A "MeasDataFile" contains zero, one or more "measData" elements. |
| measFileFooter | File footer with a time stamp indicating the end of the last granularity period contained in the file ("collectionEndTime"). |
| fileFormatVersion | File format version applied by the sender as indicated by the specific format version identifier provided for each version. |
| senderName | DN of the entity, that generated and sent the file. The entity is either a managed element represented by a "ManagedElement" or a management node represented by a "ManagementNode" |
| senderType | Type of the entity, that generated and sent the file, as defined in TS 28.620 [y]. The type of a management node is "MANAGEMENT\_NODE". |
| vendorName | Vendor of the the entity, that generated and sent the file. |
| collectionBeginTime | Time stamp indicating the begin of the first granularity period for which performance metrics are stored in the file. |
| measObjRootDn | DN of the measured object root. The measured object root is the first common object name-containing all objects that the metrics in one "measData" element are related to. When the metrics are produced by a managed element, the root object is the "ManagedElement" representing this managed element. When (aggregated) metrics are produced by a management node (based on input metrics from managed elements), such as metrics for sub-networks or network slices, the root object is the root "SubNetwork" of this management node. |
| measObjRootUserLabel | User label of the measured object root. |
| measObjRootSwVersion | Software version of the measured object root, allowing post-processing systems to take care of vendor specific performance metrics. It is either the software version of a managed element or of a management node. |
| measInfo | Information element added to "measData" for each expired granularity period, containing information on the produced performance metrics, starting with a time stamp ("measTimeStamp"), the granularity period ("granularityPeriod") and reporting period ("reportingPeriod") that are associated to the following performance metrics ("measValues"), for which is indicated the performance metric name, the measured or computed performance metric value and the object instance to which the performance metric is related to. |
| measInfoId | Identifier of a "measInfo". |
| jobId | Job identifier of the related "PerfMetricJob" in this "measInfo". |
| reportingPeriod | Period used for performance metric reporting in this "measInfo". Unit is seconds |
| granularityPeriod | Period used for performance metric production in a "measInfo". Unit is seconds. |
| measTimeStamp | End time of the granularity period in a "measInfo". |
| measTypes | Performance metric names in a "measInfo" |
| measValues | Performance metric values in a "measInfo". Each item in this list includes the LDN of the object the metrics are related to ("measObjLdn"), the measured or computed values of the metrics ("measResults") and a flag that indicates whether the metrics are reliable ("suspectFlag"). |
| measObjLdn | Local distinguished name (LDN) of the object the performance metrics are related to (measured object) within the scope defined by the "measObjRootDn". The concatenation of the "measObjRootDn" and the "measObjLdn" is the DN of the measured object. The "measObjLdn" is therefore empty if the "measObjRootDn" already specifies completely the DN of the measured object, which is the case for metrics associated to "ManagedElement" or the root "SubNetwork".  For example, if the measured object is a "ManagedElement" representing RNC "RNC-Gbg-1", then the "measObjRootDn" may look like  "DC=a1.operatorNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1"  and the "measObjLdn" is empty. However, if the measured object is an "UtranCell" representing cell "Gbg-997" managed by that RNC, then the "measObjRootDn" is the same as above, i.e.  "DC=a1.companyNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1"  and the "measObjLdn" is  "RncFunction=RF-1,UtranCell=Gbg-997".  The class of the measured object is defined in item f) of measurement definitions (TS 32.404 [47], TS 28.552 [18]) and in item d) of KPI definitions (TS 28.554 [6]). |
| measResults | List of result values for the observed or computed performance metrics. The "measResults" sequence shall have the same number of elements and follow the same order as the "measTypes" sequence. The NULL value is reserved to indicate that the performance metric is not applicable or could not be produced for the object instance. |
| suspectFlag | Reliability of the performance metrics. FALSE means the metrics are reliable, TRUE means they are not reliable. The default value is "FALSE". |
| collectionEndTime | Time stamp indicating the end of the last granularity period for which performance metrics are stored in the file. |

The representation of all timestamps in PM files shall follow the representations allowed by the ISO 8601 [20].   
The precise format for timestamp representation shall be determined by the technology used for encoding the PM file (e.g. ASN.1, XML DTD, and XML Schema). The choice of technology should ensure that this representation is derived from ISO 8601 [20]. Based on the representation used, the timestamp shall refer to either UTC time or local time or local time with offset from UTC.

##### 11.3.2.1.3 Void

###### 11.3.2.1.3.1 Void

###### 11.3.2.1.3.2 Void

##### 11.3.2.1.4 Performance data file naming convention

This clause defines a rule that shall be applied for constructing names for files containing performance data.

<Type><Startdate>.<Starttime>-[<Enddate>.]<Endtime>[\_-<jobIdList>][\_<UniqueIdList>][\_-\_<RC>]

1) The "Type" field indicates if the file contains measurement results for single or multiple measured objects and/or granularity periods where:

- "A" means single measured object, single granularity period (this is used when granularity period is equal to reporting period);

- "B" indicates multiple measured objects, single granularity period (this is used when granularity period is equal to reporting period);

- "C" signifies single measured object, multiple granularity periods (this is used when reporting period is multiples of the granularity period and will contain multiple measurement reports);

- "D" stands for multiple measured objects, multiple granularity periods (this is used when reporting period is multiples of the granularity period and will contain multiple measurement reports).

2) The "Startdate" field indicates the date when the granularity period began if the "Type" field is set to A or B. If the "Type" field is either "C" or "D" then "Startdate" contains the date when the first granularity period of the measurement results contained in the file started. The "Startdate" field is of the form YYYYMMDD, where:

- YYYY is the year in four-digit notation;

- MM is the month in two digit notation (01 - 12);

- DD is the day in two-digit notation (01 - 31).

3) The "Starttime" field indicates the time when the granularity period began if the "Type" field is set to A or B. If the "Type" field is either "C" or "D" then "Starttime" contains the time when the first granularity period of the measurement results contained in the file began. The "Starttime" field is of the form HHMMshhmm, where:

- HH is the two-digit hour of the day (local time), based on 24-hour clock (00 - 23);

- MM is the two digit minute of the hour (local time), based on 60-minutes clock (00 - 59);

- s is the sign of the local time differential from UTC (+ or -), in case the time differential to UTC is 0 then the sign may be arbitrarily set to "+" or "-";

- hh is the two-digit number of hours of the local time differential from UTC (00-23);

- mm is the two digit number of minutes of the local time differential from UTC (00-59).

4) The "Enddate" field shall only be included if the "Type" field is set to "C" or "D", i.e. measurement results for multiple granularity periods are contained in the file. It identifies the date when the last granularity period of these measurements ended, and its structure corresponds to the "Startdate" field.

5) The "Endtime" field indicates the time when the granularity period ended if the "Type" field is set to A or B. If the "Type" field is either "C" or "D" then "Endtime" contains the time when the last granularity period of the measurement results contained in the file ended. Its structure corresponds to the "Starttime" field.

6) The "UniqueIdList" field indicates the DNs of the measured objects.

7) The "RC" field is a running count, starting with the value of "1", and shall be appended only if the filename is otherwise not unique, i.e. more than one file is generated and all other parameters of the file name are identical. Therefore it may only be used by the EM, since the described situation cannot occur with NE generated files. Note that the delimiter for this field, \_-\_, is an underscore character (\_), followed by a minus character (-), followed by an underscore character (\_).

8) The "jobIdList" indicates the measurement job id(s) that the performance data file is associated with.

Some examples describing file-naming convention:

1) file name: A20000626.2315+0200-2330+0200\_gNBId,   
meaning: file produced for gNB <gNBId> on June 26, 2000, granularity period 15 minutes from 23:15 local to 23:30 local, with a time differential of +2 hours against UTC.

2) file name: B20021224.1700-1130-1705-1130\_-job10\_S-NSSAI,  
meaning: file containing results for multiple measured objects, generated for measurement job job10, produced for NSI <S-NSSAI> on December 24, 2002, granularity period 5 minutes from 17:00 local to 17:05 local, with a time differential of –11:30 hours against UTC.

3) file name: D20050907.1030+0000-20050909.1500+0000\_SubnetworkId\_-\_2,  
meaning: file containing results subnetwork <SubnetworkId>, start of first granularity period 07 September 2005, 10:30 local, end of last granularity period 09 September 2005, 15:00 local, with a time differential of 0 against UTC. This is the second file for this subnetwork/granularity period combination.

4) file name: C20050907.1030+0000-20050909.1500+0000\_gNBId,  
meaning: file produced for the gNB <gNBId>, start of first granularity period 07 September 2005, 10:30 local, end of last granularity period 09 September 2005, 15:00 local, with a time differential of 0 against UTC.

#### 11.3.2.1.4 Void

## 11.4 Heartbeat

### 11.4.1 Operations and notifications

#### 11.4.1.1 Notification notifyHeartbeat

##### 11.4.1.1.1 Definition

This notification notifies the subscribed consumer(s) that the MnS producer heartbeat period has expired or that a MnS consumer requested the emission of an immediate heartbeat notification.

The emission of heartbeat notifications is controlled by the HeartbeatControl IOC (TS 28.622 [11]).

##### 11.4.1.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | S | Information Type / Legal Values | Comment |
| objectClass | M | HeartbeatControl.objectClass |  |
| objectInstance | M | HeartbeatControl.objectInstance | Instance controlling the emission of this notifyHeartbeat notification. |
| notificationId | M | -- |  |
| notificationType | M | "notifyHeartbeat" |  |
| eventTime | M | -- | Time at which the notification is emitted.  The semantics of Generalised Time specified by RFC 3339 [52] shall be used here. |
| systemDN | M | -- |  |
| heartbeatNtfPeriod | M | HeartbeatControl.heartbeatNtfPeriod |  |

##### 11.4.1.1.3 Triggering event

###### 11.4.1.1.3.1 From-state

stateBeforeHeartbeatNotification1 OR stateBeforeHeartbeatNotification2.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateBeforeHeartbeatNotification1 | The internal countdown timer of the MOI emitting the notifyHeartbeat notification has reached the value ‘0’ (zero). |
| stateBeforeHeartbeatNotification2 | The value of the attribute triggerHeartbeatNtf of the MOI emitting the notifyHeartbeat notification is TRUE. |

###### 11.4.1.1.3.2 To-state

stateAfterOHeartbeatNotification1 OR stateAfterOHeartbeatNotification2.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| stateAfterHeartbeatNotification1 | If From-state is stateBeforeHeartbeatNotification1 then:  the internal countdown timer of the MOI is reset to the value of its heartbeatNtfPeriod attribute. |
| stateAfterHeartbeatNotification2 | If From-state is stateBeforeHeartbeatNotification2 then:  the value of the internal countdown timer of the MOI is not affected. |

## 11.5 Streaming data reporting service

### 11.5.1 Operations and notifications

#### 11.5.1.1 establishStreamingConnection operation (M)

##### 11.5.1.1.1 Definition

This operation enables the MnS producer to establish a connection to the MnS consumer (i.e. streaming target). The connection establishement includes the exchange of meta-data (producer informs consumer about its own identity and the nature of the data to be reported via streaming) phase and the actual connection (a data pipe for streaming) establishment.

Established connection supports stream multiplexing (one connection supports one or more reporting streams simultaneously).

Upon successful connection establishment, the MnS consumer is aware of the MnS producer's identity, the list of reporting streams and the nature of data being reported on each of the streams.

The established connection may be kept "alive" either by built-in functionality of the solution set or by periodic reporting of empty stream data.

##### 11.5.1.1.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| producerId | M | The identity of the producer requesting the connection establishment. | DN of the MnS producer. If the MnS producer is not modeled as 3GPP NRM MOI, an alternative identifer other than DN may be used. |
| streamInfoList | M | List of StreamInfo | This parameter contains the list of meta-data about each reporting stream.  For streaming trace reporting each StreamInfo includes:  - StreamType carrying the value "TRACE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;  - TraceJob (see clause 4.3.30 of TS 28.622 [11]) providing the details about the configuration of the trace job for which the data is being reported.  For streaming performance data reporting each StreamInfo includes:  - StreamType carrying the value "PERFORMANCE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - measObjDn: the DN of the measured object instance;  - performanceMetrics: a list of performance metric names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI;  - either:  - jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;  - or:  - jobId globally unique identifier of a measurement job (see TS 28.550 [42]).  For streaming analytics reporting each StreamInfo includes:  - StreamType carrying the value "ANALYTICS";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - AnalyticsInfo providing the details about the analytics activity for which the data is being reported.  For proprietary data streaming reporting each StreamInfo includes:  - StreamType carrying the value "PROPRIETARY";  - streamId globally unique stream identifier;  - VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported. |

##### 11.5.1.1.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| connectionId | M | Identifier of the established streaming connection. | It identifies the established streaming connection. The format may have dependency on the solution set. |
| status | M | ENUM (Success, Failure) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.1.4 Exceptions

| Exception Name | Definition |
| --- | --- |
| unexpectedStreams | **Condition:** Some information in the list of streamInfo was unexpected by the MnS consumer.  **Returned Information:** Name of the exception; status is set to "Failure". |

#### 11.5.1.2 terminateStreamingConnection operation (M)

##### 11.5.1.2.1 Definition

This operation enables the MnS producer to terminate the connection to theMnS consumer (i.e. streaming target).

Upon successful termination of the streaming connection, the MnS producer stops reporting data to the MnS consumer on this connection.

##### 11.5.1.2.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| connectionId | M | See clause 11.5.1.1.3 | It identifies the streaming connection being terminated. The format may have dependency on the solution set. |

##### 11.5.1.2.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| status | M | ENUM (Success, Failure) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.2.4 Exceptions

| Exception Name | Definition |
| --- | --- |
| unknownConnection | **Condition:** the connectionId is invalid.  **Returned Information:** Name of the exception; status is set to "Failure". |

#### 11.5.1.3 reportStreamData operation (M)

##### 11.5.1.3.1 Definition

This operation enables the MnS producer to send a unit of streaming data to the MnS consumer.

##### 11.5.1.3.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| connectionId | M | See clause 11.5.1.1.3 | It identifies the streaming connection on which the reported data are being sent. The format may have dependency on the solution set. |
| streamingData | M | Unit of streaming data | This parameter contains the actual data (payload) being reported via stream.  For streaming trace reporting each streamingData is encoded according to the format specified in the clause 5 of TS 32.423 [39].  For streaming performance data reporting each streamingData is encoded according to the format specified in the Annex C of TS 28.550 [42].  For proprietary data streaming reporting each streamingData is encoded according to the format specified in the product documentation. |

##### 11.5.1.3.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| status | M | ENUM (Success, Failure) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.3.4 Exceptions

| Exception Name | Definition |
| --- | --- |
|  |  |

#### 11.5.1.4 addStream operation (M)

##### 11.5.1.4.1 Definition

This operation allows the MnS producer to add one or more reporting streams to an already established streaming connection.

##### 11.5.1.4.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| connectionId | M | See clause 11.5.1.1.3 | It identifies the streaming connection to which new reporting streams are being added. The format may have dependency on the solution set. |
| streamInfoList | M | List of StreamInfo | This parameter contains the list of meta-data about each reporting stream being added to the already established connection.  For streaming trace reporting each StreamInfo includes:  - StreamType carrying the value "TRACE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;  - TraceJob (see clause 4.3.30 of TS 28.622 [11]) providing the details about the configuration of the trace job for which the data is being reported.  For streaming performance data reporting each StreamInfo includes:  - StreamType carrying the value "PERFORMANCE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - measObjDn: the DN of the measured object instance;  - performanceMetrics: a list of performance metric (i.e. measurement or KPI) names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream;  - either:  - jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;  - or:  - jobId globally unique identifier of a measurement job (see TS 28.550 [42]).  For streaming analytics reporting each StreamInfo includes:  - StreamType carrying the value "ANALYTICS";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - AnalyticsInfo providing the details about the analytics activity for which the data is being reported.  For proprietary data streaming reporting each StreamInfo includes:  - StreamType carrying the value "PROPRIETARY";  - streamId globally unique stream identifier;  - VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported. |

##### 11.5.1.4.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| streamInfoList | M | List of StreamInfo | This parameter contains the list of meta-data about each reporting stream that has been successfully added as a result of this operation.  For streaming trace reporting each StreamInfo includes:  - StreamType carrying the value "TRACE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;  - TraceJob (see clause 4.3.30 of TS 28.622 [11]) providing the details about the configuration of the trace job for which the data is being reported.  For streaming performance data reporting each StreamInfo includes:  - StreamType carrying the value "PERFORMANCE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - measObjDn: the DN of the measured object instance;  - performanceMetrics: a list of performance metric names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI;  - either:  - jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;  - or:  - jobId globally unique identifier of a measurement job (see TS 28.550 [42]).  For streaming analytics reporting each StreamInfo includes:  - StreamType carrying the value "ANALYTICS";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - AnalyticsInfo providing the details about the analytics activity for which the data is being reported.  For proprietary data streaming reporting each StreamInfo includes:  - StreamType carrying the value "PROPRIETARY";  - streamId globally unique stream identifier;  - VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported. |
| status | M | ENUM (Success, Failure, PartialSuccess) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.4.4 Exceptions

| Exception Name | Definition |
| --- | --- |
| duplicateStream | **Condition:** One or more of stream identifiers in the streamInfoList already exist on this connection.  **Returned Information:** Name of the exception; status is set to "Failure" or "PartialSuccess". |
| unexpectedStreams | **Condition:** Some information in the list of streamInfo was unexpected by the MnS consumer.  **Returned Information:** Name of the exception; status is set to "Failure". |
| unknownConnection | **Condition:** the connectionId is invalid.  **Returned Information:** Name of the exception; status is set to "Failure". |

#### 11.5.1.5 deleteStream operation (M)

##### 11.5.1.5.1 Definition

This operation allows the MnS producer to remove one or more reporting streams from an already established streaming connection.

##### 11.5.1.5.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| connectionId | M | See clause 11.5.1.1.3 | It identifies the streaming connection from which the reporting streams are being removed. The format may have dependency on the solution set. |
| streamIdList | M | List of stream identifiers | This parameter contains the list of identifiers for streams being removed from the already established connection.  For streaming trace reporting Trace Reference (see clause 5.6 of TS 32.422 [38]) is used as stream identifier.  For streaming performance data reporting streamId globally unique stream identifier.  For streaming analytics reporting streamId globally unique stream identifier.  For proprietary data streaming reporting streamId globally unique stream identifier. |

##### 11.5.1.5.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| status | M | ENUM (Success, Failure, PartialSuccess) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.5.4 Exceptions

| Exception Name | Definition |
| --- | --- |
| unknownStreamId | **Condition:** One or more of stream identifiers in the streamIdList does not exist on this connection.  **Returned Information:** Name of the exception; status is set to "Failure" or "PartialSuccess". |
| unknownConnection | **Condition:** the connectionId is invalid.  **Returned Information:** Name of the exception; status is set to "Failure". |

#### 11.5.1.6 getConnectionInfo operation (M)

##### 11.5.1.6.1 Definition

This operation enables the MnS producer to obtain information about one or more streaming connections from the MnS consumer.

##### 11.5.1.6.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| connectionIdList | M | List of streaming connection identifiers | This parameter contains the list of streaming connection identifiers for which the stream information is to be returned.  The empty list indicates the stream information for all connections are to be returned. |

##### 11.5.1.6.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| connectionInfoList | M | List of <connectionId, streamReporter, streamIdList> tuples | This parameter contains the list of meta-data about each streaming connection requested by this operation. Each entry in this list is a tuple of connectionId, streamReporter and streamIdList.  For streaming trace reporting:  - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;  - streamIdList is the list of Trace References (see clause 5.6 of TS 32.422 [38]) used as stream identifiers.  For streaming performance data reporting:  - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;  - streamIdList is the list of streamId globally unique stream identifiers.  For streaming analytics reporting:  - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;  - streamIdList is the list of streamId globally unique stream identifiers.  For streaming proprietary data reporting:  - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;  - streamIdList is the list of streamId globally unique stream identifiers. |
| status | M | ENUM (Success, Failure, PartialSuccess) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.6.4 Exceptions

| Exception Name | Definition |
| --- | --- |
| unknownConnectionId | **Condition:** One or more of connection identifiers in the connectionIdList is not known to this MnS consumer.  **Returned Information:** Name of the exception; status is set to "Failure" or "PartialSuccess". |

#### 11.5.1.7 getStreamInfo operation (M)

##### 11.5.1.7.1 Definition

This operation enables theMnS producer to obtain information about one or more reporting streams the MnS consumer.

##### 11.5.1.7.2 Input parameters

| Parameter Name | S | Information type | Comment |
| --- | --- | --- | --- |
| streamIdList | M | List of stream identifiers | This parameter contains the list of stream identifiers for which the stream information is to be returned.  The empty list indicates the stream information for all streams are to be returned.  For streaming trace reporting Trace Reference (see clause 5.6 of TS 32.422 [38]) is used as stream identifier.  For streaming performance data reporting streamId globally unique stream identifier.  For streaming analytics reporting streamId globally unique stream identifier.  For proprietary data streaming reporting streamId globally unique stream identifier. |

##### 11.5.1.7.3 Output parameters

| Parameter Name | S | Matching Information | Comment |
| --- | --- | --- | --- |
| streamInfoSumList | M | List of <StreamInfo, StreamReporters> tuples | This parameter contains the list of meta-data about each reporting stream requested by this operation. Each entry in this list is a tuple of StreamInfo and StreamReporters.  For streaming trace reporting each StreamInfo includes:  - StreamType carrying the value "TRACE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;  - TraceJob (see clause 4.3.30 of TS 28.622 [11]) providing the details about the configuration of the trace job for which the data is being reported.  For streaming trace the StreamReporters is a list of the identities of the streaming data reporting MnS producer(s) reporting data for this Trace Reference to this MnS consumer.  For streaming PM reporting each StreamInfo includes:  - StreamType carrying the value "PERFORMANCE";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - measObjDn: the DN of the measured object instance;  - performanceMetrics: a list of performance metric names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI;  - either:  - jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;  - or:  - jobId globally unique identifier of a measurement job (see TS 28.550 [42]).  For streaming performance data the StreamReporters is a list of the identities of the streaming data reporting MnS producer(s) reporting data for this streamId to this MnS consumer.  For streaming analytics reporting each StreamInfo includes:  - StreamType carrying the value "ANALYTICS";  - SerializationFormat carrying the value "GPB" or "ASN1";  - streamId globally unique stream identifier;  - AnalyticsInfo providing the details about the analytics activity for which the data is being reported.  For streaming analytics the StreamReporters is a list of the identities of the streaming data reporting MnS producer(s) reporting data for this streamId to this MnS consumer.  For proprietary data streaming reporting each StreamInfo includes:  - StreamType carrying the value "PROPRIETARY";  - streamId globally unique stream identifier;  - VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported.  For proprietary data streaming the StreamReporters is a list of the identities of the streaming data reporting MnS producer(s) reporting data for this streamId to this MnS consumer. |
| status | M | ENUM (Success, Failure, PartialSuccess) | An operation may fail because of a specified or unspecified reason. |

##### 11.5.1.7.4 Exceptions

| Exception Name | Definition |
| --- | --- |
| unknownStreamId | **Condition:** One or more of stream identifiers in the streamIdList is not known to this MnS consumer.  **Returned Information:** Name of the exception; status is set to "Failure" or "PartialSuccess". |

## 11.6 File data reporting service

### 11.6.1 Operations and notifications

#### 11.6.1.1 Notification notifyFileReady

##### 11.6.1.1.1 Definition

A MnS producer sends this notification to subscribed MnS consumers when a new file becomes ready (available) on the MnS producer for upload by MnS consumers. The "fileInfoList" parameter provides information (meta data) about the new file and optionally, in addition to that, information about all other files, which became ready for upload earlier and are still available for upload when the notification is sent.

The "objectClass" and "objectInstance" parameters of the notification header identify the object representing the function (process) making the file available for retrieval, such as the "PerfMetricJob" or the "TraceJob" defined in TS 28.622 [11]. When no dedicated object is standardized or instantiated, the "ManagedElement", where the file is processed, shall be used. For the case that the file is processed on a mangement node, the "ManagementNode", where the file is processed, shall be used instead.

##### 11.6.1.1.2 Input parameters

| Parameter Name | S | Information Type | Comment |
| --- | --- | --- | --- |
| objectClass | M | Entity.objectClass | See clause 11.6.1.1.1 for the definition of Entity |
| objectInstance | M | Entity.objectInstance | See clause 11.6.1.1.1 for the definition of Entity |
| notificationId | M | -- |  |
| notificationType | M | "notifyFileReady" |  |
| eventTime | M | -- | Time when the file, that triggered this notification, was ready for upload. |
| systemDN | M |  |  |
| fileInfoList | M | List of struct  <  fileLocation (M),  fileCompression (M),  fileSize (O),  fileDataType (M),  fileFormat (M),  fileReadyTime (O),  fileExpirationTime (O),  …jobId (CO)  >  Each element is defined as following:  - "fileLocation": Location of the file. The location may be a directory path or a URL, for example  "\\202.112.101.1\D:\user\Files\<xxx>", or  "ftp://nms.telecom\_org.com/datastore/<xxx>,  where <xxx> is the filename.  - "fileCompression": Name of the algorithm used for compressing the file. An empty or absent "fileCompression" parameter indicates the file is not compressed. The MnS producer selects the compression algorithm. It is encouraged to use popular algorithms such as GZIP.  - "fileSize": Size of the file. Its value is a non negative integer. The unit is byte.  - "fileDataType": Type of the management data stored in the file. Allowed values are:  - "PERFORMANCE"  - "TRACE"  - "ANALYTICS"  - "PROPRIETARY"  The value "PERFORMANCE" refers to measurements and KPIs.  - "fileFormat": Identifier of the XML or ASN.1 schema (incl. its version) used to produce the file content.  - "fileReadyTime": Date and time when the file was closed (the last time) and made available on the MnS producer. The file content will not be changed anymore.  - "fileExpirationTime": Date and time after which the file may be deleted. It shall not be empty and shall be later than "fileReadyTime".  - "jobId": Job identifier of the "PerfMetricJob" (TS 28.622 [11]) or "TraceJob" (TS 28.622 [11]) that produced the file. This parameter should be present, when the file is related to a job and that job is represented by a "PerfMetricJob" or "TraceJob". Multiple jobs may share the same job identifier. This may for example be the case for jobs collecting measurements to compuate a KPI or for jobs related to a specific task in some analytics application. Note that a specific job is identified by the objectClass/objectInstance parameters of the notification header. | Information (meta data) about the new file, that became ready for upload and triggered this notification, and information about files, which became ready for upload earlier and are still available for upload when the notification is sent. |
| additionalText | O | -- | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] |

#### 11.6.1.2 Notification notifyFilePreparationError

##### 11.6.1.2.1 Definition

A MnS producer sends this notification to subscribed MnS consumers when an error occurs while preparing a file. For many error reasons, such as low memory or hard disk full, it is very likely that all ongoing file preparation processes fail at the same time. For that reason, it is possible to report with this notification that multiple file preparation processes failed.

In case the MnS producer keeps the file, where an error occurred during preparation, the "fileInfoList" parameter contains a list item with information about that file, otherwise, if the file is deleted or not created at all, the "fileInfoList" parameter has no list item related to that file.

##### 11.6.1.2.2 Input parameters

| Parameter Name | S | Information Type | Comment |
| --- | --- | --- | --- |
| objectClass | M | Entity.objectClass. | See clause 11.6.1.1.1 for the definition of Entity |
| objectInstance | M | Entity.objectInstance | See clause 11.6.1.1.1 for the definition of Entity. |
| notificationId | M | -- | See Table 11.6.1.1.2-1. |
| notificationType | M | "notifyFilePreparationError" |  |
| eventTime | M | -- | Time when the file preparation error occured |
| systemDN | M |  |  |
| fileInfoList | M | See Table 11.6.1.1.2-1. | Each list item contains information about a file where a file preparation error occurred and that is kept on the MnS producer. Files, that are deleting or not created at all, have no list item. |
| reason | M | -- | Detailed error reason, including  - errorInPreparation  - hardDiskFull  - hardDiskFailure  - tooManyFiles  - collectionTimeOut  - incompleteTruncatedFile  - corruptedFile  - lowMemory  - dataNotAvailable |
| additionalText | O | -- | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] |

#### 11.6.1.3 Operation subscribe

##### 11.6.1.3.1 Definition

This operation allows a MnS consumer to subscribe to the notifications of the file data reporting service producer.

##### 11.6.1.3.2 Input parameters

| Parameter Name | S | Information Type | Comment |
| --- | --- | --- | --- |
| consumerReference | M | Reference (address) of the MnS consumer to which the notifications shall be sent. |  |
| timeTick | O | Initial value of a timer held by the MnS producer. This value defines the time window within which the MnS consumer intends to invoke the "subscribe" operation again to confirm its subscription. The value "0" shall indicate infinity. In this case the subscription is not terminated by the MnS producer.  Unit is minutes |  |
| filter | O | Filter constraint that the MnS producer shall use to filter notifications. The filter can be applied to all parameters of a notification  The filter constraint grammar is solution set dependent |  |

##### 11.6.1.3.3 Output parameters

| **Parameter Name** | **S** | **Matching Information** | **Comment** |
| --- | --- | --- | --- |
| subscriptionId | M | Unambiguous identity of this subscription. |  |
| status | M | ENUM (OperationSucceeded, OperationFailedExistingSubscription, OperationFailed) | If subscription is successfully created, status = OperationSuceeded.  If subscription is not created because it is duplicated or conflict with existing subscription(s), status = OperationFailedExistingSubscription  If the operation is failed for any other reason than being duplicated or conflict with existing subscription(s), status = OperationFailed. |

##### 11.6.1.3.4 Exceptions

|  |  |
| --- | --- |
| **Name** | **Definition** |
| operation\_failed\_existing\_subscription | **Condition:** The subscription is duplicated or conflict with existing subscription(s)  **Returned Information:** The output parameter status |
| operation\_failed | **Condition:** The operation failed for any other reason than being duplicated or conflict with subscription(s)  **Returned Information:** The output parameter status |

#### 11.6.1.4 Operation unsubscribe

##### 11.6.1.4.1 Definition

This operation allows a MnS consumer to cancel subscription(s) at a MnS producer.

A MnS consumer can cancel one subscription made with a "consumerReference" by providing the corresponding "subscriptionId" or all subscriptions made with the same "consumerReference" by leaving the "subscriptionId" parameter absent.

##### 11.6.1.4.2 Input parameters

| **Parameter Name** | **S** | **Information Type** | **Comment** |
| --- | --- | --- | --- |
| consumerReference | M | Reference of the MnS consumer whose subscriptions are to be cancelled. | The format of the reference may have dependency on the solution set. |
| subscriptionId | O | Subscription id returned in the subscribe operation response | If this parameter is absent, all subscriptions made with the same "consumerReference" shall be cancelled. |

##### 11.6.1.4.3 Output parameters

| **Parameter Name** | **S** | **Matching Information** | **Comment** |
| --- | --- | --- | --- |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If subscription(s) as identified in the input parameter are cancelled, status = OperationSucceeded.  If the operation is failed, status = OperationFailed. |

##### 11.6.1.4.4 Exceptions

|  |  |
| --- | --- |
| **Name** | **Definition** |
| operation\_failed | **Condition:** the operation is failed  **Returned Information:** The output parameter status |

#### 11.6.1.5 Operation listAvailableFiles

##### 11.6.1.5.1 Definition

This operation allows a MnS consumer to retrieve a list of files available for upload on a MnS producer. The request message contains the file data type of the files, that shall be listed in the response. In addition to that it is possible to specify that only files shall be included in the response whose file ready time falls into a specific time window defined by the "beginTime" and "endTime" input parameters.

##### 11.6.1.5.2 Input parameters

| **Parameter Name** | **S** | **Information type** | **Comment** |
| --- | --- | --- | --- |
| fileDataType | M | It specifies the type of the management data stored in the file. | For performance data (including measurement data and KPI) files, the value is assigned to "PERFORMANCE".  For trace data files, the value is assigned to "TRACE".  For analytic data files, the value is assigned to "ANALYTICS".  For proprietary data files, the value is assigned to "PROPRIETARY". |
| beginTime | M | The consumer requests to list information about the available file(s) whose ready time(s) are later or equal to this time.  This parameter is expressed in UTC time. | This parameter indicates date and time.  If this parameter is empty or absent, no restriction on begin time is applied on the file ready time. |
| endTime | M | The consumer requests to list information about the available file(s) whose ready time(s) are earlier than this time.  This parameter is expressed in UTC time. | This parameter indicates date and time.  If this parameter is empty or absent, no restriction on end time is applied on the file ready time. |

##### 11.6.1.5.3 Output parameters

| **Parameter Name** | **S** | **Matching Information** | **Comment** |
| --- | --- | --- | --- |
| fileInfoList | M | See "fileInfoList" defined in notifyFileReady notification (clause 11.6.1.1.1) |  |
| status | M | ENUM (Success, Failure) |  |

##### 11.6.1.5.4 Exceptions

| **Exception Name** | **Definition** |
| --- | --- |
| invalidTimes | **Condition:** Either "beginTime" or "endTime" is invalid.  **Returned information:** output parameter status is set to Failure. |

### 11.6.2 File transfer protocols

The MnS producer shall support at least one of the following file transfer protocols:

- SFTP;

- FTPES,

- HTTPS.

The MnS producer shall always act as the server while the MnS consumer shall always act as the initiator (client) of file transfer actions.

# 12 Management services – Stage 3

## 12.1 Generic provisioning management service

### 12.1.1 RESTful HTTP-based solution set

#### 12.1.1.1 Mapping of operations

##### 12.1.1.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 12.1.1.1.1-1.

Table 12.1.1.1.1-1: Mapping of IS operations to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation** | **HTTP Method** | **Resource URI** | **S** |
| createMOI | PUT | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{className}={id} | M |
| getMOIAttributes | GET | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{className}={id} | M |
| modifyMOIAttributes | PUT  PATCH | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{className}={id} | M |
| deleteMOI | DELETE | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{className}={id} | M |

##### 12.1.1.1.2 Operation createMOI

This operation creates a single resource representing a managed object instance.

Table 12.1.1.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP PUT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| managedObjectClass  managedObjectInstance | path | …/{className}={id} | className: string  id: string | M |
| attributeListIn | request body | n/a | Resource | M |

Note 1: Void.

Table 12.1.1.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP PUT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| attributeListOut | response body | n/a | Resource | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

Further details on creating a resource with HTTP PUT are provided in TS 32.158 [15], clause 5.1.2.

##### 12.1.1.1.3 Operation getMOIAttributes

This operation retrieves one or multiple resources representing managed object instances.

Table 12.1.1.1.3-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| baseObjectInstance | path | /{className}={id} | className: string  id: string | M |
| scope | query | scope | Scope  style: form  explode: true | O |
| filter | query | filter | Filter | O |
| attributeListIn | query | attributes | array(string)  style: form  explode: false | O |
| fields | array(string)  style: form  explode: false | O |

Note 1: Void.

Note 2: Void.

Table 12.1.1.1.3-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| attributeListOut | response body | n/a | Resource or  array(Resource) | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

Further details on reading resources with HTTP GET are provided in TS 32.158 [15], clause 5.2.

Further details on the SS parameters "scope" and "filter" are provided in TS 32.158 [15], clause 6.1.

Further details on the SS parameters "attributes" and "fields" are provided in TS 32.158 [15], clause 6.2.

##### 12.1.1.1.4 Operation modifyMOIAttributes

###### 12.1.1.1.4.1 Mapping to HTTP PUT

HTTP PUT is used for a full update of a single resource.

Table 12.1.1.1.4.1-1: Mapping of IS operation input parameters to SS equivalents (HTTP PUT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| baseObjectInstance | path | /{className}={id} | className: string  id: string | M |
| scope | n/a | n/a | n/a | n/a |
| filter | n/a | n/a | n/a | n/a |
| modificationList | request body | n/a | Resource | M |

The IS parameters "scope" and "filter" have no meaning when targeting a single resource with the target URI and are not mapped.

Table 12.1.1.1.4.1-2: Mapping of IS operation output parameters to SS equivalents (HTTP PUT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| attributeListOut | response body | n/a | Resource | O |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

Further details on updating a resource with HTTP PUT are provided in TS 32.158 [15], clause 5.3.

###### 12.1.1.1.4.2 Mapping to HTTP PATCH

HTTP PATCH is used to create, update or delete one or multiple resources.

Table 12.1.1.1.4.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| baseObjectInstance | path | …/{className}={id} | className: string  id: string | M |
| scope | n/a | n/a | n/a | n/a |
| filter | n/a | n/a | n/a | n/a |
| modificationList | request body | n/a | Resource, or  array(PatchItem) | M |

Four patch media types are available for the request message body. They are listed below together with their request body data types:

- "application/merge-patch+json" (RFC 7396 [37]), request body type: Resource

- "application/vnd.3gpp.merge-patch+json" (TS 32.158 [15]), request body type: Resource

- "application/json-patch+json" (RFC 6902 [36]), request body type: array(PatchItem)

- "application/vnd.3gpp.json-patch+json" (TS 32.158 [15]), request body type: array(PatchItem)

If the MnS producer cannot honor a patch request for some reason, such as malformed requests or unsupported patch operations, an error response with an appropriate error response code such as "400 Bad Request" shall be returned.

The patch operations "copy" and "move" have no corresponding definition in stage 2. Support for these operations is optional.

The IS parameters "scope" and "filter" have no SS equivalents in the present document.

Table 12.1.1.1.4.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| attributeListOut | response body | n/a | Resource | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

Further details on updating resources with HTTP PATCH and JSON Merge Patch are provided in TS 32.158 [15], clause 6.3.2.

Further details on updating resources with HTTP PATCH and 3GPP JSON Merge Patch are provided in TS 32.158 [15], clause 6.4.2.

Further details on updating resources with HTTP PATCH and JSON Patch are provided in TS 32.158 [15], clause 6.3.3.

Further details on updating resources with HTTP PATCH and 3GPP JSON Patch are provided in TS 32.158 [15], clause 6.4.3.

Note 1: Void.

##### 12.1.1.1.5 Operation deleteMOI

This operation deletes a single resource representing a managed object instance

Table 12.1.1.1.5-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| baseObjectInstance | path | /{className}={id} | className: string  id: string | M |
| scope | n/a | n/a | n/a | n/a |
| filter | n/a | n/a | n/a | n/a |

Note 1: Void.

Note 2: Void.

Table 12.1.1.1.5-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| deletionlist | n/a | n/a | n/a | n/a |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

Further details on deleting a resource with HTTP DELETE are provided in TS 32.158 [15], clause 5.4.

##### 12.1.1.1.6 Void

##### 12.1.1.1.7 Void

#### 12.1.1.2 Mapping of notifications

##### 12.1.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.1.1.2.1-1.

**Table 12.1.1.2.1-1: Mapping of IS notifications to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| **IS notification** | **HTTP Method** | **Resource URI** | **S** |
| notifyMOICreation | POST | {notificationTarget} | M |
| notifyMOIDeletion | POST | {notificationTarget} | M |
| notifyMOIAttributeValueChanges | POST | {notificationTarget} | M |
| notifyMOIChanges | POST | {notificationTarget} | M |

##### 12.1.1.2.2 Notification notifyMOICreation

The IS notification parameters are mapped to SS equivalents according to table 12.1.1.2.2-1.

Table 12.1.1.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| additionalText | request body | additionalText | AdditionalText | O |
| sourceIndicator | request body | sourceIndicator | SourceIndicator | O |
| attributeList | request body | attributeList | AttributeNameValuePairSet | O |

##### 12.1.1.2.3 Notification notifyMOIDeletion

The IS notification parameters are mapped to SS equivalents according to table 12.1.1.2.3-1.

Table 12.1.1.2.3-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| additionalText | request body | additionalText | AdditionalText | O |
| sourceIndicator | request body | sourceIndicator | SourceIndicator | O |
| attributeList | request body | attributeList | AttributeNameValuePairSet | O |

##### 12.1.1.2.4 Notification notifyMOIAttributeValueChanges

The IS notification parameters are mapped to SS equivalents according to table 12.1.1.2.4-1.

Table 12.1.1.2.4-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| additionalText | request body | additionalText | AdditionalText | O |
| sourceIndicator | request body | sourceIndicator | SourceIndicator | O |
| attributeListValueChanges | request body | attributeListValueChange | AttributeValueChangeSet | M |

##### 12.1.1.2.5 Notification notifyMOIChanges

The IS notification parameters are mapped to SS equivalents according to table 12.1.1.2.5-1.

Table 12.1.1.2.5-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| moiChanges | request body | mOIChanges | array(MoiChange) | M |

#### 12.1.1.3 Resources

##### 12.1.1.3.1 Resource structure

12.1.1.3.1.1 Resource structure on the MnS producer

Figure 12.1.1.3.1.1-1 shows the resource structure of the Provisioning MnS on the MnS producer.



Figure 12.1.1.3.1.1-1: Resource URI structure of the Provisioning MnS on the MnS producer

Table 12.1.1.3.1.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.1.1.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| MOI | …/{className}={id} | PUT | Create a resource representing a managed object instance |
| MOI | …/{className}={id} | GET | Retrieve one or multiple resources representing managed object instances |
| MOI | …/{className}={id} | PATCH | Modifiy one or multiple resources representing managed object instances |
| MOI | …/{className}={id} | DELETE | Delete one or multiple resources representing managed object instances |

###### 12.1.1.3.1.2 Resource structure on the MnS consumer

Figure 12.1.1.3.1.2-1 shows the resource structure of the Provisioning MnS on the MnS consumer.



Figure 12.1.1.3.1.2-1: Resource URI structure of the Provisioning MnS on the MnS consumer

Table 12.1.1.3.1.2-1 provides an overview of the resources and applicable HTTP methods.

Table 12.1.1.3.1.2-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| Notification Target | {notificationTarget} | POST | Send a notification to the notification target |

##### 12.1.1.3.2 Resource definitions

###### 12.1.1.3.2.1 Resource "…/{className}={id}"

12.1.1.3.2.1.1 Description

This resource represents a managed object instance.

12.1.1.3.2.1.2 URI

Resource URI: {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{className}={id}

The resource URI variables are defined in table 12.1.1.3.2.1.2-1.

Table 12.1.1.3.2.1.2-1: URI variables

|  |  |
| --- | --- |
| **Name** | **Definition** |
| MnSRoot | See clause 4.4.2 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.2 of TS 32.158 [15] |
| URI-LDN-first-part | See clause 4.4.2 of TS 32.158 [15] |
| className | Class name of the targeted resource |
| id | Identifier of the targeted resource |

12.1.1.3.2.1.3 HTTP methods

12.1.1.3.2.1.3.1 HTTP PUT

This method shall support the URI query parameters specified in the following table.

Table 12.1.1.3.2.1.3.1-1: URI query parameters supported by the PUT method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 12.1.1.3.2.1.3.1-2: Data structures supported by the PUT request body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| Resource | Resource representation of the resource to be created or replaced | M |

Table 12.1.1.3.2.1.3.1-3: Data structures supported by the PUT Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| Resource | 200 OK | Status code returned when the resource is replaced, and when the replaced resource representation is not identical to the resource representation in the request.  This status code may be retourned when the resource is updated and when the updated resource representation is identical to the resource representation in the request.  The representation of the updated resource is returned in the response message body. | M |
| Resource | 201 Created | Status code returned when the resource is created. The representation of the created resource is returned in the response message body. | M |
| n/a | 204 No Content | Status code that may be returned only when the replaced resource representation is identical to the representation in the request. The response has no message body. | M |
| ErrorResponse | 4xx/5xx | Returned in case of an error | O |

12.1.1.3.2.1.3.2 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 12.1.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| scope | Scope  style: form  explode: true | Extends the set of targeted resources beyond the base resource identified with the authority and path component of the URI. | O |
| filter | Filter | Reduces the targeted set of resources by applying a filter to the scoped set of resource representations. Only resources representations for which the filter construct evaluates to "true" are targeted. | O |
| attributes | array(string)  style: form  explode: false | Attributes of the scoped resources to be returned. The value is a comma-separated list of attribute names. | O |
| fields | array(string)  style: form  explode: false | Attribute fields of the scoped resources to be returned. The value is a comma-separated list of JSON pointers to the attribute fields. | O |

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 12.1.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

Table 12.1.1.3.2.1.3.2-3: Data structures supported by the GET response body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| Resource | 200 OK | Resources identified in the request for retrieval. In case the attributes or fields query parameters are used, only the selected attributes or sub-attributes are returned. The response message body is constructed according to the hierarchical response construction method (TS 32.158 [15]) | M |
| ErrorResponse | 4xx/5xx | Returned in case of an error | M |

12.1.1.3.2.1.3.3 HTTP PATCH

This method shall support the URI query parameters specified in the following table.

Table 12.1.1.3.2.1.3.3-1: URI query parameters supported by the PATCH method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 12.1.1.3.2.1.3.3-2: Data structures supported by the PATCH request body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| Resource, or  array(object) | Patch document describing the set of modifications to be applied to the targeted resources.  The following patch media types are available:  - "application/merge-patch+json" (RFC 7396 [37])  - "application/3gpp-merge-patch+json" (TS 32.158 [15])  - "application/json-patch+json" (RFC 6902 [36])  - "application/3gpp-json-patch+json" (TS 32.158 [15]) | M |

Table 12.1.1.2.1.1.3.3-3: Data structures supported by the PATCH response body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| ErrorResponse | 4xx/5xx | Returned in case of an error | M |

12.1.1.3.2.1.3.4 HTTP DELETE

This method shall support the URI query parameters specified in the following table.

Table 12.1.1.3.2.1.3.4-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| scope | Scope  style: form  explode: true | Extends the set of targeted resources beyond the base resource identified with the authority and path component of the URI. | O |
| filter | Filter | Reduces the targeted set of resources by applying a filter to the scoped set of resource representations. Only resources representations for which the filter construct evaluates to "true" are targeted. | O |

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 12.1.1.3.2.1.3.4-2: Data structures supported by the DELETE request body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

Table 12.1.1.3.2.1.3.4-3: Data structures supported by the DELETE response body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| array(Uri) | 200 OK | Status code returned, when query parameters are present in the request and one or multiple resources are deleted. The URIs of the deleted resources are returned in the response message body. | M |
| n/a | 204 No Content | Status code returned, when no query parameters are present in the request and only one resource is deleted. The message body is empty. | M |
| ErrorResponse | 4xx/5xx | Returned in case of an error | M |

###### 12.1.1.3.2.2 Void

###### 12.1.1.3.2.3 Void

###### 12.1.1.3.2.4 Resource "{notificationTarget}"

12.1.1.3.2.4.1 Description

This resource represents a notification target on the MnS consumer.

12.1.1.3.2.4.2 URI

Resource URI: {notificationTarget}

The resource URI variables are defined in table 12.1.1.3.2.4.2-1.

Table 12.1.1.3.2.4.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| notificationTarget | URI of the notification target on the MnS consumer, contained in the notification subscription, see notificationRecipientAddress defined in clause 4.3.22.2 in TS 28.622 [11]. |

12.1.1.3.2.4.3 HTTP methods

12.1.1.3.2.4.3.1 POST

This method shall support the URI query parameters specified in table 12.1.1.3.2.4.3.1-1.

Table 12.1.1.3.2.4.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.1.1.3.2.4.3.1-2 and the response data structures and response codes specified in table 12.1.1.3.2.4.3.1-3.

Table 12.1.1.3.2.4.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| NotifyMOICreation | Type for a notifyMOICreation notification | M |
| NotifyMOIDeletion | Type for a notifyMOIDeletion notification | M |
| NotifyAttributeValueChanges | Type for a notifyAttributeValueChanges notification | M |
| NotifyMoiChanges | Type for a notifyMOIChanges notification | M |

Table 12.1.1.3.2.4.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| n/a | 204 No Content | In case of success no message body is returned | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

#### 12.1.1.4 Data type definitions

##### 12.1.1.4.1 General

This clause defines the data types used by the Provisioning MnS. Table 12.1.1.4.1-1 specifies the data types defined in the present document and Table table 12.1.1.4.1-2 the data types imported.

Table 12.1.1.4.1-1: Data types defined in this specification

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Description |
| CmNotificationTypes | 12.1.1.4.4.3 | Notification type (notifyMOICreation, etc.) |
| SourceIndicator | 12.1.1.4.4.4 | Indicates the source of the operation that led to the generation of the notification. |
| ScopeType | 12.1.1.4.4.5 | Scope type of a scope |
| Operation | 12.1.1.4.4.6 | Enum with "create", "delete" and "replace" |
| Insert | 12.1.1.4.4.8 | Enum with "before" and "after" |
| PatchOperation | 12.1.1.4.4.7 | Enum with "add", "replace", "remove", "copy", "move" and "test" |
| Resource | 12.1.1.4.1a.1 | Used for resource representations |
| Scope | 12.1.1.4.1a.2 | Used in the query part of HTTP GET and HTTP DELETE to extend the set of targeted resources beyond the base resource identified with the authority and path component of the URI |
| CorrelatedNotification | 12.1.1.4.1a.3 | Describes the correlated notifications of a single source |
| MoiChange | 12.1.1.4.1a.4 | Single MOI change reported by notifyMOIChanges |
| NotifyMOICreation | 12.1.1.4.1a.5 | Used in the request body of HTTP POST for the notification type notifyMOICreation |
| NotifyMOIDeletion | 12.1.1.4.1a.6 | Used in the request body of HTTP POST for the notification type notifyMOIDeletion |
| NotifyMOIAttributeValueChanges | 12.1.1.4.1a.7 | Used in the request body of HTTP POST for the notification type notifyMOIAttributeValueChanges |
| NotifyMOIChanges | 12.1.1.4.1a.8 | Used in the request body of HTTP POST for the notification type notifyMOIChanges |
| PatchItem | 12.1.1.4.1a.9 | Specifies a patch item of a patch document |

Table 12.1.1.4.1-2: Data types imported

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Description |
| DateTime | TS 28.623 [44] | Date and time |
| Dn | TS 28.623 [44] | DN type |
| SystemDN | TS 28.623 [44] | systemDN type |
| Uri | TS 28.623 [44] | URI type |
| AttributeNameValuePairSet | TS 28.623 [44] | Set of attribute name/value pairs |
| AttributeValueChangeSet | TS 28.623 [44] | Set of attribute names with their old and new values |
| Filter | TS 28.623 [44] | Filter type |
| NotificationId | TS 28.623 [44] | Notification identifier as defined in ITU-T Rec. X. 733 [4] |
| NotificationType | TS 28.623 [44] | Notification type |
| NotificationHeader | TS 28.623 [44] | Notification header |
| ErrorResponse | TS 28.623 [44] | Used in the response body of multiple HTTP methods in case of error |

##### 12.1.1.4.1a Structured data types

###### 12.1.1.4.1a.1 Type Resource

**Table 12.1.1.4.1a.1 -1: Definition of type Resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| id | string | Identifier of the resource object | M |
| objectClass | string | Object class of the resource object | O |
| objectInstance | Dn | Object instance of the resource object | O |
| attributes | object | "attributes" (JSON) object whose members are the IOC attributes (except for "id”, "objectClass” and "objectInstance"). | M |
| n/a | map(array(object)) | Name contained objects | M |

This definition of "Resource" does not specify any attributes or name contained objects. Resource representations with specific attributes and name contained objects are contained in the NRM definitions. These definitions should be used in implementations of the Provisioning MnS instead of this generic definition.

###### 12.1.1.4.1a.2 Type Scope

Table 12.1.1.4.1a.2-1: Definition of type Scope

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| scopeType | ScopeType | Used in the query component of HTTP GET and HTTP DELETE together with scopeLevel to extend the set of targeted resources beyond the base resource identified with the authority and path component of the URI | M |
| scopeLevel | integer | Used in the query component of HTTP GET and HTTP DELETE together with scopeType to extend the set of targeted resources beyond the base resource identified with the path component of the URI | M |

###### 12.1.1.4.1a.3 Type CorrelatedNotification

Table 12.1.1.4.1a.3 -1: Definition of type CorrelatedNotification

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| source | Dn | Source of the correlated notifications | M |
| notificationIds | array(NotificationId) | Notification identifiers of correlated notifications of that source | M |

###### 12.1.1.4.1a.4 Type MoiChange

Table 12.1.1.4.1a.4 -1: Definition of type MoiChange

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| sourceIndicator | SourceIndicator | Indicates the source of the operation that led to the generation of this notification. | O |
| op | Operation | Operation associated to the reported change ("add", "remove , "replace"). | M |
| path | string | URI path component segments specifying when appended to "href" the created, deleted or updated resource or secondary resource | M |
| insert | Insert | Indicates whether the new attribute element was added before or after the attribute element specified by "path", only valid for attributes with the property isOrdered=True. It can take the values "before" and "after". If missing, it defaults to "before".  The "insert" attribute shall be supported only when changes from YANG defined NRMs are reported. For JSON defined NRMs the attribute shall not be supported. | CM |
| value | any type | New value of the created or updated resource or secondary resource. Optional old value of the deleted resource or secondary resource | M |
| oldValue | any type | Old value of the updated secondary resource | O |

The properties "op", "path" and "value" shall use the 3GPP JSON Patch format (TS 32.158 [15]) for reporting NRM changes. The "merge" operation specified by 3GPP JSON Patch is not supported in "notifyMOIChanges". The "move", "copy" and "test" operations specified by JSON Patch are not supported either.

The "oldValue" is an optional extension for "notifyMOIChanges" allowing to report also the value that the attribute had before replacing the value with the new value, that is contained in "value".

The following example notification (where JSON is expressed in YAML notation) reports an object creation

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: add

path: /ClassA=1

value:

id: 1,

objectClass: ClassA,

attributes:

attrA: 123

attrB:

subAttrB1: ABC

subAttrB2: 56

The following example reports the deletion of that object.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: remove

path: /ClassA=1

The following example reports the addition of a new attribute "attrC".

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: add

path: /ClassA=1#/attributes/attrC

value: xyz

The following example reports the deletion of the attribute "attrC".

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: remove

path: /ClassA=1#/attributes/attrC

The following example reports a value change for the simple attribute "attrA".

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrA

value: 456

When the old value is reported as well, the notification looks like.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrA

value: 456

oldValue: 123

The following example reports a value change for the complex attribute "attrB".

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrB

value:

subAttrB1: abc

subAttrB2: 78

The previous two notifications can be combined into a single notification as follows.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrA

value: 456

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrB

value:

subAttrB1: abc

subAttrB2: 78

Note the operation "replace" has replace semantics and not merge semantics. The following notification reports the value change of the attribute field "attrB:subAttrB1" to "def" and the deletion of the attribute field "attrB:subAttrB2".

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrB

value:

subAttrB1: def

The value change of the attribute field "attrA:subAttrB1" is reported as follows.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrA/subAttrB1

value: def

Assume "attrD" is a JSON array with simple elements, then the creation of this multi-valued attribute is reported as follows.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: add

path: /ClassA=1#/attributes/attrD

value:

- 1

- 2

- 3

Its deletion is reported by the following notification.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: remove

path: /ClassA=1#/attributes/attrD

The complete replacement of the array is reported by the following notification.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: add

path: /ClassA=1#/attributes/attrD

value:

- 11

- 21

- 31

The following example reports the second item in the array changed to "22".

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrD/1

value: 22

Note the array index of the second item is "1".

Assume now "attrE" is a JSON array with complex array items, for example.

[{subItemE1: 11, subItemD2: abc}, {subItemE1: 21, subItemE2: def}, {subItemE1: 31, subItemE2": ghi}.

A value change to

[{subItemE1: 11, subItemE2: abc}, {subItemE1: 21, subItemE2: xyz}, {subItemE1: 31, subItemE2": ghi}.

is reported by

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrE/1/subItemE2

value: xyz

When "subItemE2" is defined as array item key at stage 2, then "attrE" should contain a JSON map.

attrE:

11:

subItemE2: abc

21:

subItemE2: def

31:

subItemE2: ghi

The same change as above is now reported by the notification.

href: https://example.com/3gpp

...

moiChanges

- notificationId: 123456789

op: replace

path: /ClassA=1#/attributes/attrE/21/subItemD2

value: xyz

When all attributes of an object have been updated with a new value, the MnS producer may use a compact format reporting that the "attributes" container was updated completely.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/3gpp",  "notificationId": 123456789,  "notificationType": "notifyMOICreation",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "moiChanges": [  {  "notificationId": 123,  "op": "replace",  "path": "/ClassA=1#/attributes",  "value": {  "attrA": "newValueAttrA",  "attrB": "newValueAttrB"  }  }  ]  } |

Note that clause 4.3 of IETF RFC 6902 [13] does not consider it as an error if an attribute value is replaced with exactly the same value. For that reason, it would not be an error if in the example above an attribute value is included in the "value" property that did not change value. A MnS producer may consider this compact format hence also for the case that not all attributes of an object have been updated.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/3gpp",  "notificationId": 123456789,  "notificationType": "notifyMOICreation",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "moiChanges": [  {  "notificationId": 123,  "op": "replace",  "path": "/ClassA=1#/attributes",  "value": {  "attrA": "newValueAttrA",  "attrB": "oldValueAttrB"  }  }  ]  } |

To allow the MnS consumer to understand which attributes have been updated, the MnS producer may decide to send the following notification.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/3gpp",  "notificationId": 123456789,  "notificationType": "notifyMOICreation",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "moiChanges": [  {  "notificationId": 123,  "op": "replace",  "path": "/ClassA=1#/attributes",  "value": {  "attrA": "newValueAttrA",  "attrB": "oldValueAttrB"  },  "oldValue": {  "attrA": "oldValueAttrA",  "attrB": "oldValueAttrB"  }  ]  } |

###### 12.1.1.4.1a.5 Type NotifyMoiCreation

Table 12.1.1.4.1a.5 -1: Definition of type NotifyMoiCreation

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type ("notifyMOICreation") | M |
| eventTime | DateTime | Event (MOI creation) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| sourceIndicator | SourceIndicator | Indicates the source of the operation that led to the generation of this notification. | O |
| attributeList | AttributeNameValuePairSet | The attributes (name/value pairs) of the created MOI. | O |

The following example shows a notification reporting the creation of an object with two attributes "attrA" and "attrB". Note that the notification includes the name/value pairs representing the attributes of the created object only and not the complete object representation.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOICreation",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "attributeList":  {  "attrA": "valueAttrA",  "attrB": "valueAttrB"  }  } |

The creation of an empty object not containing any attribute values is reported as follows.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOICreation",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "attributeList":  {  }  } |

###### 12.1.1.4.1a.6 Type NotifyMoiDeletion

Table 12.1.1.4.1a.6 -1: Definition of type NotifyMoiDeletion

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type ("notifyMOIDeletion") | M |
| eventTime | DateTime | Event (MOI creation) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| sourceIndicator | SourceIndicator | Indicates the source of the operation that led to the generation of this notification. | O |
| attributeList | AttributeNameValuePairSet | Attributes (name/value pairs) of the deleted MOI. | O |

The following example demonstrates the deletion of an object. The message body includes the name/value pairs representing the attributes of the deleted object.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOIDeletion",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1"  } |

The message body may include the name/value pairs representing the attributes of the deleted object.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.com  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOIDeletion",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "attributeList":  {  "attrA": "valueAttrA",  "attrB": "valueAttrB"  }  } |

###### 12.1.1.4.1a.7 Type NotifyMoiAttributeValueChanges

Table 12.1.1.4.1a.7 -1: Definition of type NotifyMoiAttributeValueChanges

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type ("notifyMOIAttributeValueChanges") | M |
| eventTime | DateTime | Event (MOI creation) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| sourceIndicator | SourceIndicator | Indicates the source of the operation that led to the generation of this notification. | O |
| attributeListValueChanges | AttributeValueChangeSet | List with names of changed attributes, together with new value and optionally old value | M |

The following example notification reports the modification of the attribute values for "attrA" and "attrB".

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.org  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOIAttributeValueChanges",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "attributeListValueChanges": [  {  "attrA": "newValueAttrA",  "attrB": "newValueAttrB"  }  ]  } |

In addition to the new values, the old values may be included in the notification.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.org  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOIAttributeValueChanges",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "attributeListValueChanges": [  {  "attrA": "newValueAttrA",  "attrB": "newValueAttrB"  },  {  "attrA": "oldValueAttrA",  "attrB": "oldValueAttrB"  }  ]  } |

In the example above the attribute values are of simple type. For attributes of structured type, the question is if all attribute fields of an attribute, where at least one attribute field changed its value, need to be reported or only those attribute fields that changed value. Assume an attribute field that did not change value is not included in the notification. In this case the MnS consumer receiving the notification cannot tell if the attribute field was deleted or if the attribute field did not change value. It is not possible to distinguish these two cases based on the information in the notification. For that reason, always all attribute fields of an attribute need to be included in the notification. For structured attributes with many attribute fields this may not be very efficient.

In the next example "attrA" is a structured attribute with the attribute fields "attrFieldAA" and "attrFieldAB". The attribute field "attrFieldAA" changed value, the attribute field "attrFieldAB" did not change value. The attribute value change notification reporting this change may look as follows.

|  |
| --- |
| POST /3gpp-management/cm-notification-sink HTTP/1.1  Host: example.org  Content-Type: application/json  {  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",  "notificationId": 123456789,  "notificationType": "notifyMOIAttributeValueChanges",  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",  "attributeListValueChanges": [  {  "attrA": {  "attrFieldAA": "newValueAttrFieldAA",  "attrFieldAB": "oldValueAttrFieldAB"  }  },  {  "attrA": {  "attrFieldAA": "oldValueAttrFieldAA",  "attrFieldAB": "oldValueAttrFieldAB"  }  }  ]  } |

Note also that for multi-valued attributes all attribute elements of the new value need to be reported. It is not possible to report only added, deleted, or modified attribute elements. Furthermore, the notification does not allow reporting of deleted attributes. When this is required the MnS producer needs to include always all attributes of the object in the notification. It is outside the present document how the MnS producer signals to the MnS consumer if all attributes or only the changed ones are included in the attribute value change notification. The notification itself does not include this information.

###### 12.1.1.4.1a.8 Type NotifyMoiChanges

**Table 12.1.1.4.1a.8 -1: Definition of type NotifyMoiChanges**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of a common ancestor resource (object) of the resources for which changes are reported. A MnS producer may set this attribute always to the parent of the root resource in the MIB. | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4]. | M |
| notificationType | NotificationType | Notification type (notifyMOIChanges) | M |
| eventTime | DateTime | Event (NRM updates) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| moiChanges | array(MoiChange) | MOI changes to be reported | M |

###### 12.1.1.4.1a.9 Type PatchItem

Table 12.1.1.4.1a.9 -1: Definition of type PatchItem

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| op | PatchOperation | Patch operation. | M |
| from | string | Present only for "copy" and "move" operations, identifies the value to be copied or moved to the location specified by path. | M |
| path | string | Path specifying the patched value. | M |
| value | any type | New value for the resource identified by "path". | M |

##### 12.1.1.4.2 Void

##### 12.1.1.4.3 Void

##### 12.1.1.4.4 Simple data types and enumerations

12.1.1.4.4.1 General

This clause defines simple data types and enumerations that are used by the data structures defined in the previous clauses.

12.1.1.4.4.2 Simple data types

Table 12.1.1.4.3.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type name | Type definition | Description |
| n/a | n/a | n/a |

12.1.1.4.4.3 Enumeration CmNotificationTypes

Table 12.1.1.4.4.3-1: Enumeration CmNotificationTypes

|  |  |
| --- | --- |
| Enumeration value | Description |
| notifyMOICreation | Notification type is notifyMOICreation |
| notifyMOIDeletion | Notification type is notifyMOIDeletion |
| notifyMOIAttributeValueChanges | Notification type is notifyMOIAttributeValueChange |
| noitifyMOIChanges | Notification type is notifyMOIChanges |

12.1.1.4.4.4 Enumeration SourceIndicator

Table 12.1.1.4.4.4-1: Enumeration SourceIndicator

|  |  |
| --- | --- |
| Enumeration value | Description |
| RESOURCE\_OPERATION | The notification was generated in response to an internal operation of the resource. |
| MANAGEMENT\_OPERATION | The notification was generated in response to a management operation applied across the managed object boundary external to the managed object |
| SON\_OPERATION | The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . |
| UNKNOWN | It is not possible to determine the source of the operation. |

12.1.1.4.4.5 Enumeration ScopeType

Table 12.1.1.4.4.4.1-1: Enumeration ScopeType

|  |  |
| --- | --- |
| Enumeration value | Description |
| BASE\_ONLY | Selects only the base resource. The "scopeLevel" parameter shall be absent or ignored if present. |
| BASE\_ALL | Selects the base resource and all of its subordinate resources (incl. the leaf resources). The "scopeLevel" parameter shall be absent or ignored if present. |
| BASE\_NTH\_LEVEL | Selects all resources on the level, which is indicated by the "scopeLevel" parameter, below the base resource. The base resource is at "scopeLevel" zero. |
| BASE\_SUBTREE | Selects the base resource and all of its subordinate resources down to and including the resources on the level indicated by the "scopeLevel" parameter. The base resource is at "scopeLevel" zero. |

12.1.1.4.4.6 Enumeration Operation

Table 12.1.1.4.4.4.6-1: Enumeration Operation

|  |  |
| --- | --- |
| Enumeration value | Description |
| add | Create operation |
| remove | Delete operation |
| replace | Replace operation |

###### 12.1.1.4.4.7 Enumeration PatchOperation

Table 12.1.1.4.4.4.7-1: Enumeration PatchOperation

|  |  |
| --- | --- |
| Enumeration value | Description |
| add | Add operation |
| replace | Replace operation |
| remove | Remove operation |
| copy | Copy operation |
| move | Move operation |
| test | Test operation |

12.1.1.4.4.8 Enumeration Insert

Table 12.1.1.4.4.4.8-1: Enumeration Insert

|  |  |
| --- | --- |
| Enumeration value | Description |
| before | Specifies the new attribute element is inserted before the attribute element identified by the "path" attribute of "MoiChange". |
| after | Specifies the new attribute element is inserted after the attribute element identified by the "path" attribute of "MoiChange". |

### 12.1.2 RESTful HTTP-based solution set for integration with ONAP VES API

#### 12.1.2.1 Mapping of operations

NOTE: this mapping is not part of the present document.

#### 12.1.2.2 Mapping of notifications

##### 12.1.2.2.1 Introduction

###### 12.1.2.2.1.1 General

The 3GPP IS notifications are mapped to SS euivalents according to table 12.1.2.2.1.1-1.

Table 12.1.2.2.1.1-1: Mapping of 3GPP IS notifications to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **3GPP IS notifications** | **HTTP Method** | **Resource URI** | **S** |
| notifyMOICreation | POST | /eventListener | M |
| notifyMOIDeletion | POST | /eventListener | M |
| notifyMOIAttributeValueChanges | POST | /eventListener | M |
| notifyMOIChanges | POST | /eventListener | M |

###### 12.1.2.2.1.2 Void

##### 12.1.2.2.2 Notification notifyMOICreation

See clause 12.1.1.2.2..

##### 12.1.2.2.3 Notification notifyMOIDeletion

See clause 12.1.1.2.3.

##### 12.1.2.2.4 Notification notifyMOIAttributeValueChange

See clause 12.1.1.2.4.

##### 12.1.2.2.5 Notification notifyMOIChanges

See clause 12.1.1.2.5.

#### 12.1.2.3 Resources

##### 12.1.2.3.1 Resource structure

Figure 12.1.2.3.1-1 shows the resource structure of the provisioning MnS in the context of its integration with VES Event Listener 7.1.1 [45].

A screen shot of a computer program

Description automatically generated with low confidence

Figure 12.1.2.3.1-1: Resource URI structure of the provisioning MnS for integration with ONAP VES Event Listener 7.1.1 (Resource structure section) [45]

Table 12.1.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.1.2.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| eventListener | /eventListener | POST | Send notifications |

##### 12.1.2.3.2 Resource definitions

See Resource structure section in [45].

#### 12.1.2.4 Data type definitions

See clause 12.1.1.4.

### 12.1.3 YANG/Netconf-based solution set

#### 12.1.3.1 Mapping of operations

##### 12.1.3.1.1 Introduction

The YANG/Netconf based solution set is based on the TS 32.160 [33] clause 6.2 and the IETF RFC 6241 [32] including the Xpath capability.

NOTE: The clauses below omit namespaces for brevity. In NETCONF operations namespaces are included following [34]

##### 12.1.3.1.2 Operation createMOI

The operation is mapped to a NETCONF <edit-config> operation, with XML elements representing the DN path to the MOI, the MOI itself, its id/key and its attributes.

The NETCONF operation attribute on the list representing the newly created MOI should be set to ‘create’.

The default-operation parameter of the <edit-config> operation should be set to none.

The IS operation parameters are mapped to SS equivalents according to table 12.1.3.1.2-1 and table 12.1.3.1.2-2.

Table 12.1.3.1.2-1: Mapping from IS createMOI input parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| IS operation parameter name | SS parameter name | S | Remark |
| managedObjectClass | config | M | XML element’s name inside the <config> element. |
| managedObjectInstance | config | M | A sequence of embedded XML elements inside the <config> element. XML elements for all containing MOIs and their ids(keys) shall be included together wilt the XML elements representing the to be created MOI and its key. |
| attributeListIn | config | M | The key leaf, the “attributes container” and leaf, leaf-list or list entries of YANG models representing the attributes. |

Table 12.1.3.1.2-2: Mapping from IS createMOI output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| IS operation parameter name | SS parameter name | S | Remark |
| attributeListOut | no corresponding SS parameter | M | Not supported.  (note 1) |
| status | - | M | OperationSucceeded if NETCONF rpc-reply contains <ok> element.  OperationFailed if NETCONF-reply contains <rpc-error>. |

NOTE 1: Successful Netconf <edit-config> operations only return an <ok> element. Therefore, the attributeListOut can be retrieved via a separate <get-config> operation.

**Examples**

Create ManagedElement=myNode, GNBDUFunction=1

<rpc message-id="101">

<edit-config>

<target>

<running/>

</target>

<default-operation>none</default-operation>

<config>

< ManagedElement>

<id>myNode</id>

<GNBDUFunction operation=”create”>

<id>1</id>

<attributes>

<gNBIdLength>25</gNBIdLength>

<gNBId>357</gNBId>

<priorityLabel>1</priorityLabel>

<gNBDUName>du-south-1</gNBDUName>

<!-- other attributes --->

</attributes>

</GNBDUFunction>

</ManagedElement>

</config>

</edit-config>

</rpc>

<!-- createMO Response -->

<rpc-reply message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">

<ok/>

</rpc-reply>

##### 12.1.3.1.3 Operation getMOIAttributes

This IS operation is mapped to NETCONF <get> or <get-config> operation, depending on whether all configuration and state information is to be retrieved, or configuration data only. (In the next paragraphs only <get> operation is mentioned but <get-config> is always an alternative).

The IS operation patameters baseObjectInstance , (3GPP-)filter, scope, level and attributeListIn are all combined and mapped into the Netconf-filter element. The scopes BASE\_ONLY and BASE\_ALL can be mapped to both subtree and Xpath filtering. The scopes BASE\_NTH\_LEVEL and BASE\_SUBTREE can only be mapped to Xpath filtering.

The IS operation parameters are mapped to SS equivalents according to table 12.1.3.1.3-1 and table 12.1.3.1.3-2.

Table 12.1.3.1.3-1: Mapping of IS getMOIAttributes input parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| IS operation parameter name | SS parameter name | S | Remark |
| baseObjectInstance | filter | M | Initial part of the filter element.  For subtree filter this is a set of XML element representing lists containing MOIs together with the leafs representing key values for these MOIs from the root MOI (e.g. ManagedElement) to the baseObjectInstance.  For Xpath filter it is the initial parts of the Xpath expression representing the same information. |
| scope | filter | M | BASE\_ONLY and BASE\_ALL realized by the initial XML elements of the <get> operation. BASE\_SUBTREE and BASE\_NTH\_LEVEL is encoded in the Xpath filter. |
| level | filter | M | Included in the Xpath filter, see examples. (If level is used Xpath filtering must be used.  For BASE\_SUBTREE the levels number is transformed into a number of filter sub-expressions joined by the OR operator.  For BASE\_NTH\_LEVEL included in the Xpath expression as a sequence of ‘\*’ parts (descendant axis) The number of ‘\*’ correspond to the number of levels. |
| filter | filter | M | Netconf Subtree or Xpath filter |
| attributeListIn | filter | M | add the attributes to the subtree or Xpath filter |

Table 12.1.3.1.3-2: Mapping of IS getMOIAttributes output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| IS operation parameter name | SS parameter name | S | Remark |
| managedObjectClass | data | M | Can be extracted from the NETCONF <rpc-reply> <data> elements |
| managedObjectInstance | data | M | Can be extracted from the NETCONF <rpc-reply> <data> elements |
| attributeListOut | data | M | Can be extracted from the NETCONF <rpc-reply> <data> elements |
| status | data | M | rpc-reply or rpc-error indicates general status. |

If scope is ***BASE\_ONLY*** the <get> shall be directed against the “attributes” container of the baseObjectInstance.

**Example 1**

A getMOIAttributes for base object ManagedElement=myNode, scope = BASE\_ONLY, filter=none, attributesListIn=empty is mapped into the following <get-config> operation -

<rpc message-id="101"

xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">

<get-config>

<source>

<running/>

</source>

<filter type="subtree">

<ManagedElement>

<id>myNode</id>

<attributes/>

</ManagedElement>

</filter>

</get-config>

</rpc>

If scope is ***BASE\_ALL*** the <get> shall be directed against the list representing the baseObjectInstance.

**Example 2**

A getMOIAttributes for base object ManagedElement=myNode, scope = BASE\_ALL, filter=, MeasurementControl.pMAdministrativeState=UNLOCKED, attributesListIn=empty.

<rpc message-id="101"

xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">

<get>

<source>

<running/>

</source>

<filter type="subtree">

<ManagedElement>

<id>myNode</id>

<MeasurementControl>

<pMAdministrativeState>

UNLOCKED

</pMAdministrativeState>

</MeasurementControl>

</ManagedElement>

</filter>

</get>

</rpc>

If scope is ***BASE\_SUBTREE*** the <get> shall be directed against the list representing the baseObjectInstance. The Xpath filter expression will need a sub-expression for each level joined by the OR operator.

**Example 3**

A getMOIAttributes for base object ManagedElement=me1, scope = BASE\_ SUBTREE, level=2, filter=none, attributesListIn=empty.

<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">

<get>

<source>

<running/>

</source>

<filter type="xpath"

select="/me3gpp:ManagedElement[id='me1']/attributes |

/me3gpp:ManagedElement[id='me1']/\*/attributes |

/me3gpp:ManagedElement[id='me1']/\*/\*/attributes" />

</get>

</rpc>

If scope is ***BASE\_NTH\_LEVEL*** the <get> shall be directed against the list representing classes at the N*th* level under the baseObjectInstance. The number of ‘\*’ parts (descendant axis) will correspond to the number of levels.

**Example 4**

A getMOIAttributes for base object ManagedElement=myNode, scope = BASE\_NTH\_LEVEL, level=2, filter=none, attributesListIn=empty.

<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">

<get>

<source>

<running/>

</source>

<filter type="xpath"

select="/me3gpp:ManagedElement[id='me1']/\*/\*/attributes"/>

</get>

</rpc>

##### 12.1.3.1.4 Operation modifyMOIAttributes

This IS operation modifies one or multiple managed object instances. It is mapped to the NETCONF <edit-config> operation. The NETCONF <edit-config> operation can modify attributes in a given MOI or set of MOIs but only indirectly supports scope or filtered sets of MOIs that are part of the modifyMOIAttributes 3GPP operation specification. <edit-config> needs a config block, containing the explicit config changes to be made for each MOI.

The default-operation parameter should be set to none.

The Netconf operation attribute on the list representing modified MOI(s) should be set to create, replace or delete according to the ENUM in the modificationList.

The IS operation parameters are mapped to SS equivalents according to table 12.1.3.1.4-1 and table 12.1.3.1.4-2.

Table 12.1.3.1.4-1: Mapping of IS modifyMOIAttributes input parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| IS operation parameter name | SS parameter name | S | Remark |
| baseObjectInstance | config | M | A sequence of embedded XML elements inside the <config> element. XML elements for all containing MOIs and their ids(keys) shall be included together with the XML elements representing the to be modified MOI and its key. |
| scope | config | M | BASE\_ONLY supported as default. Multiple MOIs can be specified in the same operation, emulating other scopes. |
| filter | config | M | Multiple MOIs can be specified in the same operation, emulating filtering. |
| modificationList | config | M | The “attributes container” and leaf, leaf-list or list entries representing the attributes. |

Table 12.1.3.1.4-2: Mapping of IS modifyMOIAttributes output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **S** | **Remark** |
| modificationListOut | no corresponding SS parameter | M | Not supported.  (note 1) |
| status | - | M | rpc-reply or rpc-error indicates general status.  The following elements give detailed error information:  <error-tag>  <error-path> |

Note 1: Successful Netconf <edit-config> operations only return an <ok> element. Therefore, the attributeListOut can be retrieved via a separate <get-config> operation.

##### 12.1.3.1.5 Operation deleteMOI

This IS operation deletes one or multiple managed object instances. It is mapped to the NETCONF <edit-config> operation. <edit-config> can delete one or more specific MOIs but only indirectly supports scope or filtered sets of MOIs that are part of the generic deleteMOI 3GPP operation specification. <edit-config> uses a config block, indicating the MOI(s) to be deleted.

The Netconf operation attribute on the list representing the baseObjectInstance should be set to delete or remove.

The default-operation parameter should be set to none.

The IS operation parameters are mapped to SS equivalents according to table 12.1.3.1.5-1 and table 12.1.3.1.5-2.

Table 12.1.3.1.5-1: Mapping of IS deleteMOI input parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **S** | **Remark** |
| baseObjectInstance | config | M | A sequence of embedded XML elements inside the <config> element. XML elements for all containing MOIs and their ids(keys) shall be included together wilt the XML elements representing the to be deleted MOI and its key. |
| scope | config | M | BASE\_ONLY supported as default. Multiple MOIs can be specified in the same operation, emulating other scopes. |
| filter | config | M | Multiple MOIs can be specified in the same operation, emulating filtering. |

Table 12.1.3.1.5-2: Mapping of IS deleteMOI output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **S** | **Remark** |
| deletionList | no corresponding SS parameter | M | Not supported.  (note 1) |
| status | - | M | rpc-reply or rpc-error indicates general status.  The following elements give detailed error information:  <error-tag>  <error-path> |

NOTE 1: Successful Netconf <edit-config> operations only return an <ok> element. Therefore, the deletionList can be retrieved via a separate <get-config> operation.

#### 12.1.3.2 Mapping of notifications

##### 12.1.3.2.1 Introduction

The notifications "notifyMOICreation", "notifyMOIDeletion" and "notifyMOIAttributeValueChanges" should not be used in the YANG\_Netconf solution set as "notifyMOIChanges" provides the same functionality.

12.1.3.2.2 Notification notifyMOICreation

The notification is not mapped to the NETCONF/YANG solution.

12.1.3.2.3 Notification notifyMOIDeletion

The notification is not mapped to the NETCONF/YANG solution.

12.1.3.2.4 Notification notifyMOIAttributeValueChange

The notification is not mapped to the NETCONF/YANG solution.

##### 12.1.3.2.5 Notification notifyMOIChanges

The NETCONF/YANG solution set uses the same mapping as the RESTful HTTP-based solution set as described in clause 12.1.1.2.5 with the changes and additions described below.

- Any changes reported are based on the YANG NRM definitions, even though the RESTful notification mapping is reused.

- The media type as specified by the "Content-Type" header in the HTTP POST request shall be "application/yang-data+json" and not "application/json".

- The value of "href" shall be set to the FQDN or IP address identifying the NETCONF server.

- The value of "path" shall be a RESTCONF data resource identifier (RFC 8040 [49], clause 3.5.3).

- The "path" includes the YANG module name.

- The "#" character before "/attributes" in "path" is not present. NETCONF/YANG does not differentiate between the stage 2 concepts of object and attribute, hence there is no need for a delimiter.

- The value of "value" shall follow the JSON encoding of YANG (RFC 7951 [50]).

- Attribute elements are identified by their value (in case of a YANG "leaf-list") or by the values of keys (in case of a YANG "list"). In JSON Patch, attribute elements are identified based on their index, i.e. based on the position in the array.

- In case no key is defined for a YANG "list" it is not possible to report the creation, deletion or replacement of individual list entries. In this case, whenever the list is modified, the replacement of the complete attribute or attribute field (the complete list with all list enties) shall be reported.

- Similarly if an attribute(field) is mapped to a YANG leaf-list with non-unique values it is not possible to report the creation, deletion or replacement of an individual value. In this case, whenever the leaf-list is modified, the replacement of the complete attribute or attribute field (the complete leaf-list; all values) shall be reported.

- YANG default values shall be handled as follows:

- Attributes with default values, for which no value is specified in the object creation request, shall be included in the object creation report with their default values.

- Attributes with default values, that are deleted and consequently set to their default value, shall be included in attribute replacement reports.

Note all following use-cases use JSON expressed in YAML notation.

Case 1: Creation of an MOI is reported with:

- operation: add

- path: YANG resource identifier pointing to the list entry representing the MOI

- value: a complete MOI representation, represented by the "id" node and the "attributes" container but exluding the list entry itself encoded according to RFC7951 [50].

For example, the following instance of a "moiChanges" array item reports an object creation:

href: node1.lichtenberg.de

…

notificationId: 123456001

path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:PerfMetricJob=job1"

operation: add

value:

id: job1

3gpp-common-measurements:PerfMetricJob:attributes:

jobId: 9865

fileReportingPeriod: 30

Case 2: Deletion of an MOI is reported with:

- operation: remove

- path: YANG resource identifier pointing to the list entry representing the MOI

- value: not present

For example, the following instance of a "moiChanges" array item reports an object deletion:

href: node1.charlottenburg.de

…

notificationId: 123456002

path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:PerfMetricJob=job1"

operation: remove

Case 3: Creating a (complete) attribute is reported as follows. (Setting the value(s) of an attribute that had no value before the change):

- operation: add.

- path: YANG resource identifier pointing to the leaf/leaf-list/container/list representing the attribute. If the attribute is represented by a list or leaf-list, then for this last data node the equal sign, the key value(s) or leaf-list value is omitted, only the list/leaf-list name shall be present.

- value: the content of the leaf/leaf-list entry(s)/container/list entry(s) representing the created attribute encoded according to RFC7951 [50]. In case of attribute represented by a container/list the child data nodes are encoded only,the container/list itself is not.

For example, the following instance of a "moiChanges" array item reports setting the values of the performanceMetrics simple, multivalue attribute:

href: node1.spandau.de

…

notificationId: 123456003

path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:PerfMetricJob=job1/attributes/performanceMetrics"

operation: add

value:

- inOctets

- inPackets

- outPackets

Case 4: Deleting all values of a complete attribute is reported with

- operation: remove.

- path: Same as in case 3.

- value: not present.

For example, the following instance of a "moiChanges" array item reports deleting all values of the performanceMetrics attribute:

href: node1.pankow.de

…

notificationId: 123456004

path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:PerfMetricJob=job1/attributes/performanceMetrics"

operation: remove

Case 5: Replacing a (complete) attribute is reported as follows. (Removing all previous values of the attribute and setting new value(s)):

- operation: replace.

- path: Same as in case 3.

- value: Same as in case 3.

Case 6: Adding a new value to a multivalue attribute (an attribute with multiplicity upper bound greater than 1) is reported as follows. (This does not imply any change to exisiting values):

- operation: add/

- path: YANG resource identifier pointing to a leaf-list/list entry representing an attribute element(value). In case of adding a new element to an attribute with the property isOrdered=True the new element/value is inserted before the pointed element(value), unless the "insert" subparameter specifies differently.

- value: the leaf-list/list entry representing the new attribute value encoded according to RFC7951 [50]. In case of a list the child data nodes are encoded the list-entry itself is not.

- insert: an additional input subparameter is added to the moiChange input parameter. This indicates whether the new element/value was added before or after the element/value specified in path. The subparameter is only valid in case of attributes with the property isOrdered=True. It can take the values "before", "after". If missing it defaults to "before".

For example, the following instance of a "moiChanges" array item reports adding a new element/value to the "performanceMetrics" attribute before the outPackets element.:

notificationId: 123456006

path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:PerfMetricJob=job1/attributes/performanceMetrics/performanceMetrics=outPackets"

operation: add

insert: before

value: outOctets

Case 7: Deleting a single element/value from a multivalue attribute is reported as follows. (This does not imply any change to any other elements):

- operation: remove.

- path: Same as case 6.

- value: not present.

Case 8: Replacement of a single value for a multivalue attribute is reported as follows. This implies removing the old value; in case of a structured attribute removal all its subparts. This does not imply any change to any other values:

- operation: replace.

- path: Same as case 6.

- value: Same as case 6.

For example, the following instance of a "moiChanges" array item reports replacing an element/value of the "thresholdInfoList" structured attribute:

notificationId: 123456008

path: 3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:ThresholdMonitor=job1/attributes/thresholdInfoList=thr1

operation: replace

value:

- idx: thr1

thresholdDirection: UP

thresholdValue: '4.5'

Case 9: Adding afield (subpart) of an attribute value is reported as follows (only used for structured attributes represented by a list or container in YANG):

- operation: add.

- path: YANG Resource Identifier pointing to the leaf/leaf-list/container/list representing the attribute field. If the attribute field is represented by a list or leaf-list, the field has multiplicity upper bound greater than 1, with the property isOrdered=True the new element/value is inserted before the pointed element(value), unless the "insert" subparameter specifies differently.

- value: the leaf/leaf-list/container/list representing the new attribute field values encoded according to RFC7951. In case of a list/container representing the attribute field, value shall contain only the child data nodes, but not the container/list-entry itself.

- insert: In case the field has multiplicity upper bound greater than 1 and has the property isOrdered=True, the subparameter is used similarly as in case 6.

For example, the following instance of a "moiChanges" array item reports adding a value to the " hysteresis " attribute subpart:

notificationId: 123456009

path: 3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:ThresholdMonitor=job1/attributes/thresholdInfoList=thr1/hysteresis

operation: add

value: '10'

Case 10: Deleting a field (subpart) of an attribute is reported as follows. (only used for structured attributes represented by a list or container in YANG):

- operation: remove.

- path: Same as case 9.

- value: Not present.

For example, the following instance of a "moiChanges" array item reports deleting all values of the "hysteresis" attribute field:

notificationId: 123456010

path: 3gpp-common-managed-element:ManagedElement=node3/3gpp-common-measurements:ThresholdMonitor=job1/attributes/thresholdInfoList=thr1/hysteresis

operation: remove

Case 11: Replacement of a field (subpart) of an attribute is reported as follows. This implies removing previous value(s). (only used for structured attributes represented by a list or container in YANG):

- operation: replace.

- path: Same as case 9.

- value: Same as case 9.

#### 12.1.3.3 Netconf Server behavior

##### 12.1.3.3.1 Introduction

The Netconf server implementing the MnS provider shall implement some basic capabilities.

##### 12.1.3.3.2 Implement IETF RFC 6243: “With-defaults Capability for NETCONF”

The Netconf server (MnS producer) shall be compliant to RFC 6243[51] and implement the Netconf urn:ietf:params:netconf:capability:with-defaults:1.0 capability. The ‘report-all’ retrieval mode shall be supported. Other retrieval modes may be supported. The basic mode should be ‘report-all’.

## 12.2 Generic fault supervision management service

### 12.2.1 RESTful HTTP-based solution set

#### 12.2.1.1 Mapping of operations

##### 12.2.1.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 12.2.1.1.1-1.

Table 12.2.1.1.1-1: Mapping of IS operations to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation** | **HTTP Method** | **Resource URI** | **S** |
| getAlarmList | GET | /alarms | M |
| getAlarmCount | GET | /alarms/alarmCount | O |
| acknowledgeAlarms | PATCH | /alarms | M |
| PATCH | /alarms/{alarmId} | M |
| unacknowledgeAlarms | PATCH | /alarms | M |
| PATCH | /alarms/{alarmId} | M |
| clearAlarms | PATCH | /alarms | M |
| PATCH | /alarms/{alarmId} | M |
| setComment | POST | /alarms/{alarmId}/comment | O |
| subscribe | POST | /subscriptions | M |
| unsubscribe | DELETE | /subscriptions/{subscriptionId} | M |

##### 12.2.1.1.2 Operation getAlarmList

The IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.2-1 and table 12.2.1.1.2-2.

Table 12.2.1.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| alarmAckState | query | alarmAckState | AlarmAckState- | O |
| baseObjectClass  baseObjectInstance | query | baseObjectInstance | Dn | O |
| filter | query | filter | Filter | O |

Table 12.2.1.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| alarmInformationList | response body | n/a | map(lastNotificationHeader, AlarmRecord, (map(Comment)) | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow is as follows:

1. The MnS consumer sends a HTTP GET request to the MnS producer.

- The URI identifies the "…/alarms" collection resource.

- The querycomponent may contain three optional parameters: "alarmAckstate", "baseObjectInstance" and "filter". Absence of the query component means all alarms shall be returned.

- The request message body shall be empty.

2. The MnS producer sends a HTTP GET response to the MnS consumer.

- On success "200 OK" shall be returned. The response message body shall contain the queried alarm records. For each alarm, the notification header of the last alarm notification, that was related to this alarm, shall be included. Only "notifyNewAlarm", "notifyChangedAlarm" or "notifyClearedAlarm" notifications shall be considered when determining the last alarm notification. The comments related to each alarms shall be contained in the response as well.

- On failure, an appropriate error code shall be returned. The response message body may carry additional error information.

##### 12.2.1.1.3 Operation getAlarmCount

The IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.3-1 and table 12.2.1.1.3-2.

Table 12.2.1.1.3-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| alarmAckState | query | alarmAckState | AlarmAckState- | O |
| filter | query | filter | string | O |

Table 12.2.1.1.3-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| criticalCount, majorCount, minorCount, warningCount, indeterminateCount, clearedCount | response body | n/a | AlarmCount | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow is as follows:

1. The MnS consumer sends a HTTP GET request to the MnS producer.

- The URI identifies the "…/alarms/alarmsCount" collection resource.

- The query component may contain two optional parameters: "alarmAckstate" and "filter". Absence of the query component means all alarms shall be counted.

- The request message body shall be empty.

2. The MnS producer sends a HTTP GET response to the MnS consumer.

- On success "200 OK" shall be returned. The response message body shall carry the alarm count for all perceived severity values. The response format is defined by "AlarmsCount".

- On failure, an appropriate error code shall be returned. The response message body may carry additional error information.

##### 12.2.1.1.4 Operation setComment

In case a comment shall be added to a single alarm the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.4-1 and table 12.2.1.1.4-2.

Table 12.2.1.1.4-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| alarmInformationReferenceList | path | /alarms/{alarmId}/comments | n/a | M |
| commentUserId | request body | commentUserId | string | M |
| commentSystemId | request body | commentSystemId | string | O |
| commentText | request body | commentText | string | M |

Table 12.2.1.1.4-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| badAlarmInformationReferenceList | response body | n/a | ErrorResponse | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow for adding a comment to a single alarm is as follows:

1. The MnS consumer sends a HTTP POST request to the MnS producer.

- The URI identifies the "…/alarms/{alarmId}/comment" alarm resource the comment shall be added to.

- The query component shall be absent.

- The request message body shall contain a JSON object with "commentUserId" and "commentText" properties. In addition to that the request object may contain the "commentSystemId" property. .

2. The MnS producer sends a HTTP POST response to the MnS consumer.

- On success "201 Created " shall be returned. The response message body shall carry the representation of the created comment resource. The Location header shall be present and carry the URI of the created comment resource.

- On failure, an appropriate error code shall be returned. The response message body may carry additional error information.

The stage 3 solution does not support adding a comment to multiple alarms.

##### 12.2.1.1.5 Operation acknowledgeAlarms

In case a single alarm shall be acknowledged the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.5-1 and table 12.2.1.1.5-2.

Table 12.2.1.1.5-1: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| alarmInformationAndSeverityReferenceList | path | /{alarmId} | string | M |
| ackUserId | request body | ackUserId | string | M |
| ackSystemId | request body | ackSystemId | string | O |

The perceived severity is not mapped in the present documet.

Table 12.2.1.1.5-2: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| badAlarmInformationReferenceList | response body | n/a | errorResponse | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow for acknowledging a single alarm is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.

- The URI identifies the "…/alarms/{alarmId}" alarm resource to be acknowledged.

- The query component is absent..

- The request message body contains a merge patch document. The document shall patch the "ackState" and "ackUserId" property of the identified alarm resource, and may patch the "ackSystemId" property. The patch document is defined by "MergePatchAcknowledgeAlarms".

2. The MnS producer sends a HTTP PATCH response to the MnS consumer.

- On success "204 No Content" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body shall return the alarmId, together with failure reason. The response message body may carry additional error information.

In case multiple alarms shall be acknowledged the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.5-3 and table 12.2.1.1.5-4.

Table 12.2.1.1.5-3: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| alarmInformationAndSeverityReferenceList | path  request body | /alarms  alarmId (key in map) | n/a  string | M  M |
| ackUserId | request body | ackUserId | string | M |
| ackSystemId | request body | ackSystemId | string | O |

The perceived severity is not mapped in the present document.

Table 12.2.1.1.5-4: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| badAlarmInformationReferenceList | response body | n/a | array(FailedAlarm) | M |
| status | response status codes | n/a | n/a | M |

The message flow for acknowledging multiple alarms is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.

- The URI identifies the "…/alarms" collection resource.

- The query component is absent.

- The request message body contains a merge patch document. The document shall patch the "ackState" and "ackUserId" property of the identified alarm resources, and my patch the "ackSystemId" property. The patch document is defined by "MergePatchAcknowledgeAlarms".

2. The MnS producer sends a HTTP PATCH response to the MnS consumer.

- On success "200 OK" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body shall return a list with the alarmId's that did not exist or were identifying alarms that could not be acknowledged, together with the failure reasons.

##### 12.2.1.1.6 Operation unacknowledgeAlarms

In case a single alarm shall be unacknowledged the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.6-1 and table 12.2.1.1.6-2.

Table 12.2.1.1.6-1: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| alarmInformationReferenceList | path | /{alarmId} | string | M |
| ackUserId | request body | ackUserId | string | M |
| ackSystemId | request body | ackSystemId | string | O |

Table 12.2.1.1.6-2: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| badAlarmInformationReferenceList | response body | n/a | errorResponse | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow for unacknowledging a single alarm is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.

- The URI identifies the "…/alarms/{alarmId}" alarm resource to be acknowledged.

- The query component is absent.

- The request message body contains a merge patch document. The document shall patch the "ackState" and "ackUserId" property of the identified alarm resource, and may patch the "ackSystemId" property. The patch document is defined by "MergePatchAcknowledgeAlarms".

2. The MnS producer sends a HTTP PATCH response to the MnS consumer.

- On success "204 No Content" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body may carry additional error information.

In case multiple alarms shall be unacknowledged the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.6-3 and table 12.2.1.1.6-4.

Table 12.2.1.1.6-3: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| alarmInformationReferenceList | path  request body | /alarms  alarmId (key in map) | n/a  string | M  M |
| ackUserId | request body | ackUserId | string | M |
| ackSystemId | request body | ackSystemId | string | O |

Table 12.2.1.1.6-4: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| badAlarmInformationReferenceList | response body | error | array(FailedAlarm) | M |
| status | response status codes | n/a | n/a | M |

The message flow for unacknowledging multiple alarms is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.

- The URI identifies the "…/alarms" collection resource.

- The query component is absent.

- The request message body contains a merge patch document. The document shall patch the "ackState" and "ackUserId" property of the identified alarm resources, and my patch the "ackSystemId" property. The patch document is defined by "MergePatchAcknowledgeAlarms".

2. The MnS producer sends a HTTP PATCH response to the MnS consumer.

- On success "200 OK" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body shall return a list with the alarmId's that did not exist or were identifying alarms that could not be unacknowledged, together with the failure reasons.

##### 12.2.1.1.7 Operation clearAlarms

In case a single alarm shall be cleared the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.7-1 and table 12.2.1.1.7-2.

Table 12.2.1.1.7-1: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| alarmInformationReferenceList | path | /{alarmId} | string | M |
| clearUserId | request body | clearUserId | string | M |
| clearSystemId | request body | clearSystemId | string | O |

Table 12.2.1.1.7-2: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| badAlarmInformationReferenceList | response body | n/a | errorResponse | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow for clearing a single alarm is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.

- The URI identifies the "…/alarms/{alarmId}" alarm resource.

- The query component is absent.

- The request message body contains a merge patch document. The document shall patch the "clearUserId" property, may patch the "clearSystemId" property and shall patch the "perceivedSeverity" property of the identified alarm resource represented by an "alarmRecord" object. The patch document is defined by "MergePatchClearAlarms".

2. The MnS producer sends a HTTP PATCH response to the MnS consumer.

- On success "204 No content" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body shall return the alarmId that did not exist or was identifying an alarm that could not be cleared together with a failure reason. The JSON document carried in the response shall comply to "FailedAlarms-Response" .

In case multiple alarms shall be cleared the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.7-3 and table 12.2.1.1.7-4.

Table 12.2.1.1.7-3: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| alarmInformationReferenceList | path  request body | /alarms  alarmId (key in map) | n/a  string | M  M |
| clearUserId | request body | clearUserId | string | M |
| clearSystemId | request body | clearSystemId | string | O |

Table 12.2.1.1.7-4: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| badAlarmInformationReferenceList | response body | n/a | array(FailedAlarm) | M |
| status | response status codes | n/a | n/a | M |

The message flow for clearing multiple alarms is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.

- The URI identifies the "…/alarms" collection resource.

- The query component is absent..

- The request message body contains a merge patch document. The document shall patch the "clearUserId" property, may patch the "clearSystemId" property and shall patch the "perceivedSeverity" property of the identified alarm resources . The patch document is defined by "patchClearAlarms-RequestType".

2. The MnS producer sends a HTTP PATCH response to the MnS consumer.

- On success "200 OK" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body shall return a list with the alarmId's that did not exist or were identifying alarms that could not be cleared, together with the failure reasons.

##### 12.2.1.1.8 Operation subscribe

The IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.8-1 and table 12.2.1.1.8-2.

Table 12.2.1.1.8-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| consumerReference | request body | consumerReference | Uri | M |
| timeTick | request body | timeTick | integer | O |
| filter | request body | filter | Filter | O |

Table 12.2.1.1.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| subscriptionId | Location header | n/a | Uri | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The procedure for subscribing to notifications is as follows:

1. The MnS consumer sends a HTTP POST request to the MnS producer.

- The URI identifies the "…/subscriptions" collection resource.

- The query component shall be absent.

- The request message body shall carry a data structure of type "Subscription". This data structure contains filtering criteria and a consumer side URI to which the provider will subsequently send notifications about events that match the filter.

2. The MnS producer creates a new subscription for notifications related to fault management, and a resource that represents this subscription.

3. The MnS producer sends a HTTP POST response to the MnS consumer.

- On success "201 Created " shall be returned. The response message body shall carry the representation of the created subscription resource. The Location header shall be present and carry the URI of the created subscription resource.

- On failure, an appropriate error code shall be returned. The response message body may carry additional error information.

##### 12.2.1.1.9 Operation unsubscribe

In case one subscription shall be cancelled the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.9-1 and table 12.2.1.1.9-2.

Table 12.2.1.1.9-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| consumerReference | -- | -- | -- | -- |
| subscriptionId | path | /subscriptions/{subscriptionId} | string | M |

Table 12.2.1.1.9-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The consumer reference is not mapped in the present document.

The procedure for unsubscribing from one subscription is as follows:

1. The MnS consumer sends a HTTP DELETE request to the MnS producer.

- The URI identifies the "…/subscriptions/{subscriptionId}" subscription resource.

- The querycomponent shall be absent.

- The request message body shall be empty.

2. The MnS producer sends a HTTP DELETE response to the MnS consumer.

- On success "204 No Content" shall be returned. The response message body shall be empty.

- On failure, an appropriate error code shall be returned. The response message body may carry an error object.

#### 12.2.1.2 Mapping of notifications

##### 12.2.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.2.1.2.1-1.

**Table 12.2.1.2.1-1: Mapping of IS notifications to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| IS notifications | HTTP Method | Resource URI | S |
| notifyNewAlarm | POST | {notificationTarget} | M |
| notifyAckStateChanged | POST | {notificationTarget} | M |
| notifyClearedAlarm | POST | {notificationTarget} | M |
| notifyAlarmListRebuilt | POST | {notificationTarget} | M |
| notifyChangedAlarm | POST | {notificationTarget} | M |
| notifyComments | POST | {notificationTarget} | M |
| notifyPotentialFaultyAlarmList | POST | {notificationTarget} | M |
| notifyCorrelatedNotificationChanged | POST | {notificationTarget} | M |
| notifyChangedAlarmGeneral | POST | {notificationTarget} | O |

##### 12.2.1.2.2 Notification notifyNewAlarm (non-security alarm)

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.2-1.

**Table 12.2.1.2.2-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| specificProblem | request body | specificProblem | SpecificProblem | O |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| backedUpStatus | request body | backedUpStatus | boolean | O |
| backUpObject | request body | backUpObject | Dn | O |
| trendIndication | request body | trendIndication | TrendIndication | O |
| thresholdInfo | request body | thresholdInfo | ThresholdInfo | O |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| stateChangeDefinition | request body | stateChangeDefinition | AttributeValueChangeSet | O |
| monitoredAttributes | request body | monitoredAttributes | AttributeNameValuePairSet | O |
| proposedRepairActions | request body | proposedRepairActions | string | O |
| additionalText | request body | additionalText | string | O |
| additionalInformation | request body | additionalInformation | AttributeNameValuePairSet | O |

##### 12.2.1.2.3 Notification notifyNewAlarm (security alarm)

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.3-1.

**Table 12.2.1.2.3-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| additionalText | request body | additionalText | string | O |
| additionalInformation | request body | additionalInformation | AttributeNameValuePairSet | O |
| rootCauseIndicator | request body | rootCauseIndicator | boolean | O |
| serviceUser | request body | serviceUser | string | M |
| serviceProvider | request body | serviceProvider | string | M |
| securityAlarmDetector | request body | securityAlarmDetector | string | M |

##### 12.2.1.2.4 Notification notifyAckStateChanged

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.4-1.

**Table 12.2.1.2.4-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId- | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | M |
| ackState | request body | ackState | AckState | M |
| ackUserId | request body | ackUserId | string | M |
| ackSystemId | request body | ackSystemId | string | O |

##### 12.2.1.2.5 Notification notifyClearedAlarm

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.5-1.

**Table 12.2.1.2.5-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| clearUserId | request body | clearUserId | string | O |
| clearSystemId | request body | clearSystemId | string | O |

##### 12.2.1.2.6 Notification notifyAlarmListRebuilt

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.6-1.

**Table 12.2.1.2.6-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| reason | request body | reason | string | M |
| alarmListAlignmentRequirement | request body | alarmListAlignmentRequirement | AlarmListAlignmentRequirement | O |

##### 12.2.1.2.7 Notification notifyChangedAlarm

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.7-1.

**Table 12.2.1.2.7-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | M |

##### 12.2.1.2.8 Notification notifyComments

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.8-1.

**Table 12.2.1.2.8-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | M |
| comments | request body | comments | map(Comment) | M |

##### 12.2.1.2.9 Notification notifyPotentialFaultyAlarmList

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.9-1.

**Table 12.2.1.2.9-1: Mapping of IS notification parameters to SS equivalents**

| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| --- | --- | --- | --- | --- |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| reason | request body | reason | string | M |

##### 12.2.1.2.10 Notification notifyCorrelatedNotificationChanged

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.10-1.

**Table 12.2.1.2.10-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | M |
| rootCauseIndicator | request body | rootCauseIndicator | boolean | O |

##### 12.2.1.2.11 Notification notifyChangedAlarmGeneral (non-security alarm)

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.11-1.

**Table 12.2.1.2.11-1: Mapping of IS notification parameters to SS equivalents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| specificProblem | request body | specificProblem | SpecificProblem | O |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | O |
| backedUpStatus | request body | backedUpStatus | booleanbackedUpStatus | O |
| backUpObject | request body | backUpObject | Dn | O |
| trendIndication | request body | trendIndication | TrendIndication | O |
| thresholdInfo | request body | thresholdInfo | ThresholdInfo | O |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| stateChangeDefinition | request body | stateChangeDefinition | AttributeValueChangeSet | O |
| monitoredAttributes | request body | monitoredAttributes | AttributeNameValuePairSet | O |
| proposedRepairActions | request body | proposedRepairActions | string | O |
| additionalText | request body | additionalText | string | O |
| additionalInformation | request body | additionalInformation | AttributeNameValuePairSet | O |
| rootCauseIndicator | request body | rootCauseIndicator | booleanr | O |
| changedAlarmAttributes | request body | changedAlarmAttributes | AttributeNameValuePairSet | O |

##### 12.2.1.2.12 Notification notifyChangedAlarmGeneral (security alarm)

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.12-1.

Table 12.2.1.2.12-1: Mapping of IS notification parameters to SS equivalents

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| objectClass, | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| alarmId | request body | alarmId | AlarmId | M |
| alarmType | request body | alarmType | AlarmType | M |
| probableCause | request body | probableCause | ProbableCause | M |
| perceivedSeverity | request body | perceivedSeverity | PerceivedSeverity | O |
| correlatedNotifications | request body | correlatedNotifications | array(CorrelatedNotification) | O |
| additionalText | request body | additionalText | string | O |
| additionalInformation | request body | additionalInformation | AttributeNameValuePairSet | O |
| rootCauseIndicator | request body | rootCauseIndicator | boolean | O |
| serviceUser | request body | serviceUser | string | M |
| serviceProvider | request body | serviceProvider | string | M |
| securityAlarmDetector | request body | securityAlarmDetector | string | M |
| changedAlarmAttributes | request body | changedAlarmAttributes | AttributeNameValuePairSet | M |

#### 12.2.1.3 Resources

##### 12.2.1.3.1 Resource structure

12.2.1.3.1.1 Resource structure on the MnS producer

Figure 12.2.1.3.1.1-1 shows the resource structure of the Fault Supervision MnS on the MnS producer.



Figure 12.2.1.3.1-1: Resource URI structure of the Fault Supervision MnS on the MnS producer

Table 12.2.1.3.1.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.2.1.3.1.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| Alarms | .../alarms | GET | Retrieve all alarms or a filtered subset |
| PATCH | Clear, acknowledge or unacknowledge multiple alarms |
| Alarm Count | .../alarms/alarmCount | GET | Retrieve the alarm count per perceived severity |
| Alarm | .../alarms/{alarmId} | PATCH | Clear, acknowledge or unacknowledge an alarm |
| Comments | .../alarms/{alarmId}/comments | POST | Add a comment to an alarm |
| Subscriptions | .../subscriptions | POST | Create a subscription |
| Subscription | .../subscriptions/{subscriptionId} | DELETE | Delete a subscription |

###### 12.2.1.3.1.2 Resource structure on the MnS consumer

Figure 12.2.1.3.1.2-1 shows the resource structure of the Fault Supervision MnS on the MnS consumer.



Figure 12.2.1.3.1.2-1: Resource URI structure of the Fault Supervision MnS on the MnS consumer

Table 12.2.1.3.1.2-1 provides an overview of the resources and applicable HTTP methods.

Table 12.2.1.3.1.2-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| Notification Target | {notificationTarget} | POST | Send a notification to the notification target |

##### 12.2.1.3.2 Resource definitions

###### 12.2.1.3.2.1 Resource "…/alarms"

12.2.1.3.2.1.1 Description

This resource represents a collection of alarms.

12.2.1.3.2.1.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms

The resource URI variables are defined in table 12.2.1.3.2.1.2-1.

Table 12.2.1.3.2.1.2-1: URI variables

|  |  |
| --- | --- |
| **Name** | **Definition** |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |

12.2.1.3.2.1.3 HTTP methods

12.2.1.3.2.1.3.1 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 12.2.1.3.2.1.3.1-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| alarmAckState | AlarmAckState |  | O |
| href | Dn |  | O |
| filter | string |  | O |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 12.2.1.3.2.1.3.1-2: Data structures supported by the GET Request Body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

Table 12.2.1.3.2.1.3.1-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| GetAlarmsResponse | 200 OK | The alarms returned. | M |
| ErrorResponse | 4xx/5xx | Returned in case of an error | O |

12.2.1.3.2.1.3.2 Void

12.2.1.3.2.1.3.3 HTTP PATCH

This method shall support the URI query parameters specified in the following table.

Table 12.2.1.3.2.1.3.3-1: URI query parameters supported by the PATCH method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 12.2.1.3.2.1.3.3-2: Data structures supported by the PATCH Request Body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| map(MergePatchAcknowledgeAlarm) | Patch document for acknowledging one or multiple alarms | M |
| map(MergePatchClearAlarm) | Patch document for clearing one or multiple alarms | M |

Table 12.2.1.3.2.1.3.3-3: Data structures supported by the PATCH Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| n/a | 204 No Content | In case of success the response body shall be empty. | M |
| ErrorResponse | 4xx/5xx | In case of failure, the response body shall be described by "ErrorResponse". | M |

###### 12.2.1.3.2.2 Resource "…/alarms /{alarmId}"

12.2.1.3.2.2.1 Description

This resource represents an alarm.

12.2.1.3.2.2.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/{alarmId}

The resource URI variables are defined in table 12.2.1.3.2.2.2-1.

Table 12.2.1.3.2.2.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| alarmId | Alarm identifier |

12.2.1.3.2.2.3 HTTP methods

12.2.1.3.2.2.3.1 HTTP PATCH

This method shall support the URI query parameters specified in the following table.

Table 12.2.1.3.2.2.3.1-1: URI query parameters supported by the PATCH method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 12.2.1.3.2.2.3.1-2: Data structures supported by the PATCH Request Body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| MergePatchAcknowledgeAlarm | Patch document for acknowledging an alarm | M |
| MergePatchClearAlarm | Patch document for clearing an alarm | M |

Table 12.2.1.3.2.2.3.1-3: Data structures supported by the PATCH Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| n/a | 200 OK | In case of success the response body shall be empty. |  |
| ErrorResponse | 4xx/5xx | In case of failure, the response body shall carry a JSON object described by "ErrorResponse". |  |

###### 12.2.1.3.2.3 Resource "…/alarms/alarmCount"

12.2.1.3.2.3.1 Definition

This resource holds metadata about the /alarms collection resource like the alarm count per perceived severity.

12.2.1.3.2.3.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/alarmCount

The resource URI variables are defined in table 12.2.1.3.2.3.2-1.

Table 12.2.1.3.2.3.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |

12.2.1.3.2.3.3 HTTP methods

12.2.1.3.2.3.3.1 GET

This method shall support the URI query parameters specified in table 12.2.1.3.2.3.3.1-1.

Table 12.2.1.3.2.3.3.3-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| alarmAckState | AlarmAckState | Allows to control which alarms are counted based on acknowledgement state | O |
| filter | string | Allows to control which alarms are counted based on a general filter applied to the alarm records. | O |

This method shall support the request data structures specified in table 12.2.1.3.2.3.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.3.3.1-3.

Table 12.2.1.3.2.3.3.1-2: Data structures supported by the GET Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| n/a | n/a | n/a |

Table 12.2.1.3.2.3.3.1-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| AlarmsCount | 200 OK | The alarm count per severity level returned. | M |
| ErrorResponse | 4xx/5xx | Returned in case of an error | O |

###### 12.2.1.3.2.4 Resource "…/alarms/{alarmId}/comments"

12.2.1.3.2.4.1 Definition

This resource is a collection resource for comments attached to an alarm.

12.2.1.3.2.4.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/{alarmId}/comments

The resource URI variables are defined in table 12.2.1.3.2.4.2-1.

Table 12.2.1.3.2.4.2-1: URI variables

|  |  |
| --- | --- |
| **Name** | **Definition** |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| alarmId | Alarm identifier |

12.2.1.3.2.4.3 HTTP methods

12.2.1.3.2.4.3.1 POST

This method shall support the URI query parameters specified in the following table.

Table 12.2.1.3.2.4.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures, and the response data structures and response codes specified in the following tables.

Table 12.2.1.3.2.4.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| Comment | The representation of the comment to be added to an alarm. | M |

Table 12.2.1.3.2.4.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| Comment | 201 Created | In case of success, the response body shall carry the representation of a comment. The "commentTime" shall be set by the MnS producer. | M |
| ErrorResponse | 4xx/5xx | In case of failure, the response body shall be described by "ErrorResponse". | M |

###### 12.2.1.3.2.5 Resource "…/comments/{commentId}"

12.2.1.3.2.5.1 Definition

This resource represents a comment attached to an alarm.

12.2.1.3.2.5.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/{alarmId}/comments/{commentId}

The resource URI variables are defined in table 12.2.1.3.2.4.5-1.

Table 12.2.1.3.2.4.5-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| alarmId | Alarm identifier |
| commentId | Comment identifier |

12.2.1.3.2.5.3 HTTP methods

None.

###### 12.2.1.3.2.6 Resource "…/subscriptions"

12.2.1.3.2.6.1 Description

This resource is a container resource for individual subscriptions.

12.2.1.3.2.6.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/subscriptions

The resource URI variables are defined in table 12.2.1.3.2.6.2-1.

Table 12.2.1.3.2.6.2-1: URI variables

|  |  |
| --- | --- |
| **Name** | **Definition** |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |

12.2.1.3.2.6.3 HTTP methods

12.2.1.3.2.6.3.1 POST

This method shall support the URI query parameters specified in table 12.2.1.3.2.6.3.1-1.

Table 12.2.1.3.2.6.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.2.1.3.2.6.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.6.3.1-3.

Table 12.2.1.3.2.6.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| Subscription | Details of the subscription to be created | M |

Table 12.2.1.3.2.6.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| Subscription | 201 Created | In case of success the representation of the created subscription is returned. | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

12.2.1.3.2.6.3.2 Void

###### 12.2.1.3.2.7 Resource "…/subscriptions/{subscriptionId}"

12.2.1.3.2.7.1 Description

This resource represents a subscription.

12.2.1.3.2.7.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/ subscriptions/{subscriptionId}

The resource URI variables are defined in table 12.2.1.3.2.7.2-1.

Table 12.2.1.3.2.7.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| subscriptionId | Subscription identifier |

12.2.1.3.2.7.3 HTTP methods

12.2.1.3.2.7.3.1 DELETE

This method shall support the URI query parameters specified in table 12.2.1.3.2.7.3.1-1.

Table 12.2.1.3.2.7.3.1-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.2.1.3.2.7.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.7.3.1-3.

Table 12.2.1.3.2.7.3.1-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| n/a | n/a | n/a |

Table 12.2.1.3.2.7.3.1-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| n/a | 204 No Content | In case of success no message body is returned | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

###### 12.2.1.3.2.8 Resource "{notificationTarget}"

12.2.1.3.2.8.1 Description

This resource represents a notification target on the MnS consumer.

12.2.1.3.2.8.2 URI

Resource URI: {notificationTarget}

The resource URI variables are defined in table 12.2.1.3.2.8.2-1.

Table 12.2.1.3.2.8.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| notificationTarget | URI of the notification target on the MnS consumer, contained in the notification subscription |

12.2.1.3.2.8.3 HTTP methods

12.2.1.3.2.8.3.1 POST

This method shall support the URI query parameters specified in table 12.2.1.3.2.8.3.1-1.

Table 12.2.1.3.2.8.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.2.1.3.2.8.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.8.3.1-3.

Table 12.2.1.3.2.8.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| NotifyNewAlarm | Type for a notifyNewAlarm notification (non-security alarm) | M |
| NotifyNewSecAlarm | Type for a notifyNewAlarm notification (security alarm) | M |
| NotifyAckStateChanged | Type for a notifyAckStateChanged notification | M |
| NotifyClearedAlarm | Type for a notifyClearedAlarm notification | M |
| NotifyAlarmListRebuilt | Type for a notifyAlarmListRebuilt notification | M |
| NotifyChangedAlarm | Type for a notifyChangedAlarm notification | M |
| NotifyComments | Type for a notifyComments notification | M |
| NotifyPotentialFaultyAlarmList | Type for a notifyPotentialFaultyAlarmList notification | M |
| NotifyCorrelatedNotificationChanged | Type for a notifyCorrelatedNotificationChanged notification | M |
| NotifyChangedAlarmGeneral | Type for a notifyChangedAlarmGeneral notification (non-security alarm) | M |
| NotifyChangedSecAlarmGeneral | Type for a notifyChangedAlarmGeneral notification (security alarm) | M |

Table 12.2.1.3.2.8.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| n/a | 204 No Content | In case of success no message body is returned | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

#### 12.2.1.4 Data type definitions

##### 12.2.1.4.1 General

This clause defines the data types used by the Fault Supervision MnS. Table 12.2.1.4.1-1 specifies the data types defined in the present document and table 12.2.1.4.1-2 the data types imported.

Table 12.2.1.4.1-1: Data types defined in the present document

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Description |
| AlarmAckState | 12.2.1.4.3.4 | Used in the query part of HTTP GET on /alarms to discriminate alarms to be returned or counted |
| AlarmId | 12.2.1.4.4.2 | Alarm identifier, see clause 11.2.2.1.5.1 |
| AlarmType | 12.2.1.4.4.6 | Alarm type as defined in ITU-T Rec. X. 733 [4] |
| ProbableCause | 12.2.1.4.4.7 | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] |
| PerceivedSeverity | 12.2.1.4.4.9 | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] |
| TrendIndication | 12.2.1.4.4.10 | Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4] |
| ThresholdHysteresis | 12.2.1.4.1a.1 | Used in the definition of ThresholdInfo as defined in ITU-T Rec. X. 733 [4] |
| ThresholdLevelInd | 12.2.1.4.1a.2 | Used in the definition of ThresholdInfo as defined in ITU-T Rec. X. 733 [4] |
| ThresholdInfo | 12.2.1.4.1a.3 | Provides information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4] |
| CorrelatedNotification | 12.2.1.4.1a.4 | Describes the correlated notifications of a single source |
| AckState | 12.2.1.4.4.4 | Acknowledgement state, see clause 11.2.2.1.5.1 |
| AlarmNotificationTypes | 12.2.1.4.4.8 | Alarm notification types (notifyNewAlarm, etc.) |
| AlarmListAlignmentRequirement | 12.2.1.4.4.5 | Indicating if alarm list alignment is required or not |
| AlarmRecord | 12.2.1.4.1a.5 | Representation of an alarm resource |
| AlarmCount | 12.2.1.4.1a.6 | Representation of an alarmCout resource |
| Comment | 12.2.1.4.1a.7 | Representation of a comment resource |
| Subscription | 12.2.1.4.1a.8 | Representation of a subscription resource |
| MergePatchAcknowledgeAlarm | 12.2.1.4.1a.9 | Used in the request message body of HTTP PATCH to acknowledge or unacknowledge an alarm |
| MergePatchClearAlarm | 12.2.1.4.1a.10 | Used in the request body of HTTP PATCH to clear an alarm |
| FailedAlarm | 12.2.1.4.1a.11 | Used in the response body of multiple HTTP methods to indicate error reasons per alarm id |
| NotifyNewAlarm | 12.2.1.4.1a.12 | Used in the request body of HTTP POST for the notification type notifyNewAlarm |
| NotifyNewSecAlarm | 12.2.1.4.1a.13 | Used in the request body of HTTP POST for the notification type notifyNewAlarm |
| NotifyClearedAlarm | 12.2.1.4.1a.14 | Used in the request body of HTTP POST for the notification type notifyClearedAlarm |
| NotifyChangedAlarm | 12.2.1.4.1a.15 | Used in the request body of HTTP POST for the notification type notifyChangedAlarm |
| NotifyChangedAlarmGeneral | 12.2.1.4.1a.16 | Used in the request body of HTTP POST for the notification type notifyChangedAlarmGeneral |
| NotifyChangedSecAlarmGeneral | 12.2.1.4.1a.17 | Used in the request body of HTTP POST for the notification type notifyChangedAlarmGeneral |
| NotifyCorrelatedNotificationChanged | 12.2.1.4.1a.18 | Used in the request body of HTTP POST for the notification type notifyCorrelatedNotificationChanged |
| NotifyAckStateChanged | 12.2.1.4.1a.19 | Used in the request body of HTTP POST for the notification type notifyAckStateChanged |
| NotifyComments | 12.2.1.4.1a.20 | Used in the request body of HTTP POST for the notification type notifyComments |
| NotifyPotentialFaultyAlarmList | 12.2.1.4.1a.21 | Used in the request body of HTTP POST for the notification type notifyPotentialFaultyAlarmList |
| NotifyAlarmListRebuilt | 12.2.1.4.1a.22 | Used in the request body of HTTP POST for the notification type notifyAlarmListRebuilt |

Table 12.2.1.4.1-2: Data types imported

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Description |
| DateTime | TS 28.623 [44] | Date and time |
| Float | TS 28.623 [44] | Float type |
| Dn | TS 28.623 [44] | DN type |
| SystemDN | TS 28.623 [44] | systemDN type |
| Uri | TS 28.623 [44] | URI type |
| AttributeNameValuePairSet | TS 28.623 [44] | Set of attribute name/value pairs |
| AttributeValueChangeSet | TS 28.623 [44] | Set of attribute names with their old and new values |
| Filter | TS 28.623 [44] | Filter type |
| NotificationId | TS 28.623 [44] | Notification identifier as defined in ITU-T Rec. X. 733 [4] |
| NotificationType | TS 28.623 [44] | Notification type |
| NotificationHeader | TS 28.623 [44] | Notification header |
| ErrorResponse | TS 28.623 [44] | Used in the response body of multiple HTTP methods in case of error |

##### 12.2.1.4.1a Structured data types

###### 12.2.1.4.1a.1 Type ThresholdHysteresis

Table 12.2.1.4.1a.1-1: Definition of type ThresholdHysteresis

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| high | oneOf(integer, Float) | Higher value of a threshold with hysteris, the integer type is used for counter thresholds and the float type for gauge thresholds. | M |
| low | Float | Lower value of a threshold with hysteresis, applicable only to gauge thresholds. | M |

###### 12.2.1.4.1a.2 Type ThresholdLevelInd

Table 12.2.1.4.1a.2-1: Definition of type ThresholdLevelInd

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name (choice) | Data type | Description | S |
| up | ThresholdHysteresis | Indicates for counter and gauge thresholds that the threshold crossing occurred when going up. | M |
| down | ThresholdHysteresis | Indicates for gauge thresholds that the threshold crossing occurred when going down, applicable only to gauge thresholds. | M |

###### 12.2.1.4.1a.3 Type ThresholdInfo

Table 12.2.1.4.1a.3-1: Definition of type ThresholdInfo

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| observedMeasurement | string | The name of the monitored measurement that crossed the threshold and that caused the notification (Rec. ITU-T X. 733 [4]). | M |
| observedValue | number | The value of the gauge or counter which crossed the threshold. This may be different from the threshold value if, for example, the gauge may only take on discrete values. Integer values are used for counters and float values for gauges (Rec. ITU-T X. 733 [4]). Note that a "number" type property can contain both integers and floating point numbers. | M |
| thresholdLevel | ThresholdLevelInd | In the case of a gauge the threshold level specifies a pair of threshold values, the first being the value of the crossed threshold and the second, its corresponding hysteresis; in the case of a counter the threshold level specifies only the threshold value (Rec. ITU-T X. 733 [4]). | O |
| armTime | DateTime | For a gauge threshold, the time at which the threshold was last re-armed, namely the time after the previous threshold crossing at which the hysteresis value of the threshold was exceeded thus again permitting generation of notifications when the threshold is crossed. For a counter threshold, the later of the time at which the threshold offset was last applied, or the time at which the counter was last initialized (for resettable counters) (Rec. ITU-T X. 733 [4]). | O |

###### 12.2.1.4.1a.4 Type CorrelatedNotification

Table 12.2.1.4.1a.4-1: Definition of type CorrelatedNotification

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| sourceObjectInstance | Dn | Source oject instance of the notifications identified by notificationIds. The sourceObjectInstance shall be present if the sourceObjectInstance is not identical to the alarmed objectInstance of the alarmRecord | O |
| notificationIds | array(NotificationId) | Notification identifiers of notifications related to the sourceObjectInstance that are considered to be correlated to the alarmRecord | M |

###### 12.2.1.4.1a.5 Type AlarmRecord

Table 12.2.1.4.1a.5-1: Definition of type AlarmRecord

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| alarmId | key(AlarmId) | Alarm identifier, see clause 11.2.2.1.5.1. The alarmId is used as key in alarm record maps. | M |
| objectInstance | Dn | Alarmed object instance | M |
| notificationId | NotificationId | Notification identifier of the last notifyNewAlarm, notifyChangedAlarm or notifyClearedAlarm | M |
| alarmRaisedTime | DateTime | Date and time the alarm was raised the first time, see clause 11.2.2.1.5.1 | M |
| alarmChangedTime | DateTime | Date and time the perceived severity of the alarm changed the last time, see clause 11.2.2.1.5.1 | O |
| alarmClearedTime | DateTime | Date and time the alarm was cleared, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| specificProblem | oneOf(string, integer) | Refinements to the probable cause of the alarm as defined in ITU-T Rec. X. 733 [4] | O |
| perceivedSeverity | PerceivedSeverity | Perceived severity of the alarm as defined in ITU-T Rec. X. 733 [4] | M |
| backedUpStatus | boolean | Indicating if the object emitting the alarm has been backed up as defined in ITU-T Recommendation X. 733 [4] | O |
| backUpObject | Dn | Backup object of the alarmed object as defined in ITU-T Rec. X. 733 [4] | O |
| trendIndication | TrendIndication | Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4] | O |
| thresholdInfo | ThresholdInfo | Additional information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4] | O |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| stateChangeDefinition | AttributeValueChangeSet | State transition associated to an alarm as defined in ITU-T Rec. X. 733 [4] | O |
| monitoredAttributes | AttributeNameValuePairSet | Attributes of the alarmed manged object and their corresponding values at the time of the alarm as defined in ITU-T Rec. X. 733 [4]. | O |
| proposedRepairActions | string | Proposed repair action, used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| additionalInformation | AttributeNameValuePairSet | Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4] | O |
| rootCauseIndicator | boolean | Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1 | O |
| ackTime | DateTime | Time when the alarm has been acknowledged or unacknowledged the last time, see clause 11.2.2.1.5.1 | M |
| ackUserId | string | Identifier of a user acknowledging an alarm, see clause 11.2.2.1.5.1 | M |
| ackSystemId | string | Identifier of a system acknowledging an alarm, see clause 11.2.2.1.5.1 | O |
| ackState | AckState | Acknowledgement state, see clause 11.2.2.1.5.1 | M |
| clearUserId | string | Identifier of a system clearing an alarm, see clause 10.2.2.1.5.1 | O |
| clearSystemId | string | Identifier of a user clearing an alarm, see clause 11.2.2.1.5.1 | O |
| serviceUser | string | Identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm, see clause 11.2.2.1.5.1 | O |
| serviceProvider | string | Identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm, see clause 11.2.2.1.5.1 | O |
| securityAlarmDetector | string | Identity of the detector of the security alarm, see clause 11.2.2.1.5.1 | O |

###### 12.2.1.4.1a.6 Type AlarmCount

Table 12.2.1.4.1a.6-1: Definition of type AlarmCount

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| criticalCount | integer | Number of alarms with perceived severity equal to critical | M |
| majorCount | integer | Number of alarms with perceived severity equal to major | M |
| minorCount | integer | Number of alarms with perceived severity equal to minor | M |
| warningCount | integer | Number of alarms with perceived severity equal to warning | M |
| indeterminateCount | integer | Number of alarms with perceived severity equal to indeterminate | M |
| clearedCount | integer | Number of alarms with perceived severity equal to cleared | M |

###### 12.2.1.4.1a.7 Type Comment

Table 12.2.1.4.1a.7-1: Definition of type Comment

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| commentTime | DateTime | Time when the comment has been added to the alarm. | M |
| commentText | string | Comment in text form | M |
| commentUserId | string | Identifier of the user who makes the comment | M |
| commentSystemId | string | Identifier of the system which makes the comment | O |

###### 12.2.1.4.1a.8 Type Subscription

Table 12.2.1.4.1a.8-1: Definition of type Subscription

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| consumerReference | Uri | URI of the notification target on the MnS consumer | M |
| timeTick | integert | Time window within which the subscriber intends to subscribe again to confirm its subscription, see clause 11.2.2.2.5.1 | O |
| filter | Filter | Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A notification is sent to the subscriber if the filter matches, or if there is no filter. | O |

###### 12.2.1.4.1a.9 Type MergePatchAcknowledgeAlarm

Table 12.2.1.4.1a.9-1: Definition of type MergePatchAcknowledgeAlarm

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| ackUserId | string | User acknowledging an alarm | M |
| ackSystemId | string | System acknowledging an alarm | O |
| ackState | AckState | Indicates the ackState shall be set to "ACKNOWLEDGED" or "UNACKNOWLEDGED" | M |

###### 12.2.1.4.1a.10 Type MergePatchClearAlarm

Table 12.2.1.4.1a.10-1: Definition of type MergePatchClearAlarm

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| clearUserId | clearUserId | User clearing an alarm | M |
| clearSystemId | clearSystemId | System clearing an alarm | O |
| perceivedSeverity | type string, enum "CLEARED" | Indicates the perceivedSeverity shall be set to "CLEARED" | M |

###### 12.2.1.4.1a.11 Type FailedAlarm

Table 12.2.1.4.1a.11-1: Definition of type FailedAlarm

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| alarmId | AlarmId | Indicating the alarms for which the action on the alarm could not be performed | M |
| failureReason | string | Indicating the reason why the action could not be performed | M |

###### 12.2.1.4.1a.12 Type NotifyNewAlarm

Table 12.2.1.4.1a.12-1: Definition of type NotifyNewAlarm

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyNewAlarm) | M |
| eventTime | DateTime | Event (alarm) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| specificProblem | SpecificProblem | Identifies further refinements to the Probable cause of the alarm as defined in ITU-T Rec. X. 733 [4] | O |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | M |
| backedUpStatus | boolean | Indicating if the object emitting the alarm has been backed up as defined in ITU-T Recommendation X. 733 [4] | O |
| backUpObject | Dn | Indicating the backup object of the alarmed object as defined in ITU-T Rec. X. 733 [4] | O |
| trendIndication | TrendIndication | Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4] | O |
| thresholdInfo | ThresholdInfo | Provides additional information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4] | O |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| stateChangeDefinition | AttributeValueChangeSet | Indicates a state transition associated to an alarm as defined in ITU-T Rec. X. 733 [4] | O |
| monitoredAttributes | AttributeNameValuePairSet | Defines one or more attributes of the alarmed manged object and their corresponding values at the time of the alarm as defined in ITU-T Rec. X. 733 [4]. | O |
| proposedRepairActions | string | Used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| additionalInformation | AttributeNameValuePairSet | Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4] | O |
| rootCauseIndicator | boolean | Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1 | O |

###### 12.2.1.4.1a.13 Type NotifyNewSecAlarm

**Table 12.2.1.4.1a.13-1: Definition of type NotifyNewSecAlarm**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyNewAlarm) | M |
| eventTime | DateTime | Event (alarm) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| additionalInformation | AttributeNameValuePairSet | Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4] | O |
| rootCauseIndicator | boolean | Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1 | O |
| serviceUser | string | Identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm, see clause 11.2.2.1.5.1 | M |
| serviceProvider | string | Identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm, see clause 11.2.2.1.5.1 | M |
| securityAlarmDetector | string | Identity of the detector of the security alarm, see clause 11.2.2.1.5.1 | M |

###### 12.2.1.4.1a.14 Type NotifyClearedAlarm

Table 12.2.1.4.1a.14-1: Definition of type NotifyClearedAlarm

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyClearedAlarm) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | M |
| correlatedNotifications | array(correlatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| clearUserId | string | Identifier of a user clearing an alarm, see clause 11.2.2.1.5.1 | O |
| clearSystemId | string | Identifier of a system clearing an alarm, see clause 11.2.2.1.5.1 | O |

###### 12.2.1.4.1a.15 Type NotifyChangedAlarm

Table 12.2.1.1a.14.15-1: Definition of type NotifyChangedAlarm

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyChangedAlarm) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | M |

###### 12.2.1.4.1a.16 Type NotifyChangedAlarmGeneral

Table 12.2.1.4.1a.16-1: Definition of type NotifyChangedAlarmGeneral

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyChangedAlarmGeneral) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| specificProblem | SpecificProblem | Identifies further refinements to the Probable cause of the alarm as defined in ITU-T Rec. X. 733 [4] | O |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | O |
| backedUpStatus | boolean | Indicating if the object emitting the alarm has been backed up as defined in ITU-T Recommendation X. 733 [4] | O |
| backUpObject | Dn | Indicating the backup object of the alarmed object as defined in ITU-T Rec. X. 733 [4] | O |
| trendIndication | TrendIndication | Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4] | O |
| thresholdInfo | ThresholdInfo | Provides additional information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4] | O |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| stateChangeDefinition | AttributeValueChangeSet | Indicates a state transition associated to an alarm as defined in ITU-T Rec. X. 733 [4] | O |
| monitoredAttributes | AttributeNameValuePairSet | Defines one or more attributes of the alarmed manged object and their corresponding values at the time of the alarm as defined in ITU-T Rec. X. 733 [4]. | O |
| proposedRepairActions | string | Used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| additionalInformation | AttributeNameValuePairSet | Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4] | O |
| rootCauseIndicator | boolean | Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1 | O |
| changedAlarmAttributes | AttributeNameValuePairSet | Indicating the alarm attributes that have changed | O |

###### 12.2.1.4.1a.17 Type NotifyChangedSecAlarmGeneral

Table 12.2.1.4.1a.17-1: Definition of type NotifyChangedSecAlarmGeneral

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyChangedAlarmGeneral) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | O |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| additionalInformation | AttributeNameValuePairSet | Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4] | O |
| rootCauseIndicator | boolean | Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1 | O |
| serviceUser | string | Identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm, see clause 11.2.2.1.5.1 | M |
| serviceProvider | string | Identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm, see clause 11.2.2.1.5.1 | M |
| securityAlarmDetector | string | Identity of the detector of the security alarm, see clause 11.2.2.1.5.1 | M |
| changedAlarmAttributes | AttributeNameValuePairSet | Indicating the alarm attributes that have changed | O |

###### 12.2.1.4.1a.18 Type NotifyCorrelatedNotificationChanged

Table 12.2.1.4.1a.18-1: Definition of type NotifyCorrelatedNotificationChanged

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyCorrelatedNotificationChanged) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | M |
| rootCauseIndicator | boolean | Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1 | O |

###### 12.2.1.4.1a.19 Type NotifyAckStateChanged

**Table 12.2.1.4.1a.19-1: Definition of type NotifyAckStateChanged**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyAckStateChanged) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | M |
| ackState | string | Acknowledgement state, see clause 11.2.2.1.5.1 | M |
| ackUserId | string | Identifier of a system acknowledging an alarm, see clause 11.2.2.1.5.1 | M |
| ackSystemId | string | Identifier of a user acknowledging an alarm, see clause 11.2.2.1.5.1 | O |

###### 12.2.1.4.1a.20 Type NotifyComments

Table 12.2.1.4.1a.20-1: Definition of type NotifyComments

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyComments) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| alarmId | AlarmId | Alarm identifier, see clause 11.2.2.1.5.1 | M |
| alarmType | AlarmType | Alarm type as defined in ITU-T Rec. X. 733 [4] | M |
| probableCause | ProbableCause | Probable cause of an alarm as defined in ITU-T Rec. X.733 [4] | M |
| perceivedSeverity | PerceivedSeverity | Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4] | M |
| comments | map(Comment) | Set of all comments related to an alarm | M |

###### 12.2.1.4.1a.21 Type NotifyPotentialFaultyAlarmList

Table 12.2.1.4.1a.21-1: Definition of type NotifyPotentialFaultyAlarmList

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyPotentialFaultyAlarmList) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| reason | string | Indicating the reason why the alarm list has to be rebuilt. | M |

###### 12.2.1.4.1a.22 Type NotifyAlarmListRebuilt

Table 12.2.1.4.1a.22-1: Definition of type NotifyAlarmListRebuilt

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| href | Uri | URI of the resource where the event (alarm) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyAlarmListRebuilt) | M |
| eventTime | DateTime | Event occurrence time | M |
| systemDN | SystemDN | System DN | M |
| reason | string | Indicating the reason why the alarm list has been rebuilt | M |
| alarmListAlignmentRequirement | AlarmListAlignmentRequirement | Indicating if alarm list alignment is required or not | O |

##### 12.2.1.4.2 Void

##### 12.2.1.4.3 Void

##### 12.2.1.4.4 Simple data types and enumerations

###### 12.2.1.4.4.1 General

This clause defines simple data types and enumerations that are used by the data structures defined in the previous clauses.

###### 12.2.1.4.4.2 Simple data types

Table 12.2.1.4.4.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type name | Type definition | Description |
| AlarmId | string | Alarm identifier, see clause 11.2.2.1.5.1 |

###### 12.2.1.4.4.3 Enumeration AlarmAckState

Table 12.2.1.4.4.3-1: Enumeration AlarmAckState

|  |  |
| --- | --- |
| Enumeration value | Description |
| ALL\_ALARMS | All alarms shall be returned or counted. |
| ALL\_ACTIVE\_ALARMS | All active alarms shall be returned or counted. |
| ALL\_ACTIVE\_AND\_ACKNOWLEDGED \_ALARMS | All active and acknowledged alarms shall be returned or counted. |
| ALL\_ACTIVE\_AND\_UNACKNOWLEDGED\_ALARMS | All active and unacknowledged alarms shall be returned or counted. |
| ALL\_CLEARED\_AND\_ACKNOWLEDGED\_ALARMS | All cleared and unacknowledged alarms shall be returned or counted. |
| ALL\_UNACKNOWLEDGED\_ALARMS | All unacknowledged alarms shall be returned or counted |

###### 12.2.1.4.4.4 Enumeration AckState

Table 12.2.1.4.4.4-1: Enumeration ackState

|  |  |
| --- | --- |
| Enumeration value | Description |
| ACKNOWLEDGED | State acknowledged. |
| UNACKNOWLEDGED | State unacknowledged. |

###### 12.2.1.4.4.5 Enumeration AlarmListAlignmentRequirement

Table 12.2.1.4.4.5-1: Enumeration AlarmListAlignmentRequirement

|  |  |
| --- | --- |
| Enumeration value | Description |
| ALIGNMENT\_REQUIRED | Alarm list alignment is required |
| ALIGNMENT\_NOT\_REQUIRED | Alarm list alignment is not required |

###### 12.2.1.4.4.6 Enumeration AlarmType

Table 12.2.1.4.4.6-1: Enumeration AlarmType

|  |  |
| --- | --- |
| Enumeration value | Description |
| COMMUNICATIONS\_ALARM | An alarm of this type is principally associated with the procedures and/or processes required to convey information from one point to another (Rec. ITU-T X. 733 [4]). |
| PROCESSING\_ERROR\_ALARM | An alarm of this type is principally associated with a software or processing fault (Rec. ITU-T X. 733 [4]). |
| ENVIRONMENTAL\_ALARM | An alarm of this type is principally associated with a condition relating to an enclosure in which the equipment resides (Rec. ITU-T X. 733 [4]). |
| QUALITY\_OF\_SERVICE\_ALARM | An alarm of this type is principally associated with a degradation in the  quality of a service (Rec. ITU-T X. 733 [4]). |
| EQUIPMENT\_ALARM | An alarm of this type is principally associated with an equipment fault (Rec. ITU-T X. 733 [4]). |
| INTEGRITY\_VIOLATION | An indication that information may have been illegally modified, inserted or deleted. |
| OPERATIONAL\_VIOLATION | An indication that the provision of the requested service was not possible due to the unavailability, malfunction or incorrect invocation of the service. |
| PHYSICAL\_VIOLATION | An indication that a physical resource has been violated in a way that suggests a security attack. |
| SECURITY\_SERVICE\_OR\_MECHANISM\_VIOLATION | An indication that a security attack has been detected by a security service or mechanism. |
| TIME\_DOMAIN\_VIOLATION | An indication that an event has occurred at an unexpected or prohibited time. |

###### 12.2.1.4.4.7 Enumeration ProbableCause

Table 12.2.1.4.4.7-1: Enumeration ProbableCause

|  |  |
| --- | --- |
| Enumeration value | Description |
| PROBABLE\_CAUSE\_001 | Generic probable cause string 001, mapping to a concrete probable cause is vendor specific |
| PROBABLE\_CAUSE\_002 | Generic probable cause string 002, mapping to a concrete probable cause is vendor specific |
| PROBABLE\_CAUSE\_003 | Generic probable cause string 003, mapping to a concrete probable cause is vendor specific |
| PROBABLE\_CAUSE\_004 | Generic probable cause string 004, mapping to a concrete probable cause is vendor specific |
| PROBABLE\_CAUSE\_005 | Generic probable cause string 005, mapping to a concrete probable cause is vendor specific |

###### 12.2.1.4.4.8 Enumeration AlarmNotificationTypes

Table 12.2.1.4.4.8-1: Enumeration AlarmNotificationTypes

|  |  |
| --- | --- |
| Enumeration value | Description |
| notifyNewAlarm | Notification type is notifyNewAlarm |
| notifyAckStateChanged | Notification type is notifyAckStateChanged |
| notifyClearedAlarm | Notification type is notifyClearedAlarm |
| notifyAlarmListRebuilt | Notification type is notifyAlarmListRebuilt |
| notifyChangedAlarm | Notification type is notifyChangedAlarm |
| notifyComments | Notification type is notifyComments |
| notifyPotentialFaultyAlarmList | Notification type is notifyPotentialFaultyAlarmList |
| notifyCorrelatedNotificationChanged | Notification type is notifyCorrelatedNotificationChanged |
| notifyChangedAlarmGeneral | Notification type is notifyChangedAlarmGeneral |

###### 12.2.1.4.4.9 Enumeration PerceivedSeverity

Table 12.2.1.4.4.9-1: Enumeration PerceivedSeverity

|  |  |
| --- | --- |
| Enumeration value | Description |
| CRITICAL | The Critical severity level indicates that a service affecting condition has occurred and an immediate corrective action is required (Rec. ITU-T X. 733 [4]). |
| MAJOR | The Major severity level indicates that a service affecting condition has developed and an urgent corrective action is required (Rec. ITU-T X. 733 [4]). |
| 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 (Rec. ITU-T X. 733 [4]). |
| WARNING | The Warning severity level indicates the detection of a potential or impending service affecting fault, before any significant effects have been felt (Rec. ITU-T X. 733 [4]). |
| INDETERMINATE | The Indeterminate severity level indicates that the severity level cannot be determined (Rec. ITU-T X. 733 [4]). |
| CLEARED | The Cleared severity level indicates the clearing of one or more previously reported alarms (Rec. ITU-T X. 733 [4]). |

###### 12.2.1.4.4.10 Enumeration TrendIndication

Table 12.2.1.4.4.10-1: Enumeration TrendIndication

|  |  |
| --- | --- |
| Enumeration value | Description |
| MORE\_SEVERE | Severity trend of the alarmed object is more severe (Rec. ITU-T X.733 [4]) |
| NO\_CHANGE | Severity trend of the alarmed object is no change (Rec. ITU-T X.733 [4]) |
| LESS\_SEVERE | Severity trend of the alarmed object is less severe (Rec. ITU-T X.733 [4]) |

### 12.2.2 RESTful HTTP-based solution set for integration with ONAP VES API

#### 12.2.2.1 Mapping of operations

NOTE: no use case has been specified by ONAP. Therefore this mapping is not part of the present document.

#### 12.2.2.2 Mapping of notifications

##### 12.2.2.2.1 Introduction

###### 12.2.2.2.1.1 General

The 3GPP IS notifications are mapped to SS equivalents according to table 12.2.2.2.1.1-1.

Table 12.2.2.2.1.1-1: Mapping of 3GPP IS notifications to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **3GPP IS notifications** | **HTTP Method** | **Resource URI** | **S** |
| notifyNewAlarm | POST | /eventListener | M |
| notifyAckStateChanged | POST | /eventListener | M |
| notifyClearedAlarm | POST | /eventListener | M |
| notifyAlarmListRebuilt | POST | /eventListener | M |
| notifyChangedAlarm | POST | /eventListener | M |
| notifyComments | POST | /eventListener | M |
| notifyPotentialFaultyAlarmList | POST | /eventListener | M |
| notifyCorrelatedNotificationChanged | POST | /eventListener | M |
| notifyChangedAlarmGeneral | POST | /eventListener | O |

###### 12.2.2.2.1.2 Void

##### 12.2.2.2.2 Notification notifyNewAlarm (non-security alarm)

See clause 12.2.1.2.2.

##### 12.2.2.2.3 Notification notifyNewAlarm (security alarm)

See clause 12.2.1.2.3.

##### 12.2.2.2.4 Notification notifyAckStateChanged

See clause 12.2.1.2.4.

##### 12.2.2.2.5 Notification notifyClearedAlarm

See clause 12.2.1.2.5.

##### 12.2.2.2.6 Notification notifyAlarmListRebuilt

See clause 12.2.1.2.6.

##### 12.2.2.2.7 Notification notifyChangedAlarm

See clause 12.2.1.2.7.

##### 12.2.2.2.8 Notification notifyComments

See clause 12.2.1.2.8.

##### 12.2.2.2.9 Notification notifyPotentialFaultyAlarmList

See clause 12.2.1.2.9.

##### 12.2.2.2.10 Notification notifyCorrelatedNotificationChanged

See clause 12.2.1.2.10.

##### 12.2.2.2.11 Notification notifyChangedAlarmGeneral (non-security alarm)

See clause 12.2.1.2.11.

##### 12.2.2.2.12 Notification notifyChangedAlarmGeneral (security alarm)

See clause 12.2.1.2.12.

#### 12.2.2.3 Resources

##### 12.2.2.3.1 Resource structure

Figure 12.2.2.3.1-1 shows the resource structure of the fault supervision data report MnS in the context of its integration with VES Event Listener 7.1.1 [45].

A screen shot of a computer program

Description automatically generated with low confidence

Figure 12.2.2.3.1-1: Resource URI structure of the fault supervision data report MnS for integration with ONAP VES Event Listener 7.1.1 (Resource structure section) [45]

Table 12.2.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.2.2.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| eventListener | /eventListener | POST | Send notifications |

##### 12.2.2.3.2 Resource definitions

See Resource structure section in [45].

##### 12.2.2.4 Data type definitions

See clause 12.2.1.4.

## 12.3 Generic performance assurance management service

### 12.3.1 RESTful HTTP-based solution set

#### 12.3.1.1 Void

#### 12.3.1.2 Performance threshold monitoring service

##### 12.3.1.2.1 Mapping of operations

None.

##### 12.3.1.2.2 Mapping of notifications

###### 12.3.1.2.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.3.1.2.2.1-1.

**Table 12.3.1.2.2.1-1: Mapping of IS notifications to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| **IS notifications** | **HTTP Method** | **Resource URI** | **S** |
| notifyThresholdCrossing | POST | /notificationSink | M |

###### 12.3.1.2.2.2 Notification notifyThresholdCrossing

The IS notification parameters are mapped to SS equivalents according to table 12.3.1.2.2.2-1.

Table 12.3.1.2.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| observedPerfMetricName | request body | observedPerfMetricName | string | M |
| observedPerfMetricValue | request body | observedPerfMetricValue | PerfMetricValue | M |
| observedPerfMetricDirection | request body | observedPerfMetricDirection | PerfMetricDirection | M |
| thresholdValue | request body | thresholdValue | PerfMetricValue | M |
| hysteresis | request body | hysteresis | PerfMetricValue) | M |
| monitorGranularityPeriod | request body | monitorGranularityPeriod | integer | M |
| additionalText | request body | additionalText | string | O |

##### 12.3.1.2.3 Resources

###### 12.3.1.2.3.1 Resource structure

Table 12.3.1.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.3.1.2.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| notificationSink | /notificationSink | POST | Send notifications |

###### 12.3.1.2.3.2 Resource definitions

12.3.1.2.3.2.1 Resource "/notificationSink"

12.3.1.2.3.2.1.1 Description

This resource represents a resource on a MnS consumer to which notifications are sent to.

12.3.1.2.3.2.1.2 URI

The resource URI is provided by the notification subscription.

12.3.1.2.3.2.1.3 HTTP methods

12.3.1.2.3.2.1.3.1 POST

This method shall support the URI query parameters specified in table 12.3.1.2.3.2.1.3.1-1.

Table 12.3.1.2.3.2.1.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.3.1.2.3.2.1.3.1-2 and the response data structures and response codes specified in table 12.3.1.2.3.2.1.3.1-3.

Table 12.3.1.2.3.2.1.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| NotifyThresholdCrossing | Type in case a notifyThresholdCrossing notification is sent | M |

Table 12.3.1.2.3.2.1.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response  codes | Description | S |
| n/a | 204 No Content | In case of success no message body is returned | M |
| Error-Response | 4xx/5xx | In case of failure the error object is returned. | M |

##### 12.3.1.2.4 Data type definitions

###### 12.3.1.2.4.1 General

Table 12.3.1.2.4.1-1: Data types defined in this specification

|  |  |  |
| --- | --- | --- |
| **Data type** | **Reference** | **Description** |
| NotifyThresholdCrossing | 12.3.1.2.4.2.1 | Used in the request body of HTTP POST for the notification type notifyThresholdCrossing |
| PerfNotificationTypes | 12.3.1.2.4.6.4 | Performance notification types (notifyThresholdCrossing) |

Table 12.3.1.1.4.1-2: Data types imported

|  |  |  |
| --- | --- | --- |
| **Data type** | **Reference** | **Description** |
| DateTime | TS 28.623 [44] | Date and time |
| Float | TS 28.623 [44] | Float type |
| Uri | TS 28.623 [44] | URI type |
| SystemDN | TS 28.623 [44] | systemDN type |
| NotificationId | TS 28.623 [44] | Notification identifier as defined in ITU-T Rec. X. 733 [4] |
| NotificationHeader | TS 28.623 [44] | Notification header |
| ErrorResponse | TS 28.623 [44] | Used in the response body of multiple HTTP methods in case of error |

###### 12.3.1.2.4.2 Structured data types

12.3.1.2.4.2.1 Type NotifyThresholdCrossing

Table 12.3.1.2.4.2.1-1: Definition of type NotifyThresholdCrossing

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the resource where the event (threshold crossing) occurred | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyThresholdCrossing) | M |
| eventTime | DateTime | Event (threshold crossing) occurrence time | M |
| systemDN | SystemDN | System DN | M |
| observedPerfMetricName | string | Name of the performance metric that has crossed the threshold | M |
| observedPerfMetricValue | PerfMetricValue | Value of the performance metric, that has crossed the threshold, when the threshold crossing was observed | M |
| observedPerfMetricDirection | PerfMetricDirection | Direction ("UP" or "DOWN") of the performance metric, when the threshold crossing was observed | M |
| thresholdValue | PerfMetricValue | Threshold value of the triggered threshold | M |
| hysteresis | PerfMetricValue | Hysteresis of the triggered threshold | M |
| monitorGranularityPeriod | integer | Granularity period of the threshold monitor | M |
| additionalText | string | Vendor specific information | O |

12.3.1.2.4.3 Void

###### 12.3.1.2.4.4 Void

###### 12.3.1.2.4.5 Void

###### 12.3.1.2.4.6 Simple data types and enumerations

12.3.1.2.4.6.1 General

This clause defines simple data types and enumerations that are used by the data structures defined in the previous clauses.

12.3.1.2.4.6.2 Simple data types

Table 12.3.1.2.4.6.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type name | Type definition | Description |
| PerfMetricValue | Union(integer, Float) | The type of a performance metric is either integer or Float |

12.3.1.2.4.6.3 Enumeration PerfNotificationTypes

Table 12.3.1.2.4.6.3-1: Enumeration PerfNotificationTypes

|  |  |
| --- | --- |
| Enumeration value | Description |
| notifyThresholdCrossing | Notification type is notifyThresholdCrossing |

12.3.1.2.4.6.4 Enumeration PerfMetricDirection

Table 12.3.1.2.4.6.4-1: Enumeration PerfMetricDirection

|  |  |
| --- | --- |
| Enumeration value | Description |
| UP | Performance metric values are going up |
| DOWN | Performance metric values are going down |

### 12.3.2 Performance data XML file format definition

#### 12.3.2.1 Introduction

This clause describes the format of performance data file. The XML file format definition is based on XML schema ([26], [27], [28] and [29]).

#### 12.3.2.2 Mapping table

Table 12.3.2.2-1 maps the file content items in the clause 11.3.2.1.2 to those used in the XML schema based file format definitions. XML attributes are useful where data values bind tightly to its parent XML element. They have been used where appropriate.

Table 12.3.2.2-1: Mapping of File Content Items to XML tags

| File Content Item | XML schema based XML tag | Description |
| --- | --- | --- |
| measDataFile | XML element: measDataFile | Document element |
| measFileHeader | XML element: fileHeader |  |
| measData | XML element: measData |  |
| measFileFooter | XML element: fileFooter |  |
| fileFormatVersion | XML element: fileHeader  XML attribute: fileFormatVersion |  |
| senderName | XML element: fileHeader  XML attribute: dnPrefix  XML element: fileHeader:fileSender  XML attribute: senderName | The DN of the sender is split into the DN prefix contained in "dnPrefix" and the Local DN (LDN) contained in "senderName". |
| senderType | XML element fileHeader:fileSender  XML attribute: senderType |  |
| vendorName | XML element fileHeader  XML attribute vendorName |  |
| collectionBeginTime | XML element: fileHeader:measData  XML attribute beginTime |  |
| measObjRootDn | XML element fileHeader  XML attribute dnPrefix  XML element measData:measEntity  XML attribute localDn | The DN of the root object is split into the DN prefix contained in "dnPrefix" and the Local DN (LDN) contained in "localDn". |
| measObjRootUserLabel | XML element: measData:measEntity  XML attribute: userLabel |  |
| measObjRootSwVersion | XML element: measData:measEntity  XML attribute: swVersion |  |
| measInfo | XML element measInfo | An instance of this XML element is added for each expired granularity period. |
| measInfoId | XML element measData:measInfo  XML attribute measInfoId |  |
| jobId | XML element measData:measInfo:job  XML attribute jobId |  |
| reportingPeriod | XML element measData:measInfo:repPeriod  XML attribute duration | The XML attribute "duration" shall use the truncated representation for duration "PT*n*S" (see [28]). |
| granularityPeriod | XML element measData:measInfo:granPeriod  XML attribute duration | The XML attribute "duration" shall use the truncated representation for duration "PT*n*S" (see [28]). |
| measTimeStamp | XML element measData:measInfo:granPeriod  XML attribute endTime |  |
| measTypes | XML element measData:measInfo:measTypes  or  XML element measData:measInfo:measType  XML attribute p | Depending on sender's choice for optional positioning presence, either XML element "measTypes" or XML elements "measType" will be used. |
| measValues | XML element measData:measInfo:measValue |  |
| measObjLdn | XML element measData:measInfo:measValue  XML attribute measObjLdn |  |
| measResults | XML element measData:measInfo:measValue:measResults  or, when the positioning option is used,  measData:measInfo:measValue:r | Depending on sender's choice for optional positioning, either XML element "measResults" or XML elements "r" is used. |
| suspectFlag | XML element measData:measInfo:measValue:suspect |  |
| collectionEndTime | XML element fileFooter:measData  XML attribute endTime |  |
| There is no corresponding File Content Item. | XML element measType  XML attribute p | Only for the positioning option: XML attribute "p" of XML element "measType", used to link the performance metric type specified in "measType" to the result value. Its value is a positive integer (excl. zero) and shall be unique for each instance of "measType" in a file. |
| There is no corresponding File Content Item. | XML element r  XML attribute p | Only for the positioning option: XML attribute "p" of the XML element "r", used to link the result value in "r" to its performance metric type in "measType". The value of "p" shall match the value of the XML attribute "p" in the corresponding XML element "measType". |

#### 12.3.2.3 Void

##### 12.3.2.3.1 Void

##### 12.3.2.3.2 Void

#### 12.3.2.4 XML schema

This clause specifies the XML schema that shall be used for XML files containing performance data.

Name: measData.xsd

Version: 2.0.0

Identifier: measData.xsd-v2.0.0

<?xml version="1.0" encoding="UTF-8"?>

<!--

TS 28.532 Performance data XML file format definition

measData.xsd-v2.0.0

-->

<schema

xmlns="http://www.w3.org/2001/XMLSchema"

xmlns:md="http://www.3gpp.org/ftp/specs/archive/28\_series/28.532#measData"

targetNamespace="http://www.3gpp.org/ftp/specs/archive/28\_series/28.532#measData"

elementFormDefault="qualified">

<element name="measDataFile">

<complexType>

<sequence>

<element name="fileHeader">

<complexType>

<sequence>

<element name="fileSender">

<complexType>

<attribute name="senderName" type="string" use="optional"/>

<attribute name="senderType" type="string" use="optional"/>

</complexType>

</element>

<element name="measData">

<complexType>

<attribute name="beginTime" type="dateTime" use="required"/>

</complexType>

</element>

</sequence>

<attribute name="fileFormatVersion" type="string" use="required"/>

<attribute name="vendorName" type="string" use="optional"/>

<attribute name="dnPrefix" type="string" use="optional"/>

</complexType>

</element>

<element name="measData" minOccurs="0" maxOccurs="unbounded">

<complexType>

<sequence>

<element name="measEntity">

<complexType>

<attribute name="localDn" type="string" use="optional"/>

<attribute name="userLabel" type="string" use="optional"/>

<attribute name="swVersion" type="string" use="optional"/>

</complexType>

</element>

<element name="measInfo" minOccurs="0" maxOccurs="unbounded">

<complexType>

<sequence>

<element name="job" minOccurs="0">

<complexType>

<attribute name="jobId" type="string" use="required"/>

</complexType>

</element>

<element name="granPeriod">

<complexType>

<attribute name="duration" type="duration" use="required"/>

<attribute name="endTime" type="dateTime" use="required"/>

</complexType>

</element>

<element name="repPeriod" minOccurs="0">

<complexType>

<attribute name="duration" type="duration" use="required"/>

</complexType>

</element>

<choice>

<element name="measTypes">

<simpleType>

<list itemType="Name"/>

</simpleType>

</element>

<element name="measType" minOccurs="0" maxOccurs="unbounded">

<complexType>

<simpleContent>

<extension base="Name">

<attribute name="p" type="positiveInteger" use="required"/>

</extension>

</simpleContent>

</complexType>

</element>

</choice>

<element name="measValue" minOccurs="0" maxOccurs="unbounded">

<complexType>

<sequence>

<choice>

<element name="measResults">

<simpleType>

<list itemType="md:measResultType"/>

</simpleType>

</element>

<element name="r" minOccurs="0" maxOccurs="unbounded">

<complexType>

<simpleContent>

<extension base="md:measResultType">

<attribute name="p" type="positiveInteger" use="required"/>

</extension>

</simpleContent>

</complexType>

</element>

</choice>

<element name="suspect" type="boolean" minOccurs="0"/>

</sequence>

<attribute name="measObjLdn" type="string" use="required"/>

</complexType>

</element>

</sequence>

<attribute name="measInfoId" type="string" use="optional"/>

</complexType>

</element>

</sequence>

</complexType>

</element>

<element name="fileFooter">

<complexType>

<sequence>

<element name="measData">

<complexType>

<attribute name="endTime" type="dateTime" use="required"/>

</complexType>

</element>

</sequence>

</complexType>

</element>

</sequence>

</complexType>

</element>

<simpleType name="measResultType">

<union memberTypes="integer float string">

<simpleType>

<restriction base="string">

<enumeration value="NULL"/>

</restriction>

</simpleType>

</union>

</simpleType>

</schema>

## 12.4 Heartbeat

### 12.4.1 RESTful HTTP-based solution set

#### 12.4.1.1 Mapping of operations

N/A

#### 12.4.1.2 Mapping of notifications

##### 12.4.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.4.1.2.1-1.

**Table 12.4.1.2.1-1: Mapping of IS notifications to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| **IS notifications** | **HTTP Method** | **Resource URI** | **S** |
| notifyHeartbeat | POST | /notificationSink | M |

##### 12.4.1.2.2 Notification "notifyHeartbeat"

The IS notification parameters are mapped to SS equivalents according to table 12.4.1.2.2-1.

Table 12.4.1.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType (notifyHeartbeat) | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | systemDN | M |
| heartbeatNtfPeriod | request body | heartbeatNtfPeriod | integer | M |

#### 12.4.1.3 Usage of HTTP

N/A.

#### 12.4.1.4 Resources

N/A.

#### 12.4.1.5 Data type definitions

##### 12.4.1.5.1 General

Table 12.4.1.5.1-1: Data types defined in the present document

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Description |
| HeartbeatNotificationTypes | 12.4.1.4.2.2 | Haertbeat notification types |

Table 12.4.1.5.1-2: Data types imported

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Description |
| Uri | TS 28.623 [44] | URI type |
| NotificationId | TS 28.623 [44] | Notification identifier as defined in ITU-T Rec. X. 733 [4] |
| NotificationType | TS 28.623 [44] | Notification type |
| DateTime | TS 28.623 [44] | Date and time |
| SystemDN | TS 28.623 [44] | systemDN type |
| NotificationHeader | TS 28.623 [44] | Notification header |

##### 12.4.1.5.2 Structured data types

None.

##### 12.4.1.5.3 Simple data types and enumerations

###### 12.4.1.5.3.1 General

This subclause defines simple data types and enumerations that are used by the data structures defined in the previous subclauses.

###### 12.4.1.5.3.2 Simple data types

Table 12.4.1.4.3.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type Name | Type Definition | Description |
|  |  |  |

###### 12.4.1.5.3.3 Enumeration HeartbeatNotificationTypes

Table 12.4.1.4.3.3-1: Enumeration HeartbeatNotificationTypes

|  |  |
| --- | --- |
| Enumeration value | Description |
| notifyHeartbeat | Notification type is notifyHeartbeat |

### 12.4.2 RESTful HTTP-based solution set for integration with ONAP VES API

NOTE: Void.

#### 12.4.2.1 Mapping of operations

See clause 12.1.1.1.

#### 12.4.2.2 Mapping of notifications

##### 12.4.2.2.1 Introduction

###### 12.4.2.2.1.1 General

The 3GPP IS heartbeat notifications are mapped to SS equivalents according to table 12.4.2.2.1.1-1.

Table 12.4.2.2.1.1-1: Mapping of 3GPP IS notifications to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **3GPP IS notifications** | **HTTP Method** | **Resource URI** | **S** |
| notifyHeartbeat | POST | /eventListener | M |

###### 12.4.2.2.1.2 Notification parameter mapping principles

3GPP IS fault supervision alarm notification parameters are mapped to solution set equivalent as follows:

##### 12.4.2.2.2 Notification notifyHeartbeat

See clause 12.4.1.2.2.

## 12.5 Streaming data reporting service

### 12.5.1 RESTful HTTP-based solution set

#### 12.5.1.1 Mapping of operations

##### 12.5.1.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 12.5.1.1.1-1.

Table 12.5.1.1.1-1: Mapping of IS operations to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation** | **Method/frame** | **Resource/URI** | **S** |
| establishStreamingConnection | HTTP POST (see NOTE) | /connections | M |
| HTTP GET (Upgrade, see NOTE) | /connections/{connectionId} | M |
| terminateStreamingConnection | WebSocket Close frame sent (frame with opcode of 0x8), and  WebSocket Close frame received (frame with opcode of 0x8 for successful case) | /connections/{connectionId} | M |
| reportStreamData | WebSocket Data frame sent (frame with opcode of 0x2) | /connections/{connectionId} | M |
| addStream | HTTP POST | /connections/{connectionId}/streams | M |
| deleteStream | HTTP DELETE | /connections/{connectionId}/streams | M |
| getConnectionInfo | HTTP GET | /connections | M |
| HTTP GET | /connections/{connectionId} | M |
| getStreamInfo | HTTP GET | /connections/{connectionId}/streams | M |
|  | HTTP GET | /connections/{connectionId}/streams/{streamId} | M |
| Note: the establishStreamingConnection is mapped to a HTTP POST operation followed by a HTTP GET operation. The HTTP POST operation is to provide the information in streamInfoList parameter to the consumer and receive the connectionId assigned by the consumer, while the HTTP GET (Upgrade) operation is to establish the WebSocket connection. | | | |

##### 12.5.1.1.2 Operation "establishStreamingConnection"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.2-1 through 12.5.1.1.2-4.

Table 12.5.1.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS operation parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| producerId | request body | producerId | String | M |
| streamInfoList | request body | streamInfoList | array(streamInfo-Type) | M |

Table 12.5.1.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IS operation parameter name | SS parameter location | SS parameter name | SS parameter type | S |
| connectionId | location header | n/a | uri-Type | M |
| status | response status codes  response body | n/a  error | n/a  error-ResponseType | M |

Table 12.5.1.1.2-3: Mapping of IS operation input parameters to SS equivalents (HTTP GET (Upgrade))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | Headers | Request-URI | String | n/a |
| -- | HTTP-Version (Request-Line) | -- | String (see Note 1) | M |
| -- | Upgrade Header | -- | Constant string: websocket | M |
| -- | Connection Header | -- | Constant string: Upgrade | M |
| -- | Sec-WebSocket-Key Header | -- | String (see Note 2) | M |
| -- | Sec-WebSocket-Version Header | -- | String (see Note 3) | M |
| -- | See Note 4. | | | |
| NOTE 1: The HTTP version shall be not earlier than HTTP/1.1.  NOTE 2: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [40]).  NOTE 3: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [40]).  NOTE 4: Other SS parameters (not listed in this table) independent from the Stage 2 may be used, according to the WebSocket protocol (see IETF RFC 6455 [40]). | | | | |

Table 12.5.1.1.2-4: Mapping of IS operation output parameters to SS euivalents (HTTP GET (Upgrade))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | n/a | -- | n/a | n/a |
| status | HTTP-Version (Response-Line) | -- | String (see Note 1) | M |
| Status-Code | -- | String |
| response body | error | error-ResponseType |
| -- | Upgrade Header |  | Constant string: websocket | M |
| -- | Connection Header | -- | Constant string: Upgrade | M |
|  | Sec-WebSocket-Accept Header | -- | String (see Note 2) | M |
| -- | See Note 3. | | | |
| NOTE 1: The HTTP version shall be not earlier than HTTP/1.1.  NOTE 2: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [40]).  NOTE 3: Other SS parameters (not listed in this table) independent from the Stage 2 may be used, according to the WebSocket protocol (see IETF RFC 6455 [40]). | | | | |



Figure 12.5.1.1.2-1: Message flow for establishing a streaming connection

The message flow for establishing a streaming connection illustrated on Figure 12.5.1.1.2-1 is as follows:

1. The MnS producer sends a HTTP POST request to theMnS consumer.

- The URI identifies the "…/connections" collection resource.

- The request message body carries the information about the connecting producer identity via parameter "producerId" and about streams supported by the new connection via parameter "StreamInfoList".

2. The MnS consumer sends a HTTP POST response to the MnS producer.

- On success "201 Posted" shall be returned with the identifier of a newly created ".../connections/{connectionId}" resource.

- On failure, an appropriate error code shall be returned. The response message body may carry an error object.

3. If step 2 is successful, the MnS producer sends a HTTP GET (upgrade) request to theMnS consumer to establish the WebSocket connection.

- The URI identifies the ".../connections/{connectionId}" resource with the /secure/flag;

- The HTTP-version in the Request-line indicates the HTTP version which is no earlier than HTTP/1.1;

- The Upgrade header is with value "websocket";

- The Connection header is with value "Upgrade";

- The Sec-WebSocket-Key header is with a valid value according to IETF RFC 6455 [40].

- The Sec-WebSocket-Version header is with a valid according to IETF RFC 6455 [40].

4. The MnS consumer sends a HTTP GET (Upgrade) response to the MnS producer.

- On success, "101 Switching Protocols" shall be returned;

- On failure, an appropriate error code shall be returned. The response message body may carry an error object.

- The HTTP-version in the Response-line indicates the HTTP version which is no earlier than HTTP/1.1;

- The Upgrade header is with value "websocket";

- The Connection header is with value "Upgrade";

- The Sec-WebSocket-Accept header is with a valid value according to IETF RFC 6455 [40].

##### 12.5.1.1.3 Operation "terminateStreamingConnection"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.3-1 and 12.5.1.1.3-2.

Table 12.5.1.1.3-1: Mapping of IS operation input parameters to SS equivalents (WebSocket Close frame sent)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | n/a | -- | n/a | n/a |
| -- | Opcode (see clause 5 of IETF RFC 6455 [40]) | -- | Constant value: 0x8 | M |

Table 12.5.1.1.3-2: Mapping of IS operation output parameters to SS equivalents (WebSocket Close frame received)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| status | Opcode | -- | For a successful operation, the Opcode is 0x8, and for an unsuccessful operation, the Opcode has a value other than 0x8 (see clause 5 of IETF RFC 6455 [40]). | M |

##### 12.5.1.1.4 Operation "reportStreamData"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.4-1 and 12.5.1.1.4-2.

Table 12.5.1.1.4-1: Mapping of IS operation input parameters to SS equivalents (WebSocket Data frame sent with Opcode of 0x2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | n/a | -- | n/a | n/a |
| -- | Opcode (see clause 5 of IETF RFC 6455 [40]) | -- | Constant value: 0x2 ("binary") | M |
| streamingData | Payload data | Streaming Trace Payload  or  streaming performance data payload  or  streaming analytics payload  or  proprietary data payload | See clause 5 of TS 32.423 [39] for detailed definition of the Streaming Trace Payload format and Annex G of TS 28.550 [40] for detailed definition of the streaming performance data payload format. | M |

The protocol stack with Streaming Trace Payloads formatted as per clause 5 of TS 32.423 [39] carried by WebSocket binary data frames (see clause 5.6 of IETF RFC 6455 [40]) is illustrated on Figure 12.5.1.1.4-1.

The protocol stack with streaming performance data payloads formatted as per Annex G of TS 28.550 [42] carried by WebSocket binary data frames (see clause 5.6 of IETF RFC 6455 [40]) is illustrated on Figure 12.5.1.1.4-2.

Table 12.5.1.1.4-2: Mapping of IS operation output parameters to SS equivalents

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| status | n/a | -- See Note 1. | n/a | n/a |
| NOTE 1: The delivery of WebSocket Data frame is taken care of by the underlying TCP (see IETF RFC 793 [41]) which provides reliable data transmission and ensures the data delivery. There is no mechanism at WebSocket protocol level to report the delivery status for WebSocket Data frame. | | | | |



Figure 12.5.1.1.4-1: Protocol stack for streaming trace data reporting



Figure 12.5.1.1.4-2: Protocol stack for streaming performance data reporting

##### 12.5.1.1.5 Operation "addStream"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.5-1 and 12.5.1.1.5-2.

Table 12.5.1.1.5-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | Headers | Request-URI | String | n/a |
| streamInfoList | request body | streamInfoList | array(streamInfo-Type) | M |

Table 12.5.1.1.5-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| streamInfoList | response body | streamInfoList | array(streamInfo-Type) | M |
| status | response status codes  response body | n/a  error | n/a  error-ResponseType | M |

##### 12.5.1.1.6 Operation "deleteStream"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.6-1 and 12.5.1.1.6-2.

Table 12.5.1.1.6-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | headers | Request-URI | String | n/a |
| streamIdList | path,  query | /connections/{connectionId}/streams,  streamIdList | array(streamId-Type) | M |

Table 12.5.1.1.6-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| status | response status codes  response body | n/a  error | n/a  error-ResponseType | M |

##### 12.5.1.1.7 Operation "getConnectionInfo"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.7-1 and 12.5.1.1.7-2.

Table 12.5.1.1.7-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | headers | Request-URI | String | n/a |
| connectionIdList | path,  query | /connections,  /connections/{connectionId} | array(uri-Type) | M |

Table 12.5.1.1.7-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionInfoList | response body | connectionInfoList | array(uri-Type, streamReporter-Type, streamIdList-Type) | M |
| status | response status codes  response body | n/a  error | n/a  error-ResponseType | M |

##### 12.5.1.1.8 Operation "getStreamInfo"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.8-1 and 12.5.1.1.8-2.

Table 12.5.1.1.8-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| connectionId | headers | Request-URI | String | n/a |
| streamIdList | path,  query | /connections/{connectionId}/streams,  streamIdList | array(streamId-Type) | M |

Table 12.5.1.1.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| streamInfoSumList | response body | streamInfoSumList | array(streamInfo-Type, streamReporters-Type) | M |
| status | response status codes  response body | n/a  error | n/a  error-ResponseType | M |

#### 12.5.1.2 Mapping of notifications

Not applicable (no notifications defined in IS).

#### 12.5.1.3 Resources

##### 12.5.1.3.1 Resources structure

Figure 12.5.1.3.1-1 shows the resource structure of the Streaming data reporting service.



Figure 12.5.1.3.1-1: Resource URI structure of the Streaming data reporting service

Table 12.5.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| connections | …/connections | POST | Inform consumer about reporting streams to be carried by the new connection and receive a new connection id. |
| GET | Obtain information about connections |
| connection | …/connections/{connectionId} | GET (Upgrade) | Establish WebSocket for a given connection |
| GET | Obtain information about connection |
| WebSocket 0x2 | Send a unit of streaming data |
| WebSocket 0x8 | Terminate a WebSocket connection |
| streams | …/connections/{connectionId}/streams | POST | Inform consumer about new reporting streams on an existing connection. |
| DELETE | Remove reporting streams from an existing connection |
| GET | Obtain information about streams |
| stream | …/connections/{connectionId}/streams/{streamId} | GET | Obtain information about stream |

##### 12.5.1.3.2 Resources definitions

12.5.1.3.2.1 Resource "…/connections"

12.5.1.3.2.1.1 Description

This resource represents a collection of connections and can be used to establish new connections or to obtain information about existing connections.

12.5.1.3.2.1.2 URI

The resource URI is: {MnSRroot}/StreamingDataReportingMnS/{MnSVersion}/connections

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.1.2-1.

Table 12.5.1.3.2.1.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |

12.5.1.3.2.1.3 HTTP methods

12.5.1.3.2.1.3.1 HTTP POST

This method shall support the URI query parameters specified in the following table.

**Table 12.5.1.3.2.1.3.1-1: URI query parameters supported by the POST method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| none supported |  |  |  |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

**Table 12.5.1.3.2.1.3.1-2: Data structures supported by the POST request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| producerId | String representing the DN of the streaming data reporting MnS producer. | M |
| array(streamInfo-Type) | List of meta-data about each reporting stream. Where each reporting stream is represented by a streamInfo. |  |

**Table 12.5.1.3.2.1.3.1-3: Data structures supported by the POST Response Body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |
| uri-Type | 201 Posted | Connection identifier assigned by the MnS consumer | M |

12.5.1.3.2.1.3.2 HTTP GET

This method shall support the URI query parameters specified in the following table.

**Table 12.5.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| connectionIdList | array(uri-Type) | The list of connectionId for which the connection information is to be returned. | O |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

**Table 12.5.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

**Table 12.5.1.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |
| array(uri-Type, streamReporter-Type, streamIdList-Type) | 200 OK | In case of success the representation of the retrieved information is returned. | M |
| 202 Partially retrieved | In case of partial success the representation of the retrieved information is returned. | M |

12.5.1.3.2.2 Resource "…/connections/{connectionId}"

12.5.1.3.2.2.1 Description

This resource represents an individual connection and can be used for an "upgrade" to WebSocket as part of the connection establishment, or to obtain information about an existing connection, or to terminate an existing connection, or to send a unit of streaming data.

12.5.1.3.2.2.2 URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.2.2-1.

Table 12.5.1.3.2.2.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| connectionId | Represents identifier of an individual connection assigned by the MnS consumer during connection establishment |

12.5.1.3.2.2.3 HTTP methods

12.5.1.3.2.2.3.1 HTTP GET (Upgrade)

This method shall support the URI header parameters specified in the following table.

**Table 12.5.1.3.2.2.3.2-1: Header parameters supported by the GET request on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| connectionId | uri-Type | To indicate the ID (URI) of the connection being upgraded to WebSocket | M |
| Upgrade | Upgrade-HeaderType | To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol | M |
| Connection | Connection-HeaderType | To indicate the HTTP GET operation is to upgrade the connection to another protocol | M |
| Sec-WebSocket-Key | Sec-WebSocket-Key-HeaderType | The Sec-WebSocket-Key needed for establishing the WebSocket connection. | M |
| Sec-WebSocket-Version | Sec-WebSocket-Version-HeaderType | The Sec-WebSocket-Version needed for establishing the WebSocket connection. | M |

This method shall support the URI query parameters specified in the following table.

**Table 12.5.1.3.2.2.3.2-2: URI query parameters supported by the GET method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| none supported |  |  |  |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

**Table 12.5.1.3.2.2.3.2-3: Data structures supported by the GET request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

**Table 12.5.1.3.2.2.3.2-4: Header parameters supported by the GET response on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| Upgrade | Upgrade-HeaderType | To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol | M |
| Connection | Connection-HeaderType | To indicate the HTTP GET operation is to upgrade the connection to another protocol | M |
| Sec-WebSocket-Accept | Sec-WebSocket-Accept-HeaderType | The Sec-WebSocket-Accept responded when establishing the WebSocket connection. | M |

**Table 12.5.1.3.2.2.3.2-5: Data structures supported by the GET response body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response**  **codes** | **Description** | **S** |
| n/a | 101 Switching Protocols | The status code indicating the connection has been successfully upgraded to WebSocket. | M |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |

12.5.1.3.2.2.3.2 HTTP GET

This method shall support the URI query parameters specified in the following table.

**Table 12.5.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| none supported |  |  |  |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

**Table 12.5.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

**Table 12.5.1.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |
| uri-Type | 200 OK | In case of success the representation of the connectionId is returned. | M |
| streamReporter-Type | 200 OK | In case of success the representation of the streamReporter is returned. | M |
| streamIdList-Type | 200 OK | In case of success the representation of the streamIdList is returned. | M |

12.5.1.3.2.3 Resource "…/connections/{connectionId}/streams"

12.5.1.3.2.3.1 Description

This resource represents a collection of reporting streams on a particular connection and can be used to add a new reporting stream to an existing connection, or to remove a reporting stream from an existing connection, or to obtain information about reporting streams.

12.5.1.3.2.3.2 URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}/streams

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.3.2-1.

Table 12.5.1.3.2.3.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| connectionId | See table 12.5.1.3.2.2.2-1 |

12.5.1.3.2.3.3 HTTP methods

12.5.1.3.2.3.3.1 HTTP POST

This method shall support the URI query parameters specified in the following table.

**Table 12.5.1.3.2.3.3.1-1: URI query parameters supported by the POST method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| none supported |  |  |  |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

**Table 12.5.1.3.2.3.3.1-2: Data structures supported by the POST request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| array(streamInfo-Type) | The resource representation of the set of information about streams to be posted. | M |

**Table 12.5.1.3.2.3.3.1-3: Data structures supported by the POST Response Body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| array(streamInfo-Type) | 201 Posted | In case of success the representation of the posted information about streams is returned. | M |
| 202 Partially posted | In case of partial success the representation of the posted information about streams is returned. | M |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |

12.5.1.3.2.3.3.2 HTTP DELETE

This method shall support the URI query parameters specified in the following table.

Table 12.5.1.3.2.3.3.2-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| streamIdList | array(streamId-Type) | The list of streamId for the stream(s) to be deleted. | M |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 12.5.1.3.2.3.3.2: Data structures supported by the DELETE request body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

Table 12.5.1.3.2.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| n/a | 204 No Content | In case of success no message body is returned | M |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |

12.5.1.3.2.3.3.3 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 12.5.1.3.2.3.3.3-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| streamIdList | array(streamId-Type) | The list of streamId for which the stream information are to be returned. | O |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 12.5.1.3.2.3.3.3-2: Data structures supported by the GET request body on this resource

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

Table 12.5.1.3.2.3.3.3-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| array(streamInfo-Type, streamReporters-Type) | 200 OK | In case of success the representation of the retrieved stream information is returned. | M |
| 202 Partially retrieved | In case of partial success the representation of the retrieved stream information is returned. | M |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |

12.5.1.3.2.4 Resource "…/connections/{connectionId}/streams/{streamId}"

12.5.1.3.2.4.1 Description

This resource represents an individual reporting stream on an existing connection and can be used to obtain information about reporting stream.

12.5.1.3.2.4.2 URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}/streams/{streamId}

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.4.2-1.

Table 12.5.1.3.2.4.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| connectionId | See table 12.5.1.3.2.2.2-1 |
| streamId | Represents identifier of an individual stream. For Streaming Trace reporting, the Trace Reference (see clause 5.6 of TS 32.422 [38]) is used as stream identifier |

12.5.1.3.2.4.3 HTTP methods

12.5.1.3.2.4.3.1 HTTP GET

This method shall support the URI query parameters specified in the following table.

**Table 12.5.1.3.2.4.3.1-1: URI query parameters supported by the GET method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| none supported |  |  |  |

This method shall support the request data structures, the response data structures and response codes specified in the following table.

**Table 12.5.1.3.2.4.3.1-2: Data structures supported by the GET request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

**Table 12.5.1.3.2.4.3.1-3: Data structures supported by the GET Response Body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| streamInfo-Type | 200 OK | In case of success the representation of the retrieved stream information is returned. | M |
| streamReporters-Type | 200 OK | In case of success the representation of the retrieved stream reporters information is returned. | M |
| error-ResponseType | 4xx/5xx | Returned in case of an error | M |

#### 12.5.1.4 Data type definitions

##### 12.5.1.4.1 General

Table 12.5.1.4.1-1: Data types defined

|  |  |  |
| --- | --- | --- |
| **Data type** | **Reference** | **Description** |
| **General types** | | |
| uri-Type | 12.5.1.4.3 | Used to represent a URI |
| **Types used in paths** | | |
| connectionId-Type | 12.5.1.4.3 | Used to indicate the connection as a context of the operation |
| streamId-Type | 12.5.1.4.3 | Used to indicate the stream as a context of the operation |
| **Types used in headers** | | |
| websocketHeaderConnection-Type | 12.5.1.4.3 | Header value for the upgrade request and response |
| websocketHeaderUpgrade-Type | 12.5.1.4.3 | Header value for the upgrade to WebSocket request and response |
| websocketHeader-Sec-WebSocket-Accept-Type | 12.5.1.4.3 | Header value for secure WebSocket response. Carries hash. |
| websocketHeader-Sec-WebSocket-Extensions-Type | 12.5.1.4.3 | Header value for secure WebSocket request. Carries protocol extensions. |
| websocketHeader-Sec-WebSocket-Key-Type | 12.5.1.4.3 | Header value for secure WebSocket request. Provides information to the server which is needed in order to confirm that the client is entitled to request an upgrade to WebSocket. |
| websocketHeader-Sec-WebSocket-Protocol-Type | 12.5.1.4.3 | Header value for secure WebSocket request. Carries a comma-separated list of subprotocol names, in the order of preference. |
| websocketHeader-Sec-WebSocket-Version-Type | 12.5.1.4.3 | Header value for secure WebSocket request and response. Carries the WebSocket protocol version to be used. |
| **Types used in query parts** | | |
| connectionId-Type | 12.5.1.4.3 | Used to indicate the connection as a context of the operation |
| streamId-Type | 12.5.1.4.3 | Used to indicate the stream as a context of the operation |
| **Types used in request bodies** | | |
| connectionRequest-Type | 12.5.1.4.2.2 | Used to carry the meta-data during connection establishment |
| streamInfo-Type | 12.5.1.4.2.5 | Reporting stream meta-data. |
| **Types used in response bodies** | | |
| failedConnectionResponse-Type | 12.5.1.4.2.4 | Used to carry the details of a failed connection establishment |
| connectionInfo-Type | 12.5.1.4.2.1 | Used to carry connection meta-data |
| errorResponse-Type | 12.5.1.4.2.3 | Used to carry the details of an error |
| streamInfo-Type | 12.5.1.4.2.5 | Used to carry the stream meta-data |
| streamInfoWithReporters-Type | 12.5.1.4.2.6 | Used to carry the augmented stream meta-data |
| **Types used for resources** | | |
| uri-Type | 12.5.1.4.3 | Used to represent resource URI |
| **Types referenced by the definitions above** | | |
| systemDN-Type | 12.5.1.4.3 | Used to represent DN of the reporting entity |
| traceJob-Type | Generic NRM | Used to represent Trace configuration |
| producerId-Type | 12.5.1.4.3 | Used to identify the reporting entity |
| streamType-Type | 12.5.1.4.3 | Used to identify the type of a reporting stream |
| serializationFormat-Type | 12.5.1.4.3 | Used to identify serialization method |
| measObjDn-Type | 12.5.1.4.3 | Used to represent DN of the measured object instance |
| measTypes-Type | 12.5.1.4.3 | Used to represent an ordered list of measurement types or KPI |
| analyticsInfo-Type | 12.5.1.4.3 | Used to represents information about streamed analytics |
| vsDataContainer-Type | Generic NRM | Used to represent details about proprietary data |

Table 12.5.1.4.1-2: Data types imported

|  |  |  |
| --- | --- | --- |
| **Data type** | **Reference** | **Description** |
| traceJob-Type | Generic NRM | Attributes container of the TraceJob IOC (see TS 28.622 [11]). |
| vsDataContainer-Type | Generic NRM | Vendor specific data container (see TS 28.622 [11]). |

##### 12.5.1.4.2 Query, message body and resource data types

12.5.1.4.2.1 Type connectionInfo-Type

Table 12.5.1.4.2.1-1: Definition of type connectionInfo-Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| connection | connectionId-Type | Connection identifier | M |
| producer | producerId-Type | Producer identifier | M |
| streams | array(streamId-Type) | List of stream identifiers | M |

12.5.1.4.2.2 Type connectionRequest-Type

Table 12.5.1.4.2.2-1: Definition of type connectionRequest-Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| producer | producerId-Type | Producer identifier | M |
| streams | array(streamInfo-Type) | List of stream meta-data | M |

12.5.1.4.2.3 Type errorResponse-Type

Table 12.5.1.4.2.3-1: Definition of type errorResponse-Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| error | object | Key indicating the response body containing an error | M |
| > errorInfo | string | Attribute allowing to convey error information in string format | M |

12.5.1.4.2.4 Type failedConnectionResponse-Type

Table 12.5.1.4.2.4-1: Definition of type failedConnectionResponse-Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| error | object | Key indicating the response body containing an error | M |
| > streamId | array(streamId-Type) | Attribute conveying the list of "problematic" stream IDs | M |
| > errorReason | string | Attribute allowing to convey error information in string format |  |

12.5.1.4.2.5 Type streamInfo-Type

Table 12.5.1.4.2.5-1: Definition of type streamInfo-Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| streamId | streamId-Type | Stream identifier | M |
| streamType | streamType-Type | Enumerated stream type | M |
| serializationFormat | serializationFormat-Type | Enumerated serialization method | M |
| measObjDn | measObjDn-Type | DN of the measured object instance. Used for streaming performance data only. | CM |
| measTypes | measTypes-Type | Ordered list of measurement types or KPI. Used for streaming performance data only. | CM |
| analyticsInfo | analyticsInfo-Type | Information about streamed analytics. Used for streaming analytics only. | CM |
| vsDataContainer | vsDataContainer-Type | Details about proprietary data. Mandatory for proprietary data streaming only. | CM |
| traceInfo | traceJob-Type | Trace configuration. Used for streaming trace data reporting streams only. | CM |

Table 12.5.1.4.2.5-2: Attribute constraints

|  |  |
| --- | --- |
| Name | Definition |
| measObjDn (support qualifier) | Attribute shall be present for streaming performance data only. |
| measTypes (support qualifier) | Attribute shall be present for streaming performance data only. |
| analyticsInfo (support qualifier) | Attribute shall be present for streaming analytics only. |
| vsDataContainer (support qualifier) | Attribute shall be present for proprietary data streaming. |
| traceInfo (support qualifier) | Attribute shall be present for streaming trace data only. |

12.5.1.4.2.6 Type streamInfoWithReporters-Type

Table 12.5.1.4.2.6-1: Definition of type streamInfoWithReporters-Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| streamInfo | streamInfo-Type | Stream meta-data | M |
| reporters | producerId-Type | List of entities reporting streaming data | M |

##### 12.5.1.4.3 Simple data types and enumerations

12.5.1.4.3.1 General

This subclause defines simple data types and enumerations that are used by the data structures defined in the previous subclauses.

12.5.1.4.3.2 Simple data types

Table 12.5.1.4.3.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type name | Type definition | Description |
| analyticsInfo-Type | string | Information about streamed analytics. |
| measObjDn-Type | DN | See TS 32.300 [25] |
| measTypes-Type | string | See TS 28.550 [42] |
| websocketHeaderConnection-Type | Constant string "Upgrade" | Header value for the upgrade request and response. |
| websocketHeaderUpgrade-Type | Constant string "websocket" | Header value for the upgrade to WebSocket request and response. |
| websocketHeader-Sec-WebSocket-Accept-Type | string | Header value for secure WebSocket response. Carries hash. |
| websocketHeader-Sec-WebSocket-Extensions-Type | string | Header value for secure WebSocket request. Carries protocol extensions. |
| websocketHeader-Sec-WebSocket-Key-Type | string | Header value for secure WebSocket request. Provides information to the server which is needed in order to confirm that the client is entitled to request an upgrade to WebSocket. |
| websocketHeader-Sec-WebSocket-Protocol-Type | string | Header value for secure WebSocket request. Carries a comma-separated list of subprotocol names, in the order of preference. |
| websocketHeader-Sec-WebSocket-Version-Type | string | Header value for secure WebSocket request and response. Carries the WebSocket protocol version to be used. |
| connectionId-Type | uri-Type | Used to indicate the connection as a context of the operation |
| producerId-Type | systemDN-Type | Used to identify the reporting entity |
| serializationFormat-Type | enum | Enumerated serialization method with values: "GPB", "ASN1" |
| streamId-Type | Trace Reference | See TS 32.422 [38] |
| streamType-Type | enum | Enumerated stream type with values: "TRACE", "PERFORMANCE", "ANALYTICS", "PROPRIETARY" |
| systemDN-Type | DN | See TS 32.300 [25] |
| uri-Type | string | Used to represent resource URI |

## 12.6 File data reporting service

### 12.6.1 RESTful HTTP-based solution set

#### 12.6.1.1 Mapping of operations

##### 12.6.1.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 12.6.1.1.1-1.

Table 12.6.1.1.1-1: Mapping of IS operations to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| IS operation | HTTP Method | Resource URI | S |
| listAvailableFiles | GET | /files | M |
| subscribe | POST | /subscriptions | M |
| unsubscribe | DELETE | /subscriptions/{subscriptionId} | M |

##### 12.6.1.1.2 Operation listAvailableFiles

The IS operation parameters are mapped to SS equivalents according to table 12.6.1.1.2-1 and table 12.6.1.1.2-2.

Table 12.6.1.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| fileDataType | query | fileDataType | FileDataType | M |
| beginTime | query | beginTime | DateTime | M |
| endTime | query | endTime | DateTime | M |

Table 12.6.1.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| fileInfoList | response body | n/a | array(FileInfo) | M |
| status | response status codes | n/a | n/a | M |
| response body | error | ErrorResponse | O |

The message flow is as follows:

- 1. The MnS consumer sends a HTTP GET request to the MnS producer.

- The URI identifies the "…/files" collection resource.

- The query part may contain filter parameters. Absence of the query component means all available files shall be returned.

- The request message body shall be empty.

2. The MnS producer sends a HTTP GET response to the MnS consumer.

- On success "200 OK" shall be returned. The response message body shall carry the information of available files. The response format is defined by " array(FileInfo) ".

- On failure, an appropriate error code shall be returned. The response message body may provide additional error information..

##### 12.6.1.1.3 Operation subscribe

See clause 12.2.1.1.8.

##### 12.6.1.1.4 Operation unsubscribe

See clause 12.2.1.1.9.

#### 12.6.1.2 Mapping of notifications

##### 12.6.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.6.1.2.1-1.

**Table 12.6.1.2.1-1: Mapping of IS notifications to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| **IS notification** | **HTTP Method** | **Resource URI** | **S** |
| notifyFileReady | POST | {notificationTarget} | M |
| notifyFilePreparationError | POST | {notificationTarget} | M |

##### 12.6.1.2.2 Notification notifyFileReady

The IS notification parameters are mapped to SS equivalents according to table 12.6.1.2.2-1.

Table 12.6.1.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| fileInfoList | request body | fileInfoList | array(FileInfo) | M |
| additionalText | request body | additionalText | string | O |

##### 12.6.1.2.3 Notification notifyFilePreparationError

The IS notification parameters are mapped to SS equivalents according to table 12.6.1.2.3-1.

Table 12.6.1.2.3-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **S** |
| objectClass | request body | href | Uri | M |
| objectInstance |
| notificationId | request body | notificationId | NotificationId | M |
| notificationType | request body | notificationType | NotificationType | M |
| eventTime | request body | eventTime | DateTime | M |
| systemDN | request body | systemDN | SystemDN | M |
| fileInfoList | request body | fileInfoList | array(FileInfo) | M |
| reason | request body | reason | string | O |
| additionalText | request body | additionalText | string | O |

#### 12.6.1.3 Resources

##### 12.6.1.3.1 Resource structure

###### 12.6.1.3.1.1 Resource structure on the MnS producer

Figure 12.6.1.3.1.1-1 shows the resource structure of the File Data Reporting MnS on the MnS producer.



Figure 12.6.1.3.1.1-1: Resource URI structure of the File Data Reporting MnS on the MnS producer

Table 12.2.1.3.1.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.2.1.3.1.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| Files | …/files | GET | Retrieve the information of the available files |
| Subscriptions | …/subscriptions | POST | Create a subscription |
| Subscription | …/subscriptions/{subscriptionId} | DELETE | Delete a single subscription |
| Notification Target | {notificationTarget} | POST | Send a notification to the notification target |

###### 12.6.1.3.1.2 Resource structure on the MnS consumer

Figure 12.6.1.3.1.2-1 shows the resource structure of the File Data Reporting MnS on the MnS consumer.



Figure 12.6.1.3.1.2-1: Resource URI structure of the File Data Reporting MnS on the MnS consumer

Table 12.6.1.3.1.2-1 provides an overview of the resources and applicable HTTP methods.

Table 12.6.1.3.1.2-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method | Description |
| Notification Target | {notificationTarget} | POST | Send a notification to the notification target |

##### 12.6.1.3.2 Resource definitions

12.6.1.3.2.1 Resource "…/files"

12.6.1.3.2.1.1 Description

This resource represents the information about a collection of available files.

12.6.1.3.2.1.2 URI

Resource URI = {MnSRoot}/FileDataReportingMnS/{MnSVersion}/files

The resource URI variables are defined in table 12.6.1.3.2.1.1-1.

Table 12.6.1.3.2.1.1-1: URI variables

|  |  |
| --- | --- |
| **Name** | **Definition** |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |

12.6.1.3.2.1.3 HTTP methods

12.6.1.3.2.1.3.1 HTTP GET

This method shall support the URI query parameters specified in the following table.

**Table 12.6.1.3.2.1.3.1-1: URI query parameters supported by the GET method on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Description** | **S** |
| fileDataType | FileDataType | Selects files based on the file data type. | M |
| beginTime | DateTime | Selects files based on the earliest time they became available | M |
| endTime | DateTime | Selects files based on the latest time they became available | M |

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

**Table 12.6.1.3.2.1.3.1-2: Data structures supported by the GET request body on this resource**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Description** | **S** |
| n/a | n/a | n/a |

**Table 12.6.1.3.2.1.3.1-3: Data structures supported by the GET response body on this resource**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data type** | **Response codes** | **Description** | **S** |
| array(FileInfo) | 200 OK | Information about the files identified in the request | M |
| ErrorResponse | 4xx/5xx | Returned in case of an error | M |

12.6.1.3.2.2 Resource "…/subscriptions"

12.6.1.3.2.2.1 Description

This resource is a container resource for individual subscriptions.

12.6.1.3.2.2.2 URI

Resource URI: {MnSRoot}/FileDataReportingMnS/{MnSVersion}/subscriptions

The resource URI variables are defined in table 12.6.1.3.3.2.2.2-1:

Table 12.6.1.3.3.2.2.2-1: URI variables

|  |  |
| --- | --- |
| **Name** | **Definition** |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |

12.6.1.3.2.2.3 HTTP methods

12.6.1.3.2.2.3.1 POST

This method shall support the URI query parameters specified in table 12.6.1.3.2.2.3.1-1.

Table 12.6.1.3.2.2.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.6.1.3.2.2.3.1-2 and the response data structures and response codes specified in table 12.6.1.3.2.2.3.1-3.

Table 12.6.1.3.2.2.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| Subscription | Details of the subscription to be created | M |

Table 12.6.1.3.2.2.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| Subscription | 201 Created | In case of success the representation of the created subscription is returned. | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

12.6.1.3.2.2.3.2 Void

12.6.1.3.2.3 Resource ".../subscriptions/{subscriptionId}"

12.6.1.3.2.3.1 Description

This resource represents a subscription.

12.6.1.3.2.3.2 URI

Resource URI: {MnSRoot}/FileDataReportingMnS/{MnSVersion}/subscriptions/{subscriptionId}

The resource URI variables are defined in table 12.6.1.3.2.3.2-1.

Table 12.6.1.3.2.3.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| MnSRoot | See clause 4.4.3 of TS 32.158 [15] |
| MnSVersion | See clause 4.4.3 of TS 32.158 [15] |
| subscriptionId | Subscription identifier |

12.6.1.3.2.3.3 HTTP methods

12.6.1.3.2.3.3.1 DELETE

This method shall support the URI query parameters specified in table 12.6.1.3.2.3.3-1.

Table 12.6.1.3.2.3.3-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.6.1.3.2.3.3-2 and the response data structures and response codes specified in table 12.6.1.3.2.3.3-3.

Table 12.6.1.3.2.3.3-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| n/a | n/a | n/a |

Table 12.6.1.3.2.3.3-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| n/a | 204 No Content | In case of success no message body is returned | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

12.6.1.3.2.4 Resource "/notificationTarget"

12.6.1.3.2.4.1 Description

This resource represents a notification target on the MnS consumer.

12.6.1.3.2.4.2 URI

Resource URI: {notificationTarget}

The resource URI variables are defined in table 12.6.1.3.2.4.2-1.

Table 12.6.1.3.2.4.2-1: URI variables

|  |  |
| --- | --- |
| Name | Definition |
| notificationTarget | URI of the notification target on the MnS consumer, contained in the notification subscription |

12.6.1.3.2.4.3 HTTP methods

12.6.1.3.2.4.3.1 POST

This method shall support the URI query parameters specified in table 12.6.1.3.2.4.3.1-1.

Table 12.6.1.3.2.4.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Data type | Description | S |
| n/a | n/a | n/a | n/a |

This method shall support the request data structures specified in table 12.6.1.3.2.4.3.1-2 and the response data structures and response codes specified in table 12.6.1.3.2.4.3.1-3.

Table 12.6.1.3.2.4.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |
| --- | --- | --- |
| Data type | Description | S |
| NotifyFileReady | Type in case a notifyFileReady notification is sent | M |
| NotifyFilePreparationError | Type in case a notifyFilePreparationError notification is sent | M |

Table 12.6.1.3.2.4.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Response codes | Description | S |
| n/a | 204 No Content | In case of success no message body is returned | M |
| ErrorResponse | 4xx/5xx | In case of failure the error object is returned. | M |

#### 12.6.1.4 Data type definitions

##### 12.6.1.4.1 General

Table 12.6.1.4.1-1: Data types defined in this specification

|  |  |  |
| --- | --- | --- |
| **Data type** | **Reference** | **Description** |
| FileInfo | 12.6.1.4.2.1 | Information describing a file |
| NotifyFileReady | 12.6.1.4.2.2 | Used in the request body of HTTP POST for the notification type notifyFileReady |
| NotifyFilePreparationError | 12.6.1.4.2.3 | Used in the request body of HTTP POST for the notification type notifyFilePreparationError |
| FileDataType | 12.6.1.4.6.3 | File data types |
| FileNotificationTypes | 12.6.1.4.6.4 | File notification types |

Table 12.6.1.4.1-2: Data types imported

|  |  |  |
| --- | --- | --- |
| **Data type** | **Reference** | **Description** |
| DateTime | TS 28.623 [44] | Date and time |
| Float | TS 28.623 [44] | Float type |
| Uri | TS 28.623 [44] | URI type |
| SystemDN | TS 28.623 [44] | systemDN type |
| NotificationId | TS 28.623 [44] | Notification identifier as defined in ITU-T Rec. X. 733 [4] |
| NotificationHeader | TS 28.623 [44] | Notification header |
| ErrorResponse | TS 28.623 [44] | Used in the response body of multiple HTTP methods in case of error |
| Subscription | 12.2.1.4.1a.8 | Subscription resource |

##### 12.6.1.4.2 Structured data types

12.6.1.4.2.1 Type FileInfo

Table 12.6.1.4.2.1-1: Definition of FileInfo

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| fileLocation | Uri | Location of the file | M |
| fileCompression | string | Name of the compression algorithm used for compressing the file | M |
| fileSize | integer | Size of the file, unit is byte | M |
| fileDataType | FileDataType | Type of management data stored in the file | M |
| fileFormat | string | Encoding technique used for encoding the file. Its value should indicate the version of the file format specification plus to indicate if "ASN1" or "XML-schema" is used | M |
| fileReadyTime | DateTime | Date and time when the file was last closed and made available in the MnS producer. The file content will not be changed any more. | M |
| fileExpirationTime | DateTime | Date and time after which the file may be deleted | M |
| jobId | string | Job identifier of the "PerfMetricJob" or "TraceJob" that produced the file | CM |

12.6.1.4.2.2 Type NotifyFileReady

**Table 12.6.1.4.2.2-1: Definition of type NotifyFileReady**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the object representing the process, managed element or management node, which made the file available | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyFileReady, etc.) | M |
| eventTime | DateTime | Event occurrence time (e.g., the file ready time) | M |
| systemDN | SystemDN | DN of the MnS Agent emitting the notification | M |
| fileInfoList | array(FileInfo) | Information describing the available files | M |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |

12.6.1.4.2.3 Type NotifyFilePreparationError

**Table 12.6.1.4.2.3-1: Definition of type NotifyFilePreparationError**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute name** | **Data type** | **Description** | **S** |
| href | Uri | URI of the object representing the process, managed element or management node, where the file preparation error occured | M |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| notificationType | NotificationType | Notification type (notifyFileReady, etc.) | M |
| eventTime | DateTime | Event occurrence time (e.g., the file ready time) | M |
| systemDN | SystemDN | DN of the MnS Agent emitting the notification | M |
| fileInfoList | array(FileInfo) | Information about the files with a preparation error. | M |
| reason | string | Reason for the file preparation error | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |

##### 12.6.1.4.3 Void

##### 12.6.1.4.4 Void

##### 12.6.1.4.5 Void

##### 12.6.1.4.6 Simple data types and enumerations

12.6.1.4.6.1 General

This clause defines simple data types and enumerations that are used by the data structures defined in the previous clauses.

12.6.1.4.6.2 Simple data types

Table 12.6.1.4.6.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type name | Type definition | Description |
| n/a | n/a | n/a |

12.6.1.4.6.3 Enumeration FileDataType

Table 12.6.1.4.6.3-1: Enumeration FileDataType

|  |  |
| --- | --- |
| Enumeration value | Description |
| PERFORMANCE | Performance data file (measurements and KPIs) |
| TRACE | Trace data file |
| ANALYTICS | Analytics data file |
| PROPRIETARY | Proprietary data file |

12.6.1.4.6.4 Enumeration FileNotificationTypes

Table 12.6.1.4.6.4-1: Enumeration FileNotificationTypes

|  |  |
| --- | --- |
| Enumeration value | Description |
| notifyFileReady | Notification type is notifyFileReady |
| notifyFilePreparationError | Notification type is notifyFilePreparationError |

Annex A (normative):  
OpenAPI specification

# A.0 Introduction

This clause describes the capabilities of the service in the structure of the OpenAPI Specification Version 3.0.1 [A9]. The OpenAPI definitions are provided in YAML or JSON format.

# A.1 Provisioning management service

## A.1.0 Introduction

Clause A.1.1 contains the OpenAPI definition of the provisioning MnS which includes the provisioning MnS operations and the provisioning MnS notifications.

Clause A.1.2 provides indications regarding the content of the generic provisioning MnS notifications when the consumer of these notifications supports the ONAP VES API. This content is sent as payload of VES events (see Annex B).

## A.1.1 OpenAPI document "TS28532\_ProvMnS.yaml"

openapi: 3.0.1

info:

title: Provisioning MnS

version: 17.5.0

description: >-

OAS 3.0.1 definition of the Provisioning MnS

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externalDocs:

description: TS 28.532; Generic management services

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.532/

servers:

- url: '{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}'

variables:

MnSRoot:

description: See clause 4.4.2 of TS 32.158

default: http://example.com/3GPPManagement

MnSVersion:

description: Version number of the OpenAPI definition

default: XXX

URI-LDN-first-part:

description: See clause 4.4.2 of TS 32.158

default: ''

paths:

'/{className}={id}':

parameters:

- name: className

in: path

required: true

schema:

type: string

- name: id

in: path

required: true

schema:

type: string

put:

summary: Replaces a complete single resource or creates it if it does not exist

description: >-

With HTTP PUT a complete resource is replaced or created if it does not

exist. The target resource is identified by the target URI.

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/Resource'

responses:

'200':

description: >-

Success case ("200 OK").

This status code shall be returned when the resource is replaced, and

when the replaced resource representation is not identical to the resource

representation in the request.

This status code may be returned when the resource is updated and when the

updated resource representation is identical to the resource representation

in the request.

The representation of the updated resource is returned in the response

message body.

content:

application/json:

schema:

$ref: '#/components/schemas/Resource'

'201':

description: >-

Success case ("201 Created").

This status code shall be returned when the resource is created.

The representation of the created resource is returned in the response

message body.

content:

application/json:

schema:

$ref: '#/components/schemas/Resource'

'204':

description: >-

Success case ("204 No Content").

This status code may be returned only when the replaced resource

representation is identical to the representation in the request.

The response has no message body.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

callbacks:

notifyMOICreation:

'{request.body#/notificationRecipientAddress}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyMoiCreation'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response

has no message body.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyMOIDeletion:

'{request.body#/notificationRecipientAddress}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyMoiDeletion'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response

has no message body.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyMOIAttributeValueChanges:

'{request.body#/notificationRecipientAddress}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyMoiAttributeValueChanges'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response

has no message body.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyMOIChanges:

'{request.body#/notificationRecipientAddress}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyMoiChanges'

application/yang-data+json:

schema:

$ref: '#/components/schemas/NotifyMoiChanges'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response

has no message body.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

get:

summary: Reads one or multiple resources

description: >-

With HTTP GET resources are read. The resources to be retrieved are

identified with the target URI. The attributes and fields parameter

of the query components allow to select the resource properties to be returned.

parameters:

- name: scope

in: query

description: >-

This parameter extends the set of targeted resources beyond the base

resource identified with the path component of the URI. No scoping

mechanism is specified in the present document.

required: false

schema:

$ref: '#/components/schemas/Scope'

style: form

explode: true

- name: filter

in: query

description: >-

This parameter reduces the targeted set of resources by applying a

filter to the scoped set of resource representations. Only resource

representations for which the filter construct evaluates to "true"

are targeted. No filter language is specified in the present

document.

required: false

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Filter'

- name: attributes

in: query

description: >-

This parameter specifies the attributes of the scoped resources that

are returned.

required: false

schema:

type: array

items:

type: string

style: form

explode: false

- name: fields

in: query

description: >-

This parameter specifies the attribute field of the scoped resources

that are returned.

required: false

schema:

type: array

items:

type: string

style: form

explode: false

responses:

'200':

description: >-

Success case ("200 OK").

The resources identified in the request for retrieval are returned

in the response message body. In case the attributes or fields query

parameters are used, only the selected attributes or sub-attributes are

returned. The response message body is constructed according to the

hierarchical response construction method (TS 32.158 [15]).

content:

application/json:

schema:

$ref: '#/components/schemas/Resource'

application/vnd.3gpp.object-tree-hierarchical+json:

schema:

$ref: '#/components/schemas/Resource'

application/vnd.3gpp.object-tree-flat+json:

schema:

type: array

items:

$ref: '#/components/schemas/Resource'

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

patch:

summary: Patches one or multiple resources

description: >-

With HTTP PATCH resources are created, updated or deleted. The resources

to be modified are identified with the target URI (base resource) and

the patch document included in the request message body.

requestBody:

description: >-

The request body describes changes to be made to the target resources.

The following patch media types are available

- "application/merge-patch+json" (RFC 7396)

- "application/3gpp-merge-patch+json" (TS 32.158)

- "application/json-patch+json" (RFC 6902)

- "application/3gpp-json-patch+json" (TS 32.158)

required: true

content:

application/merge-patch+json:

schema:

$ref: '#/components/schemas/Resource'

application/3gpp-merge-patch+json:

schema:

$ref: '#/components/schemas/Resource'

application/json-patch+json:

schema:

type: array

items:

$ref: '#/components/schemas/PatchItem'

application/3gpp-json-patch+json:

schema:

type: array

items:

$ref: '#/components/schemas/PatchItem'

responses:

'200':

description: >-

Success case ("200 OK").

This status code is returned when the updated the resource representations

shall be returned for some reason.

The resource representations are returned in the response message body. The

response message body is constructed according to the hierarchical response

construction method (TS 32.158 [15])

content:

application/json:

schema:

$ref: '#/components/schemas/Resource'

'204':

description: >-

Success case ("204 No Content").

This status code is returned when there is no need to return the updated

resource representations.

The response message body is empty.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

delete:

summary: Deletes one resource

description: >-

With HTTP DELETE one resource is deleted. The resources to be deleted is

identified with the target URI.

responses:

'200':

description: >-

Success case ("200 OK").

This status code is returned, when the resource has been successfully deleted.

The response body is empty.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

components:

schemas:

CmNotificationTypes:

type: string

enum:

- notifyMOICreation

- notifyMOIDeletion

- notifyMOIAttributeValueChanges

- notifyMOIChanges

SourceIndicator:

type: string

enum:

- RESOURCE\_OPERATION

- MANAGEMENT\_OPERATION

- SON\_OPERATION

- UNKNOWN

ScopeType:

type: string

enum:

- BASE\_ONLY

- BASE\_NTH\_LEVEL

- BASE\_SUBTREE

- BASE\_ALL

Operation:

type: string

enum:

- add

- remove

- replace

Insert:

type: string

enum:

- before

- after

PatchOperation:

type: string

enum:

- add

- replace

- remove

- copy

- move

- test

Resource:

oneOf:

- type: object

properties:

id:

type: string

objectClass:

type: string

objectInstance:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

attributes:

type: object

additionalProperties:

type: array

items:

type: object

required:

- id

- anyOf:

- $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/resources-genericNrm'

- $ref: 'TS28541\_NrNrm.yaml#/components/schemas/resources-nrNrm'

- $ref: 'TS28541\_5GcNrm.yaml#/components/schemas/resources-5gcNrm'

- $ref: 'TS28541\_SliceNrm.yaml#/components/schemas/resources-sliceNrm'

- $ref: 'TS28536\_CoslaNrm.yaml#/components/schemas/resources-coslaNrm'

- $ref: 'TS28312\_IntentNrm.yaml#/components/schemas/resources-intentNrm'

- $ref: 'TS28104\_MdaNrm.yaml#/components/schemas/resources-mdaNrm'

- $ref: 'TS28105\_AiMlNrm.yaml#/components/schemas/resources-AiMlNrm'

- $ref: 'TS28538\_EdgeNrm.yaml#/components/schemas/resources-edgeNrm'

Scope:

type: object

properties:

scopeType:

$ref: '#/components/schemas/ScopeType'

scopeLevel:

type: integer

CorrelatedNotification:

type: object

properties:

source:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

notificationIds:

type: array

items:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationId'

required:

- source

- notificationIds

MoiChange:

type: object

properties:

notificationId:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationId'

correlatedNotifications:

type: array

items:

$ref: '#/components/schemas/CorrelatedNotification'

additionalText:

type: string

sourceIndicator:

$ref: '#/components/schemas/SourceIndicator'

op:

$ref: '#/components/schemas/Operation'

path:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Uri'

insert:

$ref: '#/components/schemas/Insert'

value: {}

oldValue: {}

required:

- notificationId

- op

- path

NotifyMoiCreation:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

correlatedNotifications:

type: array

items:

$ref: '#/components/schemas/CorrelatedNotification'

additionalText:

type: string

sourceIndicator:

$ref: '#/components/schemas/SourceIndicator'

attributeList:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

NotifyMoiDeletion:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

correlatedNotifications:

type: array

items:

$ref: '#/components/schemas/CorrelatedNotification'

additionalText:

type: string

sourceIndicator:

$ref: '#/components/schemas/SourceIndicator'

attributeList:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

NotifyMoiAttributeValueChanges:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

correlatedNotifications:

type: array

items:

$ref: '#/components/schemas/CorrelatedNotification'

additionalText:

type: string

sourceIndicator:

$ref: '#/components/schemas/SourceIndicator'

attributeListValueChanges:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeValueChangeSet'

required:

- attributeListValueChanges

NotifyMoiChanges:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

moiChanges:

type: array

items:

$ref: '#/components/schemas/MoiChange'

required:

- moiChanges

PatchItem:

type: object

properties:

op:

$ref: '#/components/schemas/PatchOperation'

from:

type: string

path:

type: string

value:

nullable: true

required:

- op

- path

## A.1.2 Integration with ONAP VES

Detailed guidelines for integration of provisioning MnS notifications with ONAP VES are provided in Annex B.

# A.2 Generic fault supervision management service

### A.2.0 Introduction

Clause A.2.1 contains the OpenAPI definition of the generic fault supervision MnS which includes the fault supervision MnS operations and the fault supervision MnS notifications.

Clause A.2.2 provides indications regarding the content of the generic fault supervision MnS notifications when the consumer of these notifications supports the ONAP VES API. This content is sent as payload of VES events (see Annex B).

## A.2.1 OpenAPI document "TS28532\_FaultMnS.yaml"

openapi: 3.0.1

info:

title: Fault Supervision MnS

version: 17.2.0

description: >-

OAS 3.0.1 definition of the Fault Supervision MnS

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externalDocs:

description: TS 28.532; Generic management services

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.532/

servers:

- url: '{MnSRoot}/FaultSupervisionMnS/{MnSversion}'

variables:

MnSRoot:

description: See subclause 4.4.3 of TS 32.158

default: http://example.com/3GPPManagement

MnSversion:

description: Version number of the OpenAPI definition

default: XXX

paths:

/alarms:

get:

summary: Retrieve multiple alarms

description: >-

Retrieves the alarms identified by alarmAckState, baseObjectInstance

and filter.

parameters:

- name: alarmAckState

in: query

required: false

schema:

$ref: '#/components/schemas/AlarmAckState'

- name: baseObjectInstance

in: query

required: false

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

- name: filter

in: query

required: false

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Filter'

responses:

'200':

description: >-

Success case ("200 OK").

Returns the alarms identified in the request. The alarmId is the key

of the map.

content:

application/json:

schema:

type: object

additionalProperties:

type: object

allOf:

- type: object

properties:

lastNotificationHeader:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- $ref: '#/components/schemas/AlarmRecord'

- type: object

properties:

comments:

$ref: '#/components/schemas/Comments'

default:

description: Response in case of error.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

patch:

summary: 'Clear, acknowledge or unacknowledge multiple alarms'

description: >-

Clears, acknowledges or unacknowledges multiple alarms using patch. Depending

on which action is to be performed, different merge patch documents need

to be used.

requestBody:

description: >-

Patch documents for acknowledging and unacknowledging, or clearing multiple

alarms. The keys in the map are the alarmIds to be patched.

content:

application/merge-patch+json:

schema:

oneOf:

- type: object

additionalProperties:

$ref: '#/components/schemas/MergePatchAcknowledgeAlarm'

- type: object

additionalProperties:

$ref: '#/components/schemas/MergePatchClearAlarm'

responses:

'204':

description: >-

Success case ("204 No content").

The response message body is empty.

default:

description: Response in case of error.

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/FailedAlarm'

/alarms/alarmCount:

get:

summary: Get the alarm count per perceived severity

parameters:

- name: alarmAckState

in: query

required: false

schema:

$ref: '#/components/schemas/AlarmAckState'

- name: filter

in: query

required: false

schema:

type: string

responses:

'200':

description: >-

Success case ("200 OK").

The alarm count per perceived severity is returned.

content:

application/json:

schema:

$ref: '#/components/schemas/AlarmCount'

default:

description: Response in case of error. The error case needs rework.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

/alarms/{alarmId}:

patch:

summary: 'Clear, acknowledge or unacknowledge a single alarm'

description: >-

Clears, acknowledges or unacknowldeges a single alarm by patching the alarm

information. A conditional acknowledge request based on the perceived

severity is not supported.

parameters:

- name: alarmId

in: path

description: Identifies the alarm to be patched.

required: true

schema:

type: string

requestBody:

required: true

content:

application/merge-patch+json:

schema:

oneOf:

- $ref: '#/components/schemas/MergePatchAcknowledgeAlarm'

- $ref: '#/components/schemas/MergePatchClearAlarm'

responses:

'204':

description: >-

Success case (204 No content).

The response message body is absent.

default:

description: Response in case of error.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

/alarms/{alarmId}/comments:

post:

summary: Add a comment to a single alarm

description: >-

Adds a comment to an alarm identified by alarmId. The id of the new comment

is allocated by the producer.

parameters:

- name: alarmId

in: path

description: Identifies the alarm to which the comment shall be added.

required: true

schema:

type: string

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/Comment'

responses:

'201':

description: >-

Success case (201 Created).

The representation of the newly created comment resource shall be returned.

content:

application/json:

schema:

$ref: '#/components/schemas/Comment'

headers:

Location:

description: URI of the newly created comment resource.

required: true

schema:

type: string

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

/subscriptions:

post:

summary: Create a subscription

description: >-

To create a subscription the representation of the subscription is

POSTed on the /subscriptions collection resource.

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/Subscription'

responses:

'201':

description: >-

Success case ("201 Created").

The representation of the newly created subscription resource shall

be returned.

content:

application/json:

schema:

$ref: '#/components/schemas/Subscription'

headers:

Location:

description: URI of the newly created subscription resource

required: true

schema:

type: string

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

callbacks:

notifyNewAlarm:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

oneOf:

- $ref: '#/components/schemas/NotifyNewAlarm'

- $ref: '#/components/schemas/NotifyNewSecAlarm'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyClearedAlarm:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyClearedAlarm'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyChangedAlarm:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyChangedAlarm'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyChangedAlarmGeneral:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

oneOf:

- $ref: '#/components/schemas/NotifyChangedAlarmGeneral'

- $ref: '#/components/schemas/NotifyChangedSecAlarmGeneral'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyCorrelatedNotificationChanged:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyCorrelatedNotificationChanged'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyAckStateChanged:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyAckStateChanged'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyComments:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyComments'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyPotentialFaultyAlarmList:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyPotentialFaultyAlarmList'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyAlarmListRebuilt:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyAlarmListRebuilt'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

/subscriptions/{subscriptionId}:

delete:

summary: Delete a subscription

description: >-

The subscription is deleted by deleting the corresponding subscription

resource. The resource to be deleted is identified with the path

component of the URI.

parameters:

- name: subscriptionId

in: path

description: Identifies the subscription to be deleted.

required: true

schema:

type: string

responses:

'204':

description: >-

Success case ("204 No Content").

The subscription resource has been deleted. The response message body

is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

components:

schemas:

#---- Definition of AlarmRecord ----------------------------------------------------#

AlarmId:

type: string

AlarmType:

type: string

enum:

- COMMUNICATIONS\_ALARM

- QUALITY\_OF\_SERVICE\_ALARM

- PROCESSING\_ERROR\_ALARM

- EQUIPMENT\_ALARM

- ENVIRONMENTAL\_ALARM

- INTEGRITY\_VIOLATION

- OPERATIONAL\_VIOLATION

- PHYSICAL\_VIOLATION

- SECURITY\_SERVICE\_OR\_MECHANISM\_VIOLATION

- TIME\_DOMAIN\_VIOLATION

ProbableCause:

description: >-

The value of the probable cause may be a specific standardized string, or any

vendor provided string. Probable cause strings are not standardized in the

present document. They may be added in a future version. Up to then the

mapping of the generic probable cause strings "PROBABLE\_CAUSE\_001" to

"PROBABLE\_CAUSE\_005" is vendor specific.

The value of the probable cause may also be an integer. The mapping of integer

values to probable causes is vendor specific.

oneOf:

- anyOf:

- type: string

enum:

- PROBABLE\_CAUSE\_001

- PROBABLE\_CAUSE\_002

- PROBABLE\_CAUSE\_003

- PROBABLE\_CAUSE\_004

- PROBABLE\_CAUSE\_005

- type: string

- type: integer

SpecificProblem:

oneOf:

- type: string

- type: integer

PerceivedSeverity:

type: string

enum:

- INDETERMINATE

- CRITICAL

- MAJOR

- MINOR

- WARNING

- CLEARED

TrendIndication:

type: string

enum:

- MORE\_SEVERE

- NO\_CHANGE

- LESS\_SEVERE

ThresholdHysteresis:

type: object

required:

- high

properties:

high:

oneOf:

- type: integer

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/Float'

low:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Float'

ThresholdLevelInd:

oneOf:

- type: object

properties:

up:

$ref: '#/components/schemas/ThresholdHysteresis'

- type: object

properties:

down:

$ref: '#/components/schemas/ThresholdHysteresis'

ThresholdInfo:

type: object

properties:

observedMeasurement:

type: string

observedValue:

type: number

thresholdLevel:

$ref: '#/components/schemas/ThresholdLevelInd'

armTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

required:

- observedMeasurement

- observedValue

CorrelatedNotification:

type: object

properties:

sourceObjectInstance:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

notificationIds:

type: array

items:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationId'

required:

- sourceObjectInstance

- notificationIds

CorrelatedNotifications:

type: array

items:

$ref: '#/components/schemas/CorrelatedNotification'

AckState:

type: string

enum:

- ACKNOWLEDGED

- UNACKNOWLEDGED

AlarmRecord:

description: >-

The alarmId is not a property of an alarm record. It is used as key

in the map of alarm records instead.

type: object

properties:

# alarmId:

# $ref: '#/components/schemas/AlarmId'

objectInstance:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

notificationId:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationId'

alarmRaisedTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

alarmChangedTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

alarmClearedTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

specificProblem:

$ref: '#/components/schemas/SpecificProblem'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

backedUpStatus:

type: boolean

backUpObject:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

trendIndication:

$ref: '#/components/schemas/TrendIndication'

thresholdinfo:

$ref: '#/components/schemas/ThresholdInfo'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

stateChangeDefinition:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeValueChangeSet'

monitoredAttributes:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

proposedRepairActions:

type: string

additionalText:

type: string

additionalInformation:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

rootCauseIndicator:

type: boolean

ackTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

ackUserId:

type: string

ackSystemId:

type: string

ackState:

$ref: '#/components/schemas/AckState'

clearUserId:

type: string

clearSystemId:

type: string

serviceUser:

type: string

serviceProvider:

type: string

securityAlarmDetector:

type: string

#---- Definition of alarm notifications --------------------------------------------#

AlarmNotificationTypes:

type: string

enum:

- notifyNewAlarm

- notifyChangedAlarm

- notifyChangedAlarmGeneral

- notifyAckStateChanged

- notifyCorrelatedNotificationChanged

- notifyComments

- notifyClearedAlarm

- notifyAlarmListRebuilt

- notifyPotentialFaultyAlarmList

AlarmListAlignmentRequirement:

type: string

enum:

- ALIGNMENT\_REQUIRED

- ALIGNMENT\_NOT\_REQUIRED

NotifyNewAlarm:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

- perceivedSeverity

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

specificProblem:

$ref: '#/components/schemas/SpecificProblem'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

backedUpStatus:

type: boolean

backUpObject:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

trendIndication:

$ref: '#/components/schemas/TrendIndication'

thresholdInfo:

$ref: '#/components/schemas/ThresholdInfo'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

stateChangeDefinition:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeValueChangeSet'

monitoredAttributes:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

proposedRepairActions:

type: string

additionalText:

type: string

additionalInformation:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

rootCauseIndicator:

type: boolean

NotifyNewSecAlarm:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

- perceivedSeverity

- serviceUser

- serviceProvider

- securityAlarmDetector

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

additionalText:

type: string

additionalInformation:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

rootCauseIndicator:

type: boolean

serviceUser:

type: string

serviceProvider:

type: string

securityAlarmDetector:

type: string

NotifyClearedAlarm:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

- perceivedSeverity

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

clearUserId:

type: string

clearSystemId:

type: string

NotifyChangedAlarm:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

- perceivedSeverity

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

NotifyChangedAlarmGeneral:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

specificProblem:

$ref: '#/components/schemas/SpecificProblem'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

backedUpStatus:

type: boolean

backUpObject:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

trendIndication:

$ref: '#/components/schemas/TrendIndication'

thresholdInfo:

$ref: '#/components/schemas/ThresholdInfo'

stateChangeDefinition:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeValueChangeSet'

monitoredAttributes:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

proposedRepairActions:

type: string

additionalText:

type: string

additionalInformation:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

rootCauseIndicator:

type: boolean

changedAlarmAttributes:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

NotifyChangedSecAlarmGeneral:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- serviceUser

- serviceProvider

- securityAlarmDetector

- probableCause

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

additionalText:

type: string

additionalInformation:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

rootCauseIndicator:

type: boolean

serviceUser:

type: string

serviceProvider:

type: string

securityAlarmDetector:

type: string

changedAlarmAttributes:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'

NotifyCorrelatedNotificationChanged:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- correlatedNotifications

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

correlatedNotifications:

$ref: '#/components/schemas/CorrelatedNotifications'

rootCauseIndicator:

type: boolean

NotifyAckStateChanged:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

- perceivedSeverity

- ackState

- ackUserId

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

ackState:

$ref: '#/components/schemas/AckState'

ackUserId:

type: string

ackSystemId:

type: string

NotifyComments:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- alarmId

- alarmType

- probableCause

- perceivedSeverity

- comments

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

alarmType:

$ref: '#/components/schemas/AlarmType'

probableCause:

$ref: '#/components/schemas/ProbableCause'

perceivedSeverity:

$ref: '#/components/schemas/PerceivedSeverity'

comments:

$ref: '#/components/schemas/Comments'

NotifyPotentialFaultyAlarmList:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- reason

properties:

reason:

type: string

NotifyAlarmListRebuilt:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

required:

- reason

properties:

reason:

type: string

alarmListAlignmentRequirement:

$ref: '#/components/schemas/AlarmListAlignmentRequirement'

#---- Definition of query parameters -----------------------------------------------#

AlarmAckState:

type: string

enum:

- ALL\_ALARMS

- ALL\_ACTIVE\_ALARMS

- ALL\_ACTIVE\_AND\_ACKNOWLEDGED\_ALARMS

- ALL\_ACTIVE\_AND\_UNACKNOWLEDGED\_ALARMS

- ALL\_CLEARED\_AND\_UNACKNOWLEDGED\_ALARMS

- ALL\_UNACKNOWLEDGED\_ALARMS

#---- Definition of patch documents ------------------------------------------------#

MergePatchAcknowledgeAlarm:

description: >-

Patch document acknowledging or unacknowledging a single alarm. For

acknowledging an alarm the value of ackState is ACKNOWLEDGED, for unacknowledging

an alarm the value of ackState is UNACKNOWLEDGED.

type: object

required:

- ackUserId

- ackState

properties:

ackUserId:

type: string

ackSystemId:

type: string

ackState:

$ref: '#/components/schemas/AckState'

MergePatchClearAlarm:

description: Patch document for clearing a single alarm

type: object

required:

- clearUserId

- perceivedSeverity

properties:

clearUserId:

type: string

clearSystemId:

type: string

perceivedSeverity:

type: string

enum:

- CLEARED

#---- Definition of method responses -----------------------------------------------#

FailedAlarm:

type: object

required:

- alarmId

- failureReason

properties:

alarmId:

$ref: '#/components/schemas/AlarmId'

failureReason:

type: string

#---- Definition of resources ------------------------------------------------------#

AlarmCount:

type: object

required:

- criticalCount

- majorCount

- minorCount

- warningCount

- indeterminateCount

- clearedCount

properties:

criticalCount:

type: integer

majorCount:

type: integer

minorCount:

type: integer

warningCount:

type: integer

indeterminateCount:

type: integer

clearedCount:

type: integer

Comment:

type: object

properties:

commentTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

commentUserId:

type: string

commentSystemId:

type: string

commentText:

type: string

Comments:

description: >-

Collection of comments. The comment identifiers are allocated by the

MnS producer and used as key in the map.

type: object

additionalProperties:

$ref: '#/components/schemas/Comment'

Subscription:

type: object

properties:

consumerReference:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Uri'

timeTick:

type: integer

filter:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Filter'

## A.2.2 Integration with ONAP VES

Detailed guidelines for integration of fault supervision MnS notifications with ONAP VES are provided in Annex B.

# A.3 Void

# A.4 Generic performance assurance management service

## A.4.1 Void

## A.4.2 OpenAPI document "TS28532\_PerfMnS.yaml"

openapi: 3.0.1

info:

title: TS 28.532 Performance Threshold Monitoring MnS

version: 17.1.0

description: >-

OAS 3.0.1 definition of the Performance Threshold Monitoring MnS

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externalDocs:

description: TS 28.532; Generic management services

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.532/

servers:

- url: '{root}'

variables:

root:

description: >-

The open API server of the performance threshold monitoring service is

located in the consumer side, see monitoringNotifTarget attribute of

the IOC ThresholdMonitor defined in TS 28.622 [11].

default: http://example.com/3GPPManagement

paths:

/notificationSink:

post:

summary: Send notifications about performance threshold crossing

description: To send a notifyThresholdCrossing notification

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyThresholdCrossing'

responses:

'204':

description: >-

Success case ("204 No Content"). The notification is successfully

delivered. The response message body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

components:

schemas:

PerfNotificationTypes:

type: string

enum:

- notifyThresholdCrossing

PerfMetricValue:

oneOf:

- type: integer

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/Float'

PerfMetricDirection:

type: string

enum:

- UP

- DOWN

NotifyThresholdCrossing:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

observedPerfMetricName:

type: string

observedPerfMetricValue:

$ref: '#/components/schemas/PerfMetricValue'

observedPerfMetricDirection:

$ref: '#/components/schemas/PerfMetricDirection'

thresholdValue:

$ref: '#/components/schemas/PerfMetricValue'

hysteresis:

$ref: '#/components/schemas/PerfMetricValue'

monitorGranularityPeriod:

type: integer

additionalText:

type: string

## A.4.3 Integration with ONAP VES

Detailed guidelines for integration of performance assurance MnS notifications with ONAP VES are provided in Annex B.

# A.5 Heartbeat

### A.5.0 Introduction

Clause A.5.1 contains the OpenAPI definition of the heartbeat management capability.

Clause A.5.2 provides indications regarding the content of the heartbeat management capability notifications when the consumer of these notifications supports the ONAP VES API. This content is sent as payload of VES events (see Annex B).

## A.5.1 OpenAPI document "TS28532\_HeartbeatNtf.yaml"

openapi: 3.0.1

info:

title: Heartbeat notification

version: 17.1.0

description: >-

OAS 3.0.1 definition of the heartbeat notification

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externalDocs:

description: TS 28.532; Generic management services

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.6532/

paths: {}

components:

schemas:

HeartbeatNotificationTypes:

type: string

enum:

- notifyHeartbeat

NotifyHeartbeat:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

heartbeatNtfPeriod:

type: integer

## A.5.2 Integration with ONAP VES

NOTE: Void.

Detailed guidelines for integration of heartbeat notifications with ONAP VES are provided in Annex B.

# A.6 Streaming data reporting management service

## A.6.1 Introduction

Clause A.6.2 contains the OpenAPI specification of the Streaming data reporting MnS.

## A.6.2 OpenAPI document "TS28532\_StreamingDataMnS.yaml"

openapi: 3.0.1

info:

title: TS 28.532 Streaming data reporting service

version: 17.1.0

description: >-

OAS 3.0.1 specification for the Streaming data reporting service (Streaming MnS)

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servers:

- url: '{MnSRoot}/StreamingDataReportingMnS/{MnSVersion}'

variables:

MnSRoot:

description: See clause 4.4.3 of TS 32.158.

default: https://example.com/3GPPManagement

MnSVersion:

description: See clause 4.4.3 of TS 32.158.

default: ''

paths:

'/connections':

post:

summary: Inform consumer about reporting streams to be carried by the new connection and receive a new connection id.

description: Exchange of meta-data (producer informs consumer about its own identity and the nature of the data to be reported via streaming) phase of the connection establishement by streaming data reporting producer to the streaming data reporting consumer (i.e. streaming target).

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/connectionRequest-Type'

responses:

'201':

description: Success case (201 Created).

headers:

Location:

description: Location of the created connection resource.

schema:

$ref: '#/components/schemas/connectionId-Type'

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/failedConnectionResponse-Type'

get:

summary: Obtain information about connections.

description: Enables the streaming data reporting service producer to obtain information about one or more streaming connections.

parameters:

- name: connectionIdList

in: query

description: The list of connectionId for which the connection information is to be returned.

required: false

schema:

type: array

items:

$ref: '#/components/schemas/connectionId-Type'

responses:

'200':

description: Success case (200 OK). The resources identified in the request for retrieval are returned in the response message body. In case the fields query parameter is used, the selected resources are returned.

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/connectionInfo-Type'

'202':

description: Partial success case (202 Partially retrieved). Subset of the resources identified in the request for retrieval are returned in the response message body.

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/connectionInfo-Type'

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/errorResponse-Type'

'/connections/{connectionId}':

get:

summary: Obtain information about a connection.

description: Enables the streaming data reporting service producer to obtain information about one streaming connection.

parameters:

- name: connectionId

in: path

description: Indicate the ID (URI) of the connection for which the information is being retrieved

required: true

schema:

$ref: '#/components/schemas/connectionId-Type'

- name: Connection

in: header

schema:

$ref: '#/components/schemas/websocketHeaderConnection-Type'

- name: Sec-WebSocket-Extensions

in: header

schema:

$ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Extensions-Type'

- name: Sec-WebSocket-Key

in: header

schema:

$ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Key-Type'

- name: Sec-WebSocket-Protocol

in: header

schema:

$ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Protocol-Type'

- name: Sec-WebSocket-Version

in: header

schema:

$ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Version-Type'

responses:

'101':

description: Success case (101 Switching Protocols). The connection has been successfully switched to WebSocket. The response message body is absent.

headers:

Upgrade:

schema:

$ref: '#/components/schemas/websocketHeaderUpgrade-Type'

Connection:

schema:

$ref: '#/components/schemas/websocketHeaderConnection-Type'

Sec-WebSocket-Accept:

schema:

$ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Accept-Type'

'200':

description: Success case (200 OK). The resource identified in the request for retrieval returned in the response message body.

content:

application/json:

schema:

$ref: '#/components/schemas/connectionInfo-Type'

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/errorResponse-Type'

'/connections/{connectionId}/streams':

post:

summary: Inform consumer about new reporting streams on an existing connection.

description: Allows the producer to add one or more reporting streams to an already established streaming connection.

parameters:

- name: connectionId

in: path

description: Indicate the ID (URI) of the connection for which the reporting stream information is being added.

required: true

schema:

$ref: '#/components/schemas/connectionId-Type'

requestBody:

required: true

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/streamInfo-Type'

responses:

'201':

description: Success case (201 Posted).

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/streamInfo-Type'

'202':

description: Partial success case (202 Posted).

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/streamInfo-Type'

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/errorResponse-Type'

delete:

summary: Remove reporting streams from an existing connection

description: Allows the producer to remove one or more reporting streams from an already established streaming connection.

parameters:

- name: connectionId

in: path

description: Indicate the ID (URI) of the connection for which the reporting stream information is being removed.

required: true

schema:

$ref: '#/components/schemas/connectionId-Type'

- name: streamIds

in: query

description: The list of streamId for the stream(s) to be deleted.

required: true

schema:

type: array

items:

$ref: '#/components/schemas/streamId-Type'

responses:

'204':

description: Success case (204 No Content). The stream information resource has been deleted. The response message body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/errorResponse-Type'

get:

summary: Obtain information about streams.

description: Enables the streaming data reporting service producer to obtain information about one or more reporting streams.

parameters:

- name: connectionId

in: path

description: Indicate the ID (URI) of the connection for which the information is being retrieved

required: true

schema:

$ref: '#/components/schemas/connectionId-Type'

- name: streamIds

in: query

description: The list of streamId for which the stream information is to be retrieved.

required: true

schema:

type: array

items:

$ref: '#/components/schemas/streamId-Type'

responses:

'200':

description: Success case (200 OK).

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/streamInfoWithReporters-Type'

'202':

description: Partial success case (202 Partially retrieved).

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/streamInfoWithReporters-Type'

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/errorResponse-Type'

'/connections/{connectionId}/streams/{streamId}':

get:

summary: Obtain information about stream

description: Enables the streaming data reporting service producer to obtain information about a reporting stream.

parameters:

- name: connectionId

in: path

description: Indicate the ID (URI) of the connection for which the information is being retrieved

required: true

schema:

$ref: '#/components/schemas/connectionId-Type'

- name: streamId

in: path

description: Indicate the ID of the reporting stream for which the information is being retrieved

required: true

schema:

$ref: '#/components/schemas/streamId-Type'

responses:

'200':

description: Success case (200 OK).

content:

application/json:

schema:

$ref: '#/components/schemas/streamInfoWithReporters-Type'

default:

description: Error case.

content:

application/json:

schema:

$ref: '#/components/schemas/errorResponse-Type'

components:

schemas:

analyticsInfo-Type:

description: Information specific to analytics reporting.

type: object

properties:

activityDetails:

type: string

connectionId-Type:

$ref: '#/components/schemas/uri-Type'

connectionInfo-Type:

type: object

properties:

connection:

$ref: '#/components/schemas/connectionId-Type'

producer:

$ref: '#/components/schemas/producerId-Type'

streams:

type: array

items:

$ref: '#/components/schemas/streamId-Type'

connectionRequest-Type:

type: object

properties:

producer:

$ref: '#/components/schemas/producerId-Type'

streams:

type: array

items:

$ref: '#/components/schemas/streamInfo-Type'

errorResponse-Type:

type: object

properties:

error:

type: object

properties:

errorInfo:

type: string

failedConnectionResponse-Type:

type: object

properties:

error:

type: array

items:

type: object

properties:

streamId:

$ref: '#/components/schemas/streamId-Type'

errorReason:

type: string

measObjDn-Type:

description: DN of the measured object instance (see TS 28.550)

allOf:

- $ref: '#/components/schemas/systemDN-Type'

performanceMetrics-Type:

description: an ordered list of performance metric names (see clause 4.4.1 of TS 28.622[11]) whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI

type: array

items:

type: string

performanceInfo-Type:

description: Information specific to performance data reporting

type: object

properties:

measObjDn:

$ref: '#/components/schemas/measObjDn-Type'

performanceMetrics:

$ref: '#/components/schemas/performanceMetrics-Type'

jobId:

type: string

required:

- measObjDn

- performanceMetrics

producerId-Type:

description: DN of the streaming data reporting MnS producer.

allOf:

- $ref: '#/components/schemas/systemDN-Type'

serializationFormat-Type:

type: string

enum:

- GPB

- ASN1

streamId-Type:

description: globally unique stream identifier

type: string

example: '26F452550021'

streamInfo-Type:

description: Reporting stream meta-data.

type: object

properties:

streamType:

$ref: '#/components/schemas/streamType-Type'

serializationFormat:

$ref: '#/components/schemas/serializationFormat-Type'

streamId:

oneOf:

- $ref: '#/components/schemas/streamId-Type'

- $ref: '#/components/schemas/traceReference-Type'

additionalInfo:

oneOf:

- $ref: '#/components/schemas/traceInfo-Type'

- $ref: '#/components/schemas/performanceInfo-Type'

- $ref: '#/components/schemas/analyticsInfo-Type'

- $ref: '#/components/schemas/vsDataContainer-Type'

required:

- streamType

- serializationFormat

- streamId

streamInfoWithReporters-Type:

description: Reporting stream meta-data with added information about reporters.

type: object

properties:

streamInfo:

$ref: '#/components/schemas/streamInfo-Type'

reporters:

type: array

items:

$ref: '#/components/schemas/producerId-Type'

systemDN-Type:

description: See TS 32.300 for details

type: string

example: 'SubNetwork=ABCNetwork,SubNetwork=MUC01,GNBDUFunction=XYZ0100'

streamType-Type:

type: string

enum:

- TRACE

- PERFORMANCE

- ANALYTICS

- PROPRIETARY

traceInfo-Type:

description: Information specific to trace data reporting

allOf:

- $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/TraceJob-Attr'

traceReference-Type:

description: Trace Reference (see clause 5.6 of TS 32.422) as stream identifier for streaming trace data reporting

type: string

example: '4358070034D7'

uri-Type:

description: Resource URI

type: string

vsDataContainer-Type:

description: container for vendor specific data (see TS 28.622)

type: object

properties:

vsDataType:

type: string

vsData:

type: string

vsDataFormatVersion:

type: string

websocketHeaderConnection-Type:

description: Header value for the upgrade request and response.

type: string

enum:

- Upgrade

websocketHeaderUpgrade-Type:

description: Header value for the upgrade to WebSocket request and response.

type: string

enum:

- websocket

websocketHeader-Sec-WebSocket-Accept-Type:

description: Header value for secure WebSocket response. Carries hash.

type: string

websocketHeader-Sec-WebSocket-Extensions-Type:

description: Header value for secure WebSocket request. Carries protocol extensions.

type: string

websocketHeader-Sec-WebSocket-Key-Type:

description: Header value for secure WebSocket request. Provides information to the server which is needed in order to confirm that the client is entitled to request an upgrade to WebSocket.

type: string

websocketHeader-Sec-WebSocket-Protocol-Type:

description: Header value for secure WebSocket request. Carries a comma-separated list of subprotocol names, in the order of preference.

type: string

websocketHeader-Sec-WebSocket-Version-Type:

description: Header value for secure WebSocket request and response. Carries the WebSocket protocol version to be used.

type: string

# A.7 File data reporting management service

## A.7.1 Introduction

Clause A.7.2 contains the OpenAPI definition of the File Data Reporting MnS.

Clause A.7.3 provides indications regarding the content of the File Data Reporting MnS notifications when the consumer of these notifications supports the ONAP VES API. This content is sent as payload of VES events (see Annex B).

## A.7.2 OpenAPI document "TS 28532\_FileDataReportingMnS.yaml"

openapi: 3.0.1

info:

title: File Data Reporting MnS

version: 17.1.0

description: >-

OAS 3.0.1 definition of the File Data Reporting MnS

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externalDocs:

description: TS 28.532; Generic management services

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.532/

servers:

- url: '{MnSRoot}/fileDataReportingMnS/{MnSVersion}'

variables:

MnSRoot:

description: See clause 4.4.3 of TS 32.158

default: http://example.com/3GPPManagement

MnSVersion:

description: Version number of the OpenAPI definition

default: XXX

paths:

/files:

get:

summary: Read information about available files

description: >-

Information about available files is read with HTTP GET. The files for

which information shall be returned are identified with the path

component (base resource) and the query component (fileDataType, beginTime,

endTime) of the URI.

parameters:

- name: fileDataType

in: query

description: >-

This parameter selects files based on the file data type.

required: true

schema:

$ref: '#/components/schemas/FileDataType'

- name: beginTime

in: query

description: >-

This parameter selects files based on the earliest time they

became available

required: false

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

- name: endTime

in: query

description: >-

This parameter selects files based on the latest time they

became available

required: false

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

responses:

'200':

description: >-

'Success case ("200 OK").

The resources identified in the request for retrieval are returned

in the response message body.'

content:

application/json:

schema:

type: array

items:

$ref: '#/components/schemas/FileInfo'

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

/subscriptions:

post:

summary: Create a subscription

description: >-

To create a subscription the representation of the subscription is

POSTed on the /subscriptions collection resource.

requestBody:

required: true

content:

application/json:

schema:

$ref: 'TS28532\_FaultMnS.yaml#/components/schemas/Subscription'

responses:

'201':

description: >-

Success case ("201 Created").

The representation of the newly created subscription resource shall

be returned.

content:

application/json:

schema:

$ref: 'TS28532\_FaultMnS.yaml#/components/schemas/Subscription'

headers:

Location:

description: URI of the newly created subscription resource

required: true

schema:

type: string

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

callbacks:

notifyFileReady:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyFileReady'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

notifyFilePreparationError:

'{request.body#/consumerReference}':

post:

requestBody:

required: true

content:

application/json:

schema:

$ref: '#/components/schemas/NotifyFilePreparationError'

responses:

'204':

description: >-

Success case ("204 No Content").

The notification is successfully delivered. The response message

body is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

/subscriptions/{subscriptionId}:

delete:

summary: Delete a subscription

description: >-

The subscription is deleted by deleting the corresponding subscription

resource. The resource to be deleted is identified with the path

component of the URI.

parameters:

- name: subscriptionId

in: path

description: Identifies the subscription to be deleted.

required: true

schema:

type: string

responses:

'204':

description: >-

Success case ("204 No Content").

The subscription resource has been deleted. The response message body

is absent.

default:

description: Error case.

content:

application/json:

schema:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/ErrorResponse'

components:

schemas:

FileDataType:

type: string

enum:

- Performance

- Trace

- Analytics

- Proprietary

FileNotificationTypes:

type: string

enum:

- notifyFileReady

- notifyFilePreparationError

FileInfo:

type: object

properties:

fileLocation:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/Uri'

fileSize:

type: integer

fileReadyTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

fileExpirationTime:

$ref: 'TS28623\_ComDefs.yaml#/components/schemas/DateTime'

fileCompression:

type: string

fileFormat:

type: string

fileDataType:

$ref: '#/components/schemas/FileDataType'

NotifyFileReady:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

fileInfoList:

type: array

items:

$ref: '#/components/schemas/FileInfo'

additionalText:

type: string

NotifyFilePreparationError:

allOf:

- $ref: 'TS28623\_ComDefs.yaml#/components/schemas/NotificationHeader'

- type: object

properties:

fileInfoList:

type: array

items:

$ref: '#/components/schemas/FileInfo'

reason:

type: string

additionalText:

type: string

## A.7.3 Integration with ONAP VES

Detailed guidelines for integration of file data reporting MnS notifications with ONAP VES are provided in Annex B.

Annex B (Informative):  
Guidelines for the integration of 3GPP MnS notifications with ONAP VES

In case the consumer of the 3GPP MnS notifications specified in the present document is an ONAP VES collector, the following guidelines are for the developer of the corresponding notification producer:

- The produced notification conforms to ONAP-defined VES specification;

- The VES Common Event Header fields are populated by the producer is as follows:

- The domain "stndDefined" is used,

- The "stndDefinedNamespace" field value is the concatenation of "3GPP-" and the name of the 3GPP MnS which the 3GPP IS notification is part of. Based on the MnS names defined in the present version of this document, VES name space values corresponding to 3GPP MnS could be:

- "3GPP-Provisioning",

- "3GPP-FaultSupervision",

- "3GPP-PerformanceAssurance",

- "3GPP-Heartbeat",

- "3GPP-DataStreamingReporting",

- "3GPP-DataFileReporting".

- How the other fields of the Common Event Header are populated is not in the scope of the present document;

- The payload part of the VES event specification conforms to the OpenAPI definitions of clause A.1.1 (for provisioning MnS notifications), A.2.1 (for the fault supervision MnS notifications), A4.2 (for the performance assurance MnS notifications), A.5.1 (for the heartbeat notifications) and A.7.2 (for the file data reporting MnS notifications) of the present document. The OpenAPI definitions of Annex A in the present document may also be found on 3GPP FORGE (see [53]).

A picture containing text, screenshot, line, font

Description automatically generated

Figure B-1: 3GPP MnS notifications consumed by ONAP VES Collector(s)

Annex C (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2018-09 | SA#81 |  |  |  |  | Upgrade to change control version | 15.0.0 |
| 2018-09 | SA#81 |  |  |  |  | EditHelp editorial fix | 15.0.1 |
| 2018-12 | SA#82 | SP-181042 | 0002 | 1 | F | Correction of references | 15.1.0 |
| 2018-12 | SA#82 | SP-181042 | 0003 | 1 | F | Align with 3GPP draft rules of the usage of must | 15.1.0 |
| 2018-12 | SA#82 | SP-181042 | 0004 | 1 | F | Correction of the numbering and title of figures and tables | 15.1.0 |
| 2018-12 | SA#82 | SP-181042 | 0005 | 1 | F | Remove unnecessary Editor’s Note and figure | 15.1.0 |
| 2018-12 | SA#82 | SP-181045 | 0006 | 1 | F | Update Resource URI of alarmCount | 15.1.0 |
| 2018-12 | SA#82 | SP-181045 | 0009 | 1 | F | Change the name of IRPAgent and IRPManager | 15.1.0 |
| 2018-12 | SA#82 | SP-181045 | 0010 | 1 | F | Remove unnecessary import table and state diagram | 15.1.0 |
| 2018-12 | SA#82 | SP-181045 | 0012 | - | F | Correct the subscription resource related errors | 15.1.0 |
| 2018-12 | SA#82 | SP-181043 | 0018 | - | F | Add notifyNewSecurityAlarm to notification type | 15.1.0 |
| 2018-12 | SA#82 | SP-181045 | 0020 | 1 | F | Change alarmIRP to FaultSupervision MnS producer | 15.1.0 |
| 2018-12 | SA#82 | SP-181042 | 0021 | 1 | F | Add stage 2 definition for provisioning management service related notifications | 15.1.0 |
| 2018-12 | SA#82 | SP-181042 | 0022 | 1 | F | Correct stage 3 description of the Provisioning Management Service | 15.1.0 |
| 2018-12 | SA#82 | SP-181045 | 0025 | - | F | Correct erroneous reference to notification header | 15.1.0 |
| 2019-03 | SA#83 | SP-190120 | 0029 | 1 | F | Correction of references | 15.2.0 |
| 2019-06 | SA#84 | SP-190372 | 0031 | 2 | B | Add RESTful HTTP-based solution set of fault supervision for integration with ONAP VES | 16.0.0 |
| 2019-06 | SA#84 | SP-190371 | 0038 | 1 | B | Add performance threshold crossing notification | 16.0.0 |
| 2019-09 | SA#85 | SP-190742 | 0038A |  |  | Global reorganization, correcting operation names, notification parameter and wrong references | 16.1.0 |
| 2019-12 | SA#86 | SP-191178 | 0055 | 1 | B | RESTful CM notifications for integration with ONAP VES | 16.2.0 |
| 2019-12 | SA#86 | SP-191219 | 0059 | 1 | A | Corrections to provisioning MnS notification definitions (Stage 2) | 16.2.0 |
| 2019-12 | SA#86 | SP-191219 | 0061 | 2 | A | Correct fault supervision management service | 16.2.0 |
| 2019-12 | SA#86 | SP-191159 | 0069 | 2 | C | Make scoping and filtering optional in the ProvMnS | 16.2.0 |
| 2019-12 | SA#86 | SP-191159 | 0071 | 2 | F | Correct and update the RESTful HTTP-based solution set of provisioning | 16.2.0 |
| 2019-12 | SA#86 | SP-191178 | 0073 | 2 | B | Introduce Heartbeat | 16.2.0 |
| 2019-12 | SA#86 | SP-191173 | 0075 | 1 | A | Correct event time defn | 16.2.0 |
| 2019-12 | SA#86 | SP-191166 | 0076 | 1 | B | Add notifyEvent | 16.2.0 |
| 2019-12 | SA#86 | SP-191159 | 0081 | 1 | F | Correct schema to reflect location in the specifications | 16.2.0 |
| 2019-12 | SA#86 | SP-191159 | 0082 | - | F | Correct XML Schema for consistency and clarity | 16.2.0 |
| 2020-03 | SA#87E | SP-200174 | 0089 | - | A | Add missing definition for matching-criteria-attributes | 16.3.0 |
| 2020-03 | SA#87E | SP-200166 | 0092 | 1 | F | Clarify capability of ack alarms and filter constraint | 16.3.0 |
| 2020-03 | SA#87E | SP-200176 | 0094 | 1 | F | Correction of MnS Stage 3 solution sets for integration with ONAP VES | 16.3.0 |
| 2020-03 | SA#87E | SP-200166 | 0096 | - | F | Rapporteur clean up | 16.3.0 |
| 2020-03 | SA#87E | SP-200169 | 0098 | 1 | B | YANG\_Netconf Operations | 16.3.0 |
| 2020-03 | SA#87E | SP-200166 | 0101 | 1 | F | Clarify and add numerous issues in the REST SS of the ProvMnS | 16.3.0 |
| 2020-03 | SA#87E | SP-200166 | 0103 | 2 | F | Correct OpenAPI definition of the ProvMnS | 16.3.0 |
| 2020-03 | SA#87E | SP-200174 | 0104 | - | A | Correct ackState attribute name | 16.3.0 |
| 2020-03 | SA#87E | SP-200169 | 0105 | - | F | Correct Heartbeat | 16.3.0 |
| 2020-06 | SA#88-e | SP-200484 | 0100 | 2 | B | Add summary CM notification to the ProvMnS | 16.4.0 |
| 2020-06 | SA#88-e | SP-200484 | 0102 | 1 | F | Remove subscribe and unsubscribe operation from ProvMnS | 16.4.0 |
| 2020-06 | SA#88-e | SP-200484 | 0107 | 1 | F | Void meaningless clauses 12.1.2.2.1.2 and 12.2.2.2.1.2 | 16.4.0 |
| 2020-06 | SA#88-e | SP-200484 | 0111 | - | F | Add missing callbacks for notifications to ProvMnS | 16.4.0 |
| 2020-06 | SA#88-e | SP-200484 | 0113 | - | F | Remove attribute referenceObjectInstance which is not supported by solution set | 16.4.0 |
| 2020-06 | SA#88-e | SP-200485 | 0114 | 2 | F | Update URI for generic fault supervision management service | 16.4.0 |
| 2020-06 | SA#88-e | SP-200485 | 0115 | 2 | F | Update URI for performance data file reporting management service | 16.4.0 |
| 2020-06 | SA#88-e | SP-200484 | 0116 | - | F | Remove data object from response types in the ProvMnS | 16.4.0 |
| 2020-06 | SA#88-e | SP-200483 | 0117 | 3 | B | Add streaming trace data reporting service stage 2 definition | 16.4.0 |
| 2020-06 | SA#88-e | SP-200483 | 0118 | 2 | B | Add streaming data reporting service stage 3 mapping of operations | 16.4.0 |
| 2020-06 | SA#88-e | SP-200483 | 0119 | 2 | B |  | 16.4.0 |
| 2020-06 | SA#88-e | SP-200483 | 0120 | 2 | B |  | 16.4.0 |
| 2020-06 | SA#88-e | SP-200483 | 0121 | 2 | B | Add streaming data reporting service stage 3 OpenAPI definition | 16.4.0 |
| 2020-06 | SA#88-e | SP-200499 | 0123 | - | A | Move XML file format from stage2 to stage3 | 16.4.0 |
| 2020-06 | SA#88-e | SP-200485 | 0126 | 1 | C | Update Fault Supervision MnS (stage 2) | 16.4.0 |
| 2020-06 | SA#88-e | SP-200485 | 0127 | 1 | C | Update Fault Supervision MnS (REST SS) | 16.4.0 |
| 2020-06 | SA#88-e | SP-200485 | 0128 | 1 | C | Update Fault Supervision MnS (OpenAPI definitions) | 16.4.0 |
| 2020-06 | SA#88-e | SP-200500 | 0133 | - | F | Correction of ONAP references | 16.4.0 |
| 2020-06 | SA#88-e | SP-200611 | 0134 | 1 | F | Convert JSON schema to YAML file for performance threshold monitoring service | 16.4.0 |
| 2020-09 | SA#89e | SP-200738 | 0135 | - | F | Change stage2 definition for performance data file report MnS to generic file data report MnS | 16.5.0 |
| 2020-09 | SA#89e | SP-200738 | 0136 | - | F | Change RESTFUL definition for performance data file report MnS to generic file data report MnS | 16.5.0 |
| 2020-09 | SA#89e | SP-200724 | 0137 | - | F | Change openAPI definition for performance data file report MnS to generic file data report MnS | 16.5.0 |
| 2020-09 | SA#89e | SP-200737 | 0138 | 1 | F | Clarification on Annex A.1, A.2 and A.5 | 16.5.0 |
| 2020-09 | SA#89e | SP-200723 | 0139 | - | F | Update URI for streamingDataReportingMnS to aligh with URI structure defined in 32.158 | 16.5.0 |
| 2020-09 | SA#89e | SP-200736 | 0141 | 1 | A | Correct the description for generic provisioning MnS | 16.5.0 |
| 2020-09 | SA#89e | SP-200724 | 0143 | - | F | Correct various smaller errors (e.g. validation errors) in faultMnS.yaml (OpenAPI definitions) | 16.5.0 |
| 2020-09 | SA#89e | SP-200724 | 0144 | - | F | Correct definition of ThresholdLevelInd (REST SS) | 16.5.0 |
| 2020-09 | SA#89e | SP-200737 | 0147 | - | F | Remove unintended normative statement from informative clause | 16.5.0 |
| 2020-09 | SA#89e |  |  |  |  | Correction of clause numbering | 16.5.1 |
| 2020-11 |  |  |  |  |  | Cleanup of custom XML, watermarks, hidden text, etc.. no technical changes | 16.5.2 |
| 2020-12 | SA#90e | SP-201050 | 0148 | 1 | F | Correction on generic file data report MnS | 16.6.0 |
| 2020-12 | SA#90e | SP-201088 | 0149 | 2 | F | Update generic streaming MnS | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0150 | 1 | F | Correct CR implementation errors (Fault MnS) | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0152 | 1 | F | Correct ThresholdLevelInd (REST SS, OpenAPI definition) | 16.6.0 |
| 2020-12 | SA#90e | SP-201054 | 0153 | - | F | Correct notifyThresholdCrossing (stage 2) | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0154 | 1 | F | Correct notifyThresholdCrossing (REST SS, OpenAPI definition) | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0155 | 1 | F | Correct notifyHeartbeat (stage 2, REST SS, OpenAPI definition) | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0156 | - | F | Correct small errors in faultMnS.yaml (OpenAPI definition) | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0157 | 1 | F | Correct notifyChangedAlarmGeneral (stage 2) | 16.6.0 |
| 2020-12 | SA#90e | SP-201050 | 0158 | - | F | Correct notifyChangedAlarmGeneral (REST SS, OpenAPI definitions) | 16.6.0 |
| 2020-12 | SA#90e | SP-201055 | 0160 | 1 | F | Fix inconsistencies in guidelines for integration with ONAP VES | 16.6.0 |
| 2020-12 | SA#90e | SP-201088 | 0161 | - | F | Correct small errors in the Fault MnS (REST SS) | 16.6.0 |
| 2020-12 | SA#90e | SP-201088 | 0162 | - | F | Align ProvMnS data type names to UpperCamel (REST SS, OpenAPI definition) | 16.6.0 |
| 2021-03 | SA#91e | SP-210150 | 0163 | 2 | F | Correct definitions for the File MnS (stage 2) | 16.7.0 |
| 2021-03 | SA#91e | SP-210150 | 0164 | 2 | F | Correct definitions for the File MnS (REST SS) | 16.7.0 |
| 2021-03 | SA#91e | SP-210150 | 0165 | 2 | F | Correct definitions for the File MnS (OpenAPI definitions) | 16.7.0 |
| 2021-03 | SA#91e | SP-210150 | 0166 | 1 | F | Correct support qualifiers of the notifyThresholdCrossing parameters (stage 2) | 16.7.0 |
| 2021-03 | SA#91e | SP-210146 | 0167 | - | F | Fix compilation errors | 16.7.0 |
| 2021-03 | SA#91e | SP-210146 | 0168 | 1 | F | Correct the misalignment information for stage2 Fault Supervision MnS | 16.7.0 |
| 2021-03 | SA#91e | SP-210146 | 0170 | 1 | F | Correct some minor errors in the Fault MnS definition (REST SS) | 16.7.0 |
| 2021-03 | SA#91e | SP-210146 | 0171 | - | F | Correct some minor errors in the Prov MnS definition (REST SS) | 16.7.0 |
| 2021-04 | SA#91e |  |  |  |  | Editorial cleanup with the help of the Rapporteur | 16.7.1 |
| 2021-06 | SA#92e | SP-210406 | 0173 | 1 | F |  | 16.8.0 |
| 2021-06 | SA#92e | SP-210406 | 0174 | 1 | F | Correct definitions for file management (stage 2, REST SS, OpenAPI definition) | 16.8.0 |
| 2021-06 | SA#92e | SP-210416 | 0175 | - | F | Align different (abbreviated) names for support qualifier to S | 16.8.0 |
| 2021-06 | SA#92e | SP-210406 | 0176 | 1 | F | Update clause 11.2.2 Managed information for fault supervision management service | 16.8.0 |
| 2021-06 | SA#92e |  |  |  |  | Editorial fix: format of tables | 16.8.1 |
| 2021-09 | SA#93e | SP-210885 | 0178 | 1 | F | Remove last occurrences of “-Type” in data type names | 16.9.0 |
| 2021-09 | SA#93e | SP-210885 | 0179 | 1 | F | Correct definition of the timeTick parameter in the File MnS | 16.9.0 |
| 2021-09 | SA#93e | SP-210885 | 0180 | 1 | F | Alignment the description for streaming data reporting MnS producer | 16.9.0 |
| 2021-09 | SA#93e | SP-210885 | 0185 | - | F | Add missing reference for TS 32.404 and RFC 6901 | 16.9.0 |
| 2021-12 | SA#94e | SP-211454 | 0187 | 1 | F | Align the description for generic provisioning MnS | 16.10.0 |
| 2021-12 | SA#94e | SP-211454 | 0188 | - | F | Fix the incorrect reference of Generic fault supervision management service to TS 32.158 | 16.10.0 |
| 2021-12 | SA#94e | SP-211454 | 0189 | - | F | Fix the incorrect reference of File data reporting service to TS 32.158 | 16.10.0 |
| 2021-12 | SA#94e | SP-211454 | 0190 | 1 | F | Fix the URI description for streaming data report MnS | 16.10.0 |
| 2021-12 | SA#94e | SP-211454 | 0193 | 1 | F | Correct spelling of notifyAlarmListRebuilt | 16.10.0 |
| 2022-03 | SA#95e | SP-220183 | 0196 | 1 | B | Add jobId to FileInfo | 17.0.0 |
| 2022-06 | SA#96 | SP-220497 | 0200 | - | A | Correct REST SS of deleteMOI | 17.1.0 |
| 2022-06 | SA#96 | SP-220497 | 0201 | - | F | Align allowed file transfer protocols in stage 2 with stage 1 requirements | 17.1.0 |
| 2022-06 | SA#96 | SP-200502 | 0202 | - | B | Update proMnS yaml file to include the resources-intentNrm | 17.1.0 |
| 2022-06 | SA#96 | SP-220497 | 0205 | - | A | OpenAPI file name and dependence change- part1 | 17.1.0 |
| 2022-06 | SA#96 | SP-220497 | 0206 | - | A | OpenAPI file name and dependence change- part2 | 17.1.0 |
| 2022-06 | SA#96 | SP-220497 | 0208 | 1 | A | Correct definition of Resource | 17.1.0 |
| 2022-06 | SA#96 | SP-220564 | 0209 | 1 | F | Correct notifyMOIChanges (stage 2) | 17.1.0 |
| 2022-06 | SA#96 | SP-220564 | 0210 | 1 | F | Correct notifyMOIChanges (REST SS) | 17.1.0 |
| 2022-06 | SA#96 | SP-220564 | 0211 | 1 | F | Correct notifyMOIChanges (OpenAPI definitions) | 17.1.0 |
| 2022-06 | SA#96 | SP-220564 | 0213 | 1 | B | Data change notifications YANG-in-Rest format | 17.1.0 |
| 2022-06 | SA#96 | SP-220497 | 0216 | - | A | Fix FileDataType definition in OpenAPI | 17.1.0 |
| 2022-06 | SA#96 |  |  |  |  | CR implementation corrections | 17.1.1 |
| 2022-09 | SA#97e | SP-220849 | 0219 | - | F | Updating Hysteresis from M to O in notifyThresholdCrossing | 17.2.0 |
| 2022-09 | SA#97e | SP-220858 | 0221 | - | A | Update provMnS yaml to include resources-coslaNrm | 17.2.0 |
| 2022-09 | SA#97e | SP-220851 | 0222 | - | F | Update provMnS yaml to include MDA NRM related resources | 17.2.0 |
| 2022-09 | SA#97e | SP-220859 | 0223 | - | F | Correct notifyMOIChanges handling for YANG leaf-lists | 17.2.0 |
| 2022-09 | SA#97e |  |  |  |  | Annex A.1.1 aligned with FORGE content | 17.2.1 |
| 2022-12 | SA#98e | SP-221169 | 0227 | 1 | A | Correct OpenAPI definition of HTTP DELETE | 17.3.0 |
| 2022-12 | SA#98e | SP-221169 | 0229 | 1 | A | Correct type of observedValue attribute | 17.3.0 |
| 2022-12 | SA#98e | SP-221169 | 0231 | 1 | A | Correct definition of the HTTP GET response | 17.3.0 |
| 2022-12 | SA#98e | SP-221169 | 0233 | 2 | A | Add missing definition of the JSON Patch document | 17.3.0 |
| 2022-12 | SA#98e | SP-221169 | 0235 | - | A | Remove duplicated message flows (REST SS of ProvMnS) | 17.3.0 |
| 2022-12 | SA#98e | SP-221169 | 0237 | 2 | A | Add introduction clause to the Prov MnS definition | 17.3.0 |
| 2022-12 | SA#98e | SP-221167 | 0238 | 1 | F | Add missing insert attribute to the data type MoiChange | 17.3.0 |
| 2022-12 | SA#98e | SP-221167 | 0239 | - | F | Clarify allowed values for href parameter in notifyMOIChanges (NETCONF/YANG) | 17.3.0 |
| 2023-03 | SA#99 | SP-230199 | 0241 | - | A | Align media type names with TS 32.158 | 17.4.0 |
| 2023-03 | SA#99 | SP-230199 | 0243 | 1 | A | Add examples for notifyMOICreation, notifyMOIDeletion and notifyAttributeValueChanges | 17.4.0 |
| 2023-03 | SA#99 | SP-230196 | 0244 | 1 | F | Clarify definitions related to attributes | 17.4.0 |
| 2023-03 | SA#99 | SP-230200 | 0245 | - | A | Updates for generic management services | 17.4.0 |
| 2023-06 | SA#100 | SP-230648 | 0249 | 1 | A | Netconf with-defaults | 17.5.0 |
| 2023-06 | SA#100 | SP-230648 | 0253 | - | A | Add missing definition of the JSON Patch document | 17.5.0 |
| 2023-06 | SA#100 | SP-230681 | 0255 | 1 | A | Correction the Information Type for objectClass and objectInstance | 17.5.0 |
| 2023-06 | SA#100 | SP-230649 | 0256 | - | F | Resources-edgeNrm is missing in resource schema | 17.5.0 |
| 2023-06 | SA#100 | SP-230648 | 0258 | - | A | Correct media types used with HTTP Patch | 17.5.0 |
| 2023-06 | SA#100 | SP-230648 | 0260 | - | A | Clarification on notification target | 17.5.0 |
| 2023-06 | SA#100 | SP-230647 | 0263 | - | A | Correction of RFC references, and alarm information | 17.5.0 |
| 2023-06 | SA#100 |  |  |  |  | Adding code files to the zip | 17.5.1 |
| 2023-07 | SA#100 |  |  |  |  | Fixing header and footer | 17.5.2 |
| 2023-09 | SA#101 | SP-230944 | 0265 | - | F | Make probableCause mandatory in notifyChangedAlarmGeneral | 17.6.0 |
| 2023-09 | SA#101 | SP-230940 | 0267 | 1 | A | Correction to ProvMnS stage3 issue concerning parameter attributes | 17.6.0 |
| 2023-09 | SA#101 | SP-230940 | 0270 | - | A | Clarify complete attribute values must be included in notifyMOIAttributeValueChanges | 17.6.0 |
| 2023-09 | SA#101 | SP-230940 | 0272 | - | A | Clarify usage of the attributes container in notifyMOIChanges | 17.6.0 |
| 2023-09 | SA#101 | SP-230940 | 0280 | 1 | A | Correction of reference to Forge OpenAPI definition | 17.6.0 |
| 2023-09 | SA#101 | SP-230940 | 0282 | - | A | Clarify description of generic provisioning service | 17.6.0 |