

# DICOM Correction Proposal

STATUS	Letter Ballot
Date of Last Update	2020/09/08
Person Assigned	Jonathan Whitby (jwhitby@vitalimages.com)
Submitter Name	Jim Philbin (james.philbin@jhmi.edu)
Submission Date	2016/03/15

Correction Number	CP1614
Log Summary: Add '/bulkdata' and /pixels sub-resources to Study Series and Instance	
Name of Standard PS3.18	
Rationale for Correction: <b>NOTE: This CP now depends on cp2040_Fix_DicomWeb_DICOM_Media_Types.</b> Enterprise imaging viewers commonly want to retrieve all the Bulkdata or all the Pixel Data (7FE0,0010) elements for a Study, Series or Instance. Additionally, enterprise imaging viewers want to retrieve Pixel Data in a Transfer Syntax that will not require the origin server to transcode before sending, Study-, Series- and Instance-level Bulkdata can currently be retrieved as DICOM resources but only with specific Accept header values as the default response is DICOM Part 10. To request Bulkdata (including Pixel Data) in any available Transfer Syntax, the request would be: <pre>Accept: multipart/related; type="application/octet-stream", multipart/related; type="image/*", multipart/related; type="video/*"</pre> There is no way to make a similar request solely for Pixel Data as the inclusion of "application/octet-stream" is needed in case of uncompressed Pixel Data and this will also retrieve non-pixel Bulkdata. This CP defines resources to support these use cases. In addition, the creation of these sub-resources means that all resource types can be retrieved using simple – or even just the default – Accept parameters.	
Correction Wording:	

*For reference unchanged PS3.18:*

## 8.7.3.3 DICOM Bulkdata Media Types

Bulkdata representations are only supported by RESTful services. There are two categories of Bulkdata: uncompressed and compressed.

The default media type for the Resource Category shall be returned when the origin server supports none of the Acceptable Media Types.

The origin server may support additional Transfer Syntaxes.

If no media type Transfer Syntax parameter is specified, then the Explicit VR Little Endian Transfer Syntax "1.2.840.10008.1.2.1" shall be used.

### Note

The tables in this section have no entries for the URI service, since they do not support separate retrieval of Bulkdata.

### 8.7.3.3.1 Uncompressed Bulkdata

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 services. Uncompressed Bulkdata is encoded as a stream of uncompressed bytes (octets) in Little Endian byte order.

Note

This is the same encoding defined in PS3.19 for the returned value of the getData() call for uncompressed Bulkdata.

**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
Multi-Frame Image	application/octet-stream	1.2.840.10008.1.2.1	Explicit VR Little Endian	D
Video	application/octet-stream	1.2.840.10008.1.2.1	Explicit VR Little Endian	D
Text	application/octet-stream	1.2.840.10008.1.2.1	Explicit VR Little Endian	D
Other	application/octet-stream	1.2.840.10008.1.2.1	Explicit VR Little Endian	D

Note

Even though the Transfer Syntax is Explicit VR Little Endian, the Value Representation is not actually encoded at the beginning of the octet-stream. The Value Representation is contained in the Metadata that references the Bulkdata.

### 8.7.3.3.2 Compressed Bulkdata

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 services.

Note

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 services (which is specified in the RESTful column of the table).

These media types can be used to retrieve Bulkdata, such as images or video, encoded in a specific Transfer Syntax.

**Table 8.7.3-5. Media Types and Transfer Syntax UIDs for Compressed Data in Bulkdata**

Category	Media Type	Transfer Syntax UID	Transfer Syntax Name	Optionality
Single Frame Image	image/jpeg	1.2.840.10008.1.2.4.70	JPEG Lossless, Non-Hierarchical, First-Order Prediction(Process 14 [Selection Value 1]) :Default Transfer Syntax for Lossless JPEG Image Compression	D
		1.2.840.10008.1.2.4.50	JPEG Baseline (Process 1) :Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression	O

Category	Media Type	Transfer Syntax UID	Transfer Syntax Name	Optionality
		1.2.840.10008.1.2.4.51	JPEG Extended (Process 2 & 4) :Default Transfer Syntax for Lossy JPEG 12 Bit Image Compression (Process 4 only)	O
		1.2.840.10008.1.2.4.57	JPEG Lossless, Non-Hierarchical (Process 14)	O
	image/dicom-rle	1.2.840.10008.1.2.5	RLE Lossless	D
	image/jls	1.2.840.10008.1.2.4.80	JPEG-LS Lossless Image Compression	D
		1.2.840.10008.1.2.4.81	JPEG-LS Lossy (Near-Lossless) Image Compression	O
	image/jp2	1.2.840.10008.1.2.4.90	JPEG 2000 Image Compression (Lossless Only)	D
		1.2.840.10008.1.2.4.91	JPEG 2000 Image Compression	O
	image/jpx	1.2.840.10008.1.2.4.92	JPEG 2000 Part 2 Multi-component Image Compression (Lossless Only)	D
		1.2.840.10008.1.2.4.93	JPEG 2000 Part 2 Multi-component Image Compression	O
	Multi-frame Image	image/jpeg	1.2.840.10008.1.2.4.70	JPEG Lossless, Non-Hierarchical, First-Order Prediction(Process 14 [Selection Value 1]) :Default Transfer Syntax for Lossless JPEG Image Compression
1.2.840.10008.1.2.4.50			JPEG Baseline (Process 1) :Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression	O
1.2.840.10008.1.2.4.51			JPEG Extended (Process 2 & 4) :Default Transfer Syntax for Lossy JPEG 12 Bit Image Compression (Process 4 only)	O
1.2.840.10008.1.2.4.57			JPEG Lossless, Non-Hierarchical (Process 14)	O
image/dicom-rle		1.2.840.10008.1.2.5	RLE Lossless	D
image/jls		1.2.840.10008.1.2.4.80	JPEG-LS Lossless Image Compression	D
		1.2.840.10008.1.2.4.81	JPEG-LS Lossy (Near-Lossless) Image Compression	O
image/jp2		1.2.840.10008.1.2.4.90	JPEG 2000 Image Compression (Lossless Only)	D
		1.2.840.10008.1.2.4.91	JPEG 2000 Image Compression	O

Category	Media Type	Transfer Syntax UID	Transfer Syntax Name	Optionality
	image/jpx	1.2.840.10008.1.2.4.92	JPEG 2000 Part 2 Multi-component Image Compression (Lossless Only)	D
		1.2.840.10008.1.2.4.93	JPEG 2000 Part 2 Multi-component Image Compression	O
Video	video/mpeg2	1.2.840.10008.1.2.4.100	MPEG2 Main Profile @ Main Level	O
		1.2.840.10008.1.2.4.101	MPEG2 Main Profile @ High Level	D
	video/mp4	1.2.840.10008.1.2.4.102	MPEG-4 AVC/H.264 High Profile / Level 4.1	D
		1.2.840.10008.1.2.4.103	MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	O
		1.2.840.10008.1.2.4.104	MPEG-4 AVC/H.264 High Profile / Level 4.2 For 2D Video	O
		1.2.840.10008.1.2.4.105	MPEG-4 AVC/H.264 High Profile / Level 4.2 For 3D Video	O
		1.2.840.10008.1.2.4.106	MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2	O
Text		N/A (no defined compression transfer syntaxes for Text)		
Other		N/A (no defined compression transfer syntaxes for Other)		

The origin server may support additional Transfer Syntaxes.

Note

1. For the media type image/jpeg Transfer Syntaxes, the image may or may not include the JFIF marker segment. The image may or may not include APP2 marker segments with an identifier of "ICC\_PROFILE". There is no requirement for the origin server to add a JFIF marker segment nor to copy the value of the ICC Profile (0028,2000) Attribute, if present, into APP2 marker segments in the compressed data stream. See Section 8.2.1 "JPEG Image Compression" in PS3.5.
2. For the media type image/jp2 and image/jpx Transfer Syntaxes, the image does not include the jp2 marker segment. See Section 8.2.4 "JPEG 2000 Image Compression" in PS3.5 and Section A.4.4 "JPEG 2000 Image Compression" in PS3.5
3. The resource on the origin server may have been encoded in the Deflated Explicit VR Little Endian (1.2.840.10008.1.2.1.99) Transfer Syntax. If so, the origin server may inflate it, and then convert it into an Acceptable Transfer Syntax. Alternatively, if the user agent allowed a Content-Encoding header field of 'deflate', then the deflated bytes may be transferred unaltered, but the Transfer Syntax parameter in the response should be the Explicit VR Little Endian Transfer Syntax.
4. Compressed multi-frame image Bulkdata is encoded as one frame per part. E.g., each frame of a JPEG 2000 multi-frame image will be encoded as a separate part with an image/jp2 media type, rather than as a single part with a video/mj2 ([RFC3745]) or uncompressed application/octet-stream media type.
5. Video Bulkdata is encoded as a single part containing all frames. E.g., all frames of an MPEG-4 video will be encoded as a single part with a video/mp4 ([RFC\_4337]) media type.

6. Many of the media types used for compressed Pixel Data transferred as Bulkdata values are also used for consumer format media types. A web browser may not be able to display the encoded data directly, even though some of the same media types are also used for encoding rendered Pixel Data. See Section 8.7.4.

For example, the media type for Bulkdata values of lossless 16-bit JPEG [ISO/IEC 10918-1] encoded Pixel Data is "image/jpeg", the same media type as might be used for 8-bit JPEG [ISO/IEC 10918-1] encoded Pixel Data, whether extracted as Bulkdata, or rendered. The Transfer Syntax parameter of the Content-Type header field is useful to signal the difference.

7. Each part of a multipart response is distinguished by the Content-Type and Content-Location header fields of the part.
8. Previously, experimental Media Types "image/x-dicom-rle" and "image/x-jls" were defined, so origin servers and user agents may want to account for these when communicating with older implementations. These have been replaced with the standard Media Types "image/dicom-rle" and "image/jls", respectively.

<i>Update PS3.18, Table 10.1.1 as follows:</i>
--

**Table 10.1-1. Resources and Descriptions**

<b>Resource</b>	<b>Description</b>
Studies Service	The Base URI of the Studies Service.
All Studies	The All Studies resource references the entire collection of Studies contained in the Studies Service.
Study	The Study resource references a single Study.
Study Metadata	The Study Metadata resource references the Metadata of a <b>single</b> Study.
<b>Study Bulkdata</b>	<b>The Study Bulkdata resource references the Bulkdata of a Study.</b>
<b>Study Pixel Data</b>	<b>The Study Pixel Data resource references the Pixel Data of a Study.</b>
Rendered Study	The Study Rendered resource references a Study to be rendered.
Study's Series	The Study's Series resource references the collection of all Series contained in a Study.
Study's Instances	The Study's Instances resource references the collection of all Instances in a single Study.
All Series	The All Series resource references the collection of all Series in all Studies contained in the Studies Service.
Series	The Series resource references a single Series.
Series Metadata	The Series Metadata resource contains the Metadata of a <b>single</b> Series in a Study.
<b>Series Bulkdata</b>	<b>The Series Bulkdata resource contains the Bulkdata of a Series.</b>
<b>Series Pixel Data</b>	<b>The Series Pixel Data resource references the Pixel Data of a Series.</b>
Rendered Series	The Series Rendered resource references a Series to be rendered.
Series' Instances	The Series' Instances resource references the collection of all Instances in a single Series.
All Instances	The All Instances resource references the collection of all Instances in all Series in all Studies contained in the Studies Service.
Instance	The Instance resource references a single Instance.
Instance Metadata	The Instance Metadata resource contains the Metadata of a <b>single</b> Instance.
<b>Instance Bulkdata</b>	<b>The Instance Bulkdata resource contains the Bulkdata of an Instance.</b>
<b>Instance Pixel Data</b>	<b>The Instance Pixel Data resource references the Pixel Data of an Instance.</b>
Rendered Instance	The Rendered Instance resource references an Instance to be rendered.
Frames	The Frames resource references an ordered collection of frames in a single multi-frame Instance.
Rendered Frames	The Rendered Frames resource references an ordered collection of frames of a single multi-frame Instance, to be rendered.
Bulkdata	The Bulkdata resource contains <b>one or more a</b> Bulkdata Values.

**Note**

**There is no Frame Bulkdata or Frame Pixel Data resource because they would be equivalent to the Frames resource.**

Update PS3.18 Table 10.3-2 as follows:

**Table 10.3-2. Resources by Transaction**

Resource	Retrieve	Store	Search
Studies Service			
All Studies		M	M
Study	M	M	M
Study Metadata	M		
Study Bulkdata	<b>MO</b>		
<b>Study Pixel Data</b>	<b>O</b>		
Rendered Study	M		
Study Thumbnail	O		
Study's Series			M
Study's Instances			M
All Series			M
Series	M		M
Series Metadata	M		
Series Bulkdata	<b>MO</b>		
<b>Series Pixel Data</b>	<b>O</b>		
Series' Instances			M
Rendered Series	M		
Series Thumbnail	O		
All Instances			M
Instance	M		M
Instance Metadata	M		
Instance Bulkdata	<b>MO</b>		
<b>Instance Pixel Data</b>	<b>O</b>		
Rendered Instance	M		
Instance Thumbnail	O		
Frames	M		
Rendered Frames	M		
Frame Thumbnail	O		
Bulkdata	M	M	

For reference unchanged PS3.18 Section 10.4.1.1

## 10.4.1.1 Target Resources

### 10.4.1.1.1 DICOM Resources

Table 10.4.1-1 defines the DICOM resources that may be retrieved.

**Table 10.4.1-1. Retrieve Transaction DICOM Resources**

Resource	URI Template
Study	/studies/{study}
Series	/studies/{study}/series/{series}
Instance	/studies/{study}/series/{series}/instances/{instance}

Resource	URI Template
Frames	/studies/{study}/series/{series}/instances/{instance}/frames/{frames}
Bulkdata	/bulkdata

#### 10.4.1.1.2 Metadata Resources

Table 10.4.1-2 defines the resources used to retrieve the metadata contained in Instances.

**Table 10.4.1-2. Retrieve Transaction Metadata Resources**

Resource	URI Template
Study Metadata	/studies/{study}/metadata
Series Metadata	/studies/{study}/series/{series}/metadata
Instance Metadata	/studies/{study}/series/{series}/instances/{instance}/metadata

The Metadata Resources are used to retrieve the DICOM instances without retrieving Bulkdata. The Metadata returned for a study, series, or instance resource includes all Attributes in the resource. For Data Elements having a Value Representation (VR) of DS, FL, FD, IS, LT, OB, OD, OF, OL, OW, SL, SS, ST, UC, UL, UN, US, and UT, the origin server is permitted to replace the Value Field of the Data Element with a Bulkdata URI. The user agent can use the Bulkdata URI to retrieve the Bulkdata.

#### 10.4.1.1.3 Rendered Resources

A Retrieve Transaction on a Rendered Resource will return a response that contains representations of a DICOM Resource rendered as appropriate images, videos, text documents, or other representations. Its primary use case is to provide user agents with a simple means to display medical images and related documents, without requiring deep knowledge of DICOM data structures and encodings.

A Rendered Resource contains one or more rendered representations, i.e., in a Rendered Media type, of its parent DICOM Resource. Table 10.4.1-3 shows the Rendered Resources supported by the Retrieve transaction along with their associated URI templates.

**Table 10.4.1-3. Retrieve Transaction Rendered Resources**

Resource	URI Template
Rendered Study	/studies/{study}/rendered
Rendered Series	/studies/{study}/series/{series}/rendered
Rendered Instance	/studies/{study}/series/{series}/instances/{instance}/rendered
Rendered Frames	/studies/{study}/series/{series}/instances/{instance}/frames/{frames}/rendered

The origin server shall be able to render all valid Instances of the Composite SOP classes for which conformance is claimed, e.g., origin server shall be able to render all Photometric Interpretations that are defined in the IOD for that SOP class.

The content type of the response payload shall be a Rendered Media Type. See Section 8.7.4.

#### 10.4.1.1.4 Thumbnail Resources

A Retrieve Transaction on a Thumbnail resource will return a response that contains a rendered representation of its parent DICOM Resource.

Table 10.4.1-4 shows the Thumbnail resources supported by the Retrieve transaction along with their associated URI templates.

**Table 10.4.1-4. Retrieve Transaction Thumbnail Resources**

Resource	URI Template
Study Thumbnail	/studies/{study}/thumbnail
Series Thumbnail	/studies/{study}/series/{series}/thumbnail
Instance Thumbnail	/studies/{study}/series/{series}/instances/{instance}/thumbnail
Frame Thumbnail	/studies/{study}/series/{series}/instances/{instance}/frames/{frames}/thumbnail

The representation returned in the response to a Retrieve Thumbnail resource request shall be in a Rendered Media Type. The Thumbnail shall not contain any Patient Identifying Information. Only a single image shall be returned.

If the origin server supports any of the Thumbnail resources, it shall support all of them.

The origin server will determine what constitutes a meaningful representation.

The origin server may return a redirection response (HTTP status code 302) to a rendered resource instead of returning a rendered image.

There is no requirement that Thumbnail resources be related to any Icon Image Sequence (0088,0200) encoded in Instances or returned in query responses.

Insert the following after PS3.18 Section 10.4.1.1.4

#### 10.4.1.1.5 Bulkdata Resources

Table 10.4.1-5 defines the Bulkdata resources that may be retrieved.

**Table 10.4.1-5. Retrieve Bulkdata Resources**

Target Resource	URI Template
Study Bulkdata	/studies/{study}/bulkdata
Series Bulkdata	/studies/{study}/series/{series}/bulkdata
Instance Bulkdata	/studies/{study}/series/{series}/instances/{instance}/bulkdata

The origin server shall return all the Bulkdata of the resource.

The content type of the response payload shall be application/octet-stream media type.

Bulkdata in a multipart response shall have a Content-Location header field that corresponds to the URL contained in the corresponding Element in the Metadata.

#### 10.4.1.1.6 Pixel Data Resources

Table 10.4.1-6 defines the Pixel Data resources that may be retrieved.

**Table 10.4.1-6. Retrieve Pixel Data Resources**



Target Resource	URI Template
Study Pixel Data	/studies/{study}/pixeldata
Series Pixel Data	/studies/{study}/series/{series}/pixeldata
Instance Pixel Data	/studies/{study}/series/{series}/instances/{instance}/pixeldata

The origin server shall return all the Pixel Data of the resource. The Pixel Data is the content of the Pixel Data, Float Pixel Data or Double Float Pixel Data Element in the top level Data Set, as defined in PS3.5.

Note: This does not include Pixel Data nested within an Icon Image Sequence or a private Data Element.

The content type of the response payload shall be application/octet-stream media type.

Pixel Data in a multipart response shall have a Content-Location header field that corresponds to the URL contained in the corresponding Element in the Metadata.

Update PS3.18 Section 10.4.3.3:

### 10.4.3.3 Response Payload

A success response shall have a payload containing one or more representations of the Target Resource in an Acceptable Media Type. The payload may be single part or multipart depending on the media type.

A failure response payload should contain a Status Report describing any failures, warnings, or other useful information.

Table 10.4.3-3 shows the media type category for each resource type. The origin server shall support the default and required media types in the media type category specified.

**Table 10.4.3-3. Resource Media Types**

Resource	Section	Media Type Category
DICOM Resources	Section 10.4.1.1.1	DICOM Media Types
Metadata Resources	Section 10.4.1.1.2	DICOM Media Types
Rendered Resources	Section 10.4.1.1.3	Rendered Media Types
Thumbnail Resources	Section 10.4.1.1.4	Rendered Media Types
Bulkdata Resources	Section 10.4.1.1.5	DICOM Bulkdata Media Types
Pixel Data Resources	Section 10.4.1.1.6	DICOM Pixel Data Media Types

DICOM Media Types are described in Section 8.7.3. Rendered Media Types are described in Section 8.7.4. **DICOM Bulkdata Media Types are described in Section 8.7.3.3.**

### 10.4.4 Media Types

The origin server shall support the media types specified as default or required in Table 10.4.4-1.

**Table 10.4.4-1. Default, Required, and Optional Media Types**

<b>Media Type Category</b>	<b>Media Type</b>	<b>Usage</b>	<b>Section</b>
<b>DICOM Media Types</b>	multipart/related; type="application/dicom"	Required	Section 8.7.3.1
	application/dicom+json	Default	Section 8.7.3.2
	multipart/related; type="application/dicom+xml"	Required	Section 8.7.3.2
	multipart/related; type="application/octet-stream"	Required	Section 8.7.3.3.1
	DICOM Multipart Compressed Pixel Data Media Types	Optional	Section 8.7.3.5.4
<b>Rendered Media Types</b>	Rendered Media Types	Optional	Section 8.7.4
	Rendered Media Types	Optional	Section 8.7.4
<b>DICOM Bulk Data Media Types</b>	<u>multipart/related; type="application/octet-stream"</u>	<u>Required</u>	<u>Section 8.7.3.3.1</u>
	<u>DICOM Multipart Compressed Pixel Data Media Types</u>	<u>Optional</u>	<u>Section 8.7.3.5.4</u>
<b>DICOM Pixel Data Media Types</b>	<u>multipart/related; type="application/octet-stream"</u>	<u>Required</u>	<u>Section 8.7.3.3.1</u>
	<u>DICOM Multipart Compressed Pixel Data Media Types</u>	<u>Optional</u>	<u>Section 8.7.3.5.4</u>

The origin server shall support the Transfer Syntax and Character Set media type parameters. See Section 8.7.3.5.2 and Section 8.7.3.5.3.