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Contents

Foreword

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

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1 Scope

The present document defines design rules for REpresentational State Transfer (REST) Solution Sets (SS). These rules are applied when specifying REST Solution Sets.

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] IETF RFC 7231: "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content".

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

[4] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".

[5] IETF RFC 7230: "Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing".

[6] IETF RFC 7159: " The JavaScript Object Notation (JSON) Data Interchange Format".

[7] draft-wright-json-schema-01 (October 2017): "JSON Schema: A Media Type for Describing JSON Documents".
Editor's note: The above document cannot be formally referenced until it is published as an RFC.

[8] draft-wright-json-schema-validation-01 (October 2017: "JSON Schema Validation: A Vocabulary for Structural Validation of JSON".
Editor's note: The above document cannot be formally referenced until it is published as an RFC.

[9] draft-wright-json-schema-hyperschema-01 (October 2017): "JSON Hyper-Schema: A Vocabulary for Hypermedia Annotation of JSON.
Editor's note: The above document cannot be formally referenced until it is published as an RFC.

[10] OpenAPI Specification (https://github.com/OAI/OpenAPI-Specification)

[11] IETF RFC 5789: "PATCH Method for HTTP".

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

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

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

[15] XML Path Language (XPath) Version 1.0, W3C Recommendation 16 November 1999 (https://www.w3.org/TR/xpath-10/)

[16] 3GPP TR 32.160: "Management and orchestration; Management service template".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

CRUD	Create, Retrieve, Update, Delete
DC	Domain Component
DN	Distinguished Name
DNS	Domain Name Service
FQDN	Fully Qualified Doman Name
HTTP	Hypertext Transfer Protocol
JSON	JavaScript Object Notation
LDN	Local Distinguished Name
MnS	Management Service
REST	REpresentational State Transfer
RPC	Remote Procedure Call
TCP	Transmission Control Protocol
URI	Uniform Resource Identifier

4 General rules

4.1 Information models and resources

4.1.1 Information models

An information model is a representation of a system. Typical models do not reflect all facets of the system, but only certain aspects required to solve the management problem the model is designed for. 3GPP follows an object-oriented modelling approach. Models are built from managed object classes. Relationships between classes represent the logical connections. Models are specified formally with class diagrams of the Unified Modelling Language (UML).

The instantiation of a managed object is called managed object instance. All managed object instances together with the relationships between them are depicted in an object diagram.

4.1.2 Resources

HTTP uses a different terminology based on the notion of resources, as defined in clause 2 of RFC 7231 [2]. Each resource is represented by a resource representation as defined in clause 3 of RFC 7231 [2]. Valid resource representations are e.g. XML instance documents or JSON instance documents.

4.1.3 Resource archetypes

Resources can be classified according to their structure and behaviour into resource archetypes. This helps specifying clear and understandable interfaces. The following three archetypes are defined:

- **Document resource**: This is the standard resource containing data in form of name value pairs and links to related resources. This kind of resource typically represents a real-world object or a logical concept.

- **Collection resource**: A collection resource is grouping resources of the same kind. The resources below the collection resource are called items of the collection. An item of a collection is normally a document resource. Collection resources typically contain links to the items of the collection and information about the collection like the total number of items in the collection. Collection resources can be further distinguished into server-managed and client-managed resources. Collection resources are also known as container resources.

- **Operation resource**: Operation resources represent executable functions. They may have input and output parameters. Operation resources allow some sort of fall back to an RPC style design in case application specific actions cannot be mapped easily to CRUD style operations.

4.1.4 Mapping of information models to resources

RESTful SS shall be specified in a way that managed object instances are described by document resources. Collection resources have no equivalent in an information model unless some dedicated collection class is introduced.

4.2 Managed object naming and resource identification

4.2.1 Managed object naming

4.2.1.0 Distinguished Name (DN)

The Distinguished Name (DN) is used in 3GPP to uniquely identify a managed object instance within a specific name space. The DN is a comma (",") separated list of Relative Distinguished Names (RDNs). Each managed object instance has an associated RDN. The sequence of RDNs is governed by name containment relationships in the UML class diagram describing the modelled network. The RDN consists of a naming attribute name separated by an equal sign ("=") from the naming attribute value. The naming attribute name is equal to the class name of the MOI.

In addition to the RDNs associated to a managed object instance the DN may have as leftmost RDN whose naming attribute name is "DC" (Domain Component) and whose value is a domain name. A DN with DC is globally unique.

The DN concept is described in detail in TS 32.300 [3].The following example DN has a DC.

```
DN = "DC=operatorA.com,subNetwork=south,managedElement=a,eNBFunction=1,cell=1"
```


4.2.1.1 Global and local namespaces

A DN in the global name space is globally unique and starts with the RDN of the global root. A DN in a local name space starts with the RDN of the local root and is unique only within this name space. A DN in a local namespace is also referred to as Local Distinguished Name (LDN). The DN of the local root relative to the global root is called DN prefix. The concatenation of DN prefix and LDN is equal to the globally unique DN of a managed object.

The local root is typically the root of the network resource model representing the managed network.

4.2.2 Resource identification

HTTP uses a subset of the generic Uniform Resource Identifier (URI) scheme (RFC 3986 [4]) defined in RFC 7230 [5] for target resource identification.

```
http-URI = "http:" "//" authority path-abempty [ "?" query ] [ "#" fragment ]
```

The path component is an absolute path (one that starts with a single slash character) or empty.

The origin server is identified by the authority component, which includes a host identifier and an optional path TCP port. The hierarchical path component and optional query component serve as an identifier for a potential target resource within that origin server’s name space. The optional fragment component allows for indirect identification of a secondary resource.The host identifier is either an IP address or an indirect identifier such as a FQDN to be resolved with DNS.

URIs are used by HTTP for routing and addressing of target resources. They shall not be used for other purposes or as an alternative for DNs.

4.2.3 Mapping of DNs to URIs

URIs are globally unique. For this reason only a globally unique DN with DC is mappable into a URI. The mapping rules are as follow:

- The DN prefix is mapped semantically to the authority component of the URI. The syntax of the DN prefix is modified to match the syntax of the authority component.
- The LDN is mapped semantically to the path component of the URI. The syntax of the LDN is modified to match the syntax of the path component.

When mapping a LDN the equal sign "="shall be used as delineator between the naming attribute name and naming attribute value when constructing a RDN.

```
URI-RDN = {namingAttributeName} "=" {namingAttributeValue}
```

The URI-LDN is the concatenation of URI-RDNs separated by a slash "/".

```
URI-LDN = *( "/" RDN )
```

For example, the LDN

```
LDN = "subNetwork=south,managedElement=a,eNBFunction=1,cell=1"
```

maps to

```
URI-LDN = "/subNetwork=south/managedElement=a/eNBFunction=1/cell=1"
```

and the LDN

```
LDN = "managedElement=a,eNBFunction=1,cell=1"
```

to

```
URI-LDN = "/managedElement=a/eNBFunction=1/cell=1"
```

When constructing the authority part from the DN prefix, it shall be reformatted according to the name conventions applying to FQDNs. For example, the DN prefix

```
DN-prefix = "DC=operatorA.com"
```

maps to

```
URI-DN-prefix = "operatorA.com"
```

and the DN prefix

```
DN-prefix = "DC=operatorA.com,subNetwork=south"
```

to

```
URI-DN-prefix = "south.subNetwork.operatorA.com"
```

The complete URIs for the examples are

```
http://operatorA.com/subNetwork=south/managedElement=a/eNBFunction=1/cell=1
http://south.subNetwork.operatorA.com/managedElement=a/eNBFunction=1/cell=1
```

The constructed URI-DN-prefix is a FQDN that can be registered into a name resolution service such as DNS. The sole presence of a constructed FQDN does not mean it can be resolved to an IP address and there is a server listening at that address.

Using the mapping rulea, a DN is mapped predictably into the URI authority component and path component.

The leftmost part of the path component may include one or more path segments ("label")

```
http://operatorA.com/{label}/subNetwork=south/.../cell=1
```

allowing to structure the resource hierarchy, for example

http://operatorA.com/3GPPmanagemen/ProvMnS/v1500/subNetwork=south/.../cell=1

The character set allowed in DNs is much bigger than the character set allowed in the path component and authority component of a URI. Care needs to be taken when selecting the naming attribute names und values that the mapping from a DN to a URI does not become impossible as a consequence of not mappable characters.

4.3 Media types

The format of resource representations carried in the message body is indicated by the media type in the Content-Type and Accept header fields. Media types that shall be supported are:

- application/json (RFC 7159 [6]).

The following JSON patch documents for partial resource modifications may be supported:

- application/merge-patch+json (RFC 7396 [12]).
- application/json-patch+json (RFC 6902 [13]).

This specification defines two new media types for JSON patch documents:

- application/3gpp-merge-patch+json.
- application/3gpp-json-patch+json.

JSON documents shall conform to JSON Schema ([7], [8], [9]).

4.4 URI structure

URIs identifying resources representing managed object instances shall follow a common structure given by

```
http://{URI-DN-prefix}/{root}/{MnSName}/{MnSVersion}/{URI-LDN}
```

where:

{URI-DN-prefix}	indicates the authority part of the URI constructed from the DN prefix.
{root}	indicates an optional root for structuring the resource hierarchy.
{MnSName}	indicates the optional MnS name.
{MnSVersion}	indicates the optional version of the MnS.
{URI-LDN}	indicates the resource path constructed from the LDN.

As seen above, to construct the URI from a DN, it is necessary to map the "DNPrefixPlusRDNSeparator" as defined in clause 7.3 of [3], the “LocalDN” as defined in clause 7.3 of [3], and to add the additional path components "/{root}/{MnSName}/{MnSVersion}".

To allow for a predictive mapping from the URI to the original DN it is necessary to specify "/{MnSName}/{MnSVersion}" in such a way that the beginning of the "LocalDN" can be identified.

4.5 Response status codes

The response status codes as defined in section 6 of RFC 7231 [2] shall be supported.