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## **Digital Imaging and Communications in Medicine (DICOM)**

*Supplement 203: Thumbnail Resources for DICOMweb*

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### **DICOM Standards Committee, Working Group 27: Web Technologies**

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VERSION: Letter Ballot

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<i>Editorial content – to be removed before Final Text</i>
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## Closed Issues

#	Closed Issues
1	What is the value of offering a Thumbnail resource at the instance level? <b>Answer:</b> If it is a multi-framed instance, the origin server can return the preferred frame. It is also useful to have Thumbnails for a single frame for display in viewers.
2	Is it a completely different service? <b>Answer:</b> No, it is a sub-resource. However, the origin server may decide to either return a representation, or specify a 302 redirect to a specific rendered URL.
3	Can you use the same query parameters on the Thumbnail resource that you can use on the instance? <b>Answer:</b> Not exactly. Parameter usage is shared with the rendered retrieve, but some are not applicable for a Thumbnail retrieve (such as window/level).
4	Does /thumbnail return an un-rendered instance? <b>Answer:</b> No, /thumbnail always returns a rendered representation.
5	Should a Thumbnail transaction be completely different from other defined transactions? <b>Answer:</b> No, it is like the rendered retrieve transaction.
6	Can I ask a study for more than one Thumbnail, if I want more than 1 representative image? <b>Answer:</b> No. But you can ask for a Thumbnail for different series within the Study.
7	What media types are supported? <b>Answer:</b> The same media types as defined by the current Rendered Retrieve transaction. Note, the Thumbnail resource is required to support image/jpeg for all resource categories.
8	Can you request a GIF Thumbnail animation of the whole series? <b>Answer:</b> No. You can request a GIF but it is undefined whether the returned GIF will be animated or not. The server might not support GIFs at all.
9	Can you request a text media type for an image resource? <b>Answer:</b> Yes, but the server might not support text at all.
10	Should the URL be /studies/{1.2.3}/rendered/thumbnail (because it is rendered?) <b>Answer:</b> No. It should be /studies/{1.2.3}/thumbnail
11	Should the user agent optionally provide a parameter to indicate intent of use? (e.g., use a Thumbnail of the modality, use an actual image, etc.) e.g. a keyword for document or image viewer. <b>Answer:</b> No. Trying to enumerate the different intents of use, and define appropriate behaviors for each is beyond the scope of this supplement.
12	Is the retrieve Thumbnail transaction valuable enough in its own right that it can be provided by an origin server without supporting any of the other RS transactions? The reason for asking this is that currently if you support rendering you must support retrieve DICOM. <b>Answer:</b> Yes, an origin server can implement Retrieve for Thumbnails only.
13	Can the origin server choose not to return certain sizes? E.G., to prevent inappropriate usage, such as diagnostic reading? <b>Answer:</b> Yes. The server can return whatever size it wants.
14	Should the Worklist Service support Thumbnail resources? <b>Answer:</b> Out of scope.
15	What are the primary use cases: 1) embedding Thumbnails in documents or 2) providing Thumbnails to viewers. <b>Answer:</b> Both.
16	Can this be used to retrieve a patient image Thumbnail? <b>Answer:</b> No. Out of scope.
17	Does the Thumbnail need to be representative of the actual resource content? Is it representative of the actual patient's images, is it iconic, i.e. representative? Does it have to be a sub-sampling of the actual Instance? <b>Answer:</b> The origin server can return anything it wants.

18	Can I return the same icon for every study or for different series in a single study? <b>Answer:</b> The origin server can return anything it wants.
19	Can we define a default Thumbnail size if none is provided, should the origin server be able to send the size it prefers to support, so that the Thumbnail can be pre-rendered?  If you ask for a size should the server be able to send whatever it wants?  The client knows its graphics capabilities much better than the server does. The client could give no size and then resize it as necessary.  The resolution of the client's screen is unknown to the origin server.  There are pros and cons on both sides. Allowing the client to dictate to the server means that the server can't cache specific common sizes and may need to retrieve an entire image to create a Thumbnail. On the other hand, the client may not be able to generate the Thumbnail size it wants.  There is more to the size than the quality of the rendering, e.g. the actual size of the target display. Knowing the display characteristics of the client device will influence the rendering process. What about frequency specific rendering, etc.  <b>Answer:</b> The origin server can return anything it wants. However, an implementation must specify its behavior in its Conformance Statement and its response to the Retrieve Capabilities transaction.
20	Should the NPI Service have Thumbnail resources, e.g., for color palettes or Hanging or Defined Protocols? <b>Answer:</b> No. A CP could be done later if needed.
21	What happens if a Thumbnail is retrieved requesting a media type of application/dicom? <b>WG-06 leaning toward:</b> the server can do what it wants. <b>Answer:</b> Return a 406 Not Acceptable response.
22	How does the Thumbnail resource relate to Icon Image Sequence? E.G., does QIDO applied to a Study resource return a Thumbnail as a JPEG. <b>Answer:</b> The Icon Image Sequence is not related to the Thumbnail resource.
23	Should the name of this resource be "icon" or "thumbnail"? <b>Answer:</b> Thumbnail because the goal of this supplement is to encourage the origin server to return a <i>representative</i> image of the target resource.
24	Should a Study/Series/Instance creator be able to specify the Thumbnail representation, i.e. content, for each resource? <b>Answer:</b> No.

---- End of Editorial content – to be removed before Final Text ----

## 30 Scope and Field of Application of this Supplement

This supplement affects Part 18 of the DICOM standard; however, it is based on the re-documentation in Supplement 183. The reader should be familiar with Supplement 183, Section 11.4.

35 This supplement defines Thumbnail resources on the WADO-RS Study, Series, Instance, and Frame resources in the DICOM RESTful web services standard. These resources provide representative images that reflect the content of the parent resources. The origin server determines the pixel content of the Thumbnail.

The primary use cases are Thumbnails for:

1. image viewers, or
2. EMR/EHRs, e.g., as referenced from HL7 FHIR Imaging Study resources.

This resource allows a web client to retrieve a representative image without having to retrieve a full study structure.

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*Insert the following at the appropriate place in Section 3.7.*

### 3.7 DICOM Web Services

...

#### Thumbnail

45 A single frame image that is representative of the content of a DICOM Study, Series, Instance, or Frame. It is encoded in a Rendered Media Type. See Section 11.4.1.1.3.

...

Update Section 11 as follows:

## 50 11 RESTful Studies Service

The RS Studies Service defines a set of RESTful transactions that enable a user agent to store, retrieve, update, and search an origin server for DICOM Studies, Series, Instances, and Frames – along with their /rendered, **and** /metadata **and /thumbnail** variants.

### 11.1 Resources

55 The Studies Service manages a collection of DICOM Study resources. Each Study is organized in a hierarchy of sub-resources that correspond to the DICOM Information Model. See PS3.3, Section 7.

There are three top level resources:

- /studies references all studies managed by the service.
- /series references all Series managed by the service.
- /instances references all Instances managed by the service.

The following URI Template variables are used in resource definitions in this Section.

- {study} the Study UID of a Study managed by the Studies Service.
- {series} the Series UID of a Series contained within a Study resource.
- {instance} the SOP Instance UID of an Instance contained within a Series resource.
- {frames} a comma-separated list of frame numbers in ascending order contained within an Instance.
- {/bulkdata} An opaque URI that references a Bulkdata Value.

The Studies Service defines the following resources:

60 **Table 11.1-1. Resources, URI Templates and Descriptions**

Resource	URI Template and Description
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. All Studies Service resources begin with this resource.
Study	The Study resource references a single Study to be retrieved in a DICOM Media Type.
Study Metadata	The Study Metadata resource references the Metadata of a single Study.
Rendered Study	The Study Rendered resource references a Study to be rendered.
<b>Study Thumbnail</b>	<b>The Study Thumbnail resource references a thumbnail image of a Study.</b>
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 to be retrieved in a DICOM Media Type.

Series Metadata	The Series Metadata resource contains the Metadata of a single Series in a Study.
Rendered Series	The Series Rendered resource references a Series to be rendered.
<b>Series Thumbnail</b>	<b><u>The Series Thumbnail resource references a thumbnail image of a Series.</u></b>
Series' Instances	The Series' Instances resource references the collection of all Series in a single Study.
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 to be retrieved in a DICOM Media Type.
Instance Metadata	The Instance Metadata resource contains the Metadata of a single Instance in a Series.
Rendered Instance	The Instance Rendered resource references an Instance to be rendered.
<b>Instance Thumbnail</b>	<b><u>The Instance Thumbnail resource references a thumbnail image of an Instance.</u></b>
Frames	The Frames resource references an ordered collection of frames in a single multi-frame Instance.
Rendered Frames	The Frames resource references an ordered collection of frames in a single multi-frame Instance.
<b>Frame Thumbnail</b>	<b><u>The Frame Thumbnail resource references a thumbnail image for frames within an Instance.</u></b>
Bulkdata	The Bulkdata resource contains one or more Bulkdata Values.

Update Table 11.2-2 as follows:

**Table 11.2-2. Resources by Transaction**

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

Update Section 11.4.1.1 as follows:

#### 65 11.4.1.1 Resources

The retrieve transaction supports DICOM, **and** Rendered, **and Thumbnail** resources.

...

Insert the following as Section 11.4.1.1.3.

#### 11.4.1.1.3 Thumbnail Resources

70 A Thumbnail URI references a Thumbnail that is a representation of its parent DICOM resource.

Table 11.4.1-X shows the Thumbnail resources supported by the Retrieve transaction along with their associated URI templates. The URL of the Thumbnail resource is created by adding "/thumbnail" to the URL of the parent DICOM resource.

**Table 11.4.1-X. Retrieve Transaction Thumbnail Resources**

Target Resource	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

75 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.

80 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 the thumbnail resources be related to any Icon Image Sequence (0088,0200) encoded in SOP Instances or returned in query responses.

Insert the following as Section 11.4.1.2.4

#### 85 11.4.1.2.4 Thumbnail Query Parameters

Table 11.4.1-3 shows the Query Parameters that may be used when requesting a Thumbnail Resource.

**Table 11.4.1-3. Retrieve Thumbnail Query Parameters**

Key	Values	Target Resource	Section
accept	Rendered Media Type	All	11.6.1.2.1
viewport	vw, vh	All	11.6.1.2.5

90 The Viewport parameter only has width and height values. If no viewport parameter is provided the origin server will determine the size of the Thumbnail. The origin server may ignore the viewport parameter and return an image of any size.

Insert the following as Section 11.4.1.2.5

#### 11.4.1.2.4 Thumbnail Response Header Fields

Table 11.4.1-4 shows the Response Header Fields that may be included in the response to a Thumbnail request.

**Table 11.4.1-4. Retrieve Header Fields**

Name	Values	Usage
Content-Type	Rendered Media Type	M
Content-Location	URI of representation in payload	O

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Update Section 11.4.1.2.6.3 as follows:

#### 11.4.1.2.6.3 Viewport Scaling

The "viewport" parameter specifies a rectangular region of the source image(s) to be cropped, and a rectangular region corresponding to the size of the user agent's viewport to which the cropped image should be scaled.

100 See Section 7.5.4.3 for details of viewport scaling.

If the target resource is a Presentation State Instance **or Thumbnail**, the syntax for-this parameter is:

...

If any of the following are true:

- If this parameter specifies viewport dimensions that are either ill-defined or not supported
- 105 • If the target resource is a Presentation State **or Thumbnail** and there are not exactly two positive integer parameters.

...

*Update Section 11.4.5 as follows:*

### **11.4.5 Conformance**

110 An implementation of the Studies service, either user agent or origin server, shall support the Retrieve transaction and all DICOM resources.

It shall document in its Conformance Statement and in its Retrieve Capabilities response:

- the resources supported for this transaction,
- whether it plays the role of origin server or user agent, or both.

115 An implementation playing the role of origin server shall also document:

- DICOM, **and** Rendered, **and Thumbnail** Media Types supported
- Rendered PS – referenced SOP classes
- Character sets supported for DICOM resources (if other than UTF-8).
- Character sets supported for Rendered and Thumbnail resources (if other than UTF-8).
- 120 • **A description of the method used to render Thumbnails.**
- **The minimum and maximum sizes of the Thumbnail Viewport parameters, if supported.**