
5

10

Digital Imaging and Communications in Medicine (DICOM)

Supplement 203: Thumbnail Resources for DICOMweb

15

20

DICOM Standards Committee, Working Group 27: Web Technologies

1300 N. 17th Street Suite 900

Rosslyn, Virginia 22209 USA

VERSION: Public Comment

Developed in accordance with work item 2017-04-B.

25

<i>Editorial content – to be removed before Final Text</i>
--

Closed Issues

#	Closed Issues
1	What is the value of offering a Thumbnail resource at the instance level? Answer: 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? Answer: 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? Answer: 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? Answer: No, /thumbnail always returns a rendered representation.
5	Should a Thumbnail transaction be completely different from other defined transactions? Answer: 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? Answer: No. But you can ask for a Thumbnail for different series within the Study.
7	What media types are supported? Answer: 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? Answer: 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? Answer: 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?) Answer: 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. Answer: 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. Answer: 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? Answer: Yes. The server can return whatever size it wants.
14	Should the Worklist Service support Thumbnail resources? Answer: Out of scope.
15	What are the primary use cases: 1) embedding Thumbnails in documents or 2) providing Thumbnails to viewers. Answer: Both.
16	Can this be used to retrieve a patient image Thumbnail? Answer: No. Out of scope.

Open Issues

#	Open Issues	Status
1	<p>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? WG-27 Leaning toward: Yes, origin servers should strive to make the response as representative as feasible. WG-06 Strongly leaning toward: the origin server can return anything it wants.</p>	
2	<p>Can I return the same icon for every study or for different series in a single study? WG-27 Strongly leaning toward: Yes; however, origin servers should return Thumbnails that are as representative as possible. WG-06 Strongly leaning towards Origin can return anything it wants.</p>	
3	<p>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?</p> <p>If you ask for a size should the server be able to send whatever it wants?</p> <p>The client knows its graphics capabilities much better than the server does. The client could give no size and then resize it as necessary.</p> <p>The resolution of the client's screen is unknown to the origin server.</p> <p>WG-27 Leading towards: Yes, with a default size (if unspecified) of a value of 128x128, or what IHE Basic Image Review (BIR) defines. Also, Cardiology profile in Part 11. WG-06 Leaning towards origin server returns what it wants, i.e. a request for a size larger than the origin server supports could get an error or a smaller image. The Thumbnail should not exceed some yet undefined maximum size.</p> <p>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.</p> <p>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.</p>	
4	<p>Should the NPI Service have Thumbnail resources, e.g., for color palettes or Hanging or Defined Protocols?</p>	
5	<p>What happens if a Thumbnail is retrieved requesting a media type of application/dicom? WG-06 leaning toward: the server can do what it wants.</p>	
6	<p>How does this relate to Icon Image Sequence? E.G., does QIDO applied to a Study resource return a Thumbnail as a JPEG.</p>	
7	<p>Should the name of this resource be "icon" or "thumbnail"? WG-06 leaning toward: "icon".</p>	
8	<p>Should a Study/Series/Instance creator be able to specify the Thumbnail representation, i.e. content, for each resource? WG-06 Leaning toward: No.</p>	

30

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

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 a Thumbnail resource on the WADO-RS study, series, and instance resources in the DICOM RESTful web services standard. This supplement provides a simple way to retrieve a representative image of a study, series, or instance.

This transaction returns an image for the parent resource that reflects the content of the resource. The primary use cases for this service are: 1) to provide Thumbnails to image viewers or 2) to provide Thumbnails to EMR/EHRs, e.g., as referenced from FHIR Imaging Study resources, in a simple and straightforward manner. An example Thumbnail resource would be:

```
https://<DICOMweb endpoint>/studies/1.2.423432.1343223/thumbnail
```

45 With existing capabilities, a web client holding a Study Instance UID, would have to make a QIDO-RS call to retrieve the full study structure, navigate (presumably) to the first series, to the first instance, and use that image, but that is inappropriate, for example, for a head CT, where this would just be the scout, or just the tip of the head. To simplify the effort of the client, a standard Thumbnail resource is added.

The origin server determines the pixel content of the Thumbnail.

Insert the following at the appropriate place in Section 3.7.

50 3.7 DICOM Web Services

...

Thumbnail Image

A representative image of a DICOM Study, Series, Instance, or Frame. See [Section 11.4](#).

Thumbnail Resource

55 The resource for retrieving a representative thumbnail image of a DICOM Study, Series, Instance, or Frame. See [Section 11](#).

...

Update Section 11 as follows:

60 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, and Instances – along with their Metadata **and Thumbnail** variants; as well as Frames and Bulkdata,

11.1 Resources

65 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:

70

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	/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	/studies/{study}
	The Study resource references a single Study to be retrieved in a DICOM Media Type.
Study Metadata	/studies/{study}/metadata
	The Study Metadata resource references the Metadata of a single Study.
Rendered Study	/studies/{study}/rendered
	The Study Rendered resource references a Study to be rendered.
<u>Study Thumbnail</u>	<u>/studies/{study}/thumbnail</u>
	The Study Thumbnail resource references a thumbnail image of Study.
Study's Series	/studies_{study}/series
	The Study's Series resource references the collection of all Series contained in a Study.
Study's Instances	/studies_{study}/instances
	The Study's Instances resource references the collection of all Instances in a single Study.
All Series	/series
	The All Series resource references the collection of all Series in all studies contained in the Studies Service.
Series	/studies_{study}/series/{series}
	The Series resource references a single Series to be retrieved in a DICOM Media Type.
Series Metadata	/studies/{study}/series/{series}/metadata
	The Series Metadata resource contains the Metadata of a single Series in a Study.
Rendered Series	/studies/{study}/series/{series}/rendered
	The Series Rendered resource references a Series to be rendered.
<u>Series Thumbnail</u>	<u>/studies/{study}/series/{series}/thumbnail</u>
	The Series Thumbnail resource references a thumbnail image of Series.
Series' Instances	/studies/{study}/series/{series}/instances
	The Series' Instances resource references the collection of all Series in a single Study.
All Instances	/instances
	The All Instances resource references the collection of all Instances in all Series in all studies contained in the Studies Service.

Instance	/studies_{study}/series/{series}/instances/{instance} The Instance resource references a single Instance to be retrieved in a DICOM Media Type.
Instance Metadata	/studies_{study}/series/{series}/instances/{instance}/metadata The Instance Metadata resource contains the Metadata of a single Instance in a Series.
Rendered Instance	/studies/{study}/series/{series}/instances/{instance}/rendered The Instance Rendered resource references an Instance to be rendered.
Instance Thumbnail	<u>/studies/{study}/series/{series}/instances/{instance}/thumbnail</u> The Instance Thumbnail resource references a thumbnail image of an Instance.
Frames	/studies_{study}/series/{series}/instances/{instance}/frames/{frames} The Frames resource references an ordered collection of frames in a single multi-frame Instance.
Rendered Frames	/studies_{study}/series/{series}/instances/{instance}/frames/{frames}/rendered The Frames resource references an ordered collection of frames in a single multi-frame Instance.
Frame Thumbnail	<u>/studies/{study}/series/{series}/instances/{instance}/frames/{frame}/thumbnail</u> The Frame Thumbnail resource references a representative image of a single frame within an Instance. See Section 6.8.1.2. {frame} is the number of a single frame.
Bulkdata	/_{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				Yes
All Studies		Yes	Yes	
Study	Yes	Yes	Yes	
Study Metadata	Yes			
Study Bulkdata	Yes			
Rendered Study	Yes			
Study Thumbnail	Yes			
Study's Series			Yes	
Study's Instances			Yes	
All Series			Yes	
Series	Yes		Yes	
Series Metadata	Yes			
Series Bulkdata	Yes			
Series' Instances			Yes	
Rendered Series	Yes			
Series Thumbnail	Yes			
All Instances			Yes	
Instance	Yes		Yes	
Instance Metadata	Yes			
Instance Bulkdata	Yes			
Rendered Instance	Yes			
Instance Thumbnail	Yes			
Frames	Yes			
Rendered Frames	Yes			
Frame Thumbnail	Yes			
Bulkdata	Yes	Yes		

Update Section 11.4.1.1 as follows:

75 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

80 A Thumbnail resource references a small rendered image that represents its parent DICOM resource, which shall be a Study, Series, Instance, or Frame. 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 11.4.1-3. 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

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

The origin server will determine what constitutes a representative image. For example, the Thumbnail representation of a Study might be created from any of the following:

- The first Instance in a CR study,
- An Instance in a CT study in a non-scout series, located 1/3 of the way through the series,
- A generic graphical representation of a CT scanner to represent a CT study,
- A generic graphical representation of a page of text to represent a Structured Report Instance,
- An Instance referenced in a Key Object Selection, or
- A still frame of a video Instance.

95 The Thumbnail resource provides imaging and non-imaging systems with a method to quickly retrieve an image that represents the parent DICOM resource.

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

100 Insert the following as Section 11.4.1.2.4

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 Representation.

Table 11.4.1-3. Retrieve Rendered Query Parameters

Key	Values	Target Resource	Section
accept	Rendered Media Type	All	11.6.1.2.1
charset	character set token	All	11.6.1.2.2
viewport	vw, vh	All	11.6.1.2.5

105 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 charset parameter is only used if the target resources is a text/* media type.

Update Section 11.4.1.2.5 as follows:

11.4.1.2.6.3 Viewport Scaling

110 See Section 7.5.4.3.

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.

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

...

115 If any of the following are true:

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

...

120 Update Section 11.4.5 as follows:

11.4.5 Conformance

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:

- 125
- the resources ~~(Information Objects)~~ supported for this transaction,
 - whether it plays the role of origin server or user agent, or both.

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

- 130
- 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).
 - **A description of the method used to render Thumbnails for the study, series, or instance, and whether it returns an image or a redirect to a rendered resource**
 - **The minimum and maximum sizes for Thumbnails**
- 135