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650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
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# Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> 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.

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# 1 Scope

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

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# 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] 3GPP TS 28.526: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures".
- [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] 3GPP TS 22.261: "Technical Specification Group Services and System Aspects; Service requirements for the 5G system; Stage 1".
- [8] 3GPP TS 23.501: "Technical Specification Group Services and System Aspects; System Architecture for the 5G System; Stage 2".
- [9] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".
- [10] ETSI GS NFV-IFA 013 V2.4.1 (2018-02) "Network Function Virtualization (NFV); Management and Orchestration; Os-Ma-nfvo Reference Point - Interface and Information Model Specification".
- [11] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".
- [12] ETSI GS NFV-IFA 015 (V2.4.1): "Network Function Virtualisation (NFV); Management and Orchestration; Report on NFV Information Model".
- [13] 3GPP TS 28.533: "Management and orchestration; Architecture framework"
- [14] ITU-T Recommendation X.734 (1992): "Information technology - Open Systems Interconnection - Systems management: Event report management function".
- [15] 3GPP TS 32.158: "Management and orchestration; Design rules for REpresentational State Transfer (REST) Solution Sets (SS)".
- [16] 3GPP TS 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP); Information Service (IS)".



- [17] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".
- [18] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".
- [19] 3GPP TS 32.401: "Telecommunication management; Performance 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] OpenAPI: "OpenAPI 3.0.1 Specification", <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.1.md>.
- [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] ITU-T Recommendation X.733 (02/92): "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".
- [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](https://github.com/onap/vnfrqts-requirements/blob/05f26fac2b941513a7d0e856b99fd8c61d688299/docs/Chapter8/ves7_1spec.rst#resource-structure).
- [46] 3GPP SA5 FORGE OpenAPI definitions: <https://forge.3gpp.org/rep/sa5/MnS/tree/Rel-16/OpenAPI>.
- [47] 3GPP TS 32.404: "Performance Management (PM); Performance measurements; Definitions and template".
- [48] IETF RFC 6901: "JavaScript Object Notation (JSON) Pointer".

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## 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].

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 3GPP 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.<br><br>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 {<br>BASE_ONLY,<br>BASE_ALL<br>}          | If the optional "scopeLevel" parameter is not supported or absent, allowed values of "scopeType" are "BASE_ONLY" and "BASE_ALL".<br><br>The value "BASE_ONLY" indicates only the base object is selected.<br><br>The value "BASE_ALL" indicates the base object and all of its subordinate objects (incl. the leaf objects) are selected.<br><br>This parameter is redundant and can be omitted when confirming only the protocol specific default behaviour.   |
|                    |   | ENUM {<br>BASE_NTH_LEVEL,<br>BASE_SUBTREE<br>} | If the "scopeLevel" parameter is supported and present, allowed values of "scopeType" are "BASE_NTH_LEVEL" and "BASE_SUBTREE".<br><br>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.<br><br>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.<br><br>The actual syntax and capabilities of the <code>filter</code> is SS specific. However, each SS should support a <code>filter</code> consisting of one or several assertions that may be grouped using the logical operators AND, OR and NOT.<br><br>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 parameter 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 3GPP 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 3GPP TS 32.300 [5].  |
| scopeType          | M | See corresponding parameter in <code>getMOIAttributes</code> .   | See corresponding parameter in <code>getMOIAttributes</code> .  |
| scopeLevel         | O | See corresponding parameter in <code>getMOIAttributes</code> .   | See corresponding parameter in <code>getMOIAttributes</code> .  |
| filter             | O | See comment.   | See corresponding parameter in <code>getMOIAttributes</code> .  |
| modificationList   | M | <p>LIST OF SEQUENCE<br/>&lt;attribute identifier, [attribute values], ENUM( replace, add values, remove values, set to default)&gt;</p> <p>See Comment for when attribute values are require and when they are optional.</p> | <p>This parameter contains a set of attribute modification specifications, each of which contains:</p> <ol style="list-style-type: none"> <li>1). attribute identifier: the identifier of the attribute whose value(s) is (are) to be modified.</li> <li>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.</li> <li>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: <ol style="list-style-type: none"> <li>a) replace: the attribute value(s) specified shall be used to replace the current values(s) of the attribute;</li> <li>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.</li> <li>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;</li> <li>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.</li> </ol> </li> </ol> <p>Note: Set is used here in the mathematical sense so that a set-valued attribute is an unordered set of unique values.</p> <p>The modify operator is optional, and if it is not specified, the replace operator shall be assumed.</p> <p>The modificationList parameter contains a single set of attribute modification specifications and this same set is applied to each MO instance to be modified.</p> |

### 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 3GPP 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  | It shall carry the ManagedEntity class name.   | It specifies the class name of the IOC. A network event has occurred in an instance of this class.   |
| objectInstance          | M  | It shall carry the DN of the ManagedEntity.  | 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 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(<br>Resource_operation,<br>Management_operation,<br>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:<br>1. resource operation: The notification was generated in response to an internal operation of the resource;<br>2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object;<br>3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. .<br>4. unknown: It is not possible to determine the source of the operation.<br><br>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<br><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  | It shall carry the ManagedEntity class name.   | It specifies the class name of the IOC. A network event has occurred in an instance of this class.   |
| objectInstance          | M  | It shall carry the DN of the ManagedEntity.  | 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 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(<br>Resource_operation,<br>Management_operation,<br>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:<br>1. resource operation: The notification was generated in response to an internal operation of the resource;<br>2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object;<br>3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. .<br>4. unknown: It is not possible to determine the source of the operation.<br><br>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<br><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  | It shall carry the ManagedEntity class name.   | It specifies the class name of the IOC. A network event has occurred in an instance of this class.   |
| objectInstance          | M  | It shall carry the DN of the ManagedEntity.  | 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 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(<br>Resource_operation,<br>Management_operation,<br>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:<br>1. resource operation: The notification was generated in response to an internal operation of the resource;<br>2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object;<br>3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. .<br>4. unknown: It is not possible to determine the source of the operation.<br><br>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 | It carries the IOC of an instance where an alert occurs. | --  |
| objectInstance   | M | It carries the DN of an instance where an alert occurs.  | --  |
| 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 ITU-T [17] 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.                       | --  |
| <p>NOTE 1: If consumer receives notifications from one producer, consumer can use the notificationId and the objectInstance to uniquely identify all received notifications.</p> <p>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.</p> <p>If consumer receives notifications from multiple producers and notifications of one or more objectInstance(s) are reported by 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.</p> <p>How notificationId of notifications are re-used to correlate notifications is outside of the scope of this specification.</p> |   |  |   |

## 11.1.1.11 Notification notifyMOIChanges

## 11.1.1.11.1 Definition

This notification notifies subscribed MnS consumers that Managed Object Instances have been created or deleted, or that values of Managed Object Instance attributes have been replaced. This notification can report multiple updates that happened at the same time.

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.

## 11.1.1.11.2 Input parameters

| Parameter Name   | S | Information Type / Legal Values   | Comment  |
|------------------|---|---|--|
| objectClass      | M | See clause 11.1.1.7.2   | This parameter specifies the class name of the local root in the MIB   |
| objectInstance   | M | See clause 11.1.1.7.2   | This parameter specifies the instance of the local root in the MIB   |
| notificationId   | M | See clause 11.1.1.7.2   | See clause 11.1.1.7.2  |
| notificationType | M | const string<br>"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 {<br>notificationId (M),<br>correlatedNotifications (O),<br>additionalText (O),<br>sourceIndicator (O),<br>path (M),<br>operation (M),<br>value (CM)<br>} | <p>This parameter describes the NRM updates to be reported.</p> <p>The <code>notificationId</code> is an identifier of one MOI change.</p> <p>The <code>path</code> specifies the MOI created or deleted, or the MOI with replaced attribute values. The <code>path</code> may identify also parts of an attribute in case the attribute is a structured data type.</p> <p>The <code>operation</code> specifies the type of operation that has been applied to the MOI specified by the path. It can have the values "CREATE", "DELETE" and "REPLACE". "CREATE" and "DELETE" refers to a MOI creation or deletion, respectively. "REPLACE" refers to the replacement of a complete attribute value of an existing MOI, or parts thereof in case the attribute is a structured data type.</p> <p>When a MOI creation is reported, the value carries an (optional) complete MOI representation.</p> <p>When a MOI deletion is reported, the value carries an (optional) complete MOI representation.</p> <p>When the replacement of the value of one or more attributes of a MOI is reported, the value carries the MOI representation without the attributes not changed.</p> <p>When the replacement of the value of a part of an attribute is reported, the value carries the new value of that part.</p> <p>When arrays are modified (by e.g. adding an array item, removing an array item or replacing an array item) the complete array shall be included in value.</p> <p>The reported MOI changes is an ordered list, since the creation of parent objects needs to be reported before the creation of child objects, and, vice versa, the deletion of child objects needs to be reported before the deletion of parent objects.</p> |

## 11.1.2 Managed Information

## 11.1.2.1 ManagedEntity &lt;&lt; ProxyClass &gt;&gt;

## 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.<br>The value is in unit of whole minute.<br>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.<br>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 = OperationSucceeded.<br>If operation_failed_existing_subscription is true, status = OperationFailedExistingSubscription<br>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 ntfSubscription 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: <ul style="list-style-type: none"> <li>- ntfSubscriptionState attribute value has been set to "notSuspended";</li> <li>- 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;</li> <li>- ntfTimeTickTimer has been reset with the value of timeTick attribute;</li> <li>- ntfFilter attribute value has been set to the value of the filter input parameter if present;</li> <li>- NtfSubscription is involved in a subscription relationship with the NtfSubscriber identified by the managerReference input parameter;</li> <li>- 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.</li> </ul> |

## 11.2.1.1.1.6 Exceptions

| Name                                   | Definition  |
|--|---|
| operation_failed_existing_subscription | <b>Condition:</b> (notificationCategoriesNotAllSubscribed OR notificationCategoriesParameterAbsentAndNotAllSubscribed) not true<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> Entry State |
| operation_failed                       | <b>Condition:</b> Post-condition is false<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> 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.<br>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 | <b>Condition:</b> Pre-condition is false or post-condition is false<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> 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.                              | <p>It carries the requested AlarmInformation instances.</p> <p>Case when synchronous mode of operation is used:<br/> (a) The MnS producer shall apply the constraints expressed in alarmAckState and filter to AlarmInformation instances when constructing this output parameter.</p> <p>Case when asynchronous mode of operation is used (i.e. this output parameter is conveyed via notifications):<br/> (a) If the filter parameter is present, the MnS 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.<br/> (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.</p> |
| status               | M | ENUM (OperationSucceeded, OperationFailed)             | <p>If all the AlarmInformation are returned, status = OperationSucceeded.<br/> If operation is failed, status = OperationFailed.</p>  |

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,<br>objectInstance     | M   | MonitoredEntity.objectClass,<br>MonitoredEntity.objectInstance   | The MonitoredEntity is identified by the relation-alarmedObject-AlarmInformation.  |
| notificationId                     | M   | AlarmInformation.notificationId  |  |
| notificationType                   | M   | "notifyNewAlarm"<br>or<br>"notifyChangedAlarm"<br>or<br>"notifyClearedAlarm"                                     | The parameter carries<br><br>- notifyNewAlarm in case the alarm has not yet changed and has not yet been cleared.<br>- notifyChangedAlarm in case the alarm has changed but has not yet been cleared.<br>- notifyClearedAlarm in case the alarm has been cleared but not yet acknowledged. |
| eventTime                          | O   | AlarmInformation.alarmRaisedTime or<br>AlarmInformation.alarmChangedTime or<br>AlarmInformation.alarmClearedTime | The parameter carries the<br><br>- alarmRaisedTime in case notificationType carries notifyNewAlarm<br>- alarmChangedTime in case notificationType carries notifyChangedAlarm<br>- alarmClearedTime in case notificationType carries notifyClearedAlarm                                     |
| systemDN                           | M   | --   |  |
| alarmId                            | M   | AlarmInformation.alarmId   |  |
| [objectClass],<br>[objectInstance] | n/a | MonitoredEntity.objectClass,<br>MonitoredEntity.objectInstance   | Parameter identical to the first parameter in this list, shown here to clarify all elements of AlarmInformation are present  |
| [notificationId]                   | n/a | AlarmInformation.notificationId  | Parameter 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.<br><br>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<br><br>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".<br>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 | <b>Condition:</b> Operation is failed<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> 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<br>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 | AlarmInformation.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 non-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  |
|--------------------------------------|---|--|--|
| <code>objectClass</code>             | M | <code>MonitoredEntity.objectClass</code>   | The <code>MonitoredEntity</code> is identified by the relation- <code>AlarmedObject-AlarmInformation</code> of the new <code>AlarmInformation</code> . |
| <code>objectInstance</code>          | M | <code>MonitoredEntity.objectInstance</code>  | The <code>MonitoredEntity</code> is identified by the relation- <code>AlarmedObject-AlarmInformation</code> of the new <code>AlarmInformation</code> . |
| <code>notificationId</code>          | M | --   |  |
| <code>notificationType</code>        | M | " <code>notifyNewAlarm</code> "  |  |
| <code>eventTime</code>               | M | <code>AlarmInformation.alarmRaisedTime</code>  |  |
| <code>systemDN</code>                | M | --   |  |
| <code>alarmId</code>                 | M | <code>AlarmInformation.alarmId</code>  |  |
| <code>alarmType</code>               | M | <code>AlarmInformation.alarmType</code>  |  |
| <code>probableCause</code>           | M | <code>AlarmInformation.probableCause</code>  |  |
| <code>perceivedSeverity</code>       | M | <code>AlarmInformation.perceivedSeverity</code>  |  |
| <code>correlatedNotifications</code> | O | The set of <code>CorrelatedNotification</code> related to this <code>AlarmInformation</code> . |  |
| <code>additionalText</code>          | O | <code>AlarmInformation.additionalText</code>   |  |
| <code>additionalInformation</code>   | O | <code>AlarmInformation.additionalInformation</code>  |  |
| <code>rootCauseIndicator</code>      | O | <code>AlarmInformation.rootCauseIndicator</code>   |  |
| <code>serviceUser</code>             | M | <code>AlarmInformation.securityServiceUser</code>  | This may contain no information if the identify of the service-user (requesting the service) is not known.   |
| <code>serviceProvider</code>         | M | <code>AlarmInformation.securityServiceProvider</code>  | This shall always identify the service-provider receiving a service request, from <code>serviceUser</code> , that provokes the security alarm.         |
| <code>securityAlarmDetector</code>   | M | <code>AlarmInformation.securityAlarmDetector</code>  | This may contain no information if the detector of the security alarm is the <code>serviceProvider</code> .  |

## 11.2.1.1.4.3 Triggering event

## 11.2.1.1.4.3.1 From-state

`noMatchedAlarm`.

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

## 11.2.1.1.4.3.2 To-state

newAlarmInAlarmList.

| Assertion Name      | Definition  |
|---------------------|---|
| newAlarmInAlarmList | <p>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.</p> <p>The following attributes of the AlarmInformation shall be populated with information in the newly generated alarm:<br/>notificationId, alarmRaisedTime, alarmId, alarmType, , probableCause, perceivedSeverity.</p> <p>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:<br/>specificProblem, backedUpStatus, trendIndication, thresholdInfo, stateChangeDefinition, monitoredAttributes, proposedRepairActions, additionalText, additionalInformation.</p> |

## 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-AlarmObject-AlarmInformation. |
| objectInstance    | M | MonitoredEntity.objectInstance                        | The MonitoredEntity is identified by the relation-AlarmObject-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:<br>- notificationId is updated;<br>- alarmChangedTime is updated;<br>- perceivedSeverity is updated;<br>- ackTime, ackUserId and ackSystemId are updated to contain no information;<br>- 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.<br><br>If this parameter specifies the class of the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may have been rebuilt.<br><br>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 objectClass parameter, the part of the alarm list that has been rebuilt.<br><br>If this parameter is equal to the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may have been rebuilt.<br><br>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  | <p>It carries a filter constraint. The operation shall apply it when counting the AlarmInformation instances in AlarmList.</p> <p>Case when synchronous mode of operation is used for getAlarmList:</p> <p>(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.</p> <p>(b) If this parameter is absent, the operation shall count all AlarmInformation instances that satisfy the condition set by input parameter alarmAckState.</p> <p>Case when asynchronous mode of operation is used for getAlarmList:</p> <p>(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.</p> <p>(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.</p> |
| 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.<br>Case when synchronous mode of operation is used:<br>(a) The operation shall apply the constraints expressed in alarmAckState and filter to AlarmInformation instances when counting.<br><br>Case when asynchronous mode of operation is used (i.e. this output parameter is conveyed via notifications):<br>(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.<br><br>(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<br>(OperationSucceeded, OperationFailed) | If allAlarmInformationCounted is true, status = OperationSucceeded.<br>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.<br>All AlarmInformation in AlarmList remains unchanged as the result of this operation. |

11.2.1.1.8.6 Exceptions

| Name                    | Definition   |
|-------------------------|--|
| operation_failed        | <b>Condition:</b> the pre-condition is false or the post-condition is true.<br><b>Returned Information:</b> The output parameter status.<br><b>Exit state:</b> Entry state.            |
| filter_complexity_limit | <b>Condition:</b> Operation not performed because the filter parameter is too complex.<br><b>Returned Information:</b> The output parameter status.<br><b>Exit state:</b> 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.<br>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(<br>Operation succeeded,<br>Operation failed,<br>Operation partially failed) | If allUpdated is true, then status = OperationSucceeded.<br>If someUpdated is true, then status = OperationPartiallyFailed.<br>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  |
|--|---|--|--|
| alarmInformationAndSeverityReferenceList | M | SET OF SEQUENCE {<br>AlarmInformation.alarmId (M)<br>AlarmInformation.perceivedSeverity (O)<br>} | 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 acknowledging 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 {<br>AlarmInformation.alarmId (M)<br>errorReason (M)<br>}<br><br>errorReason ::= ENUM {<br>UnknownAlarmId,<br>AcknowledgmentFailed,<br>WrongPerceivedSeverity<br>} | If all alarms are acknowledged, it contains no information.<br>If only some alarms are acknowledged, then it contains identifications of AlarmInformation that are<br><br>(a) present in input parameter AlarmInformationReferenceList but absent in the AlarmList (errorReason = UnknownAlarmId; or<br><br>(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<br><br>(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 {<br>OperationSucceeded,<br>OperationPartiallySucceeded,<br>OperationFailed<br>}  | If all alarms acknowledged, then status = OperationSucceeded.<br><br>If some alarms are acknowledged, then status = OperationPartiallySucceeded.<br><br>If operation failed is true, then status = OperationFailed.  |

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

11.2.1.2.1.4 Exceptions and constraints

| Exception Name   | Definition  |
|------------------|---|
| operation_failed | <b>Condition:</b> Operation is failed<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> 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 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 unacknowledged the alarm.                           |
| ackSystemId                   | O | AlarmInformation.ackSystemId     | The identifier of the system where the acknowledgement request was originated. |

## 11.2.1.2.3 Output parameters

| Parameter Name                   | S | Matching Information / Information Type / Legal Values  | Comment  |
|----------------------------------|---|---|--|
| badAlarmInformationReferenceList | M | SET OF SEQUENCE {<br>AlarmInformation.alarmId (M)<br>errorReason (M)<br>}<br><br>errorReason ::= ENUM {<br>UnknownAlarmId,<br>AcknowledgmentFailed,<br>WrongPerceivedSeverity,<br>} | If all alarms are acknowledged, it contains no information.<br><br>If only some alarms are acknowledged, then it contains identifications of AlarmInformation that are<br><br>(a) present in input parameter AlarmInformationReferenceList but absent in the AlarmList (errorReason = UnknownAlarmId; or<br><br>(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<br><br>(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 {<br>OperationSucceeded,<br>OperationPartiallySucceeded,<br>OperationFailed  | If all alarms acknowledged, then status = OperationSucceeded.<br><br>If some alarms are acknowledged, then status = OperationPartiallySucceeded.<br><br>If operation failed is true, then status = OperationFailed.  |

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

## 11.2.1.2.2.4 Exceptions and constraints

| Exception Name   | Definition  |
|------------------|---|
| Operation_failed | <b>Condition:</b> Operation is failed<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> 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 3GPP 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 <code>AlarmInformation.alarmId</code> | It carries one or more identifiers identifying <code>AlarmInformation</code> instances in the <code>AlarmList</code> .                      |
| clearUserId                   | M | <code>AlarmInformation.clearUserId</code>     | It identifies the user clearing the alarm.  |
| clearSystemId                 | O | <code>AlarmInformation.clearSystemId</code>   | 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 <code>AlarmInformation.alarmId</code> and the failure reason.  | If all alarms are cleared, it contains no information.<br><br>If some alarms are cleared, then it contains identifications of <code>AlarmInformation</code> that are not present in <code>AlarmList</code> or that are present in <code>AlarmList</code> but remain unchanged, in contrast to consumer's request. |
| status                           | M | ENUM(<br><code>OperationSucceeded</code> ,<br><code>OperationFailed</code> ,<br><code>OperationPartiallySucceeded</code> ) | If all alarms are cleared, then status = <code>OperationSucceeded</code> .<br>If some alarms are cleared, then status = <code>OperationPartiallySucceeded</code> .<br>If operation is failed, then status = <code>OperationFailed</code> .  |

## 11.2.1.2.3.4 Exceptions and constraints

| Exception Name   | Definition  |
|------------------|---|
| operation_failed | <b>Condition:</b> Operation is failed<br><b>Returned Information:</b> The output parameter status<br><b>Exit state:</b> 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.probableCause   |  |
| 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<br>AND<br>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:<br>The following attributes of the subject AlarmInformation are updated:<br>notificationId, perceivedSeverity (updated to Cleared),<br>alarmClearedTime.                                      |
| alarmInformationCleared_2 | Case if From-state is clearedByProvider:<br>The following attributes of the subject AlarmInformation are updated:<br>notificationId, alarmClearedTime, perceivedSeverity (updated to CLEARED),<br>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) acknowledgeAlarms 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:<br>-- 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 |
|--------------------------------|---|--|---------|
| <code>objectClass</code>       | M | <code>MonitoredEntity.objectClass</code>   |         |
| <code>objectInstance</code>    | M | <code>MonitoredEntity.objectInstance</code>  |         |
| <code>notificationId</code>    | M | --   |         |
| <code>notificationType</code>  | M | " <code>notifyComments</code> "  |         |
| <code>eventTime</code>         | M | <code>Comment.commentTime</code>   |         |
| <code>systemDN</code>          | M | --   |         |
| <code>alarmId</code>           | M | <code>AlarmInformation.alarmId</code>  |         |
| <code>alarmType</code>         | M | <code>AlarmInformation.alarmType</code>  |         |
| <code>probableCause</code>     | M | <code>AlarmInformation.probableCause</code>  |         |
| <code>perceivedSeverity</code> | M | <code>AlarmInformation.perceivedSeverity</code>                                    |         |
| <code>comments</code>          | M | The <code>Comment</code> instances related to this <code>AlarmInformation</code> . |         |

#### 11.2.1.2.6.3 Trigger event

##### 11.2.1.2.6.3.1 From-state

`commentedByServiceprovider` OR `commentedByServiceprovider` AND `alarmInformationExists`.

| Assertion Name                          | Definition  |
|---|---|
| <code>commentedByServiceprovider</code> | Reception of a <code>setComment</code> operation and a subsequent operation success return.                                 |
| <code>commentedByServiceprovider</code> | Reception of a local (non-standard) <code>setComment</code> equivalent operation and a subsequent operation success return. |
| <code>alarmInformationExists</code>     | The <code>AlarmInformation</code> is in <code>AlarmList</code> .  |

##### 11.2.1.2.6.3.2 To-state

`commentInserted`.

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

#### 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 loses confidence in the integrity of its alarm list.

The MnS producer may then rebuild 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 authorized consumer should take, in case it receives this notification.

- 1) The authorized consumer should not perform any task requiring the integrity of the AlarmInformation identified as faulty or unreliable by the subject notification.
- 2) The authorized consumer should not invoke operations that require integrity of the AlarmList such as getAlarmList., acknowledgeAlarms 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.<br><br>If this paramter specifies the class of the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may not be reliable.<br><br>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.<br><br>If this parameter is equal to the instance carried in systemDN, then all AlarmInformation instances in the AlarmList may not be reliable.<br><br>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           | O | 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 | AlarmInformation.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           | O | 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;<br>notificationId is updated;<br>alarmChangedTime is updated;<br>ackTime, ackUserId and ackSystemId are updated to contain no information;<br>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.

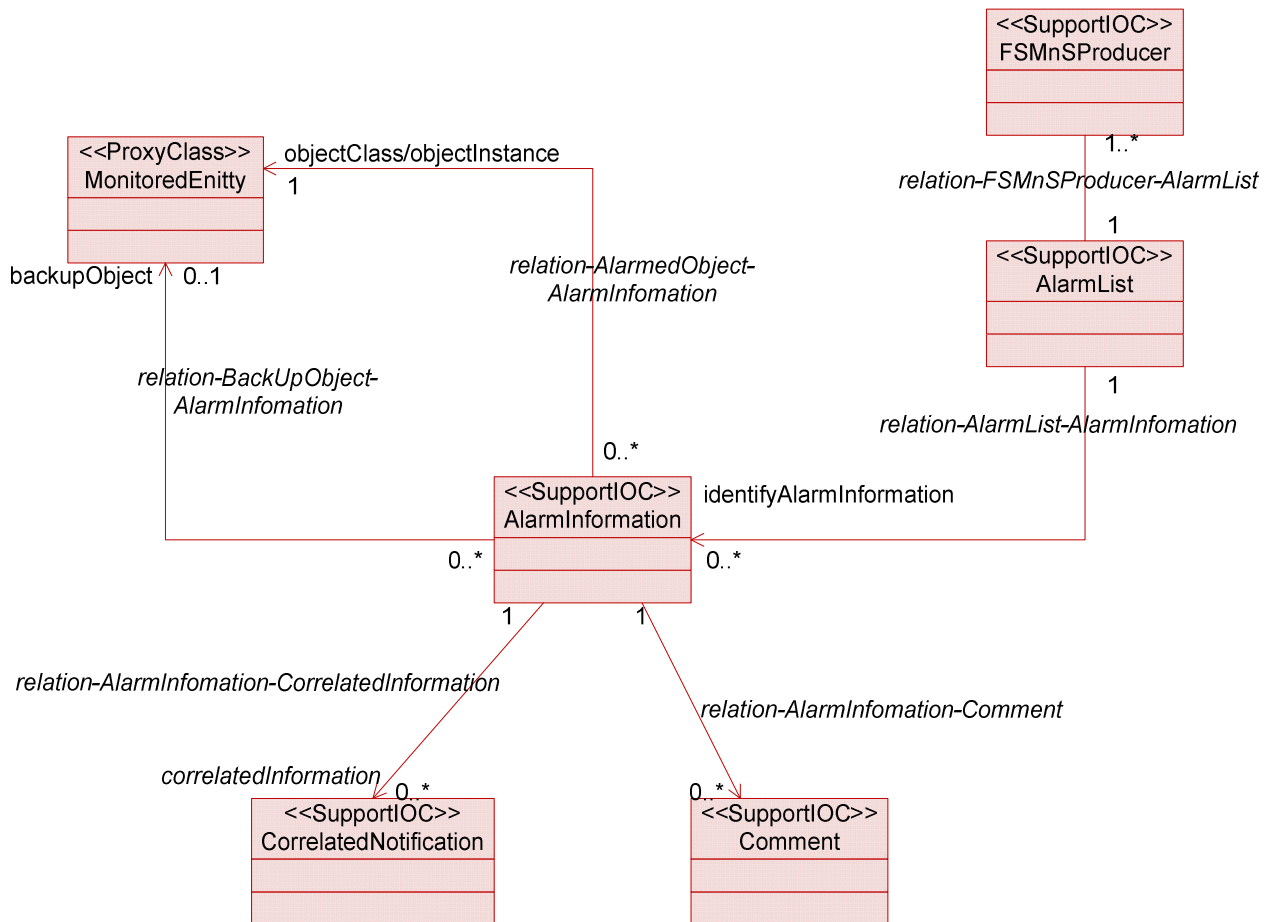
#### 11.2.2.1.2 Class diagram

##### 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.

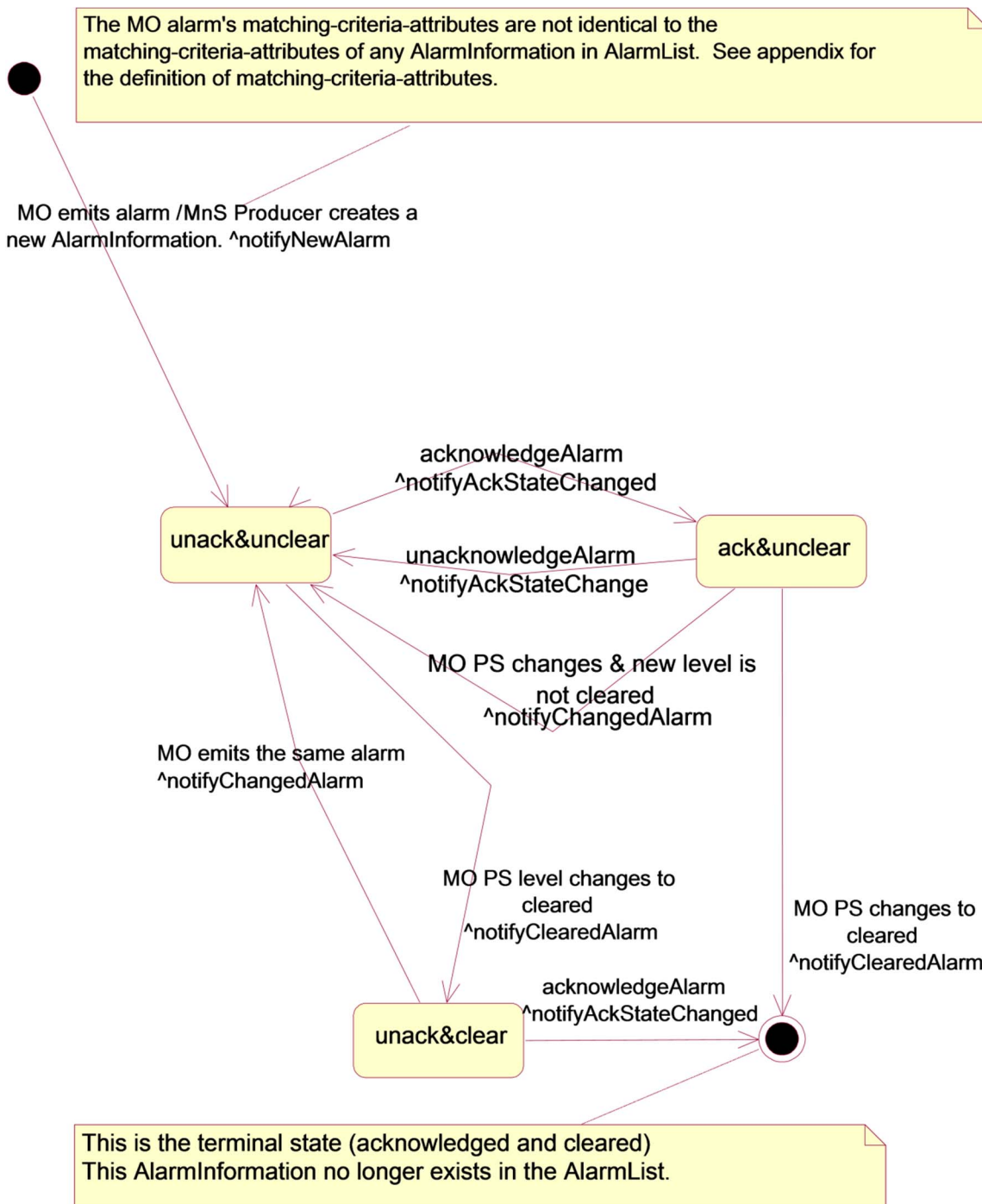


Figure 11.2.2.1.3.1.3-1 notifyChangedAlarm supported

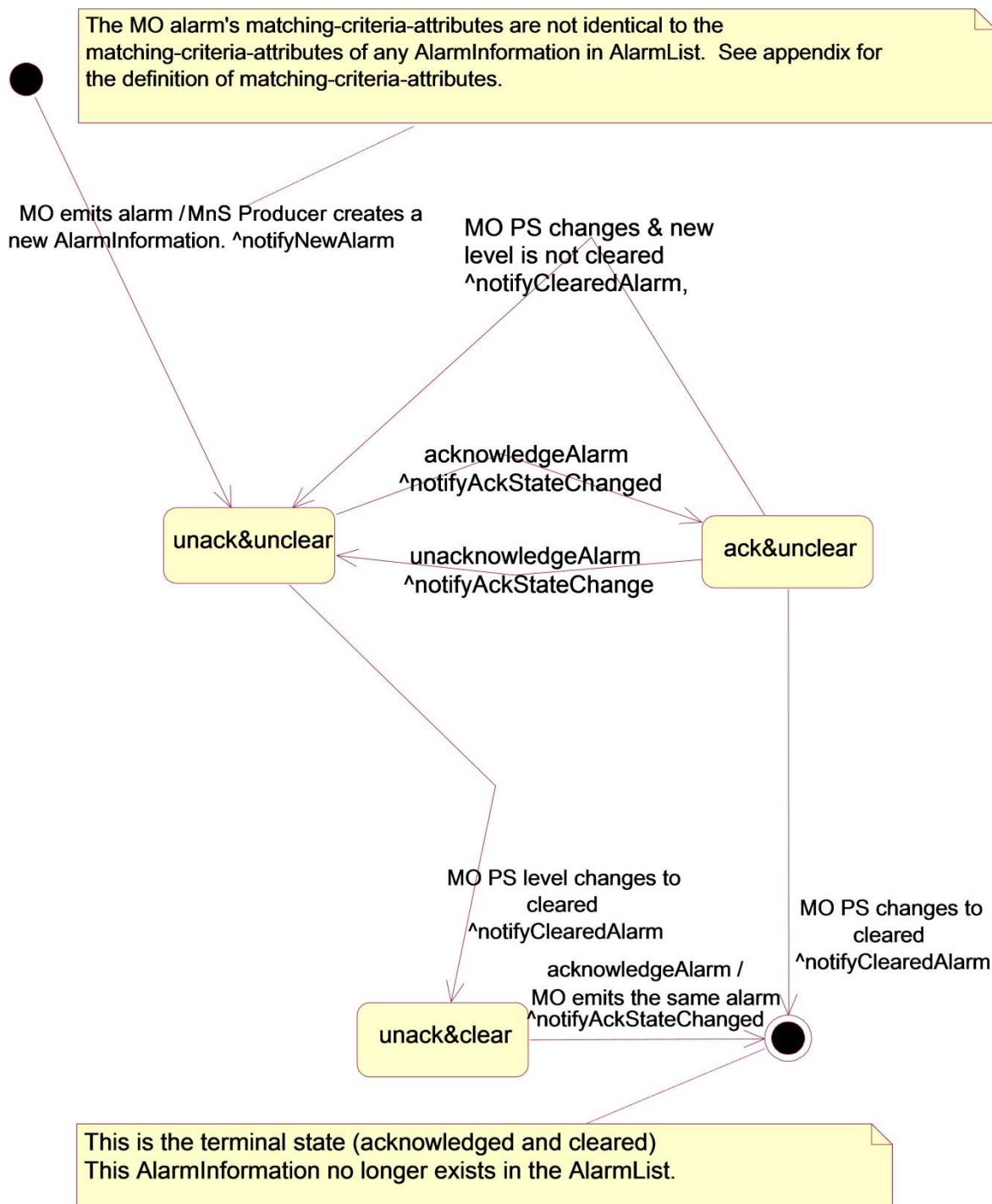


Figure 11.2.2.1.3.1.3-2 notifyChangedAlarm not supported

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 <code>AlarmInformation</code> . |

## 11.2.2.1.4.2.3 Constraint

| Name                     | Definition  |
|--------------------------|---|
| inv_hasAlarmInformation1 | No <code>AlarmInformation</code> playing the role of the <code>AlarmInformation</code> shall have its <code>perceivedSeverity = "cleared"</code> and its <code>ackState = "acknowledged"</code> . |
| inv_hasAlarmInformation2 | The <code>alarmId</code> of all <code>AlarmInformation</code> instances playing the role of the <code>AlarmInformation</code> 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 <code>Comment</code> . |

## 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         | <p>It indicates the type of alarm.</p> <p>Communications Alarm:<br/>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]).</p> <p>Processing Error Alarm:<br/>An alarm of this type is associated with a software or processing fault (ITU T Recommendation X.733 [4]).</p> <p>Environmental Alarm:<br/>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]).</p> <p>Quality of Service Alarm:<br/>An alarm of this type is associated with degradation in the quality of a service (ITU T Recommendation X.733 [4]).</p> <p>Equipment Alarm:<br/>An alarm of this type is associated with an equipment fault (ITU-T Recommendation X.733 [4]).</p> <p>Integrity Violation:<br/>An indication that information may have been illegally modified, inserted or deleted.</p> <p>Operational Violation:<br/>An indication that the provision of the requested service was not possible due to the unavailability, malfunction or incorrect invocation of the service.</p> <p>Physical Violation:<br/>An indication that a physical resource has been violated in a way that suggests a security attack.</p> <p>Security Service or Mechanism Violation:<br/>An indication that a security attack has been detected by a security service or mechanism.</p> <p>Time Domain Violation: An indication that an event has occurred at an unexpected or prohibited time.</p> |  |
| probableCause     | It qualifies alarm and provides further information than alarmType. Probable causes are outside 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. |



| Name                  | Definition  | Legal Values  |
|-----------------------|---|---|
| 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: <ul style="list-style-type: none"> <li>- The identifier of the monitored attribute whose value has crossed a threshold,</li> <li>- The threshold settings,</li> <li>- The observed value that have crossed a threshold, etc.</li> </ul> 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 8.1.2.11.  |   |
| 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.<br><br>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.<br><br>Any other uses of additional information on the alarm and its semantics is outside the scope of the present document | The additional information field is a list of one or more information parts.<br><br>The present document allows the support of two such information parts to carry <ul style="list-style-type: none"> <li>- vendor defined perceived severity</li> <li>- vendor defined alarm type</li> </ul> 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.  |

| Name                  | Definition   | Legal Values  |
|-----------------------|--|---|
| 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.<br><br>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

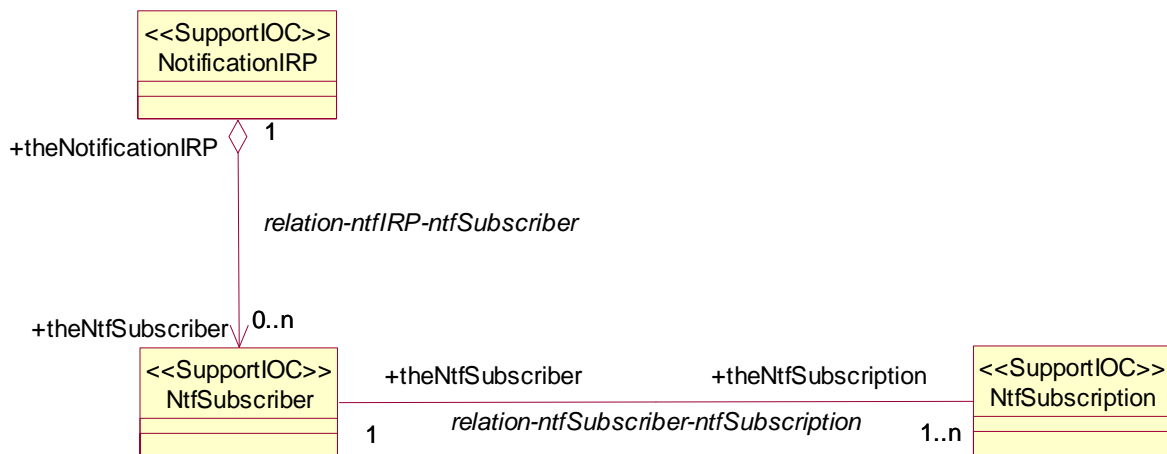
#### 11.2.2.2.1 Imported information entities and local labels

None.

#### 11.2.2.2.2 Class Diagram

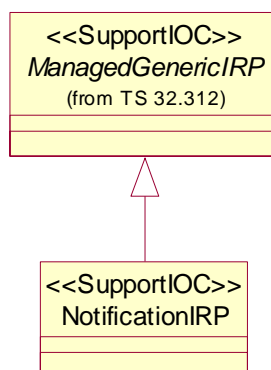
##### 11.2.2.2.2.1 Attributes and relationships

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<br>"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 <code>getSubscriptionStatus</code> (or <code>subscribe</code> ) 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 Notification management service producer interface) and to parameters of notifications defined as filterable to IManagement service producer shall notify management 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" (3GPP 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                  | M | 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.   |

| File content item    | Description   |
|----------------------|---|
| 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 3GPP 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.  |
| measInfold           | 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           | <p>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".</p> <p>For example, if the measured object is a "ManagedElement" representing RNC "RNC-Gbg-1", then the "measObjRootDn" may look like</p> <p style="padding-left: 40px;">"DC=a1.operatorNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1"</p> <p>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.</p> <p style="padding-left: 40px;">"DC=a1.companyNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1"</p> <p>and the "measObjLdn" is</p> <p style="padding-left: 40px;">"RncFunction=RF-1,UtranCell=Gbg-997".</p> <p>The class of the measured object is defined in item f) of measurement definitions (3GPP TS 32.404 [47], TS 28.552 [18]) and in item d) of KPI definitions (TS 28.554 [6]).</p> |
| 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 (3GPP 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 ITU-T [17] 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:<br>the internal countdown timer of the MOI is reset to the value of its heartbeatNtfPeriod attribute. |
| stateAfterHeartbeatNotification2 | If From-state is stateBeforeHeartbeatNotification2 then:<br>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 establishment 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 identifier other than DN may be used.  |
| streamInfoList | M | List of <i>StreamInfo</i>   | <p>This parameter contains the list of meta-data about each reporting stream.</p> <p>For streaming trace reporting each <i>StreamInfo</i> includes:</p> <ul style="list-style-type: none"> <li>- <i>StreamType</i> carrying the value "TRACE";</li> <li>- <i>SerializationFormat</i> carrying the value "GPB" or "ASN1";</li> <li>- Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;</li> <li>- <i>TraceJob</i> (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.</li> </ul> <p>For streaming performance data reporting each <i>StreamInfo</i> includes:</p> <ul style="list-style-type: none"> <li>- <i>StreamType</i> carrying the value "PERFORMANCE";</li> <li>- <i>SerializationFormat</i> carrying the value "GPB" or "ASN1";</li> <li>- <i>streamId</i> globally unique stream identifier;</li> <li>- <i>measObjDn</i>: the DN of the measured object instance;</li> <li>- <i>performanceMetrics</i>: 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;</li> <li>- either: <ul style="list-style-type: none"> <li>- <i>jobId</i> defined in the <i>PerfMetricJob</i> MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;</li> <li>- or:</li> <li>- <i>jobId</i> globally unique identifier of a measurement job (see TS 28.550 [42]).</li> </ul> </li> </ul> <p>For streaming analytics reporting each <i>StreamInfo</i> includes:</p> <ul style="list-style-type: none"> <li>- <i>StreamType</i> carrying the value "ANALYTICS";</li> <li>- <i>SerializationFormat</i> carrying the value "GPB" or "ASN1";</li> <li>- <i>streamId</i> globally unique stream identifier;</li> <li>- <i>AnalyticsInfo</i> providing the details about the analytics activity for which the data is being reported.</li> </ul> <p>For proprietary data streaming reporting each <i>StreamInfo</i> includes:</p> <ul style="list-style-type: none"> <li>- <i>StreamType</i> carrying the value "PROPRIETARY";</li> <li>- <i>streamId</i> globally unique stream identifier;</li> <li>- <i>VsDataContainer</i> (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported.</li> </ul> |

### 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 | <b>Condition:</b> Some information in the list of <code>streamInfo</code> was unexpected by the MnS consumer.<br><b>Returned Information:</b> 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 the MnS 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 | <b>Condition:</b> the <code>connectionId</code> is invalid.<br><b>Returned Information:</b> 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.<br>For streaming trace reporting each <code>streamingData</code> is encoded according to the format specified in the clause 5 of 3GPP TS 32.423 [39].<br>For streaming performance data reporting each <code>streamingData</code> is encoded according to the format specified in the Annex C of 3GPP TS 28.550 [42].<br>For proprietary data streaming reporting each <code>streamingData</code> 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    | <p>This parameter contains the list of meta-data about each reporting stream being added to the already established connection.</p> <p>For streaming trace reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "TRACE";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;</li> <li>- 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.</li> </ul> <p>For streaming performance data reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "PERFORMANCE";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- streamId globally unique stream identifier;</li> <li>- measObjDn: the DN of the measured object instance;</li> <li>- 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;</li> <li>- either: <ul style="list-style-type: none"> <li>- jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;</li> </ul> </li> <li>- or: <ul style="list-style-type: none"> <li>- jobId globally unique identifier of a measurement job (see TS 28.550 [42]).</li> </ul> </li> </ul> <p>For streaming analytics reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "ANALYTICS";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- streamId globally unique stream identifier;</li> <li>- AnalyticsInfo providing the details about the analytics activity for which the data is being reported.</li> </ul> <p>For proprietary data streaming reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "PROPRIETARY";</li> <li>- streamId globally unique stream identifier;</li> <li>- VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported.</li> </ul> |

## 11.5.1.4.3 Output parameters

| Parameter Name | S | Matching Information                    | Comment   |
|----------------|---|---|---|
| streamInfoList | M | List of StreamInfo                      | <p>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:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "TRACE";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- Trace Reference (see clause 5.6 of 3GPP TS 32.422 [38]) as stream identifier;</li> <li>- TraceJob (see clause 4.3.30 of 3GPP TS 28.622 [11]) providing the details about the configuration of the trace job for which the data is being reported.</li> </ul> <p>For streaming performance data reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "PERFORMANCE";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- streamId globally unique stream identifier;</li> <li>- measObjDn: the DN of the measured object instance;</li> <li>- 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;</li> <li>- either: <ul style="list-style-type: none"> <li>- jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of 3GPP TS 28.622 [11]) for which the data is being reported;</li> <li>- or: <ul style="list-style-type: none"> <li>- jobId globally unique identifier of a measurement job (see TS 28.550 [42]).</li> </ul> </li> </ul> </li> </ul> <p>For streaming analytics reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "ANALYTICS";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- streamId globally unique stream identifier;</li> <li>- AnalyticsInfo providing the details about the analytics activity for which the data is being reported.</li> </ul> <p>For proprietary data streaming reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "PROPRIETARY";</li> <li>- streamId globally unique stream identifier;</li> <li>- VsDataContainer (see clause 4.3.9 of 3GPP TS 28.622 [11]) providing the details about the data being reported.</li> </ul> |
| 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   | <p><b>Condition:</b> One or more of stream identifiers in the streamInfoList already exist on this connection.</p> <p><b>Returned Information:</b> Name of the exception; status is set to "Failure" or "PartialSuccess".</p> |
| unexpectedStreams | <p><b>Condition:</b> Some information in the list of streamInfo was unexpected by the MnS consumer.</p> <p><b>Returned Information:</b> Name of the exception; status is set to "Failure".</p>                                |
| unknownConnection | <p><b>Condition:</b> the connectionId is invalid.</p> <p><b>Returned Information:</b> Name of the exception; status is set to "Failure".</p>  |



### 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.<br>For streaming trace reporting Trace Reference (see clause 5.6 of 3GPP TS 32.422 [38]) is used as stream identifier.<br>For streaming performance data reporting <code>streamId</code> globally unique stream identifier.<br>For streaming analytics reporting <code>streamId</code> globally unique stream identifier.<br>For proprietary data streaming reporting <code>streamId</code> 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   | <b>Condition:</b> One or more of stream identifiers in the <code>streamIdList</code> does not exist on this connection.<br><b>Returned Information:</b> Name of the exception; status is set to "Failure" or "PartialSuccess". |
| unknownConnection | <b>Condition:</b> the <code>connectionId</code> is invalid.<br><b>Returned Information:</b> 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.<br>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.<br>For streaming trace reporting:<br>- streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;<br>- streamIdList is the list of Trace References (see clause 5.6 of 3GPP TS 32.422 [38]) used as stream identifiers.<br>For streaming performance data reporting:<br>- streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;<br>- streamIdList is the list of streamId globally unique stream identifiers.<br>For streaming analytics reporting:<br>- streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;<br>- streamIdList is the list of streamId globally unique stream identifiers.<br>For streaming proprietary data reporting:<br>- streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId;<br>- 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 | <b>Condition:</b> One or more of connection identifiers in the connectionIdList is not known to this MnS consumer.<br><b>Returned Information:</b> 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 the MnS 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.<br>The empty list indicates the stream information for all streams are to be returned.<br>For streaming trace reporting Trace Reference (see clause 5.6 of 3GPP TS 32.422 [38]) is used as stream identifier.<br>For streaming performance data reporting streamId globally unique stream identifier.<br>For streaming analytics reporting streamId globally unique stream identifier.<br>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 | <p>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.</p> <p>For streaming trace reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "TRACE";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;</li> <li>- 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.</li> </ul> <p>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.</p> <p>For streaming PM reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "PERFORMANCE";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- streamId globally unique stream identifier;</li> <li>- measObjDn: the DN of the measured object instance;</li> <li>- 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;</li> <li>- either: <ul style="list-style-type: none"> <li>- jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;</li> <li>- or:</li> <li>- jobId globally unique identifier of a measurement job (see TS 28.550 [42]).</li> </ul> </li> </ul> <p>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.</p> <p>For streaming analytics reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "ANALYTICS";</li> <li>- SerializationFormat carrying the value "GPB" or "ASN1";</li> <li>- streamId globally unique stream identifier;</li> <li>- AnalyticsInfo providing the details about the analytics activity for which the data is being reported.</li> </ul> <p>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.</p> <p>For proprietary data streaming reporting each StreamInfo includes:</p> <ul style="list-style-type: none"> <li>- StreamType carrying the value "PROPRIETARY";</li> <li>- streamId globally unique stream identifier;</li> <li>- VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported.</li> </ul> <p>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.</p> |
| 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 | <b>Condition:</b> One or more of stream identifiers in the <code>streamIdList</code> is not known to this MnS consumer.<br><b>Returned Information:</b> 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 | <p>List of struct</p> <pre>&lt; fileLocation (M), fileSize (O), fileReadyTime (O), fileExpirationTime (O), fileCompression (M), fileFormat (M), fileDataType (M), &gt;</pre> <p>Each element is defined as following:</p> <ul style="list-style-type: none"> <li>- "fileLocation": Location of the file. The location may be a directory path or a URL, for example<br/> "\202.112.101.1\D:user\Files&lt;xxx&gt;", or<br/> "ftp://nms.telecom_org.com/datastore/&lt;xxx&gt;,"<br/> where &lt;xxx&gt; is the filename.</li> <li>- "fileSize": Size of the file. Its value is a non negative integer. The unit is byte.</li> <li>- "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.</li> <li>- "fileExpirationTime": Date and time after which the file may be deleted. It shall not be empty and shall be later than "fileReadyTime".</li> <li>- "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.</li> <li>- "fileFormat": Identifier of the XML or ASN.1 schema (incl. its version) used to produce the file content.</li> <li>- "fileDataType": Type of the management data stored in the file. Allowed values are : <ul style="list-style-type: none"> <li>- "PERFORMANCE"</li> <li>- "TRACE"</li> <li>- "ANALYTICS"</li> <li>- "PROPRIETARY"</li> </ul> The value "PERFORMANCE" refers to measurements and KPIs.</li> </ul> | 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 occurred   |
| 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<br>- errorInPreparation<br>- hardDiskFull<br>- hardDiskFailure<br>- tooManyFiles<br>- collectionTimeOut<br>- incompleteTruncatedFile<br>- corruptedFile<br>- lowMemory<br>- 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.<br><br>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<br><br>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 = OperationSucceeded.<br>If subscription is not created because it is duplicated or conflict with existing subscription(s), status = OperationFailedExistingSubscription<br>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 | <b>Condition:</b> The subscription is duplicated or conflict with existing subscription(s)<br><b>Returned Information:</b> The output parameter status                         |
| operation_failed                       | <b>Condition:</b> The operation failed for any other reason than being duplicated or conflict with subscription(s)<br><b>Returned Information:</b> 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.<br>If the operation is failed, status = OperationFailed. |

## 11.6.1.4.4 Exceptions

| Name             | Definition  |
|------------------|---|
| operation_failed | <b>Condition:</b> the operation is failed<br><b>Returned Information:</b> 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".<br>For trace data files, the value is assigned to "TRACE".<br>For analytic data files, the value is assigned to "ANALYTICS".<br>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.<br>This parameter is expressed in UTC time. | This parameter indicates date and time.<br>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.<br>This parameter is expressed in UTC time.      | This parameter indicates date and time.<br>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   | <b>Condition:</b> Either "beginTime" or "endTime" is invalid.<br><b>Returned information:</b> 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:

- FTP;
- SFTP.

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.

**Table 12.1.1.1-1: 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<br>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    | path                  | .../{className}={id} | className: string | M |
| managedObjectInstance |                       |                      | id: string        |   |
| 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<br>id: string                | M |
| scope              | query                 | scope             | Scope<br>style: form<br>explode: true          | O |
| filter             | query                 | filter            | Filter   | O |
| attributeListIn    | query                 | attributes        | array(string)<br>style: form<br>explode: false | O |
|                    |                       | fields            | array(string)<br>style: form<br>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<br>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<br>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          | M |
| 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<br>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<br>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<br>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)**

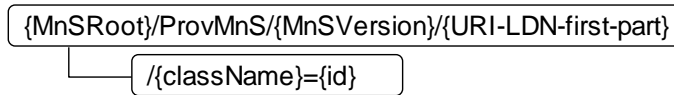
| IS parameter name | SS parameter location | SS parameter name | SS parameter type | S |
|-------------------|-----------------------|-------------------|-------------------|---|
| objectClass       | request body          | href              | Uri               | M |
| objectInstance    |                       |                   |                   |   |
| 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**

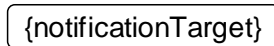
Table 12.1.1.3.1.1-1 provides an overview of the resources and applicable HTTP methods.

**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       | Modify 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.<br><br>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.<br><br>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<br>style: form<br>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)<br>style: form<br>explode: false | Attributes of the scoped resources to be returned. The value is a comma-separated list of attribute names.  | O |
| fields     | array(string)<br>style: form<br>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.<br>The following patch media types are available:<br>- "application/merge-patch+json" (RFC 7396 [37])<br>- "application/3gpp-merge-patch+json" (TS 32.158 [15])<br>- "application/json-patch+json" (RFC 6902 [36])<br>- "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<br>style: form<br>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 |

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"  |
| 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 |
| path                    | Uri   | URI specifying the created, deleted or updated resource  | M |
| operation               | Operation   | Operation associated to the reported change ("CREATE", "DELETE", "REPLACE")  | M |
| value                   | oneOf(AttributeNameValuePairSet, AttributeValueChangeSet) | For reporting resource creation or deletion, the optional resource representation (MOC attributes only). In this case, the data type of value is "AttributeNameValuePairSet".<br>For reporting attribute value changes, the (mandatory) new values and (optional) old values. In this case, the data type of value is "AttributeValueChangeSet". | M |

For a "CREATE" or "DELETE" operation only the host and path components are present in the URI carried by the "path" attribute of "MoiChange". They identify the created or deleted resource. The "value" attribute of "MoiChange" may optionally carry the MOC attribute name value pairs of the created or deleted resource in the format of a map. The keys of the map are equal to the MOC attribute names, and the values are equal to the MOC attribute values.

For a "REPLACE" operation, two cases need to be distinguished.

In the first case, one or more value changes of complete MOC attributes are reported. Only the host and path components are present in the URI carried by the "path" attribute of "MoiChanges". They identify the resource, where attribute value changes occurred. The "value" attribute is an array of minimum one and maximum two items. If only one array item is present, it carries the MOC attribute names that changed value and their new values. If the optional second array item is present as well, it carries the MOC attribute names that changed value and their old values. The order of items in the array carries semantics and shall therefore not be reversed.

In the second case, a single value change of an attribute part (sub-attribute) is reported. Here the URI needs to carry, besides the host and path components, also the fragment component. The host and path components identify the resource, where the attribute part value change occurred. The fragment component identifies the attribute part inside the resource. The URI fragment is specified using JSON pointer in the URI fragment identifier representation as defined in clause 6 of RFC 6901 [48]. The context for JSON pointer is the updated resource. The "value" is an array of minimum one and maximum two items. If only one item is present, it carries the name of the attribute part that changed value and its new value. If the optional second array item is present as well, it carries the name of the attribute part that changed value and its old value. Hence also in this case, the order of items in the array carries semantics and shall not be reversed.

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

```
notificationId: 123456789
path: 'https://example.com/3GPP/ClassA=1'
operation: CREATE
value:
  attrA:
    subAttrA1: ABC
    subAttrA2: 56
  attrB: XYZ
  attrC: 123
```

or, when omitting the optional attribute name value pairs of the created object, the instance looks like

```
notificationId: 123456789
path: 'https://nokia.com/3GPP/ClassA=1'
```

operation: CREATE

The following instance reports a change of the attributes "attrA" and "attrC" with new and old values

```
notificationId: 123456789
path: 'https://example.com/3GPP/ClassA=1'
operation: REPLACE
value:
  - attrA:
      subAttrA1: ABC
      subAttrA2: 56
      attrC: 123
  - attrA:
      subAttrA1: DEF
      subAttrA2: 67
      attrC: 345
```

and the following with new values only

```
notificationId: 123456789
path: 'https://example.com/3GPP/ClassA=1'
operation: REPLACE
value:
  - attrA:
      subAttrA1: ABC
      subAttrA2: 56
      attrC: 123
```

When a change of the attribute part "attrA:subAttrA1" shall be reported, the instance looks like

```
notificationId: 123456789
path: 'https://example.com/3GPP/ClassA=1?attributes/attrA/subAttrA1'
operation: REPLACE
value:
  - subAttrA1: ABC
  - subAttrA1: DEF
```

or, with the new value only, like

```
notificationId: 123456789
path: 'https://example.com/3GPP/ClassA=1?attributes/attrA/subAttrA1'
operation: REPLACE
value:
  - subAttrA1: ABC
```

#### 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=MEL,MnsAgent=MA1",
"attributeListValueChanges": [
  {
    "attrA": "newValueAttrA",
    "attrB": "newValueAttrB"
  },
  {
    "attrA": "oldValueAttrA",
    "attrB": "oldValueAttrB"
  }
]
}
    
```

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 the local root 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 |
| notifyMOIChanges               | 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       |
|-------------------|-------------------|
| CREATE            | Create operation  |
| DELETE            | 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    |

## 12.1.2 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 equivalents 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.

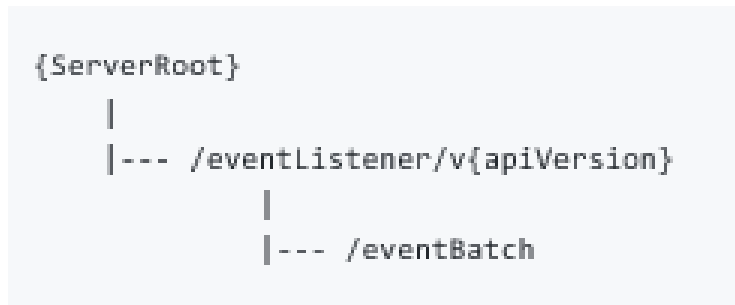
##### 12.1.2.2.5 Notification notifyMOIChanges

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].



**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 3GPP 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 with 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.<br>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, GNBDFunction=1

```
<rpc message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <default-operation>none</default-operation>
    <config>
      < ManagedElement>
        <id>myNode</id>
        <GNBDFunction operation="create">
          <id>1</id>
          <attributes>
            <gNBIdLength>25</gNBIdLength>
            <gNBId>357</gNBId>
            <priorityLabel>1</priorityLabel>
            <gNBDUName>du-south-1</gNBDUName>
            <!-- other attributes ---->
          </attributes>
        </GNBDFunction>
      </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 parameters 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.<br>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.<br>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.<br><br>For BASE_SUBTREE the levels number is transformed into a number of filter sub-expressions joined by the OR operator.<br><br>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.pMAAdministrativeState=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>
        <pMAAdministrativeState>
          UNLOCKED
        </pMAAdministrativeState>
      </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" />
    </get>
</rpc>
```

If scope is **BASE\_NTH\_LEVEL** the <get> shall be directed against the list representing classes at the *Nth* 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:<br><error-tag><br><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 with 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.<br>(note 1)   |
| status                      | -                             | M | rpc-reply or rpc-error indicates general status.<br>The following elements give detailed error information:<br><error-tag><br><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.

## 12.2 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    | query                 | baseObjectInstance | Dn                | O |
| baseObjectInstance |                       |                    |                   |   |
| 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:

- 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.
- 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:

- 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 document.

**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                  | /alarms              | n/a               | M |
|  | request body          | alarmId (key in map) | string            | 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 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 "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                  | /alarms              | n/a               | M |
|                               | request body          | alarmId (key in map) | string            | 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 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 "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                  | /alarms              | n/a               | M |
|                               | request body          | alarmId (key in map) | string            | 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,<br>objectInstance | request body          | href                    | Uri                           | M |
| 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,<br>objectInstance | request body          | href                    | Uri                           | M |
| 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,<br>objectInstance | request body          | href              | Uri               | M |
| 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,<br>objectInstance | request body          | href                    | Uri                           | M |
| 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<br>objectInstance | request body          | href              | Uri               | M |
| 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,<br>objectInstance | request body          | href              | Uri               | M |
| 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,<br>objectInstance | request body          | href              | Uri               | M |
| 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,<br>objectInstance | request body          | href              | Uri               | M |
| 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                 | O |
| 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                 | O |
| 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 |

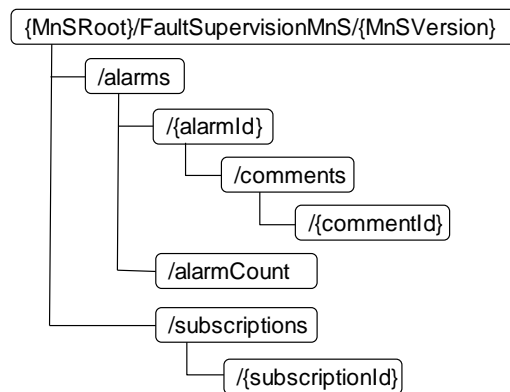
|                        |              |                        |                           |   |
|------------------------|--------------|------------------------|---------------------------|---|
| serviceUser            | request body | serviceUser            | string                    | M |
| serviceProvider        | 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 12.2.1.3.1.1-1: Resource URI structure of the Fault Supervision MnS on the MnS producer**

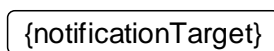
Table 12.2.1.3.1.1-1 provides an overview of the resources and applicable HTTP methods.

**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 12.2.1.3.2.3.1-2: 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 12.2.1.3.2.3.1-3: 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 alarmCount 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 hysteresis, 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 object 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 managed 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          | integer   | 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 managed 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 12.2.1.4.1a.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]   | O |
| 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 managed 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]   | O |
| 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.

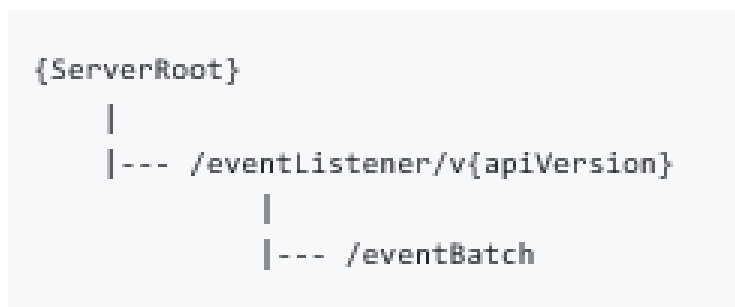
#### 12.2.2.2.12 Notification notifyChangedAlarmGeneral (security alarm)

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].



**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<br>XML attribute: fileFormatVersion   |  |
| senderName          | XML element: fileHeader<br>XML attribute: dnPrefix<br>XML element: fileHeader:fileSender<br>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<br>XML attribute: senderType  |  |
| vendorName          | XML element fileHeader<br>XML attribute vendorName  |  |
| collectionBeginTime | XML element: fileHeader:measData<br>XML attribute beginTime   |  |
| measObjRootDn       | XML element fileHeader<br>XML attribute dnPrefix<br>XML element measData:measEntity<br>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". |

| File Content Item                            | XML schema based XML tag  | Description   |
|--|---|---|
| measObjRootUserLabel                         | XML element: measData:measEntity<br>XML attribute: userLabel  |   |
| measObjRootSwVersion                         | XML element: measData:measEntity<br>XML attribute: swVersion  |   |
| measInfo                                     | XML element measInfo  | An instance of this XML element is added for each expired granularity period.   |
| measInfold                                   | XML element measData:measInfo<br>XML attribute measInfold   |   |
| jobId  | XML element measData:measInfo:job<br>XML attribute jobId  |   |
| reportingPeriod                              | XML element measData:measInfo:repPeriod<br>XML attribute duration   | The XML attribute "duration" shall use the truncated representation for duration "PTnS" (see [28]).   |
| granularityPeriod                            | XML element measData:measInfo:granPeriod<br>XML attribute duration  | The XML attribute "duration" shall use the truncated representation for duration "PTnS" (see [28]).   |
| measTimeStamp                                | XML element measData:measInfo:granPeriod<br>XML attribute endTime   |   |
| measTypes                                    | XML element measData:measInfo:measTypes<br>or<br>XML element measData:measInfo:measType<br>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<br>XML attribute measObjLdn   |   |
| measResults                                  | XML element<br>measData:measInfo:measValue:measResults<br>or, when the positioning option is used,<br>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<br>XML attribute endTime  |   |
| There is no corresponding File Content Item. | XML element measType<br>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<br>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"?>
<!--
  3GPP 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>
                    </choice>
                  </sequence>
                </complexType>
              </element>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </complexType>
  </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>
  <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 | Heartbeat 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<br>(see NOTE)  | /connections                                   | M |
|  | HTTP GET<br>(Upgrade, see NOTE)  | /connections/{connectionId}                    | M |
| terminateStreamingConnection   | WebSocket<br>Close frame sent<br>(frame with<br>opcode of 0x8),<br>and<br>WebSocket<br>Close frame<br>received (frame<br>with opcode of<br>0x8 for<br>successful case) | /connections/{connectionId}                    | M |
| reportStreamData   | WebSocket<br>Data frame sent<br>(frame with<br>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 <code>establishStreamingConnection</code> is mapped to a HTTP POST operation followed by a HTTP GET operation. The HTTP POST operation is to provide the information in <code>streamInfoList</code> parameter to the consumer and receive the <code>connectionId</code> 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<br>response body | n/a<br>error      | n/a<br>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 equivalents (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<br>response body | --<br>error       | String<br>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 the MnS 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 the MnS 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)**

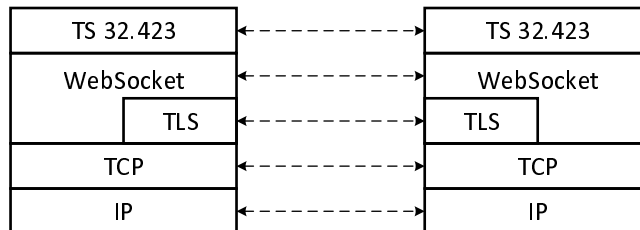
| IS operation parameter name | SS parameter location                       | SS parameter name  | SS parameter type  | S   |
|-----------------------------|---|--|--|-----|
| connectionId                | n/a   | --   | n/a  | n/a |
| --                          | Opcode (see clause 5 of IETF RFC 6455 [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 3GPP TS 32.423 [39] for detailed definition of the Streaming Trace Payload format and Annex G of 3GPP 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 3GPP 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.

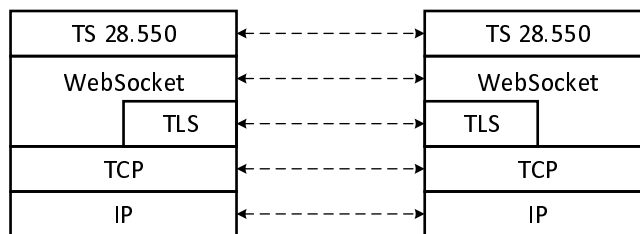
The protocol stack with streaming performance data payloads formatted as per Annex G of 3GPP TS 28.550 [42] carried by WebSocket binary data frames (see clause 5.6 of IETF RFC 6455 [40]) is illustrated on Figure 12.5.1.1.4-2.

**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                   | --<br>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<br>response body | n/a<br>error      | n/a<br>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,<br>query        | /connections/{connectionId}/streams,<br>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<br>response body | n/a<br>error      | n/a<br>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,<br>query        | /connections,<br>/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,<br>streamReporter-Type,<br>streamIdList-Type) | M |
| status                      | response status codes<br>response body | n/a<br>error       | n/a<br>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,<br>query        | /connections/{connectionId}/streams,<br>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,<br>streamReporters-Type) | M |
| status                      | response status codes<br>response body | n/a<br>error      | n/a<br>error-ResponseType                       | M |

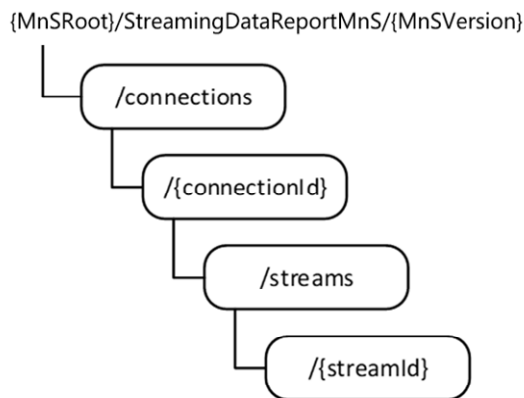
### 12.5.1.2 Mapping of notifications

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: {MnSRoot}/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 12.5.1.3.2.2-1           |

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 3GPP 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   |
|--|--------------|---|
| <b>General types</b>                             |              |   |
| uri-Type   | 12.5.1.4.3   | Used to represent a URI   |
| <b>Types used in paths</b>                       |              |   |
| 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   |
| <b>Types used in headers</b>                     |              |   |
| 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.  |
| <b>Types used in query parts</b>                 |              |   |
| 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   |
| <b>Types used in request bodies</b>              |              |   |
| 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.   |
| <b>Types used in response bodies</b>             |              |   |
| 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  |
| <b>Types used for resources</b>                  |              |   |
| uri-Type   | 12.5.1.4.3   | Used to represent resource URI  |
| <b>Types referenced by the definitions above</b> |              |   |
| 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 3GPP TS 28.622 [11]). |
| vsDataContainer-Type | Generic NRM | Vendor specific data container (see 3GPP 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 3GPP TS 32.300 [25]   |
| measTypes-Type                                | string                      | See 3GPP 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 3GPP TS 32.422 [38]   |
| streamType-Type                               | enum                        | Enumerated stream type with values: "TRACE", "PERFORMANCE", "ANALYTICS", "PROPRIETARY"  |
| systemDN-Type                                 | DN                          | See 3GPP 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 |

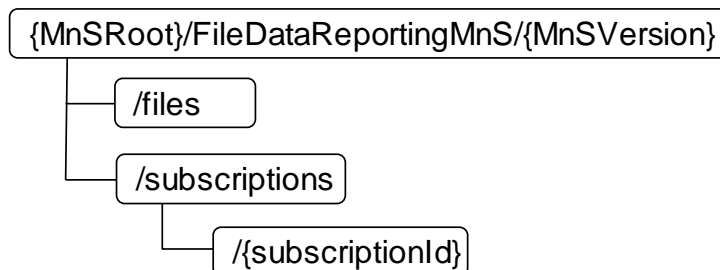


### 12.6.1.3 Resources

#### 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**

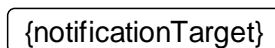
Table 12.2.1.3.1.1-1 provides an overview of the resources and applicable HTTP methods.

**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 12.6.1.3.3.2.2-1:

**Table 12.6.1.3.3.2.2-1: 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 |
| fileSize           | integer      | Size of the file, unit is byte   | 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 |
| fileCompression    | string       | Name of the compression algorithm used for compressing 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 |
| fileDataType       | FileDataType | Type of management data stored in the file   | M |

## 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 occurred | 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: 16.12.0
  description: >-
    OAS 3.0.1 definition of the Provisioning MnS
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP 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'
        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: true
  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:
          - CREATE
          - DELETE
          - REPLACE
      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'

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'
    path:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
    operation:
      $ref: '#/components/schemas/Operation'
    value:
      oneOf:
        - $ref: 'TS28623_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'
        - $ref: 'TS28623_ComDefs.yaml#/components/schemas/AttributeValueChangeSet'

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

```

## 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: 16.12.0
  description: >-
    OAS 3.0.1 definition of the Fault Supervision MnS
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP 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'
                properties:
                  comments:
                    $ref: '#/components/schemas/Comments'
              default:
                description: Response in case of error.
            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
    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
    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 documeTS28532\_Pnt "prfMnS.yaml"

```

openapi: 3.0.1
info:
  title: TS 28.532 Performance Threshold Monitoring MnS
  version: 16.6.0
  description: >-
    OAS 3.0.1 definition of the Performance Threshold Monitoring MnS
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 28.532 V16.6.0; 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 3GPP 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: 16.6.0
  description: >-
    OAS 3.0.1 definition of the heartbeat notification
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 28.532 V16.6.0; 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: 16.10.0
  description: OAS 3.0.1 specification for the Streaming data reporting service (Streaming MnS)
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 establishment 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 3GPP 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 3GPP 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 3GPP 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 3GPP 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 3GPP 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 "TS28532\_FileDataReportingMnS.yaml"

```

openapi: 3.0.1
info:
  title: File Data Reporting MnS
  version: 16.10.0
  description: >-
    OAS 3.0.1 definition of the File Data Reporting MnS
    © 2021, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP 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_C omDefs.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 "stdDefined" is used,
  - The "stdDefinedNamespace" 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), A.4.2 (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](#) [46]).

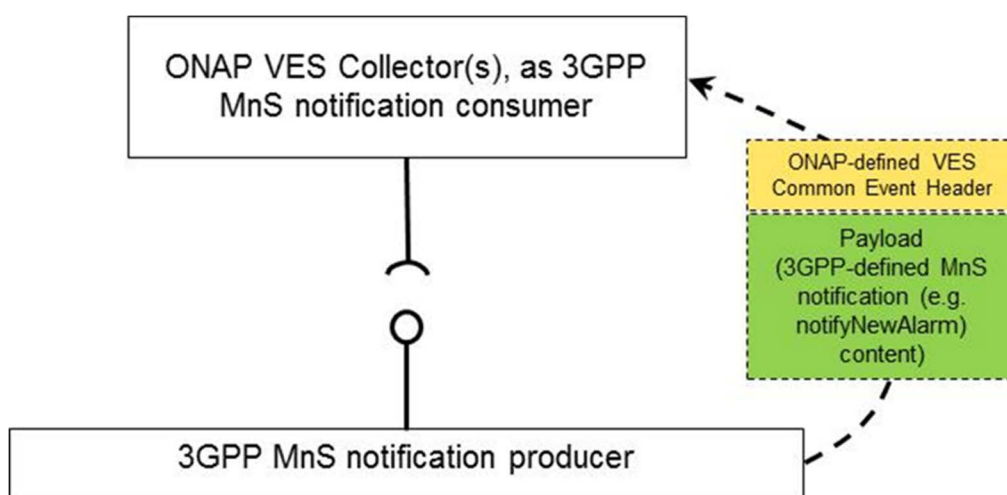


Figure X-1. 3GPP MnS notifications consumed by ONAP VES Collector(s).

## 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 | 0038<br>A |     |     | 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 | Add streaming data reporting service stage 3 resources   | 16.4.0 |
| 2020-06 | SA#88-e | SP-200483 | 0120 | 2 | B | Add streaming data reporting service stage 3 data types  | 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 align 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 | Correct definitions for performance assurance (stage 2 and 3)                                  | 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 |
| 2022-06 | SA#96  | SP-220497 | 0199 | - | F | Correct REST SS of deleteMOI   | 16.11.0 |
| 2022-06 | SA#96  | SP-220497 | 0203 | - | F | OpenAPI file name and dependence change- part1   | 16.11.0 |
| 2022-06 | SA#96  | SP-220497 | 0204 | - | F | OpenAPI file name and dependence change- part2   | 16.11.0 |
| 2022-06 | SA#96  | SP-220497 | 0207 | 1 | F | Correct definition of Resource   | 16.11.0 |
| 2022-06 | SA#96  | SP-220497 | 0215 | - | F | Fix FileDataType definition in OpenAPI   | 16.11.0 |
| 2022-06 | SA#96  |           |      |   |   | CR implementation corrections  | 16.11.1 |
| 2022-09 | SA#97e | SP-220858 | 0220 | - | F | Update provMnS yaml to include resources-coslaNrm  | 16.12.0 |
| 2022-09 | SA#97e |           |      |   |   | Alignign FORGE with A.1.1  | 16.12.1 |
| 2022-09 | SA#98e | SP-221169 | 0226 | 1 | F | Correct OpenAPI definition of HTTP DELETE  | 16.13.0 |
| 2022-09 | SA#98e | SP-221169 | 0228 | 1 | F | Correct type of observedValue attribute  | 16.13.0 |
| 2022-09 | SA#98e | SP-221169 | 0230 | 1 | F | Correct definition of the HTTP GET response  | 16.13.0 |
| 2022-09 | SA#98e | SP-221169 | 0232 | 2 | F | Add missing definition of the JSON Patch document  | 16.13.0 |
| 2022-09 | SA#98e | SP-221169 | 0234 | - | F | Remove duplicated message flows (REST SS of ProvMnS)                                     | 16.13.0 |
| 2022-09 | SA#98e | SP-221169 | 0236 | 2 | F | Add introduction clause to the Prov MnS definition                                       | 16.13.0 |
| 2023-03 | SA#99  | SP-230199 | 0240 | - | F | Align media type names with TS 32.158  | 16.14.0 |
| 2023-03 | SA#99  | SP-230199 | 0242 | 1 | F | Add examples for notifyMOICreation, notifyMOIDeletion and notifyAttributeValueChanges    | 16.14.0 |
| 2023-03 | SA#99  | SP-230200 | 0246 | - | A | Updates for generic management services  | 16.14.0 |

## History

| <b>Document history</b> |                |                         |
|-------------------------|----------------|-------------------------|
| V16.4.0                 | August 2020    | Publication             |
| V16.5.1                 | October 2020   | Publication (withdrawn) |
| V16.5.2                 | November 2020  | Publication             |
| V16.6.0                 | January 2021   | Publication             |
| V16.7.0                 | April 2021     | Publication (withdrawn) |
| V16.7.1                 | May 2021       | Publication             |
| V16.8.1                 | August 2021    | Publication             |
| V16.9.0                 | September 2021 | Publication             |
| V16.10.0                | January 2022   | Publication             |
| V16.11.1                | July 2022      | Publication             |
| V16.12.1                | October 2022   | Publication             |
| V16.13.0                | January 2023   | Publication             |
| V16.14.0                | April 2023     | Publication             |