3GPP TSG SA WG5 Meeting 137-e TDoc S5-213125

electronic meeting, online, 10 - 19 May 2021

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **28.622** | **CR** | **0101** | **rev** |  | **Current version:** | **16.7.1** |  |
|  |
| *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:***  | Add IOC for discovery of management services |
|  |  |
| ***Source to WG:*** | S5 |
| ***Source to TSG:*** | Huawei, Ericsson |
|  |  |
| ***Work item code:*** | 5GDMS |  | ***Date:*** | 2021-05-10 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | As described in 28.533 clause 4.7, MnS data should be stored in the Network Resource Model to allow discovery of management services. |
|  |  |
| ***Summary of change:*** | New IOC and related DataType are added. |
|  |  |
| ***Consequences if not approved:*** | NRM does not support discovery of management services. |
|  |  |
| ***Clauses affected:*** | 2, 4.2.1, 4.2.2, 4.3.x (new), 4.3.y (new), 4.4.1 |
|  |  |
|  | **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 28.623 CR 0126  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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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 TS 32.101: "Telecommunication management; Principles and high level requirements".

[2] 3GPP TS 32.102: "Telecommunication management; Architecture".

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

[4] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and Definitions".

[5] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification"

[6] 3GPP TS 32.532: " Telecommunication management; Software Management Integration Reference Point (IRP); Information Service (IS) "

[7] ITU-T Recommendation X.710 (1991): "Common Management Information Service Definition for CCITT Applications".

[8] TS 32.107: "Telecommunication management; Fixed Mobile Convergence (FMC) Federated Network Information Model (FNIM)"

[9] TS 28.620: "Telecommunication management; Fixed Mobile Convergence (FMC) Federated Network Information Model (FNIM) Umbrella Information Model (UIM)"

[10] TS 32.156: "Telecommunication management; Fixed Mobile Convergence (FMC) Model Repertoire"

[11] 3GPP TS 32.111-2: "Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)".

[12] 3GPP TS 32.662: "Telecommunication management; Configuration Management (CM); Kernel CM Information Service (IS)".

[13] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[14] 3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[15] ETSI GS NFV 003 V1.1.1: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[16] ETSI GS NFV-IFA 008 v2.1.1: "Network Functions Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[17] ETSI GS NFV-IFA 015 v2.1.2: "Network Functions Virtualisation (NFV); Management and Orchestration; Report on NFV Information Model".

[18] ETSI ES 202 336-12 V1.1.1: "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (power, cooling and building environment systems used in telecommunication networks); Part 12: ICT equipment power, energy and environmental parameters monitoring information model".

[19] ITU-T Recommendation X.731: "Information technology - Open Systems Interconnection - Systems Management: State management function".

[20] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[21] 3GPP TS 28.625: "State Management Data Definition Integration Reference Point (IRP); Information Service (IS) ".

[22] 3GPP TS 23.501: "System Architecture for the 5G System".

[23] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[24] IETF RFC 791: "Internet Protocol".

[25] IETF RFC 2373: "IP Version 6 Addressing Architecture".

[26] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[27] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[28] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[29] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[30] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".

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

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

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| **2nd change** |

### 4.2.1 Relationships

This clause depicts the set of classes (e.g. IOCs) that encapsulates the information relevant for this IRP. This clause provides the overview of the relationships of relevant classes in UML. Subsequent clauses provide more detailed specification of various aspects of these classes.

The following figure shows the containment/naming hierarchy and the associations of the classes defined in the present document. See Annex A of a class diagram that combines this figure with Figure 1 of [2], the class diagram of UIM.



NOTE 1: ManagedElement may be contained either

- in a SubNetwork (since *SubNetwork* inherits from *Domain*\_ and *ManagedElement* inherits from *ManagedElement*\_ and *Domain*\_ name-contained *ManagedElement\_* as observed in the figure of Annex A) or

- in a MeContext instance as observed by the above figure or in the figure of Annex A.

This either-or relation cannot be shown by using an {xor} constraint in the above figure.

ManagedElement may also have no parent instance at all.

NOTE 2: Void

NOTE 3: If the configuration contains several instances of SubNetwork, exactly one SubNetwork instance shall directly or indirectly contain all the other SubNetwork instances.

NOTE 4: The SubNetwork instance not contained in any other instance of SubNetwork is referred to as "the root SubNetwork instance".

NOTE 5: ManagementNode shall be contained in the root SubNetwork instance.

NOTE 6: If contained in a SubNetwork instance, IRPAgent shall be contained in the root SubNetwork instance.

NOTE 7: For a clarification on the choice of containment of the IRPAgent (since it has three possible parents), see the def. of IRPAgent.

NOTE 8: Cardinality \* is identical to multiplicity 0..\*.

Figure 4.2.1-1: Containment/Naming and Association NRM fragment

Each Managed Object is identified with a Distinguished Name (DN) according to 3GPP TS 32.300 [13] that expresses its containment hierarchy. As an example, the DN of a ManagedElement instance could have a format like:

 SubNetwork=Sweden,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1.



NOTE 8: Void

NOTE 9: Void

Figure 4.2.1-2: Vendor specific data container NRM fragment



Figure 4.2.1-3: PM control NRM fragment



Figure 4.2.1-4: Threshold monitoring control NRM fragment



Figure 4.2.1-5: Notification subscription and heartbeat notification control NRM fragment



Figure 4.2.1-6: FM control NRM fragment



Figure 4.2.1-7: Trace control NRM fragment

<<InformationObjectClass>>

SubNetwork

<<InformationObjectClass>>

MNSRegistry

<<names>>

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Figure 4.2.1-8: MnS Registry NRM fragment

### 4.2.2 Inheritance

This clause depicts the inheritance relationships.



Figure 4.2.2-1: Inheritance Hierarchy NRM fragment



Figure 4.2.2-2: PM control NRM fragment



Figure 4.2.2-3: Threshold monitoring control NRM fragment



Figure 4.2.2-4: Notification subscription and heartbeat notification control NRM fragment



Figure 4.2.2-5: FM control NRM fragment



Figure 4.2.2-6: Trace control NRM fragment

<<InformationObjectClass>>

Top

<<InformationObjectClass>>

MNSRegistry

Figure 4.2.2-7: MnS Registry NRM fragment

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| **3rd change** |

### 4.3.x MNSRegistry

#### 4.3.x.1 Definition

This IOC contains a list of available Management Services (MnS). It is name-contained by SubNetwork.

Consumers access the registry to retrieve information to facilitate MnS instance discovery.

Entries are provided per MnS to support MnS discovery as defined in 28.533 [x].

The registry is defined in the NRM, and maintained by the service provider via generic provisioning operations.

Authorized consumers can create, read, update, and delete entries in the registry.

#### 4.3.x.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| mnsList | M | T | T | F | T |

#### 4.3.x.3 Constraints

None.

### 4.3.y ManagementService <<dataType>>

#### 4.3.y.1 Definition

This datatype represents an available Management Service (MnS) and provides the data required to support its discovery.

MnS Data as defined in 28.533 [x] clause 4.7 are provided. This information is used by the consumer to discover specific Management Services and to derive the addresses of the Management Service operations and the Management Service information models.

Attributes nmsName, nmsType, and nmsVersion are used to describe the Management Service.

Attribute componentTypeA is used to provide addressing information for the Management Service operations.

Attribute componentTypeB is used to provide addressing information for the Management Service information models. In the case of Provisioning Service, attribute componentTypeB indicates the root address of the supported NRM fragment.

The entries are not intended to be used for detailed runtime information on specific Management Services.

#### 4.3.y.2 Attributes

The ManagementService type includes following attributes:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| mnsName | M | T | T | F | T |
| mnsType | M | T | T | F | T |
| mnsVersion | M | T | T | F | T |
| componentTypeA | M | T | T | F | T |
| componentTypeB | O | T | T | F | T |

#### 4.3.y.3 Constraints

None.

#### 4.3.y.4 Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions

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| **4th change** |

### 4.4.1 Attribute properties

The following table defines the properties of attributes specified in the present document.

| Attribute Name | Documentation and Allowed Values | Properties |
| --- | --- | --- |
| heartbeatNtfPeriod | Periodicity of the heartbeat notification emission. The value of zero has the special meaning of stopping the heartbeat notification emission.Unit is in seconds.AllowedValues: non-negative integers | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: 0isNullable: False |
| triggerHeartbeatNtf | Setting this attribute to TRUE triggers an immediate additional heartbeat notification emission. Setting the value to FALSE has no observable result.The periodicity of notifyHeartbeat emission is not changed.AllowedValues: TRUE, FALSE | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: FALSE isNullable: False |
| notificationRecipientAddress | Address of the notification recipient.allowedValues: N/A | type: String multiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| notificationTypes | Notification types of notifications that are candidates for being forwarding to the notification recipient. If this attribute is absent, notifications of all types are candidates for being forwarding to the notification recipient.If the notificationFilter attribute is absent, all candidate notifications are forwarded to the notification recipient, otherwise the candidate notifications are discriminated by the filter specified by the notificationFilter attribute.AllowedValues: - notifyMOICreation- notifyMOIDeletion- notifyMOIAttributeValueChanges- notifyMOIChanges- notifyEvent- notifyNewAlarm- notifyChangedAlarm- notifyAckStateChanged- notifyComments- notifyCorrelatedNotificationChanged- notifyChangedAlarmGeneral- notifyAlarmListRebuilt- notifyPotentialFaultyAlarmList- notifyFileReady- notifyFilePreparationError- notifyThresholdCrossing | type: ENUMmultiplicity: \*isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| notificationFilter | Filter to be applied to candidate notifications identified by the notificationTypes attribute. Only notifications that pass the filter criteria are forwarded to the notification recipient. All other notifications are discarded.The filter can be applied to any field of a notification.allowedValues: N/A | type: String multiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| scope | Scopes the managed object instances included in the notification subscription. If this attribute is absent, all objects below and including the base object are scoped.allowedValues: N/A | type: Scopemultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| scopeType | If the optional scopeLevel attribute 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.If the scopeLevel attribute 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 attribute, below the base object are selected. The base object is at scopeLevel zero.The value BASE\_SUBTREE indicates the base object and all subordinate objects down to and including the objects on the level, which is specified by the scopeLevel attribute, are selected. The base object is at scopeLevel zero.allowedValues: N/A | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| scopeLevel | See definition of scopeType attribute.allowedValues: N/A | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| farEndEntity | The value of this attribute shall be the Distinguished Name of the far end network entity to which the reference point is related.As an example, with EP\_Iucs, if the instance of EP\_Iucs is contained by one RncFunction instance, the farEndEntity is the Distinguished Name of the MscServerFunction instance to which this Iucs reference point is related. allowedValues: N/A | type: DNmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| linkType | This attribute defines the type of the link. allowedValues: Signalling, Bearer, OAM&P, Other or multiple combinations of this type. | type: Stringmultiplicity: 0..\*isOrdered: FalseisUnique: TruedefaultValue: No isNullable: False |
| locationName | The physical location of this entity (e.g. an address). allowedValues: N/A | type: Stringmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: False |
| monitorGranularityPeriod | Granularity period used to monitor measurements for threshold crossings. The period is defined in seconds.See Note 5allowedValues: Integer with a minimum value of 1 | type: Integermultiplicity: 1isOrdered: FalseisUnique: TruedefaultValue: None isNullable: False |
| monitorGranularityPeriods | Granularity periods supported for the monitoring of associated measurement types for thresholds. The period is defined in seconds.allowedValues: Integer with a minimum value of 1 | type: Integermultiplicity: \*isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| thresholdInfoList | List of threshold infos. | type: ThresholdInfomultiplicity: 1..\*isOrdered: FalseisUnique: TruedefaultValue: NoneisNullable: False |
| thresholdValue | Value against which the monitored performance metric is compared at a threshold level in case the hysteresis is zero.allowedValues: float or integer | type: Unionmultiplicity: 1isOrdered: NAisUnique: NAdefaultValue: NoneisNullable: False |
| hysteresis | Hysteresis of a threshold. If this attribute is present the monitored performance metric is not compared against the threshold value as specified by the thresholdValue attribute but against a high and low threshold value given byhighThresholdValue- = thresholdValue + hysteresislowThresholdValue = thresholdValue - hysteresisWhen going up, the threshold is triggered when the performance metric reaches or crosses the high threshold value. When going down, the threshold is triggered when the performance metric reaches or crosses the low threshold value.A hysteresis may be present only when the monitored performance metric is not of type counter that can go up only. If present for a performance metric of type counter, it shall be ignored.allowedValues: non-negative float or integer | type: Unionmultiplicity: 0..1isOrdered: NAisUnique: NAdefaultValue: NoneisNullable: False |
| thresholdDirection | Direction of a threshold indicating the direction for which a threshold crossing triggers a threshold.When the threshold direction is configured to "UP", the associated treshold is triggered only when the performance metric value is going up upon reaching or crossing the threshold value. The treshold is not triggered, when the performance metric is going down upon reaching or crossing the threshold value.Vice versa, when the threshold direction is configured to "DOWN", the associated treshold is triggered only when the performance metric is going down upon reaching or crossing the threshold value. The treshold is not triggered, when the performance metric is going up upon reaching or crossing the threshold value.When the threshold direction is set to "UP\_AND\_DOWN" the treshold is active in both direcions.In case a threshold with hysteresis is configured, the threshold direction attribute shall be set to "UP\_AND\_DOWN".allowedValues:- UP- DOWN- UP\_AND\_DOWN | type: ENUMmultiplicity: 1isOrdered: NAisUnique: NAdefaultValue: NoneisNullable: False |
| objectClass | Class of a managed object instance.allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| objectInstance | Managed object instance identified by its DN.allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| objectInstances | List of managed object instances. Each object instance is identified by its DN.allowedValues: N/A | type: Dnmultiplicity: \*isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| peeParametersList | This attribute contains the parameter list for the control and monitoring of power, energy and environmental parameters of ManagedFunction instance(s). This list contains the following parameters:- siteIdentification- siteLatitude (optional)- siteLongitude (optional)- siteDescription - equipmentType- environmentType- powerInterface siteIdentification: The identification of the site where the ManagedFunction resides.allowedValues: N/AsiteLatitude: The latitude of the site where the ManagedFunction instance resides, based on World Geodetic System (1984 version) global reference frame (WGS 84). Positive values correspond to the northern hemisphere. This attribute is optional in case of BTSFunction and RNCFunction instance(s).allowedValues: -90.0000 to +90.0000siteLongitude: The longitude of the site where the ManagedFunction instance resides, based on World Geodetic System (1984 version) global reference frame (WGS 84). Positive values correspond to degrees east of 0 degrees longitude. This attribute is optional in case of BTSFunction and RNCFunction instance(s).allowedValues: -180.0000 to +180.0000siteDescription: An operator defined description of the site where the ManagedFunction instance resides.allowedValues: N/A equipmentType: The type of equipment where the managedFunction instance resides. allowedValues: see clause 4.4.1 of ETSI ES 202 336-12 [18].environmentType: The type of environment where the managedFunction instance resides. allowedValues: see clause 4.4.1 of ETSI ES 202 336-12 [18].powerInterface: The type of power.allowedValues: see clause 4.4.1 of ETSI ES 202 336-12 [18]. | type: Stringmultiplicity: 0..\*isOrdered: N/AisUnique: TruedefaultValue: NoneisNullable: True |
| priorityLabel | This is a label that consumer would assign a value on a concrete instance of the managed object. The management system takes the value of this attribute into account. The effect of this attribute value to the subject managed entity is not standardized | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| protocolVersion | Versions(s) and additional descriptive information for the protocol(s) used for the associated communication link. Syntax and semantic is not specified.allowedValues: N/A | type: Stringmultiplicity: \*isOrdered: FalseisUnique: TruedefaultValue: NoneisNullable: False |
| setOfMcc | Set of Mobile Country Code (MCC). The MCC uniquely identifies the country of domicile of the mobile subscriber. MCC is part of the IMSI (TS 23.003 [5])This list contains all the MCC values in subordinate object instances to this SubNetwork instance.allowedValues: See clause 2.3 of TS 23.003 [5] for MCC allocation principles. | type: Integermultiplicity: 1..\*isOrdered: FalseisUnique: TruedefaultValue: No default valueisNullable: False |
| swVersion | The software version of the ManagementNode or ManagedElement (this is used for determining which version of the vendor specific information is valid for the ManagementNode or ManagedElement).allowedValues: N/A | type: Stringmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| systemDN | The Distinguished Name (DN) of IRPAgent (or consumer). Defined in 3GPP TS 32.300.allowedValues: N/A | type: DNmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| userDefinedState | An operator defined state for operator specific usage.allowedValues: N/A | type: Stringmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| userLabel | A user-friendly (and user assignable) name of this object.allowedValues: N/A | type: Stringmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| vendorName | The name of the vendor.allowedValues: N/A | type: Stringmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| vnfParametersList | This attribute contains the parameter set of the VNF instance(s) corresponding to an NE. Each entry in the list contains:- vnfInstanceId- vnfdId (optional)- flavourId (optional) - autoScalable vnfInstanceId: VNF instance identifier (vnfInstanceId, see section 9.4.2 of [16] and section B2.4.2.1.2.3 of [17]).See Note 1.vnfdId: Identifier of the VNFD on which the VNF instance is based, see section 9.4.2 of [16]. This attribute is optional.Note: the value of this attribute is identical to that of the same attribute in clause 9.4.2 of ETSI GS NFV-IFA 008 [16].flavourId: Identifier of the VNF Deployment Flavour applied to this VNF instance, see section 9.4.3 of [16]. This attribute is optional.Note: the value of this attribute is identical to that of the same attribute in clause 9.4.3 of ETSI GS NFV-IFA 008 [16].autoScalable: Indicator of whether the auto-scaling of this VNF instance is enabled or disabled. The type is Boolean.See Note2.The presence of this attribute indicates that the ManagedFunction represented by the MOI is a virtualized function. See Note 3.allowedValues: N/AA string length of zero for vnfInstanceId means the VNF instance(s) corresponding to the MOI does not exist (e.g. has not been instantiated yet, has already been terminated). | type: Stringmultiplicity: \*isOrdered: N/AisUnique: TruedefaultValue: NoneisNullable: True |
| vsData | Vendor specific attributes of the type vsDataType. The attribute definitions including constraints (value ranges, data types, etc.) are specified in a vendor specific data format file. allowedValues: -- | type: --multiplicity: --isOrdered: --isUnique: --defaultValue: --isNullable: False |
| vsDataFormatVersion | Name of the data format file, including version.allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| vsDataType | Type of vendor specific data contained by this instance, e.g. relation specific algorithm parameters, cell specific parameters for power control or re-selection or a timer. The type itself is also vendor specific.allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| supportedPerfMetricGroups | A set of performance metric groups. When this attribute is contained in a managed object it may define performance metrics for this object and all descendant objects.allowedValues: N/A | type: SupportedPerfMetricGroupmultiplicity: \*isOrdered: N/AisUnique: N/AdefaultValue: NoneallowedValues: N/AisNullable: False |
| performanceMetrics | List of performance metrics.Performance metrics include measurements defined in TS 28.552 [20] and KPIs defined in TS 28.554 [28]. Performance metrics can also be those specified by other SDOs or vendor specific metrics. Performance metrics are identified with their names. A name can als identify a vendor specific group of performance metrics.For measurements defined in TS 28.552 [20] the name is constructed as follows:- "family.measurementName.subcounter" for measurement types with subcounters- "family.measurementName" for measurement types without subcounters- "family" for measurement familiesFor KPIs defined in TS 28.554 [28] the name is defined in the KPI definitions template as the component designated with e).allowedValues: N/A | type: Stringmultiplicity: \*isOrdered: N/AisUnique: TruedefaultValue: NoneisNullable: False |
| rootObjectInstances | List of object instances. Each object instance is identified by its DN and designates the root of a subtree that contains the root object and all descendant objects. | Type: Dnmultiplicity: \*isOrdered: N/AisUnique: TruedefaultValue: NoneisNullable: False |
| reportingMethods | List of reporting methods for performance metricsallowedValues:  - "FILE\_BASED\_LOC\_SET\_BY\_PRODUCER", - "FILE\_BASED\_LOC\_SET\_BY\_CONSUMER", - "STREAM\_BASED" | Type: ENUMmultiplicity: \*isOrdered: N/AisUnique: TruedefaultValue: NoneisNullable: False |
| nFServiceType | The parameter defines the type of the managed NF service instanceallowedValues: See clause 7.2 of TS 23.501[22] | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: TruedefaultValue: NoneisNullable: False |
| operations | This parameter defines set of operations supported by the managed NF service instance.allowedValues: See TS 23.502[23] for supporting operations | type: Operationmultiplicity: 1..\*isOrdered: FalseisUnique: FalsedefaultValue: No default valueisNullable: False |
| Operation.name | This parameter defines the name of the operation of the managed NF service instance.allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: FalseisUnique: FalsedefaultValue: NoneisNullable: True |
| allowedNFTypes | This parameter identifies the type of network functions allowed to access the operation of the managed NF service instance.allowedValues: See TS 23.501[22] for NF types | type: ENUMmultiplicity: 1..\*isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| operationSemantics | This paramerter identifies the semantics type of the operation. See TS 23.502[23]allowedValues: “Request/Response”, “Subscribe/Notify”.  | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| sAP | This parameter specifies the service access point of the managed NF service instance.allowedValues: N/A | type: SAPmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| host | This parameter specifies the host address of the managed NF service instance. It can be FQDN (See TS 23.003 [5]) or an IPv4 address (See RFC 791 [24]) or an IPv6 address (See RFC 2373 [25]).allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: FalseisUnique: N/AdefaultValue: NoneisNullable: False |
| port | This parameter specifies the transport port of the managed NF service instance.allowedValues: 1 - 65535 | type: Integermultiplicity: 1isOrdered: FalseisUnique: FalsedefaultValue: NoneisNullable: False |
| usageStae | Usage state of a managed object instance. It describes whether the resource is actively in use at a specific instant, and if so, whether or not it has spare capacity for additional users at that instant. allowedValues: "IDLE", "ACTIVE", "BUSY".The meaning of these values is as defined in 3GPP TS 28.625 [21] and ITU-T X.731 [19]. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| registrationState | This parameter defines the registration status of the managed NF service instance.allowedValues: "Registered", "Deregistered". | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: DeregisteredisNullable: False |
| jobId | Id for a PerfMetricJob job. | type: Stringmultiplicity: 0..1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| granularityPeriod | Granularity period used to produce measurements. The period is defined in seconds.See Note 4.allowedValues: Integer with a minimum value of 1 | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| granularityPeriods | Granularity periods supported for the production of associated measurement types. The period is defined in seconds.allowedValues: Integer with a minimum value of 1 | type: Integermultiplicity: \*isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| reportingCtrl | Selecting the reporting method and defining associated control parameters. | type: ReportingCtrlmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| fileReportingPeriod | For the file-based reporting method this is the time window during which collected measurements are stored into the same file before the file is closed and a new file is opened. The period is defined in minutes.allowedValues: Multiples of granularityPeriod | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| fileLocation | File location allowedValues: Not applicable. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: True |
| streamTarget | The stream target for the stream-based reporting method.allowedValues: N/A | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: None isNullable: True |
| administrativeState | Administrative state of a managed object instance. The administrative state describes the permission to use or prohibition against using the object instance. The adminstrative state is set by the MnS consumer.allowedValues: LOCKED, UNLOCKED.  | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: LOCKEDisNullable: False |
| operationalState | Operational state of manged object instance. The operational state describes if an object instance is operable ("ENABLED") or inoperable ("DISABLED"). This state is set by the object instance or the MnS producer and is hence READ-ONLY.allowedValues: ENABLED, DISABLED. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: DISABLEDisNullable: False |
| alarmRecords | List of alarm recordsallowedValues: N/A | type: AlarmRecordmultiplicity: \*isOrdered: N/AisUnique: Truedefault value: NoneisNullable: True |
| numOfAlarmRecords | Number of alarm records in the AlarmList.allowedValues: 0 to x where x is vendor specific. | type: integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| lastModification | Time an alarm record was modified the last timeallowedValues: N/A | type: DateTimemultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| tjJobType | It specifies the MDT mode and it specifies also whether the TraceJob represents only MDT, Logged MBSFN MDT, Trace or a combined Trace and MDT job. The attribute is applicable for Trace, MDT, RCEF and RLF reporting.See the clause 5.9a of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: TRACE\_ONLYisNullable: False |
| tjListOfInterfaces | It specifies the interfaces that need to be traced in the given ManagedEntityFunction.The attribute is applicable only for Trace. In case this attribute is not used, it carries a null semantic.See the clause 5.5 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1..\*isOrdered: N/AisUnique: N/AdefaultValue: NoisNullable: True |
| tjListOfNeTypes | It specifies in which type of ManagedFunction the trace should be activated. The attribute is applicable only for Trace with Signalling Based Trace activation. In case this attribute is not used, it carries a null semantic.See the clause 5.4 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1..\*isOrdered: N/AisUnique: N/AdefaultValue: NoisNullable: True |
| tjPLMNTarget | It specifies which PLMN that the subscriber of the session to be recorded uses as selected PLMN. PLMN Target might differ from the PLMN specified in the Trace Reference.See the clause 5.9b of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: TruedefaultValue: No isNullable: True |
| tjStreamingTraceConsumerURI | It specifies the URI of the Streaming Trace data reporting MnS consumer (a.k.a. streaming target).See the clause 5.9 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjTraceCollectionEntityAddress | It specifies the address of the Trace Collection Entity when the attribute tjTraceReportingFormat is configured for the file-based reporting. The attribute is applicable for both Trace and MDT.See the clause 5.9 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjTraceDepth | It specifies the trace depth. The attribute is applicable only for Trace. In case this attribute is not used, it carries a null semantic.See the clause 5.3 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: MAXIMUM isNullable: True |
| tjTraceReference | A globally unique identifier, which uniquely identifies the Trace Session that is created by the TraceJob. In case of shared network, it is the MCC and MNC of the Participating Operator that request the trace session that shall be provided.The attribute is applicable for both Trace and MDT.See the clause 5.6 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: TruedefaultValue: None isNullable: False |
| tjTraceReportingFormat | It specifies the trace reporting format - streaming trace reporting or file-based trace reporting.See the clause 5.11 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: FILE isNullable: False |
| tjTraceTarget | It specifies the target object of the Trace and MDT. The attribute is applicable for both Trace and MDT. This attribute includes the ID type of the target as an enumeration and the ID value.See the 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjTriggeringEvent | It specifies the triggering event parameter of the trace session. The attribute is applicable only for Trace. In case this attribute is not used, it carries a null semantic.See the clause 5.1 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTAnonymizationOfData | It specifies the level of anonymization for management based MDT.See the clause 5.10.12 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NO\_IDENTITY isNullable: True |
| tjMDTAreaConfigurationForNeighCell | It specifies the area for which UE is requested to perform measurement logging for neighbour cells which have list of frequencies. If it is not configured, the UE shall perform measurement logging for all the neighbour cells.Applicable only to NR Logged MDT.See the clause 5.10.26 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1..\*isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTAreaScope | It specifies MDT area scope when activates an MDT job. For RLF and RCEF reporting it specifies the eNB or list of eNBs where the RLF or RCEF reports should be collected.List of cells/TA/LA/RA for signaling based MDT or management based Logged MDT.List of cells for management based Immediate MDT.Cell, TA, LA, RA are mutually exclusive.One or list of eNBs for RLF and RCEFreportingSee the clause 5.10.2 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1..\*isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTCollectionPeriodRrmLte | It specifies the collection period for collecting RRM configured measurement samples for M2, M3 in LTE. The attribute is applicable only for Immediate MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.20 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTCollectionPeriodRrmUmts | It specifies the collection period for collecting RRM configured measurement samples for M3, M4, M5 in UMTS. The attribute is applicable only for Immediate MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.21 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTEventListForTriggeredMeasurement | It specifies event types for event triggered measurement in the case of logged NR MDT. Each trace session may configure at most one event. The UE shall perform logging of measurements only upon certain condition being fulfilled:- Out of coverage.- A2 event.See the clause 5.10.28 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTEventThreshold | It specifies the threshold which should trigger the reporting in case A2 event reporting in LTE or 1F/1l event in UMTS. The attribute is applicable only for Immediate MDT and when reportingTrigger is configured for A2 event in LTE or 1F event or 1l event in UMTS. In case this attribute is not used, it carries a null semantic.See the clauses 5.10.7 and 5.10.7a of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTListOfMeasurements | It specifies the UE measurements that shall be collected in an Immediate MDT job. The attribute is applicable only for Immediate MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.3 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTLoggingDuration | It specifies how long the MDT configuration is valid at the UE in case of Logged MDT. The attribute is applicable only for Logged MDT and Logged MBSFN MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.9 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTLoggingInterval | It specifies the periodicty for Logged MDT. The attribute is applicable only for Logged MDT and Logged MBSFN MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.8 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTMBSFNAreaList | The MBSFN Area consists of a MBSFN Area ID and Carrier Frequency (EARFCN). The target MBSFN area List can have up to 8 entries. This parameter is applicable only if the job type is Logged MBSFN MDT.See the clause 5.10.25 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Stringmultiplicity: 1..8isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTMeasurementPeriodLTE | It specifies the measurement period for the Data Volume and Scheduled IP throughput measurements for MDT taken by the eNB. The attribute is applicable only for Immediate MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.23 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTMeasurementPeriodUMTS | It specifies the measurement period for the Data Volume and Throughput measurements for MDT taken by RNC. The attribute is applicable only for Immediate MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.22 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTCollectionPeriodRrmNR | It specifies the collection period for collecting RRM configured measurement samples for M4, M5 in NR. The attribute is applicable only for Immediate MDT. In case this attribute is not used, it carries a null semantic.See the clause 5.10.30 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTMeasurementQuantity | It specifies the measurements that are collected in an MDT job for a UMTS MDT configured for event triggered reporting.See the clause 5.10.15 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTPLMList | It indicates the PLMNs where measurement collection, status indication and log reporting is allowed.See the clause 5.10.24 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: PLMNmultiplicity: 1..16isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTPositioningMethod | It specifies what positioning method should be used in the MDT job.See the clause 5.10.19 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTReportAmount | It specifies the number of measurement reports that shall be taken for periodic reporting while the UE is in connected. The attribute is applicable only for Immediate MDT and when tjMDTReportingTrigger is configured for periodical measurements. In case this attribute is not used, it carries a null semantic.See the clause 5.10.6 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTReportingTrigger | It specifies whether periodic or event based measurements should be collected. The attribute is applicable only for Immediate MDT and when the tjMDTListOfMeasurements is configured for M1 (for both UMTS and LTE) or M2 (only for UMTS). In case this attribute is not used, it carries a null semantic.See the clause 5.10.4 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTReportInterval | It specifies the interval between the periodical measurements that shall be taken when the UE is in connected mode. The attribute is applicable only for Immediate MDT and when tjMDTReportingTrigger is configured for periodical measurements. In case this attribute is not used, it carries a null semantic.See the clause 5.10.5 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTReportType | It specifies report type for logged NR MDT as:- periodical.- event triggered.See the clause 5.10.27 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTSensorInformation | It specifies which sensor information shall be included in logged NR MDT and immediate NR MDT measurement if they are available. The following sensor measurement can be included or excluded for the UE: - Barometric pressure.- UE speed.- UE orientation.See the clause 5.10.29 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: ENUMmultiplicity: 1..\*isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| tjMDTTraceCollectionEntityID | It specifies the TCE Id which is sent to the UE in Logged MDT.See the clause 5.10.11 of 3GPP TS 32.422 [30] for additional details on the allowed values. | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: No isNullable: True |
| mnsList | List of ManagementService. | type: ManagementServicemultiplicity: 0..\*isOrdered: FalseisUnique: TruedefaultValue: NoneisNullable: False |
| mnsName | Human-readable name of management service. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| mnsType | Type of management service.allowedValues: PROVISIONING, FAULT\_SUPERVISION, PERFORMANCE\_ASSURANCE. | type: ENUMmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| mnsVersion | Version of management service.allowedValues: For OpenAPI-based services, this should be equal to the parameter “MnSVersion”.Not relevant for NETCONF-based services. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| componentTypeA | Addressing information for Management Service operations.allowedValues: For OpenAPI-based services, this should be equal to the parameter “MnSRoot”.For NETCONF-based services, this should identify the host and optionally the port in the format “netconf://{host}[:{port}]. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| componentTypeB | Addressing information for Management Service information models.For Provisioning Service, this defines the root NRM path for supported Management Service IOCs. For other Management Services, this defines the NRM path for the Management Service IOCs. | type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| NOTE 1: The value of this attribute is identical to that of the same attribute in clause 9.4.2 of ETSI GS NFV-IFA 008 [16].NOTE 2: The value of this attribute is identical to that of the same attribute included in vnfConfigurableProperty in clause 9.4.2 of ETSI GS NFV-IFA 008 [16].NOTE 3: The presence of the attribute vnfParametersList, whose vnfInstanceId with a string length of zero, in createMO operation can trigger the instantiation of the related VNF/VNFC instances.NOTE 4: The GP defines the measurement data production rate. The supported rates are dependent on the capacity of the producer involved (e.g. the processing power of the producer, the complexity of the measurement type involved etc) and therefore, it cannot be standardized for all producers involved. The supported GPs reflects the agreement between producer and the consumer involved.NOTE 5: The monitoring granularity period defines the measurements monitoring period. The supported monitoring periods are dependent on the capacity of the producer involved (e.g. the processing power of the producer, the complexity of the measurement type involved etc) and therefore, it cannot be standardized for all producers involved. The supported monitoring GPs reflect the agreement between producer and the consumer involved.NOTE 6: The supported threshold levels are dependent on the capacity of the producer involved (e.g. the processing power of the producer, number of measurements being measured by the producer at the time, the complexity of the measurement type involved etc) and therefore, it cannot be standardized for all producers involved. The supported levels can only reflect the negotiated agreement between producer and the consumer involved. |

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| **End of changes** |