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Contents

Foreword

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1 Scope

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

[2] 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; Perfomance Measurement (PM); Concept and requirements".

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

[21] Void.

[22] Void.

[23] Void.

[24] Void.

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

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

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

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

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

[30] Void.

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

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

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

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

[35] 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.

[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".

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

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

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

11.1.1 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. If the "scope" parameter is absent, then either only the base object or the complete subtree below and including the base object shall be selected. The default behaviour is protocol specific.
scope	M	n/a	This parameter specifies the scope. It is a structured parameter and consists of the sub-parameters "scopeType" and "scopeLevel". The scope describes which object instances are selected with respect to a base object instance. The base object instance needs to be specified using a dedicated attribute.

> scopeType	M	ENUM {
		BASE_ONLY,
		BASE_ALL
		}
			If the optional "scopeLevel" parameter is not supported or absent, allowed values of "scopeType" are "BASE_ONLY" and "BASE_ALL".
			
			The value "BASE_ONLY" indicates only the base object is selected.
			
			The value "BASE_ALL" indicates the base object and all of its subordinate objects (incl. the leaf objects) are selected.
			
			This parameter is redundant and can be omitted when confirming only the protocol specific default behaviour.

		ENUM {
		BASE_NTH_LEVEL,
		BASE_SUBTREE
		}
			If the "scopeLevel" parameter is supported and present, allowed values of "scopeType" are "BASE_NTH_LEVEL" and "BASE_SUBTREE".
			
			The value "BASE_NTH_LEVEL" indicates all objects on the level, which is specified by the "scopeLevel" parameter, below the base object are selected. The base object is at "scopeLevel" zero.
			
			The value "BASE_SUBTREE" indicates the base object and all of its subordinate objects down to and including the objects on the level, which is specified by the "scopeLevel" parameter, are selected. The base object is at "scopeLevel" zero.

> scopeLevel	O	Integer	See definition of "scopeType" parameter.
filter	O	See Comment.	This parameter defines filter criteria to be applied to the objects selected by the "baseObjectInstance", "scope" and "scopeLevel" parameters. The actual syntax and capabilities of the `filter` is SS specific. However, each SS should support a `filter` consisting of one or several assertions that may be grouped using the logical operators AND, OR and NOT. Each assertion is a logical expression of attribute existence, attribute value comparison ("equal to X, less than Y" etc.) and MO Class.
attributeListIn	O	LIST OF attribute name.	This parameter identifies the attributes to be returned by this operation. If the parmeter is absent or empty all attributes shall be returned.

11.1.1.2.3 Output Parameters

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

11.1.1.3.3 Output parameters

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

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

11.1.1.3.4 Results

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

11.1.1.4 deleteMOI operation

11.1.1.4.1 Description

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

11.1.1.4.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
baseObjectInstance	M	DN	The MO instance that is to be used as the starting point for the selection of managed objects to which the `filter` (when supplied) is to be applied. This is a full DN according to 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 ManagedEntitiy.	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(Resource_operation, Management_operation, SON_operation,Unknown)	This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values: 1. resource operation: The notification was generated in response to an internal operation of the resource; 2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object; 3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . 4. unknown: It is not possible to determine the source of the operation. Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON_operation for sourceIndicator might be sent.
attributeList	O	LIST OF SEQUENCE <AttributeName, AttributeValue>	The attributes (name/value pairs) of the created MOI.

11.1.1.7.3 Triggering event

11.1.1.7.3.1 From-state

stateBeforeObjectCreation.

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

11.1.1.7.3.2 To-state

stateAfterObjectCreation.

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

11.1.1.8 Notification notifyMOIDeletion

11.1.1.8.1 Definition

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

11.1.1.8.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	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 ManagedEntitiy.	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(Resource_operation, Management_operation, SON_operation,Unknown)	This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values: 1. resource operation: The notification was generated in response to an internal operation of the resource; 2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object; 3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . 4. unknown: It is not possible to determine the source of the operation. Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON_operation for sourceIndicator might be sent.
attributeList	O	LIST OF SEQUENCE <AttributeName, AttributeValue>	The attributes (name/value pairs) of the deleted MOI.

11.1.1.8.3 Triggering event

11.1.1.8.3.1 From-state

stateBeforeObjectDeletion.

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

11.1.1.8.3.2 To-state

stateAfterObjectDeletion.

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

11.1.1.9 Notification notifyMOIAttributeValueChanges

11.1.1.9.1 Definition

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

11.1.1.9.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	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 ManagedEntitiy.	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(Resource_operation, Management_operation, SON_operation,Unknown)	This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values: 1. resource operation: The notification was generated in response to an internal operation of the resource; 2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object; 3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . 4. unknown: It is not possible to determine the source of the operation. Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON_operation for sourceIndicator might be sent.

attributeValueChange	M	LIST OF SEQUENCE <AttributeName, NewAttributeValue, CHOICE [NULL, OldAttributeValue]>	The changed attributes (name/value pairs) of the MOI (with both new and, optionally, old values).

11.1.1.9.3 Triggering event

11.1.1.9.3.1 From-state

stateBeforeAttributeValueChange.

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

11.1.1.9.3.2 To-state

stateAfterAttributeValueChange.

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

11.1.1.10 Notification notifyEvent

11.1.1.10.1 Definition

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

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

11.1.1.10.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	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.	--
NOTE 1: If consumer receives notifications from one producer, consumer can use the notificationId and the objectInstance to uniquely identify all received notifications. If consumer receives notifications from multiple producers and notifications of each objectInstance are reported to at most by one producer, consumer can use the notificationId and objectInstance to uniquely identify all received notifications. If consumer receives notifications from multiple producers and notifications of one or more objectInstance(s) are reported byo two or more producers, consumer can use the notificationId together with objectInstance and the identity of producer (systemDN), to uniquely identify all received notifications. If the information systemDN is absent, consumer needs other means, which are outside the scope of this TS, to determine the identity of producer. How notificationId of notifications are re-used to correlate notifications is outside of the scope of this specification.			

11.1.1.11 Notification notifyMOIChanges

11.1.1.11.1 Definition

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

- Creation and deletion of an object.
- Creation and deletion of an attribute, attribute field, attribute element and attribute field element.
- Replacement of an attribute value, attribute field value, attribute element and attribute field element.

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

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

In this clause the following definitions apply.

simple type: A value defined by a simple type is a scalar.

complex type: A value defined by a complex type is either a set of multiple (sub-)values (of the same simple or complex type), or a value containing one or more attribute fields.

attribute: An information element composed of an attribute name and an attribute value.

attribute name: The name of an attribute.

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

attribute field: An attribute contained inside an (top-level) attribute. Attribute fields can contain attribute fields.

attribute field name: The name of an attribute field.

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

simple attribute: Attribute whose value is defined by a simple type.

complex attribute: Attribute whose value is defined by a complex type.

structured attribute: Special kind of complex attribute containing at least one attribute field, but usually multiple attribute fields with different data types.

multi-value attribute: Special kind of complex attribute with multiplicity greater than "1", i.e. an attribute whose value is composed of multiple (sub-)values (of the same simple or complex type).

attribute element: Single (sub-) value of the value of a multi-value attribute.

attribute field element: Single (sub-) value of the value of a multi-value attribute field.

11.1.1.11.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	See clause 11.1.1.7.2	Identifies the classe name of a common ancestor object of the objects for which changes are reported. A MnS producer may set this parameter always to the class name of the parent of the local root object in the MIB.
objectInstance	M	See clause 11.1.1.7.2	Identifies the instance of a common ancestor object of the objects for which changes are reported. A MnS producer may set this parameter always to the instance of the parent of the local root object in the MIB.
notificationId	M	See clause 11.1.1.7.2	See clause 11.1.1.7.2
notificationType	M	const string “notifyMOIChanges”	See clause 11.1.1.7.2
eventTime	M	See clause 11.1.1.7.2	See clause 11.1.1.7.2
systemDN	M	See clause 11.1.1.7.2	See clause 11.1.1.7.2

moiChanges	M	SEQUENCE OF SET {
		notificationId (M),
		correlatedNotifications (O),
		additionalText (O),
		sourceIndicator (O),
		op (M),
		path (M),
		value (M) ,
		oldValue (O)
		}
			This parameter describes the reported NRM updates. It is a list of items; each item reports a single NRM update. The "notificationId" identifies an item.
			
			The NRM update itself is described by the parameters "op", "path", "value" and "oldValue". The parameters "correlatedNotifications", "additionalText" and "sourceIndicator " provide context information.
			
			The parameter "op" specifies the type of operation reporting the NRM update. Valid values are "add", "remove" and "replace". The operation describes what has conceptually happened to the NRM on the MnS producer. The operation applied to the NRM by the MnS producer and causing the reported NRM update can be different.
			
			"add" shall be used for reporting the creation of an object, attribute, attribute field or multi-value attribute element.
			
			"remove" shall be used for reporting the deletion of an object, attribute, attribute field or multi-value attribute element.
			
			"replace" shall be used for reporting the replacement of an existing attribute value, attribute field value or multi-value attribute element.
			
			The "path" and "objectInstance" identify the object, attribute, attribute field or multi-value attribute element, that was created, deleted or replaced.
			
			If an object creation is reported with "add", the "value" shall carry a complete representation of the created object. If an object deletion is reported with "remove", the "value" shall be absent. It may optionally carry a complete representation of the deleted object.
			
			If an attribute, attribute field or multi-value attribute element creation is reported with "add", the "value" shall carry the value of the created attribute, attribute field or multi-value attribute element.
			
			If an attribute, attribute field or multi-value attribute element deletion is reported with "remove", the "value" shall be absent. It may optionally carry the old value of the deleted attribute, attribute field or multi-value attribute element.
			
			If the replacement of an attribute, attribute field or multi-value attribute element value is reported with "replace", the "value" shall carry the new value of the attribute, attribute field or multi-value attribute element. The "oldValue" may optionally carry the old value of the attribute, attribute field or multi-value attribute element before the replacement.
			
			If multiple objects are created, the creation of parent objects shall be reported before the creation of the child objects. Vice versa, when the deletion of multiple objects is reported, the deletion of child objects shall be reported before the deletion of the parent objects.

11.1.2 Managed Information

11.1.2.1 ManagedEntity

11.1.2.1.1 Definition

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

11.2 Generic fault supervision management service

11.2.1 Operations and notifications

11.2.1.1 Fault supervision data report

11.2.1.1.1 subscribe

11.2.1.1.1.1 Definition

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

11.2.1.1.1.2 Input parameters

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

11.2.1.1.1.3 Output parameters

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

11.2.1.1.1.4 Pre-condition

notificationCategoriesNotAllSubscribed OR notificationCategoriesParameterAbsentAndNotAllSubscribed.

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

11.2.1.1.1.5 Post-condition

subscriberPossiblyCreated AND subscriptionCreated.

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

11.2.1.1.1.6 Exceptions

Name	Definition
operation_failed_existing_subscription	**Condition:** (notificationCategoriesNotAllSubscribed OR notificationCategoriesParameterAbsentAndNotAllSubscribed) not true **Returned Information:** The output parameter status **Exit state:** Entry State
operation_failed	**Condition:** Post-condition is false **Returned Information:** The output parameter status **Exit state:** Entry State

11.2.1.1.2 unsubscribe

11.2.1.1.2.1 Definition

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

11.2.1.1.2.2 Input parameters

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

11.2.1.1.2.3 Output parameters

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

11.2.1.1.2.4 Pre-condition

validSubscriptionId&ManagerReference OR SubscriptionIdAbsent&ValidManagerReference.

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

11.2.1.1.2.5 Post-condition

subscriptionDeleted OR allSubscriptionDeleted.

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

11.2.1.1.2.6 Exceptions

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

11.2.1.1.3 getAlarmList

11.2.1.1.3.1 Definition

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

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

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

11.2.1.1.3.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
alarmAckState	O	ENUM (all alarms, all active alarms, all active and acknowledged alarms, all active and unacknowledged, all Cleared and unacknowledged alarms, all unacknowledged)	It carries a constraint. The FaultSupervision MnS producer shall apply it on AlarmInformation instances in AlarmList when constructing its output parameter AlarmInformationList.
baseObjectClass	O, see note 1	This parameter is either absent or carries the object class of a certain class.	See how this attribute is used to support full alarm alignment and partial alarm alignment in 11.1.2.3.3.1. 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 11.1.2.3.3.1. See note 2.
filter	O	N/A	It carries a filter constraint. If the `filter` is present, the MnS producer shall apply it on `AlarmInformation` instances in `AlarmList` when constructing its output parameter `AlarmInformationList`. If the `filter` is not present, all of the `AlarmInformation` instances included by the scope are selected.
NOTE 1: If the notification `notifyAlarmListRebuilt` supports indicating that only a part of the alarm list has been rebuilt then the operation `getAlarmList` shall support partial alarm alignment. NOTE 2: The legal values of the parameters `baseObjectClass` and `baseObjectInstance` are restricted to those carried by the parameters `baseObjectClass` and `baseObjectInstance` in the recent `notifyAlarmListRebuilt` notifications. The timeline for "recent" is vendor-specific.			

11.2.1.1.3.3 Output parameters

Table 11.2.1.1.3.3-1: Output parameters for the operation getAlarmList

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

The following table defines an item of `alarmInformationList`.

Table 11.2.1.1.3.3-2: Definition of an item of `alarmInformationList`

Parameter name	S	Matching information	Comment
objectClass, objectInstance	M	MonitoredEntity.objectClass, MonitoredEntity.objectInstance	The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation.
notificationId	M	AlarmInformation.notificationId	
notificationType	M	"notifyNewAlarm" or "notifyChangedAlarm" or "notifyClearedAlarm"	The parameter carries - notifyNewAlarm in case the alarm has not yet changed and has not yet been cleared. - notifyChangedAlarm in case the alarm has changed but has not yet been cleared. - notifyClearedAlarm in case the alarm has been cleared but not yet acknowledged.
eventTime	O	AlarmInformation.alarmRaisedTime or AlarmInformation.alarmChangedTime or AlarmInformation.alarmClearedTime	The parameter carries the - alarmRaisedTime in case notificationType carries notifyNewAlarm - alarmChangedTime in case notificationType carries notifyChangedAlarm - alarmClearedTime in case notificationType carries notifyClearedAlarm
systemDN	M	--	
alarmId	M	AlarmInformation.alarmId	
[objectClass], [objectInstance]	n/a	MonitoredEntity.objectClass, MonitoredEntity.objectInstance	Parmeter identical to the first parameter in this list, shown here to clarify all elements of AlarmInformation are present
[notificationId]	n/a	AlarmInformation.notificationId	Parmeter identical to the second parameter in this list, shown here to clarify all elements of AlarmInformation are present
alarmRaisedTime	M	AlarmInformation.alarmRaisedTime	
alarmChangedTime	O	AlarmInformation.alarmChangedTime	not applicable if the severity of related alarm was not changed
alarmClearedTime	M	AlarmInformation.alarmClearedTime	not applicable if related alarm was not cleared
alarmType	M	AlarmInformation.alarmType	
probableCause	M	AlarmInformation.probableCause	
specificProblem	O	AlarmInformation.specificProblem	
perceivedSeverity	M	AlarmInformation.perceivedSeverity	
backedUpStatus	O	AlarmInformation.backedUpStatus	not applicable if related alarm is a security alarm
backUpObject	O	MonitoredEntity.objectInstance	The MonitoredEntity is identified by relation-BackUpObject-AlarmInformation. Not applicable if related alarm is a security alarm
trendIndication	O	AlarmInformation.trendIndication	not applicable if related alarm is a security alarm
thresholdInfo	O	AlarmInformation.thresholdInfo	not applicable if related alarm is a security alarm
correlatedNotifications	O	The set of CorrelatedNotification instances related to this AlarmInformation.	
stateChangeDefinition	O	AlarmInformation.stateChange	not applicable if related alarm is a security alarm
monitoredAttributes	O	AlarmInformation.monitoredAttributes	not applicable if related alarm is a security alarm

proposedRepairActions	O	AlarmInformation.proposedRepairActions	not applicable if related alarm is a security alarm
additionalText	O	AlarmInformation.additionalText	
additionalInformation	O	AlarmInformation.additionalInformation	
rootCauseIndicator	O	AlarmInformation.rootCauseIndicator	
ackTime	M	AlarmInformation.ackTime	not applicable if related alarm was not acknowledged nor unacknowledged The availability and accuracy of time carried by the time parameters in individual entries of the list (i.e. eventTime, alarmRaisedTime, alarmClearedTime and ackTime) shall be "best effort". Reason: A Management System is not required to persistently store these times or other alarm information (as in case of synchronization information may be provided by the NE), while also some NE's do not keep these times (and a later attempt to retrieve the alarm data from the NEs will not deliver these time data).
ackUserId	M	AlarmInformation.ackUserId	not applicable if related alarm was not acknowledged nor unacknowledged
ackSystemId	O	AlarmInformation.ackSystemId	not applicable if related alarm was not acknowledged nor unacknowledged
ackState	M	AlarmInformation.ackState	not applicable if related alarm was not acknowledged nor unacknowledged
clearUserId	O	AlarmInformation.clearUserId	not applicable if related alarm was not cleared
clearSystemId	O	AlarmInformation.clearSystemId	not applicable if related alarm was not cleared
serviceUser	M	AlarmInformation.serviceUser	not applicable if related alarm is not a security alarm
serviceProvider	M	AlarmInformation.serviceProvider	not applicable if related alarm is not a security alarm
securityAlarmDetector	M	AlarmInformation.securityAlarmDetector	not applicable if related alarm is not a security alarm
comments	M	The set of Comment instances related to this AlarmInformation.	Not applicable if the related alarm has no related comments

11.2.1.1.3.4 Exceptions and constraints

Exception Name	Definition
operation_failed	**Condition:** Operation is failed **Returned Information:** The output parameter status **Exit state:** Entry State

11.2.1.1.4 notifyNewAlarm

11.2.1.1.4.1 Definition

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

11.2.1.1.4.2 Input parameters

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

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

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

11.2.1.1.4.2a Input parameters for notifications related to 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
objectClass	M	MonitoredEntity.objectClass	The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.
objectInstance	M	MonitoredEntity.objectInstance	The MonitoredEntity is identified by the relation-AlarmedObject-AlarmInformation of the new AlarmInformation.
notificationId	M	--	
notificationType	M	"notifyNewAlarm"	
eventTime	M	AlarmInformation.alarmRaisedTime	
systemDN	M	--	
alarmId	M	AlarmInformation.alarmId	
alarmType	M	AlarmInformation.alarmType	
probableCause	M	AlarmInformation.probableCause	
perceivedSeverity	M	AlarmInformation.perceivedSeverity	
correlatedNotifications	O	The set of CorrelatedNotification related to this AlarmInformation.	
additionalText	O	AlarmInformation.additionalText	
additionalInformation	O	AlarmInformation.additionalInformation	
rootCauseIndicator	O	AlarmIngormation.rootCauseIndicator	
serviceUser	M	AlarmInformation.securityServiceUser	This may contain no information if the identify of the service-user (requesting the service) is not known.
serviceProvider	M	AlarmInformation.securityServiceProvider	This shall always identify the service-provider receiving a service request, from serviceUser, that provokes the security alarm.
securityAlarmDetector	M	AlarmInformation.securityAlarmDetector	This may contain no information if the detector of the security alarm is the serviceProvider.

11.2.1.1.4.3 Triggering event

11.2.1.1.4.3.1 From-state

`noMatchedAlarm.`

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

11.2.1.1.4.3.2 To-state

`newAlarmInAlarmList.`

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

11.2.1.1.5 notifyChangedAlarm

11.2.1.1.5.1 Definition

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

11.2.1.1.5.2 Input parameters

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

11.2.1.1.5.3 Triggering event

11.2.1.1.5.3.1 From-state

alarmMatched AND alarmNotCleared AND alarmChanged.

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

11.2.1.1.5.3.2 To-state

`informationUpdate`.

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

11.2.1.1.6 notifyAlarmListRebuilt

11.2.1.1.6.1 Definition

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

11.2.1.1.6.2 Input parameters

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

11.2.1.1.6.3 Triggering event

11.2.1.1.6.3.1 From-state

`alarmListRebuilt_0 OR alarmListRebuilt_1.`

Assertion Name	Definition
alarmListRebuilt_0	MnS producer has cold-started, initialized, re-initialized or rebooted and it has initiated procedure to rebuild its AlarmList.
alarmListRebuilt_1	MnS producer loses confidence in part or whole of its AlarmList. MnS producer has initiated procedure to repair its AlarmList.

11.2.1.1.6.3.2 To-state

`alarmListRebuilt_2.`

Assertion Name	Definition
alarmListRebuilt_2	MnS producer rebuilds the whole or part of AlarmList.

11.2.1.1.7 notifyCorrelatedNotificationChanged

11.2.1.1.7.1 Definition

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

11.2.1.1.7.2 Input parameters

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

11.2.1.1.7.3 Triggering event

11.2.1.1.7.3.1 From-state

`newAlarmCorrelationInfoIsAvailable AND alarmInformationExists.`

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

11.2.1.1.7.3.2 To-state

`alarmCorrelatedInfoUpdated`.

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

11.2.1.1.8 getAlarmCount

11.2.1.1.8.1 Definition

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

11.2.1.1.8.2 Input parameters

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

11.2.1.1.8.3 Output parameters

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

11.2.1.1.8.4 Pre-condition

There are no pre-conditions.

11.2.1.1.8.5 Post-condition

`allAlarmInformationCounted.`

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

11.2.1.1.8.6 Exceptions

Name	Definition
operation_failed	**Condition:** the pre-condition is false or the post-condition is true. **Returned Information:** The output parameter status. **Exit state:** Entry state.
filter_complexity_limit	**Condition:** Operation not performed because the filter parameter is too complex. **Returned Information**: The output parameter status. **Exit state:** Entry state.

11.2.1.1.9 setComment

11.2.1.1.9.1 Definition

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

11.2.1.1.9.2 Input parameters

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

11.2.1.1.9.3 Output Parameters

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

11.2.1.2 Fault supervision data control

11.2.1.2.1 acknowledgeAlarms

11.2.1.2.1.1 Definition

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

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

11.2.1.2.1.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment

alarmInformationAndSeverityReferenceList	M	SET OF SEQUENCE {
		AlarmInformation.alarmId (M)
		AlarmInformation.perceivedSeverity (O)
		}
			It identifies the alarms to be acknowledged. If an alarm id is qualified with an optional perceived severity, the alarm shall be acknowledged only when the perceived severity in the alarm list matches the perceived severity provided in the operation request.

ackUserId	M	AlarmInformation.ackUserId	The identifier of the user acknowledgeding the alarm.
ackSystemId	O	AlarmInformation.ackSystemId	The identifier of the system where the acknowledgement request was originated.

11.2.1.2.1.3 Output parameters

Parameter Name	S	Matching Information / Information Type / Legal Values	Comment

badAlarmInformation ReferenceList	M	SET OF SEQUENCE {
		AlarmInformation.alarmId (M)
		errorReason (M)
		}
		
		errorReason ::= ENUM {
		UnknownAlarmId,
		AcknowledgmentFailed,
		WrongPerceivedSeverity
		}
			If all alarms are acknowledged, it contains no information.
			If only some alarms are acknowledged, then it contains identifications of `AlarmInformation` that are
			
			(a) present in input parameter `AlarmInformationReferenceList` but absent in the `AlarmList` (errorReason = UnknownAlarmId; or
			
			(b) present in input parameter `AlarmInformationReferenceList` and present in the AlarmList but the Acknowledgement Information (see note below table) has not changed despite the consumer's request (errorReason = AcknowledgmentFailed); or
			
			(c) present in input parameter `AlarmInformationReferenceList` and present in the AlarmList but the `perceivedSeverity` to be acknowledged has changed and/or is different in the Alarm List (ErrorReason = WrongPerceivedSeverity), applicable only if perceivedSeverity is provided.

status	M	ENUM {
		OperationSucceeded,
		OperationPartiallySucceeded,
		OperationFailed
		}
			If all alarms acknowledged, then status = OperationSucceeded.
			
			If some alarms are acknowledged, then status = OperationPartiallySuceeded.
			
			If operation failed is true, then status = OperationFailed.

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

11.2.1.2.1.4 Exceptions and constraints

Exception Name	Definition
operation_failed	**Condition:** Operation is failed **Returned Information:** The output parameter status **Exit state:** Entry State

11.2.1.2.2 unacknowledgeAlarms

11.2.1.2.2.1 Definition

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

11.2.1.2.2.2 Input parameters

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

11.2.1.2.2.3 Output parameters

Parameter Name	S	Matching Information / Information Type / Legal Values	Comment

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

status	M	ENUM { OperationSucceeded, OperationPartiallySucceeded, OperationFailed	If all alarms acknowledged, then status = OperationSucceeded. If some alarms are acknowledged, then status = OperationPartiallySuceeded. If operation failed is true, then status = OperationFailed.

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

11.2.1.2.2.4 Exceptions and constraints

Exception Name	Definition
Operation_failed	**Condition:** Operation is failed **Returned Information:** The output parameter status **Exit state:** Entry State

11.2.1.2.3 clearAlarms

11.2.1.2.3.1 Definition

The authorized consumer invokes this operation to clear one or more `AlarmInformation` instances in AlarmList. For example, this operation can be used to support the manual clearing of the ADMC (automatic detection and manual clearing, see also 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 AlarmInformation.alarmId	It carries one or more identifiers identifying AlarmInformation instances in the AlarmList.
clearUserId	M	AlarmInformation.clearUserId	It identities the user clearing the alarm.
clearSystemId	O	AlarmInformation.clearSystemId	It identifies the authorized consumer. It may be absent implying that consumer does not wish this information be known to the MnS producer.

11.2.1.2.3.3 Output parameters

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

11.2.1.2.3.4 Exceptions and constraints

Exception Name	Definition
operation_failed	**Condition:** Operation is failed **Returned Information:** The output parameter status **Exit state:** Entry State

11.2.1.2.4 notifyClearedAlarm

11.2.1.2.4.1 Definition

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

11.2.1.2.4.2 Input parameters

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

11.2.1.2.4.3 Triggering event

11.2.1.2.4.3.1 From-state

`alarmMatchedAndCleared OR clearedByProvider`.

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

11.2.1.2.4.3.2 To-state

`alarmInformationCleared_1 OR alarmInformationCleared_2.`

Assertion Name	Definition
alarmInformationCleared_1	Case if From-state is alarmMatchedAndCleared: The following attributes of the subject `AlarmInformation` are updated: `notificationId`, `perceivedSeverity` (updated to `Cleared`), `alarmClearedTime`.
alarmInformationCleared_2	Case if From-state is clearedByProvider: The following attributes of the subject AlarmInformation are updated: notificationId, alarmClearedTime, perceivedSeverity (updated to CLEARED), alarmClearedUserId, alarmClearedSystemId.

11.2.1.2.5 notifyAckStateChanged

11.2.1.2.5.1 Definition

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

11.2.1.2.5.2 Input parameters

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

11.2.1.2.5.3 Triggering event

11.2.1.2.5.3.1 From-state

`ackedByConsumer OR ackedByProvider AND alarmInformationExists.`

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

11.2.1.2.5.3.2 To-state

`alarmAckStateHasChanged.`

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

11.2.1.2.6 notifyComments

11.2.1.2.6.1 Definition

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

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

11.2.1.2.6.2 Input parameters

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

11.2.1.2.6.3 Trigger event

11.2.1.2.6.3.1 From-state

`commentedByServiceprovider OR commentedByServiceprovider AND alarmInformationExists.`

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

11.2.1.2.6.3.2 To-state

`commentInserted`.

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

11.2.1.2.7 notifyPotentialFaultyAlarmList

11.2.1.2.7.1 Definition

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

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

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

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

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

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

11.2.1.2.7.2 Input parameters

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

11.2.1.2.7.3 Trigger event

11.2.1.2.7.3.1 From-state

`faultyAlarmListDetected.`

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

11.2.1.2.7.3.2 To-state

`faultyAlarmList`

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

11.2.1.2.8 notifyChangedAlarmGeneral

11.2.1.2.8.1 Definition

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

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

11.2.1.2.8.2 Input parameters for notifications related to non-security alarms

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

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

Parameter Name	S	Matching Information/ Information Type / Legal Values	Comment
objectClass	M	MonitoredEntity.objectClass	
objectInstance	M	MonitoredEntity.objectInstance	
notificationId	M	--	
notificationType	M	"notifyChangedAlarmGeneral"	
eventTime	M	AlarmInformation.alarmChangedTime	
systemDN	M	--	
alarmId	M	AlarmInformation.alarmId	
alarmType	M	AlarmInformation.alarmType	
probableCause	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	AlarmInformaton.proposedRepairActions	
additionalText	O	AlarmInformation.additionalText	
additionalInformation	O	AlarmInformation.additionalInformation	
rootCauseIndicator	O	alarmInformation.rootCauseIndicator	
changedAlarmAttributes	O	LIST OF SEQUENCE <AttributeName, OldAttributeValue>	The changed alarm attributes (name/value pairs) (with old values).

11.2.1.2.8.3 Input parameters for notifications related to security alarm

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

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

Parameter Name	S	Matching Information/ Information Type / Legal Values	Comment
objectClass	M	MonitoredEntity.objectClass	
objectInstance	M	MonitoredEntity.objectInstance	
notificationId	M	--	
notificationType	M	"notifyChangedAlarmGeneral".	
eventTime	M	AlarmInformation.alarmChangedTime	
systemDN	M	--	
alarmId	M	AlarmInformation.alarmId	
alarmType	M	AlarmInformation.alarmType	
probableCause	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; notificationId is updated; alarmChangedTime is updated; ackTime, ackUserId and ackSystemId are updated to contain no information; ackState is updated to "unacknowledged";

11.2.2 Managed information

11.2.2.1 Alarm information, alarm state change and Information Object Classes

11.2.2.1.1 Imported information entities and local labels

None.

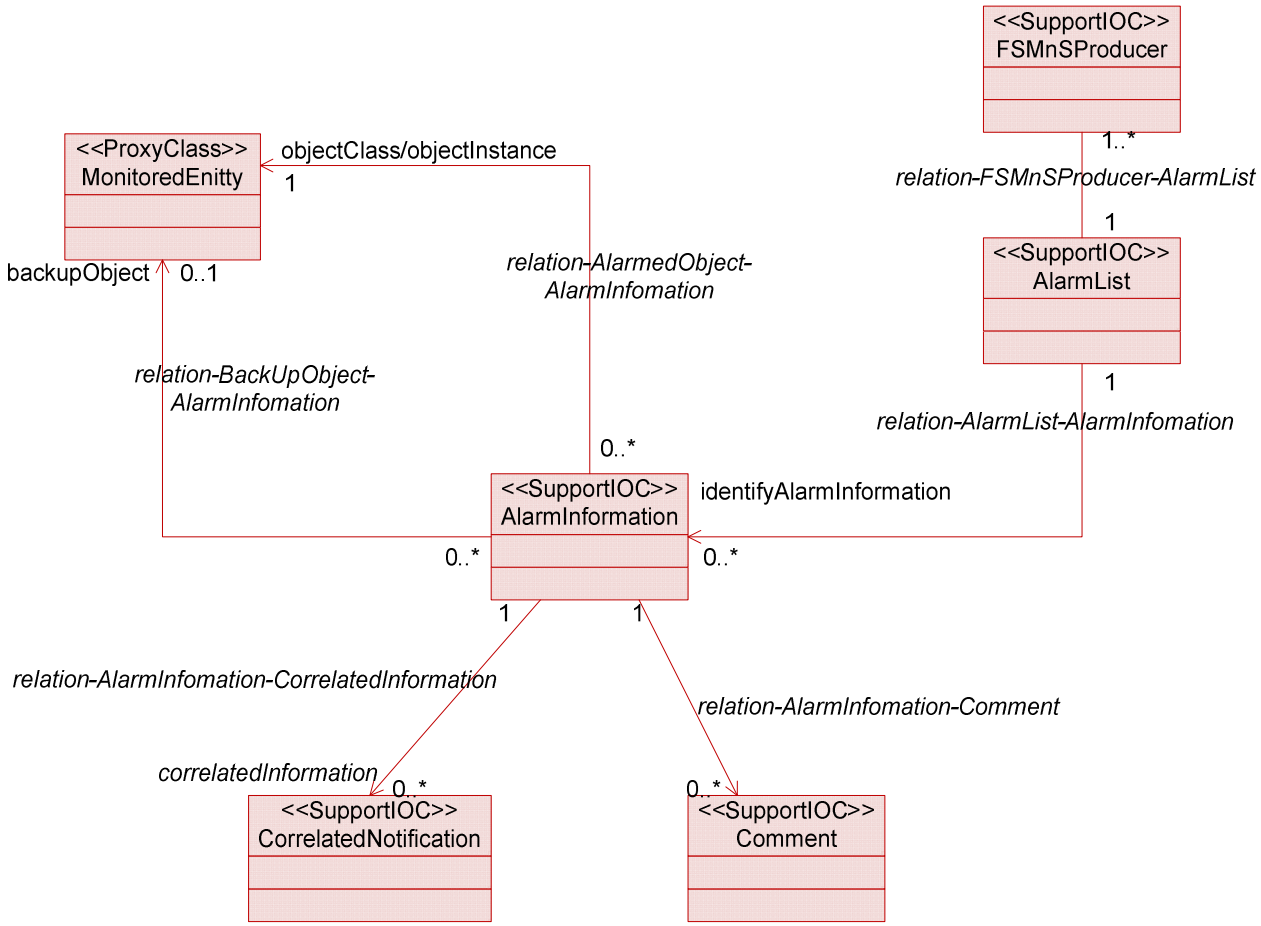
11.2.2.1.2 Class diagram

11.2.2.1.2.1 Introduction

This clause introduces the fault supervision related classes (i.e. IOCs, SupportIOCs). The intent is to identify the information required for the Fault management service implementation of its operations and notification emission. This

clause provides the overview of all support object classes in UML. Subsequent clauses provide more detailed specification of various aspects of these support object classes.

11.2.2.1.2.2 Attributes and relationships



11.2.2.1.3 Information Object Class Definitions

11.2.2.1.3.1 AlarmInformation

11.2.2.1.3.1.1 Definition

`AlarmInformation` contains information about alarm conditions of an alarmed `MonitoredEntity.`

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

11.2.2.1.3.1.2 Attribute

Attribute name	S
alarmId	M
objectClass/objectInstance (attribute related to role)	M
notificationId	M
alarmRaisedTime	M
alarmChangedTime	O
alarmClearedTime	M
alarmType	M
probableCause	M
specificProblem	O
perceivedSeverity	M
backedUpStatus	O
backUpObject (attribute related to role)	O
trendIndication	O
thresholdInfo	O
correlatedNotifications (attribute related to role)	O
stateChangeDefinition	O
monitoredAttributes	O
proposedRepairActions	O
additionalText	O
additionalInformation	O(see note 3)
rootCauseIndicator	O
ackTime	M
ackUserId	M
ackSystemId	O
ackState	M
clearUserId	O (see note 1)
clearSystemId	O (see note 1)
serviceUser	O (see note 2)
serviceProvider	O (see note 2)
securityAlarmDetector	O (see note 2)

NOTE 1: These attributes and qualifiers are applicable only if the management service producer supports clearAlarms() (they are absent if clearAlarms() is not supported).
NOTE 2: These attributes are supported if the management service producer emits `notifyNewAlarm` that carries security alarm information.
NOTE 3: This attribute is optionally populated whenever vendor specific attributes are needed.

11.2.2.1.3.1.3 State diagram

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

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

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

- X identifies the triggering event;
- Y identifies the action of FaultSupervision MnS producer because of the triggering event;
- Z is the notification to be emitted by FaultSupervision MnS producer because of the triggering event.

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

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

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

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

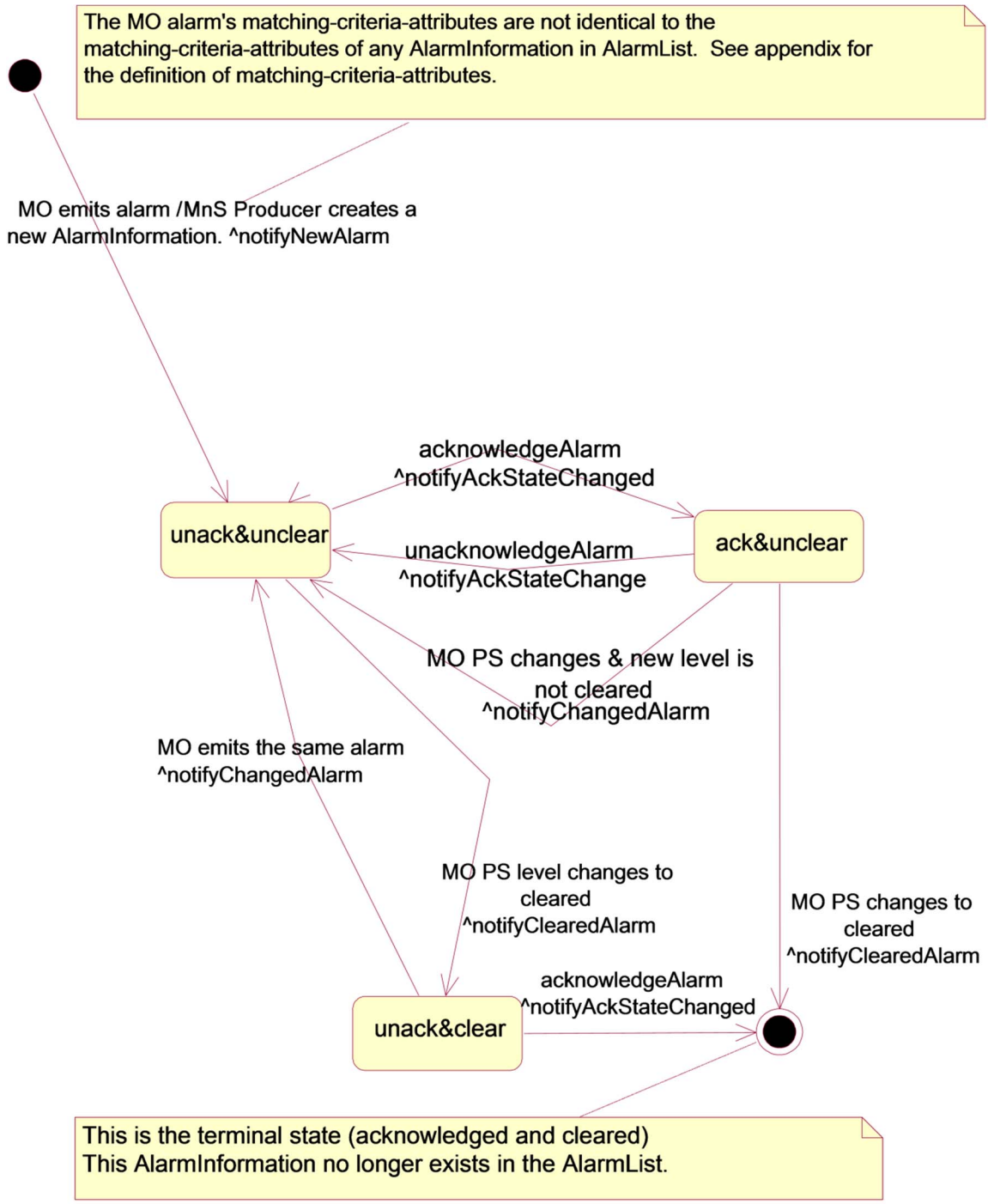


Figure 11.2.2.1.3.1.3-1 notifyChangedAlarm supported

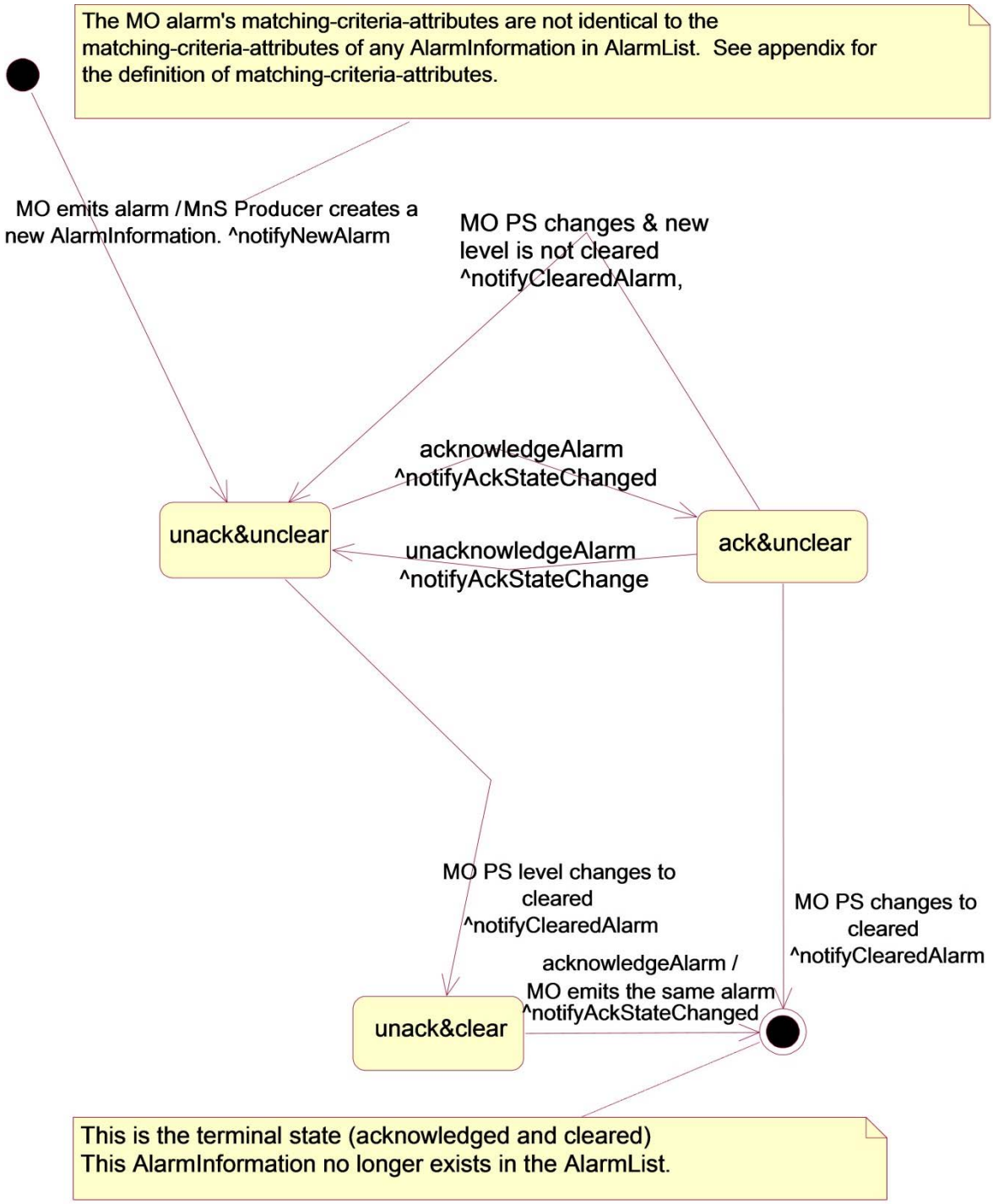


Figure 11.2.2.1.3.1.3-2 notifyChangedAlarm not supported

11.2.2.1.3.2 AlarmList

11.2.2.1.3.2.1 Definition

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

11.2.2.1.3.2.2 Attribute

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

11.2.2.1.3.3 FSMnSProducer

11.2.2.1.3.3.1 Definition

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

11.2.2.1.3.3.2 Attribute

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

11.2.2.1.3.3.3 Notification Table

Name	S	Notes
notifyAlarmListRebuilt	M	
notifyPotentialFaultyAlarmList	O	.

11.2.2.1.3.4 Comment

11.2.2.1.3.4.1 Definition

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

11.2.2.1.3.4.2 Attribute

Attribute Name	S
commentTime	M
commentUserId	M
commentSystemId	O
commentText	M

11.2.2.1.3.5 CorrelatedNotification

11.2.2.1.3.5.1 Definition

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

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

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

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

11.2.2.1.3.5.2 Attribute

Attribute Name	S
sourceObjectInstance	M
notificationIdSet	M

11.2.2.1.3.6 MonitoredEntity

11.2.2.1.3.6.1 Definition

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

a) All classes whose Notification Tables include alarm notifications.

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

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

11.2.2.1.3.6.2 Attribute

There is no attribute for this class.

11.2.2.1.4 Information relationships definition

11.2.2.1.4.1 relation-FSMnSProducer-AlarmList (M)

11.2.2.1.4.1.1 Definition

This represents the relationship between `FSMnSProducer` and `AlarmList`.

11.2.2.1.4.1.2 Role

There is no role defined for this relationship.

11.2.2.1.4.1.3 Constraint

There is no constraint for this relationship.

11.2.2.1.4.2 relation-AlarmList-AlarmInformation (M)

11.2.2.1.4.2.1 Definition

This represents the relationship between `AlarmList` and `AlarmInformation.`

11.2.2.1.4.2.2 Role

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

11.2.2.1.4.2.3 Constraint

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

11.2.2.1.4.3 relation-AlarmInformation-Comment (M)

11.2.2.1.4.3.1 Definition

This represents the relationship between `AlarmInformation` and `Comment.`

11.2.2.1.4.3.2 Role

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

11.2.2.1.4.3.3 Constraint

There is no constraint.

11.2.2.1.4.4 relation-AlarmInformation-CorrelatedNotification (M)

11.2.2.1.4.4.1 Definition

This represents the relationship between `AlarmInformation` and `CorrelatedNotification.`

11.2.2.1.4.4.2 Role

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

11.2.1.4.4.3 Constraint

There is no constraint.

11.2.2.1.4.5 relation-AlarmedObject-AlarmInformation (M)

11.2.2.1.4.5.1 Definition

This represents the relationship between `MonitoredEntity` and `AlarmInformation`.

11.2.2.1.4.5.2 Role

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

11.2.2.1.4.5.3 Constraint

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

11.2.2.1.4.6 relation-backUpObject-AlarmInformation (O)

11.2.2.1.4.6.1 Definition

The relationship represents the relationship between `AlarmInformation` and the `backUpObject`.

11.2.2.1.4.6.2 Role

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

11.2.2.1.4.6.3 Constraint

Name	Definition
inv_identifyBackUpObject	This relationship is present if and only if the AlarmInformation.backedUpStatus attribute is present and is indicating true.

11.2.2.1.5 Information attribute definition

11.2.2.1.5.1 Definition and legal values

Name	Definition	Legal Values
alarmId	It identifies one AlarmInformation in the AlarmList.	
notificationId	It identifies the notification that carries the AlarmInformation.	
alarmRaisedTime	It indicates the date and time when the alarm is first raised by the alarmed resource.	All values indicating valid date and time.
alarmChangedTime	It indicates the last date and time when the AlarmInformation is changed by the alarmed resource. Changes to AlarmInformation caused by invocations of the management service consumer would not change this date and time.	All values indicating valid date and time.
alarmClearedTime	It indicates the date and time when the alarm is cleared.	All values indicating valid date and time.
alarmType	It indicates the type of alarm. Communications Alarm: An alarm of this type is associated with the procedure and/or process required conveying information from one point to another (ITU-T Recommendation X.733 [4]). Processing Error Alarm: An alarm of this type is associated with a software or processing fault (ITU T Recommendation X.733 [4]). Environmental Alarm: An alarm of this type is associated with a condition related to an enclosure in which the equipment resides (ITU-T Recommendation X.733 [4]). Quality of Service Alarm: An alarm of this type is associated with degradation in the quality of a service (ITU T Recommendation X.733 [4]). Equipment Alarm: An alarm of this type is associated with an equipment fault (ITU-T Recommendation X.733 [4]). Integrity Violation: An indication that information may have been illegally modified, inserted or deleted. Operational Violation: An indication that the provision of the requested service was not possible due to the unavailability, malfunction or incorrect invocation of the service. Physical Violation: An indication that a physical resource has been violated in a way that suggests a security attack. Security Service or Mechanism Violation: An indication that a security attack has been detected by a security service or mechanism. Time Domain Violation: An indication that an event has occurred at an unexpected or prohibited time.	
probableCause	It qualifies alarm and provides further information than alarmType. Probable causes are ouside the scope of the present document.	
specificProblem	It provides further refinement to the probableCause. This attribute value shall be single-valued and of simple type such as integer or string. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.2.	Provided by vendor.
perceivedSeverity	It indicates the relative level of urgency for operator attention.	Critical, Major, Minor, Warning, Indeterminate, Cleared: see ITU-T Recommendation X.733 [4]. The present document does not recommend the use of indeterminate.

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: - The identifier of the monitored attribute whose value has crossed a threshold, - The threshold settings, - The observed value that have crossed a threshold, etc. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.7. See also for information in TS 32.401 [19] clause 5.6.	
stateChangeDefinition	It indicates attribute value changes associated with the alarm for state attributes of the monitored entity (state transitions). The change is reported with the name of the state attribute, the new value and an optional old value. See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.11.	
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. A specific condition for this optional population is when an alarm presented by the Management System (e.g. via the user interface) has different values of perceived severity, and / or alarm type, compared with the values presented to the Itf-N. Any other uses of additional information on the alarm and its semantics is outside the scope of the present document	The additional information field is a list of one or more information parts. The present document allows the support of two such information parts to carry - vendor defined perceived severity - vendor defined alarm type using defined identification. Other vendor specific information parts are allowed by using vendor specific identifications.
rootCauseIndicator	It indicates that this `AlarmInformation` is the root cause of the events captured by the notifications whose identifiers are in the related `CorrelatedNotification` instances.	boolean
ackTime	It identifies the time when the alarm has been acknowledged or unacknowledged the last time, i.e. it registers the time when ackState changes.	All values that indicate valid time that are later than that carried in alarmRaisedTime.

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. Unacknowledged: the alarm has been unacknowledged or the alarm has never been acknowledged.
commentTime	It carries the time when the comment has been added to the alarm.	
commentText	It carries the textual comment.	
commentUserId	It carries the identification of the user who made the comment.	
commentSystemId	It carries the identification of the system (Management System) from which the comment is made. That system supports the user that made the comment.	
clearUserId	It carries the identity of the user who invokes the clearAlarms operation.	It can be used to identify the human operator such as "John Smith" or it can identify a group, such as "Team Six", or it can contain no information such as "".
clearSystemId	It carries the identity of the system in consuming the fault management service. That management service consumer supports the user who invokes the clearAlarms().	It can be used to identify the system, such as "system 6" or it can contain no information such as "".
serviceUser	It identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm.	This attribute may carry no information if the server user is not identifiable.
serviceProvider	It identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm.	
securityAlarmDetector	It carries the identity of the detector of the security alarm.	This attribute may carry no information if the security alarm detector is not identifiable.
sourceObjectInstance	It identifies one MonitoredEntity.	All values that carry the semantics of DN.
notificationIdSet	It carries one or more notification identifiers.	

11.2.2.1.5.2 Constraints

Name	Definition
inv_alarmChangedTime	Time indicated shall be later than that carried in alarmRaisedTime.
inv_alarmClearedTime	Time indicated shall be later than that carried in alarmRaisedTime.
inv_ackTime	Time indicated shall be later than that carried in alarmRaisedTime.
inv_notificationId	NotificationIds shall be chosen to be unique across all notifications of a particular Managed Object throughout the time that alarm correlation is significant. The algorithm by which alarm correlation is accomplished is outside the scope of the present document.

11.2.2.2 Subscription information, subscription state and Information Object Classes

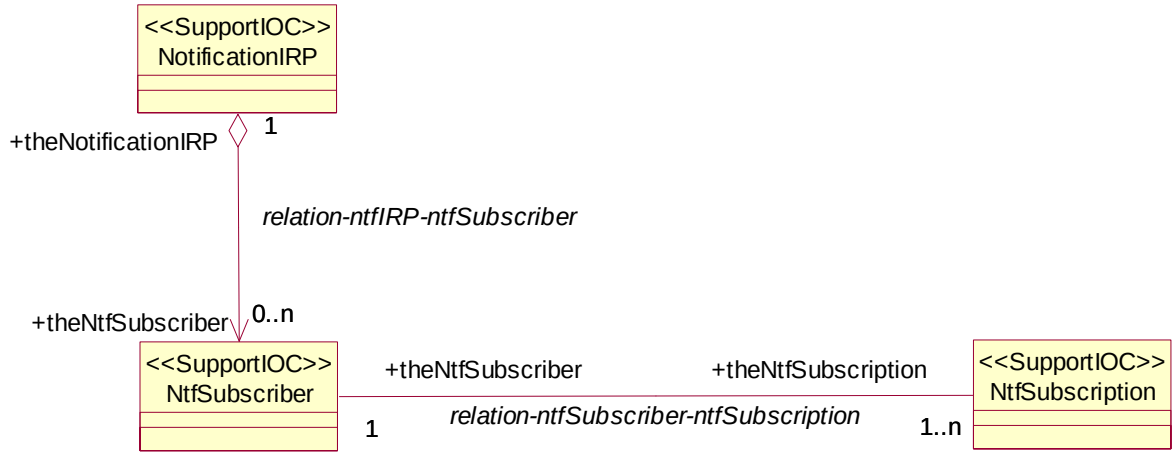
11.2.2.2.1 Imported information entities and local labels

None.

11.2.2.2.2 Class Diagram

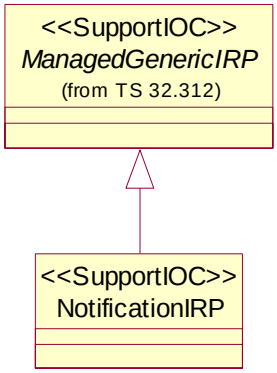
11.2.2.2.2.1 Attributes and relationships

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



11.2.2.2.2.2 Inheritance

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



11.2.2.2.3 Information object classes definition

11.2.2.2.3.1 `NtfSubscriber`

11.2.2.2.3.1.1 Definition

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

11.2.2.2.3.1.2 Attributes

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

11.2.2.2.3.2 NtfSubscription

11.2.2.2.3.2.1 Definition

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

11.2.2.2.3.2.2 Attributes

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

11.2.2.2.3.2.3 Void

11.2.2.2.3.3 NotificationIRP

11.2.2.2.3.3.1 Definition

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

11.2.2.2.4 Information relationship definitions

11.2.2.2.4.1 relation-ntfSubscriber-ntfSubscription (M)

11.2.2.2.4.1.1 Definition

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

11.2.2.2.4.1.2 Roles

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

11.2.2.2.4.1.3 Constraints

Name	Definition
inv_notificationCategoriesAllDistinct	The notification categories contained in the ntfNotificationCategorySet attribute of NtfSubscription playing the role theNtfSubscription are all distinct from each other.

11.2.2.2.4.2 relation-ntfIRP-ntfSubscriber (M)

11.2.2.2.4.2.1 Definition

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

11.2.2.2.4.2.2 Roles

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

11.2.2.2.4.2.3 Constraints

Name	Definition
inv_uniqueManagerReference	All NtfSubscriber involved in the subscriptionRegistration relationship are distinguished from each other by their ntfManagerReference Attribute.

11.2.2.2.5 Information attribute definitions

11.2.2.2.5.0 Introduction

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

11.2.2.2.5.1 Definitions and legal values

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

11.2.2.2.5.2 Constraints

- "ntfTimeTickTimer is lower.

11.3 Performance assurance

11.3.1 Operations and notifications

11.3.1.1 Void

11.3.1.2 Void

11.3.1.3 Notification notifyThresholdCrossing

11.3.1.3.1 Definition

A MnS producer sends this notification to subscribed MnS consumers when a "ThresholdMonitor" (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.
measInfoId	Identifier of a "measInfo".
jobId	Job identifier of the related "PerfMetricJob" in this "measInfo".
reportingPeriod	Period used for performance metric reporting in this "measInfo". Unit is seconds
granularityPeriod	Period used for performance metric production in a "measInfo". Unit is seconds.
measTimeStamp	End time of the granularity period in a "measInfo".
measTypes	Performance metric names in a "measInfo"
measValues	Performance metric values in a "measInfo". Each item in this list includes the LDN of the object the metrics are related to ("measObjLdn"), the measured or computed values of the metrics ("measResults") and a flag that indicates whether the metrics are reliable ("suspectFlag").
measObjLdn	Local distinguished name (LDN) of the object the performance metrics are related to (measured object) within the scope defined by the "measObjRootDn". The concatenation of the "measObjRootDn" and the "measObjLdn" is the DN of the measured object. The "measObjLdn" is therefore empty if the "measObjRootDn" already specifies completely the DN of the measured object, which is the case for metrics associated to "ManagedElement" or the root "SubNetwork". For example, if the measured object is a "ManagedElement" representing RNC "RNC-Gbg-1", then the "measObjRootDn" may look like "DC=a1.operatorNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1" and the "measObjLdn" is empty. However, if the measured object is an "UtranCell" representing cell "Gbg-997" managed by that RNC, then the "measObjRootDn" is the same as above, i.e. "DC=a1.companyNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1" and the "measObjLdn" is "RncFunction=RF-1,UtranCell=Gbg-997". The class of the measured object is defined in item f) of measurement definitions (3GPP TS 32.404 [47], TS 28.552 [18]) and in item d) of KPI definitions (TS 28.554 [6]).
measResults	List of result values for the observed or computed performance metrics. The "measResults" sequence shall have the same number of elements and follow the same order as the "measTypes" sequence. The NULL value is reserved to indicate that the performance metric is not applicable or could not be produced for the object instance.
suspectFlag	Reliability of the performance metrics. FALSE means the metrics are reliable, TRUE means they are not reliable. The default value is "FALSE".
collectionEndTime	Time stamp indicating the end of the last granularity period for which performance metrics are stored in the file.

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

11.3.2.1.3 Void

11.3.2.1.3.1 Void

11.3.2.1.3.2 Void

11.3.2.1.4 Performance data file naming convention

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

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

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

   - "A" means single measured object, single granularity period (this is used when granularity period is equal to reporting period);
   - "B" indicates multiple measured objects, single granularity period (this is used when granularity period is equal to reporting period);
   - "C" signifies single measured object, multiple granularity periods (this is used when reporting period is multiples of the granularity period and will contain multiple measurement reports);
   - "D" stands for multiple measured objects, multiple granularity periods (this is used when reporting period is multiples of the granularity period and will contain multiple measurement reports).

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

   - YYYY is the year in four-digit notation;
   - MM is the month in two digit notation (01 - 12);
   - DD is the day in two-digit notation (01 - 31).

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

   - HH is the two-digit hour of the day (local time), based on 24-hour clock (00 - 23);
   - MM is the two digit minute of the hour (local time), based on 60-minutes clock (00 - 59);
   - s is the sign of the local time differential from UTC (+ or -), in case the time differential to UTC is 0 then the sign may be arbitrarily set to "+" or "-";
   - hh is the two-digit number of hours of the local time differential from UTC (00-23);
   - mm is the two digit number of minutes of the local time differential from UTC (00-59).

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

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

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

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

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

Some examples describing file-naming convention:

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

2) file name: B20021224.1700-1130-1705-1130_-job10_S-NSSAI,
meaning: file containing results for multiple measured objects, generated for measurement job job10, produced for NSI <S-NSSAI> on December 24, 2002, granularity period 5 minutes from 17:00 local to 17:05 local, with a time differential of –11:30 hours against UTC.

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

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

11.3.2.1.4 Void

11.4 Heartbeat

11.4.1 Operations and notifications

11.4.1.1 Notification notifyHeartbeat

11.4.1.1.1 Definition

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

The emission of heartbeat notifications is controlled by the `HeartbeatControl` IOC (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: the internal countdown timer of the MOI is reset to the value of its heartbeatNtfPeriod attribute.
stateAfterHeartbeatNotification2	If From-state is `stateBeforeHeartbeatNotification2` then: the value of the internal countdown timer of the MOI is not affected.

11.5 Streaming data reporting service

11.5.1 Operations and notifications

11.5.1.1 establishStreamingConnection operation (M)

11.5.1.1.1 Definition

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

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

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

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

11.5.1.1.2 Input parameters

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

11.5.1.1.3 Output parameters

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

11.5.1.1.4 Exceptions

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

11.5.1.2 terminateStreamingConnection operation (M)

11.5.1.2.1 Definition

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

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

11.5.1.2.2 Input parameters

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

11.5.1.2.3 Output parameters

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

11.5.1.2.4 Exceptions

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

11.5.1.3 reportStreamData operation (M)

11.5.1.3.1 Definition

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

11.5.1.3.2 Input parameters

Parameter Name	S	Information type	Comment
connectionId	M	See clause 11.5.1.1.3	It identifies the streaming connection on which the reported data are being sent. The format may have dependency on the solution set.
streamingData	M	Unit of streaming data	This parameter contains the actual data (payload) being reported via stream. For streaming trace reporting each `streamingData` is encoded according to the format specified in the clause 5 of 3GPP TS 32.423 [39]. For streaming performance data reporting each `streamingData` is encoded according to the format specified in the Annex C of 3GPP TS 28.550 [42]. For proprietary data streaming reporting each `streamingData` is encoded according to the format specified in the product documentation.

11.5.1.3.3 Output parameters

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

11.5.1.3.4 Exceptions

Exception Name	Definition

11.5.1.4 addStream operation (M)

11.5.1.4.1 Definition

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

11.5.1.4.2 Input parameters

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

11.5.1.4.3 Output parameters

Parameter Name	S	Matching Information	Comment
streamInfoList	M	List of `StreamInfo`	This parameter contains the list of meta-data about each reporting stream that has been successfully added as a result of this operation. For streaming trace reporting each `StreamInfo` includes: - `StreamType` carrying the value "TRACE"; - `SerializationFormat` carrying the value "GPB" or "ASN1"; - Trace Reference (see clause 5.6 of 3GPP TS 32.422 [38]) as stream identifier; - `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. For streaming performance data reporting each `StreamInfo` includes: - `StreamType` carrying the value "PERFORMANCE"; - `SerializationFormat` carrying the value "GPB" or "ASN1"; - `streamId` globally unique stream identifier; - `measObjDn`: the DN of the measured object instance; - `performanceMetrics`: a list of performance metric names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI; - either: - `jobId` defined in the `PerfMetricJob` MOI (see clause 4.3.31 of 3GPP TS 28.622 [11]) for which the data is being reported; - or: - `jobId` globally unique identifier of a measurement job (see TS 28.550 [42]). For streaming analytics reporting each `StreamInfo` includes: - `StreamType` carrying the value "ANALYTICS"; - `SerializationFormat` carrying the value "GPB" or "ASN1"; - `streamId` globally unique stream identifier; - `AnalyticsInfo` providing the details about the analytics activity for which the data is being reported. For proprietary data streaming reporting each `StreamInfo` includes: - `StreamType` carrying the value "PROPRIETARY"; - `streamId` globally unique stream identifier; - `VsDataContainer` (see clause 4.3.9 of 3GPP TS 28.622 [11]) providing the details about the data being reported.
status	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail because of a specified or unspecified reason.

11.5.1.4.4 Exceptions

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

11.5.1.5 deleteStream operation (M)

11.5.1.5.1 Definition

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

11.5.1.5.2 Input parameters

Parameter Name	S	Information type	Comment
connectionId	M	See clause 11.5.1.1.3	It identifies the streaming connection from which the reporting streams are being removed. The format may have dependency on the solution set.
streamIdList	M	List of stream identifiers	This parameter contains the list of identifiers for streams being removed from the already established connection. For streaming trace reporting Trace Reference (see clause 5.6 of 3GPP TS 32.422 [38]) is used as stream identifier. For streaming performance data reporting `streamId` globally unique stream identifier. For streaming analytics reporting `streamId` globally unique stream identifier. For proprietary data streaming reporting `streamId` globally unique stream identifier.

11.5.1.5.3 Output parameters

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

11.5.1.5.4 Exceptions

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

11.5.1.6 getConnectionInfo operation (M)

11.5.1.6.1 Definition

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

11.5.1.6.2 Input parameters

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

11.5.1.6.3 Output parameters

Parameter Name	S	Matching Information	Comment
connectionInfoList	M	List of <connectionId, streamReporter, streamIdList> tuples	This parameter contains the list of meta-data about each streaming connection requested by this operation. Each entry in this list is a tuple of connectionId, streamReporter and streamIdList. For streaming trace reporting: - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId; - streamIdList is the list of Trace References (see clause 5.6 of 3GPP TS 32.422 [38]) used as stream identifiers. For streaming performance data reporting: - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId; - streamIdList is the list of streamId globally unique stream identifiers. For streaming analytics reporting: - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId; - streamIdList is the list of streamId globally unique stream identifiers. For streaming proprietary data reporting: - streamReporter is the identity of the streaming data reporting MnS producer reporting data for this connectionId; - streamIdList is the list of streamId globally unique stream identifiers.
status	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail because of a specified or unspecified reason.

11.5.1.6.4 Exceptions

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

11.5.1.7 getStreamInfo operation (M)

11.5.1.7.1 Definition

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

11.5.1.7.2 Input parameters

Parameter Name	S	Information type	Comment
streamIdList	M	List of stream identifiers	This parameter contains the list of stream identifiers for which the stream information is to be returned. The empty list indicates the stream information for all streams are to be returned. For streaming trace reporting Trace Reference (see clause 5.6 of 3GPP TS 32.422 [38]) is used as stream identifier. For streaming performance data reporting streamId globally unique stream identifier. For streaming analytics reporting streamId globally unique stream identifier. For proprietary data streaming reporting streamId globally unique stream identifier.

11.5.1.7.3 Output parameters

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

11.5.1.7.4 Exceptions

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

11.6 File data reporting service

11.6.1 Operations and notifications

11.6.1.1 Notification notifyFileReady

11.6.1.1.1 Definition

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

The "objectClass" and "objectInstance" parameters of the notification header identify the object representing the function (process) making the file available for retrieval, such as the "PerfMetricJob" or the "TraceJob" defined in TS 28.622 [11]. When no dedicated object is standardized or instantiated, the "ManagedElement", where the file is

processed, shall be used. For the case that the file is processed on a mangement node, the "ManagementNode", where the file is processed, shall be used instead.

11.6.1.1.2 Input parameters

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

Parameter Name	S	Information Type	Comment
additionalText	O	--	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]

11.6.1.2 Notification notifyFilePreparationError

11.6.1.2.1 Definition

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

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

11.6.1.2.2 Input parameters

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

11.6.1.3 Operation subscribe

11.6.1.3.1 Definition

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

11.6.1.3.2 Input parameters

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

11.6.1.3.3 Output parameters

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

11.6.1.3.4 Exceptions

Name	Definition
operation_failed_existing_subscription	**Condition:** The subscription is duplicated or conflict with existing subscription(s) **Returned Information:** The output parameter status
operation_failed	**Condition:** The operation failed for any other reason than being duplicated or conflict with subscription(s) **Returned Information:** The output parameter status

11.6.1.4 Operation unsubscribe

11.6.1.4.1 Definition

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

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

11.6.1.4.2 Input parameters

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

11.6.1.4.3 Output parameters

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

11.6.1.4.4 Exceptions

Name	Definition
operation_failed	**Condition:** the operation is failed **Returned Information:** The output parameter status

11.6.1.5 Operation listAvailableFiles

11.6.1.5.1 Definition

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

11.6.1.5.2 Input parameters

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

11.6.1.5.3 Output parameters

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

11.6.1.5.4 Exceptions

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

11.6.2 File transfer protocols

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

- SFTP;
- FTPES,
- HTTPS.

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

12 Management services – Stage 3

12.1 Generic provisioning management service

12.1.1 RESTful HTTP-based solution set

12.1.1.1 Mapping of operations

12.1.1.1.1 Introduction

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

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

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

12.1.1.1.2 Operation createMOI

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

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

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

Note 1: Void.

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

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

The message flow for creating a resource is as follows:

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

   - The target URI identifies the location of the new resource to be created.

   - The message body shall carry the complete representation of the resource to be created.

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

   - On success, "201 Created" shall be returned. The Location header shall carry the URI of the new resource and the message body the complete representation of the new resource.

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

12.1.1.1.3 Operation getMOIAttributes

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

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

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

The SS parameters "scope", "filter", "attributes" and "fields" are defined in TS 32.158 [15].

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	M
status	response status codes	n/a	n/a	M
	response body	error	ErrorResponse	O

The message flow for retrieval of one or multiple resources is as follows:

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

   - The authority and path component of the target URI identify the base resource.

   - If present, the scope query parameter identifies other resources besides the base resource.

   - The filter query parameter is applied to the set of scoped resources. Only resources passing the filter criteria are targeted.

   - The attributes and fields query parameters identify the attributes and sub-attributes to be returned.

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

   - On success, "200 OK" shall be returned. The response message body is constructed according to the hierarchical response construction method (TS 32.158 [15]).

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

12.1.1.1.4 Operation modifyMOIAttributes

12.1.1.1.4.1 Mapping to HTTP PUT

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

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

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

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

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

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

The message flow is as follows:

1. The MnS consumer sends a HTTP PUT request to the MnS producer.
   - The target URI identifies the target resource.
   - The message body shall contain the representation the target resource shall be replaced with.
2. The MnS producer sends a HTTP PUT response to the MnS consumer.
   - On success, "200 OK" or "204 No Content" shall be returned. In the former case the response carries the representation of the updated resource in the message body. In the latter case the response has no message body. A "200 OK" response including the representation of the updated resource shall be sent in case the updated representation of the resource is not identical to the representation received in the request.
   - On failure, an appropriate error code shall be returned. The response message body may provide additional error information.

12.1.1.1.4.2 Mapping to HTTP PATCH

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

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

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

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

- "application/merge-patch+json" (RFC 7396 [37]), request body type: Resource
- "application/3gpp-merge-patch+json" (TS 32.158 [15]), request body type: Resource
- "application/json-patch+json" (RFC 6902 [36]), request body type: array(object)
- "application/3gpp-json-patch+json" (TS 32.158 [15]), request body type: array(object)

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	n/a	n/a	n/a	n/a
status	response status codes	n/a	n/a	M
	response body	error	ErrorResponse	O

The message flow for modification of one or multiple resources is as follows:

1. The MnS consumer sends a HTTP PATCH request to the MnS producer.
   - The path component of the target URI identifies the base resource.
   - The message body shall contain the patch document.
2. The MnS producer sends a HTTP PATCH response to the MnS consumer.
   - On success, "200 OK" or "204 No Content" shall be returned. When "200 OK" is returned the message body shall include a representation of the updated resources constructed according to the hierarchical response construction method (TS 32.158 [15]).
   - On failure, an appropriate error code shall be returned. The response message body may provide additional error information

Note 1: Void.

12.1.1.1.5 Operation deleteMOI

This operation deletes a single resource representing a managed object instance

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

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

Note 1: Void.

Note 2: Void.

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

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

The message flow for deletion of one or multiple resources is as follows:

1. The MnS consumer sends a HTTP DELETE request to the MnS producer.
   - The authority and path components of the target URI identify the resource to be deleted.
2. The MnS producer sends a HTTP DELETE response to the MnS consumer.
   - On success "204 No Content" shall be returned.
   - On failure, an appropriate error code shall be returned. The response message body shall provide additional error information

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 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
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 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
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 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
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 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
moiChanges	request body	mOIChanges	array(MoiChange)	M

12.1.1.3 Resources

12.1.1.3.1 Resource structure

12.1.1.3.1.1 Resource structure on the MnS producer

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

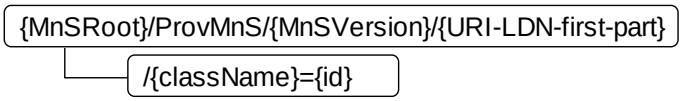


Figure 12.1.1.3.1.1-1: Resource URI structure of the Provisioning MnS on the MnS producer

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

Table 12.1.1.3.1-1: Resources and methods overview

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

12.1.1.3.1.2 Resource structure on the MnS consumer

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

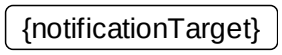


Figure 12.1.1.3.1.2-1: Resource URI structure of the Provisioning MnS on the MnS consumer

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

Table 12.1.1.3.1.2-1: Resources and methods overview

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

12.1.1.3.2 Resource definitions

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

12.1.1.3.2.1.1 Description

This resource represents a managed object instance.

12.1.1.3.2.1.2 URI

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

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

Table 12.1.1.3.2.1.2-1: URI variables

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

12.1.1.3.2.1.3 HTTP methods

12.1.1.3.2.1.3.1 HTTP PUT

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

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

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

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

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

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

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

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

12.1.1.3.2.1.3.2 HTTP GET

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

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

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

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

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

Data type	Description	S
n/a	n/a	n/a

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

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

12.1.1.3.2.1.3.3 HTTP PATCH

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

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

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

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

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

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

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

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

12.1.1.3.2.1.3.4 HTTP DELETE

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

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

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

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

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

Data type	Description	S
n/a	n/a	n/a

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

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

12.1.1.3.2.2 Void

12.1.1.3.2.3 Void

12.1.1.3.2.4 Resource "{notificationTarget}"

12.1.1.3.2.4.1 Description

This resource represents a notification target on the MnS consumer.

12.1.1.3.2.4.2 URI

Resource URI: {notificationTarget}

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

Table 12.1.1.3.2.4.2-1: URI variables

Name	Definition
notificationTarget	URI of the notification target on the MnS consumer, contained in the notification subscription

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
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
ScopeType	12.1.1.4.4.5	Scope type of a scope
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.
CorrelatedNotification	12.1.1.4.1a.3	Describes the correlated notifications of a single source
Resource	12.1.1.4.1a.1	Used for resource representations
Operation	12.1.1.4.4.6	Enum with "create", "delete" and "replace"
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.5	Used in the request body of HTTP POST for the notification type notifyMOIDeletion
NotifyMOIAttributeValueChanges	12.1.1.4.1a.5	Used in the request body of HTTP POST for the notification type notifyMOIAttributeValueChanges
NotifyMOIChanges	12.1.1.4.1a.5	Used in the request body of HTTP POST for the notification type notifyMOIChanges

Table 12.1.1.4.1-2: Data types imported

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

12.1.1.4.1a Structured data types

12.1.1.4.1a.1 Type Resource

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

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

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

12.1.1.4.1a.2 Type Scope

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

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

12.1.1.4.1a.3 Type CorrelatedNotification

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

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

12.1.1.4.1a.4 Type MoiChange

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

Attribute name	Data type	Description	S
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
correlatedNotifications	array(CorrelatedNotification)	Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4]	O
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O
sourceIndicator	SourceIndicator	Indicates the source of the operation that led to the generation of this notification.	O
op	Operation	Operation associated to the reported change ("add", "remove , "replace")	M
path	string	URI path component segments specifying when appended to "href" the created, deleted or updated resource or secondary resource	M
value	any type	New value of the created or updated resource or secondary resource. Optional old value of the deleted resource or secondary resource	M
oldValue	any type	Old value of the updated secondary resource	O

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

The "oldValue" is an optional extension for "notifyMOIChanges" allowing to report also the old value before the replacemement of the value by the new value contained in "value".

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: add
    path: /ClassA=1
    value:
      id: 1,
      objectClass: ClassA,
      attributes:
        attrA: 123
        attrB:
          subAttrB1: ABC
          subAttrB2: 56
```

The following example reports the deletion of an object.

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: remove
    path: /ClassA=1
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: add
    path: /ClassA=1#/attributes/attrC
    value: XYZ
```

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

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

```
...
moiChanges
  - notificationId: 123456789
    op: remove
    path: /ClassA=1#/attributes/attrC
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrA
    value: 456
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrA
    value: 456
    oldValue: 123
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrB
    value:
      subAttrB1: DEF
      subAttrB2: 78
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrA
    value: 456
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrB
    value:
      subAttrB1: DEF
      subAttrB2: 78
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrB
    value:
      subAttrB1: DEF
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrA/subAttrB1
    value: DEF
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: add
    path: /ClassA=1#/attributes/attrD
    value:
      - 1
      - 2
      - 3
```

Its deletion is reported by the following notification.

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: remove
    path: /ClassA=1#/attributes/attrD
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: add
    path: /ClassA=1#/attributes/attrD
    value:
      - 11
      - 21
      - 31
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrD/1
    value: 22
```

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

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

```
[{subItemE1: 11, subItemD2: ABC}, {subItemE1: 21, subItemE2: DEF}, {subItemE1: 31, subItemE2": GHI}.
```

A value change to

```
[{subItemE1: 11, subItemE2: ABC}, {subItemE1: 21, subItemE2: XYZ}, {subItemE1: 31, subItemE2": GHI}.
```

is reported by

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrE/1/subItemE2
    value: XYZ
```

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

```
attrE:
  11:
    subItemE2: ABC
  21:
    subItemE2: DEF
  31:
    subItemE2: GHI
```

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

```
href: https://example.com/3gpp
...
moiChanges
  - notificationId: 123456789
    op: replace
    path: /ClassA=1#/attributes/attrE/21/subItemD2
    value: XYZ
```

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

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

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

12.1.1.4.1a.8 Type NotifyMoiChanges

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

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

12.1.1.4.2 Void

12.1.1.4.3 Void

12.1.1.4.4 Simple data types and enumerations

12.1.1.4.4.1 General

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

12.1.1.4.4.2 Simple data types

Table 12.1.1.4.3.2-1: Simple data types

Type name	Type definition	Description
n/a	n/a	n/a

12.1.1.4.4.3 Enumeration CmNotificationTypes

Table 12.1.1.4.4.3-1: Enumeration CmNotificationTypes

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

12.1.1.4.4.4 Enumeration SourceIndicator

Table 12.1.1.4.4.4-1: Enumeration SourceIndicator

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

12.1.1.4.4.5 Enumeration ScopeType

Table 12.1.1.4.4.4.1-1: Enumeration ScopeType

Enumeration value	Description
BASE_ONLY	Selects only the base resource. The "scopeLevel" parameter shall be absent or ignored if present.
BASE_ALL	Selects the base resource and all of its subordinate resources (incl. the leaf resources). The "scopeLevel" parameter shall be absent or ignored if present.
BASE_NTH_LEVEL	Selects all resources on the level, which is indicated by the "scopeLevel" parameter, below the base resource. The base resource is at "scopeLevel" zero.
BASE_SUBTREE	Selects the base resource and all of its subordinate resources down to and including the resources on the level indicated by the "scopeLevel" parameter. The base resource is at "scopeLevel" zero.

12.1.1.4.4.6 Enumeration Operation

Table 12.1.1.4.4.4.6-1: Enumeration Operation

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

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

12.1.2.1 Mapping of operations

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

12.1.2.2 Mapping of notifications

12.1.2.2.1 Introduction

12.1.2.2.1.1 General

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

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

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

12.1.2.2.1.2 Void

12.1.2.2.2 Notification notifyMOICreation

See clause 12.1.1.2.2..

12.1.2.2.3 Notification notifyMOIDeletion

See clause 12.1.1.2.3.

12.1.2.2.4 Notification notifyMOIAttributeValueChange

See clause 12.1.1.2.4.

12.1.2.2.5 Notification notifyMOIChanges

See clause 12.1.1.2.5.

12.1.2.3 Resources

12.1.2.3.1 Resource structure

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

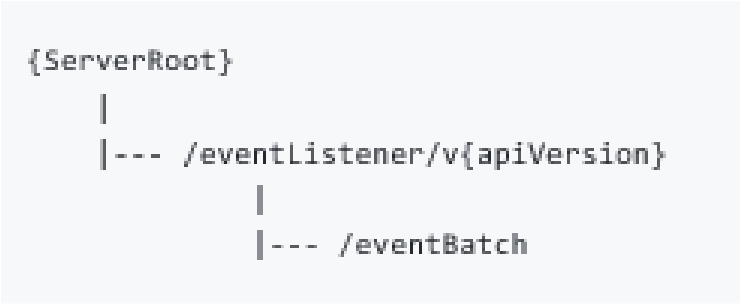


Figure 12.1.2.3.1-1: Resource URI structure of the provisioning MnS for integration with ONAP VES Event Listener 7.1.1 (Resource structure section) [45]

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 wilt the XML elements representing the to be created MOI and its key.
attributeListIn	config	M	The key leaf, the “attributes container” and leaf, leaf-list or list entries of YANG models representing the attributes.

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

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

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

Examples

Create `ManagedElement=myNode, GNBDUFunction=1`

```
<rpc message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <default-operation>none</default-operation>
    <config>
      < ManagedElement>
        <id>myNode</id>
        <GNBDUFunction operation=”create”>
          <id>1</id>
          <attributes>
            <gNBIdLength>25</gNBIdLength>
            <gNBId>357</gNBId>
            <priorityLabel>1</priorityLabel>
            <gNBDUName>du-south-1</gNBDUName>
            <!-- other attributes --->
          </attributes>
        </GNBDUFunction>
      </ManagedElement>
    </config>
  </edit-config>
</rpc>

<!-- createMO Response -->
<rpc-reply message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <ok/>
</rpc-reply>
```

12.1.3.1.3 Operation `getMOIAttributes`

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

The IS operation patameters `baseObjectInstance`, `(3GPP-)filter`, `scope`, `level` and `attributeListIn` are all combined and mapped into the Netconf-filter element. The scopes `BASE_ONLY` and `BASE_ALL` can be mapped to both subtree and Xpath filtering. The scopes `BASE_NTH_LEVEL` and `BASE_SUBTREE` can only be mapped to Xpath filtering.

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

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

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

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

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

If scope is ***BASE_ONLY*** the <get> shall be directed against the "attributes" container of the baseObjectInstance.

Example 1

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

```
<rpc message-id="101"
      xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
   <get-config>
     <source>
       <running/>
     </source>
     <filter type="subtree">
       <ManagedElement>
           <id>myNode</id>
       <attributes/>
       </ManagedElement>
     </filter>
   </get-config>
 </rpc>
```

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

Example 2

A `getMOIAttributes` for base object `ManagedElement=myNode, scope = BASE_ALL, filter=, MeasurementControl.pMAdministrativeState=UNLOCKED, attributesListIn=empty`.

```
    <rpc message-id="101"
         xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
      <get>
        <source>
          <running/>
        </source>
        <filter type="subtree">
          <ManagedElement>
            <id>myNode</id>
         <MeasurementControl>
          <pMAdministrativeState>
             UNLOCKED
          </pMAdministrativeState>
         </MeasurementControl>
          </ManagedElement>
        </filter>
      </get>
    </rpc>
```

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

Example 3

A `getMOIAttributes` for base object `ManagedElement=me1, scope = BASE_ SUBTREE, level=2, filter=none, attributesListIn=empty`.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <source>
      <running/>
    </source>
  <filter type="xpath"
     select="/me3gpp:ManagedElement[id='me1']/attributes |
        /me3gpp:ManagedElement[id='me1']/*/attributes |
        /me3gpp:ManagedElement[id='me1']/*/*/attributes"  />
  </get>
</rpc>
```

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

Example 4

A `getMOIAttributes` for base object `ManagedElement=myNode, scope = BASE_NTH_LEVEL, level=2, filter=none, attributesListIn=empty`.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <source>
      <running/>
    </source>
  <filter type="xpath"
     select="/me3gpp:ManagedElement[id='me1']/*/*/attributes"/>
  </get>
</rpc>
```

12.1.3.1.4 Operation `modifyMOIAttributes`

This IS operation modifies one or multiple managed object instances. It is mapped to the NETCONF <edit-config> operation. The NETCONF <edit-config> operation can modify attributes in a given MOI or set of MOIs but only

indirectly supports scope or filtered sets of MOIs that are part of the modifyMOIAttributes 3GPP operation specification. <edit-config> needs a config block, containing the explicit config changes to be made for each MOI.

The default-operation parameter should be set to none.

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

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

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

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

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

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

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

12.1.3.1.5 Operation `deleteMOI`

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

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

The default-operation parameter should be set to none.

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

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

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

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

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

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

12.1.3.2 Mapping of notifications

12.1.3.2.1 Introduction

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

12.1.3.2.2 Notification notifyMOICreation

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

12.1.3.2.3 Notification notifyMOIDeletion

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

12.1.3.2.4 Notification notifyMOIAttributeValueChange

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

12.1.3.2.5 Notification notifyMOIChanges

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

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

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

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

  - The "path" includes the YANG module name.

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

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

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

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

- YANG default values shall be handled as follows:

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

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

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

Case 1: Creation of an MOI is reported with:

- operation: add
- path: YANG resource identifier pointing to the list entry representing the MOI
- value: a complete MOI representation, represented by the "id" node and the "attributes" container but exluding the list entry itself encoded according to RFC7951 [50].

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

```
href: node1.lichtenberg.de
…
notificationId: 123456001
path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:PerfMetricJob=job1"
operation: add
value:
  id: job1
  3gpp-common-measurements:PerfMetricJob:attributes:
    jobId: 9865
    fileReportingPeriod: 30
```

Case 2: Deletion of an MOI is reported with:

- operation: remove
- path: YANG resource identifier pointing to the list entry representing the MOI
- value: not present

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

```
href: node1.charlottenburg.de
…
notificationId: 123456002
path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:PerfMetricJob=job1"
operation: remove
```

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

- operation: add.
- path: YANG resource identifier pointing to the leaf/leaf-list/container/list representing the attribute. If the attribute is represented by a list or leaf-list, then for this last data node the equal sign, the key value(s) or leaf-list value is omitted, only the list/leaf-list name shall be present.
- value: the content of the leaf/leaf-list entry(s)/container/list entry(s) representing the created attribute encoded according to RFC7951 [50]. In case of attribute represented by a container/list the child data nodes are encoded only,the container/list itself is not.

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

```
href: node1.spandau.de
…
notificationId: 123456003
path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:PerfMetricJob=job1/attributes/performanceMetrics"
operation: add
value:
```

```
- inOctets
- inPackets
- outPackets
```

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

- operation: remove.
- path: Same as in case 3.
- value: not present.

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

```
href: node1.pankow.de
…
notificationId: 123456004
path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:PerfMetricJob=job1/attributes/performanceMetrics"
operation: remove
```

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

- operation: replace.
- path: Same as in case 3.
- value: Same as in case 3.

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

- operation: add/
- path: YANG resource identifier pointing to a leaf-list/list entry representing an attribute element(value). In case of adding a new element to an attribute with the property isOrdered=True the new element/value is inserted before the pointed element(value), unless the "insert" subparameter specifies differently.
- value: the leaf-list/list entry representing the new attribute value encoded according to RFC7951 [50]. In case of a list the child data nodes are encoded the list-entry itself is not.
- insert: an additional input subparameter is added to the moiChange input parameter. This indicates whether the new element/value was added before or after the element/value specified in path. The subparameter is only valid in case of attributes with the property isOrdered=True. It can take the values "before", "after". If missing it defaults to "before".

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

```
notificationId: 123456006
path: "/3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:PerfMetricJob=job1/attributes/performanceMetrics/performanceMetrics=outPackets"
operation: add
insert: before
value: outOctets
```

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

- operation: remove.
- path: Same as case 6.
- value: not present.

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

- operation: replace.
- path: Same as case 6.
- value: Same as case 6.

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

```
notificationId: 123456008
path: 3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:ThresholdMonitor=job1/attributes/thresholdInfoList=thr1
operation: replace
value:
- idx: thr1
  thresholdDirection: UP
  thresholdValue: '4.5'
```

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

- operation: add.
- path: YANG Resource Identifier pointing to the leaf/leaf-list/container/list representing the attribute field. If the attribute field is represented by a list or leaf-list, the field has multiplicity upper bound greater than 1, with the property isOrdered=True the new element/value is inserted before the pointed element(value), unless the "insert" subparameter specifies differently.
- value: the leaf/leaf-list/container/list representing the new attribute field values encoded according to RFC7951. In case of a list/container representing the attribute field, value shall contain only the child data nodes, but not the container/list-entry itself.
- insert: In case the field has multiplicity upper bound greater than 1 and has the property isOrdered=True, the subparameter is used similarly as in case 6.

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

```
notificationId: 123456009
path: 3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:ThresholdMonitor=job1/attributes/thresholdInfoList=thr1/hysteresis
operation: add
value: '10'
```

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

- operation: remove.
- path: Same as case 9.
- value: Not present.

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

```
notificationId: 123456010
path: 3gpp-common-managed-element:ManagedElement=node3/3gpp-common-
measurements:ThresholdMonitor=job1/attributes/thresholdInfoList=thr1/hysteresis
operation: remove
```

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

- operation: replace.
- path: Same as case 9.
- value: Same as case 9.

12.2 Generic fault supervision management service

12.2.1 RESTful HTTP-based solution set

12.2.1.1 Mapping of operations

12.2.1.1.1 Introduction

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

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

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

12.2.1.1.2 Operation getAlarmList

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

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

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

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

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

The message flow is as follows:

1. The MnS consumer sends a HTTP GET request to the MnS producer.
   - The URI identifies the "…/alarms" collection resource.
   - The querycomponent may contain three optional parameters: "alarmAckstate", "baseObjectInstance" and "filter". Absence of the query component means all alarms shall be returned.

- The request message body shall be empty.

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

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

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

12.2.1.1.3 Operation getAlarmCount

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

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

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

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

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

The message flow is as follows:

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

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

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

   - The request message body shall be empty.

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

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

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

12.2.1.1.4 Operation setComment

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

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

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

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

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

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

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

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

   - The query component shall be absent.

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

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

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

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

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

12.2.1.1.5 Operation acknowledgeAlarms

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

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

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

The perceived severity is not mapped in the present documet.

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

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

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

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

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

- The query component is absent..

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

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

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

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

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

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

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

The perceived severity is not mapped in the present document.

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

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

The message flow for acknowledging multiple alarms is as follows:

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

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

- The query component is absent.

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

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

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

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

12.2.1.1.6 Operation unacknowledgeAlarms

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

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

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

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

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

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

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

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

   - The query component is absent.

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

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

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

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

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

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

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

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

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

The message flow for unacknowledging multiple alarms is as follows:

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

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

   - The query component is absent.

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

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

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

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

12.2.1.1.7 Operation clearAlarms

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

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

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

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

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

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

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

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

   - The query component is absent.

   - The request message body contains a merge patch document. The document shall patch the "clearUserId" property, may patch the "clearSystemId" property and shall patch the "perceivedSeverity" property of the identified alarm resource represented by an "alarmRecord" object. The patch document is defined by "MergePatchClearAlarms".

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

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

   - On failure, an appropriate error code shall be returned. The response message body shall return the alarmId that did not exist or was identifying an alarm that could not be cleared together with a failure reason. The JSON document carried in the response shall comply to "FailedAlarms-Response" .

In case multiple alarms shall be cleared the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.7-3 and table 12.2.1.1.7-4.

Table 12.2.1.1.7-3: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

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

Table 12.2.1.1.7-4: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

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

The message flow for clearing multiple alarms is as follows:

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

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

   - The query component is absent..

   - The request message body contains a merge patch document. The document shall patch the "clearUserId" property, may patch the "clearSystemId" property and shall patch the "perceivedSeverity" property of the identified alarm resources . The patch document is defined by "patchClearAlarms-RequestType".

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

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

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

12.2.1.1.8 Operation subscribe

The IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.8-1 and table 12.2.1.1.8-2.

Table 12.2.1.1.8-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
consumerReference	request body	consumerReference	Uri	M
timeTick	request body	timeTick	integer	O
filter	request body	filter	Filter	O

Table 12.2.1.1.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
subscriptionId	Location header	n/a	Uri	M
status	response status codes	n/a	n/a	M
	response body	error	ErrorResponse	O

The procedure for subscribing to notifications is as follows:

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

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

   - The query component shall be absent.

   - The request message body shall carry a data structure of type "Subscription". This data structure contains filtering criteria and a consumer side URI to which the provider will subsequently send notifications about events that match the filter.

2. The MnS producer creates a new subscription for notifications related to fault management, and a resource that represents this subscription.

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

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

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

12.2.1.1.9 Operation unsubscribe

In case one subscription shall be cancelled the IS operation parameters are mapped to SS equivalents according to table 12.2.1.1.9-1 and table 12.2.1.1.9-2.

Table 12.2.1.1.9-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
consumerReference	--	--	--	--
subscriptionId	path	/subscriptions/{subscriptionId}	string	M

Table 12.2.1.1.9-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

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

The consumer reference is not mapped in the present document.

The procedure for unsubscribing from one subscription is as follows:

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

   - The URI identifies the "…/subscriptions/{subscriptionId}" subscription resource.

   - The querycomponent shall be absent.

   - The request message body shall be empty.

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

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

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

12.2.1.2 Mapping of notifications

12.2.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.2.1.2.1-1.

Table 12.2.1.2.1-1: Mapping of IS notifications to SS equivalents

IS notifications	HTTP Method	Resource URI	S
notifyNewAlarm	POST	{notificationTarget}	M
notifyAckStateChanged	POST	{notificationTarget}	M
notifyClearedAlarm	POST	{notificationTarget}	M
notifyAlarmListRebuilt	POST	{notificationTarget}	M
notifyChangedAlarm	POST	{notificationTarget}	M
notifyComments	POST	{notificationTarget}	M
notifyPotentialFaultyAlarmList	POST	{notificationTarget}	M
notifyCorrelatedNotificationChanged	POST	{notificationTarget}	M
notifyChangedAlarmGeneral	POST	{notificationTarget}	O

12.2.1.2.2 Notification notifyNewAlarm (non-security alarm)

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.2-1.

Table 12.2.1.2.2-1: Mapping of IS notification parameters to SS equivalents

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass, 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, 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,	request body	href	Uri	M

objectInstance				
notificationId	request body	notificationId	NotificationId	M
notificationType	request body	notificationType	NotificationType	M
eventTime	request body	eventTime	DateTime	M
systemDN	request body	systemDN	SystemDN	M
alarmId	request body	alarmId	AlarmId-	M
alarmType	request body	alarmType	AlarmType	M
probableCause	request body	probableCause	ProbableCause	M
perceivedSeverity	request body	perceivedSeverity	PerceivedSeverity	M
ackState	request body	ackState	AckState	M
ackUserId	request body	ackUserId	string	M
ackSystemId	request body	ackSystemId	string	O

12.2.1.2.5 Notification notifyClearedAlarm

The IS notification parameters are mapped to SS equivalents according to table 12.2.1.2.5-1.

Table 12.2.1.2.5-1: Mapping of IS notification parameters to SS equivalents

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass, 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 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, 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, 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, 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, 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
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, 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	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, 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	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.

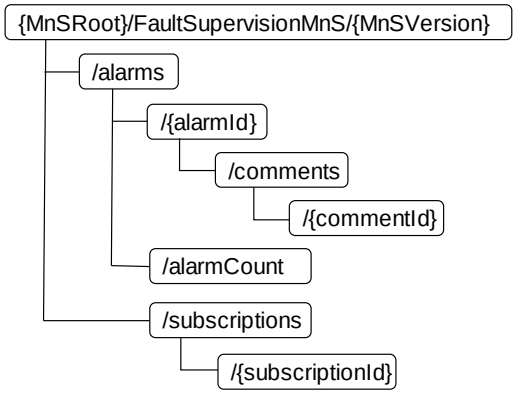


Figure 12.2.1.3.1-1: Resource URI structure of the Fault Supervision MnS on the MnS producer

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

Table 12.2.1.3.1.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Description
Alarms	.../alarms	GET	Retrieve all alarms or a filtered subset
		PATCH	Clear, acknowledge or unacknowledge multiple alarms
Alarm Count	.../alarms/alarmCount	GET	Retrieve the alarm count per perceived severity
Alarm	.../alarms/{alarmId}	PATCH	Clear, acknowledge or unacknowledge an alarm
Comments	.../alarms/{alarmId}/comments	POST	Add a comment to an alarm
Subscriptions	.../subscriptions	POST	Create a subscription
Subscription	.../subscriptions/{subscriptionId}	DELETE	Delete a subscription

12.2.1.3.1.2 Resource structure on the MnS consumer

Figure 12.2.1.3.1.2-1 shows the resource structure of the Fault Supervision MnS on the MnS consumer.

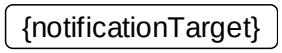


Figure 12.2.1.3.1.2-1: Resource URI structure of the Fault Supervision MnS on the MnS consumer

Table 12.2.1.3.1.2-1 provides an overview of the resources and applicable HTTP methods.

Table 12.2.1.3.1.2-1: Resources and methods overview

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

12.2.1.3.2 Resource definitions

12.2.1.3.2.1 Resource "…/alarms"

12.2.1.3.2.1.1 Description

This resource represents a collection of alarms.

12.2.1.3.2.1.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms

The resource URI variables are defined in table 12.2.1.3.2.1.2-1.

Table 12.2.1.3.2.1.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]

12.2.1.3.2.1.3 HTTP methods

12.2.1.3.2.1.3.1 HTTP GET

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

Table 12.2.1.3.2.1.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
alarmAckState	AlarmAckState		O
href	Dn		O
filter	string		O

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

Table 12.2.1.3.2.1.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.2.1.3.2.1.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
GetAlarmsResponse	200 OK	The alarms returned.	M
ErrorResponse	4xx/5xx	Returned in case of an error	O

12.2.1.3.2.1.3.2 Void

12.2.1.3.2.1.3.3 HTTP PATCH

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

Table 12.2.1.3.2.1.3.3-1: URI query parameters supported by the PATCH method on this resource

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

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

Table 12.2.1.3.2.1.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	Description	S
map(MergePatchAcknowledgeAlarm)	Patch document for acknowledging one or multiple alarms	M
map(MergePatchClearAlarm)	Patch document for clearing one or multiple alarms	M

Table 12.2.1.3.2.1.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	Response codes	Description	S
n/a	204 No Content	In case of success the response body shall be empty.	M
ErrorResponse	4xx/5xx	In case of failure, the response body shall be described by "ErrorResponse".	M

12.2.1.3.2.2 Resource "…/alarms /{alarmId}"

12.2.1.3.2.2.1 Description

This resource represents an alarm.

12.2.1.3.2.2.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/{alarmId}

The resource URI variables are defined in table 12.2.1.3.2.2.2-1.

Table 12.2.1.3.2.2.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
alarmId	Alarm identifier

12.2.1.3.2.2.3 HTTP methods

12.2.1.3.2.2.3.1 HTTP PATCH

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

Table 12.2.1.3.2.2.3.1-1: URI query parameters supported by the PATCH method on this resource

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

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

Table 12.2.1.3.2.2.3.1-2: Data structures supported by the PATCH Request Body on this resource

Data type	Description	S
MergePatchAcknowledgeAlarm	Patch document for acknowledging an alarm	M
MergePatchClearAlarm	Patch document for clearing an alarm	M

Table 12.2.1.3.2.2.3.1-3: Data structures supported by the PATCH Response Body on this resource

Data type	Response codes	Description	S
n/a	200 OK	In case of success the response body shall be empty.	
ErrorResponse	4xx/5xx	In case of failure, the response body shall carry a JSON object described by "ErrorResponse".	

12.2.1.3.2.3 Resource "…/alarms/alarmCount"

12.2.1.3.2.3.1 Definition

This resource holds metadata about the /alarms collection resource like the alarm count per perceived severity.

12.2.1.3.2.3.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/alarmCount

The resource URI variables are defined in table 12.2.1.3.2.3.2-1.

Table 12.2.1.3.2.3.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]

12.2.1.3.2.3.3 HTTP methods

12.2.1.3.2.3.3.1 GET

This method shall support the URI query parameters specified in table 12.2.1.3.2.3.3.1-1.

Table 12.2.1.3.2.3.3.3-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
alarmAckState	AlarmAckState	Allows to control which alarms are counted based on acknowledgement state	O
filter	string	Allows to control which alarms are counted based on a general filter applied to the alarm records.	O

This method shall support the request data structures specified in table 12.2.1.3.2.3.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.3.3.1-3.

Table 12.2.1.3.2.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.2.1.3.2.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
AlarmsCount	200 OK	The alarm count per severity level returned.	M
ErrorResponse	4xx/5xx	Returned in case of an error	O

12.2.1.3.2.4 Resource "…/alarms/{alarmId}/comments"

12.2.1.3.2.4.1 Definition

This resource is a collection resource for comments attached to an alarm.

12.2.1.3.2.4.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/{alarmId}/comments

The resource URI variables are defined in table 12.2.1.3.2.4.2-1.

Table 12.2.1.3.2.4.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
alarmId	Alarm identifier

12.2.1.3.2.4.3 HTTP methods

12.2.1.3.2.4.3.1 POST

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

Table 12.2.1.3.2.4.3.1-1: URI query parameters supported by the POST method on this resource

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

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

Table 12.2.1.3.2.4.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	Description	S
Comment	The representation of the comment to be added to an alarm.	M

Table 12.2.1.3.2.4.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
Comment	201 Created	In case of success, the response body shall carry the representation of a comment. The "commentTime" shall be set by the MnS producer.	M
ErrorResponse	4xx/5xx	In case of failure, the response body shall be described by "ErrorResponse".	M

12.2.1.3.2.5 Resource "…/comments/{commentId}"

12.2.1.3.2.5.1 Definition

This resource represents a comment attached to an alarm.

12.2.1.3.2.5.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/alarms/{alarmId}/comments/{commentId}

The resource URI variables are defined in table 12.2.1.3.2.4.5-1.

Table 12.2.1.3.2.4.5-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
alarmId	Alarm identifier
commentId	Comment identifier

12.2.1.3.2.5.3 HTTP methods

None.

12.2.1.3.2.6 Resource "…/subscriptions"

12.2.1.3.2.6.1 Description

This resource is a container resource for individual subscriptions.

12.2.1.3.2.6.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/subscriptions

The resource URI variables are defined in table 12.2.1.3.2.6.2-1.

Table 12.2.1.3.2.6.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]

12.2.1.3.2.6.3 HTTP methods

12.2.1.3.2.6.3.1 POST

This method shall support the URI query parameters specified in table 12.2.1.3.2.6.3.1-1.

Table 12.2.1.3.2.6.3.1-1: URI query parameters supported by the POST method on this resource

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

This method shall support the request data structures specified in table 12.2.1.3.2.6.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.6.3.1-3.

Table 12.2.1.3.2.6.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	Description	S
Subscription	Details of the subscription to be created	M

Table 12.2.1.3.2.6.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
Subscription	201 Created	In case of success the representation of the created subscription is returned.	M
ErrorResponse	4xx/5xx	In case of failure the error object is returned.	M

12.2.1.3.2.6.3.2 Void

12.2.1.3.2.7 Resource "…/subscriptions/{subscriptionId}"

12.2.1.3.2.7.1 Description

This resource represents a subscription.

12.2.1.3.2.7.2 URI

Resource URI: {MnSRoot}/FaultSupervisionMnS/{MnSVersion}/ subscriptions/{subscriptionId}

The resource URI variables are defined in table 12.2.1.3.2.7.2-1.

Table 12.2.1.3.2.7.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
subscriptionId	Subscription identifier

12.2.1.3.2.7.3 HTTP methods

12.2.1.3.2.7.3.1 DELETE

This method shall support the URI query parameters specified in table 12.2.1.3.2.7.3.1-1.

Table 12.2.1.3.2.7.3.1-1: URI query parameters supported by the DELETE method on this resource

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

This method shall support the request data structures specified in table 12.2.1.3.2.7.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.7.3.1-3.

Table 12.2.1.3.2.7.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.2.1.3.2.7.3.1-3: Data structures supported by the DELETE Response Body on this resource

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

12.2.1.3.2.8 Resource "{notificationTarget}"

12.2.1.3.2.8.1 Description

This resource represents a notification target on the MnS consumer.

12.2.1.3.2.8.2 URI

Resource URI: {notificationTarget}

The resource URI variables are defined in table 12.2.1.3.2.8.2-1.

Table 12.2.1.3.2.8.2-1: URI variables

Name	Definition
notificationTarget	URI of the notification target on the MnS consumer, contained in the notification subscription

12.2.1.3.2.8.3 HTTP methods

12.2.1.3.2.8.3.1 POST

This method shall support the URI query parameters specified in table 12.2.1.3.2.8.3.1-1.

Table 12.2.1.3.2.8.3.1-1: URI query parameters supported by the POST method on this resource

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

This method shall support the request data structures specified in table 12.2.1.3.2.8.3.1-2 and the response data structures and response codes specified in table 12.2.1.3.2.8.3.1-3.

Table 12.2.1.3.2.8.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	Description	S
NotifyNewAlarm	Type for a notifyNewAlarm notification (non-security alarm)	M
NotifyNewSecAlarm	Type for a notifyNewAlarm notification (security alarm)	M
NotifyAckStateChanged	Type for a notifyAckStateChanged notification	M
NotifyClearedAlarm	Type for a notifyClearedAlarm notification	M
NotifyAlarmListRebuilt	Type for a notifyAlarmListRebuilt notification	M
NotifyChangedAlarm	Type for a notifyChangedAlarm notification	M
NotifyComments	Type for a notifyComments notification	M
NotifyPotentialFaultyAlarmList	Type for a notifyPotentialFaultyAlarmList notification	M
NotifyCorrelatedNotificationChanged	Type for a notifyCorrelatedNotificationChanged notification	M
NotifyChangedAlarmGeneral	Type for a notifyChangedAlarmGeneral notification (non-security alarm)	M
NotifyChangedSecAlarmGeneral	Type for a notifyChangedAlarmGeneral notification (security alarm)	M

Table 12.2.1.3.2.8.3.1-3: Data structures supported by the POST Response Body on this resource

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

12.2.1.4 Data type definitions

12.2.1.4.1 General

This clause defines the data types used by the Fault Supervision MnS. Table 12.2.1.4.1-1 specifies the data types defined in the present document and table 12.2.1.4.1-2 the data types imported.

Table 12.2.1.4.1-1: Data types defined in the present document

Data type	Reference	Description
AlarmAckState	12.2.1.4.3.4	Used in the query part of HTTP GET on /alarms to discriminate alarms to be returned or counted
AlarmId	12.2.1.4.4.2	Alarm identifier, see clause 11.2.2.1.5.1
AlarmType	12.2.1.4.4.6	Alarm type as defined in ITU-T Rec. X. 733 [4]
ProbableCause	12.2.1.4.4.7	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]
PerceivedSeverity	12.2.1.4.4.9	Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4]
TrendIndication	12.2.1.4.4.10	Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4]
ThresholdHysteresis	12.2.1.4.1a.1	Used in the definition of ThresholdInfo as defined in ITU-T Rec. X. 733 [4]
ThresholdLevelInd	12.2.1.4.1a.2	Used in the definition of ThresholdInfo as defined in ITU-T Rec. X. 733 [4]
ThresholdInfo	12.2.1.4.1a.3	Provides information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4]
CorrelatedNotification	12.2.1.4.1a.4	Describes the correlated notifications of a single source
AckState	12.2.1.4.4.4	Acknowledgement state, see clause 11.2.2.1.5.1
AlarmNotificationTypes	12.2.1.4.4.8	Alarm notification types (notifyNewAlarm, etc.)
AlarmListAlignmentRequirement	12.2.1.4.4.5	Indicating if alarm list alignment is required or not
AlarmRecord	12.2.1.4.1a.5	Representation of an alarm resource
AlarmCount	12.2.1.4.1a.6	Representation of an alarmCout resource
Comment	12.2.1.4.1a.7	Representation of a comment resource
Subscription	12.2.1.4.1a.8	Representation of a subscription resource
MergePatchAcknowledgeAlarm	12.2.1.4.1a.9	Used in the request message body of HTTP PATCH to acknowledge or unacknowledge an alarm
MergePatchClearAlarm	12.2.1.4.1a.10	Used in the request body of HTTP PATCH to clear an alarm
FailedAlarm	12.2.1.4.1a.11	Used in the response body of multiple HTTP methods to indicate error reasons per alarm id
NotifyNewAlarm	12.2.1.4.1a.12	Used in the request body of HTTP POST for the notification type notifyNewAlarm
NotifyNewSecAlarm	12.2.1.4.1a.13	Used in the request body of HTTP POST for the notification type notifyNewAlarm
NotifyClearedAlarm	12.2.1.4.1a.14	Used in the request body of HTTP POST for the notification type notifyClearedAlarm
NotifyChangedAlarm	12.2.1.4.1a.15	Used in the request body of HTTP POST for the notification type notifyChangedAlarm
NotifyChangedAlarmGeneral	12.2.1.4.1a.16	Used in the request body of HTTP POST for the notification type notifyChangedAlarmGeneral
NotifyChangedSecAlarmGeneral	12.2.1.4.1a.17	Used in the request body of HTTP POST for the notification type notifyChangedAlarmGeneral
NotifyCorrelatedNotificationChanged	12.2.1.4.1a.18	Used in the request body of HTTP POST for the notification type notifyCorrelatedNotificationChanged
NotifyAckStateChanged	12.2.1.4.1a.19	Used in the request body of HTTP POST for the notification type notifyAckStateChanged
NotifyComments	12.2.1.4.1a.20	Used in the request body of HTTP POST for the notification type notifyComments
NotifyPotentialFaultyAlarmList	12.2.1.4.1a.21	Used in the request body of HTTP POST for the notification type notifyPotentialFaultyAlarmList
NotifyAlarmListRebuilt	12.2.1.4.1a.22	Used in the request body of HTTP POST for the notification type notifyAlarmListRebuilt

Table 12.2.1.4.1-2: Data types imported

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

12.2.1.4.1a Structured data types

12.2.1.4.1a.1 Type ThresholdHysteresis

Table 12.2.1.4.1a.1-1: Definition of type ThresholdHysteresis

Attribute name	Data type	Description	S
high	oneOf(integer, Float)	Higher value of a threshold with hysteris, the integer type is used for counter thresholds and the float type for gauge thresholds.	M
low	Float	Lower value of a threshold with hysteresis, applicable only to gauge thresholds.	M

12.2.1.4.1a.2 Type ThresholdLevelInd

Table 12.2.1.4.1a.2-1: Definition of type ThresholdLevelInd

Attribute name (choice)	Data type	Description	S
up	ThresholdHysteresis	Indicates for counter and gauge thresholds that the threshold crossing occurred when going up.	M
down	ThresholdHysteresis	Indicates for gauge thresholds that the threshold crossing occurred when going down, applicable only to gauge thresholds.	M

12.2.1.4.1a.3 Type ThresholdInfo

Table 12.2.1.4.1a.3-1: Definition of type ThresholdInfo

Attribute name	Data type	Description	S
observedMeasurement	string	The name of the monitored measurement that crossed the threshold and that caused the notification (Rec. ITU-T X. 733 [4]).	M
observedValue	oneOf(integer, Float)	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. The integer type is used for counters and the float type for gauges (Rec. ITU-T X. 733 [4]).	M
thresholdLevel	ThresholdLevelInd	In the case of a gauge the threshold level specifies a pair of threshold values, the first being the value of the crossed threshold and the second, its corresponding hysteresis; in the case of a counter the threshold level specifies only the threshold value (Rec. ITU-T X. 733 [4]).	O
armTime	DateTime	For a gauge threshold, the time at which the threshold was last re-armed, namely the time after the previous threshold crossing at which the hysteresis value of the threshold was exceeded thus again permitting generation of notifications when the threshold is crossed. For a counter threshold, the later of the time at which the threshold offset was last applied, or the time at which the counter was last initialized (for resettable counters) (Rec. ITU-T X. 733 [4]).	O

12.2.1.4.1a.4 Type CorrelatedNotification

Table 12.2.1.4.1a.4-1: Definition of type CorrelatedNotification

Attribute name	Data type	Description	S
sourceObjectInstance	Dn	Source oject instance of the notifications identified by notificationIds. The sourceObjectInstance shall be present if the sourceObjectInstance is not identical to the alarmed objectInstance of the alarmRecord	O
notificationIds	array(NotificationId)	Notification identifiers of notifications related to the sourceObjectInstance that are considered to be correlated to the alarmRecord	M

12.2.1.4.1a.5 Type AlarmRecord

Table 12.2.1.4.1a.5-1: Definition of type AlarmRecord

Attribute name	Data type	Description	S
alarmId	key(AlarmId)	Alarm identifier, see clause 11.2.2.1.5.1. The alarmId is used as key in alarm record maps.	M
objectInstance	Dn	Alarmed object instance	M
notificationId	NotificationId	Notification identifier of the last notifyNewAlarm, notifyChangedAlarm or notifyClearedAlarm	M
alarmRaisedTime	DateTime	Date and time the alarm was raised the first time, see clause 11.2.2.1.5.1	M
alarmChangedTime	DateTime	Date and time the perceived severity of the alarm changed the last time, see clause 11.2.2.1.5.1	O
alarmClearedTime	DateTime	Date and time the alarm was cleared, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	M
specificProblem	oneOf(string, integer)	Refinements to the probable cause of the alarm as defined in ITU-T Rec. X. 733 [4]	O
perceivedSeverity	PerceivedSeverity	Perceived severity of the alarm as defined in ITU-T Rec. X. 733 [4]	M
backedUpStatus	boolean	Indicating if the object emitting the alarm has been backed up as defined in ITU-T Recommendation X. 733 [4]	O
backUpObject	Dn	Backup object of the alarmed object as defined in ITU-T Rec. X. 733 [4]	O
trendIndication	TrendIndication	Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4]	O
thresholdInfo	ThresholdInfo	Additional information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4]	O
correlatedNotifications	array(CorrelatedNotification)	Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4]	O
stateChangeDefinition	AttributeValueChangeSet	State transition associated to an alarm as defined in ITU-T Rec. X. 733 [4]	O
monitoredAttributes	AttributeNameValuePairSet	Attributes of the alarmed manged object and their corresponding values at the time of the alarm as defined in ITU-T Rec. X. 733 [4].	O
proposedRepairActions	string	Proposed repair action, used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4]	O
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O
additionalInformation	AttributeNameValuePairSet	Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4]	O
rootCauseIndicator	boolean	Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1	O
ackTime	DateTime	Time when the alarm has been acknowledged or unacknowledged the last time, see clause 11.2.2.1.5.1	M
ackUserId	string	Identifier of a user acknowledging an alarm, see clause 11.2.2.1.5.1	M
ackSystemId	string	Identifier of a system acknowledging an alarm, see clause 11.2.2.1.5.1	O
ackState	AckState	Acknowledgement state, see clause 11.2.2.1.5.1	M
clearUserId	string	Identifier of a system clearing an alarm, see clause 10.2.2.1.5.1	O
clearSystemId	string	Identifier of a user clearing an alarm, see clause 11.2.2.1.5.1	O
serviceUser	string	Identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm, see clause 11.2.2.1.5.1	O
serviceProvider	string	Identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm, see clause 11.2.2.1.5.1	O

securityAlarmDetector	string	Identity of the detector of the security alarm, see clause 11.2.2.1.5.1	O

12.2.1.4.1a.6 Type AlarmCount

Table 12.2.1.4.1a.6-1: Definition of type AlarmCount

Attribute name	Data type	Description	S
criticalCount	integer	Number of alarms with perceived severity equal to critical	M
majorCount	integer	Number of alarms with perceived severity equal to major	M
minorCount	integer	Number of alarms with perceived severity equal to minor	M
warningCount	integer	Number of alarms with perceived severity equal to warning	M
indeterminateCount	integer	Number of alarms with perceived severity equal to indeterminate	M
clearedCount	integer	Number of alarms with perceived severity equal to cleared	M

12.2.1.4.1a.7 Type Comment

Table 12.2.1.4.1a.7-1: Definition of type Comment

Attribute name	Data type	Description	S
commentTime	DateTime	Time when the comment has been added to the alarm.	M
commentText	string	Comment in text form	M
commentUserId	string	Identifier of the user who makes the comment	M
commentSystemId	string	Identifier of the system which makes the comment	O

12.2.1.4.1a.8 Type Subscription

Table 12.2.1.4.1a.8-1: Definition of type Subscription

Attribute name	Data type	Description	S
consumerReference	Uri	URI of the notification target on the MnS consumer	M
timeTick	integert	Time window within which the subscriber intends to subscribe again to confirm its subscription, see clause 11.2.2.2.5.1	O
filter	Filter	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A notification is sent to the subscriber if the filter matches, or if there is no filter.	O

12.2.1.4.1a.9 Type MergePatchAcknowledgeAlarm

Table 12.2.1.4.1a.9-1: Definition of type MergePatchAcknowledgeAlarm

Attribute name	Data type	Description	S
ackUserId	string	User acknowledging an alarm	M
ackSystemId	string	System acknowledging an alarm	O
ackState	AckState	Indicates the ackState shall be set to "ACKNOWLEDGED" or "UNACKNOWLEDGED"	M

12.2.1.4.1a.10 Type MergePatchClearAlarm

Table 12.2.1.4.1a.10-1: Definition of type MergePatchClearAlarm

Attribute name	Data type	Description	S
clearUserId	clearUserId	User clearing an alarm	M
clearSystemId	clearSystemId	System clearing an alarm	O
perceivedSeverity	type string, enum "CLEARED"	Indicates the perceivedSeverity shall be set to "CLEARED"	M

12.2.1.4.1a.11 Type FailedAlarm

Table 12.2.1.4.1a.11-1: Definition of type FailedAlarm

Attribute name	Data type	Description	S
alarmId	AlarmId	Indicating the alarms for which the action on the alarm could not be performed	M
failureReason	string	Indicating the reason why the action could not be performed	M

12.2.1.4.1a.12 Type NotifyNewAlarm

Table 12.2.1.4.1a.12-1: Definition of type NotifyNewAlarm

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (alarm) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyNewAlarm)	M
eventTime	DateTime	Event (alarm) occurrence time	M
systemDN	SystemDN	System DN	M
alarmId	AlarmId	Alarm identifier, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	M
specificProblem	SpecificProblem	Identifies further refinements to the Probable cause of the alarm as defined in ITU-T Rec. X. 733 [4]	O
perceivedSeverity	PerceivedSeverity	Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4]	M
backedUpStatus	boolean	Indicating if the object emitting the alarm has been backed up as defined in ITU-T Recommendation X. 733 [4]	O
backUpObject	Dn	Indicating the backup object of the alarmed object as defined in ITU-T Rec. X. 733 [4]	O
trendIndication	TrendIndication	Severity trend of the alarmed object as defined in ITU-T Rec. X. 733 [4]	O
thresholdInfo	ThresholdInfo	Provides additional information for threshold crossing alarms as defined in ITU-T Rec. X. 733 [4]	O
correlatedNotifications	array(CorrelatedNotification)	Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4]	O
stateChangeDefinition	AttributeValueChangeSet	Indicates a state transition associated to an alarm as defined in ITU-T Rec. X. 733 [4]	O
monitoredAttributes	AttributeNameValuePairSet	Defines one or more attributes of the alarmed manged object and their corresponding values at the time of the alarm as defined in ITU-T Rec. X. 733 [4].	O
proposedRepairActions	string	Used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4]	O
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O
additionalInformation	AttributeNameValuePairSet	Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4]	O
rootCauseIndicator	boolean	Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1	O

12.2.1.4.1a.13 Type NotifyNewSecAlarm

Table 12.2.1.4.1a.13-1: Definition of type NotifyNewSecAlarm

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (alarm) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyNewAlarm)	M
eventTime	DateTime	Event (alarm) occurrence time	M
systemDN	SystemDN	System DN	M
alarmId	AlarmId	Alarm identifier, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	M
perceivedSeverity	PerceivedSeverity	Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4]	M
correlatedNotifications	array(CorrelatedNotification)	Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4]	O
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O
additionalInformation	AttributeNameValuePairSet	Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4]	O
rootCauseIndicator	boolean	Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1	O
serviceUser	string	Identifies the service-user whose request for service provided by the serviceProvider led to the generation of the security alarm, see clause 11.2.2.1.5.1	M
serviceProvider	string	Identifies the service-provider whose service is requested by the serviceUser and the service request provokes the generation of the security alarm, see clause 11.2.2.1.5.1	M
securityAlarmDetector	string	Identity of the detector of the security alarm, see clause 11.2.2.1.5.1	M

12.2.1.4.1a.14 Type NotifyClearedAlarm

Table 12.2.1.4.1a.14-1: Definition of type NotifyClearedAlarm

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (alarm) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyClearedAlarm)	M
eventTime	DateTime	Event occurrence time	M
systemDN	SystemDN	System DN	M
alarmId	AlarmId	Alarm identifier, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	M
perceivedSeverity	PerceivedSeverity	Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4]	M
correlatedNotifications	array(correlatedNotification)	Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4]	O
clearUserId	string	Identifier of a user clearing an alarm, see clause 11.2.2.1.5.1	O
clearSystemId	string	Identifier of a system clearing an alarm, see clause 11.2.2.1.5.1	O

12.2.1.4.1a.15 Type NotifyChangedAlarm

Table 12.2.1.1a.14.15-1: Definition of type NotifyChangedAlarm

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (alarm) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyChangedAlarm)	M
eventTime	DateTime	Event occurrence time	M
systemDN	SystemDN	System DN	M
alarmId	AlarmId	Alarm identifier, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	M
perceivedSeverity	PerceivedSeverity	Perceived severity of an alarm as defined in ITU-T Rec. X. 733 [4]	M

12.2.1.4.1a.16 Type NotifyChangedAlarmGeneral

Table 12.2.1.4.1a.16-1: Definition of type NotifyChangedAlarmGeneral

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (alarm) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyChangedAlarmGeneral)	M
eventTime	DateTime	Event occurrence time	M
systemDN	SystemDN	System DN	M
alarmId	AlarmId	Alarm identifier, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	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 manged object and their corresponding values at the time of the alarm as defined in ITU-T Rec. X. 733 [4].	O
proposedRepairActions	string	Used if the cause is known and the system being managed can suggest one or more solutions to fix the problem causing the alarm as defined in ITU-T Rec. X. 733 [4]	O
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O
additionalInformation	AttributeNameValuePairSet	Allows the inclusion of a set of additional information in the event report as defined in ITU-T Rec. X. 733 [4]	O
rootCauseIndicator	boolean	Indicates if this event is the root cause of the events captured by the notifications whose identifiers are in the related correlatedNotifications attribute, see clause 11.2.2.1.5.1	O
changedAlarmAttributes	AttributeNameValuePairSet	Indicating the alarm attributes that have changed	O

12.2.1.4.1a.17 Type NotifyChangedSecAlarmGeneral

Table 12.2.1.4.1a.17-1: Definition of type NotifyChangedSecAlarmGeneral

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (alarm) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyChangedAlarmGeneral)	M
eventTime	DateTime	Event occurrence time	M
systemDN	SystemDN	System DN	M
alarmId	AlarmId	Alarm identifier, see clause 11.2.2.1.5.1	M
alarmType	AlarmType	Alarm type as defined in ITU-T Rec. X. 733 [4]	M
probableCause	ProbableCause	Probable cause of an alarm as defined in ITU-T Rec. X.733 [4]	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].

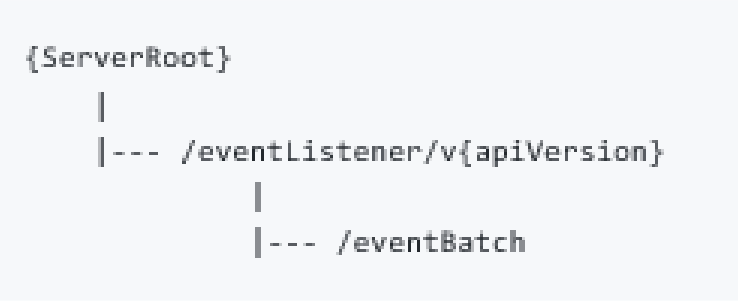


Figure 12.2.2.3.1-1: Resource URI structure of the fault supervision data report MnS for integration with ONAP VES Event Listener 7.1.1 (Resource structure section) [45]

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 XML attribute: fileFormatVersion	
senderName	XML element: fileHeader XML attribute: dnPrefix XML element: fileHeader:fileSender XML attribute: senderName	The DN of the sender is split into the DN prefix contained in "dnPrefix" and the Local DN (LDN) contained in "senderName".
senderType	XML element fileHeader:fileSender XML attribute: senderType	
vendorName	XML element fileHeader XML attribute vendorName	
collectionBeginTime	XML element: fileHeader:measData XML attribute beginTime	
measObjRootDn	XML element fileHeader XML attribute dnPrefix XML element measData:measEntity XML attribute localDn	The DN of the root object is split into the DN prefix contained in "dnPrefix" and the Local DN (LDN) contained in "localDn".

File Content Item	XML schema based XML tag	Description
measObjRootUserLabel	XML element: measData:measEntity XML attribute: userLabel	
measObjRootSwVersion	XML element: measData:measEntity XML attribute: swVersion	
measInfo	XML element measInfo	An instance of this XML element is added for each expired granularity period.
measInfoId	XML element measData:measInfo XML attribute measInfoId	
jobId	XML element measData:measInfo:job XML attribute jobId	
reportingPeriod	XML element measData:measInfo:repPeriod XML attribute duration	The XML attribute "duration" shall use the truncated representation for duration "PT*n*S" (see [28]).
granularityPeriod	XML element measData:measInfo:granPeriod XML attribute duration	The XML attribute "duration" shall use the truncated representation for duration "PT*n*S" (see [28]).
measTimeStamp	XML element measData:measInfo:granPeriod XML attribute endTime	
measTypes	XML element measData:measInfo:measTypes or XML element measData:measInfo:measType XML attribute p	Depending on sender's choice for optional positioning presence, either XML element "measTypes" or XML elements "measType" will be used.
measValues	XML element measData:measInfo:measValue	
measObjLdn	XML element measData:measInfo:measValue XML attribute measObjLdn	
measResults	XML element measData:measInfo:measValue:measResults or, when the positioning option is used, measData:measInfo:measValue:r	Depending on sender's choice for optional positioning, either XML element "measResults" or XML elements "r" is used.
suspectFlag	XML element measData:measInfo:measValue:suspect	
collectionEndTime	XML element fileFooter:measData XML attribute endTime	
There is no corresponding File Content Item.	XML element measType XML attribute p	Only for the positioning option: XML attribute "p" of XML element "measType", used to link the performance metric type specified in "measType" to the result value. Its value is a positive integer (excl. zero) and shall be unique for each instance of "measType" in a file.
There is no corresponding File Content Item.	XML element r XML attribute p	Only for the positioning option: XML attribute "p" of the XML element "r", used to link the result value in "r" to its performance metric type in "measType". The value of "p" shall match the value of the XML attribute "p" in the corresponding XML element "measType".

12.3.2.3 Void

12.3.2.3.1 Void

12.3.2.3.2 Void

12.3.2.4 XML schema

This clause specifies the XML schema that shall be used for XML files containing performance data.

Name: measData.xsd
Version: 2.0.0
Identifier: measData.xsd-v2.0.0

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
  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>
```

```
                    <element name="measType" minOccurs="0" maxOccurs="unbounded">
                      <complexType>
                        <simpleContent>
                          <extension base="Name">
                            <attribute name="p" type="positiveInteger" use="required"/>
                          </extension>
                        </simpleContent>
                      </complexType>
                    </element>
                  </choice>
                  <element name="measValue" minOccurs="0" maxOccurs="unbounded">
                    <complexType>
                      <sequence>
                        <choice>
                          <element name="measResults">
                            <simpleType>
                              <list itemType="md:measResultType"/>
                            </simpleType>
                          </element>
                          <element name="r" minOccurs="0" maxOccurs="unbounded">
                            <complexType>
                              <simpleContent>
                                <extension base="md:measResultType">
                                  <attribute name="p" type="positiveInteger" use="required"/>
                                </extension>
                              </simpleContent>
                            </complexType>
                          </element>
                        </choice>
                        <element name="suspect" type="boolean" minOccurs="0"/>
                      </sequence>
                      <attribute name="measObjLdn" type="string" use="required"/>
                    </complexType>
                  </element>
                </sequence>
                <attribute name="measInfoId" type="string" use="optional"/>
              </complexType>
            </element>
          </sequence>
        </complexType>
      </element>

      <element name="fileFooter">
        <complexType>
          <sequence>
            <element name="measData">
              <complexType>
                <attribute name="endTime" type="dateTime" use="required"/>
              </complexType>
            </element>
          </sequence>
        </complexType>
      </element>
    </sequence>
  </complexType>
</element>

<simpleType name="measResultType">
  <union memberTypes="integer float string">
    <simpleType>
      <restriction base="string">
        <enumeration value="NULL"/>
      </restriction>
    </simpleType>
  </union>
</simpleType>
</schema>
```

12.4 Heartbeat

12.4.1 RESTful HTTP-based solution set

12.4.1.1 Mapping of operations

N/A

12.4.1.2 Mapping of notifications

12.4.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.4.1.2.1-1.

Table 12.4.1.2.1-1: Mapping of IS notifications to SS equivalents

IS notifications	HTTP Method	Resource URI	S
notifyHeartbeat	POST	/notificationSink	M

12.4.1.2.2 Notification "notifyHeartbeat"

The IS notification parameters are mapped to SS equivalents according to table 12.4.1.2.2-1.

Table 12.4.1.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass objectInstance	request body	href	Uri	M
notificationId	request body	notificationId	NotificationId	M
notificationType	request body	notificationType	NotificationType (notifyHeartbeat)	M
eventTime	request body	eventTime	DateTime	M
systemDN	request body	systemDN	systemDN	M
heartbeatNtfPeriod	request body	heartbeatNtfPeriod	integer	M

12.4.1.3 Usage of HTTP

N/A.

12.4.1.4 Resources

N/A.

12.4.1.5 Data type definitions

12.4.1.5.1 General

Table 12.4.1.5.1-1: Data types defined in the present document

Data type	Reference	Description
HeartbeatNotificationTypes	12.4.1.4.2.2	Haertbeat notification types

Table 12.4.1.5.1-2: Data types imported

Data type	Reference	Description
Uri	TS 28.623 [44]	URI type
NotificationId	TS 28.623 [44]	Notification identifier as defined in ITU-T Rec. X. 733 [4]
NotificationType	TS 28.623 [44]	Notification type
DateTime	TS 28.623 [44]	Date and time
SystemDN	TS 28.623 [44]	systemDN type
NotificationHeader	TS 28.623 [44]	Notification header

12.4.1.5.2 Structured data types

None.

12.4.1.5.3 Simple data types and enumerations

12.4.1.5.3.1 General

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

12.4.1.5.3.2 Simple data types

Table 12.4.1.4.3.2-1: Simple data types

Type Name	Type Definition	Description

12.4.1.5.3.3 Enumeration HeartbeatNotificationTypes

Table 12.4.1.4.3.3-1: Enumeration HeartbeatNotificationTypes

Enumeration value	Description
notifyHeartbeat	Notification type is notifyHeartbeat

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

NOTE: Void.

12.4.2.1 Mapping of operations

See clause 12.1.1.1.

12.4.2.2 Mapping of notifications

12.4.2.2.1 Introduction

12.4.2.2.1.1 General

The 3GPP IS heartbeat notifications are mapped to SS equivalents according to table 12.4.2.2.1.1-1.

Table 12.4.2.2.1.1-1: Mapping of 3GPP IS notifications to SS equivalents

3GPP IS notifications	HTTP Method	Resource URI	S
notifyHeartbeat	POST	/eventListener	M

12.4.2.2.1.2 Notification parameter mapping principles

3GPP IS fault supervision alarm notification parameters are mapped to solution set equivalent as follows:

12.4.2.2.2 Notification notifyHeartbeat

See clause 12.4.1.2.2.

12.5 Streaming data reporting service

12.5.1 RESTful HTTP-based solution set

12.5.1.1 Mapping of operations

12.5.1.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 12.5.1.1.1-1.

Table 12.5.1.1.1-1: Mapping of IS operations to SS equivalents

IS operation	Method/frame	Resource/URI	S
establishStreamingConnection	HTTP POST (see NOTE)	/connections	M
	HTTP GET (Upgrade, see NOTE)	/connections/{connectionId}	M
terminateStreamingConnection	WebSocket Close frame sent (frame with opcode of 0x8), and WebSocket Close frame received (frame with opcode of 0x8 for successful case)	/connections/{connectionId}	M
reportStreamData	WebSocket Data frame sent (frame with opcode of 0x2)	/connections/{connectionId}	M
addStream	HTTP POST	/connections/{connectionId}/streams	M
deleteStream	HTTP DELETE	/connections/{connectionId}/streams	M
getConnectionInfo	HTTP GET	/connections	M
	HTTP GET	/connections/{connectionId}	M
getStreamInfo	HTTP GET	/connections/{connectionId}/streams	M
	HTTP GET	/connections/{connectionId}/streams/{streamId}	M
Note: the `establishStreamingConnection` is mapped to a HTTP POST operation followed by a HTTP GET operation. The HTTP POST operation is to provide the information in `streamInfoList` parameter to the consumer and receive the `connectionId` assigned by the consumer, while the HTTP GET (Upgrade) operation is to establish the WebSocket connection.			

12.5.1.1.2 Operation "establishStreamingConnection"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.2-1 through 12.5.1.1.2-4.

Table 12.5.1.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
producerId	request body	producerId	String	M
streamInfoList	request body	streamInfoList	array(streamInfo-Type)	M

Table 12.5.1.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	location header	n/a	uri-Type	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

Table 12.5.1.1.2-3: Mapping of IS operation input parameters to SS equivalents (HTTP GET (Upgrade))

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	Headers	Request-URI	String	n/a
--	HTTP-Version (Request-Line)	--	String (see Note 1)	M
--	Upgrade Header	--	Constant string: websocket	M
--	Connection Header	--	Constant string: Upgrade	M
--	Sec-WebSocket-Key Header	--	String (see Note 2)	M
--	Sec-WebSocket-Version Header	--	String (see Note 3)	M
--	See Note 4.			

NOTE 1: The HTTP version shall be not earlier than HTTP/1.1.
NOTE 2: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [40]).
NOTE 3: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [40]).
NOTE 4: Other SS parameters (not listed in this table) independent from the Stage 2 may be used, according to the WebSocket protocol (see IETF RFC 6455 [40]).

Table 12.5.1.1.2-4: Mapping of IS operation output parameters to SS euivalents (HTTP GET (Upgrade))

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	n/a	--	n/a	n/a
status	HTTP-Version (Response-Line)	--	String (see Note 1)	M
	Status-Code	--	String	
	response body	error	error-ResponseType	
--	Upgrade Header		Constant string: websocket	M
--	Connection Header	--	Constant string: Upgrade	M
	Sec-WebSocket-Accept Header	--	String (see Note 2)	M
--	See Note 3.			

NOTE 1: The HTTP version shall be not earlier than HTTP/1.1.
NOTE 2: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [40]).
NOTE 3: Other SS parameters (not listed in this table) independent from the Stage 2 may be used, according to the WebSocket protocol (see IETF RFC 6455 [40]).

Figure 12.5.1.1.2-1: Message flow for establishing a streaming connection

The message flow for establishing a streaming connection illustrated on Figure 12.5.1.1.2-1 is as follows:

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

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

   - The request message body carries the information about the connecting producer identity via parameter "producerId" and about streams supported by the new connection via parameter "StreamInfoList".

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

   - On success "201 Posted" shall be returned with the identifier of a newly created ".../connections/{connectionId}" resource.

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

3. If step 2 is successful, the MnS producer sends a HTTP GET (upgrade) request to theMnS consumer to establish the WebSocket connection.

   - The URI identifies the ".../connections/{connectionId}" resource with the /secure/flag;

   - The HTTP-version in the Request-line indicates the HTTP version which is no earlier than HTTP/1.1;

   - The Upgrade header is with value "websocket";

   - The Connection header is with value "Upgrade";

   - The Sec-WebSocket-Key header is with a valid value according to IETF RFC 6455 [40].

   - The Sec-WebSocket-Version header is with a valid according to IETF RFC 6455 [40].

4. The MnS consumer sends a HTTP GET (Upgrade) response to the MnS producer.

   - On success, "101 Switching Protocols" shall be returned;

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

   - The HTTP-version in the Response-line indicates the HTTP version which is no earlier than HTTP/1.1;

   - The Upgrade header is with value "websocket";

   - The Connection header is with value "Upgrade";

   - The Sec-WebSocket-Accept header is with a valid value according to IETF RFC 6455 [40].

12.5.1.1.3 Operation "terminateStreamingConnection"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.3-1 and 12.5.1.1.3-2.

Table 12.5.1.1.3-1: Mapping of IS operation input parameters to SS equivalents (WebSocket Close frame sent)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	n/a	--	n/a	n/a
--	Opcode (see clause 5 of IETF RFC 6455 [40])	--	Constant value: 0x8	M

Table 12.5.1.1.3-2: Mapping of IS operation output parameters to SS equivalents (WebSocket Close frame received)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
status	Opcode	--	For a successful operation, the Opcode is 0x8, and for an unsuccessful operation, the Opcode has a value other than 0x8 (see clause 5 of IETF RFC 6455 [40]).	M

12.5.1.1.4 Operation "reportStreamData"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.4-1 and 12.5.1.1.4-2.

Table 12.5.1.1.4-1: Mapping of IS operation input parameters to SS equivalents (WebSocket Data frame sent with Opcode of 0x2)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	n/a	--	n/a	n/a
--	Opcode (see clause 5 of IETF RFC 6455 [40])	--	Constant value: 0x2 ("binary")	M
streamingData	Payload data	Streaming Trace Payload or streaming performance data payload or streaming analytics payload or proprietary data payload	See clause 5 of 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	-- See Note 1.	n/a	n/a
NOTE 1: The delivery of WebSocket Data frame is taken care of by the underlying TCP (see IETF RFC 793 [41]) which provides reliable data transmission and ensures the data delivery. There is no mechanism at WebSocket protocol level to report the delivery status for WebSocket Data frame.				

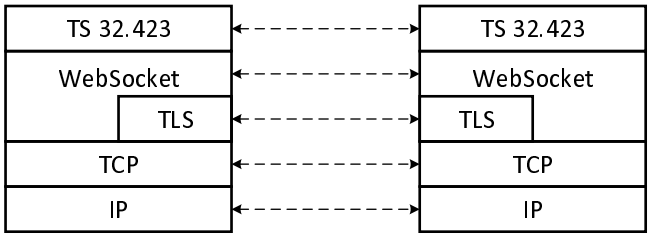


Figure 12.5.1.1.4-1: Protocol stack for streaming trace data reporting

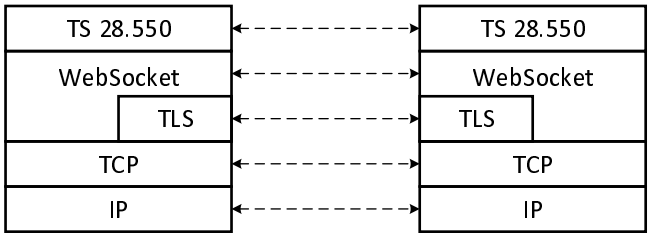


Figure 12.5.1.1.4-2: Protocol stack for streaming performance data reporting

12.5.1.1.5 Operation "addStream"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.5-1 and 12.5.1.1.5-2.

Table 12.5.1.1.5-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	Headers	Request-URI	String	n/a
streamInfoList	request body	streamInfoList	array(streamInfo-Type)	M

Table 12.5.1.1.5-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
streamInfoList	response body	streamInfoList	array(streamInfo-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.1.6 Operation "deleteStream"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.6-1 and 12.5.1.1.6-2.

Table 12.5.1.1.6-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	headers	Request-URI	String	n/a
streamIdList	path, query	/connections/{connectionId}/streams, streamIdList	array(streamId-Type)	M

Table 12.5.1.1.6-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.1.7 Operation "getConnectionInfo"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.7-1 and 12.5.1.1.7-2.

Table 12.5.1.1.7-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	headers	Request-URI	String	n/a
connectionIdList	path, query	/connections, /connections/{connectionId}	array(uri-Type)	M

Table 12.5.1.1.7-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionInfoList	response body	connectionInfoList	array(uri-Type, streamReporter-Type, streamIdList-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.1.8 Operation "getStreamInfo"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.8-1 and 12.5.1.1.8-2.

Table 12.5.1.1.8-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	headers	Request-URI	String	n/a
streamIdList	path, query	/connections/{connectionId}/streams, streamIdList	array(streamId-Type)	M

Table 12.5.1.1.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
streamInfoSumList	response body	streamInfoSumList	array(streamInfo-Type, streamReporters-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.2 Mapping of notifications

Not applicable (no notifications defined in IS).

12.5.1.3 Resources

12.5.1.3.1 Resources structure

Figure 12.5.1.3.1-1 shows the resource structure of the Streaming data reporting service.

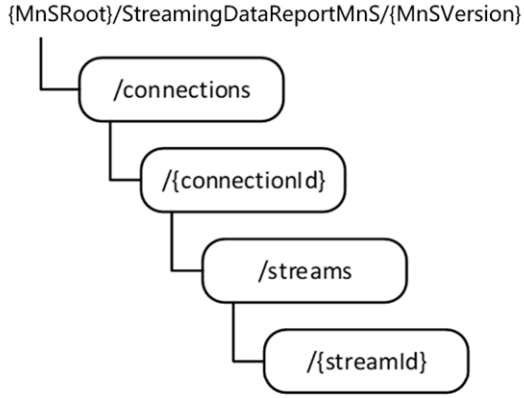


Figure 12.5.1.3.1-1: Resource URI structure of the Streaming data reporting service

Table 12.5.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Resource name	Resource URI	HTTP method	Description
connections	…/connections	POST	Inform consumer about reporting streams to be carried by the new connection and receive a new connection id.
		GET	Obtain information about connections
connection	…/connections/{connectionId}	GET (Upgrade)	Establish WebSocket for a given connection
		GET	Obtain information about connection
		WebSocket 0x2	Send a unit of streaming data
		WebSocket 0x8	Terminate a WebSocket connection
streams	…/connections/{connectionId}/streams	POST	Inform consumer about new reporting streams on an existing connection.
		DELETE	Remove reporting streams from an existing connection
		GET	Obtain information about streams
stream	…/connections/{connectionId}/streams/{streamId}	GET	Obtain information about stream

12.5.1.3.2 Resources definitions

12.5.1.3.2.1 Resource "…/connections"

12.5.1.3.2.1.1 Description

This resource represents a collection of connections and can be used to establish new connections or to obtain information about existing connections.

12.5.1.3.2.1.2 URI

The resource URI is: {MnSRroot}/StreamingDataReportingMnS/{MnSVersion}/connections

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.1.2-1.

Table 12.5.1.3.2.1.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]

12.5.1.3.2.1.3 HTTP methods

12.5.1.3.2.1.3.1 HTTP POST

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

Table 12.5.1.3.2.1.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.1.3.1-2: Data structures supported by the POST request body on this resource

Data type	Description	S
producerId	String representing the DN of the streaming data reporting MnS producer.	M
array(streamInfo-Type)	List of meta-data about each reporting stream. Where each reporting stream is represented by a streamInfo.	

Table 12.5.1.3.2.1.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
error-ResponseType	4xx/5xx	Returned in case of an error	M
uri-Type	201 Posted	Connection identifier assigned by the MnS consumer	M

12.5.1.3.2.1.3.2 HTTP GET

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

Table 12.5.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
connectionIdList	array(uri-Type)	The list of connectionId for which the connection information is to be returned.	O

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

Table 12.5.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.5.1.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
error-ResponseType	4xx/5xx	Returned in case of an error	M
array(uri-Type, streamReporter-Type, streamIdList-Type)	200 OK	In case of success the representation of the retrieved information is returned.	M
	202 Partially retrieved	In case of partial success the representation of the retrieved information is returned.	M

12.5.1.3.2.2 Resource "…/connections/{connectionId}"

12.5.1.3.2.2.1 Description

This resource represents an individual connection and can be used for an "upgrade" to WebSocket as part of the connection establishment, or to obtain information about an existing connection, or to terminate an existing connection, or to send a unit of streaming data.

12.5.1.3.2.2.2 URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.2.2-1.

Table 12.5.1.3.2.2.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
connectionId	Represents identifier of an individual connection assigned by the MnS consumer during connection establishment

12.5.1.3.2.2.3 HTTP methods

12.5.1.3.2.2.3.1 HTTP GET (Upgrade)

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

Table 12.5.1.3.2.2.3.2-1: Header parameters supported by the GET request on this resource

Name	Data type	Description	S
connectionId	uri-Type	To indicate the ID (URI) of the connection being upgraded to WebSocket	M
Upgrade	Upgrade-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol	M
Connection	Connection-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to another protocol	M
Sec-WebSocket-Key	Sec-WebSocket-Key-HeaderType	The Sec-WebSocket-Key needed for establishing the WebSocket connection.	M
Sec-WebSocket-Version	Sec-WebSocket-Version-HeaderType	The Sec-WebSocket-Version needed for establishing the WebSocket connection.	M

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

Table 12.5.1.3.2.2.3.2-2: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.2.3.2-3: Data structures supported by the GET request body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.5.1.3.2.2.3.2-4: Header parameters supported by the GET response on this resource

Name	Data type	Description	S
Upgrade	Upgrade-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol	M
Connection	Connection-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to another protocol	M
Sec-WebSocket-Accept	Sec-WebSocket-Accept-HeaderType	The Sec-WebSocket-Accept responded when establishing the WebSocket connection.	M

Table 12.5.1.3.2.2.3.2-5: Data structures supported by the GET response body on this resource

Data type	Response codes	Description	S
n/a	101 Switching Protocols	The status code indicating the connection has been successfully upgraded to WebSocket.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.2.3.2 HTTP GET

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

Table 12.5.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.5.1.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
error-ResponseType	4xx/5xx	Returned in case of an error	M
uri-Type	200 OK	In case of success the representation of the connectionId is returned.	M
streamReporter-Type	200 OK	In case of success the representation of the streamReporter is returned.	M
streamIdList-Type	200 OK	In case of success the representation of the streamIdList is returned.	M

12.5.1.3.2.3 Resource "…/connections/{connectionId}/streams"

12.5.1.3.2.3.1 Description

This resource represents a collection of reporting streams on a particular connection and can be used to add a new reporting stream to an existing connection, or to remove a reporting stream from an existing connection, or to obtain information about reporting streams.

12.5.1.3.2.3.2 URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}/streams

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.3.2-1.

Table 12.5.1.3.2.3.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
connectionId	See table 12.5.1.3.2.2.2-1

12.5.1.3.2.3.3 HTTP methods

12.5.1.3.2.3.3.1 HTTP POST

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

Table 12.5.1.3.2.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.3.3.1-2: Data structures supported by the POST request body on this resource

Data type	Description	S
array(streamInfo-Type)	The resource representation of the set of information about streams to be posted.	M

Table 12.5.1.3.2.3.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
array(streamInfo-Type)	201 Posted	In case of success the representation of the posted information about streams is returned.	M
	202 Partially posted	In case of partial success the representation of the posted information about streams is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.3.3.2 HTTP DELETE

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

Table 12.5.1.3.2.3.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	Description	S
streamIdList	array(streamId-Type)	The list of streamId for the stream(s) to be deleted.	M

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

Table 12.5.1.3.2.3.3.2: Data structures supported by the DELETE request body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.5.1.3.2.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	Response codes	Description	S
n/a	204 No Content	In case of success no message body is returned	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.3.3.3 HTTP GET

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

Table 12.5.1.3.2.3.3.3-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
streamIdList	array(streamId-Type)	The list of streamId for which the stream information are to be returned.	O

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

Table 12.5.1.3.2.3.3.3-2: Data structures supported by the GET request body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.5.1.3.2.3.3.3-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
array(streamInfo-Type, streamReporters-Type)	200 OK	In case of success the representation of the retrieved stream information is returned.	M
	202 Partially retrieved	In case of partial success the representation of the retrieved stream information is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.4 Resource "…/connections/{connectionId}/streams/{streamId}"

12.5.1.3.2.4.1 Description

This resource represents an individual reporting stream on an existing connection and can be used to obtain information about reporting stream.

12.5.1.3.2.4.2 URI

The resource URI is:
{MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}/streams/{streamId}

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.4.2-1.

Table 12.5.1.3.2.4.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
connectionId	See table 12.5.1.3.2.2.2-1
streamId	Represents identifier of an individual stream. For Streaming Trace reporting, the Trace Reference (see clause 5.6 of 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
General types		
uri-Type	12.5.1.4.3	Used to represent a URI
Types used in paths		
connectionId-Type	12.5.1.4.3	Used to indicate the connection as a context of the operation
streamId-Type	12.5.1.4.3	Used to indicate the stream as a context of the operation
Types used in headers		
websocketHeaderConnection-Type	12.5.1.4.3	Header value for the upgrade request and response
websocketHeaderUpgrade-Type	12.5.1.4.3	Header value for the upgrade to WebSocket request and response
websocketHeader-Sec-WebSocket-Accept-Type	12.5.1.4.3	Header value for secure WebSocket response. Carries hash.
websocketHeader-Sec-WebSocket-Extensions-Type	12.5.1.4.3	Header value for secure WebSocket request. Carries protocol extensions.
websocketHeader-Sec-WebSocket-Key-Type	12.5.1.4.3	Header value for secure WebSocket request. Provides information to the server which is needed in order to confirm that the client is entitled to request an upgrade to WebSocket.
websocketHeader-Sec-WebSocket-Protocol-Type	12.5.1.4.3	Header value for secure WebSocket request. Carries a comma-separated list of subprotocol names, in the order of preference.
websocketHeader-Sec-WebSocket-Version-Type	12.5.1.4.3	Header value for secure WebSocket request and response. Carries the WebSocket protocol version to be used.
Types used in query parts		
connectionId-Type	12.5.1.4.3	Used to indicate the connection as a context of the operation
streamId-Type	12.5.1.4.3	Used to indicate the stream as a context of the operation
Types used in request bodies		
connectionRequest-Type	12.5.1.4.2.2	Used to carry the meta-data during connection establishment
streamInfo-Type	12.5.1.4.2.5	Reporting stream meta-data.
Types used in response bodies		
failedConnectionResponse-Type	12.5.1.4.2.4	Used to carry the details of a failed connection establishment
connectionInfo-Type	12.5.1.4.2.1	Used to carry connection meta-data
errorResponse-Type	12.5.1.4.2.3	Used to carry the details of an error
streamInfo-Type	12.5.1.4.2.5	Used to carry the stream meta-data
streamInfoWithReporters-Type	12.5.1.4.2.6	Used to carry the augmented stream meta-data
Types used for resources		
uri-Type	12.5.1.4.3	Used to represent resource URI
Types referenced by the definitions above		
systemDN-Type	12.5.1.4.3	Used to represent DN of the reporting entity
traceJob-Type	Generic NRM	Used to represent Trace configuration
producerId-Type	12.5.1.4.3	Used to identify the reporting entity
streamType-Type	12.5.1.4.3	Used to identify the type of a reporting stream
serializationFormat-Type	12.5.1.4.3	Used to identify serialization method
measObjDn-Type	12.5.1.4.3	Used to represent DN of the measured object instance
measTypes-Type	12.5.1.4.3	Used to represent an ordered list of measurement types or KPI
analyticsInfo-Type	12.5.1.4.3	Used to represents information about streamed analytics
vsDataContainer-Type	Generic NRM	Used to represent details about proprietary data

Table 12.5.1.4.1-2: Data types imported

Data type	Reference	Description
traceJob-Type	Generic NRM	Attributes container of the TraceJob IOC (see 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 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
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 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
fileInfoList	request body	fileInfoList	array(FileInfo)	M
reason	request body	reason	string	O
additionalText	request body	additionalText	string	O

12.6.1.3 Resources

12.6.1.3.1 Resource structure

12.6.1.3.1.1 Resource structure on the MnS producer

Figure 12.6.1.3.1.1-1 shows the resource structure of the File Data Reporting MnS on the MnS producer.

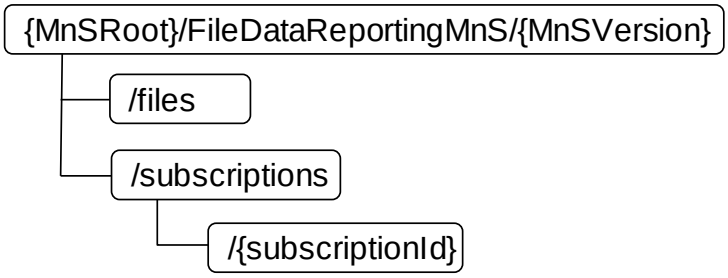


Figure 12.6.1.3.1.1-1: Resource URI structure of the File Data Reporting MnS on the MnS producer

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

Table 12.2.1.3.1.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Description
Files	…/files	GET	Retrieve the information of the available files
Subscriptions	…/subscriptions	POST	Create a subscription
Subscription	…/subscriptions/{subscriptionId}	DELETE	Delete a single subscription
Notification Target	{notificationTarget}	POST	Send a notification to the notification target

12.6.1.3.1.2 Resource structure on the MnS consumer

Figure 12.6.1.3.1.2-1 shows the resource structure of the File Data Reporting MnS on the MnS consumer.

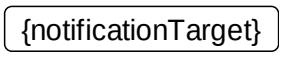


Figure 12.6.1.3.1.2-1: Resource URI structure of the File Data Reporting MnS on the MnS consumer

Table 12.6.1.3.1.2-1 provides an overview of the resources and applicable HTTP methods.

Table 12.6.1.3.1.2-1: Resources and methods overview

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

12.6.1.3.2 Resource definitions

12.6.1.3.2.1 Resource "…/files"

12.6.1.3.2.1.1 Description

This resource represents the information about a collection of available files.

12.6.1.3.2.1.2 URI

Resource URI = {MnSRoot}/FileDataReportingMnS/{MnSVersion}/files

The resource URI variables are defined in table 12.6.1.3.2.1.1-1.

Table 12.6.1.3.2.1.1-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]

12.6.1.3.2.1.3 HTTP methods

12.6.1.3.2.1.3.1 HTTP GET

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

Table 12.6.1.3.2.1.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
fileDataType	FileDataType	Selects files based on the file data type.	M
beginTime	DateTime	Selects files based on the earliest time they became available	M
endTime	DateTime	Selects files based on the latest time they became available	M

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

Table 12.6.1.3.2.1.3.1-2: Data structures supported by the GET request body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.6.1.3.2.1.3.1-3: Data structures supported by the GET response body on this resource

Data type	Response codes	Description	S
array(FileInfo)	200 OK	Information about the files identified in the request	M
ErrorResponse	4xx/5xx	Returned in case of an error	M

12.6.1.3.2.2 Resource "…/subscriptions"

12.6.1.3.2.2.1 Description

This resource is a container resource for individual subscriptions.

12.6.1.3.2.2.2 URI

Resource URI: {MnSRoot}/FileDataReportingMnS/{MnSVersion}/subscriptions

The resource URI variables are defined in table 12.6.1.3.3.2.2.2-1:

Table 12.6.1.3.3.2.2.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]

12.6.1.3.2.2.3 HTTP methods

12.6.1.3.2.2.3.1 POST

This method shall support the URI query parameters specified in table 12.6.1.3.2.2.3.1-1.

Table 12.6.1.3.2.2.3.1-1: URI query parameters supported by the POST method on this resource

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

This method shall support the request data structures specified in table 12.6.1.3.2.2.3.1-2 and the response data structures and response codes specified in table 12.6.1.3.2.2.3.1-3.

Table 12.6.1.3.2.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	Description	S
Subscription	Details of the subscription to be created	M

Table 12.6.1.3.2.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
Subscription	201 Created	In case of success the representation of the created subscription is returned.	M
ErrorResponse	4xx/5xx	In case of failure the error object is returned.	M

12.6.1.3.2.2.3.2 Void

12.6.1.3.2.3 Resource ".../subscriptions/{subscriptionId}"

12.6.1.3.2.3.1 Description

This resource represents a subscription.

12.6.1.3.2.3.2 URI

Resource URI: {MnSRoot}/FileDataReportingMnS/{MnSVersion}/subscriptions/{subscriptionId}

The resource URI variables are defined in table 12.6.1.3.2.3.2-1.

Table 12.6.1.3.2.3.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
subscriptionId	Subscription identifier

12.6.1.3.2.3.3 HTTP methods

12.6.1.3.2.3.3.1 DELETE

This method shall support the URI query parameters specified in table 12.6.1.3.2.3.3-1.

Table 12.6.1.3.2.3.3-1: URI query parameters supported by the DELETE method on this resource

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

This method shall support the request data structures specified in table 12.6.1.3.2.3.3-2 and the response data structures and response codes specified in table 12.6.1.3.2.3.3-3.

Table 12.6.1.3.2.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	Description	S
n/a	n/a	n/a

Table 12.6.1.3.2.3.3-3: Data structures supported by the DELETE Response Body on this resource

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

12.6.1.3.2.4 Resource "/notificationTarget"

12.6.1.3.2.4.1 Description

This resource represents a notification target on the MnS consumer.

12.6.1.3.2.4.2 URI

Resource URI: {notificationTarget}

The resource URI variables are defined in table 12.6.1.3.2.4.2-1.

Table 12.6.1.3.2.4.2-1: URI variables

Name	Definition
notificationTarget	URI of the notification target on the MnS consumer, contained in the notification subscription

12.6.1.3.2.4.3 HTTP methods

12.6.1.3.2.4.3.1 POST

This method shall support the URI query parameters specified in table 12.6.1.3.2.4.3.1-1.

Table 12.6.1.3.2.4.3.1-1: URI query parameters supported by the POST method on this resource

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

This method shall support the request data structures specified in table 12.6.1.3.2.4.3.1-2 and the response data structures and response codes specified in table 12.6.1.3.2.4.3.1-3.

Table 12.6.1.3.2.4.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	Description	S
NotifyFileReady	Type in case a notifyFileReady notification is sent	M
NotifyFilePreparationError	Type in case a notifyFilePreparationError notification is sent	M

Table 12.6.1.3.2.4.3.1-3: Data structures supported by the POST Response Body on this resource

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

12.6.1.4 Data type definitions

12.6.1.4.1 General

Table 12.6.1.4.1-1: Data types defined in this specification

Data type	Reference	Description
FileInfo	12.6.1.4.2.1	Information describing a file
NotifyFileReady	12.6.1.4.2.2	Used in the request body of HTTP POST for the notification type notifyFileReady
NotifyFilePreparationError	12.6.1.4.2.3	Used in the request body of HTTP POST for the notification type notifyFilePreparationError
FileDataType	12.6.1.4.6.3	File data types
FileNotificationTypes	12.6.1.4.6.4	File notification types

Table 12.6.1.4.1-2: Data types imported

Data type	Reference	Description
DateTime	TS 28.623 [44]	Date and time
Float	TS 28.623 [44]	Float type
Uri	TS 28.623 [44]	URI type
SystemDN	TS 28.623 [44]	systemDN type
NotificationId	TS 28.623 [44]	Notification identifier as defined in ITU-T Rec. X. 733 [4]
NotificationHeader	TS 28.623 [44]	Notification header
ErrorResponse	TS 28.623 [44]	Used in the response body of multiple HTTP methods in case of error
Subscription	12.2.1.4.1a.8	Subscription resource

12.6.1.4.2 Structured data types

12.6.1.4.2.1 Type FileInfo

Table 12.6.1.4.2.1-1: Definition of FileInfo

Attribute name	Data type	Description	S
fileLocation	Uri	Location of the file	M
fileCompression	string	Name of the compression algorithm used for compressing the file	M
fileSize	integer	Size of the file, unit is byte	M
fileDataType	FileDataType	Type of management data stored in the file	M
fileFormat	string	Encoding technique used for encoding the file. Its value should indicate the version of the file format specification plus to indicate if "ASN1" or "XML-schema" is used	M
fileReadyTime	DateTime	Date and time when the file was last closed and made available in the MnS producer. The file content will not be changed any more.	M
fileExpirationTime	DateTime	Date and time after which the file may be deleted	M
jobId	string	Job identifier of the "PerfMetricJob" or "TraceJob" that produced the file	CM

12.6.1.4.2.2 Type NotifyFileReady

Table 12.6.1.4.2.2-1: Definition of type NotifyFileReady

Attribute name	Data type	Description	S
href	Uri	URI of the object representing the process, managed element or management node, which made the file available	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyFileReady, etc.)	M
eventTime	DateTime	Event occurrence time (e.g., the file ready time)	M
systemDN	SystemDN	DN of the MnS Agent emitting the notification	M
fileInfoList	array(FileInfo)	Information describing the available files	M
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O

12.6.1.4.2.3 Type NotifyFilePreparationError

Table 12.6.1.4.2.3-1: Definition of type NotifyFilePreparationError

Attribute name	Data type	Description	S
href	Uri	URI of the object representing the process, managed element or management node, where the file preparation error occured	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyFileReady, etc.)	M
eventTime	DateTime	Event occurrence time (e.g., the file ready time)	M
systemDN	SystemDN	DN of the MnS Agent emitting the notification	M
fileInfoList	array(FileInfo)	Information about the files with a preparation error.	M
reason	string	Reason for the file preparation error	O
additionalText	string	Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4]	O

12.6.1.4.3 Void

12.6.1.4.4 Void

12.6.1.4.5 Void

12.6.1.4.6 Simple data types and enumerations

12.6.1.4.6.1 General

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

12.6.1.4.6.2 Simple data types

Table 12.6.1.4.6.2-1: Simple data types

Type name	Type definition	Description
n/a	n/a	n/a

12.6.1.4.6.3 Enumeration FileDataType

Table 12.6.1.4.6.3-1: Enumeration FileDataType

Enumeration value	Description
PERFORMANCE	Performance data file (measurements and KPIs)
TRACE	Trace data file
ANALYTICS	Analytics data file
PROPRIETARY	Proprietary data file

12.6.1.4.6.4 Enumeration FileNotificationTypes

Table 12.6.1.4.6.4-1: Enumeration FileNotificationTypes

Enumeration value	Description
notifyFileReady	Notification type is notifyFileReady
notifyFilePreparationError	Notification type is notifyFilePreparationError

Annex A (normative): OpenAPI specification

A.0 Introduction

This clause describes the capabilities of the service in the structure of the OpenAPI Specification Version 3.0.1 [A9]. The OpenAPI definitions are provided in YAML or JSON format.

A.1 Provisioning management service

A.1.0 Introduction

Clause A.1.1 contains the OpenAPI definition of the provisioning MnS which includes the provisioning MnS operations and the provisioning MnS notifications.

Clause A.1.2 provides indications regarding the content of the generic provisioning MnS notifications when the consumer of these notifications supports the ONAP VES API. This content is sent as payload of VES events (see Annex B).

A.1.1 OpenAPI document "TS28532_ProvMnS.yaml"

```
openapi: 3.0.1
info:
  title: Provisioning MnS
  version: 17.1.0
  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 retourned when the resource is updated and when the
        updated resource representation is identical to the resource representation
        in the request.
        The representation of the updated resource is returned in the response
        message body.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/Resource'
    '201':
      description: >-
        Success case ("201 Created").
        This status code shall be returned when the resource is created.
        The representation of the created resource is returned in the response
        message body.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/Resource'
    '204':
      description: >-
        Success case ("204 No Content").
        This status code may be returned only when the replaced resource
        representation is identical to the representation in the request.
        The response has no message body.
    default:
      description: Error case.
      content:
        application/json:
          schema:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
  callbacks:
    notifyMOICreation:
      '{request.body#/notificationRecipientAddress}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/NotifyMoiCreation'
          responses:
            '204':
              description: >-
                Success case ("204 No Content").
                The notification is successfully delivered. The response
                has no message body.
            default:
              description: Error case.
              content:
                application/json:
                  schema:
                    $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
    notifyMOIDeletion:
      '{request.body#/notificationRecipientAddress}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/NotifyMoiDeletion'
          responses:
            '204':
              description: >-
                Success case ("204 No Content").
                The notification is successfully delivered. The response
```

```
                has no message body.
            default:
              description: Error case.
              content:
                application/json:
                  schema:
                    $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
    notifyMOIAttributeValueChanges:
      '{request.body#/notificationRecipientAddress}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/NotifyMoiAttributeValueChanges'
          responses:
            '204':
              description: >-
                Success case ("204 No Content").
                The notification is successfully delivered. The response
                has no message body.
            default:
              description: Error case.
              content:
                application/json:
                  schema:
                    $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
    notifyMOIChanges:
      '{request.body#/notificationRecipientAddress}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/NotifyMoiChanges'
              application/yang-data+json:
                schema:
                  $ref: '#/components/schemas/NotifyMoiChanges'              responses:
            '204':
              description: >-
                Success case ("204 No Content").
                The notification is successfully delivered. The response
                has no message body.
            default:
              description: Error case.
              content:
                application/json:
                  schema:
                    $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
  get:
    summary: Reads one or multiple resources
    description: >-
      With HTTP GET resources are read. The resources to be retrieved are
      identified with the target URI. The attributes and fields parameter
      of the query components allow to select the resource properties to be returned.
    parameters:
      - name: scope
        in: query
        description: >-
          This parameter extends the set of targeted resources beyond the base
          resource identified with the path component of the URI. No scoping
          mechanism is specified in the present document.
        required: false
        schema:
          $ref: '#/components/schemas/Scope'
        style: form
        explode: true
      - name: filter
        in: query
        description: >-
          This parameter reduces the targeted set of resources by applying a
          filter to the scoped set of resource representations. Only resource
          representations for which the filter construct evaluates to "true"
          are targeted. No filter language is specified in the present
          document.
        required: false
```

```
        schema:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/Filter'
      - name: attributes
        in: query
        description: >-
          This parameter specifies the attributes of the scoped resources that
          are returned.
        required: 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'
      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:
              type: object
        application/3gpp-json-patch+json:
          schema:
            type: array
            items:
              type: object
    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 or multiple resources
      description: >-
        With HTTP DELETE resources are deleted. The resources to be deleted are
        identified with the target URI.
      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 resources
            representations for which the filter construct evaluates to "true"
            are returned. No filter language is specified in the present
            document.
          required: false
          schema:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/Filter'
      responses:
        '200':
          description: >-
            Success case ("200 OK").
            This status code shall be 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.
        '204':
          description: >-
            Success case ("204 No Content").
            This status code shall be returned, when no query parameters are present in
            the request and only one resource is deleted.
            The message body is empty.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
components:
```

```
schemas:
  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
  CmNotificationTypes:
    type: string
    enum:
      - notifyMOICreation
      - notifyMOIDeletion
      - notifyMOIAttributeValueChanges
      - notifyMOIChanges
  SourceIndicator:
    type: string
    enum:
      - RESOURCE_OPERATION
      - MANAGEMENT_OPERATION
      - SON_OPERATION
      - UNKNOWN
  Operation:
    type: string
    enum:
      - add
      - remove
      - replace
  ScopeType:
    type: string
    enum:
      - BASE_ONLY
      - BASE_NTH_LEVEL
      - BASE_SUBTREE
      - BASE_ALL
  Scope:
    type: object
    properties:
      scopeType:
        $ref: '#/components/schemas/ScopeType'
      scopeLevel:
        type: integer


  Resource:
    oneOf:
      - type: object
        properties:
          id:
          objectClass:
            type: string
          objectInstance:
            $ref: 'comDefs.yaml#/components/schemas/Dn'
            type: string
          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: 'intentNrm.yaml#/components/schemas/resources-intentNrm'

  MoiChange:
    type: object
    properties:
      notificationId:
```

```
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationId'
    correlatedNotifications:
      type: array
      items:
        $ref: '#/components/schemas/CorrelatedNotification'
    additionalText:
      type: string
    sourceIndicator:
      $ref: '#/components/schemas/SourceIndicator'
    op:
      $ref: '#/components/schemas/Operation'
    path:
      type: string
    value:{}
    oldValue: {}
  required:
    - notificationId
    - op
    - path

NotifyMoiCreation:
  allOf:
    - $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
    - type: object
      properties:
        correlatedNotifications:
          type: array
          items:
            $ref: '#/components/schemas/CorrelatedNotification'
        additionalText:
          type: string
        sourceIndicator:
          $ref: '#/components/schemas/SourceIndicator'
        attributeList:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'
NotifyMoiDeletion:
  allOf:
    - $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
    - type: object
      properties:
        correlatedNotifications:
          type: array
          items:
            $ref: '#/components/schemas/CorrelatedNotification'
        additionalText:
          type: string
        sourceIndicator:
          $ref: '#/components/schemas/SourceIndicator'
        attributeList:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/AttributeNameValuePairSet'
NotifyMoiAttributeValueChanges:
  allOf:
    - $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
    - type: object
      properties:
        correlatedNotifications:
          type: array
          items:
            $ref: '#/components/schemas/CorrelatedNotification'
        additionalText:
          type: string
        sourceIndicator:
          $ref: '#/components/schemas/SourceIndicator'
        attributeListValueChanges:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/AttributeValueChangeSet'
      required:
        - attributeListValueChanges
NotifyMoiChanges:
  allOf:
    - $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
    - type: object
      properties:
        moiChanges:
          type: array
          items:
            $ref: '#/components/schemas/MoiChange'
      required:
        - moiChanges
```

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: 16.10.0
  description: >-
    OAS 3.0.1 definition of the Fault Supervision 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}/FaultSupervisionMnS/{MnSversion}'
    variables:
      MnSRoot:
        description: See subclause 4.4.3 of TS 32.158
        default: http://example.com/3GPPManagement
      MnSversion:
        description: Version number of the OpenAPI definition
        default: XXX
paths:
  /alarms:
    get:
      summary: Retrieve multiple alarms
      description: >-
        Retrieves the alarms identified by alarmAckState, baseObjectInstance
        and filter.
      parameters:
        - name: alarmAckState
          in: query
          required: false
          schema:
            $ref: '#/components/schemas/AlarmAckState'
        - name: baseObjectInstance
          in: query
          required: false
          schema:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'
        - name: filter
          in: query
          required: false
          schema:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/Filter'
      responses:
        '200':
          description: >-
            Success case ("200 OK").
            Returns the alarms identified in the request. The alarmId is the key
            of the map.
```

```
        content:
          application/json:
            schema:
              type: object
              additionalProperties:
                type: object
                allOf:
                    - type: object
                      properties:
                        lastNotificationHeader:
                          $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
                    - $ref: '#/components/schemas/AlarmRecord'
                    - type: object
                      properties:
                        comments:
                          $ref: '#/components/schemas/Comments'
      default:
        description: Response in case of error.
        content:
          application/json:
            schema:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
  patch:
    summary: 'Clear, acknowledge or unacknowledge multiple alarms'
    description: >-
      Clears, acknowledges or unacknowledges multiple alarms using patch. Depending
      on which action is to be performed, different merge patch documents need
      to be used.
    requestBody:
      description: >-
        Patch documents for acknowledging and unacknowledging, or clearing multiple
        alarms. The keys in the map are the alarmIds to be patched.
      content:
        application/merge-patch+json:
          schema:
            oneOf:
              - type: object
                additionalProperties:
                  $ref: '#/components/schemas/MergePatchAcknowledgeAlarm'
              - type: object
                additionalProperties:
                  $ref: '#/components/schemas/MergePatchClearAlarm'
    responses:
      '204':
        description: >-
          Success case ("204 No content").
          The response message body is empty.
      default:
        description: Response in case of error.
        content:
          application/json:
            schema:
              type: array
              items:
                $ref: '#/components/schemas/FailedAlarm'
/alarms/alarmCount:
  get:
    summary: Get the alarm count per perceived severity
    parameters:
      - name: alarmAckState
        in: query
        required: false
        schema:
          $ref: '#/components/schemas/AlarmAckState'
      - name: filter
        in: query
        required: false
        schema:
          type: string
    responses:
      '200':
        description: >-
          Success case ("200 OK").
          The alarm count per perceived severity is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AlarmCount'
```

```
      default:
        description: Response in case of error. The error case needs rework.
        content:
          application/json:
            schema:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
/alarms/{alarmId}:
  patch:
    summary: 'Clear, acknowledge or unacknowledge a single alarm'
    description: >-
      Clears, acknowledges or uncknowldeges 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:
          oneOf:
            - type: integer
            - $ref: 'TS28623_ComDefs.yaml#/components/schemas/Float'
        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
          iTS28623_Ctems:
            $ref: 'omDefs.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: '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: '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
      acknowleding an alarm the value of ackState is ACKNOWLEDGED, for unacknowleding
      an alarm the value of ackState is UNACKNOWLEDGED.
    type: object
    required:
      - ackUserId
      - ackState
    properties:
      ackUserId:
        type: string
      ackSystemId:
        type: string
      ackState:
        $ref: '#/components/schemas/AckState'
  MergePatchClearAlarm:
    description: Patch document for clearing a single alarm
    type: object
    required:
      - clearUserId
      - perceivedSeverity
    properties:
```

```
      clearUserId:
        type: string
      clearSystemId:
        type: string
      perceivedSeverity:
        type: string
        enum:
          - CLEARED

#---- Definition of method responses -----------------------------------------------#

  FailedAlarm:
    type: object
    required:
      - alarmId
      - failureReason
    properties:
      alarmId:
        $ref: '#/components/schemas/AlarmId'
      failureReason:
        type: string

#---- Definition of resources ------------------------------------------------------#

  AlarmCount:
    type: object
    required:
      - criticalCount
      - majorCount
      - minorCount
      - warningCount
      - indeterminateCount
      - clearedCount
    properties:
      criticalCount:
        type: integer
      majorCount:
        type: integer
      minorCount:
        type: integer
      warningCount:
        type: integer
      indeterminateCount:
        type: integer
      clearedCount:
        type: integer
  Comment:
    type: object
    properties:
      commentTime:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
      commentUserId:
        type: string
      commentSystemId:
        type: string
      commentText:
        type: string
  Comments:
    description: >-
      Collection of comments. The comment identifiers are allocated by the
      MnS producer and used as key in the map.
    type: object
    additionalProperties:
      $ref: '#/components/schemas/Comment'
  Subscription:
    type: object
    properties:
      consumerReference:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
      timeTick:
        type: integer
      filter:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Filter'
```

A.2.2 Integration with ONAP VES

Detailed guidelines for integration of fault supervision MnS notifications with ONAP VES are provided in Annex B.

A.3 Void

A.4 Generic performance assurance management service

A.4.1 Void

A.4.2 OpenAPI document "TS28532_PerfMnS.yaml"

```
openapi: 3.0.1
info:
  title: TS 28.532 Performance Threshold Monitoring MnS
  version: 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
      MnSersion:
        description: See clause 4.4.3 of TS 32.158.
        default: ''
paths:
  '/connections':
    post:
      summary: Inform consumer about reporting streams to be carried by the new connection and
receive a new connection id.
      description: Exchange of meta-data (producer informs consumer about its own identity and the
nature of the data to be reported via streaming) phase of the connection establishement by streaming
data reporting producer to the streaming data reporting consumer (i.e. streaming target).
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/connectionRequest-Type'
      responses:
        '201':
          description: Success case (201 Created).
          headers:
            Location:
              description: Location of the created connection resource.
              schema:
                $ref: '#/components/schemas/connectionId-Type'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/failedConnectionResponse-Type'
    get:
      summary: Obtain information about connections.
      description: Enables the streaming data reporting service producer to obtain information about
one or more streaming connections.
      parameters:
        - name: connectionIdList
          in: query
          description: The list of connectionId for which the connection information is to be
returned.
          required: false
```

```
          schema:
            type: array
            items:
              $ref: '#/components/schemas/connectionId-Type'
      responses:
        '200':
          description: Success case (200 OK). The resources identified in the request for retrieval
are returned in the response message body. In case the fields query parameter is used, the selected
resources are returned.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/connectionInfo-Type'
        '202':
          description: Partial success case (202 Partially retrieved). Subset of the resources
identified in the request for retrieval are returned in the response message body.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/connectionInfo-Type'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/errorResponse-Type'
  '/connections/{connectionId}':
    get:
      summary: Obtain information about a connection.
      description: Enables the streaming data reporting service producer to obtain information about
one streaming connection.
      parameters:
        - name: connectionId
          in: path
          description: Indicate the ID (URI) of the connection for which the information is being
retrieved
          required: true
          schema:
            $ref: '#/components/schemas/connectionId-Type'
        - name: Connection
          in: header
          schema:
            $ref: '#/components/schemas/websocketHeaderConnection-Type'
        - name: Sec-WebSocket-Extensions
          in: header
          schema:
            $ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Extensions-Type'
        - name: Sec-WebSocket-Key
          in: header
          schema:
            $ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Key-Type'
        - name: Sec-WebSocket-Protocol
          in: header
          schema:
            $ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Protocol-Type'
        - name: Sec-WebSocket-Version
          in: header
          schema:
            $ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Version-Type'
      responses:
        '101':
          description: Success case (101 Switching Protocols). The connection has been successfully
switched to WebSocket. The response message body is absent.
          headers:
            Upgrade:
              schema:
                $ref: '#/components/schemas/websocketHeaderUpgrade-Type'
            Connection:
              schema:
                $ref: '#/components/schemas/websocketHeaderConnection-Type'
            Sec-WebSocket-Accept:
              schema:
                $ref: '#/components/schemas/websocketHeader-Sec-WebSocket-Accept-Type'
        '200':
```

```
          description: Success case (200 OK). The resource identified in the request for retrieval
returned in the response message body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/connectionInfo-Type'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/errorResponse-Type'
  '/connections/{connectionId}/streams':
    post:
      summary: Inform consumer about new reporting streams on an existing connection.
      description: Allows the producer to add one or more reporting streams to an already
established streaming connection.
      parameters:
        - name: connectionId
          in: path
          description: Indicate the ID (URI) of the connection for which the reporting stream
information is being added.
          required: true
          schema:
            $ref: '#/components/schemas/connectionId-Type'
      requestBody:
        required: true
        content:
          application/json:
            schema:
              type: array
              items:
                $ref: '#/components/schemas/streamInfo-Type'
      responses:
        '201':
          description: Success case (201 Posted).
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/streamInfo-Type'
        '202':
          description: Partial success case (202 Posted).
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/streamInfo-Type'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/errorResponse-Type'
    delete:
      summary: Remove reporting streams from an existing connection
      description: Allows the producer to remove one or more reporting streams from an already
established streaming connection.
      parameters:
        - name: connectionId
          in: path
          description: Indicate the ID (URI) of the connection for which the reporting stream
information is being removed.
          required: true
          schema:
            $ref: '#/components/schemas/connectionId-Type'
        - name: streamIds
          in: query
          description: The list of streamId for the stream(s) to be deleted.
          required: true
          schema:
            type: array
            items:
              $ref: '#/components/schemas/streamId-Type'
      responses:
        '204':
```

```
          description: Success case (204 No Content). The stream information resource has been
deleted. The response message body is absent.
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/errorResponse-Type'
    get:
      summary: Obtain information about streams.
      description: Enables the streaming data reporting service producer to obtain information about
one or more reporting streams.
      parameters:
        - name: connectionId
          in: path
          description: Indicate the ID (URI) of the connection for which the information is being
retrieved
          required: true
          schema:
            $ref: '#/components/schemas/connectionId-Type'
        - name: streamIds
          in: query
          description: The list of streamId for which the stream information is to be retrieved.
          required: true
          schema:
            type: array
            items:
              $ref: '#/components/schemas/streamId-Type'
      responses:
        '200':
          description: Success case (200 OK).
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/streamInfoWithReporters-Type'
        '202':
          description: Partial success case (202 Partially retrieved).
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/streamInfoWithReporters-Type'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/errorResponse-Type'
  '/connections/{connectionId}/streams/{streamId}':
    get:
      summary: Obtain information about stream
      description: Enables the streaming data reporting service producer to obtain information about
a reporting stream.
      parameters:
        - name: connectionId
          in: path
          description: Indicate the ID (URI) of the connection for which the information is being
retrieved
          required: true
          schema:
            $ref: '#/components/schemas/connectionId-Type'
        - name: streamId
          in: path
          description: Indicate the ID of the reporting stream for which the information is being
retrieved
          required: true
          schema:
            $ref: '#/components/schemas/streamId-Type'
      responses:
        '200':
          description: Success case (200 OK).
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/streamInfoWithReporters-Type'
```

```
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/errorResponse-Type'
components:
  schemas:
    analyticsInfo-Type:
      description: Information specific to analytics reporting.
      type: object
      properties:
        activityDetails:
          type: string
    connectionId-Type:
      $ref: '#/components/schemas/uri-Type'
    connectionInfo-Type:
      type: object
      properties:
        connection:
          $ref: '#/components/schemas/connectionId-Type'
        producer:
          $ref: '#/components/schemas/producerId-Type'
        streams:
          type: array
          items:
            $ref: '#/components/schemas/streamId-Type'
    connectionRequest-Type:
      type: object
      properties:
        producer:
          $ref: '#/components/schemas/producerId-Type'
        streams:
          type: array
          items:
            $ref: '#/components/schemas/streamInfo-Type'
    errorResponse-Type:
      type: object
      properties:
        error:
          type: object
          properties:
            errorInfo:
              type: string
    failedConnectionResponse-Type:
      type: object
      properties:
        error:
          type: array
          items:
            type: object
            properties:
              streamId:
                $ref: '#/components/schemas/streamId-Type'
              errorReason:
                type: string
    measObjDn-Type:
      description: DN of the measured object instance (see 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 "TS 28532_FileDataReportingMnS.yaml"

```
openapi: 3.0.1
info:
  title: File Data Reporting MnS
  version: 17.0.0
  description: >-
    OAS 3.0.1 definition of the File Data Reporting 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}/fileDataReportingMnS/{MnSVersion}'
    variables:
      MnSRoot:
        description: See clause 4.4.3 of TS 32.158
        default: http://example.com/3GPPManagement
      MnSVersion:
        description: Version number of the OpenAPI definition
        default: XXX
paths:
  /files:
    get:
      summary: Read information about available files
```

```
      description: >-
        Information about available files is read with HTTP GET. The files for
        which information shall be returned are identified with the path
        component (base resource) and the query component (fileDataType, beginTime,
        endTime) of the URI.
      parameters:
        - name: fileDataType
          in: query
          description: >-
            This parameter selects files based on the file data type.
          required: true
          schema:
            $ref: '#/components/schemas/FileDataType'
        - name: beginTime
          in: query
          description: >-
            This parameter selects files based on the earliest time they
            became available
          required: false
          schema:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
        - name: endTime
          in: query
          description: >-
            This parameter selects files based on the latest time they
            became available
          required: false
          schema:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
      responses:
        '200':
          description: >-
            'Success case ("200 OK").
            The resources identified in the request for retrieval are returned
            in the response message body.'
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/FileInfo'
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
  /subscriptions:
    post:
      summary: Create a subscription
      description: >-
        To create a subscription the representation of the subscription is
        POSTed on the /subscriptions collection resource.
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: 'TS28532_FaultMnS.yaml#/components/schemas/Subscription'
      responses:
        '201':
          description: >-
            Success case ("201 Created").
            The representation of the newly created subscription resource shall
            be returned.
          content:
            application/json:
              schema:
                $ref: 'TS28532_FaultMnS.yaml#/components/schemas/Subscription'
          headers:
            Location:
              description: URI of the newly created subscription resource
              required: true
              schema:
                type: string
        default:
          description: Error case.
          content:
```

```
            application/json:
              schema:
                $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
      callbacks:
        notifyFileReady:
          '{request.body#/consumerReference}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/NotifyFileReady'
              responses:
                '204':
                  description: >-
                    Success case ("204 No Content").
                    The notification is successfully delivered. The response message
                    body is absent.
                default:
                  description: Error case.
                  content:
                    application/json:
                      schema:
                        $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
        notifyFilePreparationError:
          '{request.body#/consumerReference}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/NotifyFilePreparationError'
              responses:
                '204':
                  description: >-
                    Success case ("204 No Content").
                    The notification is successfully delivered. The response message
                    body is absent.
                default:
                  description: Error case.
                  content:
                    application/json:
                      schema:
                        $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
  /subscriptions/{subscriptionId}:
    delete:
      summary: Delete a subscription
      description: >-
        The subscription is deleted by deleting the corresponding subscription
        resource. The resource to be deleted is identified with the path
        component of the URI.
      parameters:
        - name: subscriptionId
          in: path
          description: Identifies the subscription to be deleted.
          required: true
          schema:
            type: string
      responses:
        '204':
          description: >-
            Success case ("204 No Content").
            The subscription resource has been deleted. The response message body
            is absent.
        default:
          description: Error case.
          content:
            application/json:
              schema:
                $ref: 'TS28623_ComDefs.yaml#/components/schemas/ErrorResponse'
components:
  schemas:
    FileDataType:
      type: string
      enum:
        - Performance
```

```
      - Trace
      - Analytics
      - Proprietary
  FileNotificationTypes:
    type: string
    enum:
      - notifyFileReady
      - notifyFilePreparationError
  FileInfo:
    type: object
    properties:
      fileLocation:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
      fileCompression:
        type: string
      fileSize:
        type: integer
      fileDataType:
         $ref: '#/components/schemas/FileDataType'
      fileFormat:
        type: string
      fileReadyTime:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
      fileExpirationTime:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
      jobId:
        type: string
  NotifyFileReady:
    allOf:
      - $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
      - type: object
        properties:
          fileInfoList:
            type: array
            items:
              $ref: '#/components/schemas/FileInfo'
          additionalText:
            type: string
  NotifyFilePreparationError:
    allOf:
      - $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationHeader'
      - type: object
        properties:
          fileInfoList:
            type: array
            items:
              $ref: '#/components/schemas/FileInfo'
          reason:
            type: string
          additionalText:
            type: string
```

A.7.3 Integration with ONAP VES

Detailed guidelines for integration of file data reporting MnS notifications with ONAP VES are provided in Annex B.

Annex B (Informative): Guidelines for the integration of 3GPP MnS notifications with ONAP VES

In case the consumer of the 3GPP MnS notifications specified in the present document is an ONAP VES collector, the following guidelines are for the developer of the corresponding notification producer:

- The produced notification conforms to ONAP-defined VES specification;
- The VES Common Event Header fields are populated by the producer is as follows:
  - The domain "stndDefined" is used,
  - The "stndDefinedNamespace" field value is the concatenation of "3GPP-" and the name of the 3GPP MnS which the 3GPP IS notification is part of. Based on the MnS names defined in the present version of this document, VES name space values corresponding to 3GPP MnS could be:
    - "3GPP-Provisioning",
    - "3GPP-FaultSupervision",
    - "3GPP-PerformanceAssurance",
    - "3GPP-Heartbeat",
    - "3GPP-DataStreamingReporting",
    - "3GPP-DataFileReporting".
  - How the other fields of the Common Event Header are populated is not in the scope of the present document;
- The payload part of the VES event specification conforms to the OpenAPI definitions of clause A.1.1 (for provisioning MnS notifications), A.2.1 (for the fault supervision MnS notifications), A4.2 (for the performance assurance MnS notifications), A.5.1 (for the heartbeat notifications) and A.7.2 (for the file data reporting MnS notifications) of the present document. The OpenAPI definitions of Annex A in the present document may also be found on 3GPP FORGE (see [46]).

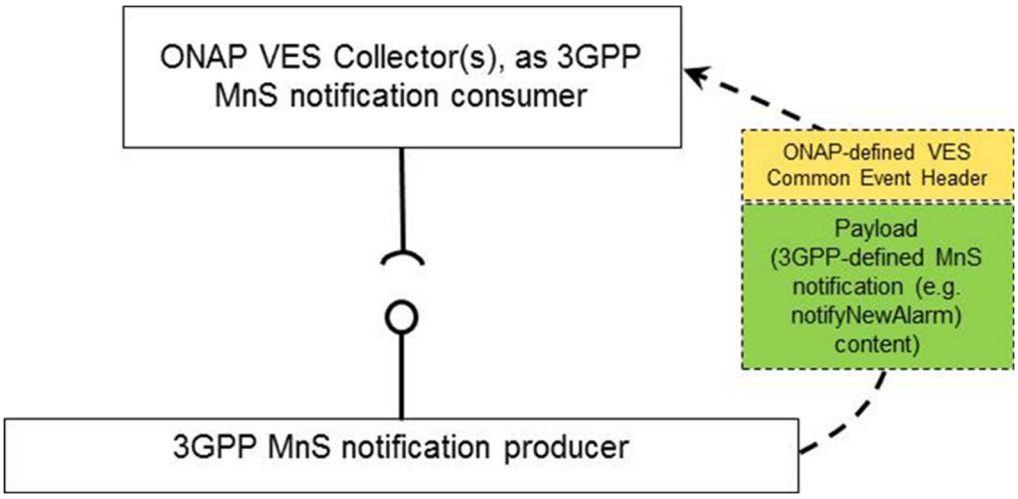


Figure X-1. 3GPP MnS notifications consumed by ONAP VES Collector(s).

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 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 aligh with URI structure defined in 32.158	16.5.0
2020-09	SA#89e	SP-200736	0141	1	A	Correct the description for generic provisioning MnS	16.5.0
2020-09	SA#89e	SP-200724	0143	-	F	Correct various smaller errors (e.g. validation errors) in faultMnS.yaml (OpenAPI definitions)	16.5.0
2020-09	SA#89e	SP-200724	0144	-	F	Correct definition of ThresholdLevelInd (REST SS)	16.5.0
2020-09	SA#89e	SP-200737	0147	-	F	Remove unintended normative statement from informative clause	16.5.0
2020-09	SA#89e					Correction of clause numbering	16.5.1
2020-11						Cleanup of custom XML, watermarks, hidden text, etc.. no technical changes	16.5.2
2020-12	SA#90e	SP-201050	0148	1	F	Correction on generic file data report MnS	16.6.0
2020-12	SA#90e	SP-201088	0149	2	F	Update generic streaming MnS	16.6.0
2020-12	SA#90e	SP-201050	0150	1	F	Correct CR implementation errors (Fault MnS)	16.6.0
2020-12	SA#90e	SP-201050	0152	1	F	Correct ThresholdLevelInd (REST SS, OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201054	0153	-	F	Correct notifyThresholdCrossing (stage 2)	16.6.0
2020-12	SA#90e	SP-201050	0154	1	F	Correct notifyThresholdCrossing (REST SS, OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201050	0155	1	F	Correct notifyHeartbeat (stage 2, REST SS, OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201050	0156	-	F	Correct small errors in faultMnS.yaml (OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201050	0157	1	F	Correct notifyChangedAlarmGeneral (stage 2)	16.6.0
2020-12	SA#90e	SP-201050	0158	-	F	Correct notifyChangedAlarmGeneral (REST SS, OpenAPI definitions)	16.6.0
2020-12	SA#90e	SP-201055	0160	1	F	Fix inconsistencies in guidelines for integration with ONAP VES	16.6.0
2020-12	SA#90e	SP-201088	0161	-	F	Correct small errors in the Fault MnS (REST SS)	16.6.0
2020-12	SA#90e	SP-201088	0162	-	F	Align ProvMnS data type names to UpperCamel (REST SS, OpenAPI definition)	16.6.0
2021-03	SA#91e	SP-210150	0163	2	F	Correct definitions for the File MnS (stage 2)	16.7.0
2021-03	SA#91e	SP-210150	0164	2	F	Correct definitions for the File MnS (REST SS)	16.7.0
2021-03	SA#91e	SP-210150	0165	2	F	Correct definitions for the File MnS (OpenAPI definitions)	16.7.0
2021-03	SA#91e	SP-210150	0166	1	F	Correct support qualifiers of the notifyThresholdCrossing parameters (stage 2)	16.7.0
2021-03	SA#91e	SP-210146	0167	-	F	Fix compilation errors	16.7.0
2021-03	SA#91e	SP-210146	0168	1	F	Correct the misalignment information for stage2 Fault Supervision MnS	16.7.0
2021-03	SA#91e	SP-210146	0170	1	F	Correct some minor errors in the Fault MnS definition (REST SS)	16.7.0
2021-03	SA#91e	SP-210146	0171	-	F	Correct some minor errors in the Prov MnS definition (REST SS)	16.7.0
2021-04	SA#91e					Editorial cleanup with the help of the Rapporteur	16.7.1
2021-06	SA#92e	SP-210406	0173	1	F	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
2022-03	SA#95e	SP-220183	0196	1	B	Add jobId to FileInfo	17.0.0
2022-06	SA#96	SP-220497	0200	-	A	Correct REST SS of deleteMOI	17.1.0
2022-06	SA#96	SP-220497	0201	-	F	Align allowed file transfer protocols in stage 2 with stage 1 requirements	17.1.0
2022-06	SA#96	SP-200502	0202	-	B	Update proMnS yaml file to include the resources-intentNrm	17.1.0
2022-06	SA#96	SP-220497	0205	-	A	OpenAPI file name and dependence change- part1	17.1.0
2022-06	SA#96	SP-220497	0206	-	A	OpenAPI file name and dependence change- part2	17.1.0
2022-06	SA#96	SP-220497	0208	1	A	Correct definition of Resource	17.1.0
2022-06	SA#96	SP-220564	0209	1	F	Correct notifyMOIChanges (stage 2)	17.1.0
2022-06	SA#96	SP-220564	0210	1	F	Correct notifyMOIChanges (REST SS)	17.1.0
2022-06	SA#96	SP-220564	0211	1	F	Correct notifyMOIChanges (OpenAPI definitions)	17.1.0
2022-06	SA#96	SP-220564	0213	1	B	Data change notifications YANG-in-Rest format	17.1.0
2022-06	SA#96	SP-220497	0216	-	A	Fix FileDataType definition in OpenAPI	17.1.0
2022-06	SA#96					CR implementation corrections	17.1.1

History

Document history		
V17.0.0	May 2022	Publication
V17.1.1	July 2022	Publication