**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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:***  | Rel-17 CR 28.532 Clarify usage of notifyMOIChanges for NRMs defined in YANG |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** | SA5 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | The notification "notifyMOIChanges" needs some clarifications when used together with a YANG defined NRM to enable interoperability.. |
|  |  |
| ***Summary of change:*** | Clarifications for "notifyMOIChanges" when used with a YANG defined NRM are provided. |
|  |  |
| ***Consequences if not approved:*** | Different implementations are possible resulting in interoperability issuers. |
|  |  |
| ***Clauses affected:*** | 12.1.1.4.1a.4 |
|  |  |
|  | **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 ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| **First modification** |

# 2 References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[21] Void.

[22] Void.

[23] Void.

[24] Void.

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

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

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

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

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

[30] Void.

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

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

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

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

[35] OpenAPI: "OpenAPI 3.0.1 Specification", <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.1.md>.

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

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

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

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

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

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

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

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

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

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

[46] 3GPP SA5 FORGE OpenAPI definitions: <https://forge.3gpp.org/rep/sa5/MnS/tree/Rel-16/OpenAPI>.

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

[48] IETF RFC 6901: "JavaScript Object Notation (JSON) Pointer".

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

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

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| **Next modification** |

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

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

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute name | Data type | Description | S |
| notificationId | NotificationId | Notification identifier as defined in ITU-T Rec. X. 733 [4] | M |
| correlatedNotifications | array(CorrelatedNotification) | Set of all notifications to which this notification is considered to be correlated as defined in ITU-T Rec. X. 733 [4] | O |
| additionalText | string | Allows a free form text description to be reported as defined in ITU-T Rec. X. 733 [4] | O |
| sourceIndicator | SourceIndicator | Indicates the source of the operation that led to the generation of this notification. | O |
| path | Uri | URI specifying the created, deleted or updated resource | M |
| operation | Operation | Operation associated to the reported change ("CREATE", "DELETE", "REPLACE") | M |
| value | oneOf(AttributeNameValuePairSet, AttributeValueChangeSet) | or reporting resource creation or deletion, the optional resource representation (MOC attributes only). In this case, the data type of value is "AttributeNameValuePairSet".For reporting attribute value changes, the (mandatory) new values and (optional) old values. In this case, the data type of value is "AttributeValueChangeSet". | M |

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

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

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

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

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

notificationId: 123456789

path: 'https://example.com/3GPP/ClassA=1'

operation: CREATE

value:

 attrA:

 subAttrA1: ABC

 subAttrA2: 56

 attrB: XYZ

 attrC: 123

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

notificationId: 123456789

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

operation: CREATE

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

notificationId: 123456789

path: 'https://example.com/3GPP/ClassA=1'

operation: REPLACE

value:

 - attrA:

 subAttrA1: ABC

 subAttrA2: 56

 attrC: 123

 - attrA:

 subAttrA1: DEF

 subAttrA2: 67

 attrC: 345

and the following with new values only

notificationId: 123456789

path: 'https://example.com/3GPP/ClassA=1'

operation: REPLACE

value:

 - attrA:

 subAttrA1: ABC

 subAttrA2: 56

 attrC: 123

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

notificationId: 123456789

path: 'https://example.com/3GPP/ClassA=1?attributes/attrA/subAttrA1'

operation: REPLACE

value:

 - subAttrA1: ABC

 - subAttrA1: DEF

or, with the new value only, like

notificationId: 123456789

path: 'https://example.com/3GPP/ClassA=1?attributes/attrA/subAttrA1'

operation: REPLACE

value:

 - subAttrA1: ABC

When NRM updates from a YANG defined NRM are reported the following rules apply:

* The RESTCONF resource identifier syntax (RFC 8040 [aa], section 3.5.3) shall be used to construct the "href" and “path” values instead of the 3GPP JSON Patch syntax (3GPP TS 32.158 [15], clause 6.4.3).
* The value of "href" shall specify the FQDN of the the NETCONF server emitting the notification, for example "example.com".
* The value of "value" shall follow the JSON encoding of YANG defined in to RFC 7951 [bb].
* The media type as specified by the "Content-Type" header in the HTTP POST request is "application/yang-data+json" and not "application/json".

The difference between the RESTCONF resource identifier and the 3GPP JSON Patch syntax is the following:

* The module name is prepended to the node name where the node is defined for the cases described in RFC 8040 [aa], section 3.5.3.
* The "#" character before "/attributes" in "path" is not present. NETCONF/YANG does not differentiate between the stage 2 concepts of object and attribute. Both objects and attributes are represented by a (primary) resource (node), whereas in the REST solution objects are represented by (primary) resources and attributes by secondary resources.
* Multi-value attribute elements are not identified based on their index (locction). Multi-value attribute elements of scalar types are identified using the element value. Multi-value attribute elements of complex types are identified using keys, that are specified in the YANG definition of the NRM. The path segment to identify an element is "/<attribute name>=<key value>". If no key is defined, a multi-value attribute element cannot be identified.

The following example notification (where JSON is expressed in YAML notation) reports the creation of a resource.

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

...

moiChanges

 - notificationId: 123456789

 op: add

 path: /moduleA:ClassA=1

 value:

 id: 1,

 objectClass: moduleA:ClassA,

 attributes:

 attrA: 123

 attrB:

 subAttrB1: ABC

 subAttrB2: 56

Assume "attrD" is a multi-value attribute. The elements are of type integer with the current value [11, 21,31]. The following notification reports the replacement of the element "21" with "22".

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

...

moiChanges

 - notificationId: 123456789

 op: replace

 path: /moduleA:ClassA=1/attributes/attrD=21

 value: 22

Starting from [11, 22, 31] now, the following notification reports the addition of element "12" before element "22".

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

...

moiChanges

 - notificationId: 123456789

 op: add

 path: /moduleA:ClassA=1/attributes/attrD=22

 value: 12

The result is [11, 12, 22, 31].

Now assume "attrD" is a multi-value attribute whose elements are of complex type. Assume further the current value is

[{subItemD1: 11, subItemD2: ABC}, {subItemD1: 21, subItemD2: DEF}, {subItemD1: 31, subItemD2": GHI}.

and the key is "subItemD1". Then the following notification reports the element identified by the key "21" changed value; the value of "subItemD2" was replaced with "XYZ".

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

...

moiChanges

 - notificationId: 123456789

 op: replace

 path: /moduleA:ClassA=1/attributes/attrD=21

 value:

 subItemD1: 21

 subItemD2: XYZ

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| **End of modifications** |