DICOM Change Proposal

STATUS	Assigned
Date of Last Update	2025-11-05
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Change Number CP-2584
Log Summary: Harmonize definitions and references for REST and RESTful
Name of Standard PS3.1, PS3.2, PS3.17, PS3.18
Rationale for Change: It was observed that currently, PS3.1 and PS3.2 use a slightly different definition of the terms “REST” and “RESTful” than PS3.18. Considering this raised the question of whether the concepts should be used at all. It is proposed to remove the distinction between “REST” and “RESTful” and delete normative references, since the DICOMweb services in PS3.18 are sufficiently explicitly described, clarify that the mention of the concept is nominal since what is in DICOM may not actually comply with the characteristics of REST architecture nor implement a RESTful web service literally (e.g., may not be stateless), and limit the use of the terminology except in the definition of QIDO-RS, STOW-RS, WADO-RS and to distinguish them from URI services. *[Open Issue. Should we use just REST, or RESTful, since in all cases it seems, we are referring to the web service and not the architecture.]* *[Open Issue. Is it necessary to consistently repeat “Representational State Transfer (REST) Web Service” with each invocation, or will “REST Web Service” suffice without a definition of REST?]* *[Open Issue. The primary concept re-used in DICOM -RS services seems to be the concept of a “resource” regardless of whether it is truly a REST architecture – can we re-frame the -RS terminology as being a “Resource-based Web Service” rather than a “Representational State Transfer (REST) Web Service”? Perhaps as distinction from being “action-based” web services, but that distinction may be invalid too, e.g., for UPS and storage commitment.]*
Change Wording:

Modify PS3.1 Chapters 4 and 7 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

4 Symbols and Abbreviations

…

QIDO-RS **Query based on ID for DICOM Objects by Representational State Transfer (REST) Web Services**

…

~~**REST** **Representational State Transfer**~~

~~**RESTful** **A RESTful Web service is a Web service implemented using REST architecture and HTTP (see http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf)**~~

…

STOW-RS STore Over the Web by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

…

WADO-RS Web Access to DICOM Objects by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

WADO-URI Web Access to DICOM Objects by URI **Web Service**

7 Referencing The DICOM Standard

…

Note

1. Some Media Storage Application Profiles and Web Services may fully specify the information objects exchanged, while others may require explicit specification of SOP Classes in the references.

2. Examples:

   - "The modality shall be conformant to the DICOM CT Image Storage and MR Image Storage SOP Classes for network exchange as a Service Class User, as specified in DICOM PS3.4: Service Class Specifications."

   - "The workstation shall be conformant to the DICOM STD-XA1K-DVD Media Storage Application Profile as a File Set Reader, as specified in DICOM PS3.11: Media Storage Application Profiles."

   - "The PACS shall be conformant to the DICOM WADO-RS**, QIDO-RS,** and STOW-RS Web Services as an Origin-server for the SOP Classes listed in Table X, as specified in DICOM PS3.18: Web Services."

3. …

Modify PS3.2 Chapter 4 as indicated

(changes to existing text are bold and underlined for additions and bold and struckthrough for removals):

4 Symbols and Abbreviations

…

QIDO-RS Query based on ID for DICOM Objects by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

~~**REST Representational State Transfer**~~

~~**RESTful A RESTful Web service is a Web service implemented using REST architecture and HTTP (see http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf**~~)

…

STOW-RS STore Over the Web by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

…

WADO-RS Web Access to DICOM Objects by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

WADO-URI Web Access to DICOM Objects by URI **Web Service**

…

Modify PS3.17 as indicated

HHH Transition from WADO to ~~RESTful~~ Representational State Transfer (REST) Web Services (Informative)

This annex discusses the design considerations that went into the definition of the WADO extension to Web and **Representational State Transfer** REST **Web S~~s~~**ervices.

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HHH.1.2.4 STOW-RS

The STOW-RS Service provides the ability to STore Over the Web using ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services (i.e., HTTP based functionality equivalent to C-Store).

…

HHH.4.2.2 Populating FHIR Resources

HL7 has introduced FHIR (Fast Healthcare Interoperability Resources) as a means of providing access to healthcare informatics information using ~~**RESTful**~~ web services.

While FHIR will not replicate the information contained in a PACS or other medical imaging storage system, it is desirable for FHIR to present a view of the medical imaging studies available for a particular patient along with the means of retrieving the imaging data using other ~~**RESTful**~~ services.

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HHH.7 Uses for Server Options Services

Clients would like to be able to discover a list of devices that support DICOM ~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervices and query a DICOM ~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervice to determine which options are supported, such as:

…

Modify PS3.18 as indicated

2 Normative References

2.3 Other References

…

[Fielding] *Architectural Styles and the Design of Network-based Software Architectures*. Fielding. 2000. http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf .

…

[Wikipedia REST] Wikipedia. . *Representational State Transfer*. http://en.wikipedia.org/wiki/~~Representational_state_transfer~~**REST**

3 Definitions

3.9 Web Services Definitions

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~~**RESTful Web Service** A web service is RESTful if it is implemented using the REST architecture and principles. See https://en.wikipedia.org/wiki/Representational_state_transfer.~~

…

4 Symbols and Abbreviated Terms

…

QIDO-RS Query based on ID for DICOM Objects by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

~~**REST Representational State Transfer, a web services architecture. See [Wikipedia REST] and [Fielding].**~~

~~**RESTful A service implemented using the REST architecture.**~~

…

STOW-RS STore Over the Web by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

…

UPS-RS Unified Procedure Step by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

…

WADO-RS Web Access to DICOM Objects by ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services

WADO-URI Web Access to DICOM Objects by URI **Web Service**

7 Overview of DICOM Web Services (Informative)

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7.1 DICOM Web Service Types

This Part of the Standard defines DICOM Web Services. Each service allows a user agent to interact with an origin server to manage a set of DICOM Resources. Each DICOM Web Service operates on a set of resources and defines a set of Transactions that operate on those resources. All Transactions are defined in terms of HTTP request/response message pairs.

When used in this Part of the Standard, the term HTTP refers to the family of HTTP protocols including: HTTP/1.1, HTTPS/1.1, HTTP/2, and HTTPS/2, as defined by the relevant IETF RFCs, but does not include HTTP/1.0 or HTTPS/1.0. The HTTP standards are normative for all aspects of HTTP message format and transmission.

There are two general types of DICOM Web Services: URI and RESTful. This distinction is based on the type of web service protocol used to specify resources and transactions.

7.1.1 URI Web Service

The URI Web Service retrieves representations of its resources, those resources being Composite SOP Instances (Instance). The URI service defines two transactions that retrieve Instances in different Media Types. All URI transactions use the query component of the URI in the request message to specify the transaction.

The functionality of the URI Web Service Transactions is similar to, but more limited than, the Retrieve Transaction of the Studies Web Service.

7.1.2 ~~RESTful~~ Representational State Transfer (REST) Web Services and Resources

Each ~~**RESTful**~~ **Representational State Transfer (REST)** Web Service defines the set of resources, and the transactions that can be applied to those resources.

> **Note. Though DICOM Representational State Transfer (REST) Web Services nominally follow the principles elucidated in Fielding's dissertation [Fielding] as widely implemented [Wikipedia REST], strict adherence to those concepts is not enforced.**

The defined ~~**RESTful**~~ **Representational State Transfer (REST)** Web Services are:

Studies Web Service Enables a user agent to manage Studies stored on an origin server.

Worklist Web Service Enables a user agent to manage the Worklist containing Workitems stored on an origin server.

Non-Patient Instance Web Service Enables a user agent to manage Non-Patient Instances, e.g., Color Palettes, stored on an origin server.

Storage Commitment Service The Storage Commitment Service enables a user agent to request the safekeeping of Instances on an origin server.

7.2 Resources, Representations, and Target URIs

In ~~**RESTful**~~ **Representational State Transfer (REST)** Web Services, a resource is an abstract object with a type, associated data, relationships to other resources, and a set of methods that operate on it. Resources are grouped into collections. Collections are themselves resources as well. Each collection is unordered and contains only one type of resource. Collections can exist globally, at the top level of an API, but can also be contained inside a resource. In the latter case, we refer to these collections as sub-collections. Sub-collections usually express some kind of "contained in" relationship.

7.2.1 DICOM Restful Resources

The DICOM Resources defined in this Part of the Standard are typically either a DICOM Web Services or DICOM Information Objects. Examples include Studies, Series, Instances, Worklists, and Workitems.

DICOM Resources are grouped into collections and hierarchies. The following resources are examples of collections:

Resource Path	Contents
/studies	A collection of Studies.
/series	A collection of Series.
/instance	A collection of Instances.
/frames	A sequence of Frames.

The following resources are examples of hierarchies:

/studies/{study}/series	Contains a collection of Series.
/studies/{study}/series/{series}/instances	Contains a collection of Instances.
/studies/{study}/series/{series}/instances/{instance}/frames	Contains a sequence of Frames.

A DICOM Web Service origin server manages a collection of resources. This might not be done directly; for example, an origin server could act as a proxy, converting ~~**RESTful**~~ **Representational State Transfer (REST) Web Service** requests into DIMSE requests, and DIMSE responses into ~~**RESTful**~~ **Representational State Transfer (REST) Web Service** responses.

Resources are typically created and/or accessed by user agents.

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8.7 Media Types

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The Media Type also specifies whether the payload contains a single representation (single part), or multiple representations (multipart). Multipart payloads are only defined for the ~~**RESTful API**~~**Representational State Transfer (REST) Web Service**s. See Section 8.6.1.2 and Section 10.4.3.

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8.7.1 Multipart Media Types

Some of the services defined in this Part of the Standard support the multipart Media Types [RFC2387]. The syntax is:

```
multipart-media-type = "multipart" "/" subtype *(OWS ";" OWS parameter)
```

The application/multipart-related Media Type is used by the ~~**RESTful**~~ **Representational State Transfer (REST) Web S**~~**s**~~services. Its syntax is:

…

8.7.3.2 Metadata Media Types

Table 8.7.3-3 specifies the Media Types that may be used to encode representations of Metadata for the URI and RESTful services. Only the ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services support Metadata representations.

Table 8.7.3-3. Media Types for Metadata

Media Type	Descriptions	URI	RESTful
application/dicom+xml	Encodes Instances as XML Infosets defined in the Native DICOM Model defined in PS3.19.	not applicable	required
application/dicom+json	Encodes Instances in the JSON format defined in Annex F.	not applicable	required

8.7.3.3 Bulkdata Media Types

Bulkdata representations are only supported by ~~**RESTful**~~ **Representational State Transfer (REST) Web S**~~**s**~~services. There are two categories of Bulkdata: uncompressed and compressed.

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8.7.3.3.1 Uncompressed Bulkdata Media Types

Table 8.7.3-4 specifies the default Media Type and Transfer Syntax UIDs, by Resource Category (see Table 8.7.2-1) that can be used with uncompressed Bulkdata for the ~~**RESTful**~~ **Representational State Transfer (REST) Web S**~~**s**~~services. Uncompressed Bulkdata is encoded as a stream of uncompressed bytes (octets) in Little Endian byte order.

Note

1. ...

Table 8.7.3-4. Transfer Syntax UIDs for Uncompressed Data in Bulkdata

Category	Media Type	Transfer Syntax UID	Transfer Syntax Name	RESTful
Single Frame Image	application/octet-stream	1.2.840.10008.1.2.1	Explicit VR Little Endian	D
		1.2.840.10008.1.2.1.98	Encapsulated Uncompressed Explicit VR Little Endian	O
…				

…

8.7.3.3.2 Compressed Bulkdata Media Types

Compressed Bulkdata contains only the compressed octet stream without the fragment delimiters.

Table 8.7.3-5 specifies the default and optional Media Types and Transfer Syntax UID combinations for each Resource Category (see Table 8.7.2-1) of compressed Bulkdata for the ~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervices.

Note

1. Some of the Transfer Syntax Names include text about Default Transfer Syntax, however this applies to its role in DIMSE transactions, rather than the default for ~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervices (which is specified in the RESTful column of the table).
2. ...

…

8.7.3.5.2 Transfer Syntax Parameter

For a given DICOM Media Type, a single Transfer Syntax parameter value may be specified, but its usage may be constrained by the service for which they are used.

~~**RESTful**~~ **Representational State Transfer (REST)** origin servers shall support the Transfer Syntax parameter.

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8.7.3.6 Transfer Syntax Query Parameter

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This Query Parameter is only used by the URI Service.

~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervices specify the Transfer Syntax in the "accept" Query Parameter (see Section 8.3.3.1) and do not use Transfer Syntax Query Parameter.

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8.7.4 Rendered Media Types

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Table 8.7.4-1. Rendered Media Types by Resource Category

Category	Media Type	URI	RESTful
Single Frame Image	image/jpeg	D	D
…			

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8.8 Character Sets

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The origin server shall support the "UTF-8" charset name for ~~**RESTful**~~ **Representational State Transfer (REST)** Retrieve Rendered transaction but is not required to support the DICOM Defined Term "ISO_IR 192". Some DICOM Defined Terms for character sets contain space characters, and shall be enclosed in double quotes in HTTP Header Fields and percent encoded in URIs.

The Conformance Statement shall document all supported character sets. The Retrieve Capabilities response for all ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services shall also document all supported character sets.

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8.9 Retrieve Capabilities Transaction

This transaction retrieves a Capabilities Description (see Annex H), which is a machine-readable description of the service(s) implemented by an origin server. All ~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervices defined by this Part of the Standard shall implement this transaction.

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8.10.1 Overview

Some ~~**RESTful**~~ **Representational State Transfer (REST) Web** Services support Notifications.

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8.10.4.1.1 Target Resources

The Target Resource is an origin server implementing a DICOM ~~**RESTful**~~ **Representational State Transfer (REST) Web** Service.

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9.1.2.2.1 Acceptable Media Types

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Note

URI origin servers may support Transfer Syntax and charset Query Parameters. This is different from the approach used by the DICOM ~~**RESTful**~~ **Representational State Transfer (REST) Web S~~s~~**ervices, which uses transfer-syntax and charset Media Type parameters.

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10 Studies Service and Resources

10.1 Overview

The Studies Resource enables a user agent to store, retrieve, update, and search an origin server for DICOM Studies, Series, and Instances, along with their /metadata, /rendered, and /thumbnail variants; as well as Frames and Bulkdata.

The Studies Service defines a Representational State Transfer (REST) Web Service that includes a set of transactions. The Retrieve transaction of this Service is also known as WADO-RS. The Store transaction of this Service is also known as STOW-RS. The Search transaction of this Service is also known as QIDO-RS. See Section 10.3.

…

11 Worklist Service and Resources

11.1 Overview

The Worklist Service, also known as UPS-RS, defines a ~~**RESTful interface**~~ **Representational State Transfer (REST) Web Service equivalent** to the Unified Procedure Step Service SOP Classes defined in Section B.26 “Unified Procedure Step IOD” in PS3.3 and Section CC “Unified Procedure Step Service and SOP Classes” in PS3.4, in which UPS behavior is specified.

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11.1.1.2 Web Services and DIMSE Terminology

Table 11.1.1-2. Correspondence between ~~RESTful~~ Representational State Transfer (REST) Web Service and DIMSE Terminology

~~RESTful~~ Term	DIMSE Term
Worklist	Worklist
…	

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F.1 Introduction to JavaScript Object Notation (JSON)

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The DICOM JSON Model complements the XML-based Native DICOM Model, by providing a lightweight representation of data returned by DICOM web services. While this representation can be used to encode any type of DICOM Data Set it is expected to be used by client applications, especially mobile clients, such as described in the QIDO-RS use cases (see Annex HHH "Transition from WADO to ~~RESTful~~ Representational State Transfer (REST) Web Services (Informative)" in PS3.17).

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H Capabilities Description

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The Capabilities Description resource follows directly and unambiguously from the ~~RESTful~~ Representational State Transfer (REST) Web Service resources defined in Section 10, Section 11, Section 12, Section 13, Section 14, and Section 15.