**3GPP TSG-SA5 Meeting #129-e *S5-201344***

**Online, , 24th Feb 2020 - 4th Mar 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **28.532** | **CR** | **0098** | **rev** | **-** | **Current version:** | **16.2.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network | **X** |

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|  |
| ***Title:***  | YANG\_Netconf Operations |
|  |  |
| ***Source to WG:*** | Ericsson, Orange, Telecom Italia, China Mobile |
| ***Source to TSG:*** | SA5 |
|  |  |
| ***Work item code:*** | eNRM |  | ***Date:*** | 2020-02-14 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | An NRM solution set needs a set of operations to be able to use it; without a standard way to manipulate the data the SS is incomplete because it would result in proprietary and undefined management transactions.There is no defined mapping defined for operations for the YANG NRM SS.General industry practice to manipulate YANG based data is by using the Netconf protocol.  |
|  |  |
| ***Summary of change:*** | Add a YANG/Netconf SS for the operations createMOI, getMOIAttributes, modifyMOIAttributes and deleteMOIWe specify one specific Netconf based mapping for the 3GPP operations, while still allowing alternative Netconf operations conforming to the 3GPP YANG models. |
|  |  |
| ***Consequences if not approved:*** | Different vendors will use different protocols to manipulate the YANG based 3GPP data or even worse attempt to define their own proprietary protocols for this purpose. |
|  |  |
| ***Clauses affected:*** | 2, 12.1.x, 12.1.x.1, 12.1.x.1.1, 12.1.x.1.2, 12.1.x.1.3, 12.1.x.1.4, 12.1.x.1.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | rev1 is the same as the original, but the Word change marks are corrected |
|  |  |
| ***This CR's revision history:*** | S5-197247, S5-197718 |

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| **1st Change** |

2 References

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

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

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

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

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

[2] 3GPP TS 28.526: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures".

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

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

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

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

[7] 3GPP TS 22.261: "Technical Specification Group Services and System Aspects; Service requirements for the 5G system; Stage 1".

[8] 3GPP TS 23.501: "Technical Specification Group Services and System Aspects; System Architecture for the 5G System; Stage 2".

[9] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".

[10] ETSI GS NFV-IFA 013 V2.4.1 (2018-02) "Network Function Virtualization (NFV); Management and Orchestration; Os-Ma-nfvo Reference Point - Interface and Information Model Specification".

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

[12] ETSI GS NFV-IFA 015 (V2.4.1): "Network Function Virtualisation (NFV); Management and Orchestration; Report on NFV Information Model".

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

[14] ITU-T Recommendation X.734 (1992): "Information technology - Open Systems Interconnection - Systems management: Event report management function".

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

[16] 3GPP TS 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP); Information Service (IS)".

[17] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

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

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

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

[21] 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://docs.onap.org/en/latest/_downloads/2c2b5962df52a0c1f2862f3bba3d67c7/CommonEventFormat_30.1_ONAP.json>, accessed 21.03.2019.

[22] Figure Attribution: Creator: ONAP, under Creative Commons Attribution 4.0 International License, https://creativecommons.org/licenses/by/4.0/, URI to access the figure: <https://docs.onap.org/en/latest/submodules/vnfsdk/model.git/docs/files/ves7_1spec.html?highlight=heartbeatIntervalChange#resource-structure>, accessed 21.03.2019).

[23] 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://docs.onap.org/en/latest/submodules/vnfsdk/model.git/docs/files/VESEventListener_7_0_1.html?highlight=ves%207#naming-standards-for-eventname>, accessed 11.04.2019).

[24] 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://docs.onap.org/en/latest/submodules/vnfsdk/model.git/docs/files/VESEventListener_7_0_1.html?highlight=ves%207#datatype-commoneventheader>, accessed 11.04.2019).

[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".

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

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

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

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| **2nd Change** |

### 12.1.x YANG/Netconf-based solution set

#### 12.1.x.1 Mapping of operations

##### 12.1.x.1.1 Introduction

The YANG/Netconf based solution set is based on the 3GPP TS 32.160 [y] clause 6.2 and the IETF RFC 6241 [x] including the Xpath capability.

This clause specifies how the IS operations specified in clause 11 of the present document can be mapped to standard NETCONF operations based on the UML-to-YANG mapping specified in the 3GPP TS 32.160 [y] YANG related clauses.

The IS operations used to read/modify individual MOs or a set of MOs are mapped to NETCONF operations, e.g. edit-config operation. The solution described below specifies one way to use Netconf to read/write YANG based NRM fragments. Other methods described by the referenced RFCs and YANG models should also be available as methods to achieve the same goals. The detailed mapping of the YANG data nodes to XML is defined in IETF RFC7950 [z].

Note: The examples below omit namespaces for brevity. In NETCONF operations namespaces shall be included following [z]

12.1.x.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.x.1.2-1 and table 12.1.x.1.2-2.

**Table 12.1.x.1.2-1: Mapping from IS createMOI input parameters to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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. |
| referenceObjectInstance | config |  | Not supported. |
| 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.x.1.2-2: Mapping from IS createMOI output parameters to SS equivalents**

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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.x.1.3 Operation getMOIAttributes

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

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

The IS operation parameters are mapped to SS equivalents according to table 12.1.x.1.3-1 and table 12.1.x.1.3-2.

Table 12.1.x.1.3-1: Mapping of IS getMOIAttributes input parameters to SS equivalents

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

Table 12.1.x.1.3-2: Mapping of IS getMOIAttributes output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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.x.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.x.1.4-1 and table 12.1.x.1.4-2.

Table 12.1.x.1.4-1: Mapping of IS modifyMOIAttributes input parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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.x.1.4-2: Mapping of IS modifyMOIAttributes output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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.x.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.x.1.5-1 and table 12.1.x.1.5-2.

Table 12.1.x.1.5-1: Mapping of IS deleteMOI input parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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.x.1.5-2: Mapping of IS deleteMOI output parameters to SS equivalents

|  |  |  |  |
| --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter name** | **SQ** | **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.

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| **End of Change** |