

**Question(s):** Q7/2

Geneva, 4-13 July 2018

**CONTRIBUTION****Source:** Beijing University of Posts and Telecommunications**Title:** The proposal to create a new work item on “REST-based management services”**Purpose:** [Choose a purpose from the dropdown list]**Contact:** WANG Zhili  
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Email: zlwang@bupt.edu.cn**Keywords:** Distributed processing; (REST), managed objects, network management interfaces, JSON, JSON Schema.**Abstract:** This document defines a set of services required to support REST-based interfaces and along with draft contribution X.rest composes a framework for REST-based network management interfaces. It specifies protocol requirements, and defines some network management-specific support services. The REST/JSON interface definitions for the network management-specific support services are also provided.**1. Background**

REST technology is now broadly used in IT Industry. In some organization and fora, they have started the research work on how to apply REST technology in network management field as an alternative interface technology.

In another related contribution on “Guidelines for defining REST-based managed objects and management interfaces”, the background information, the overview of REST/HTTP solutions, and the benefit of introducing REST into the network domain have been explained.

The purpose of this document is trying to provide the supporting services using REST technology, in order to establish the framework for REST-based network management interface, so that in the future, specific REST-based interface definition can follow those guidelines, and reuse some common services.

**2. Framework overview**

This framework for REST-based management interfaces is a collection of capabilities. The framework defines the support services to be standards on network management interfaces conforming to this framework. The REST interfaces for these services will be defined in Annex A.

To support the software objects representing manageable resources, the framework requires that they implement some common basic capabilities. Therefore, one base class (JSON-based) is defined in draft [ITU-T X.rest] for use in modelling network management resources. Managed object classes in information models must inherit and implement a basic set of capabilities from the base class in order to operate within this framework. Finally, some rules and conventions are defined for

information modellers developing models for use with this framework. These consist of modelling guidelines and JSON style idioms. All of these are depicted graphically in Figure 1.

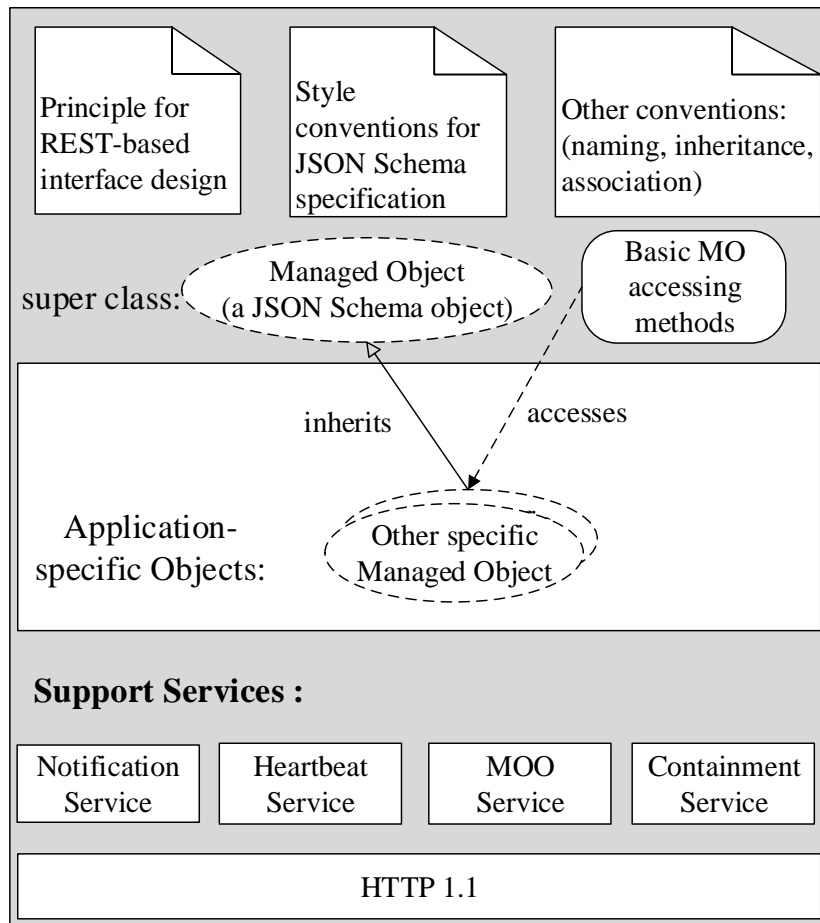


Figure 1 Framework overview.

Figure 1 shows the framework in grey. In the middle are the application-specific objects that are supported by the framework. Along the bottom is a box representing the communication protocol: HTTP. Above that are a number of boxes with names in them representing the services that compose the framework. Along the top of the figure are icons representing the super class managed object, and the basic MO accessing methods. Each managed object supported by this framework must ultimately inherit from the super class. Also shown on Figure 1 are icons of pages with up-turned corners representing standard object modelling conventions.

The framework services, represented as boxes with square corners, are defined in this draft Recommendation. The super class, object modelling conventions and other conversions are defined in draft [ITU-T X.rest].

### 3. Management services to be provided in the REST-based management interfaces

The following services are to be addressed in future version of this document.

#### 3.1 Notification Service

REST-base notification service provides a standard approach for notification consumers and providers to transfer notification information using a topic-based publish/subscribe pattern. The contents of notification service include standard message exchanges to be implemented by

notification providers, operational requirements expected of service providers and requesters that participate in notifications, and an JSON model that describes topics.

The REST-based notification service supports the asynchronous exchange of event messages between clients using a subscribe-and-publish paradigm. It may also support the filtering of notifications which are also needed in network management interfaces.

### **3.2 Heartbeat service**

The heartbeat service is used to verify the operation of the notification forwarding mechanism in a managed system, as well as the communications network between the managed system and managing system.

It periodically sends a small notification to a managing system interested in receiving it and that notification identifies the system that emitted the heartbeat. After configuring this service a managing system can ensure the notification service is functioning. Since these notifications flow through the same software and networks as notifications from other resources, they periodically verify the operation of these resources.

### **3.3 Multiple Object operation service**

The multiple object operation (MOO) service provides a set of generic capabilities that may be invoked on any kinds of sets of managed objects (of any kind). The operations supported are listed below.

- Scoped get: Returns the values from each of the objects for a list of attributes.
- Scoped update: Used to replace an attribute value or to add or remove values to/from set-valued attributes. May be used to update one or multiple attributes in a single object or multiple objects.
- Scoped delete: Deletes multiple objects.

A basic service only needs to implement the scoped get operation. The other two operations are optional.

### **3.4 Containment service**

In the network management field a function is needed to be able to report which objects are contained by a superior object, to verify that a superior object exists before a subordinate is created, to make sure two objects with the same name are not created, etc. The framework will be extended to support this function by adding a new service, the containment service.

The main function to be supported by the containment service is to enable a managing system to query a managed system with the name of an object, and receive back the names of the objects contained by that object. In addition, a means of getting names added to and removed from the service will be defined. These are not for use by managing systems but internally by managed objects, factories, and other parts of a managed system. They are provided to promote the development of reusable components, possibly by third parties, and are defined on an interface separate from that used by managing systems.

#### **4. Proposal**

It is proposed to start a new work item on “Guidelines for defining REST-based managed objects and management interfaces”.

The intended draft content for this work item may include the following aspects:

- 1) Framework overview and protocol requirements
- 2) The definitions of REST-based notification service interface and notification format.
- 3) The interface definitions of REST-based heartbeat service
- 4) The interface definitions of REST-based multiple objects operation service
- 5) The interface definitions of REST-based containment service
- 6) Compliance and conformance

The outline text for the first draft can be found below :

## Baseline text for “REST-based management services”

### 1 Scope

The network management architecture defined in [ITU-T M.3010] introduces the use of multiple management protocols. So far, the GDMO/CMIP, CORBA GIOP/IIOP, SMI/SNMP, Web Service/SOAP are possible choices at the application layer. Based on the management interface specification methodology defined in [ITU-T M.3020], more technology-based paradigms can be introduced into network management interfaces, and REST/SOAP is now an additional paradigm for network management.

This draft document, together with draft [ITU-T X.rest] sets out to define a framework for defining how interfaces supported by management systems and network elements should be modelled using REST/JSON schema. It is within the scope of this Recommendation to provide the following guidelines or instructions:

- protocol requirements for using REST in network management;
- how a REST-based notification service is used in network management interfaces;
- how to monitor the availability of a REST notification forwarding mechanism;
- how to access multiple managed objects in one operation;
- how to access the containment information through a REST containment service;
- compliance and conformance requirements.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T M.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network*.
- [ITU-T M.3020] Recommendation ITU-T M.3020 (2011), *Management interface specification methodology*.
- [RFC 4230] IETF RFC 7230: *Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing*.
- [RFC 7231] IETF RFC 7231: *Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content*.
- [RFC 3986] IETF RFC 3986: *Uniform Resource Identifier (URI): Generic Syntax*.
- [RFC 7232] IETF RFC 7232, *Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests*.
- [RFC 5789] IETF RFC 5789, *PATCH Method for HTTP*.
- [RFC 6902] IETF RFC 6902, *JavaScript Object Notation (JSON) Patch*.
- [RFC 6901] IETF RFC 6901, *JavaScript Object Notation (JSON) Pointer*.

Editors's Note: to be extended.

### 3 Definitions

#### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

Editors's Note: to be extended.

#### 3.2 Terms defined in this Recommendation

This Recommendation does not define any new terms.

Editors's Note: to be extended.

### 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

HTTP	Hyper Text Transfer Protocol
JSON	JavaScript Object Notation
REST	REpresentational State Transfer
SOAP	Simple Object Access Protocol
TMN	Telecommunications Management Network
XML	extensible Markup Language
XSD	XML Schema Definition

Editors's Note: to be extended.

### 5 Conventions

A few conventions are followed in this Recommendation to make the reader aware of the purpose of the text. While most of the Recommendation is normative, paragraphs succinctly stating mandatory requirements to be met by a management system (managing and/or managed) are preceded by a boldface "R" enclosed in parentheses, followed by a short name indicating the subject of the requirement, and a number. For example:

**(R) EXAMPLE-1** An example mandatory requirement.

Requirements that may be optionally implemented by a management system are preceded by an "O" instead of an "R". For example:

**(O) EXAMPLE-2** An example optional requirement.

The requirement statements are used to create compliance and conformance profiles.

Examples of JSON are included in this Recommendation and normative JASON schema specifying the data types, base classes and other modelling constructs of the framework are included in Annex A. The JSON are written in a 10 point courier typeface:

```
{  
  "title": "root",  
  "items": {  
    "title": "array item"  
  }  
}
```

## **6 REST-based network management services goal and requirements**

### **6.1 Goals**

### **6.2 Information modelling dependencies**

### **6.3 Scoping**

### **6.4 Notifications**

## **7 Framework overview and protocol requirements**

### **7.1 Framework overview**

### **7.2 Protocol, languages and services requirements**

## **8 REST-based notification service and notification format**

## **9 REST-based heartbeat service**

## **10 REST-based multiple objects operation service**

## **11 REST-based containment service**

## **12 Compliance and conformance**

### **12.1 System conformance points**

### **12.2 Basic conformance profile**

## **REST/JSON Scheme definition of framework support services**

(This annex forms an integral part of this Recommendation.)

- A.1 REST-based notification service interface and JSON schema definition**
  - A.2 REST-based heartbeat service interface and JSON schema definition**
  - A.3 REST-based MOO service interface and JSON schema definition**
  - A.4 REST-based containment service interface and JSON schema definition**
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### A.1 justification for proposed draft new Recommendation X.xxx

<b>Question:</b>	7/2	<b>Proposed new ITU-T Recommendation</b>	July, 2018
<b>Reference and title:</b>	Recommendation ITU-T Q.rest: "REST-based management services"		
<b>Base text:</b>		<b>Timing:</b>	2019
<b>Editor(s):</b>		<b>Approval process:</b>	AAP
<p><b>Scope</b> (defines the intent or object of the Recommendation and the aspects covered, thereby indicating the limits of its applicability):</p> <p>The network management architecture defined in [ITU-T M.3010] introduces the use of multiple management protocols. So far, the GDMO/CMIP, CORBA GIOP/IOP, SMI/SNMP, Web Service/SOAP are possible choices at the application layer. Based on the management interface specification methodology defined in [ITU-T M.3020], more technology-based paradigms can be introduced into network management interfaces, and REST/SOAP is now an additional paradigm for network management.</p> <p>This draft document, together with draft [ITU-T X.rest] sets out to define a framework for defining how interfaces supported by management systems and network elements should be modelled using REST/JSON schema. It is within the scope of this Recommendation to provide the following guidelines or instructions:</p> <ul style="list-style-type: none"> <li>– protocol requirements for using REST in network management;</li> <li>– how a REST-based notification service is used in network management interfaces;</li> <li>– how to monitor the availability of a REST notification forwarding mechanism;</li> <li>– how to access multiple managed objects in one operation;</li> <li>– how to access the containment information through a REST containment service;</li> <li>– compliance and conformance requirements.</li> </ul>			
<p><b>Summary</b> (provides a brief overview of the purpose and contents of the Recommendation, thus permitting readers to judge its usefulness for their work):</p> <p>This document defines a set of services required to support REST-based interfaces and along with draft contribution X.rest composes a framework for REST-based network management interfaces. It specifies protocol requirements, and defines some network management-specific support services. The REST/JSON interface definitions for the network management-specific support services are also provided.</p>			
<p><b>Relations to ITU-T Recommendations or to other standards</b> (approved or under development):</p> <p>[ITU-T M.3020]: provides Management interface specification methodology. This draft Recommendation has this methodology as one of its basis.</p>			
<p><b>Liaisons with other study groups or with other standards bodies:</b></p> <p>3GPP SA5</p>			
<p><b>Supporting members that are committing to contributing actively to the work item:</b></p> <p>BUPT, ZTE, CATTSOft, Telnor</p>			