

Integrating the Healthcare Enterprise



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**IHE Radiology
Technical Framework Supplement**

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**Web-based Image Access
(WIA)**

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Draft for Public Comment

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Please verify you have the most recent version of this document. See [here](#) for Trial Implementation and Final Text versions and [here](#) for Public Comment versions.

Foreword

30 This is a supplement to the IHE Radiology Technical Framework V16.0. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on September 15, 2017 for public comment. Comments are invited and may be submitted at http://www.ihe.net/Radiology_Public_Comments. In order to be considered in development of the trial implementation version of the supplement, comments 35 must be received by October 15, 2017.

This supplement describes changes to the existing technical framework documents.

“Boxed” instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume.

<i>Amend Section X.X by the following:</i>

40 Where the amendment adds text, make the added text **bold underline**. Where the amendment removes text, make the removed text **~~bold strikethrough~~**. When entire new sections are added, introduce with editor’s instructions to “add new text” or similar, which for readability are not bolded or underlined.

45 General information about IHE can be found at: www.ihe.net.

Information about the IHE Radiology domain can be found at: ihe.net/IHE_Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the process used to create them can be found at: http://ihe.net/IHE_Process and <http://ihe.net/Profiles>.

50 The current version of the IHE Radiology Technical Framework can be found at: http://www.ihe.net/Technical_Frameworks.

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Introduction to this Supplement

Web-based Image Access (WIA) Profile, formerly known as Mobile Access to Health Document for Imaging (MHD-I), defines methods for image sharing and interactive viewing of imaging studies using RESTful services such as WADO-RS and QIDO-RS.

180 WIA can be used independently or combined with the IT Infrastructure Mobile access to Health Document (MHD) Profile. When combined with MHD, it allows the MHD Document Consumer to locate and access imaging studies using document metadata.

185 For readers familiar with MHD-I, the original design of MHD-I depends on MHD to search for imaging manifests. Then MHD-I complemented MHD by supporting retrieval of imaging studies referenced by the manifest using WADO-RS. After several design iterations, the Radiology Technical Committee determined that using QIDO-RS is necessary to support interactive viewing use case. Also compared to using an imaging manifest, QIDO-RS is more natural to use when searching for imaging studies. Furthermore, having a separate Imaging Document Responder to handle the QIDO-RS Query enables proxying of QIDO-RS query requests to
 190 different imaging sharing backends (e.g. XDS-I, DICOM^{®1}/DICOMweb). As a result, the design of the WIA Profile only depends on QIDO-RS query and WADO-RS retrieve. It no longer has any direct dependency on MHD. Therefore the name of the profile is also updated to WIA to reflect the fact that the WIA profile no longer depends on MHD.

Open Issues

#	Issue / Answer
1	Institutional Department Name and Institution Name are equipment attributes which are at the series level. Should they be allowed in the QIDO-RS query when XDS-I Backend Option is used?
2	What instance level attributes are required for interactive viewing use case beyond those already defined in Query Images [RAD-14]? E.g. in what order are the slices for a 1000s slide CT? What is the orientation? WADO-RS supports retrieving full metadata of an object, but it is a less efficient mechanism than QIDO-RS if there is a specific list of attributes to be retrieved.
3	Is MHD Integration Option necessary? Or just leave it as cross-profile consideration?
4	Should actors in WIA have mandatory grouping of Secure Node / Secure Application in ATNA?

¹ DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

#	Issue / Answer
5	Requesting Service may be used to specify a care team per DICOM CP-1722. Should there be any requirements or informative text showing how does a care team maps to practice setting code?
6	In XDS environment, what is the current practice regarding the Practice Setting Code attribute? What are the best attributes in DICOM that can be used to map to Practice Setting Code? Do we need to specify further how to map QIDO-RS query to PracticeSettingCode?
7	Should the semantics defined in the XDS-I Backend Option be actually defined in ITI XDS Registry Stored Query [ITI-18]?
8	Should the Responder require to support all the different object types (e.g. presentation state, DICOM structured report, key image note) and therefore remove the options for the Responder? Options for different object types will be specified only for the Consumer.
9	Does the Query audit message capture enough information? For example, currently the Query audit message only requires to audit the query request, but not the query response.

195

Closed Issues

#	Issue / Answer
1.	Why did we leverage the transactions in MHD, which states that the profile is not stable (from the supplement, “The IHE MHD Profile and the HL7^{®2} FHIR^{®3} activities are working together to revise and enhance the transactions profiled here”), rather than creating the query and retrieve manifest transactions in this profile? The MHD Profile provides sufficient underlying methodology to achieve the goals of this profile. With some restrictions on some of the transactions, it was deemed redundant to recreate them here, and with imposing specific restrictions on newly created transaction (such as limiting the query to just manifests), it left more to be desired. Should, in the future, the MHD Profile moves in a direction not suitable for MHD I-RS consumers, action will be taken then to have the MHD I-RS Profile updated. WIA no longer directly depends on MHD. WIA defines its own QIDO-RS and WADO-RS transactions. On the other hand, WIA can be grouped with MHD to ease imaging manifest handling. Also WIA has XDS-I Backend Option which enables WIA to support XDS-I infrastructure.
2.	This profile has a noticeable gap and that is the lack of posting new imaging studies. Why is this excluded? For the use cases that MHD I-RS addresses, content creation is not feasible (i.e., on a mobile device, to acquire images in DICOM format, structure them in a study / series / instance hierarchy, and upload the content). To upload DICOM objects using RESTful API, IHE Radiology WIC Profile can be used. To upload an XDS-I.b manifest using a RESTful API, one may consider using WIC to upload DICOM instances to an XDS-I.b Imaging Document Source which will then create the manifest and submit to XDS. Alternatively, one may use MHD to upload an imaging manifest.

² HL7 is the registered trademark of Health Level Seven International.

³ FHIR is the registered trademark of Health Level Seven International.

#	Issue / Answer
3.	<p>Should QIDO-RS be included in this profile? No. QIDO-RS is not necessary to satisfy the MHD-I-RS use cases. Yes, QIDO-RS is added to support advanced image viewer use cases.</p>
4.	<p>Should WADO-RS or WADO-URI be mandatory? URI is mandatory, and RS is optional. WADO-URI is widely supported, whereas WADO-RS is still fairly new at the time this profile was created. WADO-RS is also missing key functionality (rendering); however, that is being addressed in future DICOM work. WIA only supports WADO-RS since QIDO-RS only specifies WADO-RS URL in the Retrieve URL attribute.</p>
5.	<p>Should we use URI or URL as the terminology in the WADO-RS transaction, and do we need to indicate it must be fully qualified (absolute rather than relative)? Sentences that reflected the inconsistency have been adjusted.</p>
6.	<p>Should we incorporate DICOM CP 1352 regarding series and instance level metadata queries in metadata queries of WADO-RS? Yes, this has been incorporated.</p>
7.	<p>Should we incorporate DICOM CP 1351 regarding retrieving WADO-RS metadata in JSON? Yes, this has been incorporated.</p>
8.	<p>When DICOM CP 1350 to include a URL in the KOS manifest is completed, should we update the JSON Imaging Manifest to recommend it be included by XDS-I systems? No, a separate CP should be created to add WADO-RS to XDS-I.b and any other relevant profiles.</p>
9.	<p>In the example, we copied the formatCode from the XDS-I.b manifest registry metadata format code as the class code for the MHD JSON representation of the manifest header. We selected our own display name since that is not specified in XDS-I.b. Is this correct? When WIA Imaging Document Responder grouped with an XDS-I Imaging Document Consumer to query the XDS Document Registry, the standard XDS-I formatCode for imaging manifest is used.</p>
10.	<p>Should the home community ID be required for the MHD-I Profile retrieve transactions even for cross-community (rather than cross-enterprise access) to assure all implementations in the future support cross-community access? In the cross profile consideration section, XCA-I support is discussed; in particular how to handle homeCommunityID.</p>
11.	<p>Is Instance-Stored the correct ATNA event for a WADO-RS retrieval? (That is what is used in WADO-URI, where this originated) Yes, this is consistent with WADO Retrieve [RAD-55].</p>
12.	<p>Should MHD-I returns ImagingStudy instead of ImagingManifest? WIA no longer make use of FHIR resources for conveying imaging studies. WIA uses DICOM QIDO-RS which returns a query response in DICOM JSON or XML format.</p>

General Introduction

200 *Update the following Appendices to the General Introduction as indicated below. Note that these are not appendices to Volume 1.*

Appendix A – Actor Summary Definitions

Add the following actors to the IHE Technical Frameworks General Introduction list of actors:

Actor	Definition
Imaging Document Responder	The Imaging Document Responder returns imaging study metadata upon query requests from an Imaging Document Consumer.

205 Appendix B – Transaction Summary Definitions

Add the following transactions to the IHE Technical Frameworks General Introduction list of Transactions:

Transaction	Definition
WADO-RS Retrieve [RAD-107]	Web Access to DICOM Object by RESTful Services
QIDO-RS Query [RAD-YY]	Query based on ID for DICOM Objects by RESTful Services

Glossary

210 *Add the following glossary terms to the IHE Technical Frameworks General Introduction Glossary:*

Glossary Term	Definition
JSON	JavaScript Object Notation
WADO-RS	Web Access to DICOM Object by RESTful Services
QIDO-RS	Query based on ID for DICOM Objects by RESTful Services

Volume 1 – Profiles

Add Section 42 to Volume 1

215 **42 Web-based Image Access Profile**

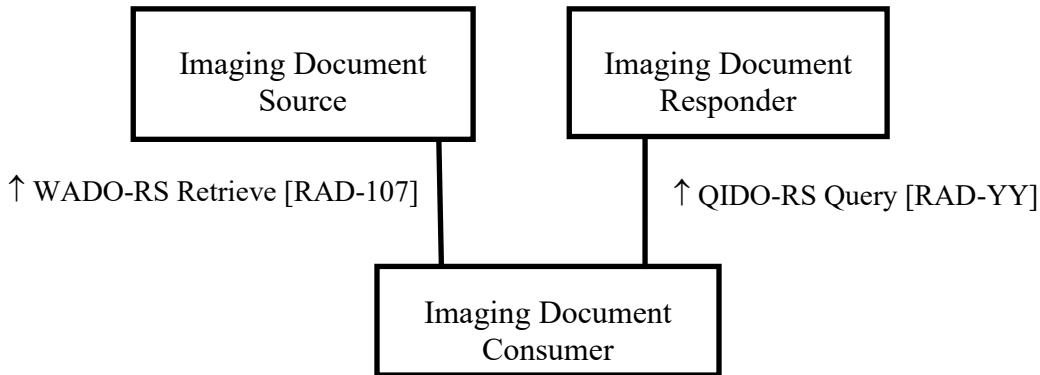
Web-based Image Access (WIA) Profile defines methods for image sharing and interactive viewing of imaging studies using RESTful services such as WADO-RS and QIDO-RS.

220 WIA can be used independently or combined with IT Infrastructure Mobile access to Health Document (MHD). When combined with MHD, it allows the MHD Document Consumer to locate and access imaging studies using document metadata.

42.1 WIA Actors, Transactions, and Content Modules

This section defines the actors, transactions, and/or content modules in this profile. General definitions of actors are given in the Technical Frameworks General Introduction Appendix A at http://ihe.net/Technical_Frameworks.

225 Figure 42.1-1 shows the actors directly involved in the WIA Profile and the relevant transactions between them. If needed for context, other actors that may be indirectly involved due to their participation in other related profiles are shown in dotted lines. Actors which have a mandatory grouping are shown in conjoined boxes.



230 **Figure 42.1-1: WIA Actor Diagram**

Table 42.1-1 lists the transactions for each actor directly involved in the WIA Profile. To claim compliance with this profile, an actor shall support all required transactions (labeled “R”) and may support the optional transactions (labeled “O”).

Table 42.1.2-1: WIA-RS Profile - Actors and Transactions

Actors	Transactions	Optionality	Reference
Imaging Document Responder	QIDO-RS Query [RAD-YY]	R	RAD TF-3: 4.YY
Imaging Document	WADO-RS Retrieve [RAD-107]	R	RAD TF-3: 4.107

Actors	Transactions	Optionality	Reference
Consumer	QIDO-RS Query [RAD-YY]	R	RAD TF-3: 4.YY
Imaging Document Source	WADO-RS Retrieve [RAD-107]	R	RAD TF-3: 4.107

235

42.1.1 WIA Actor Descriptions and Actor Profile Requirements

Most requirements are documented in Transactions (Volumes 2 and 3) and Content Modules (Volume 3). This section documents any additional requirements on WIA actors.

42.1.1.1 Imaging Document Responder

240 No extra requirements.

42.1.1.2 Imaging Document Consumer

No extra requirements.

42.1.1.3 Imaging Document Source

No extra requirements.

245

42.2 WIA Actor Options

Options that may be selected for each actor, if any, are listed in the Table 42.2-1. Dependencies between options when applicable are specified in notes.

Table 42.2-1: Mobile access to Health Documents for Imaging - Actors and Options

Actor	Option Name	Reference
Imaging Document Responder	XDS-I Backend	RAD TF-1: 42.2.1.1
	Extended Study Metadata Query	RAD TF-1: 42.2.3
	Presentation State Query	RAD TF-1: 42.2.4
	DICOM Structured Report Query	RAD TF-1: 42.2.5
	Key Image Note Query	RAD TF-1: 42.2.6
Imaging Document Consumer	MHD Integration	RAD TF-1: 42.2.2
	Extended Study Metadata Query	RAD TF-1: 42.2.3
	Presentation State Query	RAD TF-1: 42.2.4
	DICOM Structured Report Query	RAD TF-1: 42.2.5
	Key Image Note Query	RAD TF-1: 42.2.6
Imaging Document Source	XDS-I Backend	RAD TF-1: 42.2.1.2

250 **42.2.1 XDS-I Backend Option**

42.2.1.1 Imaging Document Responder

An Imaging Document Responder that supports the XDS-I Backend Option can find imaging manifests from an XDS-I environment and generate the corresponding imaging study metadata query response.

255 An Imaging Document Responder shall be grouped with either:

- an XDS Document Consumer, or
- an MHD Document Responder that supports the XDS on FHIR Option.

Either method enables the Imaging Document Responder to find imaging manifests from an XDS-I environment.

260 The Imaging Document Responder shall support the requirements as defined in RAD TF-3: 4.YY.4.1.3.1.

To support Use Case #4 in Section 42.4.2.4 or Use Case #5 in Section 42.4.2.5, the Imaging Document Responder shall implement this option.

42.2.1.2 Imaging Document Source

265 An Imaging Document Source that supports the XDS-I Backend Option can retrieve imaging studies from an XDS-I Imaging Document Source and return the imaging studies to the Imaging Document Consumer.

The Imaging Document Source shall be grouped with an XDS-I Imaging Document Consumer.

270 To support Use Case #5 in Section 42.4.2.5, the Imaging Document Source shall implement this option.

42.2.2 MHD Integration Option

This option specifies that the Imaging Document Consumer shall be grouped an MHD Document Consumer such that when it finds a reference to an imaging study or an imaging manifest, it can query for additional imaging study metadata using QIDO-RS Query [RAD-YY] and retrieve the images using WADO-RS Retrieve [RAD-107], provided that the attribute `related.identifier` is returned in the Find Document References [ITI-67] response and it contains the following value:

- 275
- An accession number, i.e. a value with `identifier.type` set with the coded value (“ACSN”, <http://hl7.org/fhir/v2/0203>, “Accession ID”)

280 **42.2.3 Extended Study Metadata Query Option**

The Imaging Document Consumer shall support the query matching and return keys as Query SCU defined in RAD TF-3: 4.YY.4.1.2.2.

The Imaging Document Responder shall support the query matching and return keys as Query SCP defined in RAD TF-3: 4.YY.4.1.2.2.

285 **42.2.4 Presentation State Query Option**

The Imaging Document Consumer shall support the query matching and return keys as Query SCU defined in RAD TF-3: 4.YY.4.1.2.3.

The Imaging Document Responder shall support the query matching and return keys as Query SCP defined in RAD TF-3: 4.YY.4.1.2.3.

290 **42.2.5 DICOM Structured Report Query Option**

The Imaging Document Consumer shall support the query matching and return keys as Query SCU defined in RAD TF-3: 4.YY.4.1.2.4.

The Imaging Document Responder shall support the query matching and return keys as Query SCP defined in RAD TF-3: 4.YY.4.1.2.4.

295 **42.2.6 Key Image Note Query Option**

The Imaging Document Consumer shall support the query matching and return keys as Query SCU defined in RAD TF-3: 4.YY.4.1.2.5.

The Imaging Document Responder shall support the query matching and return keys as Query SCP defined in RAD TF-3: 4.YY.4.1.2.5.

300 **42.3 WIA Required Actor Groupings**

An actor from this profile (Column 1) shall implement all required transactions for the grouped actor (Column 3) in Table 42.3-1.

Section 42.5 describes some optional groupings that may be of interest for security considerations and Section 42.6 describes some optional groupings in other related profiles.

305 **Table 42.3-1: Web-based Image Access - Required Actor Groupings**

WIA Actor	Grouping Condition	Actor(s) to be grouped with	Reference
Imaging Document Responder	XDS-I Backend Option	ITI XDS.b / Document Consumer (Note 1)	ITI TF-1:10
		ITI MHD / Document Responder with the XDS on FHIR Option (Note 1)	ITI TF-1:33 (Note 2)
Imaging Document Consumer	MHD Integration Option	ITI MHD / Document Consumer	ITI TF-1:33 (Note 2)
Imaging Document Source	XDS-I Backend Option	XDS-I / Imaging Document Consumer	RAD TF-1:18

Note 1: The Imaging Document Responder that supports the XDS-I Backend Option shall be grouped with at least one of these actors.

Note 2: Currently in the ITI MHD Trial Implementation Supplement

310 **42.4 WIA Overview**

42.4.1 Concepts

42.4.1.1 Support different image sharing infrastructures

315 WIA enables retrieval of imaging studies (performed procedures) shared within an enterprise and across enterprises using RESTful services. WIA can be used with different image sharing infrastructures, including but not limited to XDS / XDS-I and DICOM / DICOMweb.

The Imaging Document Responder returns imaging study metadata in response to query requests. The source of the imaging study metadata is not constrained, but several models are possible. The Imaging Document Responder can find imaging study metadata:

- 320 • From sources such as an Image Manager/Image Archive. The Imaging Document Responder can have direct access to the Image Manager/Image Archive, or it can communicate with one or more Image Managers/Image Archives via standard mechanism such as Query Images [RAD-14].
- 325 • From sources such as an XDS Document Registry. When WIA Imaging Document Responder is grouped with an XDS Document Consumer, the Imaging Document Responder can transform the query submitted by the Imaging Document Consumer into the corresponding XDS Registry Stored Query [ITI-18] transaction as well as translate the response back.

As a result, the Imaging Document Consumer can interactive with imaging study published to XDS the same way as it would do in a non-XDS environment.

330 **42.4.1.2 Access to imaging study and other imaging study related documents**

WIA focuses on retrieving imaging studies using RESTful services. Retrieving other imaging study related documents, such as radiology reports, may be done using the ITI MHD Profile.

335 WIA can be used independently or combined with MHD. When combined with MHD, an MHD Document Consumer can be grouped with a WIA Imaging Document Consumer with MHD Integration Option. This enables the MHD Document Consumer to interact with imaging studies without first fetching an imaging manifest.

42.4.2 Use Cases

42.4.2.1 Use Case #1: Image Study Sharing

42.4.2.1.1 Image Study Sharing Use Case Description

340 A radiologist, using a mobile or desktop device, has been asked to have a quick review of some images of a patient. In his EMR client, he looks up the patient details. He would like to discover

345 what studies are available for his patient within and across the enterprises. He queries the Imaging Document Responder for his patient using the patient’s identifier provided by the EMR client. The responder returns several responses, one per matching study. He then selects one study, and his device retrieves the instances via WADO-RS, and render them.

An example of the transactions supporting this use case can be found in RAD TF-3: Appendix X.1.

42.4.2.1.2 Image Study Sharing Process Flow

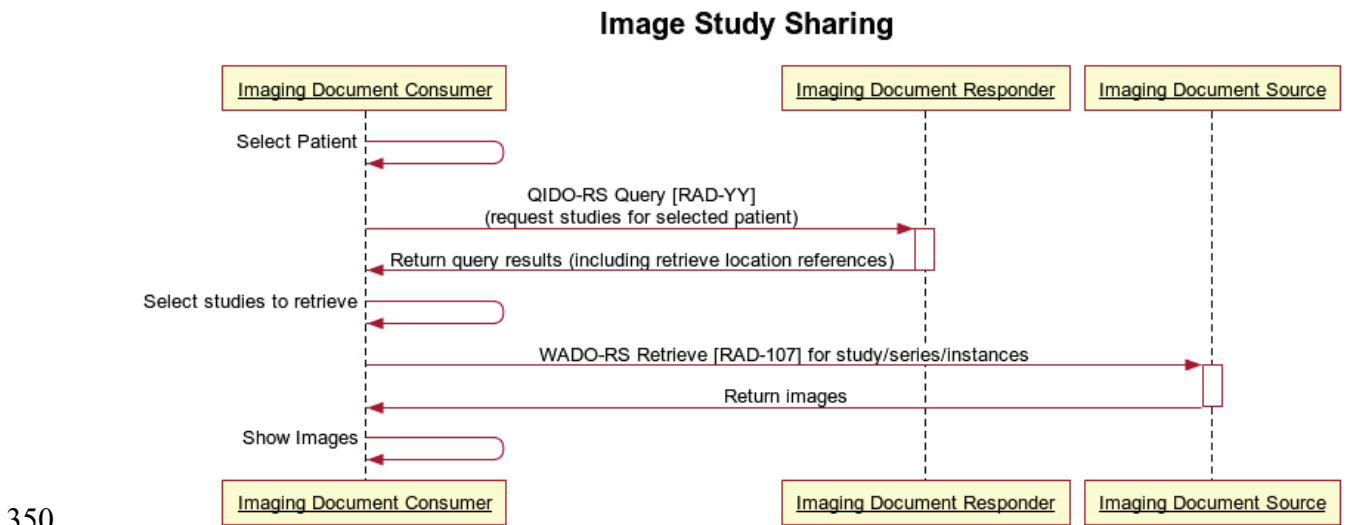


Figure 42.4.2.1.2-1: Image Study Sharing Diagram

The text in Figure 42.4.2.1.2-2 was used to generate the diagram in Figure 42.4.2.1.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

355

```

title Image Study Sharing

participant Imaging Document Consumer as IDC
participant Imaging Document Responder as IDR
participant Imaging Document Source as IDS

IDC->IDC: Select Patient
IDC->+IDR: QIDO-RS Query [RAD-YY]\n(request studies for selected patient)
IDR->-IDC: Return query results (including retrieve location references)
IDC->IDC: Select studies to retrieve
IDC->+IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
IDS->-IDC: Return images
IDC->IDC: Show Images
    
```

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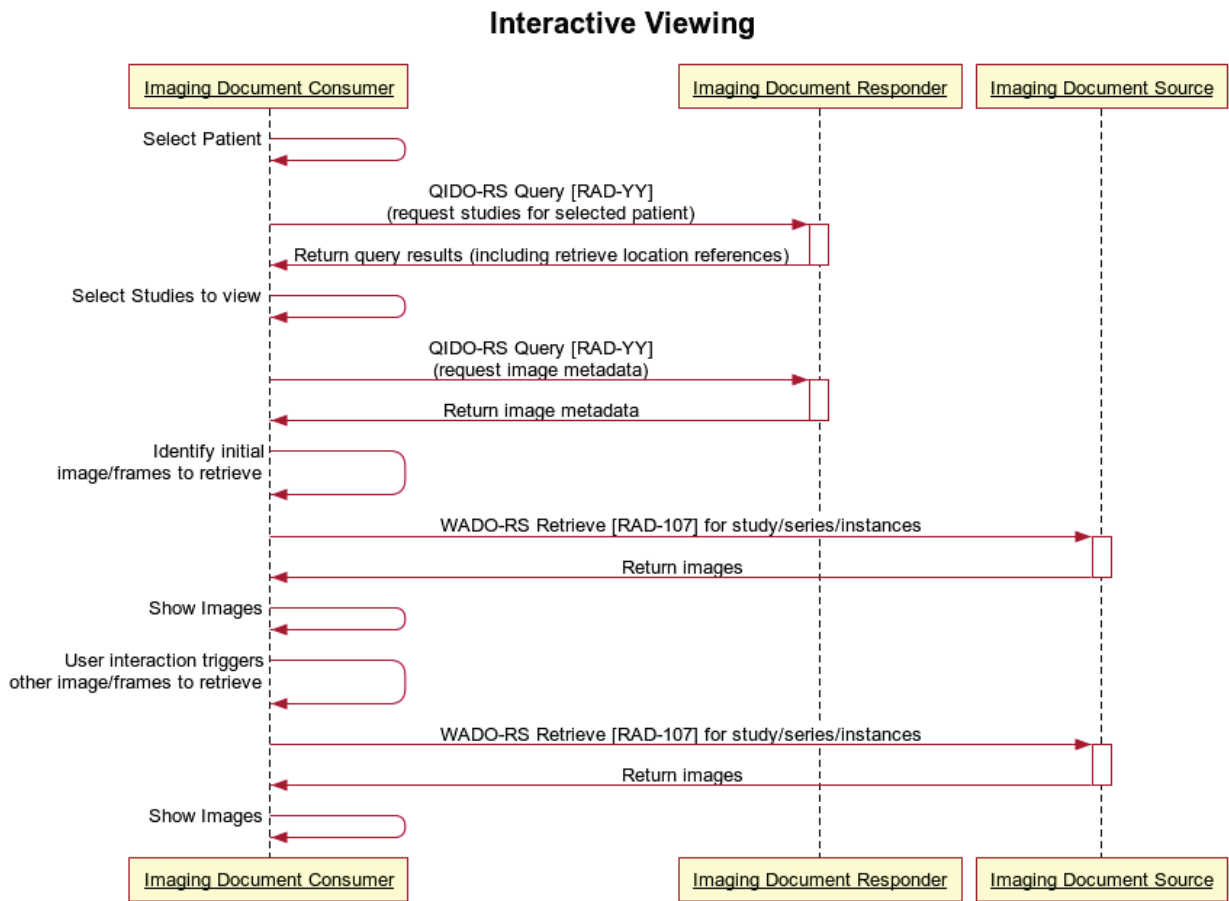
Figure 42.4.2.1.2-2: Imaging Study Sharing Diagram Pseudocode

370 **42.4.2.2 Use Case #2: Interactive Viewing**

42.4.2.2.1 Interactive Viewing Use Case Description

375 A radiologist, using a mobile or desktop device, has been asked to have a quick review of some images of a patient. In his EMR client, he looks up the patient details. He would like to discover what studies are available for his patient. He queries the Imaging Document Responder for his patient using the patient’s identifier provided by the EMR client. To view the study, the viewer queries for additional image metadata to determine which objects to retrieve for the initial view. The viewer uses WADO-RS to retrieve initial set of images/frames and display them. Then based on user interactions, additional images/frames are retrieved and displayed accordingly.

42.4.2.2.2 Interactive Viewing Process Flow



380

Figure 42.4.2.2.2-1: Interactive Viewing Diagram

The text in Figure 42.4.2.2.2-2 was used to generate the diagram in Figure 42.4.2.2.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```

385 title Image Study Sharing
    title Interactive Viewing

    participant Imaging Document Consumer as IDC
    participant Imaging Document Responder as IDR
390 participant Imaging Document Source as IDS

    IDC->IDC: Select Patient
    IDC->+IDR: QIDO-RS Query [RAD-YY]\n(request studies for selected patient)
    IDR->-IDC: Return query results (including retrieve location references)
395 IDC->IDC: Select Studies to view
    IDC->+IDR: QIDO-RS Query [RAD-YY]\n(request image metadata)
    IDR->-IDC: Return image metadata
    IDC->IDC: Identify initial\nimage/frames to retrieve
    IDC->+IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
400 IDS->-IDC: Return images
    IDC->IDC: Show Images
    IDC->IDC: User interaction triggers\nother image/frames to retrieve
    IDC->+IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
405 IDS->-IDC: Return images
    IDC->IDC: Show Images

```

Figure 42.4.2.2-2: Interactive Viewing Diagram Pseudocode

42.4.2.3 Use Case #3: MHD Document Consumer accessing Imaging Study

42.4.2.3.1 MHD Document Consumer accessing Imaging Study Use Case Description

410 A radiologist, using a mobile or desktop device, has been asked to have a quick review of some clinical documents of a patient. In his EMR client, he looks up the patient details. He would like to discover what documents are available for his patient. He queries the responder for his patient using the patient's identifier provided by the EMR client, and discovers several document references, in which some of them correspond to imaging studies. He then selects one or more

415 imaging study document references, and his device queries for additional imaging study metadata, may include the retrieve location references. With this information, his device is able to retrieve the instances via WADO-RS and render them.

42.4.2.3.2 MHD Document Consumer accessing Imaging Study Process Flow

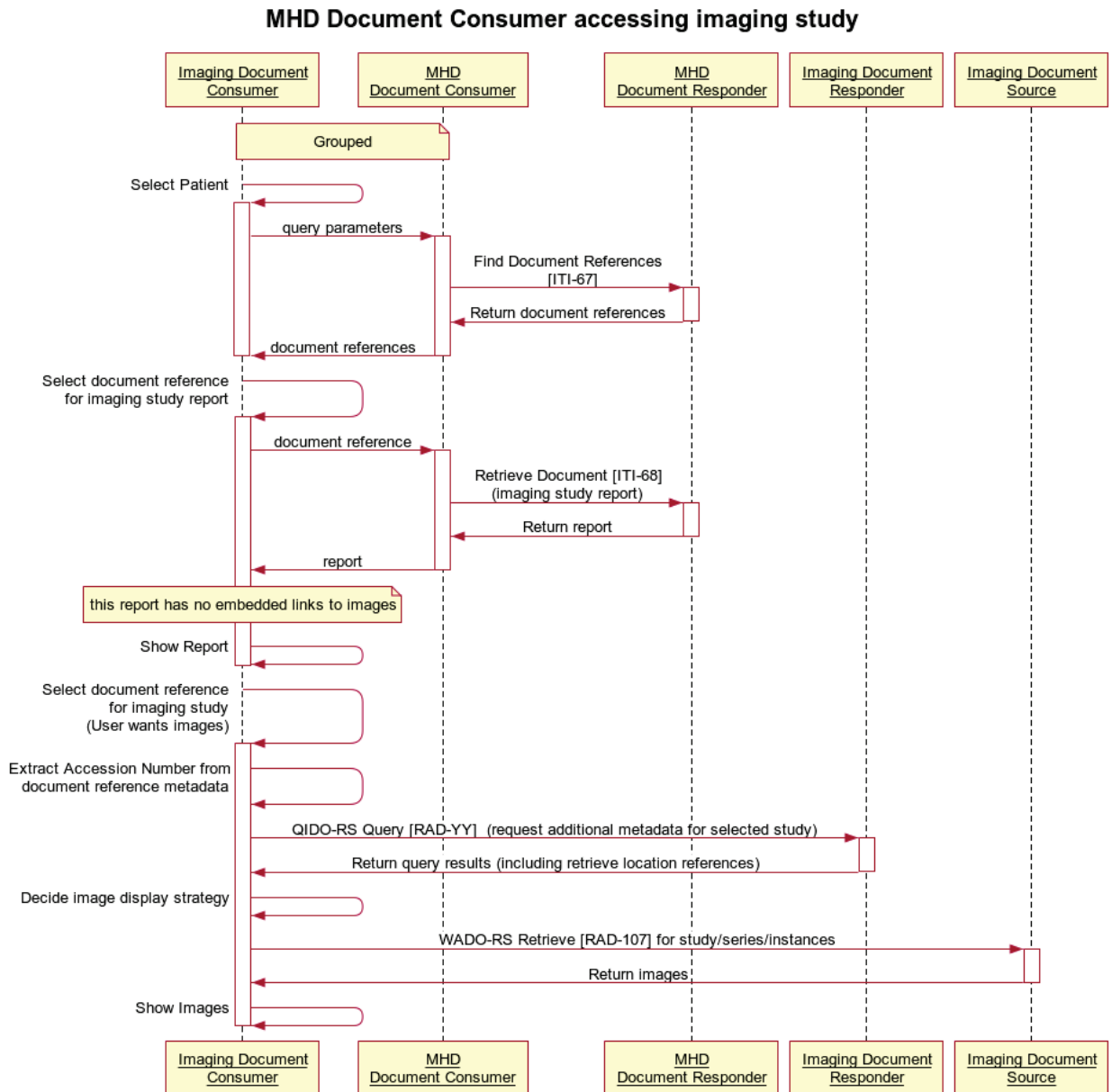


Figure 42.4.2.3.2-1: MHD Document Consumer accessing imaging study Diagram

The text in Figure 42.4.2.3.2-2 was used to generate the diagram in Figure 42.4.2.3.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```

425 title MHD Document Consumer accessing imaging study

participant Imaging Document\nConsumer as IDC
participant MHD\nDocument Consumer as MDC

430 note over IDC, MDC: Grouped

participant MHD\nDocument Responder as MDR
participant Imaging Document\nResponder as IDR
participant Imaging Document\nSource as IDS

435 IDC->+IDC: Select Patient
IDC->+MDC: query parameters
MDC->+MDR: Find Document References\n [ITI-67]
MDR->-MDC: Return document references
440 MDC->-IDC: document references
deactivate IDC

IDC->+IDC: Select document reference\nfor imaging study report
IDC->+MDC: document reference
445 MDC->+MDR: Retrieve Document [ITI-68]\n(imaging study report)
MDR->-MDC: Return report
MDC->-IDC: report
note over IDC: this report has no embedded links to images
IDC->IDC: Show Report
450 deactivate IDC

IDC->+IDC: Select document reference\nfor imaging study\n(User wants images)
IDC->IDC: Extract Accession Number from\ndocument reference metadata
IDC->+IDR: QIDO-RS Query [RAD-YY] (request additional metadata for selected
455 study)
IDR->-IDC: Return query results (including retrieve location references)
IDC->IDC: Decide image display strategy
IDC->+IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
IDS->-IDC: Return images
460 IDC->IDC: Show Images
deactivate IDC

```

Figure 42.4.2.3.2-2: MHD Document Consumer accessing imaging study Pseudocode

42.4.2.4 Use Case #4: Interactive Viewing in XDS-I environment with Grouped Imaging Document Source

465 42.4.2.4.1 Interactive Viewing in XDS-I environment with Grouped Imaging Document Source Use Case Description

A radiologist, using a mobile or desktop device, has been asked to have a quick review of some clinical documents of a patient. In his EMR client, he looks up the patient details. He would like to discover what imaging studies are available for his patient. He queries the responder for his patient using the patient's identifier provided by the EMR client. The responder in turn queries the XDS environment for imaging manifest. He then selects one or more imaging study and starts interactive viewing as defined in Use Case #2.

In order to support this use case, the Imaging Document Responder is required to support the XDS-I Backend Option.

475 In this use case, an XDS-I Imaging Document Source is grouped with a WIA Imaging Document Source. As a result, the Imaging Document Consumer can directly retrieve the imaging study from the Imaging Document Source.

480 Note: XDS-I Imaging Document Consumer is not required in this use case because the Imaging Document Source is grouped with the XDS-I Imaging Document Source. Therefore the Imaging Document Source has direct access to the imaging study.

Note that in some cases, the Imaging Document Responder may interact with one or more Imaging Document Sources to query imaging study metadata (as shown in the diagram below). In other cases, Imaging Document Source may be grouped with an Imaging Document Responder so that the Imaging Document Consumer can query the grouped Imaging Document Source/Responder Actor directly (not shown in the diagram).

485

42.4.2.4.2 Interactive Viewing in XDS-I environment with Grouped Imaging Document Source Process Flow

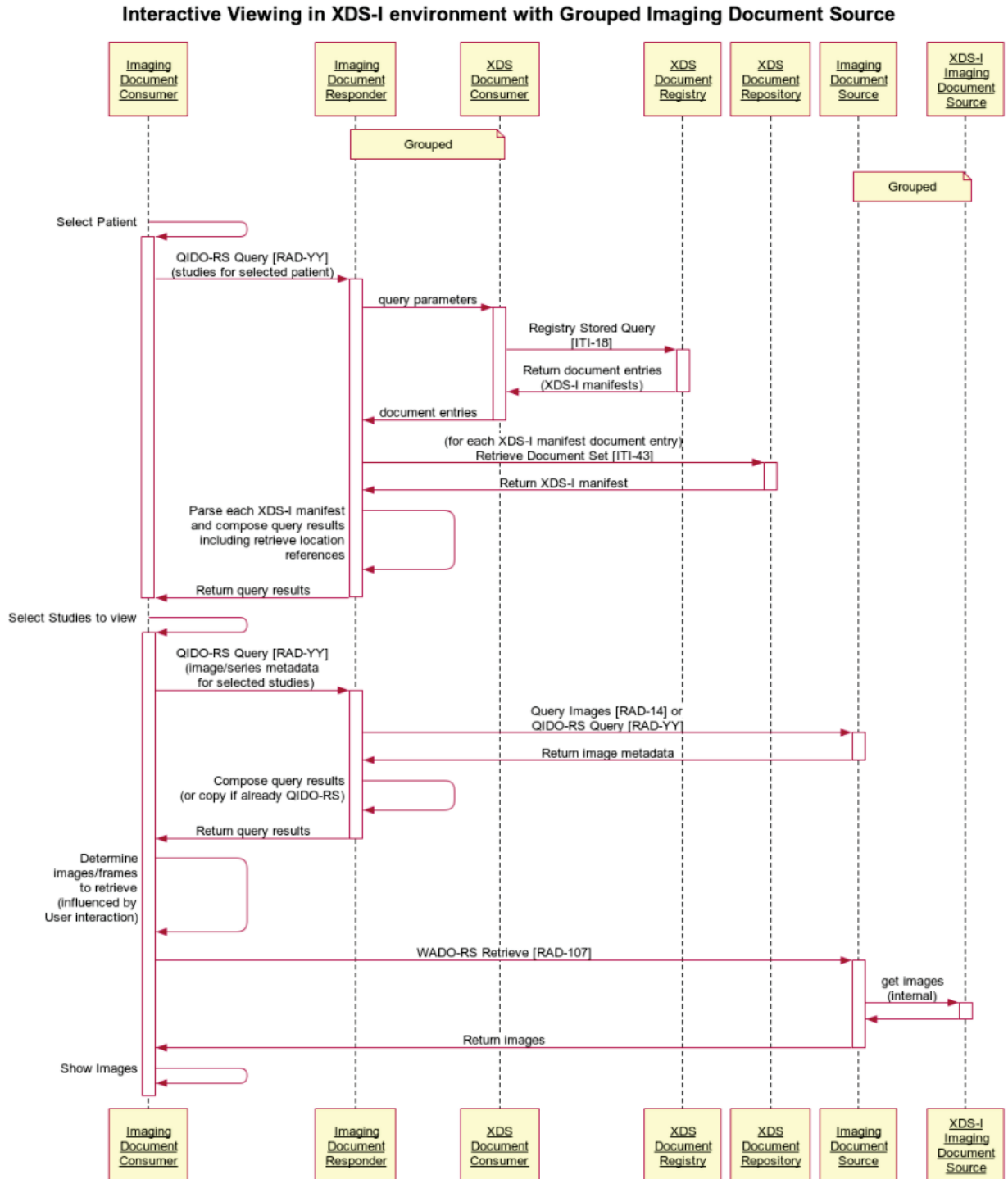


Figure 42.4.2.4.2-1: Interactive Viewing with XDS-I Imaging Doc Source Diagram

The text in Figure 42.4.2.4.2-2 was used to generate the diagram in Figure 42.4.2.4.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

495

```
title Interactive Viewing in XDS-I environment with Grouped Imaging Document Source
```

500

```
participant Imaging\Document\Consumer as IDC
participant Imaging\Document\Responder as IDR
participant XDS\Document\Consumer as DCon
participant XDS\Document\Registry as DReg
participant XDS\Document\Repository as DRepo
participant Imaging\Document\Source as IDS
participant XDS-I\Imaging\Document\Source as XIDS
```

505

```
note over IDR, DCon: Grouped
note over IDS, XIDS: Grouped
```

510

```
IDC->+IDC: Select Patient
IDC->+IDR: QIDO-RS Query [RAD-YY]\n(studies for selected patient)
IDR->+DCon: query parameters
DCon->+DReg: Registry Stored Query\n[ITI-18]
DReg->-DCon: Return document entries\n(XDS-I manifests)
DCon->-IDR: document entries
```

515

```
IDR->+DRepo: (for each XDS-I manifest document entry)\nRetrieve Document Set [ITI-43]
DRepo->-IDR: Return XDS-I manifest
```

520

```
IDR->IDR: Parse each XDS-I manifest\nand compose query results\nincluding retrieve location\nreferences
```

```
IDR->-IDC: Return query results
deactivate IDC
```

525

```
IDC->+IDC: Select Studies to view
IDC->+IDR: QIDO-RS Query [RAD-YY]\n(image/series metadata\n for selected studies)
```

530

```
IDR->+IDS: Query Images [RAD-14] or\nQIDO-RS Query [RAD-YY]
IDS->-IDR: Return image metadata
IDR->IDR: Compose query results\n(or copy if already QIDO-RS)
IDR->-IDC: Return query results
IDC->IDC: Determine\nimages/frames\nto retrieve\n(influenced by\nUser interaction)
```

535

```
IDC->+IDS: WADO-RS Retrieve [RAD-107]
IDS->+XIDS: get images\n(internal)
XIDS->-IDS:
IDS->-IDC: Return images
IDC->IDC: Show Images
```

Figure 42.4.2.4.2-2: Interactive Viewing with XDS-I Imaging Doc Source Pseudocode

540

42.4.2.5 Use Case #5: Interactive Viewing in XDS-I environment

42.4.2.5.1 Interactive Viewing in XDS-I environment Use Case Description

545 This use case is the same as Use Case #4 except that the XDS-I Imaging Document Source does not group with a WIA Imaging Document Source. Since XDS-I does not support WADO-RS Retrieve [RAD-107], the WIA Imaging Document Source is required to support the XDS-I Backend Option. This option enables the Imaging Document Source to proxy the imaging study retrieve request to the XDS-I Imaging Document Source using one of the three imaging study retrieve methods supported by XDS-I.

42.4.2.5.2 Interactive Viewing in XDS-I environment Process Flow

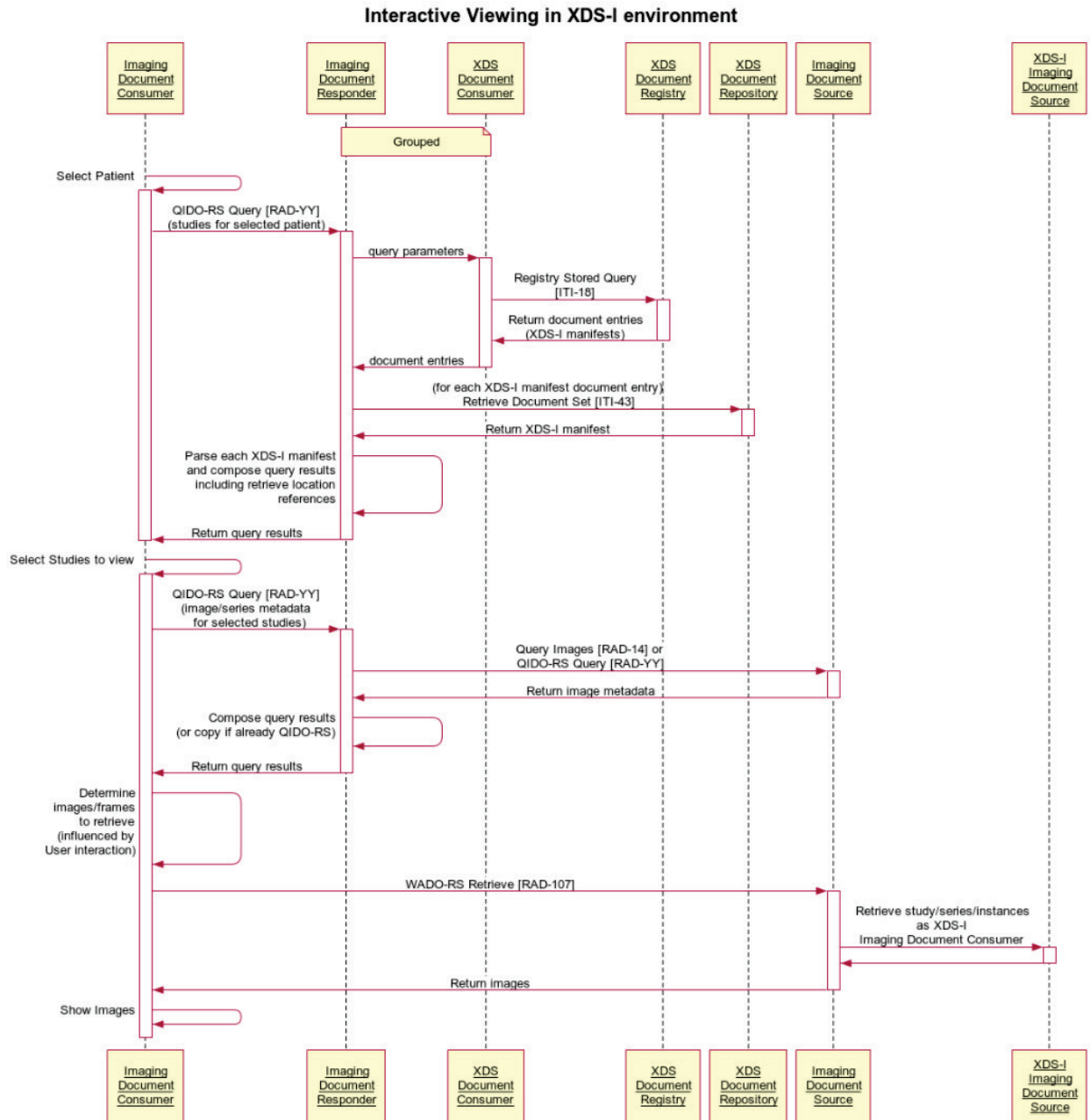


Figure 42.4.2.5.2-1: Interactive Viewing in an XDS-I Environment Diagram

The text in Figure 42.4.2.5.2-2 was used to generate the diagram in Figure 42.4.2.5.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```

555 title Interactive Viewing in XDS-I environment

participant Imaging\nDocument\nConsumer as IDC
participant Imaging\nDocument\nResponder as IDR
560 participant XDS\nDocument\nConsumer as DCon
participant XDS\nDocument\nRegistry as DReg
participant XDS\nDocument\nRepository as DRepo
participant Imaging\nDocument\nSource as IDS
participant XDS-I\nImaging\nDocument\nSource as XIDS

565 note over IDR, DCon: Grouped

IDC->+IDC: Select Patient
IDC->+IDR: QIDO-RS Query [RAD-YY]\n(studies for selected patient)
IDR->+DCon: query parameters
570 DCon->+DReg: Registry Stored Query\n[ITI-18]
DReg->-DCon: Return document entries\n(XDS-I manifests)
DCon->-IDR: document entries

IDR->+DRepo: (for each XDS-I manifest document entry)\nRetrieve Document Set
575 [ITI-43]
DRepo->-IDR: Return XDS-I manifest

IDR->IDR: Parse each XDS-I manifest\nand compose query results\nincluding
580 retrieve location\nreferences

IDR->-IDC: Return query results
deactivate IDC

IDC->+IDC: Select Studies to view
585 IDC->+IDR: QIDO-RS Query [RAD-YY]\n(image/series metadata\n for selected
studies)
IDR->+IDS: Query Images [RAD-14] or\nQIDO-RS Query [RAD-YY]
IDS->-IDR: Return image metadata
IDR->IDR: Compose query results\n(or copy if already QIDO-RS)
590 IDR->-IDC: Return query results
IDC->IDC: Determine\nimages/frames\nto retrieve\n(influenced by\nUser
interaction)
IDC->+IDS: WADO-RS Retrieve [RAD-107]
IDS->+XIDS: Retrieve study/series/instances\nas XDS-I\nImaging Document
595 Consumer
XIDS->-IDS:
IDS->-IDC: Return images
IDC->IDC: Show Images

```

Figure 42.4.2.5.2-2: Interactive Viewing in an XDS-I Environment Diagram

600 42.5 WIA Security Considerations

The WIA Profile has similar considerations to the IT Infrastructure Mobile access to Health Documents (MHD) Profile as stated in ITI TF-2x: Appendix Z.8 (currently in the ITI Appendix Z on FHIR Trial Implementation Supplement). These include recommendations for secure transportation, authentication and authorization. Implementers are encouraged to review that

605 section for applicability to their product ecosystem and environment.

When WIA actors are grouped with XDS actors to access XDS-I.b infrastructure, all the XDS security requirements apply. See ITI TF-1: 10.7 for details.

610 Implementers may also consider implementing Cross-Origin Resource Sharing (CORS) (<https://www.w3.org/TR/cors/>) support to allow browser-based clients to retrieve information from distributed sources (for example, queries are performed on server A, and instances are downloaded from server B).

Deployments should consider whether or not:

- The Imaging Document Consumer performs user authentication to access patient data, or what other method is used.
- 615 • The Imaging Document Responder and Imaging Document Source use credentials supplied by the Imaging Document Consumer in the QIDO-RS Query and WADO-RS Retrieve transactions
- The Imaging Document Consumer, Imaging Document Responder or the Imaging Document Source (or all) records access in an audit log.

620 The form and granularity (patient or study level) of any audit logging by the Imaging Document Consumer, Imaging Document Responder and the Imaging Document Source are outside the scope of the WIA Profile. Use of the IHE ITI Audit Trail and Node Authentication (ATNA) Profile is recommended.

625 This profile does not define how the Imaging Document Consumer supplies credentials to the Imaging Document Responder or Imaging Document Source in order to provide the user with a seamless "single sign on" experience. The HTTP GET URL transaction allows for a range of authentication mechanisms including HTTP basic authentication (over a secure connection to protect the cleartext credentials), digest authentication, client certificate based authentication, provision of a SAML assertion in an authentication header, or other mechanisms that are suitable
630 for stateless atomic single phase transactions.

The user authentication method is outside the scope of the WIA Profile. The ITI profiles for Enterprise User Authentication (EUA) and Internet User Authorization (IUA) may be useful both for authentication of operators and for accurately logging events about those users.

635 Implementations should also consider how availability and integrity will be protected. For example, what protections will be provided against intentional attacks such as maliciously crafted query intended to interfere with proper operation.

42.6 WIA Cross Profile Considerations

42.6.1 MHD – Mobile access to Health Documents

640 An Imaging Document Consumer may be grouped with a MHD Document Consumer to query and retrieve clinical documents other than imaging manifests.

42.6.2 XDS.b – Cross-Enterprise Document Sharing

An Imaging Document Consumer may be grouped with a MHD Document Consumer that supports the XDS on FHIR Option to access clinical documents published in an XDS environment.

645 **42.6.3 XDS-I.b – Cross-Enterprise Document Sharing for Imaging**

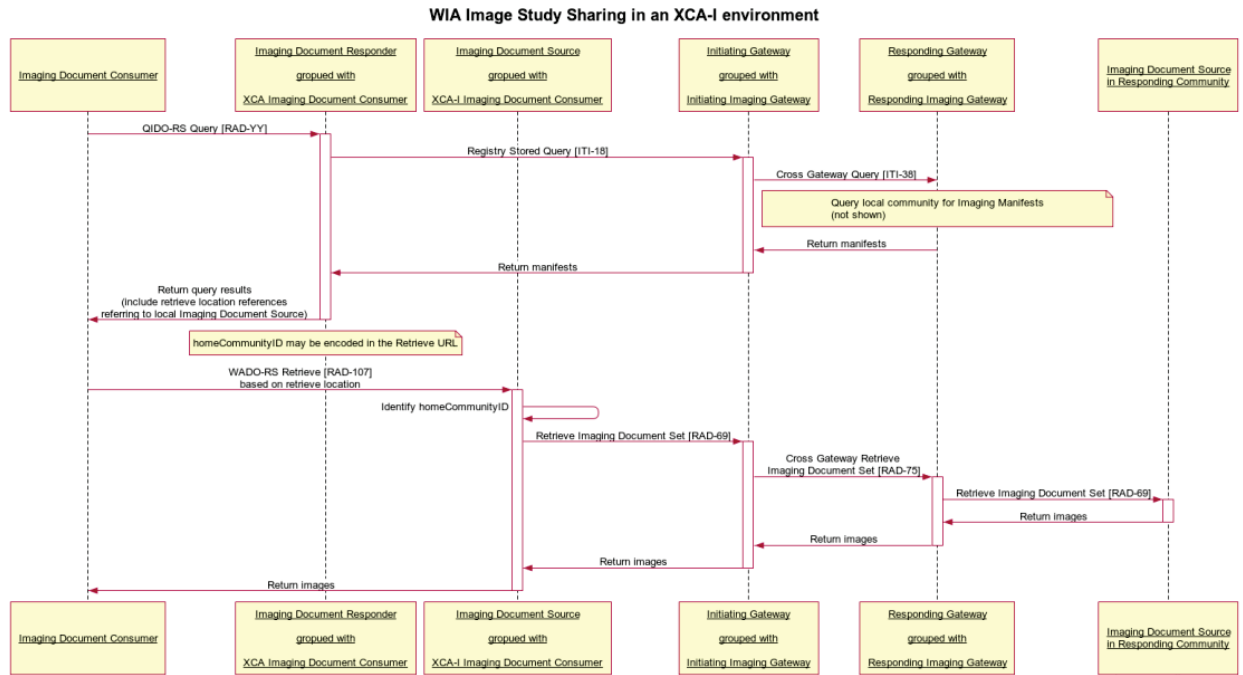
Section 42.4.2.4: Use Case #4 and Section 42.4.2.5: Use Case #5 describe how WIA Imaging Document Responder can be grouped with an XDS Document Consumer. Since XDS-I.b does not define a WADO-RS transaction, the WIA Imaging Document Consumer may not be able to directly use WADO-RS Retrieve [RAD-107] to retrieve images from an XDS-I.b Imaging Document Source, unless the XDS-I.b Imaging Document Source is also grouped with a WIA Imaging Document Source (i.e. Use Case #4), or the WIA Imaging Document Source implements the XDS-I Backend Option (i.e. Use Case #5).

650 Since XDS-I.b Imaging Document Source is not required to support any query mechanism, the Imaging Document Consumer may not be able to directly use QIDO-RS Query [RAD-YY] to query for additional metadata from an XDS-I.b Imaging Document Source, unless the XDS-I.b Imaging Document Source is also grouped with a WIA Imaging Document Responder.

42.6.4 XCA-I – Cross-Community Access for Imaging

The following diagram shows how the WIA actors can be grouped with XCA/XCA-I actors. XCA-I is an extension of XCA that supports retrieving imaging documents across communities.

660 A WIA Imaging Document Responder may be grouped with an XCA Document Consumer. This enables the Imaging Document Responder to find XDS-I manifests that exists in another community.



665

Figure 42.6.4-1: WIA Image Study Sharing in an XCA-I environment Process Flow

The text in Figure 42.6.4-2 was used to generate the diagram in Figure 42.6.4-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

670

```

title WIA Image Study Sharing in an XCA-I environment

participant Imaging Document Consumer as IDC
participant Imaging Document Responder\n\ngrouped with\n\nXCA Imaging Document
675 Consumer as IDR
participant Imaging Document Source\n\ngrouped with\n\nXCA-I Imaging Document
Consumer as IDS
participant Initiating Gateway\n\ngrouped with\n\nInitiating Imaging Gateway as
680 IIG
participant Responding Gateway\n\ngrouped with\n\nResponding Imaging Gateway as
RIG
participant Imaging Document Source\n\nin Responding Community as IDSR

IDC->+IDR: QIDO-RS Query [RAD-YY]
IDR->+IIG: Registry Stored Query [ITI-18]
IIG->RIG: Cross Gateway Query [ITI-38]
note over RIG: Query local community for Imaging Manifests\n(not shown)
RIG->IIG: Return manifests
690 IIG->-IDR: Return manifests
IDR->-IDC: Return query results\n(include retrieve location
references\nreferring to local Imaging Document Source)
note over IDR: homeCommunityID may be encoded in the Retrieve URL
IDC->+IDS: WADO-RS Retrieve [RAD-107]\nbased on retrieve location
695 IDS->IDS: Identify homeCommunityID
IDS->+IIG: Retrieve Imaging Document Set [RAD-69]
IIG->+RIG: Cross Gateway Retrieve\nImaging Document Set [RAD-75]
RIG->+IDSR: Retrieve Imaging Document Set [RAD-69]
IDSR->-RIG: Return images
700 RIG->-IIG: Return images
IIG->-IDS: Return images
IDS->-IDC: Return images

```

Figure 42.6.4-2: WIA Image Study Sharing in an XCA-I environment Process Pseudocode

Since the Imaging Document Consumer has no direct access to the Imaging Document Source in another community, the Imaging Document Responder may return a retrieve location in the QIDO-RS response that corresponds to a local Imaging Document Source proxy. When the Imaging Document Consumer issues WADO-RS Retrieve [RAD-107] to the Imaging Document Source proxy, it will translate the retrieve requests into a corresponding Retrieve Imaging Document Set [RAD-69] transaction to the Initiating Imaging Gateway.

Note that QIDO-RS Query response does not support the homeCommunityId attribute. Therefore, the Imaging Document Responder may have to rely on other methods not defined in WIA to communicate the homeCommunityId such that subsequent WADO-RS Retrieve requests received by the Imaging Document Source proxy can determine which Responding Imaging Gateway to forward the image retrieve request to. In the example above, the homeCommunityId is embedded as part of the Retrieve URL (0008,1190) in the QIDO-RS Query response.

Also note that XCA / XCA-I does not support image query like QIDO-RS between the Initiating Imaging Gateway and Responding Imaging Gateway. Therefore, it is more difficult to support the interactive viewing use case in an XCA-I environment.

42.6.5 PIX or PIXv3 or PIXm – Patient Identifier Cross-Referencing

720 For Imaging Document Responder that supports the XDS-I Backend Option, it may be grouped with a PIX Consumer to identify the affinity domain patient ID based on the patient ID provided in the QIDO-RS query.

Volume 3 – Transactions

725 *Add Section 4.107*

4.107 WADO-RS Retrieve [RAD-107]

4.107.1 Scope

The WADO-RS Retrieve transaction accesses DICOM SOP Instances via an HTTP interface.

730 For information on how to map DICOM AE Title or Retrieve Location UIDs to WADO-RS, see Appendix G.X.

4.107.2 Actor Roles

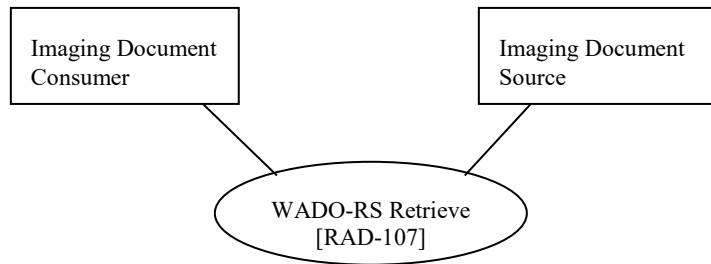


Figure 4.107.2-1: Use Case Diagram

735 The roles in this transaction are defined in the following table and may be played by the actors shown here:

Table 4.107.2-1: Actor Roles

Role:	Requester: Submit retrieve DICOM object requests
Actor(s):	The following actors may play the role of Requester: Imaging Document Consumer
Role:	Responder: Returns the requested DICOM object
Actor(s):	The following actors may play the role of Responder: Imaging Document Source

Transaction text specifies behavior for each Role. The behavior of specific actors may also be specified when it goes beyond that of the general Role.

740 **4.107.3 Referenced Standards**

RFC1738 Uniform Resource Locators (URL), <http://www.ietf.org/rfc/rfc1738.txt>

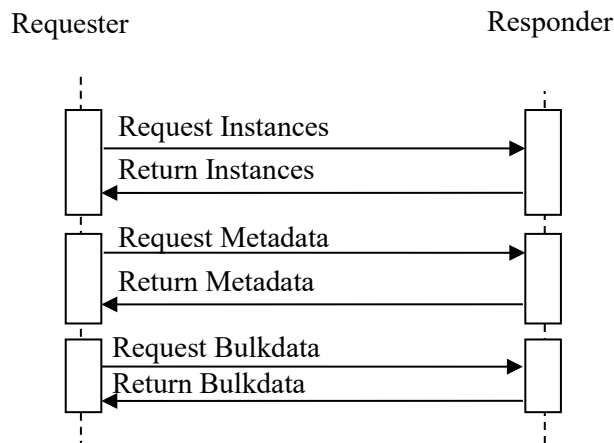
RFC2616 HyperText Transfer Protocol HTTP/1.1, <http://www.ietf.org/rfc/rfc2616.txt>

RFC4627 The application/json Media Type for JavaScript Object Notation (JSON), <http://www.ietf.org/rfc/rfc4627.txt>

745 Extensible Markup Language (XML) 1.0 (Second Edition). W3C Recommendation 6 October 2000, <http://www.w3.org/TR/REC-xml>

DICOM PS3.18: Web Services

4.107.4 Interaction Diagram



750 **4.107.4.1 Request Instances**

The Requester retrieves one or more DICOM instances from the Responder.

The Requester shall support making requests to more than one Responder. The Responder shall support handling such messages from more than one Requester.

4.107.4.1.1 Trigger Events

755 The Requester wishes to retrieve DICOM instances.

4.107.4.1.2 Message Semantics

The message is a DICOM WADO-RS request. The Requester is the User Agent, and the Responder is the Origin Server.

760 The request shall correspond to one of the WADO-RS Action Types listed in Table 4.107.4.1.2-1. The only binding required for both the Responder and the Requester is to HTTP-GET.

The Requester must already know the URI to perform this transaction.

Table 4.107.4.1.2-1: WADO-RS Action Types

Action Type	URL	Expected Response
RetrieveStudy	http://<location>/studies/<studyUID>	All instances within the specified study
RetrieveSeries	http://<location>/studies/<studyUID>/series/<seriesUID>	All instances within the specified series
RetrieveInstance	http://<location>/studies/<studyUID>/series/<seriesUID>/instances/<instanceUID>	Specified instance
RetrieveFrames	http://<location>/studies/<studyUID>/series/<seriesUID>/instances/<instanceUID>/frames/<frameList>	Specified frames within the specified instance

765 The parameters of the request are defined in Table 4.107.4.1.2-2. All path parameter names are case-sensitive.

Table 4.107.4.1.2-2: WADO-RS Request Path Parameters

Path Parameter	Description	Notes
location	The host name, an optional port address, and may be followed by an optional path	See the discussion about location in ITI TF-2a: 3.11.3.1.2 Message Semantics.
studyUID	Study Instance UID of the study to be returned.	Shall be formatted as a DICOM UID.
seriesUID	Series Instance UID of the series to be returned.	Shall be formatted as a DICOM UID.
instanceUID	SOP Instance UID of the instance to be returned.	Shall be formatted as a DICOM UID.
frameList	Frame numbers of the frames to be returned from the SOP instance.	Shall be a comma-separated list of frame numbers, in any order, of non-duplicated integers.

The request shall include the header parameters defined in Table 4.107.4.1.2-3 to indicate the type of response to return. All header names and values are case-sensitive.

770

Table 4.107.4.1.2-3: WADO-RS Request Header Parameters

Header Name	REQ	Description
Accept	R	The representation scheme being posted to the RESTful service. Accepted values depend on the request made; refer to DICOM PS3.18 for accepted types.

The Requester may perform the request to the web service utilizing HTTPS protocol.

4.107.4.1.2.1 Example of a WADO-RS Request-URI

775 The following is an example of HTTP Request-URI for retrieving a composite DICOM object using WADO-RS:

```
https://www.hospital.com/studies/1.2.250.1.59.40211.12345678.678910/series/1.2.250.1.59.40211.789001276.14556172.67789/instances/1.2.250.1.59.40211.2678810.87991027.899772.2
Accept: multipart/related; type=application/dicom
```

780

This example uses an Accept header of application/dicom to request the DICOM SOP Instance returned in the native DICOM PS3.10 file format.

4.107.4.1.3 Expected Actions

The Responder shall parse the request and return a response as described in Section 4.107.4.2.

785 The Responder shall respond using HTTPS if requested.

4.107.4.2 Return Instances

The Responder reports the outcome of the Request Instances Message.

4.107.4.2.1 Trigger Events

The Responder receives a Request Instances Message.

790 4.107.4.2.2 Message Semantics

The message shall be a DICOM WADO-RS response. The Requester is the User Agent, and the Responder is the Origin Server.

It is implemented as an HTTP response. It shall include a multipart/related media type with each part containing a DICOM instance, as requested.

795 The Responder shall provide a response message header containing the appropriate status code indicating success, warning, or failure. See DICOM PS3.18 Table 6.5-2. HTTP redirect responses to a request, specified by the HTTP 1.1 response code, are also valid.

4.107.4.2.3 Expected Actions

The Requester receives the data requested or an error response.

800 The Requester should follow redirects (responses with values of 301, 302, 303 or 307. See <https://tools.ietf.org/html/rfc7231#section-6.4> for details). Requester may return an error if a loop is detected or due to other security policy violation.

The Requester processes the returned responses in a manner that is specific to its application. IHE does not mandate application-specific behavior.

805 **4.107.4.3 Request Metadata**

The Requester retrieves metadata regarding one or more DICOM instances from the Responder.

The Requester shall support making requests to more than one Responder. The Responder shall support handling such messages from more than one Requester.

4.107.4.3.1 Trigger Events

810 The Requester wishes to retrieve metadata regarding DICOM instances.

4.107.4.3.2 Message Semantics

The message is a DICOM WADO-RS request. The Requester is the User Agent, and the Responder is the Origin Server.

815 The request shall correspond to one of the WADO-RS Action Types in Table 4.107.4.3.2-1. It is implemented as an HTTP request. The only binding required for both the Responder and the Requester is to HTTP-GET.

The Requester must already know the URI to perform this transaction.

Table 4.107.4.3.2-1: WADO-RS Action Types

Action Type	URL	Expected Response
RetrieveMetadata	http://<location>/studies/<studyUID>/metadata	All metadata within the specified study
RetrieveMetadata	http://<location>/studies/<studyUID>/series/<series UID>/metadata	All metadata within the specified series
RetrieveMetadata	http://<location>/studies/<studyUID>/series/<series UID>/instances/<instanceUID>/metadata	All metadata for a specified instance

820 The parameters of the request are defined in Table 4.107.4.1.2-2. All path parameter names are case-sensitive.

The request shall include the header parameters defined in Table 4.107.4.1.2-3 to indicate the type of response to return. All header names and values are case-sensitive.

The Requester may perform the request to the web service utilizing HTTPS protocol.

825 **4.107.4.3.2.1 Example of WADO-RS Request Metadata**

The following is an example for retrieving a composite DICOM object using WADO-RS:

```
https://www.hospital.com/studies/1.2.250.1.59.40211.12345678.678910/metadata
Accept: multipart/related; type=application/dicom+xml
```

830

This example uses an Accept header for application/dicom+xml to request the DICOM SOP Instance metadata returned in the Native DICOM Model in XML.

4.107.4.3.3 Expected Actions

The Responder shall parse the request and return responses described in Section 4.107.4.4.

835 The Responder shall respond using HTTPS if requested.

4.107.4.4 Return Metadata

The Responder reports the outcome of the Request Metadata Message.

4.107.4.4.1 Trigger Events

The Responder receives a Request Metadata Message.

840 4.107.4.4.2 Message Semantics

The message is a DICOM WADO-RS response. The Requester is the User Agent, and the Responder is the Origin Server.

It is implemented as an HTTP response. It shall include a multipart/related media type with each part containing DICOM instance metadata, as requested. It shall use the negotiated character set.

845 The Responder shall provide a response message header containing the appropriate status code indicating success, warning, or failure. See DICOM PS3.18 Table 6.5-2. HTTP redirect responses to a request, specified by the HTTP 1.1 response code, are also valid.

4.107.4.4.3 Expected Actions

The Requester receives the data requested or an error response.

850 The Requester should follow redirects (responses with values of 301, 302, 303 or 307. See <https://tools.ietf.org/html/rfc7231#section-6.4> for details). Requester may return an error if a loop is detected or due to other security policy violation.

The Requester processes the returned responses in a manner that is specific to its application. IHE does not mandate application-specific behavior.

855 4.107.4.5 Request Bulk Data

The Requester retrieves bulk data from the Responder.

The Requester shall support making requests to more than one Responder. The Responder shall support handling such messages from more than one Requester.

4.107.4.5.1 Trigger Events

860 The Requester wishes to retrieve bulk data referenced in a Native DICOM Model in XML or DICOM JSON Model document.

4.107.4.5.2 Message Semantics

The message is a DICOM WADO-RS request. The Requester is the User Agent, and the Responder is the Origin Server.

865 The request shall correspond to one of the WADO-RS Action Types listed in Table 4.107.4.5.2-1. The message is implemented as an HTTP request. The only binding required for both the Responder and the Requester is to HTTP-GET.

The Requester must already know the URI to perform this transaction.

Table 4.107.4.5.2-1: WADO-RS Action Types

Action Type	URL	Expected Response
RetrieveBulkdata	http://< bulkdataURL>	The data contained by the bulk data reference

870

The request shall include the header parameters defined in Table 4.107.4.5.2-2 to indicate the type of response to return. All header names and values are case-sensitive.

Table 4.107.4.5.2-2: WADO-RS Request Header Parameters

Header Name	REQ	Description
Accept	R	The representation scheme being posted to the RESTful service. Accepted values include: multipart/related; type=application/octet-stream multipart/related; type={MediaType}
Range	O	See RFC2616 Section 14.35. If omitted in the request the server shall return the entire bulk data object

875 The Requester may perform the request to the web service utilizing HTTPS protocol.

4.107.4.5.2.1 Example of Request Bulk Data

The following is an example of HTTP Request-URI for retrieving a composite DICOM object using WADO-RS:

880

```
https://www.hospital.com/stuff/hfslkhgkjhgkdjhdk
Accept: multipart/related; type=application/octet-stream
```

This example uses an Accept header for application/octet-stream to request uncompressed bulk data.

4.107.4.5.3 Expected Actions

885 The Responder shall parse the request and return responses as described in Section 4.107.4.6.

The Responder may return HTTP redirect responses to a request.

The Responder shall respond using HTTPS if requested.

4.107.4.6 Return Bulk Data

The Responder reports the outcome of the Request Bulk Data Message.

890 **4.107.4.6.1 Trigger Events**

The Responder receives a Request Bulk Data Message.

4.107.4.6.2 Message Semantics

The message is a DICOM WADO-RS response. The Requester is the User Agent, and the Responder is the Origin Server.

895 It is implemented as an HTTP response. It shall include a multipart/related media type with a single part containing DICOM instance bulk data, as requested.

The Responder shall provide a response message header containing the appropriate status code indicating success, warning, or failure. See DICOM PS3.18 Table 6.5-2. HTTP redirect responses to a request, specified by the HTTP 1.1 response code, are also valid.

900 **4.107.4.6.3 Expected Actions**

The Requester receives the data requested or an error response.

The Requester should follow redirects (responses with values of 301, 302, 303 or 307. See <https://tools.ietf.org/html/rfc7231#section-6.4> for details). Requester may return an error if a loop is detected or due to other security policy violation.

905 The Requester processes the returned responses in a manner that is specific to its application. IHE does not mandate application-specific behavior.

4.107.5 Security Considerations

910 User access control is managed outside of the specification of this transaction. This transaction does not specify the security environment (see RAD TF-1: 42.5 – WIA Security Considerations for profile level security considerations).

4.107.5.1 Security Audit Considerations

The Radiology Audit Trail Option in the IHE ITI Audit Trail and Node Authentication Profile (ITI TF-1:9) defines audit requirements for IHE Radiology transactions. See RAD TF-3:5.1.

915

<i>Add RAD-YY QIDO-RS Query Images transaction</i>

4.YY QIDO-RS Query Images [RAD-YY]

4.YY.1 Scope

The QIDO-RS Query Images transaction searches for DICOM study, series, instances via an HTTP interface.

920 **4.YY.2 Use Case Roles**

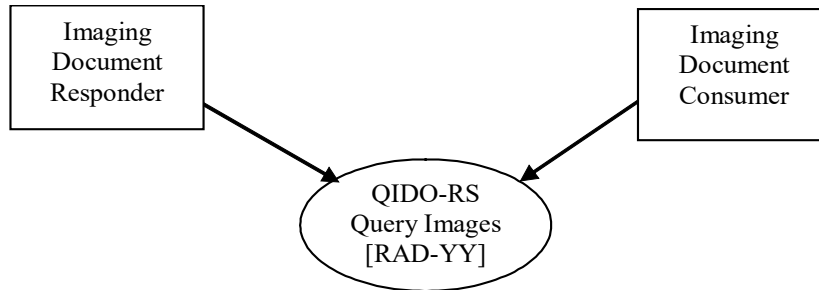


Figure 4.YY.2-1: Use Case Diagram

925 The Roles in this transaction are defined in the following table and may be played by the actors shown here:

Table 4.YY.2-1: Actor Roles

Role:	Requester: Query study metadata
Actor(s):	The following actors may play the role of Requester: Imaging Document Consumer
Role:	Responder: Returns the matching results
Actor(s):	The following actors may play the role of Responder: Imaging Document Responder

Transaction text specifies behavior for each Role. The behavior of specific actors may also be specified when it goes beyond that of the general Role.

930

4.YY.3 Referenced Standards

RFC1738 Uniform Resource Locators (URL), <http://www.ietf.org/rfc/rfc1738.txt>

RFC2616 HyperText Transfer Protocol HTTP/1.1, <http://www.ietf.org/rfc/rfc2616.txt>

935 RFC4627 The application/json Media Type for JavaScript Object Notation (JSON), <http://www.ietf.org/rfc/rfc4627.txt>

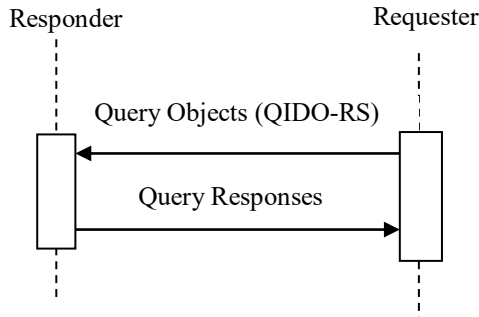
Extensible Markup Language (XML) 1.0 (Second Edition). W3C Recommendation 6 October 2000, <http://www.w3.org/TR/REC-xml>

DICOM PS3.4: Query/Retrieve Service Class

DICOM PS3.18: QIDO-RS Request/Response

940

4.YY.4 Interaction Diagram



4.YY.4.1 Query Objects

The Requester queries the Responder for studies, series or instances based on some query keys.

945

The Requester shall support making requests to more than one Responder. The Responder shall support handling such messages from more than one Requester.

4.YY.4.1.1 Trigger Events

A user or an automated function on the Requester needs to query for studies, series or instances matching various metadata parameters.

950

4.YY.4.1.2 Message Semantics

This message is a DICOM QIDO-RS request. The Requester is the User Agent. The Responder is the Origin Server.

The request shall correspond to one of the QIDO-RS Action Types listed in Table 4.YY.4.1.2-1. The only binding required for both the Responder and the Requester is to HTTP-GET.

955

Table 4.YY.4.1.2-1: QIDO-RS Action Types

Action Type	URL	Expected Response
SearchForStudies	http://<location>/studies{?query*,limit,offset}	All studies that satisfy the query parameters

Action Type	URL	Expected Response
SearchForSeries	http://<location>/studies/<studyUID>/series {?query*,limit,offset} http://<location>/series {?query*,limit,offset}	All series that satisfy the query parameters
SearchForInstances	http://<location>/studies/<studyUID>/series/<seriesUID>/instances {?query*,limit,offset} http://<location>/studies/<studyUID>/instances {?query*,limit,offset} http://<location>/instances {?query*,limit,offset}	All instances that satisfy the query parameters

Note: Support of the fuzzymatching parameter by the Responder as defined in DICOM PS3.18 is neither prohibited nor required.

960 The parameters of the request are defined in Table 4.YY.4.1.2-2. All path parameter names are case-sensitive.

Table 4.YY.4.1.2-2: QIDO-RS Request Path Parameters

Path Parameter	Description	Notes
location	The host name, an optional port address, and may be followed by an optional path	See the discussion about location in ITI TF-2a: 3.11.3.1.2 Message Semantics.
studyUID	Study Instance UID of the study to be returned.	Shall be formatted as a DICOM UID.
seriesUID	Series Instance UID of the series to be returned.	Shall be formatted as a DICOM UID.
query	<ul style="list-style-type: none"> - A set of attribute/value pairs for matching keys, or - A set of 'includefield' attributes for return keys, or - 'all' for all available attributes 	See DICOM PS3.18 Section 6.7.1.1 for details
limit	An unsigned integer specifies the maximum number of results the origin server shall return	See DICOM PS3.18 Section 6.7.1.1 for details
offset	An unsigned integer specifies the number of results the origin server shall skip before the first returned result.	See DICOM PS3.18 Section 6.7.1.1 for details

The request shall include the header parameters defined in Table 4.YY.4.1.2-3 to indicate the type of response to return. All header names and values are case-sensitive.

965

Table 4.YY.4.1.2-3: QIDO-RS Request Header Parameters

Header Name	REQ	Description
Accept	R	The representation scheme being posted to the RESTful service. Refer to DICOM PS3.18 for accepted types.

The Requester may perform the request to the web service utilizing HTTPS protocol.

The Requester uses one or more matching keys as search criteria to obtain the list of matching entries in the Responder using a selected action type.

970 The Requester shall be capable of using all search query keys defined in DICOM PS3.18 Section 6.7.1.2.1.1, 6.7.1.2.1.2, and 6.7.1.2.1.3 as matching keys and return keys. In addition, the Requester shall support Issuer of Patient ID (0010,0021) as a matching key and return key.

Note: Any given query will likely use only a subset of the keys.

975 Although Institutional Department Name is defined in the General Equipment module in DICOM PS3.3, which is a series level module, it may be used as an input to map to the \$XDSDocumentEntryPracticeSettingCode.

4.YY.4.1.2.1 Extended Study Metadata Query Option

The Requester that supports the Extended Study Metadata Query Option shall support the Query SCU requirements as defined in RAD TF-2: 4.14.4.1.2 and Table 4.14-1.

4.YY.4.1.2.2 Presentation State Query Option

980 The Requester that supports the Presentation State Query Option shall support the Query SCU requirements as defined in RAD TF-2: 4.15.4.1.2 and Table 4.15-1.

4.YY.4.1.2.3 DICOM Structured Report Query Option

The Requester that supports the Presentation State Query Option shall support the Query SCU requirements as defined in RAD TF-2: 4.26.4.1.2 and Table 4.26-1.

985 4.YY.4.1.2.4 Key Image Note Query Option

The Requester that supports the Presentation State Query Option shall support the Query SCU requirements as defined in RAD TF-2: 4.30.4.1.2 and Table 4.30-1.

4.YY.4.1.2.5 Example of a QIDO-RS Request-URI

990 The following is an example of HTTP Request-URI for querying DICOM objects instance level attributes for the study with Study Instance UID 1.2.3.4.5 using QIDO-RS:

```
https://www.hospital.com/studies/1.2.3.4.5/instances?SOPInstanceUID=1.2.3.4.5.1.1
```

995 This example does not specify an Accept header and therefore the returned results will be encoded in the DICOM JSON Results format by default.

4.YY.4.1.3 Expected Actions

The Responder shall parse the request and return a response as described in Section 4.YY.4.2.

The Responder shall respond using HTTPS if requested.

1000 The Responder shall support all search query keys defined in DICOM PS3.18 Section 6.7.1.2.1.1, 6.7.1.2.1.2, and 6.7.1.2.1.3 as matching keys and return keys. In addition, the Responder shall support Issuer of Patient ID (0010,0021) as a matching key and return key.

4.YY.4.1.3.1 XDS-I Backend Option

The Responder shall support the Registry Stored Query [ITI-18] transaction (see ITI TF-2a: 3.18).

1005 The Responder shall support the FindDocuments query and FindDocumentsByReferenceId as defined in ITI TF-2a: 3.18.4.1.2.3.7.1 and 3.18.4.1.2.3.7.14 respectively. The Responder may support other query methods defined in [ITI-18].

1010 The following requirements address mapping between the DICOM data model and XDS Document Sharing Metadata, as well as between the QIDO-RS query model and XDS Registry Stored Query [ITI-18]:

- The Responder shall support mapping QIDO-RS Query Keys to Registry Stored Query Parameters as defined in Table 4.YY.4.1.3.1-1.
- The Responder shall support all QIDO-RS Query Keys shown in Table 4.YY.4.1.3.1-1 as matching keys and return keys. This is in addition to the baseline set required in 4.YY.4.1.3.
- The Responder shall support all QIDO-RS Query Keys shown in Table 4.YY.4.1.3.1-2 as return keys.
- Since FindDocuments query and FindDocumentsByReferenceId query does not support matching on Patient Name, the Responder may ignore Patient Name as a matching key.
- The Responder may support mapping of additional QIDO-RS Query Keys but is permitted to ignore any matching keys or return keys not shown in Table 4.YY.4.1.3.1-1 or 4.YY.4.1.3.1-2. Not all DICOM Query Keys exist in the XDS Document Sharing Metadata which is organized at the study level.

1025 See RAD TF-3: 4.68.4.1.2.3.2 and 4.68.4.1.2.3.3 for information on mapping DICOM attributes to XDS Document Sharing metadata and data types.

1030

Table 4.YY.4.1.3.1-1: QIDO-RS Query Matching Keys and XDS Registry Stored Query Mapping

QIDO-RS Matching Keys	Registry Stored Query Parameter	Details
Patient ID (0010,0020) and Issuer of Patient ID (0010,0021)	\$XDSDocumentEntryPatientId	<p>The Responder shall return an error if it is unable to determine a Patient ID for the affinity domain of the XDS Document Registry. Two ways the Responder may determine the Patient ID for the affinity domain are:</p> <p>(1) from the Patient ID and Issuer of Patient ID in the QIDO-RS Query, or</p> <p>(2) from ITI PIX (or PIX v3 or PIXm).</p>
Modalities in Study (0008,0061)	\$XDSDocumentEntryEventCodeList	<p>Only single modality can be specified as a matching key. Unlike XDS Registry Stored Query, QIDO-RS does not support query semantics with multiple values as logical AND or OR. The response will include all modalities in the study.</p> <p>See Note 1</p>
Anatomic Regions in Study Code Sequence	\$XDSDocumentEntryEventCodeList	Anatomic Regions in Study Code Sequence is currently defined in DICOM CP-1690.
N/A	\$XDSDocumentEntryFormatCode	<p>Shall use “1.2.840.10008.5.1.4.1.1.88.59” (DICOM KOS SOP Class UID) as the Format Code Value and “1.2.840.10008.2.6.1” (DICOM UID Registry UID) as the Format Coding Scheme OID. The target of all QIDO-RS Queries that are mapping to XDS document query in an XDS-I environment are studies represented as DICOM Manifest documents.</p>

QIDO-RS Matching Keys	Registry Stored Query Parameter	Details
<p>Institutional Department Name (0008,1040) or Requesting Service Code Sequence (0032,1034) or Requesting Service (0032,1033)</p>	<p>\$XDSDocumentEntryPracticeSettingCode</p>	<p>\$XDSDocumentEntryPracticeSettingCode communicates the clinical specialty where the act that resulted in the document was performed (e.g. Family Practice, Laboratory, Radiology). The list of acceptable values is constrained by the organization managing the XDS Document Registry (i.e., the XDS Affinity Domain).</p> <p>There is no direct correspondence in DICOM. The Responder may be able to use Institutional Department Name, Requesting Service Code Sequence (with coded values defined in DICOM PS3.16 CID 7030) or Requesting Service to map to the appropriate practice setting code defined by the affinity domain.</p> <p>Both Requesting Service and Requesting Service Code Sequence are study level attributes. See DICOM CP-1722 for updated semantics regarding Requesting Service. However, the Practice Setting typically reflects the performing service, not the requesting service.</p>
<p>Accession Number (0008,0050) and Issuer of Accession Number Sequence (0008,0051)</p>	<p>\$XDSDocumentEntryReferenceIdList</p>	<p>If Accession Number is defined as a matching key in the QIDO-RS query, then the Responder shall use the FindDocumentsByReferenceId query. Note that to support FindDocumentsByReferenceId query, the XDS Document Registry is also required to support the Reference Id Option.</p> <p>Also the Requester might not include Issuer of Accession Number Sequence in the QIDO-RS query as a matching key. In this case, the Responder shall include the assigning authority corresponding to the Requester in \$XDSDocumentEntryReferenceIdList query parameter.</p>

QIDO-RS Matching Keys	Registry Stored Query Parameter	Details
Study Date (0008,0020) and Study Time (0008,0030)	\$XDSDocumentEntryServiceStartTimeFrom \$XDSDocumentEntryServiceStartTimeTo	If Study Date and Study Time is specified as single value, then the Responder shall map the value to \$XDSDocumentEntryServiceStartTimeFrom. See ITI TF-2a: Section 3.18.4.1.2.3.3. QIDO-RS supports range matching for Study Date and Study Time, while XDS Registry Stored Query defines two separate query parameters for time range. Therefore, the Responder shall extract the beginning of the range matching constraint (if specified) as \$XDSDocumentEntryServiceStartTimeFrom, and the end of the range matching constraint (if specified) as \$XDSDocumentEntryServiceStartTimeTo. Note that QIDO-RS uses Combined Datetime matching semantics. See DICOM PS3.18 Section 6.7.1.2.1.
Procedure Code Sequence (0008,1032)	\$XDSDocumentEntryTypeCode	
N/A	\$XDSDocumentEntryStatus	\$XDSDocumentEntryStatus shall have the value of “urn:oasis:names:tc:ebxml-regrep:StatusType:Approved”. The Responder may include additional values in \$XDSDocumentEntryStatus based on local requirement and business logic.
N/A	\$XDSDocumentEntryClassCode	Use the appropriate value for imaging study defined by the affinity domain.

1035

Note 1: The original Requester may want to find studies with a specific combination of modalities. Since the Requester can only ask the Responder for a single modality, the Requester will need to use one of the modalities as a matching key, and then locally filter the results by looking for the second modality in Modalities in Study (0008,0061). Alternatively, one may send multiple queries, one per modality, and compare the results.

The Responder shall use Table 4.YY.4.1.3.1-2 to map the Registry Stored Query response attributes into the QIDO-RS response.

1040

Table 4.YY.4.1.3.1-2: QIDO-RS Query Return Keys and XDS Registry Stored Query Response Mapping

QIDO-RS Return Keys	Registry Stored Query Response Attribute	Details
Institution Name (0008,0080)	DocumentEntry.author.authorInstitution	If there are multiple authorInstitutions returned, the Responder is responsible for resolving what to put in Institution Name.

QIDO-RS Return Keys	Registry Stored Query Response Attribute	Details
Patient's Name (0010,0010)	DocumentEntry.sourcePatientInfo	Patient's Name might be available in the sourcePatientInfo attribute.
Patient's Birth Date (0010,0030)	DocumentEntry.sourcePatientInfo	Patient's Birth Date might be available in the sourcePatientInfo attribute.
Patient's Sex (0010,0040)	DocumentEntry.sourcePatientInfo	Patient's Sex might be available in the sourcePatientInfo attribute.

4.YY.4.1.3.2 Extended Study Metadata Query Option

1045 The Responder that supports the Extended Study Metadata Query Option shall support the Query SCP requirements as defined in RAD TF-2: 4.14.4.1.2 and Table 4.14-1.

4.YY.4.1.3.3 Presentation State Query Option

The Responder that supports the Presentation State Query Option shall support the Query SCP requirements as defined in RAD TF-2: 4.15.4.1.2 and Table 4.15-1.

4.YY.4.1.3.4 DICOM Structured Report Query Option

1050 The Responder that supports the Presentation State Query Option shall support the Query SCP requirements as defined in RAD TF-2: 4.26.4.1.2 and Table 4.26-1.

4.YY.4.1.3.5 Key Image Note Query Option

The Responder that supports the Presentation State Query Option shall support the Query SCP requirements as defined in RAD TF-2: 4.30.4.1.2 and Table 4.30-1.

1055 **4.YY.4.2 Query Responses**

The Responder reports the outcome of the Query Objects Message.

4.YY.4.2.1 Trigger Events

The Responder receives a Query Objects Message.

4.YY.4.2.2 Message Semantics

1060 The message is a DICOM QIDO-RS response. The Requester is the User Agent, and the Responder is the Origin Server.

The Responder shall construct a response message as specified in DICOM PS3.18 Section 6.7.1.2.

1065 It is the responsibility of the Responder to ensure that the patient and procedure information is current in the query results.

4.YY.4.2.3 Expected Actions

The Requester receives the matching query results or an error response.

1070 The Requester should follow redirects (responses with values of 301, 302, 303 or 307. See <https://tools.ietf.org/html/rfc7231#section-6.4> for details). Requester may return an error if a loop is detected or due to other security policy violation.

The Retrieve URL (0008,1190) attribute in the query results may be used to initiate subsequent WADO-RS Retrieve requests. The Requester may modify the URL if needed.

4.YY.5 Security Considerations

1075 User access control is not specified by this transaction. This transaction does not specify the security environment (see RAD TF-1: 42.5 – WIA Security Considerations for profile level security considerations).

1080 QIDO-RS Query response includes the Retrieve URL (0008,1190) which specifies where the corresponding objects can be retrieved. In the absence of protection, such as TLS, a malicious attacker may intercept the response and rewrite the Retrieve URL. A Requester should verify if the Retrieve URL is a valid URL corresponding to known Imaging Document Sources.

4.YY.5.1 Security Audit Considerations

The Radiology Audit Trail Option in the IHE ITI Audit Trail and Node Authentication Profile (ITI TF-1:9) defines audit requirements for IHE Radiology transactions. See RAD TF-3:5.1.

Add the following row to RAD TF-3: Table 5.1-2

1085 **Table 5.1-2: IHE Radiology transactions and resulting ATNA trigger events**

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Patient Registration [RAD-1]	Patient-record-event	ADT Order Placer, DSS/OF – when PHI is presented
...		
<u>WADO-RS Retrieve [RAD-107]</u>	<u>Instance-Stored</u>	<u>Imaging Document Source</u>
<u>QIDO-RS Query [RAD-YY]</u>	<u>Query</u>	<u>Imaging Document Source</u>

Appendices

Add Appendix X to RAD TF-3.

Appendix X – WIA Profile Examples (Informative)

1090 This appendix contains examples of the transactions in the Web-based Image Access (WIA) Profile, and is informative only.

X.1 Query for Study Metadata

The client application needs to know what studies are available for patient with Patient ID 123. It issues QIDO-RS Query [RAD-YY].

1095 GET https://radiology.hospital.com/qido-rs/studies?PatientID=12345&includefield=NumberOfStudyRelatedSeries&includefield=NumberOfStudyRelatedInstances HTTP/1.1
Accept: application/dicom+json

The response from this request is:

1100 Note: the comments are included for illustration purpose only. They are legal JSON constructs and are not included in a proper query response.

1105 HTTP/1.1 200 OK
Content-Type: application/dicom+json

```
[
  {
    "00080005": { // Specific Character Set
      "vr": "CS",
      "Value": [
1110         "ISO_IR192"
      ]
    },
    "00080020": { // Study Date
      "vr": "DT",
1115       "Value": [
          "20170405"
        ]
    },
    "00080030": { // Study Time
```

```

1120         "vr": "TM",
           "Value": [
             "152900.0000"
           ]
         },
1125     "00080050": { // Accession Number
           "vr": "SH",
           "Value": [
             "1619823"
           ]
1130     },
     "00080056": { // Instance Availability
           "vr": "CS",
           "Value": [
             "ONLINE"
1135         ]
         },
         "00080061": { // Modality in Study
           "vr": "CS",
           "Value": [
1140             "CT"
           ]
         },
         "00080090": { // Referring Physician's Name
           "vr": "PN",
1145         "Value": [
           {
             "Alphabetic": {
               "Family": [
                 "Brown"
1150             ],
               "Given": [
                 "Larry"
               ]
             }
           }
         ]
       }
     }

```

```

1155         }
           ]
         },
         "00081190": { // Retrieve URL
1160             "vr": "UT",
                 "Value": [
                     " https://radiology.hospital.com/wado-
rs/studies/1.2.250.1.59.40211.12345678.678910"
                 ]
         },
1165     "00100010": { // Patient's Name
                 "vr": "PN",
                 "Value": [
                     {
1170                         "Alphabetic": {
                                 "Family": [
                                     "WALLACE"
                                 ],
                                 "Given": [
                                     "PETE"
1175                                 ]
                             }
                         }
                 ]
         },
1180     "00100020": { // Patient ID
                 "vr": "LO",
                 "Value": [
                     "12345"
                 ]
         },
1185     },
         "00100030": { // Patient's Birth Date
                 "vr": "DT",
                 "Value": [
                     "19740701"
                 ]
         }
     ]
 }

```

```

1190     ]
        },
        "00100040": { // Patient's Sex
            "vr": "CS",
1195            "Value": [
                "M"
            ]
        },
        "0020000D": { // Study Instance UID
            "vr": "UI",
1200            "Value": [
                "1.2.250.1.59.40211.12345678.678910"
            ]
        },
        "00200010": { // Study ID
1205            "vr": "SH",
            "Value": [
                "1619823"
            ]
        },
1210        "00201206": { // Number of Study Related Series
            "vr": "IS",
            "Value": [
                4
            ]
1215        },
        "00201208": { // Number of Study Related Instances
            "vr": "IS",
            "Value": [
                500
1220            ]
        }
    }
}
]

```

X.2 Retrieve DICOM Instances

1225 The client receives a high level description of the study and a study level WADO-RS URL. The client can proceed with retrieving the full study by executing the WADO-RS URL as specified in the Retrieve URL (0008,1190) attribute. The client can also include additional parameters in the request, for example, request the image returned as image/jpeg instead of default application/dicom.

1230 This results in the following URL:

```
GET https://radiology.hospital.com/wado-  
rs/studies/1.2.250.1.59.40211.12345678.678910 HTTP/1.1  
Accept: image/jpeg
```

1235 The response from this request is:

```
HTTP/1.1 200 OK  
Content-Type: image/jpeg  
  
<binary image data>
```

1240