**3GPP TSG-SA5 Meeting #157 *S5-245755***

Hyderabad, India, 14 - 18 October 2024

**Source: Ericsson**

**Title:** **pCR TR 28.871 Rapporteur clean-up**

**Document for: Approval**

**Agenda Item: 6.19.8**

# 1 Decision/action requested

***The group is asked to approve the updates to the TR in the detailed proposal.***

# 2 References

[1] 3GPP TS 32.500 SON Concepts and Requirements

[2] 3GPP TS 99.999 This example has a very long name, because then we can see how thi References paragraph will handle paragraphs spanning more than one line.

[3] 3GPP TS 99.999 Title of the document

[4] S5-991234, CR 32.999 v10.1.1, Inverting architecture of SON

[5] [S5-100001](http://www.3gpp.com/ftp/TSG_SA/WG5_TM/TSGS5_69/Docs/S5-100001.zip), Agenda, 3GPP SA5#69 Comment>

# 3 Rationale

The study is nearly completed, and we have asked EditHelp to review the draft study report. EditHelp came back with comments which are both editorial and non-editorial, the latter needs agreement from the group before they can be implemented. The editorial comments have been implemented by MCC in TS 28.871 v1.0.1.

This contribution addresses the non-editorial comments using v1.0.1 as baseline.

The following non-editorial issues are addressed:

* References to include TR or TS.
* Incorrect spelling of words.
* The use of “shall” is not allowed in TRs outside the “Potential requirements” clause.
* The use of “must” is not allowed in any TRs/TSs unless this is a quotation from another standard.
* Fix any hanging paragraph (there should be no text between a clause and its subclause).

# 4 Detailed proposal

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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 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[3] 3GPP TS 28.537: "Management and orchestration; Management capabilities".

[4] 3GPP TS 28.623: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Solution Set (SS) definitions".

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

[6] 3GPP TS 28.104: "Management and orchestration; Management Data Analytics (MDA)".

[7] 3GPP TS 28.105: "Management and orchestration; Artificial Intelligence/ Machine Learning (AI/ML) management".

[8] 3GPP TS 28.111: "Fault management".

[9] 3GPP TS 28.311: "Management and orchestration; Network policy management for mobile networks based on Network Function Virtualization (NFV) scenarios".

[10] 3GPP TS 28.312: "Management and orchestration; Intent driven management services for mobile networks".

[11] 3GPP TS 28.317: "Management and orchestration; Self-configuration of Radio Access Network Entities (RAN NEs)".

[12] 3GPP TS 28.318: "Management and Orchestration; Network and services operations for energy utilities".

[13] 3GPP TS 28.319: "Management and orchestration; Access Control for Management services".

[14] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[15] 3GPP TS 28.536: "Management and orchestration; Management services for communication service assurance; Stage 2 and stage 3".

[16] 3GPP TS 28.538: "Management and orchestration; Edge Computing Management".

[17] 3GPP TS 28.556: "Management and orchestration; Network policy management for 5G mobile networks; Stage 2 and stage 3".

[18] 3GPP TS 28.404 "Telecommunication management; Quality of Experience (QoE) measurement collection; Concepts, use cases and requirements)".

[19] 3GPP TS 28.405 "Telecommunication management; Quality of Experience (QoE) measurement collection; Control and configuration)".

[20] 3GPP TS 28.406 "Telecommunication management; Quality of Experience (QoE) measurement collection; Information definition and transport".

[21] 3GPP TS 28.520 "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Requirements".

[22] 3GPP TS 28.521 "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Procedures".

[23] 3GPP TS 28.522 Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2".

[24] 3GPP TS 28.523 Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3".

[25] 3GPP TS 28.550 "Management and orchestration; Performance assurance".

[26] 3GPP TS 28.552 "Management and orchestration; 5G performance measurements".

[27] 3GPP TS 28.554 "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[28] 3GPP TS 28.558 "Management and orchestration; UE level measurements for 5G system".

[29] 3GPP TS 32.401 "Telecommunication management; Performance Management (PM);Concept and requirements".

[30] 3GPP TS 32.404 "Telecommunication management; Performance Management (PM); Performance measurements; Definitions and template".

[31] 3GPP TS 32.421 "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[32] 3GPP TS 32.422 "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".

[33] 3GPP TS 32.423 "Telecommunication management; Subscriber and equipment trace; Trace data definition and management".

[34] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

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| **2nd Change** |

### 5.1.3 Potential solutions

**Solution proposal 1**

Do nothing.

Pro: No risk for inconsistencies. No work needs to be done.

Con: Non SA5 NRM experts continue to have the problem of understanding the 3GPP 5G network resource model.

**Solution proposal 2**

Describe the dependencies in a more understandable way in a 900-series TR.

Pro: Non SA5 NRM experts have an easier way of understanding how SA5 NRM specifications relate to each other. Since this would be a 900-series TR it would be visible to organizations outside 3GPP and kept up-to-date across releases.

Con: As the information is duplicated, it is a risk for not being consistent.

**Solution proposal 3**

Change the structure of the NRM TSs. E.g. One TS could be for RAN NFs, another for Core Network NFs, a third for management system MnFs.

Pro: The understanding per NRM fragment would be better.

Con: All dependencies might not be visible. It is a very large work.

**Solution proposal 4**

Augment the "5G specifications overview" [28.533, Annex E] to include the NRM components. For example, the column currently headed "Related specifications" could be split into one describing use cases and requirements, and another defining common/specific NRM. A separate column could also be added, including not only the TS but the specific NRM component(s) defined in it that are related to the management feature. To increase visibility, and promote maintenance, the Annex could be promoted to normative, or even moved into the main body of the TS.

Pro: The mapping between specifications, management features, and NRM would be captured in a single location.

Con: The amount of information in the table could be large and difficult to maintain.

**Solution proposal 5**

Augment the existing specifications containing NRM definitions to indicate a clear "entry point" or "root" NRM component for each management feature. E.g. the "ManagementDataCollection" IOC for MADCOL, "Intent" IOC for IDMS, etc. Each of these would then document the management feature(s) to which it applies and the other IOCs/DTs which comprise the complete solution. E.g. Intent IOC would indicate it is the root for IDMS and that the IntentReport and related DTs are also required.

NOTE: This solution could also be combined with Proposal 4 to reduce the amount of information required in the table.

Pro: Existing information is retained and augmented with more detail. The documentation on dependencies could be kept to the minimal number of 'root' NRM components.

Con: Could be difficult for multi-release maintenance when some components (or parts thereof) only apply to specific release(s).

**Solution proposal 6**

Create a new type of document, such as a web/wiki page, to document the NRMs and dependencies.

Pro: Could be easier to maintain and have least impact on existing specs. Method to introduce different 'views' on NRM usage for potentially different audiences. E.g. Rel-17 vs. Rel-18 view, Slice vs. NF mgmt., ORAN centric implementation, etc.

Con: Separation of the information from the actual specs could lead to inconsistencies.

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| **3rd Change** |

#### 5.2.3.1 Potential solution#1 Add reference for solution description (NRM fragment) for each management capability in TS 28.537.

Following clauses 5.1 overview and 5.2 specification level requirements are the existing clauses of 3GPP TS 28.537 [3], clause 5.3 solution (between quotes) is proposed to be added in clause 5 in 3GPP TS 28.537 [3] “to add reference to solution description (NRM fragment) for management capability of discovery of Management Services in 3GPPTS 28.537 [3]”.

5 Discovery of Management Services

5.1 Overview

5.2 Specification level requirements

5.3 Solution

“The stage 2 for this management capability is described in 3GPP TS 28.622 [3], clause X (MnSRegistry NRM fragment).”

“The stage 3 for this management capability is described in 3GPP TS 28.623 [4], clause X (YAML) and clause Y (YANG).”

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| **4th Change** |

#### 5.2.3.3 Potential solution#3 Add reference for management capability requirements for each NRM fragment in 3GPP TS 28.622

Following clause 4.3.42 is the existing clause, the sentence (in italic) and table below are proposed to be added in clause 4.3.42.1 in 3GPP TS 28.622 [2].

4.3.42 MnsInfo

4.3.42.1 Definition

This IOC represents an available Management Service (MnS) and provides the data required to support its discovery. It is name-contained by MnsRegistry.

This information is used by the consumer to discover the producers of specific Management Services and to derive the addresses of the Management Service.

Attributes mnsLabel, mnsType, and mnsVersion are used to describe the Management Service.

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

Attribute mnsScope is used to provide information about the management scope of the Management Service. The management scope is defined as the set of managed object instances that can be accessed using the Management Service.

Following requirements related to management capability of Discovery of Management Services supported by the MnsInfo IOC.

Table 5.2.3.3-1: MnSInfo requirements references

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.537 [3] | REQ-DMS-1 |  |
| 3GPP TS 28.537 [3] | REQ-DMS-2 |  |
| 3GPP TS 28.537 [3] | REQ-DMS-3 |  |
| 3GPP TS 28.537 [3] | REQ-DMS-4 |  |

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| **5th Change** |

### 5.3.1 Description

The use cases and requirements for discovery of Management Services are described in 3GPP TS 28.537 [3], which includes:

- MnS Consumer retrieves management service information from MnS registry

- MnS Consumer retrieves detailed capabilities about management service

In TS 28.622[2], MnsInfo IOC is introduced to describe the management service information and detailed capabilities about management service, which includes:

Table 5.3.1-1: MnSInfo properties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | S | isReadable | isWritable | isInvariant | isNotifyable |
| mnsLabel | M | T | F | F | T |
| mnsType | M | T | F | F | T |
| mnsVersion | M | T | F | F | T |
| mnsAddress | M | T | F | F | T |
| mnsScope | M | T | F | F | T |

The model driven approach (i.e. usage of provisioning MnS operations specified in 3GPP TS 28.532 [14] and NRM fragments) can be used to support various types of management capabilities in SBMA. MnS consumer may need to get management capability information of the MnS in an convenient way. For example, MnS consumer may need to query which MnS can provide the threshold control capability. The current MnSType attribute in MnSInfo IOC cannot be used to represent the management capability information of MnS.

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| **6th Change** |

### 5.3.3 Potential solutions

Following are the proposed enhancement for MnSInfo IOC defined in 3GPP TS 28.622 [2]:

**Enhancement Aspect 1:** Add attribute 'mnsCapability' to represent the types of management capabilities provided by MnS instance that the MnSType is ProvMnS.

| Table 5.3.3-1: mnsCapability descriptionAttribute Name | Documentation and Allowed Values | Properties |
| --- | --- | --- |
| mnsCapability | It describes the types of management capabilities provided by MnS instance that the MnSType is ProvMnS. The allowed values:* MANAGEMENT\_DATA\_CONTROL
* FAULT\_MANAGEMENT
* FILE\_MANAGEMENT
* NR\_PROVISIONING
* 5GC\_PROVISIONING
* NETWORK\_SLICING\_PROVISIONING
* EDGE\_COMPUTING\_PROVISIONING
* AI/ML\_MANAGEMENT
* MDA
* SON\_POLICY
* RANSC\_MANAGEMENT
* INTENT\_DRIVEN\_MANAGEMENT
* MNS\_REGISTRY\_AND\_DISCOVERY
* COMMUNICATION\_SERVICE\_ASSURANCE
* NSOEU
* MSAC\_MANAGEMENT
 | Type: Enummultiplicity: 0..\*isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |

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| **6th Change** |

### 5.6.3 Potential solutions

**Solution proposal 1**

Do nothing.

Pro: No risk for inconsistencies. No work needs to be done.

Con: Non SA5 PM experts continue to have the problem of understanding how the 3GPP 5G performance TSs relate to each other.

**Solution proposal 2**

Describe the dependencies in a more understandable way in a 900-series TR.

Pro: Non SA5 PM experts have an easier way of understanding how SA5 performance specifications relate to each other. Since this would be a 900-series TR it would be visible to organizations outside 3GPP and kept up-to-date across releases.

Con: As the information is duplicated, it is a risk for not being consistent.

**Solution proposal 3a**

Change the structure of the performance TSs. E.g. One TS could be for RAN NFs, another for Core Network NFs, a third for management system MnFs.

Pro: The understanding for which performance metrics are produced would be better. It would mitigate compliance work.

Con: All dependencies might not be visible. It is a very large work.

**Solution proposal 3b**

Change the structure of the Subscriber and Equipment Trace and the Quality of Experience (QoE) measurement collection. The other PM specifications are divided into mechanism and performance data, which is not the case for the Subscriber and Equipment Trace and the Quality of Experience (QoE) measurement collection, so also these specifications can be changed to the structure of separating mechanism and performance data.

Pro: The mechanism is common for different 3GPP systems, while the performance data may differ. It will be very clear on what data is valid for which 3GPP system.

Con: When performance data is used for several 3GPP systems (e.g. NSA), the description of these cases needs to refer to another TS.

**Solution proposal 4**

Augment the "5G specifications overview" (3GPP TS 28.533 [34], Annex E) to include the performance components. For example, the column currently headed "Related specifications" could be split into one describing use cases and requirements, and another defining performance data. A separate column could also be added, including not only the TS but the specific performance data definitions defined in it that are related to the management feature. To increase visibility, and promote maintenance, the Annex could be promoted to normative, or even moved into the main body of the TS. Different releases can have different clauses or annexes in the TS.

Pro: The mapping between specifications, management features, and performance data definitions would be captured in a single location.

Con: The amount of information in the table could be large and difficult to maintain.

For example, the performance components table can be summarized as follows:

Editor notes: where to put the following table in normative work needs FFS.

Table 5.6.3-1: QoE measurements collection

|  |  |  |
| --- | --- | --- |
| Category | Performance Measurements | Related specifications |
| QoE measurements | QoE metrics for 3GP-DASHQoE metrics for MTSIQoE metrics for VR | 3GPP TS 28.404 [18] for the requirements of QoE measurement collection3GPP TS 28.405 [19] for the procedure of QoE measurement collection3GPP TS 28.406 [20] for the definition of recording content of QoE measurement |

Table 5.6.3-2: PM/KPI for 5G networks

|  |  |  |
| --- | --- | --- |
| Category | Performance Measurements | Related specifications |
| Performance measurements for gNB | Packet related measurements | 3GPP TS 28.552 [26] for the definition of performance measurements3GPP TS 28.550 [25] for the performance measurements management services  |
| Radio resource utilization related measurements |
| UE throughput measurements |
| RRC related measurements |
| Mobility related measurements |
| TB related Measurements |
| DRB related measurements |
| QoS related measurements |
| Energy related measurements |
| Random access related measurements |
| Signal related measurements |
| MRO related measurements |
| Paging Measurement |
| MU-MIMO related measurements |
| GTP related measurements |
| Performance measurements for 5GC | Performance measurements for NSOEU |
| Performance measurements for AMF |
| Performance measurements for SMF |
| Performance measurements for UPF |
| Performance measurements for PCF |
| Performance measurements for UDM |
| Common performance measurements for NFs |
| Performance measurements for N3IWF |
| Performance measurements for NEF |
| Performance measurements for NRF |
| Performance measurements for NSSF |
| Performance measurements for SMSF |
| Performance measurements for UDR |
| Performance measurements for ECS |
| Performance measurements for EES |
| Performance measurements for LMF |
| Performance measurements for NWDAF |
| Performance measurements for network slicing | Measurements related to end-to-end 5G network and network slicing | 3GPP TS 28.552 [26] for the definition of performance measurements3GPP TS 28.550 [25] for the performance measurements management services |
| Key Performance Indicators (KPIs) | Accessibility KPI | 3GPP TS 28.554 [27] for the definition of the Key Performance Indicators3GPP TS 28.550 [25] for the performance measurements management services |
| Integrity KPI |
| Utilization KPI |
| Retainability KPI |
| Mobility KPI |
| Energy Efficiency (EE) KPI |
| Reliability KPI |
| Average air-interface efficiency KPI |
| Network and Service Operations for Energy Utilities (NSOEU) KPI |

Table 5.6.3-3: performance measurements for UE

| Category | Performance Measurements | Related specifications |
| --- | --- | --- |
| UE level measurements for UPF | Packet delay related UE level measurements | 3GPP TS 28.558 [28] for the definition of UE performance measurements3GPP TS 32.421 [31], 3GPP TS 32.422 [32], TS 32.423 [33] for the definition of UE performance measurements reporting and recording content |
| UE level measurements for gNB | Packet delay related UE level measurements |
| Packet Loss related UE level measurements |
| UE throughput related UE level measurements |

Table 5.6.3-4: MDT/Trace measurements for 5G networks

|  |  |  |
| --- | --- | --- |
| Category | Performance Measurements | Related specifications |
| MDT/Trace measurements | AMF Trace RecordSMF Trace RecordPCF Trace RecordAUSF Trace RecordNEF Trace RecordNRF Trace RecordNSSF Trace RecordUDM Trace RecordUPF Trace RecordSMSF Trace RecordAF Trace RecordgNB-CU-CP Trace RecordgNB-CU-UP Trace RecordgNB-DU Trace Recordng-eNB Trace RecordNR MDT Trace Record Content5GC UE level measurement Trace Record | 3GPP TS 32.421 [31] for the requirements of MDT/Trace measurements reporting3GPP TS 32.422 [32] for the definition of MDT/Trace measurements reporting procedure3GPP TS 32.423 [33] for the definition of recording content of MDT/Trace measurement |

**Solution proposal 5**

Augment the existing specifications containing performance information to indicate a clear "entry point" or "root" NRM component for each management feature. E.g. the "PerfMetricJob" IOC for PM measurements, "TraceJob" IOC for Subscriber and Equipment trace, etc. Each of these would then document the management feature(s) to which it applies and the other IOCs/DTs which comprise the complete solution.

NOTE: This solution could also be combined with Proposal 4 to reduce the amount of information required in the table.

Pro: Existing information is retained and augmented with more detail. The documentation on dependencies could be kept to the minimal number of 'root' NRM components.

Con: Could be difficult for multi-release maintenance when some components (or parts thereof) only apply to specific release(s).

**Solution proposal 6**

Create a new type of document, such as a web/wiki page, to document the performance data dependencies.

Pro: Could be easier to maintain and have least impact on existing specs. Method to introduce different 'views' on usage performance information for potentially different audiences. E.g. Rel-17 vs. Rel-18 view, Slice vs. NF mgmt., ORAN centric implementation, etc.

Con: Separation of the information from the actual specs could lead to inconsistencies.

Different solutions proposals can be combined. E.g. the proposals 4 and 3b can be combined, which would mean that the structure for Subscriber and Equipment Trace and the Quality of Experience (QoE) measurement collection is changed and the relations between the specifications are described in the annex in 28.533.

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| **7th Change** |

### 5.7.3 Potential solutions

#### 5.7.3.1 Potential solution#1 Add definition of the common notification header to 3GPP TS 28.532

Common notification header parameters

All notifications emitted by any MnS or function, support and contain the following parameters:

**Table 5.7.3.1-1: Input parameters**

| **Parameter Name** | **S** | **Documentation and Allowed Values** | **Properties** |
| --- | --- | --- | --- |
| objectClass | M | Name of an IOC identified by objectInstance. | Type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/A |
| objectInstance | M | Distinguished name (DN) of an MOI.Together with objectClass it identifies an MOI the notification is related to. It can be e.g. an MOI that caused the notification to be emitted or an MOI about which the notification reports some information. | Type: DNmultiplicity: 1isOrdered: N/AisUnique: N/A |
| notificationId | M | This is an identifier for the individual 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 MOI specified by objectInstance. | Type: Integermultiplicity: 1isOrdered: N/AisUnique: N/A |
| notificationType | M | String: It specifies the type of notification and hence the information carried by the notification.It should be a fixed, short, human readable string for each type of notification. | Type: Stringmultiplicity: 1isOrdered: N/AisUnique: N/A |
| eventTime | M | The date and time when the event that triggered the sending of the notification occurred. | Type: DateTimemultiplicity: 1isOrdered: N/AisUnique: N/A |
| systemDN | M | Distinguished name of the MnS producer. If an MnSAgent MOI is present, systemDN should be the DN of an MnSAgent. | Type: DNmultiplicity: 1isOrdered: N/AisUnique: N/A |

The parameters may be further specified by the individual notification types.

Individual notification types may define additional parameters.

### 5.7.4 Evaluation of potential solutions

TBD

## 5.8 Schema retrieval enhancements

### 5.8.1 Description

This enhancement proposes methods to support retrieval of schema files/modules.

### 5.8.2 Potential requirements

**REQ-Schema-retrieval -1:** The MnS Producer shall support advertising its supported schema files/modules.

**REQ-Schema-retrieval -2:** The schema advertisement shall support files/modules located at any location specified by the MnS Producer.

**REQ-Schema-retrieval -3:** The MnS Producer shall support retrieval of all files/modules.

**REQ-Schema-retrieval -4:** The MnS Producer shall support retrieval of specific schema files/modules.

### 5.8.3 Potential solutions

#### 5.8.3.1 Potential solution#1, Schema list at known location

This enhancement proposes methods to support advertisement and retrieval of schema files/modules using a model- based approach:

1. Add objects to define each available schema. E.g. *Schema* IOC with properties:
	1. Schema id (identifier, e.g. file/module name).
	2. Schema version (based on versioning information in the file/module).
	3. Schema format (Enum: yang, yaml).
	4. Schema namespace (URI).
	5. Schema location (file URI).
	6. Supported feature list (if applicable).
	7. Indicator of "implemented" vs. "imported" (if applicable).
2. Advertisement of supported schema:
	1. Define a specific location from which the list of supported schema is available. Similar to the ../schemas/.. tree defined in [3], clause 2.1.3 this would be a predefined location from which any consumer can query the list.
	2. Each schema would be an entry in a 'list' of schema available at this location.
3. Schema retrieval:
	1. Consumer uses the information in the schema list entries to retrieve the schema file(s) of interest.
	2. The actual method to retrieve them (e.g. HTTP, sftp) is defined by the solution and indicated in the <protocol> portion of the schema location URI.

#### 5.8.3.2 Potential solution#2 Schema lists as capabilities

This enhancement is similar to #1, but instead of placing the schema at a known location the schema files would be added to the capabilities advertised by specific MnS and/or managed entities. I.e. the schema file details would be data in the capabilities, not individual MOIs per schema file.

#### 5.8.3.3 Potential solution#3 Solution set specific solutions

This enhancement proposes different methods based on solution set:

1. OpenAPI: predefine a resource end point from which the schema list can be queried. Define as a tree allowing single/multiple entries to be queried.
2. NETCONF: implement per RFC6022 or RFC8525

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| **8th Change** |

## 5.9 Schema reference enhancements

### 5.9.1 Description

The current ProvMnS.yaml contains all possible schema entries when only a subset may actually be supported by a particular management system. Additionally, a management system may require adjustment of the list of supported schema at runtime, e.g. when new NFs with different schema and/or versions are introduced.

In both cases above the current hard-coded ProvMnS which contains all possible entries despite their applicability, and which cannot be adjusted at runtime is not sufficient.

### 5.9.2 Potential requirements

**REQ-Schema-retrieval -1:** The MnS Producer shall support flexible extension of the required schema files.

### 5.9.3 Potential solutions

#### 5.9.3.1 Potential solution#1, Update ProvMnS OpenAPI definition to be more generic

This enhancement proposes replacing the current predefined schema references in ProvMns.yaml with an extensible mechanism allowing the ProvMnS to dynamically adjust to the required schema list at runtime.

Currently the ProvMnS.yaml includes the following specific list of schema entries:

    Resource:

      oneOf:

        - type: object

          properties:

            id:

              type: string

            objectClass:

              type: string

            objectInstance:

              $ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

            attributes:

              type: object

          additionalProperties:

            type: array

            items:

              type: object

          required:

            - id

        - anyOf:

            - $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/resources-genericNrm'

            - $ref: 'TS28541\_NrNrm.yaml#/components/schemas/resources-nrNrm'

            - $ref: 'TS28541\_5GcNrm.yaml#/components/schemas/resources-5gcNrm'

            - $ref: 'TS28541\_SliceNrm.yaml#/components/schemas/resources-sliceNrm'

            - $ref: 'TS28536\_CoslaNrm.yaml#/components/schemas/resources-coslaNrm'

            - $ref: 'TS28312\_IntentNrm.yaml#/components/schemas/resources-intentNrm'

            - $ref: 'TS28104\_MdaNrm.yaml#/components/schemas/resources-mdaNrm'

            - $ref: 'TS28105\_AiMlNrm.yaml#/components/schemas/resources AiMlNrm'

            - $ref: 'TS28538\_EdgeNrm.yaml#/components/schemas/resources-edgeNrm'

            - $ref: 'TS28317\_RanScNrm.yaml#/components/schemas/resources-RanScNrm'

Proposal is to update this to remove the references, and allow the ProvMnS to provide its list of supported schema (i.e. all supported schema as advertised/available for the MnS):

Resource:   # For a resource to be compliant with application/vnd.3gpp.object-tree-flat+json or application/vnd.3gpp.object-tree-hierarchical+json as per NRM definitions (28.541), See 32.158 $4.3.1, $ 6.1.4 for more info

         type: object

          properties:

            id:

              type: string

            objectClass:

              type: string

            objectInstance:

              $ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

            attributes:

              type: object

          additionalProperties:

            type: array

            items:

              type: object

#### 5.9.3.2 Potential solution#2, decouples the ProvMnS schema and supported feature schema

This enhancement proposes replacing the current predefined schema references in ProvMns.yaml with an extensible mechanism allowing the ProvMnS to dynamically adjust to the required schema list at runtime.

Currently the ProvMnS.yaml includes the following specific list of schema entries for Resource:

 Resource:

 oneOf:

 - type: object

 properties:

 id:

 type: string

 objectClass:

 type: string

 objectInstance:

 $ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

 attributes:

 type: object

 additionalProperties:

 type: array

 items:

 type: object

 required:

 - id

 - anyOf:

 - $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/resources-genericNrm'

 - $ref: 'TS28541\_NrNrm.yaml#/components/schemas/resources-nrNrm'

 - $ref: 'TS28541\_5GcNrm.yaml#/components/schemas/resources-5gcNrm'

 - $ref: 'TS28541\_SliceNrm.yaml#/components/schemas/resources-sliceNrm'

 - $ref: 'TS28536\_CoslaNrm.yaml#/components/schemas/resources-coslaNrm'

 - $ref: 'TS28312\_IntentNrm.yaml#/components/schemas/resources-intentNrm'

 - $ref: 'TS28104\_MdaNrm.yaml#/components/schemas/resources-mdaNrm'

 - $ref: 'TS28105\_AiMlNrm.yaml#/components/schemas/resources AiMlNrm'

 - $ref: 'TS28538\_EdgeNrm.yaml#/components/schemas/resources-edgeNrm'

 - $ref: 'TS28317\_RanScNrm.yaml#/components/schemas/resources-RanScNrm'

 - $ref: 'TS28623\_FileManagementNrm.yaml#/components/schemas/resources-fileMgmtNrm'

 - $ref: 'TS28623\_ManagementDataCollectionNrm.yaml#/components/schemas/resources-mgmtDataCollectionNrm'

 - $ref: 'TS28623\_MnSRegistryNrm.yaml#/components/schemas/resources-mnSRegistryNrm'

 - $ref: 'TS28623\_PmControlNrm.yaml#/components/schemas/resources-pmControlNrm'

 - $ref: 'TS28111\_FaultNrm.yaml#/components/schemas/resources-faultNrm'

 - $ref: 'TS28623\_QoEMeasurementCollectionNrm.yaml#/components/schemas/resources-qoEMeasuremetCollectionNrm'

 - $ref: 'TS28623\_SubscriptionControlNrm.yaml#/components/schemas/resources-subscriptionControlNrm'

 - $ref: 'TS28623\_ThresholdMonitorNrm.yaml#/components/schemas/resources-thresholdMonitorNrm'

 - $ref: 'TS28623\_TraceControlNrm.yaml#/components/schemas/resources-traceControlNrm'

 - $ref: 'TS28319\_MsacNrm.yaml#/components/schemas/resources-msacNrm'

 - $ref: 'TS28318\_DsoNrm.yaml#/components/schemas/resources-DSORecovery'

Proposal is to add a separate feature NRM schema and move all the schema references to the new separate feature NRM schema. A reference to the new separate feature NRM schema also needs to be added in the ProvMnS schema.

New feature NRM schema see below:

openapi: 3.0.1

info:

 title: NRM Feature

 version: 18.1.0

 description: >-

 OAS 3.0.1 definition of the features of NRM

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externalDocs:

 description: 3GPP TS 28.623; Generic NRM, NRM feature

 url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.623/

paths: {}

components:

 schemas:

#----- Definitions in TS 28.623 for TS 28.532 --------------------------#

 resources-feature:

 anyOf:

 - $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/resources-genericNrm'

 - $ref: 'TS28541\_NrNrm.yaml#/components/schemas/resources-nrNrm'

 - $ref: 'TS28541\_5GcNrm.yaml#/components/schemas/resources-5gcNrm'

 - $ref: 'TS28541\_SliceNrm.yaml#/components/schemas/resources-sliceNrm'

 - $ref: 'TS28536\_CoslaNrm.yaml#/components/schemas/resources-coslaNrm'

 - $ref: 'TS28312\_IntentNrm.yaml#/components/schemas/resources-intentNrm'

 - $ref: 'TS28104\_MdaNrm.yaml#/components/schemas/resources-mdaNrm'

 - $ref: 'TS28105\_AiMlNrm.yaml#/components/schemas/resources-AiMlNrm'

 - $ref: 'TS28538\_EdgeNrm.yaml#/components/schemas/resources-edgeNrm'

 - $ref: 'TS28317\_RanScNrm.yaml#/components/schemas/resources-RanScNrm'

 - $ref: 'TS28623\_FileManagementNrm.yaml#/components/schemas/resources-fileMgmtNrm'

 - $ref: 'TS28623\_ManagementDataCollectionNrm.yaml#/components/schemas/resources-mgmtDataCollectionNrm'

 - $ref: 'TS28623\_MnSRegistryNrm.yaml#/components/schemas/resources-mnSRegistryNrm'

 - $ref: 'TS28623\_PmControlNrm.yaml#/components/schemas/resources-pmControlNrm'

 - $ref: 'TS28111\_FaultNrm.yaml#/components/schemas/resources-faultNrm'

 - $ref: 'TS28623\_QoEMeasurementCollectionNrm.yaml#/components/schemas/resources-qoEMeasuremetCollectionNrm'

 - $ref: 'TS28623\_SubscriptionControlNrm.yaml#/components/schemas/resources-subscriptionControlNrm'

 - $ref: 'TS28623\_ThresholdMonitorNrm.yaml#/components/schemas/resources-thresholdMonitorNrm'

 - $ref: 'TS28623\_TraceControlNrm.yaml#/components/schemas/resources-traceControlNrm'

 - $ref: 'TS28319\_MsacNrm.yaml#/components/schemas/resources-msacNrm'

 - $ref: 'TS28318\_DsoNrm.yaml#/components'

#----- Definitions in TS 28.623 for TS 28.532 --------------------------#

Updated Resource schema in ProvMnS schema see below:

 Resource:

 oneOf:

 - type: object

 properties:

 id:

 type: string

 objectClass:

 type: string

 objectInstance:

 $ref: 'TS28623\_ComDefs.yaml#/components/schemas/Dn'

 attributes:

 type: object

 additionalProperties:

 type: array

 items:

 type: object

 - $ref: 'TS28623\_featureNrm.yaml#/components/schemas/resources-feature'

#### 5.9.4 Evaluation of potential solutions

Solution #1 is not recommended for the reason it introduces a missing connection between ProvMnS schema and supported feature schema.

Solution#2 is recommended which addresses above concern. This solution decouples the ProvMnS schema and supported feature schema without missing connection.

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| **9th Change** |

### 5.10.2 Potential requirements

**Table 5.10.2-1: Requirements**

|  |  |  |
| --- | --- | --- |
| **Requirement label** | **Description** | **Related use case(s)/Motivation** |
| REQ-MS-FMAL-1 | A producer should be able to provide a list of all the alarming-conditions it might raise an alarm for. |  |
| REQ-MS- FMAL-2 | Every alarming-condition should have a set of associated data that describes the alarming-condition. The information set includes at least: alarmType, probableCause, specificProblem | The information helps the user correctly handle an alarm. Additional information may be included for each alarming-condition |
| REQ-MS- FMAL-3 | It should be possible to filter alarm related notifications based on the alarming-condition. | Motivation: Management systems may not want to handle all alarming-conditions.  |

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| **10th Change** |

### 5.11.2 Potential solutions

The Table 5.11.2-1: Overview of MnS usage label for different types of management capabilities implemented by CRUD operations and an NRM fragment in 3GPP TS 28.533 [34] can be updated to illustrate the Overview of management capabilities and corresponding solution sets.

Editor's Note: the alignment with the ENUM value for attribute "mnSCapability" needs further discussion.

Table 5.11.2-1: Overview of management capabilities and corresponding solution sets

| Management Feature | Management Capability | MnS definition | Solution Sets |
| --- | --- | --- | --- |
| Provisioning  | NR Provisioning | CRUD operations/notifications (3GPP TS 28.532) + NR NRM fragment (3GPP TS 28.541) | RESTFUL |
| NETCONF/YANG |
| 5GC Provisioning | CRUD operations/notifications (TS 28.532) + 5GC NRM fragment (3GPP TS 28.541) | RESTFUL |
| NETCONF/YANG |
| Network Slicing Provisioning  | CRUD operations/notifications (3GPP TS 28.532) + Network Slicing NRM fragment (3GPP TS 28.541) | RESTFUL |
| NETCONF/YANG |
| Network Slice Provisioning MnS (3GPP TS 28.531) + Network Slice Subnet Provisioning MnS (3GPP TS 28.531) | RESTFUL |
| Edge Computing Provisioning | CRUD operations/notifications (3GPP TS 28.532) + Edge NRM fragment (3GPP TS 28.538 [40]) | RESTFUL |
| Performance Assurance  | Performance Metric Collection Control | CRUD operations/notifications (3GPP TS 28.532) + PM control NRM fragment (3GPP TS 28.622) | RESTFUL |
| NETCONF/YANG |
| CRUD operations/notifications (3GPP TS 28.532) + ManagementDataCollection control NRM fragment (3GPP TS 28.622 [23]) | RESTFUL |
| NETCONF/YANG |
| Performance measurement job control (3GPP TS 28.550) | RESTFUL |
| Performance Metric Data Report | Streaming data reporting service (3GPP TS 28.532) + Performance data stream units (TS 28.550) | RESTFUL+WebSocket+(GPB/ASN.1) |
| File data reporting service (3GPP TS 28.532) + Performance data file format (3GPP TS 28.532) | RESTFUL+( SFTP/FTPES/HTTPS)+XML |
| Performance Metric Threshold Monitor Control | CRUD operations/notifications (3GPP TS 28.532) + Threshold monitoring control NRM fragment (3GPP TS 28.622) | RESTFUL |
| NETCONF/YANG |
| Performance Metric Threshold Notification  | notifyThresholdCrossing notification (3GPP TS 28.532) | RESTFUL |
| Fault Management | Fault control  | CRUD operations/notifications (3GPP TS 28.532) + FM control NRM fragment (3GPP TS 28.111) | RESTFUL |
| NETCONF/YANG |
| Fault Notification  | Fault Notifications (3GPP TS 28.111) | RESTFUL(also used by NETCONF/YANG) |
| Trace&MDT | Trace/MDT data collection control | CRUD operations/notifications (3GPP TS 28.532) + Trace control NRM fragment (3GPP TS 28.622 [32]) | RESTFUL |
| NETCONF/YANG |
| CRUD operations/notifications (3GPP TS 28.532) + ManagementDataCollection control NRM fragment (3GPP TS 28.622 [23]) | RESTFUL |
| NETCONF/YANG |
| Trace/MDT data report | Streaming data reporting service (3GPP TS 28.532) + Trace/MDT stream date schema definition (3GPP TS 32.423) | RESTFUL+WebSocket+(GPB/ASN.1) |
| File data reporting service (3GPP TS 28.532) + Trace/MDT file date format definition (TS 32.423) | RESTFUL+( SFTP/FTPES/HTTPS)+XML |
| QoE  | QoE data collection control | CRUD operations/notifications (3GPP TS 28.532) + QoE Measurement Collection control NRM fragment (3GPP TS 28.622 [32]) | RESTFUL |
| NETCONF/YANG |
| QoE data report | File data reporting service (3GPP TS 28.532) + QoE data file format (3GPP TS 26.247) | RESTFUL+XML |
| File Management | File Retrieval | CRUD operations/notifications (3GPP TS 28.532) + File retrieval NRM fragment (3GPP TS 28.622 [32]) | RESTFUL |
| NETCONF/YANG |
| File Download | CRUD operations/notifications (3GPP TS 28.532) + File download NRM fragment (3GPP TS 28.622 [32]) | RESTFUL |
| NETCONF/YANG |
| Notification subscription and Heartbeat notification control | Subscription Control | CRUD operations/notifications (3GPP TS 28.532) + Notification subscription and heartbeat notification control NRM fragment (3GPP TS 28.622) | RESTFUL |
| NETCONF/YANG |
| Heartbeat Control | CRUD operations/notifications (3GPP TS 28.532) + Heartbeat notification control NRM fragment (3GPP TS 28.622) | RESTFUL |
| NETCONF/YANG |
| Heartbeat Notification | notifyHeartbeat notification (3GPP TS 28.532) | RESTFUL |
| MDAS | Management Data Analytic | CRUD operations/notifications (3GPP TS 28.532) + NRM fragment for MDA request and MDA report (3GPP TS 28.104) | RESTFUL |
| SON  | RANSC Management | CRUD operations/notifications (3GPP TS 28.532) + RANSC NRM Fragment 3GPP TS 28.317) | RESTFUL |
| SON policy | CRUD operations/notifications (3GPP TS 28.532) + NRM Fragment for DANR/DES/DRACH/DMRO/DPCI/CES/CPCI/DLMO/CCO Management | RESTFUL |
| NETCONF/YANG |
| Closed-loop SLS | Communication Service Assurance Control | CRUD operations/notifications (3GPP TS 28.532) + Assurance management NRM fragment (3GPP TS 28.536) | RESTFUL |
| Intent-driven | Intent Driven Management | CRUD operations/notifications (3GPP TS 28.532) + NRM fragment for intent driven management (3GPP TS 28.312) | RESTFUL |
| AI/ML  | ML model Management | NRM fragment for ML model training/testing/ inference emulation control/ ML model loading / inference (3GPP TS 28.105) | RESTFUL |
| MnS Registry and Discovery | MnS Registry and Discovery | CRUD operations/notifications (3GPP TS 28.532) + MnS Registry NRM fragment (TS 28.622) | RESTFUL |
| NETCONF/YANG |
| MSAC  | MnS Access Control | CRUD operations/notifications (3GPP TS 28.532) + Information model for role based access control (3GPP TS 28.319) | RESTFUL |
| NSOEU | DSO Rapid Recovery and Threshold Monitoring | CRUD operations/notifications (3GPP TS 28.532)+ DSO Rapid Recovery NRM fragment (3GPP TS 28.318) + DSO Rapid Recovery NRM fragment(3GPP TS 28.318) | RESTFUL |

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| **End of changes** |