ETSI TS 128 532 V18.3.0 (2024-07)

TECHNICAL SPECIFICATION

5G;
Management and orchestration;
Generic management services
(3GPP TS 28.532 version 18.3.0 Release 18)

Reference

RTS/TSGS-0528532vi30

Keywords

5G

ETSI

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

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

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from the
ETSI Search & Browse Standards application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on ETSI deliver.

Users should be aware that the present document may be revised or have its status changed, this information is available in the Milestones listing.

If you find errors in the present document, please send your comments to the relevant service listed under Committee Support Staff.

If you find a security vulnerability in the present document, please report it through our Coordinated Vulnerability Disclosure (CVD) program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.
No recommendation as to products and services or vendors is made or should be implied.
No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.
In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under https://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

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

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Foreword

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

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

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

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

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

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

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

shall   indicates a mandatory requirement to do something

shall not   indicates an interdiction (prohibition) to do something

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

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

should   indicates a recommendation to do something

should not   indicates a recommendation not to do something

may   indicates permission to do something

need not   indicates permission not to do something

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

can   indicates that something is possible

cannot   indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

1 Scope

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

2 References

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

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

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

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

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

[2]   Void

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

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

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

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

[7]   Void

[8]   Void

[9]   Void

[10]   Void

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

[12]   Void

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

[14]   Void

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

[16]   Void

[17]   Void

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

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

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

[21]   Void.

[22]   Void.

[23]   Void.

[24]   Void.

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

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

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

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

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

[30]   Void.

[31]   Void.

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

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

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

[35]   Void

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

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

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

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

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

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

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

[43]   Void

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

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

[46]   Void

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

[48]   Void

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

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

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

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

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

[54]   3GPP TS 28.111: "Management and orchestration; Study on Network Slice Management Enhancement".

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] apply.

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].

MnS   Management Service

4   Overview

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

5   Void

6   Void

7   Void

8   Void

9   Void

10 Void

11 Management services – Stage 2

11.1 Generic provisioning management service

11.1.0 Introduction

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

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

11.1.1 Operations and notifications

11.1.1.1 createMOI operation

11.1.1.1.1 Description

This operation is invoked by MnS consumers to request a MnS producer to create a (single) managed object instance on the MnS producer.

The "managedObjectClass" parameter in the request specifies the class name and the "managedObjectInstance" parameter the instance name of the object to be created. Both parameters shall be included in the request.

The MnS consumer shall generate the instance name by first assigning a value to the naming attribute of the new instance, and then constructing a DN according to TS 32.300 [25].

The MnS consumer shall provide in "attributeListIn" none, some or all values for the attributes specified by the managed object class definition of the class to be created. The MnS producer shall not update attribute values or remove attribute values, that are provided in the request, before creating the object and returning the "createMOI" response.

The properties of an attribute determine if attribute values shall, shall not or may be provided in the "createMOI" request. If no value is provided and a default value is specified for the attribute, the MnS producer shall set the attribute value to the default value. For further information on attribute properties and their impact on the presence or absence of attribute values in object creation requests and MnS producer behaviour, see TS 32.156 [x], clause 5.2.1 and annex B.

When the MnS producer assigns values, that are not known to the MnS consumer, to one or more attributes for which no value is included in the "createMOI" request, the MnS producer shall include "attributeListOut" in the "createMOI" response, otherwise "attributeListOut" may be omitted.

In case of a successful operation, the object shall be created immediately upon reception of the "createMOI" request, and the "createMOI" response shall be returned immediately after the creation of the object. The MnS producer shall not wait with the creation of the object or returning the response until some other potentially long-lasting process or activity, that might be triggered by the reception of the request or the creation of the object, has completed.

Only objects, whose parent exists, can be created (directly under that parent). The MnS producer shall consider an attempt to create an object whose parent object does not exist as an error.

The model state after applying the "createMOI" request shall fulfill all model constraints such as cardinality, multiplicity, allowed values, or data types, otherwise the operation shall fail.

Note that stage 3 protocols may represent missing values for attributes, that are defined by the object class, in the "createMOI" request in different ways. For some protocols just the attribute name may be present, without an attribute value. For other protocols, the complete attribute name/value pair may be absent.

Some stage 3 protocols do not support returning "attributeListOut". In this case, the MnS producer shall not modify the attribute list provided in the request before creating the object. If required by TS 32.156 [x], clause 5.2.1 and annex B, the MnS producer shall assign default values to attributes only after returning the "createMOI" response. Attribute value change notifications may be used to notify MnS consumers about the changes. Only default values, that have a specific definitive value may be assigned upon object creation. This is because the MnS consumer knows the MnS producer will assign this value when required according to TS 32.156 [x], clause 5.2.1 and annex B. Default values that are determined by the MnS producer based on standardized or proprietary selection methods are typically not known to MnS consumers.

11.1.1.1.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
managedObjectClass	M	string	Class name of the managed object to be created.
managedObjectInstance	M	DN	Distinguished Name of the managed object to be created.
attributeListIn	M	LIST OF SEQUENCE< attribute name, attribute value>	List of attribute name/value pairs of the managed object to be created.

11.1.1.1.3 Output parameters

Parameter name	S	Matching Information / Legal Values	Comment
attributeListOut	O	LIST OF SEQUENCE< attribute name, attribute value>	List of attribute name/value pairs of the created object. The parameter shall be present if the MnS producer assigns values, that are not known to the MnS consumer, to one or more attributes, otherwise it may be absent.
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.

The operation allows a MnS consumer to specify the data nodes to be returned with two optional methods. The first method allows to select objects with the "scope" and "filter" parameters. The second method uses the "dataNodeSelector" to specify the data nodes to be returned. All kinds of data nodes (i.e. objects, attributes, attribute

fields and attribute elements) can be selected. The selection may be based on conditions. The value of "dataNodeSelector" is an expression constructed based on a SS specific grammar.

Note that the functionality of the "scope" and "filter" parameters is fully covered by the functionality of the "dataNodeSelector" parameter. Therefore, a MnS producer supporting the "dataNodeSelector" parameter is not expected to support the "filter" parameter.

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.
CHOICE 1.1 scope	O	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.

CHOICE 1.2 > scopeType	O	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.

CHOICE_1.3 > scopeLevel	O	Integer	See definition of "scopeType" parameter.
CHOICE_1.4 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.
CHOICE_1.5 attributeListIn	O	LIST OF attribute name.	This parameter identifies the attributes to be returned by this operation. If the parameter is absent or empty all attributes shall be returned.
CHOICE_2.1 dataNodeSelector	O	string	This parameter contains an expression allowing to conditionally select data nodes. The expression semantic and syntax is SS specific.

11.1.1.2.3   Output Parameters

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

11.1.1.2.4   Results

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

11.1.1.3   modifyMOIAttributes operation

11.1.1.3.1   Description

This operation is invoked by MnS consumers to request a MnS producer to modify one or more attributes of one or more managed objects on that MnS producer. More specifically, this operation allows to modify (replace, add, remove) complete attributes, attribute fields and attribute elements.

The selection of the objects to be modified is achieved with the parameters "baseObjectInstance", "scopeType", "scopeLevel" and "filter". If no "scopeType" is specified, the value defaults to "BASE_ONLY". Also, when no scoping is supported by the MnS producer, the value in "baseObjectInstance" identifies the object to be modified.

A specific protocol solution may choose to split the selection of objects with scoping and filtering and the modification of the attributes of the selected objects into different operations.

The modifications to be applied to the selected objects are described in the "modificationList" parameter. This is a multi-valued parameter. Each value is a structure composed of "modifyOperator", "nodeIdentifier" and "nodeValue". The values of "modificationList" are ordered and shall be applied in the sequence as they occur in the list.

The parameter "nodeIdentifier" is used to identify the attribute, attribute field or attribute element to which the modification shall be applied. Attributes within one managed object can be identified with their name only. Unambiguous identification of attribute fields is not possible with their names only, because multiple attribute fields within one object may have the same name. Therefore, the identification needs to be based e.g. on global or local identifiers, or on the specification of a path allowing to navigate to the attribute field. Details are protocol specific.

For the modification of multi-valued attributes or multi-valued attribute fields two cases are distinguished:

- All values (elements) are considered as a single value. Elements cannot be addressed individually. If replaced, all existing elements are replaced with the new elements received in the modification request. If deleted, all existing elements are deleted. Addition of new elements to existing elements is not possible.

- Each element can be addressed individually. Single elements can be added, replaced, and deleted.

The first case does not need any further considerations. The second case requires the identification of attribute elements and attribute field elements in the modification request, when replacing and deleting elements in ordered and unordered lists, and when adding elements to ordered lists. Details are not defined at stage 2. They are protocol specific and include identification by the element value, identification by a positional index or identification by an auxiliary key added at stage 3. Note that the concept of element keys is not defined at stage 2. Identification of elements may be provided also by the "nodeIdentifier" parameter.

The "modifyOperator" parameter specifies the modification to be applied to the value of the attribute or attribute field, or the attribute element or attribute field element identified by the "nodeIdentifier". The parameter can have the values "replace", "add", "remove" or "setToDefault":

- For "replace", the "nodeValue" specifies the attribute value, attribute field value, attribute element or attribute field element that shall replace the existing value.

- For "add", the "nodeValue" specifies the attribute value or attribute field value to be added to an attribute or attribute field without value, or the new attribute element or attribute field element to be added to a multi-valued attribute.

- For "remove", the "nodeValue" is absent when an attribute value or attribute field value is removed. When an attribute element or attribute field element is removed, "nodeValue" may carry the element to be removed, depending on how on protocol level attribute elements and attribute field elements are identified.

- For "setToDefault", the "nodeValue" is absent.

Attributes and attribute fields without value can be represented in different protocol specific ways, for example by an attribute name without attribute value, by an absent attribute name/value pair, or by a specific attribute value (such as "null" or "nil").

The "modifyMOIAttributes" operation allows to modify one or more attributes in one or more objects. When not all attribute modifications can be applied successfully, the MnS producer has different options how to proceed. He may not perform any of the modifications and roll back to the state at the reception of the modification request. He may apply the changes that can be applied, so that some of the requested modifications are applied and some are not applied. He may stop processing the modification request when the first error occurs. The stage 2 definition of this operation does not include any provisions on how to proceed in case an error occurs. These provisions are left to stage 3.

The model state after applying the " modifyMOIAttributes " request shall fulfill all model constraints such as cardinality, multiplicity, allowed values, or data types, otherwise the operation shall fail.

11.1.1.3.2   Input parameters

Parameter Name	S	Matching Information / Legal Values	Comment
baseObjectInstance	M	ManagedEntity.objectInstance	Base object used for scoping the target objects of the operation. If no scoping is applied, the base object is the only target object.
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 corresponding parameter in "getMOIAttributes".	See corresponding parameter in "getMOIAttributes".
modificationList	M	LIST OF SEQUENCE < nodeIdentifier modifyOperator, nodeValue >	Set of sub-operations to be applied to attributes and attribute fields of the target objects. The "nodeIdentifier" specifies the target attribute or target attribute field of the sub-operation. The "modifyOperator" specifies the operation to be applied to the target attribute or target attribute field . The parameter can have the values "replace", "add", "remove" or "setToDefault". The "nodeValue" specifies the value used by the sub-operation. This parameter is absent for "remove" operations.

11.1.1.3.3 Output parameters

Parameter name	S	Matching Information / Legal Values	Comment
modificationsOut	O	LIST OF SEQUENCE < objectInstance DN, objectClass string, LIST OF SEQUENCE< attribute name, attribute value > >	Provides for each object, that is selected by the request, the object name, the object class, and a list of name/value pairs with the values of *all* attributes after modification. If all requested modifications are applied, the parameter may be absent. If no requested modification is applied and an error response is returned, the parameter may be absent, too..
status	M	ENUM (SUCCEEDED, PARTIALLY_FAILED, FAILED)	Indicates if all, some or none of the requested modifications were applied. Details on the error, such as which modification could not be applied and the corresponding reason, may be returned as well.

11.1.1.3.4 Results

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

11.1.1.4 deleteMOI operation

11.1.1.4.1 Description

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

11.1.1.4.2 Input parameters

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

11.1.1.4.3 Output parameters

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

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

11.1.1.4.4 Results

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

11.1.1.4a changeMOIs operation

11.1.1.4a.1 Definition

This operation is invoked by MnS consumers to request a MnS producer to create, delete, and update one or more objects using a single request. The request contains an ordered set of sub-operations. Each sub-operation creates an object, deletes an object, or updates attribute or attribute field values. Sub-operations should be executed in the order they appear in the request.

The "baseObjectInstance" parameter is common for all sub-operations and identifies the root of the object tree where changes can be made. Each sub-operation is defined by the "path", "modifyOperator" and "nodeValue" parameters. The "path" parameter specifies the offset from the root object to the target object, the target attribute or the target attribute field of the sub-operation. The "modifyOperator" specifies the operation to be applied. Valid values are "replace", "add", remove, and for attributes and attributes fields also the value "setToDefault".

The "nodeValue" provides the value for the sub-operation. The parameter shall be absent for "remove" operations.

For operations on attribute values or attribute field values the same provisions as in clause 11.1.1.3 apply.

When adding (creating) objects, the "nodeValue" contains the object representation.

The model state after applying the "changeMOIs" request shall fulfill all model constraints such as cardinality, multiplicity, allowed values, or data types, otherwise the operation shall fail.

Note that the parameters introduced and used in this clause just serve the purpose of explaining the functionality. Specific stage 3 solutions may implement the functionality in very different ways.

11.1.1.4a.2 Input parameters

Parameter Name	S	Matching Information / Legal Values	Comment
baseObjectInstance	M	ManagedEntity.objectInstance	Identifies the base object, that together with the "path" identifies the nodes to be modified.
modificationsIn	M	LIST OF SEQUENCE < path, modifyOperator, nodeValue >	Set of sub-operations to be applied to the target node. The "nodeIdentifier" specifies the target node. The "modifyOperator" specifies the operation to be applied to the target attribute node. The parameter can have the values "replace", "add", "remove" or "setToDefault". The value "replace" is not applicable, when the target node is an object. The value "SetToDefault" is applicable only to attributes and attribute fields. The "nodeValue" specifies the value for the sub-operation. This parameter is absent for "remove" operations.

11.1.1.4a.3   Output parameters

Parameter name	S	Matching Information / Legal Values	Comment

modificationsOut	O	LIST OF SEQUENCE <
		  objectInstance DN,
		  objectClass string,
		  LIST OF SEQUENCE<
		    attribute name,
		    attribute value >
		>
			Provides for each object, that is modified, the object name, the object class, and a list of name/value pairs with the values of *all* attributes after modification.
			
			If all requested modifications are applied, the parameter may be absent.
			
			If no requested modification is applied and an error response is returned, the parameter may be absent, too.

status	M	ENUM (
		  SUCCEEDED,
		  PARTIALLY_FAILED,
		  FAILED
		)
			Indicates if all, some or none of the requested modifications were applied. Details on the error, such as which modification could not be applied and the corresponding reason, may be returned as well.

11.1.1.5   Void

11.1.1.6   Void

11.1.1.7   Notification notifyMOICreation

11.1.1.7.1   Definition

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

11.1.1.7.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	ManagedEntity.objectClass	It specifies the class name of the IOC. A network event has occurred in an instance of this class.
objectInstance	M	ManagedEntity.objectInstance	It specifies a new instance of the above IOC in which the network event related to by carrying the Distinguished Name (DN) for the instance.
notificationId	M	This is an identifier for the notification, which may be used to correlate notifications.	The identifier of the notification shall be chosen to be unique across all notifications of a particular managed object instance throughout the time that correlation is significant, it uniquely identifies the notification from other notifications generated by the subject MOI.
notificationType	M	It specifies the type of provisioning management services related notifications. The value "notifyMOICreation" shall be carried.	It specifies the type of notification.
eventTime	M	It indicates the MOICreation event time.	See RFC 3339 [52] section 5.6 for details.
systemDN	M	It shall carry the DN of management service providers.	-
correlatedNotifications	CM	It specifies a set of notifications that are correlated to the subject notification.	The condition is that the MnS producer support the correlation of notifications
additionalText	O	It can contain further information in text on the event of the ManagedEntity(s).	-
sourceIndicator	O	ENUM(Resource_operation, Management_operation, SON_operation,Unknown)	This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values: 1. resource operation: The notification was generated in response to an internal operation of the resource; 2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object; 3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . 4. unknown: It is not possible to determine the source of the operation. Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON_operation for sourceIndicator might be sent.
attributeList	O	LIST OF SEQUENCE <AttributeName, AttributeValue>	The attributes (name/value pairs) of the created MOI.

11.1.1.7.3   Triggering event

11.1.1.7.3.1   From-state

stateBeforeObjectCreation.

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

11.1.1.7.3.2   To-state

stateAfterObjectCreation.

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

11.1.1.8   Notification notifyMOIDeletion

11.1.1.8.1   Definition

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

11.1.1.8.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	ManagedEntity.objectClass	It specifies the class name of the IOC. A network event has occurred in an instance of this class.
objectInstance	M	ManagedEntity.objectInstance	It specifies an existing instance of the above IOC in which the network event related to by carrying the Distinguished Name (DN) for the instance.
notificationId	M	This is an identifier for the notification, which may be used to correlate notifications.	The identifier of the notification shall be chosen to be unique across all notifications of a particular managed object throughout the time that correlation is significant, it uniquely identifies the notification from other notifications generated by the subject MOI.
notificationType	M	It specifies the type of provisioning management services related notifications. The value "notifyMOIDeletion" shall be carried.	It specifies the type of notification.
eventTime	M	It indicates the MOIDeletion event time.	See RFC 3339 [52] section 5.6 for details.
systemDN	M	It shall carry the DN of management service providers.	-
correlatedNotifications	CM	It specifies a set of notifications that are correlated to the subject notification.	The condition is that the MnS producer support the correlation of notifications
additionalText	O	It can contain further information in text on the event of the ManagedEntity(s).	-
sourceIndicator	O	ENUM(Resource_operation, Management_operation, SON_operation,Unknown)	This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values: 1. resource operation: The notification was generated in response to an internal operation of the resource; 2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object; 3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . 4. unknown: It is not possible to determine the source of the operation. Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON_operation for sourceIndicator might be sent.
attributeList	O	LIST OF SEQUENCE <AttributeName, AttributeValue>	The attributes (name/value pairs) of the deleted MOI.

11.1.1.8.3 Triggering event

11.1.1.8.3.1 From-state

stateBeforeObjectDeletion.

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

11.1.1.8.3.2 To-state

stateAfterObjectDeletion.

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

11.1.1.9 Notification notifyMOIAttributeValueChanges

11.1.1.9.1 Definition

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

11.1.1.9.2   Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	ManagedEntity.objectClass	It specifies the class name of the IOC. A network event has occurred in an instance of this class.
objectInstance	M	ManagedEntity.objectInstance	It specifies the existing instance of the above IOC in which the network event related to by carrying the Distinguished Name (DN) for the instance.
notificationId	M	This is an identifier for the notification, which may be used to correlate notifications.	The identifier of the notification shall be chosen to be unique across all notifications of a particular managed object throughout the time that correlation is significant, it uniquely identifies the notification from other notifications generated by the subject Information Object.
notificationType	M	It specifies the type of provisioning management services related notifications. The value "notifyMOIAttributeValueChange" shall be carried.	It specifies the type of notification.
eventTime	M	It indicates the MOIAttributeValueChange event time.	See RFC 3339 [52] section 5.6 for details.
systemDN	M	It shall carry the DN of management service providers.	-
correlatedNotifications	CM	It specifies a set of notifications that are correlated to the subject notification.	The condition is that the MnS producer support the correlation of notifications
additionalText	O	It can contain further information in text on the event of the ManagedEntity(s).	-
sourceIndicator	O	ENUM(Resource_operation, Management_operation, SON_operation,Unknown)	This parameter, when present, indicates the source of the operation that led to the generation of this notification. It can have one of the following values: 1. resource operation: The notification was generated in response to an internal operation of the resource; 2. management operation: The notification was generated in response to a management operation applied across the managed object boundary external to the managed object; 3. SON operation: The notification was generated as result of a SON (Self Organising Network) process like self-configuration, self-optimization, self-healing etc. . 4. unknown: It is not possible to determine the source of the operation. Remark: A provisioning MnS provider may not in any case be aware that SON operation lead to the generation of this generation. In this case another value than SON_operation for sourceIndicator might be sent.

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

11.1.1.9.3 Triggering event

11.1.1.9.3.1 From-state

stateBeforeAttributeValueChange.

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

11.1.1.9.3.2 To-state

stateAfterAttributeValueChange.

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

11.1.1.10 Notification notifyEvent

11.1.1.10.1 Definition

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

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

11.1.1.10.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	ManagedEntity.objectClass	--
objectInstance	M	ManagedEntity.objectInstance	--
notificationId	M	It carries the identifier for the subject notification.	See Note 1.
eventTime	M	It indicates the time of the event.	See RFC 3339 [52] section 5.6 for details.
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.

The scope of the subscription for this notification may specify managed objects, attributes, attribute fields or attribute elements. This allows for example to create subscriptions for `notifyMOIChanges` notifications that report attribute value changes of one attribute only.

11.1.1.11.2   Input parameters

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

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

11.1.2 Managed Information

11.1.2.1 ManagedEntity `<< ProxyClass>>`

11.1.2.1.1 Definition

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

11.2 Void

11.2a Generic fault supervision management service

See TS 28.111 [54] for more information on Generic fault supervision management service.

11.3 Performance assurance

11.3.1 Operations and notifications

11.3.1.1 Void

11.3.1.2 Void

11.3.1.3 Notification notifyThresholdCrossing

11.3.1.3.1 Definition

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

11.3.1.3.2 Notification information

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

11.3.2 Managed information

11.3.2.1 Performance data file

11.3.2.1.1 Void

11.3.2.1.2 Performance data file content description

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

Table 11.3.2.1.2-1: Performance data file content description

File content item	Description
measDataFile	Top-level tag indicating the file contains performance metrics. Each file includes a header ("measFileHeader"), a collection of information elements with produced performance metrics and associated meta data ("measData") and a footer ("measFileFooter").
measFileHeader	File header including the file format version, information about the sending node (DN, type and vendor) and a time stamp indicating the begin of the first granularity period contained in the file ("collectionBeginTime").
measData	Information element containing the DN of the common root of the measured object instances ("measObjRootDn ") included in that information element, followed by a list of information elements containing the produced performance metrics and associated meta data ("measInfo"). A "MeasDataFile" contains zero, one or more "measData" elements.
measFileFooter	File footer with a time stamp indicating the end of the last granularity period contained in the file ("collectionEndTime").
fileFormatVersion	File format version applied by the sender as indicated by the specific format version identifier provided for each version.

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 TS 28.620 [y]. The type of a management node is "MANAGEMENT_NODE".
vendorName	Vendor of the the entity, that generated and sent the file.
collectionBeginTime	Time stamp indicating the begin of the first granularity period for which performance metrics are stored in the file.
measObjRootDn	DN of the measured object root. The measured object root is the first common object name-containing all objects that the metrics in one "measData" element are related to. When the metrics are produced by a managed element, the root object is the "ManagedElement" representing this managed element. When (aggregated) metrics are produced by a management node (based on input metrics from managed elements), such as metrics for sub-networks or network slices, the root object is the root "SubNetwork" of this management node.
measObjRootUserLabel	User label of the measured object root.
measObjRootSwVersion	Software version of the measured object root, allowing post-processing systems to take care of vendor specific performance metrics. It is either the software version of a managed element or of a management node.
measInfo	Information element added to "measData" for each expired granularity period, containing information on the produced performance metrics, starting with a time stamp ("measTimeStamp"), the granularity period ("granularityPeriod") and reporting period ("reportingPeriod") that are associated to the following performance metrics ("measValues"), for which is indicated the performance metric name, the measured or computed performance metric value and the object instance to which the performance metric is related to.
measInfoId	Identifier of a "measInfo".
jobId	Job identifier of the related "PerfMetricJob" in this "measInfo".
reportingPeriod	Period used for performance metric reporting in this "measInfo". Unit is seconds
granularityPeriod	Period used for performance metric production in a "measInfo". Unit is seconds.
measTimeStamp	End time of the granularity period in a "measInfo".
measTypes	Performance metric names in a "measInfo"
measValues	Performance metric values in a "measInfo". Each item in this list includes the LDN of the object the metrics are related to ("measObjLdn"), the measured or computed values of the metrics ("measResults") and a flag that indicates whether the metrics are reliable ("suspectFlag").

measObjLdn	Local distinguished name (LDN) of the object the performance metrics are related to (measured object) within the scope defined by the "measObjRootDn". The concatenation of the "measObjRootDn" and the "measObjLdn" is the DN of the measured object. The "measObjLdn" is therefore empty if the "measObjRootDn" already specifies completely the DN of the measured object, which is the case for metrics associated to "ManagedElement" or the root "SubNetwork".
	
	For example, if the measured object is a "ManagedElement" representing RNC "RNC-Gbg-1", then the "measObjRootDn" may look like
	
	  "DC=a1.operatorNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1"
	
	and the "measObjLdn" is empty. However, if the measured object is an "UtranCell" representing cell "Gbg-997" managed by that RNC, then the "measObjRootDn" is the same as above, i.e.
	
	  "DC=a1.companyNN.com,SubNetwork=CountryNN,ManagedElement=RNC-Gbg-1"
	
	and the "measObjLdn" is
	
	  "RncFunction=RF-1,UtranCell=Gbg-997".
	
	The class of the measured object is defined in item f) of measurement definitions (TS 32.404 [47], TS 28.552 [18]) and in item d) of KPI definitions (TS 28.554 [6]).

measResults	List of result values for the observed or computed performance metrics. The "measResults" sequence shall have the same number of elements and follow the same order as the "measTypes" sequence. The NULL value is reserved to indicate that the performance metric is not applicable or could not be produced for the object instance.
suspectFlag	Reliability of the performance metrics. FALSE means the metrics are reliable, TRUE means they are not reliable. The default value is "FALSE".
collectionEndTime	Time stamp indicating the end of the last granularity period for which performance metrics are stored in the file.

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

11.3.2.1.3 Void

11.3.2.1.3.1 Void

11.3.2.1.3.2 Void

11.3.2.1.4 Performance data file naming convention

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

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

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

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

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

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

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

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

   - YYYY is the year in four-digit notation;

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

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

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

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

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

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

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

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

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

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

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

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

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

Some examples describing file-naming convention:

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

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

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

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

11.3.2.1.4   Void

11.4   Heartbeat notification

11.4.1   Operations and notifications

11.4.1.1   Notification notifyHeartbeat

11.4.1.1.1   Definition

This notification allows a MnS producer to send heartbeats to consumer(s) when the MnS producer heartbeat period has expired or when a MnS consumer requests the emission of an immediate heartbeat notification.

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

11.4.1.1.2 Input parameters

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	HeartbeatControl.objectClass	
objectInstance	M	HeartbeatControl.objectInstance	Instance controlling the emission of this notifyHeartbeat notification.
notificationId	M	--	
notificationType	M	"notifyHeartbeat"	
eventTime	M	--	Time at which the notification is emitted. See RFC 3339 [52] section 5.6 for details.
systemDN	M	MnSAgent.objectInstance	
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";
			  - streamId globally unique stream identifier;
			  - Trace Reference (see clause 5.6 of TS 32.422 [38]) as stream identifier;
			  - list of Trace Reference (see clause 5.6 of TS 32.422 [38]) for signaling based trace
			  - list of tuple of <Trace Reference (see clause 5.6 of TS 32.422 [38]), jobId (see clause 4.3.30 of TS 28.622 [11]) providing the id of the job for the configuration> for management based trace
			For streaming performance data reporting each StreamInfo includes:
			  - StreamType carrying the value "PERFORMANCE";
			  - SerializationFormat carrying the value "GPB" or "ASN1";
			  - streamId globally unique stream identifier;
			  - measObjDn: the DN of the measured object instance;
			  - performanceMetrics: a list of performance metric names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI;
			  - either:
			    - jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;
			  - or:
			    - jobId globally unique identifier of a measurement job (see TS 28.550 [42]).
			For streaming analytics reporting each StreamInfo includes:
			  - StreamType carrying the value "ANALYTICS";
			  - SerializationFormat carrying the value "GPB" or "ASN1";
			  - streamId globally unique stream identifier;
			  - AnalyticsInfo providing the details about the analytics activity for which the data is being reported.
			For proprietary data streaming reporting each StreamInfo includes:
			  - StreamType carrying the value "PROPRIETARY";
			  - streamId globally unique stream identifier;
			  - VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported.

11.5.1.1.3 Output parameters

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

11.5.1.1.4 Exceptions

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

11.5.1.2 terminateStreamingConnection operation (M)

11.5.1.2.1 Definition

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

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

11.5.1.2.2 Input parameters

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

11.5.1.2.3 Output parameters

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

11.5.1.2.4 Exceptions

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

11.5.1.3 reportStreamData operation (M)

11.5.1.3.1 Definition

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

11.5.1.3.2 Input parameters

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

11.5.1.3.3   Output parameters

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

11.5.1.3.4   Exceptions

Exception Name	Definition

11.5.1.4   addStream operation (M)

11.5.1.4.1   Definition

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

11.5.1.4.2 Input parameters

Parameter Name	S	Information type	Comment
connectionId	M	See clause 11.5.1.1.3	It identifies the streaming connection to which new reporting streams are being added. The format may have dependency on the solution set.

streamInfoList	M	List of StreamInfo	This parameter contains the list of meta-data about each reporting stream being added to the already established connection.
			For streaming trace reporting each StreamInfo includes:
			  - StreamType carrying the value "TRACE";
			  - SerializationFormat carrying the value "GPB" or "ASN1";
			  - streamId globally unique stream identifier
			  - list of Trace Reference (see clause 5.6 of TS 32.422 [38]) for signaling based trace
			  - list of tuple of <Trace Reference (see clause 5.6 of TS 32.422 [38]), jobId (see clause 4.3.30 of TS 28.622 [11]) providing the id of the job for the configuration> for management based trace
			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";
			    - streamId globally unique stream identifier
			    - list of Trace Reference (see clause 5.6 of TS 32.422 [38]) for signaling based
			    - list of tuple of <Trace Reference (see clause 5.6 of TS 32.422 [38]), jobId (see clause 4.3.30 of TS 28.622 [11]) providing the id of the job for the configuration> for management based trace
			For streaming performance data reporting each StreamInfo includes:
			    - StreamType carrying the value "PERFORMANCE";
			    - SerializationFormat carrying the value "GPB" or "ASN1";
			    - streamId globally unique stream identifier;
			    - measObjDn: the DN of the measured object instance;
			    - performanceMetrics: a list of performance metric names whose values are to be reported by the Performance Data Stream Units (see Annex C of TS 28.550 [42]) via this stream. Performance metrics include measurement and KPI;
			    - either:
			        - jobId defined in the PerfMetricJob MOI (see clause 4.3.31 of TS 28.622 [11]) for which the data is being reported;
			    - or:
			        - jobId globally unique identifier of a measurement job (see TS 28.550 [42]).
			For streaming analytics reporting each StreamInfo includes:
			    - StreamType carrying the value "ANALYTICS";
			    - SerializationFormat carrying the value "GPB" or "ASN1";
			    - streamId globally unique stream identifier;
			    - AnalyticsInfo providing the details about the analytics activity for which the data is being reported.
			For proprietary data streaming reporting each StreamInfo includes:
			    - StreamType carrying the value "PROPRIETARY";
			    - streamId globally unique stream identifier;
			    - VsDataContainer (see clause 4.3.9 of TS 28.622 [11]) providing the details about the data being reported.

status	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail because of a specified or unspecified reason.

11.5.1.4.4 Exceptions

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

11.5.1.5 deleteStream operation (M)

11.5.1.5.1 Definition

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

11.5.1.5.2 Input parameters

Parameter Name	S	Information type	Comment
connectionId	M	See clause 11.5.1.1.3	It identifies the streaming connection from which the reporting streams are being removed. The format may have dependency on the solution set.
streamIdList	M	List of stream identifiers	This parameter contains the list of identifiers for streams being removed from the already established connection. For streaming trace reporting streamId globally unique stream identifier and Trace Reference (see clause 5.6 of TS 32.422 [38]). 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 `streamId` globally unique 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 `streamId` globally unique 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"; - `streamId` globally unique stream identifier - list of Trace Reference (see clause 5.6 of TS 32.422 [38]) for signaling based - list of tuple of <Trace Reference (see clause 5.6 of TS 32.422 [38]), `jobId` (see clause 4.3.30 of TS 28.622 [11]) providing the id of the job for the configuration> for management based trace 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
changeMOIs	PATCH	{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	ErrorResponseDefault	O

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

12.1.1.1.3 Operation getMOIAttributes

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

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

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

Note 1: Void.

Note 2: Void.

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

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

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

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

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

Further details on the SS parameter "dataNodeSelector" is provided in TS 32.158 [15], clause 6.2a.

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	ErrorResponseDefault	O

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

12.1.1.1.4.2   Mapping to HTTP PATCH

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

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

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

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

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

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

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

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

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

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

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

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

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
attributeListOut	response body	n/a	Resource	M
status	response status codes	n/a	n/a	M
	response body	error	ErrorResponseDefault, or ErrorResponsePatch	O

For JSON Merge Patch and 3GPP JSON Merge Patch the type "ErrorResponseDefault" is used.

For JSON Patch and 3GPP JSON Patch the type "ErrorResponsePatch" is used.

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

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

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

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

Note 1: Void.

12.1.1.1.5 Operation deleteMOI

This operation deletes a single resource representing a managed object instance

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

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

Note 1: Void.

Note 2: Void.

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

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

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

12.1.1.1.6 Void

12.1.1.1.7 Void

12.1.1.1.8 Operation changeMOIs

This operation creates, deletes, and updates one or more objects using a single request.

Table 12.1.1.1.8-1: 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
modificationsIn	query	n/a	Resource, or array(PatchItem)	M

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

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

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

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

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

Table 12.1.1.1.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
modificationsOut	response body	n/a	Resource	M
status	response status codes	n/a	n/a	M
	response body	n/a	ErrorResponseDefault, or ErrorResponsePatch	O

For JSON Merge Patch and 3GPP JSON Merge Patch the "ErrorResponseDefault" is used.

For JSON Patch and 3GPP JSON Patch the "ErrorResponsePatch" is used.

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

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

Further details on the error response formats are provided in TS 32.158 [15], clause 6.6.

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
notifyEvent	POST	{notificationTarget}	M

12.1.1.2.2   Notification notifyMOICreation

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

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

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

12.1.1.2.3   Notification notifyMOIDeletion

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

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

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

12.1.1.2.6   Notification notifyEvent

The IS notification parameters are mapped to SS equivalents according to table 12.1.1.2.6-1.

Table 12.1.1.2.6-1: 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
specificProblem	request body	specificProblem	SpecificProblem	M
additionalText	request body	additionalText	string	O
additionalInformation	request body	additionalInformation	AttributeNameValuePairSet	O

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.

{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}
/{className}={id}
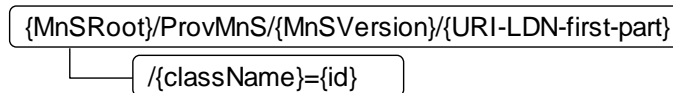
Figure 12.1.1.3.1.1-1: Resource URI structure of the Provisioning MnS on the MnS producer

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.

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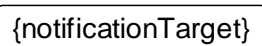
Figure 12.1.1.3.1.2-1: Resource URI structure of the Provisioning MnS on the MnS consumer

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

Table 12.1.1.3.1.2-1: Resources and methods overview

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

12.1.1.3.2 Resource definitions

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

12.1.1.3.2.1.1 Description

This resource represents a managed object instance.

12.1.1.3.2.1.2 URI

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

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

Table 12.1.1.3.2.1.2-1: URI variables

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

12.1.1.3.2.1.3 HTTP methods

12.1.1.3.2.1.3.1 HTTP PUT

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

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

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

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

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

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

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

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

12.1.1.3.2.1.3.2   HTTP GET

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

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

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

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

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

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

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

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

12.1.1.3.2.1.3.3   HTTP PATCH

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

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

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

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

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

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

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

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

12.1.1.3.2.1.3.4   HTTP DELETE

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

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

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

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

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

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

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

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

12.1.1.3.2.2 Void

12.1.1.3.2.3 Void

12.1.1.3.2.4 Resource "{notificationTarget}"

12.1.1.3.2.4.1 Description

This resource represents a notification target on the MnS consumer.

12.1.1.3.2.4.2 URI

Resource URI: {notificationTarget}

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

Table 12.1.1.3.2.4.2-1: URI variables

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

12.1.1.3.2.4.3 HTTP methods

12.1.1.3.2.4.3.1 POST

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

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

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

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

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

Data type	Description	S
NotifyMOICreation	Type for a notifyMOICreation notification	M
NotifyMOIDeletion	Type for a notifyMOIDeletion notification	M
NotifyAttributeValueChanges	Type for a notifyAttributeValueChanges notification	M
NotifyMoiChanges	Type for a notifyMOIChanges notification	M
NotifyEvent	Type for a notifyEvent notification	O

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

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

12.1.1.4 Data type definitions

12.1.1.4.1 General

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

Table 12.1.1.4.1-1: Data types defined in this specification

Data type	Reference	Description
CmNotificationTypes	12.1.1.4.4.3	Notification type (notifyMOICreation, etc.)
SourceIndicator	12.1.1.4.4.4	Indicates the source of the operation that led to the generation of the notification.
ScopeType	12.1.1.4.4.5	Scope type of a scope
Operation	12.1.1.4.4.6	Enum with "create", "delete" and "replace"
Insert	12.1.1.4.4.8	Enum with "before" and "after"
PatchOperation	12.1.1.4.4.7	Enum with "add", "replace", "remove", "copy", "move" and "test"
Resource	12.1.1.4.1a.1	Used for resource representations
Scope	12.1.1.4.1a.2	Used in the query part of HTTP GET and HTTP DELETE to extend the set of targeted resources beyond the base resource identified with the authority and path component of the URI
CorrelatedNotification	12.1.1.4.1a.3	Describes the correlated notifications of a single source
MoiChange	12.1.1.4.1a.4	Single MOI change reported by notifyMOIChanges
NotifyMOICreation	12.1.1.4.1a.5	Used in the request body of HTTP POST for the notification type notifyMOICreation
NotifyMOIDeletion	12.1.1.4.1a.6	Used in the request body of HTTP POST for the notification type notifyMOIDeletion
NotifyMOIAttributeValueChanges	12.1.1.4.1a.7	Used in the request body of HTTP POST for the notification type notifyMOIAttributeValueChanges
NotifyMOIChanges	12.1.1.4.1a.8	Used in the request body of HTTP POST for the notification type notifyMOIChanges
NotifyEvent	12.1.1.4.1a.10	Used in the request body of HTTP POST for the notification type notifyEvent
PatchItem	12.1.1.4.1a.9	Specifies a patch item of a patch document

Table 12.1.1.4.1-2: Data types imported

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

12.1.1.4.1a   Structured data types

12.1.1.4.1a.1   Type Resource

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

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

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

12.1.1.4.1a.2   Type Scope

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

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

12.1.1.4.1a.3   Type CorrelatedNotification

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

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

12.1.1.4.1a.4   Type MoiChange

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

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

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

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

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

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

The following example reports the deletion of that object.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Its deletion is reported by the following notification.

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

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

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

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

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

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

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

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

A value change to

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

is reported by

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

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

```
attrE:
  11:
    subItemE2: abc
  21:
    subItemE2: def
  31:
    subItemE2: ghi
```

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

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

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.com
Content-Type: application/json

{
  "href": "http://example.com/3gpp",
  "notificationId": 123456789,
  "notificationType": "notifyMOICreation",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "moiChanges": [
    {
      "notificationId": 123,
      "op": "replace",
      "path": "/ClassA=1#/attributes",
      "value": {
        "attrA": "newValueAttrA",
        "attrB": "newValueAttrB"
      }
    }
  ]
}
```

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.com
Content-Type: application/json

{
  "href": "http://example.com/3gpp",
  "notificationId": 123456789,
  "notificationType": "notifyMOICreation",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "moiChanges": [
    {
      "notificationId": 123,
      "op": "replace",
      "path": "/ClassA=1#/attributes",
      "value": {
        "attrA": "newValueAttrA",
        "attrB": "oldValueAttrB"
      }
    }
  ]
}
```

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.com
Content-Type: application/json

{
  "href": "http://example.com/3gpp",
  "notificationId": 123456789,
  "notificationType": "notifyMOICreation",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "moiChanges": [
    {
      "notificationId": 123,
      "op": "replace",
      "path": "/ClassA=1#/attributes",
      "value": {
        "attrA": "newValueAttrA",
        "attrB": "oldValueAttrB"
      },
      "oldValue": {
        "attrA": "oldValueAttrA",
        "attrB": "oldValueAttrB"
      }
    }
  ]
}
```

12.1.1.4.1a.5   Type NotifyMoiCreation

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

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

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.com
Content-Type: application/json

{
  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",
  "notificationId": 123456789,
  "notificationType": "notifyMOICreation",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "attributeList":
    {
      "attrA": "valueAttrA",
      "attrB": "valueAttrB"
```

```
    }
}
```

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.com
Content-Type: application/json

{
  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",
  "notificationId": 123456789,
  "notificationType": "notifyMOICreation",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "attributeList":
    {
    }
}
```

12.1.1.4.1a.6   Type NotifyMoiDeletion

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

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

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

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

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

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

```
    }
}
```

12.1.1.4.1a.7   Type NotifyMoiAttributeValueChanges

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

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

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.org
Content-Type: application/json

{
  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",
  "notificationId": 123456789,
  "notificationType": "notifyMOIAttributeValueChanges",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "attributeListValueChanges": [
    {
      "attrA": "newValueAttrA",
      "attrB": "newValueAttrB"
    }
  ]
}
```

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.org
Content-Type: application/json

{
  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",
  "notificationId": 123456789,
  "notificationType": "notifyMOIAttributeValueChanges",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "attributeListValueChanges": [
    {
      "attrA": "newValueAttrA",
      "attrB": "newValueAttrB"
    },
    {
      "attrA": "oldValueAttrA",
      "attrB": "oldValueAttrB"
    }
  ]
}
```

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

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

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: example.org
Content-Type: application/json

{
  "href": "http://example.com/ManagedElement=ME1/ClassA=CA1",
  "notificationId": 123456789,
  "notificationType": "notifyMOIAttributeValueChanges",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=example.com,ManagedElement=ME1,MnsAgent=MA1",
  "attributeListValueChanges": [
    {
      "attrA": {
        "attrFieldAA": "newValueAttrFieldAA",
        "attrFieldAB": "oldValueAttrFieldAB"
      }
    },
    {
      "attrA": {
        "attrFieldAA": "oldValueAttrFieldAA",
        "attrFieldAB": "oldValueAttrFieldAB"
      }
    }
  ]
}
```

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

12.1.1.4.1a.8   Type NotifyMoiChanges

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

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

12.1.1.4.1a.9   Type PatchItem

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

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

12.1.1.4.1a.10   Type NotifyMoiEvent

Table 12.1.1.4.1a.10 -1: Definition of type NotifyEvent

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 ("notifyEvent")	M
eventTime	DateTime	Date and time of the event	M
systemDN	SystemDN	It carries the DN of producer of the notification.	M
specificProblem	SpecificProblem	It indicates a problem detected	M
additionalText	string	It carries additional information.	O
additionalInformation	AttributeNameValuePairSet	It carries additional information.	O

The following is an example of the notifyEvent notification.

```
POST /3gpp-management/cm-notification-sink HTTP/1.1
Host: myMns.mytelecom.com
Content-Type: application/json
{
  "href": "http://myNode.com/ManagedElement=ME1 ",
  "notificationId": 123456789,
  "notificationType": "notifyEvent",
  "eventTime": "Tue, 06 Aug 2019 16:50:26 GMT",
  "systemDN":"DC=myNode.com,ManagedElement=ME1,MnsAgent=MA1",
  "specificProblem": "Restart",
  "additionalText": "Restart due to overheating",
  "additionalInformation":
    {
      "temperature": "94.7",
      "trendIndication": "MORE_SEVERE"
    }
}
```

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
notifyEvent	Notification type is notifyEvent

12.1.1.4.4.4   Enumeration SourceIndicator

Table 12.1.1.4.4.4-1: Enumeration SourceIndicator

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

12.1.1.4.4.5   Enumeration ScopeType

Table 12.1.1.4.4.4.1-1: Enumeration ScopeType

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

12.1.1.4.4.6   Enumeration Operation

Table 12.1.1.4.4.4.6-1: Enumeration Operation

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

12.1.1.4.4.7   Enumeration PatchOperation

Table 12.1.1.4.4.4.7-1: Enumeration PatchOperation

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

12.1.1.4.4.8   Enumeration Insert

Table 12.1.1.4.4.4.8-1: Enumeration Insert

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

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

12.1.2.1   Mapping of operations

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

12.1.2.2   Mapping of notifications

12.1.2.2.1   Introduction

12.1.2.2.1.1   General

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

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

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

12.1.2.2.6 Notification notifyEvent

See clause 12.1.1.2.6.

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].

```
{ServerRoot}
    |
    |--- /eventListener/v{apiVersion}
                |
                |--- /eventBatch
```
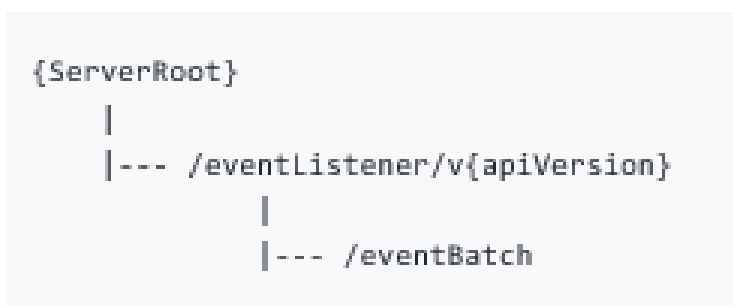
Figure 12.1.2.3.1-1: Resource URI structure of the provisioning MnS for integration with ONAP VES Event Listener 7.1.1 (Resource structure section) [45]

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

Table 12.1.2.3.1-1: Resources and methods overview

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

12.1.2.3.2 Resource definitions

See Resource structure section in [45].

12.1.2.4 Data type definitions

See clause 12.1.1.4.

12.1.3 YANG/Netconf-based solution set

12.1.3.1 Mapping of operations

12.1.3.1.1 Introduction

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

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

12.1.3.1.2 Operation `createMOI`

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

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

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

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

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

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

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

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

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

Examples

Create ManagedElement=myNode, GNBDUFunction=1

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

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

12.1.3.1.3　　　　Operation `getMOIAttributes`

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

The IS operation patameters `baseObjectInstance`, `(3GPP-)filter`, `scope`, `level`, `dataNodeSelector` 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
dataNodeSelector	filter	M	Included in the 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.

12.1.3.1.4a   Operation `changeMOIs`

The operation is mapped to a NETCONF <edit-config> operation, with XML elements representing the DN path to the MOI and any attributes or attribute fields.

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 12.1.3.1.4a-1 and table 12.1.3.1.4a-2.

The detailed semantics is specified by the Netconf protocol and the related YANG models.

Table 12.1.3.1.4a-1: Mapping from IS `changeMOIs` 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 created MOI and its key.
modificationsIn	config	M	Path and nodeValue are represented by XML elements inside the <config> element. modifyOperator is represented by the Netconf operation parameter.

Table 12.1.3.1.4a-2: Mapping from IS `changeMOIs` output parameters to SS equivalents

IS operation parameter name	SS parameter name	S	Remark
attributeListOut	-	O	Not supported. (note 1)
status	-	M	SUCCEEDED if NETCONF rpc-reply contains an <ok> element. FAILED if NETCONF-reply contains an <rpc-error>. Support for PARTIALLY_FAILED depends on the NETCONF error-option. It is recommended to always use the error-option=rollback-on-error as semantics for stop-on-error, and continue-on-error is not well defined.

NOTE 1: 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". If the ONAP VES API integration is used the "Content-Type" shall be set to *application/json as dictated by the VES specification[45]*.

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

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

  - The "path" includes the YANG module name.

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

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

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

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

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

- YANG default values shall be handled as follows:

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

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

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

Case 1: Creation of an MOI is reported with:

- operation: add

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

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

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

```
href: node1.lichtenberg.de
…
notificationId: 123456001
path: "/_3gpp-common-managed-element:ManagedElement=node3/PerfMetricJob=job1"
operation: add
value:
  id: job1
  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/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/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/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/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/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/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/ThresholdMonitor=job1/attributes/
thresholdInfoList=thr1/hysteresis
operation: remove
```

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

- operation: replace.

- path: Same as case 9.

- value: Same as case 9.

12.1.3.2.6 Notification notifyEvent

The NETCONF/YANG solution set uses the same mapping as the RESTful HTTP-based solution set. See clause 12.1.1.2.6.

12.1.3.3 Netconf Server behavior

12.1.3.3.1 Introduction

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

12.1.3.3.2 Implement IETF RFC 6243: "With-defaults Capability for NETCONF"

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

12.2 Void

12.3 Generic performance assurance management service

12.3.1 RESTful HTTP-based solution set

12.3.1.1 Void

12.3.1.2 Performance threshold monitoring service

12.3.1.2.1 Mapping of operations

None.

12.3.1.2.2 Mapping of notifications

12.3.1.2.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.3.1.2.2.1-1.

Table 12.3.1.2.2.1-1: Mapping of IS notifications to SS equivalents

IS notifications	HTTP Method	Resource URI	S
notifyThresholdCrossing	POST	/notificationSink	M

12.3.1.2.2.2   Notification notifyThresholdCrossing

The IS notification parameters are mapped to SS equivalents according to table 12.3.1.2.2.2-1.

Table 12.3.1.2.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass	request body	href	Uri	M
objectInstance				
notificationId	request body	notificationId	NotificationId	M
notificationType	request body	notificationType	NotificationType	M
eventTime	request body	eventTime	DateTime	M
systemDN	request body	systemDN	SystemDN	M
observedPerfMetricName	request body	observedPerfMetricName	string	M
observedPerfMetricValue	request body	observedPerfMetricValue	PerfMetricValue	M
observedPerfMetricDirection	request body	observedPerfMetricDirection	PerfMetricDirection	M
thresholdValue	request body	thresholdValue	PerfMetricValue	M
hysteresis	request body	hysteresis	PerfMetricValue)	M
monitorGranularityPeriod	request body	monitorGranularityPeriod	integer	M
additionalText	request body	additionalText	string	O

12.3.1.2.3   Resources

12.3.1.2.3.1   Resource structure

Table 12.3.1.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 12.3.1.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Description
notificationSink	/notificationSink	POST	Send notifications

12.3.1.2.3.2   Resource definitions

12.3.1.2.3.2.1   Resource "/notificationSink"

12.3.1.2.3.2.1.1   Description

This resource represents a resource on a MnS consumer to which notifications are sent to.

12.3.1.2.3.2.1.2   URI

The resource URI is provided by the notification subscription.

12.3.1.2.3.2.1.3   HTTP methods

12.3.1.2.3.2.1.3.1   POST

This method shall support the URI query parameters specified in table 12.3.1.2.3.2.1.3.1-1.

Table 12.3.1.2.3.2.1.3.1-1: URI query parameters supported by the POST method on this resource

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

This method shall support the request data structures specified in table 12.3.1.2.3.2.1.3.1-2 and the response data structures and response codes specified in table 12.3.1.2.3.2.1.3.1-3.

Table 12.3.1.2.3.2.1.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	Description	S
NotifyThresholdCrossing	Type in case a notifyThresholdCrossing notification is sent	M

Table 12.3.1.2.3.2.1.3.1-3: Data structures supported by the POST Response Body on this resource

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

12.3.1.2.4 Data type definitions

12.3.1.2.4.1 General

Table 12.3.1.2.4.1-1: Data types defined in this specification

Data type	Reference	Description
NotifyThresholdCrossing	12.3.1.2.4.2.1	Used in the request body of HTTP POST for the notification type notifyThresholdCrossing
PerfNotificationTypes	12.3.1.2.4.6.4	Performance notification types (notifyThresholdCrossing)

Table 12.3.1.1.4.1-2: Data types imported

Data type	Reference	Description
DateTime	TS 28.623 [44]	Date and time
Float	TS 28.623 [44]	Float type
Uri	TS 28.623 [44]	URI type
SystemDN	TS 28.623 [44]	systemDN type
NotificationId	TS 28.623 [44]	Notification identifier as defined in ITU-T Rec. X. 733 [4]
NotificationHeader	TS 28.623 [44]	Notification header
ErrorResponse	TS 28.623 [44]	Used in the response body of multiple HTTP methods in case of error

12.3.1.2.4.2 Structured data types

12.3.1.2.4.2.1 Type NotifyThresholdCrossing

Table 12.3.1.2.4.2.1-1: Definition of type NotifyThresholdCrossing

Attribute name	Data type	Description	S
href	Uri	URI of the resource where the event (threshold crossing) occurred	M
notificationId	NotificationId	Notification identifier as defined in ITU-T Rec. X. 733 [4]	M
notificationType	NotificationType	Notification type (notifyThresholdCrossing)	M
eventTime	DateTime	Event (threshold crossing) occurrence time	M
systemDN	SystemDN	System DN	M
observedPerfMetricName	string	Name of the performance metric that has crossed the threshold	M
observedPerfMetricValue	PerfMetricValue	Value of the performance metric, that has crossed the threshold, when the threshold crossing was observed	M
observedPerfMetricDirection	PerfMetricDirection	Direction ("UP" or "DOWN") of the performance metric, when the threshold crossing was observed	M
thresholdValue	PerfMetricValue	Threshold value of the triggered threshold	M
hysteresis	PerfMetricValue	Hysteresis of the triggered threshold	M
monitorGranularityPeriod	integer	Granularity period of the threshold monitor	M
additionalText	string	Vendor specific information	O

12.3.1.2.4.3   Void

12.3.1.2.4.4   Void

12.3.1.2.4.5   Void

12.3.1.2.4.6   Simple data types and enumerations

12.3.1.2.4.6.1   General

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

12.3.1.2.4.6.2   Simple data types

Table 12.3.1.2.4.6.2-1: Simple data types

Type name	Type definition	Description
PerfMetricValue	Union(integer, Float)	The type of a performance metric is either integer or Float

12.3.1.2.4.6.3   Enumeration PerfNotificationTypes

Table 12.3.1.2.4.6.3-1: Enumeration PerfNotificationTypes

Enumeration value	Description
notifyThresholdCrossing	Notification type is notifyThresholdCrossing

12.3.1.2.4.6.4   Enumeration PerfMetricDirection

Table 12.3.1.2.4.6.4-1: Enumeration PerfMetricDirection

Enumeration value	Description
UP	Performance metric values are going up
DOWN	Performance metric values are going down

12.3.2   Performance data XML file format definition

12.3.2.1   Introduction

This clause describes the format of performance data file. The XML file format definition is based on XML schema ([26], [27], [28] and [29]).

12.3.2.2   Mapping table

Table 12.3.2.2-1 maps the file content items in the clause 11.3.2.1.2 to those used in the XML schema based file format definitions. XML attributes are useful where data values bind tightly to its parent XML element. They have been used where appropriate.

Table 12.3.2.2-1: Mapping of File Content Items to XML tags

File Content Item	XML schema based XML tag	Description
measDataFile	XML element: measDataFile	Document element
measFileHeader	XML element: fileHeader	
measData	XML element: measData	
measFileFooter	XML element: fileFooter	
fileFormatVersion	XML element: fileHeader XML attribute: fileFormatVersion	
senderName	XML element: fileHeader XML attribute: dnPrefix XML element: fileHeader:fileSender XML attribute: senderName	The DN of the sender is split into the DN prefix contained in "dnPrefix" and the Local DN (LDN) contained in "senderName".
senderType	XML element fileHeader:fileSender XML attribute: senderType	
vendorName	XML element fileHeader XML attribute vendorName	
collectionBeginTime	XML element: fileHeader:measData XML attribute beginTime	
measObjRootDn	XML element fileHeader XML attribute dnPrefix XML element measData:measEntity XML attribute localDn	The DN of the root object is split into the DN prefix contained in "dnPrefix" and the Local DN (LDN) contained in "localDn".
measObjRootUserLabel	XML element: measData:measEntity XML attribute: userLabel	
measObjRootSwVersion	XML element: measData:measEntity XML attribute: swVersion	
measInfo	XML element measInfo	An instance of this XML element is added for each expired granularity period.
measInfoId	XML element measData:measInfo XML attribute measInfoId	
jobId	XML element measData:measInfo:job XML attribute jobId	
reportingPeriod	XML element measData:measInfo:repPeriod XML attribute duration	The XML attribute "duration" shall use the truncated representation for duration "PTnS" (see [28]).
granularityPeriod	XML element measData:measInfo:granPeriod XML attribute duration	The XML attribute "duration" shall use the truncated representation for duration "PTnS" (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.

File Content Item	XML schema based XML tag	Description
There is no corresponding File Content Item.	XML element r XML attribute p	Only for the positioning option: XML attribute "p" of the XML element "r", used to link the result value in "r" to its performance metric type in "measType". The value of "p" shall match the value of the XML attribute "p" in the corresponding XML element "measType".

12.3.2.3 Void

12.3.2.3.1 Void

12.3.2.3.2 Void

12.3.2.4 XML schema

This clause specifies the XML schema that shall be used for XML files containing performance data.

Name: measData.xsd
Version: 2.0.0
Identifier: measData.xsd-v2.0.0

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
  TS 28.532 Performance data XML file format definition
  measData.xsd-v2.0.0
-->
<schema
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:md="http://www.3gpp.org/ftp/specs/archive/28_series/28.532#measData"
  targetNamespace="http://www.3gpp.org/ftp/specs/archive/28_series/28.532#measData"
  elementFormDefault="qualified">

  <element name="measDataFile">
    <complexType>
      <sequence>

        <element name="fileHeader">
          <complexType>
            <sequence>
              <element name="fileSender">
                <complexType>
                  <attribute name="senderName" type="string" use="optional"/>
                  <attribute name="senderType" type="string" use="optional"/>
                </complexType>
              </element>
              <element name="measData">
                <complexType>
                  <attribute name="beginTime" type="dateTime" use="required"/>
                </complexType>
              </element>
            </sequence>
            <attribute name="fileFormatVersion" type="string" use="required"/>
            <attribute name="vendorName" type="string" use="optional"/>
            <attribute name="dnPrefix" type="string" use="optional"/>
          </complexType>
        </element>

        <element name="measData" minOccurs="0" maxOccurs="unbounded">
          <complexType>
            <sequence>
              <element name="measEntity">
                <complexType>
```

```
                    <attribute name="localDn" type="string" use="optional"/>
                    <attribute name="userLabel" type="string" use="optional"/>
                    <attribute name="swVersion" type="string" use="optional"/>
                  </complexType>
                </element>
                <element name="measInfo" minOccurs="0" maxOccurs="unbounded">
                  <complexType>
                    <sequence>
                      <element name="job" minOccurs="0">
                        <complexType>
                          <attribute name="jobId" type="string" use="required"/>
                        </complexType>
                      </element>
                      <element name="granPeriod">
                        <complexType>
                          <attribute name="duration" type="duration" use="required"/>
                          <attribute name="endTime" type="dateTime" use="required"/>
                        </complexType>
                      </element>
                      <element name="repPeriod" minOccurs="0">
                        <complexType>
                          <attribute name="duration" type="duration" use="required"/>
                        </complexType>
                      </element>
                      <choice>
                        <element name="measTypes">
                          <simpleType>
                            <list itemType="Name"/>
                          </simpleType>
                        </element>
                        <element name="measType" minOccurs="0" maxOccurs="unbounded">
                          <complexType>
                            <simpleContent>
                              <extension base="Name">
                                <attribute name="p" type="positiveInteger" use="required"/>
                              </extension>
                            </simpleContent>
                          </complexType>
                        </element>
                      </choice>
                      <element name="measValue" minOccurs="0" maxOccurs="unbounded">
                        <complexType>
                          <sequence>
                            <choice>
                              <element name="measResults">
                                <simpleType>
                                  <list itemType="md:measResultType"/>
                                </simpleType>
                              </element>
                              <element name="r" minOccurs="0" maxOccurs="unbounded">
                                <complexType>
                                  <simpleContent>
                                    <extension base="md:measResultType">
                                      <attribute name="p" type="positiveInteger" use="required"/>
                                    </extension>
                                  </simpleContent>
                                </complexType>
                              </element>
                            </choice>
                            <element name="suspect" type="boolean" minOccurs="0"/>
                          </sequence>
                          <attribute name="measObjLdn" type="string" use="required"/>
                        </complexType>
                      </element>
                    </sequence>
                    <attribute name="measInfoId" type="string" use="optional"/>
                  </complexType>
                </element>
              </sequence>
            </complexType>
          </element>

          <element name="fileFooter">
            <complexType>
              <sequence>
                <element name="measData">
                  <complexType>
                    <attribute name="endTime" type="dateTime" use="required"/>
```

```
                </complexType>
              </element>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </complexType>
  </element>

  <simpleType name="measResultType">
    <union memberTypes="integer float string">
      <simpleType>
        <restriction base="string">
          <enumeration value="NULL"/>
        </restriction>
      </simpleType>
    </union>
  </simpleType>
</schema>
```

12.4   Heartbeat

12.4.1   RESTful HTTP-based solution set

12.4.1.1   Mapping of operations

N/A

12.4.1.2   Mapping of notifications

12.4.1.2.1   Introduction

The IS notifications are mapped to SS equivalents according to table 12.4.1.2.1-1.

Table 12.4.1.2.1-1: Mapping of IS notifications to SS equivalents

IS notifications	HTTP Method	Resource URI	S
notifyHeartbeat	POST	/notificationSink	M

12.4.1.2.2   Notification "notifyHeartbeat"

The IS notification parameters are mapped to SS equivalents according to table 12.4.1.2.2-1.

Table 12.4.1.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass 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 TS 32.423 [39] for detailed definition of the Streaming Trace Payload format and Annex G of TS 28.550 [40] for detailed definition of the streaming performance data payload format.	M

The protocol stack with Streaming Trace Payloads formatted as per clause 5 of TS 32.423 [39] carried by WebSocket binary data frames (see clause 5.6 of IETF RFC 6455 [40]) is illustrated on Figure 12.5.1.1.4-1.

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

Table 12.5.1.1.4-2: Mapping of IS operation output parameters to SS equivalents

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
status	n/a	-- See Note 1.	n/a	n/a
NOTE 1: The delivery of WebSocket Data frame is taken care of by the underlying TCP (see IETF RFC 793 [41]) which provides reliable data transmission and ensures the data delivery. There is no mechanism at WebSocket protocol level to report the delivery status for WebSocket Data frame.				
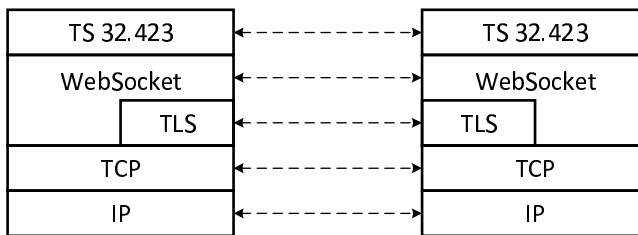
Figure 12.5.1.1.4-1: Protocol stack for streaming trace data reporting
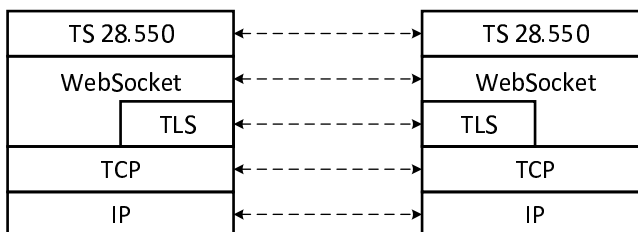
Figure 12.5.1.1.4-2: Protocol stack for streaming performance data reporting

12.5.1.1.5   Operation "addStream"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.5-1 and 12.5.1.1.5-2.

Table 12.5.1.1.5-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	Headers	Request-URI	String	n/a
streamInfoList	request body	streamInfoList	array(streamInfo-Type)	M

Table 12.5.1.1.5-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
streamInfoList	response body	streamInfoList	array(streamInfo-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.1.6   Operation "deleteStream"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.6-1 and 12.5.1.1.6-2.

Table 12.5.1.1.6-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	headers	Request-URI	String	n/a
streamIdList	path, query	/connections/{connectionId}/streams, streamIdList	array(streamId-Type)	M

Table 12.5.1.1.6-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.1.7 Operation "getConnectionInfo"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.7-1 and 12.5.1.1.7-2.

Table 12.5.1.1.7-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	headers	Request-URI	String	n/a
connectionIdList	path, query	/connections, /connections/{connectionId}	array(uri-Type)	M

Table 12.5.1.1.7-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionInfoList	response body	connectionInfoList	array(uri-Type, streamReporter-Type, streamIdList-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.1.8 Operation "getStreamInfo"

The IS operation parameters are mapped to SS equivalents according to the tables 12.5.1.1.8-1 and 12.5.1.1.8-2.

Table 12.5.1.1.8-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
connectionId	headers	Request-URI	String	n/a
streamIdList	path, query	/connections/{connectionId}/streams, streamIdList	array(streamId-Type)	M

Table 12.5.1.1.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	S
streamInfoSumList	response body	streamInfoSumList	array(streamInfo-Type, streamReporters-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

12.5.1.2 Mapping of notifications

Not applicable (no notifications defined in IS).

12.5.1.3   Resources

12.5.1.3.1   Resources structure

Figure 12.5.1.3.1-1 shows the resource structure of the Streaming data reporting service.

{MnSRoot}/StreamingDataReportMnS/{MnSVersion}
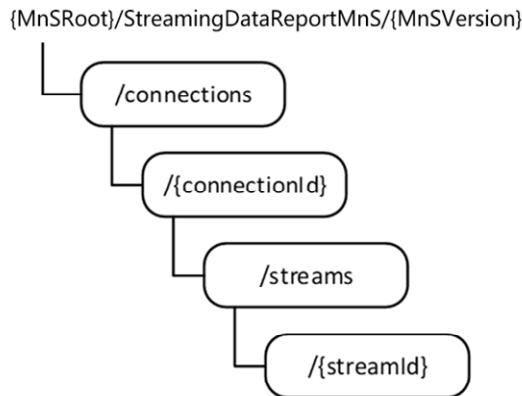
Figure 12.5.1.3.1-1: Resource URI structure of the Streaming data reporting service

Table 12.5.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Resource name	Resource URI	HTTP method	Description
connections	…/connections	POST	Inform consumer about reporting streams to be carried by the new connection and receive a new connection id.
		GET	Obtain information about connections
connection	…/connections/{connectionId}	GET (Upgrade)	Establish WebSocket for a given connection
		GET	Obtain information about connection
		WebSocket 0x2	Send a unit of streaming data
		WebSocket 0x8	Terminate a WebSocket connection
streams	…/connections/{connectionId}/streams	POST	Inform consumer about new reporting streams on an existing connection.
		DELETE	Remove reporting streams from an existing connection
		GET	Obtain information about streams
stream	…/connections/{connectionId}/streams/{streamId}	GET	Obtain information about stream

12.5.1.3.2   Resources definitions

12.5.1.3.2.1   Resource "…/connections"

12.5.1.3.2.1.1   Description

This resource represents a collection of connections and can be used to establish new connections or to obtain information about existing connections.

12.5.1.3.2.1.2   URI

The resource URI is: {MnSRroot}/StreamingDataReportingMnS/{MnSVersion}/connections

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.1.2-1.

Table 12.5.1.3.2.1.2-1: URI variables

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

12.5.1.3.2.1.3   HTTP methods

12.5.1.3.2.1.3.1   HTTP POST

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

Table 12.5.1.3.2.1.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.1.3.1-2: Data structures supported by the POST request body on this resource

Data type	Description	S
producerId	String representing the DN of the streaming data reporting MnS producer.	M
array(streamInfo-Type)	List of meta-data about each reporting stream. Where each reporting stream is represented by a streamInfo.	

Table 12.5.1.3.2.1.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
error-ResponseType	4xx/5xx	Returned in case of an error	M
uri-Type	201 Posted	Connection identifier assigned by the MnS consumer	M

12.5.1.3.2.1.3.2   HTTP GET

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

Table 12.5.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
connectionIdList	array(uri-Type)	The list of connectionId for which the connection information is to be returned.	O

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

Table 12.5.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource

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

Table 12.5.1.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
error-ResponseType	4xx/5xx	Returned in case of an error	M
array(uri-Type, streamReporter-Type, streamIdList-Type)	200 OK	In case of success the representation of the retrieved information is returned.	M
	202 Partially retrieved	In case of partial success the representation of the retrieved information is returned.	M

12.5.1.3.2.2   Resource ".../connections/{connectionId}"

12.5.1.3.2.2.1   Description

This resource represents an individual connection and can be used for an "upgrade" to WebSocket as part of the connection establishment, or to obtain information about an existing connection, or to terminate an existing connection, or to send a unit of streaming data.

12.5.1.3.2.2.2   URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.2.2-1.

Table 12.5.1.3.2.2.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
connectionId	Represents identifier of an individual connection assigned by the MnS consumer during connection establishment

12.5.1.3.2.2.3   HTTP methods

12.5.1.3.2.2.3.1   HTTP GET (Upgrade)

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

Table 12.5.1.3.2.2.3.2-1: Header parameters supported by the GET request on this resource

Name	Data type	Description	S
connectionId	uri-Type	To indicate the ID (URI) of the connection being upgraded to WebSocket	M
Upgrade	Upgrade-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol	M
Connection	Connection-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to another protocol	M
Sec-WebSocket-Key	Sec-WebSocket-Key-HeaderType	The Sec-WebSocket-Key needed for establishing the WebSocket connection.	M
Sec-WebSocket-Version	Sec-WebSocket-Version-HeaderType	The Sec-WebSocket-Version needed for establishing the WebSocket connection.	M

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

Table 12.5.1.3.2.2.3.2-2: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.2.3.2-3: Data structures supported by the GET request body on this resource

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

Table 12.5.1.3.2.2.3.2-4: Header parameters supported by the GET response on this resource

Name	Data type	Description	S
Upgrade	Upgrade-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol	M
Connection	Connection-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to another protocol	M
Sec-WebSocket-Accept	Sec-WebSocket-Accept-HeaderType	The Sec-WebSocket-Accept responded when establishing the WebSocket connection.	M

Table 12.5.1.3.2.2.3.2-5: Data structures supported by the GET response body on this resource

Data type	Response codes	Description	S
n/a	101 Switching Protocols	The status code indicating the connection has been successfully upgraded to WebSocket.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.2.3.2   HTTP GET

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

Table 12.5.1.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.1.3.2-2: Data structures supported by the GET request body on this resource

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

Table 12.5.1.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
error-ResponseType	4xx/5xx	Returned in case of an error	M
uri-Type	200 OK	In case of success the representation of the connectionId is returned.	M
streamReporter-Type	200 OK	In case of success the representation of the streamReporter is returned.	M
streamIdList-Type	200 OK	In case of success the representation of the streamIdList is returned.	M

12.5.1.3.2.3   Resource ".../connections/{connectionId}/streams"

12.5.1.3.2.3.1   Description

This resource represents a collection of reporting streams on a particular connection and can be used to add a new reporting stream to an existing connection, or to remove a reporting stream from an existing connection, or to obtain information about reporting streams.

12.5.1.3.2.3.2   URI

The resource URI is: {MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}/streams

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.3.2-1.

Table 12.5.1.3.2.3.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
connectionId	See table 12.5.1.3.2.2.2-1

12.5.1.3.2.3.3   HTTP methods

12.5.1.3.2.3.3.1   HTTP POST

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

Table 12.5.1.3.2.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.3.3.1-2: Data structures supported by the POST request body on this resource

Data type	Description	S
array(streamInfo-Type)	The resource representation of the set of information about streams to be posted.	M

Table 12.5.1.3.2.3.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	S
array(streamInfo-Type)	201 Posted	In case of success the representation of the posted information about streams is returned.	M
	202 Partially posted	In case of partial success the representation of the posted information about streams is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.3.3.2   HTTP DELETE

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

Table 12.5.1.3.2.3.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	Description	S
streamIdList	array(streamId-Type)	The list of streamId for the stream(s) to be deleted.	M

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

Table 12.5.1.3.2.3.3.2: Data structures supported by the DELETE request body on this resource

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

Table 12.5.1.3.2.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	Response codes	Description	S
n/a	204 No Content	In case of success no message body is returned	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.3.3.3 HTTP GET

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

Table 12.5.1.3.2.3.3.3-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
streamIdList	array(streamId-Type)	The list of streamId for which the stream information are to be returned.	O

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

Table 12.5.1.3.2.3.3.3-2: Data structures supported by the GET request body on this resource

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

Table 12.5.1.3.2.3.3.3-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
array(streamInfo-Type, streamReporters-Type)	200 OK	In case of success the representation of the retrieved stream information is returned.	M
	202 Partially retrieved	In case of partial success the representation of the retrieved stream information is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.3.2.4 Resource ".../connections/{connectionId}/streams/{streamId}"

12.5.1.3.2.4.1 Description

This resource represents an individual reporting stream on an existing connection and can be used to obtain information about reporting stream.

12.5.1.3.2.4.2 URI

The resource URI is:
{MnSRoot}/StreamingDataReportingMnS/{MnSVersion}/connections/{connectionId}/streams/{streamId}

This resource shall support the resource URI variables defined in the table 12.5.1.3.2.4.2-1.

Table 12.5.1.3.2.4.2-1: URI variables

Name	Definition
MnSRoot	See clause 4.4.3 of TS 32.158 [15]
MnSVersion	See clause 4.4.3 of TS 32.158 [15]
connectionId	See table 12.5.1.3.2.2.2-1
streamId	Represents identifier of an individual stream. For Streaming Trace reporting, the Trace Reference (see clause 5.6 of TS 32.422 [38]) is used as stream identifier

12.5.1.3.2.4.3   HTTP methods

12.5.1.3.2.4.3.1   HTTP GET

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

Table 12.5.1.3.2.4.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	S
none supported			

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

Table 12.5.1.3.2.4.3.1-2: Data structures supported by the GET request body on this resource

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

Table 12.5.1.3.2.4.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	S
streamInfo-Type	200 OK	In case of success the representation of the retrieved stream information is returned.	M
streamReporters-Type	200 OK	In case of success the representation of the retrieved stream reporters information is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

12.5.1.4 Data type definitions

12.5.1.4.1 General

Table 12.5.1.4.1-1: Data types defined

Data type	Reference	Description
General types		
uri-Type	12.5.1.4.3	Used to represent a URI
Types used in paths		
connectionId-Type	12.5.1.4.3	Used to indicate the connection as a context of the operation
streamId-Type	12.5.1.4.3	Used to indicate the stream as a context of the operation
Types used in headers		
websocketHeaderConnection-Type	12.5.1.4.3	Header value for the upgrade request and response
websocketHeaderUpgrade-Type	12.5.1.4.3	Header value for the upgrade to WebSocket request and response
websocketHeader-Sec-WebSocket-Accept-Type	12.5.1.4.3	Header value for secure WebSocket response. Carries hash.
websocketHeader-Sec-WebSocket-Extensions-Type	12.5.1.4.3	Header value for secure WebSocket request. Carries protocol extensions.
websocketHeader-Sec-WebSocket-Key-Type	12.5.1.4.3	Header value for secure WebSocket request. Provides information to the server which is needed in order to confirm that the client is entitled to request an upgrade to WebSocket.
websocketHeader-Sec-WebSocket-Protocol-Type	12.5.1.4.3	Header value for secure WebSocket request. Carries a comma-separated list of subprotocol names, in the order of preference.
websocketHeader-Sec-WebSocket-Version-Type	12.5.1.4.3	Header value for secure WebSocket request and response. Carries the WebSocket protocol version to be used.
Types used in query parts		
connectionId-Type	12.5.1.4.3	Used to indicate the connection as a context of the operation
streamId-Type	12.5.1.4.3	Used to indicate the stream as a context of the operation
Types used in request bodies		
connectionRequest-Type	12.5.1.4.2.2	Used to carry the meta-data during connection establishment
streamInfo-Type	12.5.1.4.2.5	Reporting stream meta-data.
Types used in response bodies		
failedConnectionResponse-Type	12.5.1.4.2.4	Used to carry the details of a failed connection establishment
connectionInfo-Type	12.5.1.4.2.1	Used to carry connection meta-data
errorResponse-Type	12.5.1.4.2.3	Used to carry the details of an error
streamInfo-Type	12.5.1.4.2.5	Used to carry the stream meta-data
streamInfoWithReporters-Type	12.5.1.4.2.6	Used to carry the augmented stream meta-data
Types used for resources		
uri-Type	12.5.1.4.3	Used to represent resource URI
Types referenced by the definitions above		
systemDN-Type	12.5.1.4.3	Used to represent DN of the reporting entity
traceJob-Type	Generic NRM	Used to represent Trace configuration
producerId-Type	12.5.1.4.3	Used to identify the reporting entity
streamType-Type	12.5.1.4.3	Used to identify the type of a reporting stream
serializationFormat-Type	12.5.1.4.3	Used to identify serialization method
measObjDn-Type	12.5.1.4.3	Used to represent DN of the measured object instance
measTypes-Type	12.5.1.4.3	Used to represent an ordered list of measurement types or KPI
analyticsInfo-Type	12.5.1.4.3	Used to represents information about streamed analytics
vsDataContainer-Type	Generic NRM	Used to represent details about proprietary data

Table 12.5.1.4.1-2: Data types imported

Data type	Reference	Description
traceJob-Type	Generic NRM	Attributes container of the TraceJob IOC (see TS 28.622 [11]).
vsDataContainer-Type	Generic NRM	Vendor specific data container (see TS 28.622 [11]).

12.5.1.4.2 Query, message body and resource data types

12.5.1.4.2.1 Type connectionInfo-Type

Table 12.5.1.4.2.1-1: Definition of type connectionInfo-Type

Attribute name	Data type	Description	S
connection	connectionId-Type	Connection identifier	M
producer	producerId-Type	Producer identifier	M
streams	array(streamId-Type)	List of stream identifiers	M

12.5.1.4.2.2 Type connectionRequest-Type

Table 12.5.1.4.2.2-1: Definition of type connectionRequest-Type

Attribute name	Data type	Description	S
producer	producerId-Type	Producer identifier	M
streams	array(streamInfo-Type)	List of stream meta-data	M

12.5.1.4.2.3 Type errorResponse-Type

Table 12.5.1.4.2.3-1: Definition of type errorResponse-Type

Attribute name	Data type	Description	S
error	object	Key indicating the response body containing an error	M
> errorInfo	string	Attribute allowing to convey error information in string format	M

12.5.1.4.2.4 Type failedConnectionResponse-Type

Table 12.5.1.4.2.4-1: Definition of type failedConnectionResponse-Type

Attribute name	Data type	Description	S
error	object	Key indicating the response body containing an error	M
> streamId	array(streamId-Type)	Attribute conveying the list of "problematic" stream IDs	M
> errorReason	string	Attribute allowing to convey error information in string format	

12.5.1.4.2.5 Type streamInfo-Type

Table 12.5.1.4.2.5-1: Definition of type streamInfo-Type

Attribute name	Data type	Description	S
streamId	streamId-Type	Stream identifier	M
streamType	streamType-Type	Enumerated stream type	M
serializationFormat	serializationFormat-Type	Enumerated serialization method	M
measObjDn	measObjDn-Type	DN of the measured object instance. Used for streaming performance data only.	CM
measTypes	measTypes-Type	Ordered list of measurement types or KPI. Used for streaming performance data only.	CM
analyticsInfo	analyticsInfo-Type	Information about streamed analytics. Used for streaming analytics only.	CM
vsDataContainer	vsDataContainer-Type	Details about proprietary data. Mandatory for proprietary data streaming only.	CM
traceInfo	traceJob-Type	Trace configuration. Used for streaming trace data reporting streams only.	CM

Table 12.5.1.4.2.5-2: Attribute constraints

Name	Definition
measObjDn (support qualifier)	Attribute shall be present for streaming performance data only.
measTypes (support qualifier)	Attribute shall be present for streaming performance data only.
analyticsInfo (support qualifier)	Attribute shall be present for streaming analytics only.
vsDataContainer (support qualifier)	Attribute shall be present for proprietary data streaming.
traceInfo (support qualifier)	Attribute shall be present for streaming trace data only.

12.5.1.4.2.6   Type streamInfoWithReporters-Type

Table 12.5.1.4.2.6-1: Definition of type streamInfoWithReporters-Type

Attribute name	Data type	Description	S
streamInfo	streamInfo-Type	Stream meta-data	M
reporters	producerId-Type	List of entities reporting streaming data	M

12.5.1.4.3   Simple data types and enumerations

12.5.1.4.3.1   General

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

12.5.1.4.3.2   Simple data types

Table 12.5.1.4.3.2-1: Simple data types

Type name	Type definition	Description
analyticsInfo-Type	string	Information about streamed analytics.
measObjDn-Type	DN	See TS 32.300 [25]
measTypes-Type	string	See TS 28.550 [42]
websocketHeaderConnection-Type	Constant string "Upgrade"	Header value for the upgrade request and response.
websocketHeaderUpgrade-Type	Constant string "websocket"	Header value for the upgrade to WebSocket request and response.
websocketHeader-Sec-WebSocket-Accept-Type	string	Header value for secure WebSocket response. Carries hash.
websocketHeader-Sec-WebSocket-Extensions-Type	string	Header value for secure WebSocket request. Carries protocol extensions.
websocketHeader-Sec-WebSocket-Key-Type	string	Header value for secure WebSocket request. Provides information to the server which is needed in order to confirm that the client is entitled to request an upgrade to WebSocket.
websocketHeader-Sec-WebSocket-Protocol-Type	string	Header value for secure WebSocket request. Carries a comma-separated list of subprotocol names, in the order of preference.
websocketHeader-Sec-WebSocket-Version-Type	string	Header value for secure WebSocket request and response. Carries the WebSocket protocol version to be used.
connectionId-Type	uri-Type	Used to indicate the connection as a context of the operation
producerId-Type	systemDN-Type	Used to identify the reporting entity
serializationFormat-Type	enum	Enumerated serialization method with values: "GPB", "ASN1"
streamId-Type	Trace Reference	See TS 32.422 [38]
streamType-Type	enum	Enumerated stream type with values: "TRACE", "PERFORMANCE", "ANALYTICS", "PROPRIETARY"
systemDN-Type	DN	See TS 32.300 [25]
uri-Type	string	Used to represent resource URI

12.6 File data reporting service

12.6.1 RESTful HTTP-based solution set

12.6.1.1 Mapping of operations

12.6.1.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 12.6.1.1.1-1.

Table 12.6.1.1.1-1: Mapping of IS operations to SS equivalents

IS operation	HTTP Method	Resource URI	S
listAvailableFiles	GET	/files	M
subscribe	POST	/subscriptions	M
unsubscribe	DELETE	/subscriptions/{subscriptionId}	M

12.6.1.1.2 Operation listAvailableFiles

The IS operation parameters are mapped to SS equivalents according to table 12.6.1.1.2-1 and table 12.6.1.1.2-2.

Table 12.6.1.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
fileDataType	query	fileDataType	FileDataType	M
beginTime	query	beginTime	DateTime	M
endTime	query	endTime	DateTime	M

Table 12.6.1.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
fileInfoList	response body	n/a	array(FileInfo)	M
status	response status codes	n/a	n/a	M
	response body	error	ErrorResponse	O

The message flow is as follows:

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

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

  - The query part may contain filter parameters. Absence of the query component means all available files shall be returned.

  - The request message body shall be empty.

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

  - On success "200 OK" shall be returned. The response message body shall carry the information of available files. The response format is defined by " array(FileInfo) ".

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

12.6.1.1.3 Operation subscribe

See clause 12.2.1.1.8.

12.6.1.1.4 Operation unsubscribe

See clause 12.2.1.1.9.

12.6.1.2 Mapping of notifications

12.6.1.2.1 Introduction

The IS notifications are mapped to SS equivalents according to table 12.6.1.2.1-1.

Table 12.6.1.2.1-1: Mapping of IS notifications to SS equivalents

IS notification	HTTP Method	Resource URI	S
notifyFileReady	POST	{notificationTarget}	M
notifyFilePreparationError	POST	{notificationTarget}	M

12.6.1.2.2 Notification notifyFileReady

The IS notification parameters are mapped to SS equivalents according to table 12.6.1.2.2-1.

Table 12.6.1.2.2-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass	request body	href	Uri	M
objectInstance				
notificationId	request body	notificationId	NotificationId	M
notificationType	request body	notificationType	NotificationType	M
eventTime	request body	eventTime	DateTime	M
systemDN	request body	systemDN	SystemDN	M
fileInfoList	request body	fileInfoList	array(FileInfo)	M
additionalText	request body	additionalText	string	O

12.6.1.2.3 Notification notifyFilePreparationError

The IS notification parameters are mapped to SS equivalents according to table 12.6.1.2.3-1.

Table 12.6.1.2.3-1: Mapping of IS notification input parameters to SS equivalents (HTTP POST)

IS parameter name	SS parameter location	SS parameter name	SS parameter type	S
objectClass	request body	href	Uri	M
objectInstance				
notificationId	request body	notificationId	NotificationId	M
notificationType	request body	notificationType	NotificationType	M
eventTime	request body	eventTime	DateTime	M
systemDN	request body	systemDN	SystemDN	M
fileInfoList	request body	fileInfoList	array(FileInfo)	M
reason	request body	reason	string	O
additionalText	request body	additionalText	string	O

12.6.1.3   Resources

12.6.1.3.1   Resource structure

12.6.1.3.1.1   Resource structure on the MnS producer

Figure 12.6.1.3.1.1-1 shows the resource structure of the File Data Reporting MnS on the MnS producer.

{MnSRoot}/FileDataReportingMnS/{MnSVersion}

/files

/subscriptions

/{subscriptionId}
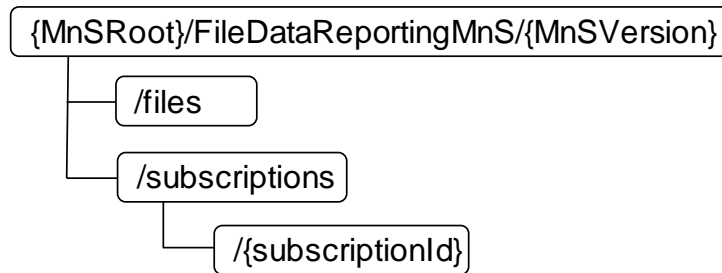
Figure 12.6.1.3.1.1-1: Resource URI structure of the File Data Reporting MnS on the MnS producer

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.

{notificationTarget}
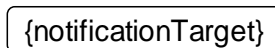
Figure 12.6.1.3.1.2-1: Resource URI structure of the File Data Reporting MnS on the MnS consumer

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.

The OpenAPI/YAML definitions are specified in 3GPP Forge, refer to clause 4.3 of TS 28.623 [44] for the Forge location. An example of Forge location is: "https://forge.3gpp.org/rep/sa5/MnS/-/tree/Tag_Rel18_SA104/".

Directory: OpenAPI

File: TS28532_ProvMnS.yaml

File: TS28532_PerfMnS.yam

File: TS28532_HeartbeatNtf.yaml

File: TS28532_StreamingDataMnS.yaml

File: TS28532_FileDataReportingMnS.yaml

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"

Note that clause A.0 includes the location of TS28532_ProvMnS.yaml.

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 Void

A.3 Void

A.4 Generic performance assurance management service

A.4.1 Void

A.4.2 OpenAPI document "TS28532_PerfMnS.yaml"

Note that clause A.0 includes the location of TS28532_PerfMnS.yaml.

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"

Note that clause A.0 includes the location of TS28532_HeartbeatNtf.yaml.

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"

Note that clause A.0 includes the location of TS28532_StreamingDataMnS.yaml.

A.7　File data reporting management service

A.7.1　Introduction

Clause A.7.2 contains the OpenAPI definition of the File Data Reporting MnS.

Clause A.7.3 provides indications regarding the content of the File Data Reporting MnS notifications when the consumer of these notifications supports the ONAP VES API. This content is sent as payload of VES events (see Annex B).

A.7.2　OpenAPI document "TS28532_FileDataReportingMnS.yaml"

Note that clause A.0 includes the location of TS28532_FileDataReportingMnS.yaml.

A.7.3　Integration with ONAP VES

Detailed guidelines for integration of file data reporting MnS notifications with ONAP VES are provided in Annex B.

Annex B (Informative):
Guidelines for the integration of 3GPP MnS notifications with ONAP VES

In case the consumer of the 3GPP MnS notifications specified in the present document is an ONAP VES collector, the following guidelines are for the developer of the corresponding notification producer:

- The produced notification conforms to ONAP-defined VES specification;

- The VES Common Event Header fields are populated by the producer is as follows:

  - The domain "stndDefined" is used,

  - The "stndDefinedNamespace" field value is the concatenation of "3GPP-" and the name of the 3GPP MnS which the 3GPP IS notification is part of. Based on the MnS names defined in the present version of this document, VES name space values corresponding to 3GPP MnS could be:

    - "3GPP-Provisioning",

    - "3GPP-FaultSupervision",

    - "3GPP-PerformanceAssurance",

    - "3GPP-Heartbeat",

    - "3GPP-DataStreamingReporting",

    - "3GPP-DataFileReporting".

  - How the other fields of the Common Event Header are populated is not in the scope of the present document;

- The payload part of the VES event specification conforms to the OpenAPI definitions of clause A.1.1 (for provisioning MnS notifications), A.2.1 (for the fault supervision MnS notifications), A4.2 (for the performance assurance MnS notifications), A.5.1 (for the heartbeat notifications) and A.7.2 (for the file data reporting MnS notifications) of the present document. The OpenAPI definitions of Annex A in the present document may also be found on 3GPP FORGE (see [53]).
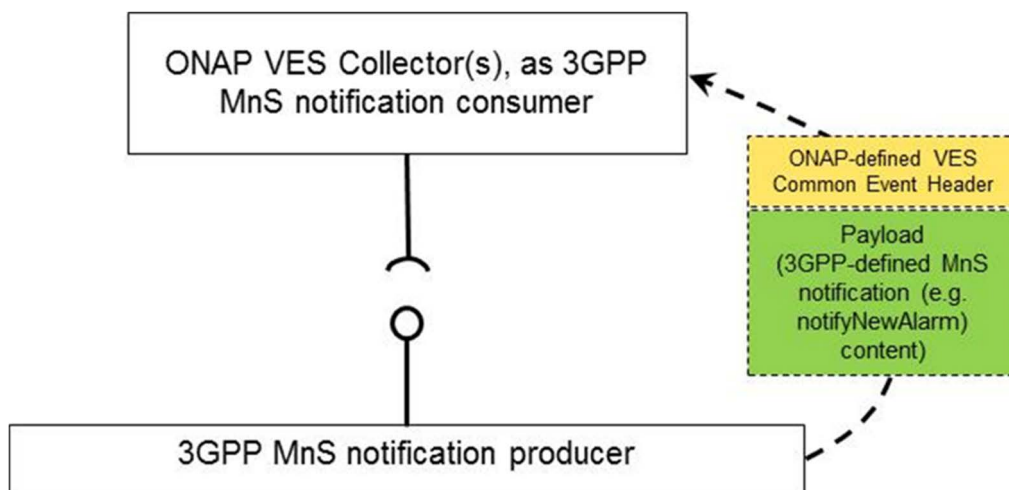

Figure B-1: 3GPP MnS notifications consumed by ONAP VES Collector(s)

Annex C (informative):
Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2018-09	SA#81					Upgrade to change control version	15.0.0
2018-09	SA#81					EditHelp editorial fix	15.0.1
2018-12	SA#82	SP-181042	0002	1	F	Correction of references	15.1.0
2018-12	SA#82	SP-181042	0003	1	F	Align with 3GPP draft rules of the usage of must	15.1.0
2018-12	SA#82	SP-181042	0004	1	F	Correction of the numbering and title of figures and tables	15.1.0
2018-12	SA#82	SP-181042	0005	1	F	Remove unnecessary Editor's Note and figure	15.1.0
2018-12	SA#82	SP-181045	0006	1	F	Update Resource URI of alarmCount	15.1.0
2018-12	SA#82	SP-181045	0009	1	F	Change the name of IRPAgent and IRPManager	15.1.0
2018-12	SA#82	SP-181045	0010	1	F	Remove unnecessary import table and state diagram	15.1.0
2018-12	SA#82	SP-181045	0012	-	F	Correct the subscription resource related errors	15.1.0
2018-12	SA#82	SP-181043	0018	-	F	Add notifyNewSecurityAlarm to notification type	15.1.0
2018-12	SA#82	SP-181045	0020	1	F	Change alarmIRP to FaultSupervision MnS producer	15.1.0
2018-12	SA#82	SP-181042	0021	1	F	Add stage 2 definition for provisioning management service related notifications	15.1.0
2018-12	SA#82	SP-181042	0022	1	F	Correct stage 3 description of the Provisioning Management Service	15.1.0
2018-12	SA#82	SP-181045	0025	-	F	Correct erroneous reference to notification header	15.1.0
2019-03	SA#83	SP-190120	0029	1	F	Correction of references	15.2.0
2019-06	SA#84	SP-190372	0031	2	B	Add RESTful HTTP-based solution set of fault supervision for integration with ONAP VES	16.0.0
2019-06	SA#84	SP-190371	0038	1	B	Add performance threshold crossing notification	16.0.0
2019-09	SA#85	SP-190742	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
2022-09	SA#97e	SP-220849	0219	-	F	Updating Hysteresis from M to O in notifyThresholdCrossing	17.2.0
2022-09	SA#97e	SP-220858	0221	-	A	Update provMnS yaml to include resources-coslaNrm	17.2.0
2022-09	SA#97e	SP-220851	0222	-	F	Update provMnS yaml to include MDA NRM related resources	17.2.0
2022-09	SA#97e	SP-220859	0223	-	F	Correct notifyMOIChanges handling for YANG leaf-lists	17.2.0
2022-09	SA#97e					Annex A.1.1 aligned with FORGE content	17.2.1
2022-12	SA#98e	SP-221169	0227	1	A	Correct OpenAPI definition of HTTP DELETE	17.3.0
2022-12	SA#98e	SP-221169	0229	1	A	Correct type of observedValue attribute	17.3.0
2022-12	SA#98e	SP-221169	0231	1	A	Correct definition of the HTTP GET response	17.3.0
2022-12	SA#98e	SP-221169	0233	2	A	Add missing definition of the JSON Patch document	17.3.0
2022-12	SA#98e	SP-221169	0235	-	A	Remove duplicated message flows (REST SS of ProvMnS)	17.3.0
2022-12	SA#98e	SP-221169	0237	2	A	Add introduction clause to the Prov MnS definition	17.3.0
2022-12	SA#98e	SP-221167	0238	1	F	Add missing insert attribute to the data type MoiChange	17.3.0
2022-12	SA#98e	SP-221167	0239	-	F	Clarify allowed values for href parameter in notifyMOIChanges (NETCONF/YANG)	17.3.0
2023-03	SA#99	SP-230199	0241	-	A	Align media type names with TS 32.158	17.4.0
2023-03	SA#99	SP-230199	0243	1	A	Add examples for notifyMOICreation, notifyMOIDeletion and notifyAttributeValueChanges	17.4.0
2023-03	SA#99	SP-230196	0244	1	F	Clarify definitions related to attributes	17.4.0
2023-03	SA#99	SP-230200	0245	-	A	Updates for generic management services	17.4.0
2023-06	SA#100	SP-230648	0249	1	A	Netconf with-defaults	17.5.0
2023-06	SA#100	SP-230648	0253	-	A	Add missing definition of the JSON Patch document	17.5.0

2023-06	SA#100	SP-230681	0255	1	A	Correction the Information Type for objectClass and objectInstance	17.5.0
2023-06	SA#100	SP-230649	0256	-	F	Resources-edgeNrm is missing in resource schema	17.5.0
2023-06	SA#100	SP-230648	0258	-	A	Correct media types used with HTTP Patch	17.5.0
2023-06	SA#100	SP-230648	0260	-	A	Clarification on notification target	17.5.0
2023-06	SA#100	SP-230647	0263	-	A	Correction of RFC references, and alarm information	17.5.0
2023-06	SA#100					Adding code files to the zip	17.5.1
2023-07	SA#100					Fixing header and footer	17.5.2
2023-09	SA#101	SP-230944	0265	-	F	Make probableCause mandatory in notifyChangedAlarmGeneral	17.6.0
2023-09	SA#101	SP-230940	0267	1	A	Correction to ProvMnS stage3 issue concerning parameter attributes	17.6.0
2023-09	SA#101	SP-230940	0270	-	A	Clarify complete attribute values must be included in notifyMOIAttributeValueChanges	17.6.0
2023-09	SA#101	SP-230940	0272	-	A	Clarify usage of the attributes container in notifyMOIChanges	17.6.0
2023-09	SA#101	SP-230940	0280	1	A	Correction of reference to Forge OpenAPI definition	17.6.0
2023-09	SA#101	SP-230940	0282	-	A	Clarify description of generic provisioning service	17.6.0
2023-09	SA#101	SP-230960	0268	-	C	Deprecate FM subscribe-unsubscribe	18.0.0
2023-12	SA#102	SP-231487	0285	-	A	Correction to eventTime description for NotifyMoiDeletion & NotifyMoiAttributeValueChanges	18.1.0
2023-12	SA#102	SP-231472	0293	1	C	Update definition of createMOI (stage 2)	18.1.0
2023-12	SA#102	SP-231472	0294	1	C	Update definition of modifyMOIAttributes	18.1.0
2023-12	SA#102	SP-231472	0295	1	B	Add definition of changeMOIs (stage 2)	18.1.0
2023-12	SA#102	SP-231494	0296	-	D	Editorial Correction – Not implemented due to clash with 0294	18.1.0
2023-12	SA#102	SP-231487	0297	1	A	Clarify MnS capability definitions	18.1.0
2023-12	SA#102	SP-231485	0299	-	B	Add resources-RanScNrm as Resource for provisioning MnS	18.1.0
2023-12	SA#102	SP-231490	0300	-	A	Clarify streaming data reporting service definitions	18.1.0
2023-12	SA#102	SP-231458	0301	-	F	Update the reference for TraceJob in StreamingDataReport MnS	18.1.0
2024-03	SA#103	SP-240185	0304		A	notifyEvent stage 3	18.2.0
2024-03	SA#103	SP-240168	0305		B	Add new HTTP error response format (REST SS)	18.2.0
2024-03	SA#103	SP-240168	0306	1	B	Add dataNodeSelector to getMOIAttributes (stage 2, REST SS)	18.2.0
2024-03	SA#103	SP-240168	0307	1	B	Add dataNodeSelector to getMOIAttributes (NETCONF)	18.2.0
2024-03	SA#103	SP-240168	0308	1	B	Add stage 3 definition of changeMOIs (REST SS)	18.2.0
2024-03	SA#103	SP-240168	0309	1	C	Remove-Update FM related parts	18.2.0
2024-03	SA#103	SP-240168	0310		B	Add new HTTP error response format (OpenAPI)	18.2.0
2024-03	SA#103	SP-240168	0311		B	Add dataNodeSelector to getMOIAttributes (OpenAPI)	18.2.0
2024-03	SA#103	SP-240395	0312	1	F	Add resource-nrm for control NRM in provisioning MnS	18.2.0
2024-03	SA#103	SP-240174	0313	1	B	resources-msacNrm is missing in resource schema	18.2.0
2024-03	SA#103	SP-240168	0314	1	F	Clarify for each CM notification type the allowed targets of notification subscriptions	18.2.0
2024-03	SA#103	SP-240185	0319		A	Correction of attribute description	18.2.0
2024-06	SA#104	SP-240820	0323		F	Rel-18 CR TS 28.532 add missing resource-NRM for fault mangement in provisioning MnS	18.3.0
2024-06	SA#104	SP-240803	0325		A	Rel-18 CR 28.532 Fix inconsistent streaming data reporting service input parameter	18.3.0
2024-06	SA#104	SP-240820	0328		F	TS28.532 Rel18 corrections to remove reference to TS28532_FaultMnS.yaml	18.3.0
2024-06	SA#104	SP-240820	0329	1	F	Rel-18 CR TS 28.532 Correct Missing reference to TS 28.811	18.3.0
2024-06	SA#104	SP-240808	0330	1	F	TS28.532 Rel18 Moving normative stage3 to Forge	18.3.0
2024-06	SA#104	SP-240820	0331		F	Rel-18 CR 28.532 Add reference to the new Fault Management specification ==NOT IMPLEMENTED AS NOT COMPLIANT WITH DRAFTING TULES==	18.3.0
2024-06	SA#104	SP-240803	0333		A	Rel-18 CR 28.532 Correct notifyMOIChanges YANG mapping	18.3.0

History

Document history		
V18.2.0	May 2024	Publication
V18.3.0	July 2024	Publication