Integrating the Healthcare Enterprise

IHE

IHE Radiology
Technical Framework Supplement

Web-based Image Access
(WIA)

Rev. 1.3 − Trial Implementation

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Foreword

30   This is a supplement to the IHE Radiology Technical Framework V21.0. 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 for Trial Implementation on June 15, 2023 and may be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the
35   results of testing. Following successful testing it will be incorporated into the Radiology Technical Framework. Comments are invited and may be submitted at https://www.ihe.net/Radiology_Public_Comments.

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
40   relevant section(s) into the relevant Technical Framework volume.

Amend Section X.X by the following:

Where the amendment adds text, make the added text **<u>bold underline</u>**. 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
45   bolded or underlined.

General information about IHE can be found at IHE.net.

Information about the IHE Radiology domain can be found at IHE Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the
50   process used to create them can be found at Profiles and IHE Process

The current version of the Radiology Technical Framework can be found at Radiology Technical Framework.

55 **CONTENTS**

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.

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.

For readers familiar with MHD-I, the original design of MHD-I depended 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 different imaging sharing backends (e.g., XDS-I, DICOM/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 reflect the fact that the profile no longer depends on MHD.

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 FHIR activities are working together to revise and enhance the transactions profiled here"), rather than creating the query and retrieve manifest transactions in this profile?** 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?** 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.
3.	**Should QIDO-RS be included in this profile?** Yes, QIDO-RS is added to support advanced image viewer use cases.
4.	**Should WADO-RS or WADO-URI be mandatory?** WIA only supports WADO-RS since QIDO-RS only specifies WADO-RS URL in the Retrieve URL attribute.

#	Issue / Answer
5.	**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.
6.	**Should we incorporate DICOM CP 1352 regarding series and instance level metadata queries in metadata queries of WADO-RS?** Yes, this has been incorporated.
7.	**Should we incorporate DICOM CP 1351 regarding retrieving WADO-RS metadata in JSON?** Yes, this has been incorporated.
8.	**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. WIA does not specify a JSON Imaging Manifest anymore and does not depend on XDS-I manifest. A separate CP should be created to add WADO-RS to XDS-I.b and any other relevant profiles.
9.	**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?** WIA no longer depends on MHD to query for XDS-I manifest and therefore there is no more WIA specific requirement on the MHD response. 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.
10.	**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?** Cross-community access is outside the scope of WIA. QIDO-RS and WADO-RS does not support a similar concept as homeCommunityId.
11.	**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].
12.	**Should MHD-I return 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.
13.	**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?** Yes, XDS-I Backend Option supports the same semantics as the baseline QIDO-RS semantics. Therefore XDS-I Backend Option is not limited to study level query. However, Requesting Service Code Sequence (0032,1034), which is defined in the General Study Module in DICOM PS3.3, is used to map to $XDSDocumentEntryPracticeSettingCode. As a result, it is possible to use a study level QIDO-RS query to search on Practice Setting Code.

#	Issue / Answer
14.	**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?** Instance level and Image level attributes defined in RAD-14 are generally enough. For more specific attributes, WADO-RS supports retrieving full metadata of an object.
15.	**Is MHD Integration Option necessary? Or just leave it as cross-profile consideration?** Yes, it is necessary. It highlights how a MHD Document Consumer can use the information from the DocumentReference in Find Document Reference response to initiate subsequent QIDO-RS or WADO-RS requests. Also, it enables testing at Connectathon and vendors can claim to support this in their IHE Integration Statement.
16.	**Should actors in WIA have mandatory grouping of Secure Node / Secure Application in ATNA?** Recommended use of the IHE ITI Audit Trail and Node Authentication (ATNA) Profile is recommended. This is consistent with ITI Appendix Z and other Radiology profiles.
17.	**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?** Requesting Service Code Sequence is defined to map to $XDSDocumentEntryPracticeSettingCode in XDS-I Backend Option. The Practice Setting Code mapping defined in RAD-68 is consistent with the code (PS3.16 CID 7030) defined for Requesting Service Code Sequence.
18.	**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?** Requesting Service Code Sequence is defined to map to $XDSDocumentEntryPracticeSettingCode in XDS-I Backend Option. The Practice Setting Code mapping defined in RAD-68 is consistent with the code (PS3.16 CID 7030) defined for Requesting Service Code Sequence.
19.	**Should the semantics defined in the XDS-I Backend Option be actually defined in ITI XDS Registry Stored Query [ITI-18]?** The mapping is specific for imaging and should be defined in WIA rather than in ITI-18. A table is added to provide requirements for mapping QIDO-RS to XDS Registry Stored Query [ITI-18] mapping.
20.	**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?** No options for different objects types. The Imaging Document Consumer may support them, and the Imaging Document Responder is required to support these object types.
21.	**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**. Yes, this is consistent with ITI and Rad audit requirements on other transactions.

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History of Changes (as of June 2023)

Date	Document Revision	Change Summary
June 2023	1.3	Updated by CP-RAD-468 and CP-RAD-499. Refer to IHE Radiology's Incorporated CPs.

185 **IHE Technical Frameworks General Introduction**

The [IHE Technical Framework General Introduction](#) is shared by all of the IHE domain technical frameworks. Each technical framework volume contains links to this document where appropriate.

9   Copyright Licenses

190 IHE technical documents refer to, and make use of, a number of standards developed and published by several standards development organizations. Please refer to the IHE Technical Frameworks General Introduction, [Chapter 9 - Copyright Licenses](#) for copyright license information for frequently referenced base standards. Information pertaining to the use of IHE International copyrighted materials is also available there.

195 ## 10 Trademark

IHE® and the IHE logo are trademarks of the Healthcare Information Management Systems Society in the United States and trademarks of IHE Europe in the European Community. Please refer to the IHE Technical Frameworks General Introduction, [Chapter 10 - Trademark](#) for information on their use.

200 IHE Technical Frameworks General Introduction Appendices

The IHE Technical Framework General Introduction Appendices are components shared by all of the IHE domain technical frameworks. Each technical framework volume contains links to these documents where appropriate.

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205 | *Update the following appendices to the General Introduction as indicated below. Note that these are **not** appendices to this domain's Technical Framework (TF-1, TF-2, TF-3 or TF-4) but rather, they are appendices to the IHE Technical Frameworks General Introduction located here.*

210 Appendix A – Actors

*Add the following **new or modified** actors to the IHE Technical Frameworks General Introduction Appendix A:*

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

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Appendix B – Transactions

*Add the following **new or modified** transactions to the IHE Technical Frameworks General Introduction Appendix B:*

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New (or modified) Transaction Name and Number	Definition
WADO-RS Retrieve [RAD-107]	The WADO-RS Retrieve transaction accesses DICOM SOP Instances via an HTTP interface.
QIDO-RS Query [RAD-129]	Query based on ID for DICOM Objects by RESTful Services.

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Appendix D – Glossary

*Add the following **new or modified** glossary terms to the IHE Technical Frameworks General Introduction Appendix D:*

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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

42 Web-based Image Access Profile

235 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.
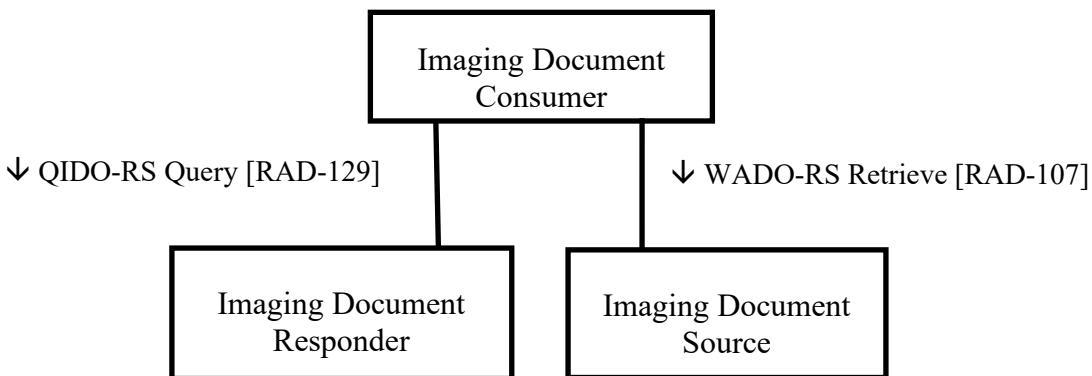
A consumer, such as an enterprise viewer, can retrieve metadata about studies from a PACS, VNA, etc. and then it can retrieve the images and display to the user, all using RESTful services.

WIA can be used independently or combined with other profiles such as the IT Infrastructure domain's Mobile access to Health Document (MHD) Profile. When combined with MHD, it
240 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
245 http://ihe.net/Technical_Frameworks.

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.

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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").

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Table 42.1-1: WIA-RS Profile - Actors and Transactions

Actors	Transactions	Initiator or Responder	Optionality	TF Reference
Imaging Document Consumer	WADO-RS Retrieve [RAD-107]	Initiator	R	RAD TF-2: 4.107
	QIDO-RS Query [RAD-129]	Initiator	R	RAD TF-2: 4.129
Imaging Document Responder	QIDO-RS Query [RAD-129]	Responder	R	RAD TF-2: 4.129
Imaging Document Source	WADO-RS Retrieve [RAD-107]	Responder	R	RAD TF-2: 4.107

42.1.1 WIA Actor Descriptions and Actor Profile Requirements

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

260 #### 42.1.1.1 Imaging Document Consumer

The Imaging Document Consumer requests imaging study metadata from an Imaging Document Responder using the QIDO-RS Query [RAD-129] transaction. Using these results, the Imaging Document Consumer determines which images are needed for their application. The Imaging Document Consumer can issue a WADO-RS Retrieve [RAD-107] transaction to the Imaging 265 Document Source to either retrieve detailed metadata or the objects.

42.1.1.2 Imaging Document Responder

The Imaging Document Responder receives a QIDO-RS Query [RAD-129] transaction request from the Imaging Document Consumer and returns matching imaging study metadata. This includes a URL that can be used by the Imaging Document Consumer to retrieve the detailed 270 metadata or objects from the Imaging Document Source using the WADO-RS Retrieve [RAD-107] transaction.

42.1.1.3 Imaging Document Source

The Imaging Document Source receives a WADO-RS Retrieve [RAD-107] transaction request from an Imaging Document Consumer to retrieve the detailed metadata or objects.

275 ## 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: Web-based Image Access - Actors and Options

Actor	Option Name	TF Reference
Imaging Document Consumer	XDS-I Backend Option	Section 42.2.1
	MHD Document Consumer Integration Option	Section 42.2.2
Imaging Document Responder	XDS-I Backend Option	Section 42.2.1
Imaging Document Source	XDS-I Backend Option	Section 42.2.1

280 **42.2.1 XDS-I Backend Option**

The XDS-I Backend Option accesses imaging studies within an XDS-I infrastructure.

An **Imaging Document Consumer** can select the appropriate endpoint for the desired behavior.

An Imaging Document Consumer shall:

- Support the requirements defined in RAD TF-2: 4.129.4.1.2.1.

285 An **Imaging Document Responder** can find imaging manifests from an XDS-I environment and generate the corresponding imaging study metadata query response. By implementing this option, the Imaging Document Responder can support interactive viewing in an XDS-I environment (see Use Case #4 in Section 42.4.2.4).

An Imaging Document Responder shall:

290 - Be grouped with an XDS.b Document Consumer.

- Support the requirements defined in RAD TF-2: 4.129.4.1.3.1.

- Provide a separate endpoint that services a QIDO-RS query supporting the XDS-I Backend Option behavior.
Note: This profile does not specify how endpoints are communicated to the Imaging
295 Document Consumer.

An **Imaging Document Source** can retrieve imaging studies from an XDS-I Imaging Document Source and return the imaging studies to the Imaging Document Consumer. By implementing this option, the Imaging Document Source can support interactive viewing in an XDS-I environment (see Use Case #4 in Section 42.4.2.4).

300 An Imaging Document Source shall:

- Be grouped with an XDS-I.b Imaging Document Consumer.

42.2.2 MHD Document Consumer Integration Option

The MHD Document Consumer Integration Option enables an Imaging Document Consumer to follow imaging study document references found in MHD responses to retrieve the study without
305 retrieving the XDS-I Imaging Manifest.

An Imaging Document Consumer can then access the referenced imaging studies using the retrieved document references (see Use Case #3 in Section 42.4.2.3).

The Imaging Document Consumer shall be grouped with an MHD Document Consumer.

310 The grouped MHD Document Consumer will find a document reference for an XDS-I Imaging Manifest in the Find Document References [ITI-67] response. In that document reference, a `DocumentReference.context.related.identifier.value` may be present with an Accession Number or a Study Instance UID needed to execute the QIDO-RS Query [RAD-129] request. If not present, the MHD Document Consumer shall retrieve the XDS-I Imaging Manifest using the Retrieve Document [ITI-68] transaction to locate these values.

315 Note: For more information on identifier coding, see ITI TF-2: Appendix Z Section 9.1.2 - XDS CXi mapped to FHIR Identifier Type.

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.

320 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.

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

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

42.4 WIA Overview

325 ### 42.4.1 Concepts

42.4.1.1 Image sharing infrastructures

WIA enables retrieval of imaging studies 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.

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

- 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 the Query Images [RAD-14] transaction.

- 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 Registry Stored Query [ITI-18] transaction as well as translate the response back.

As a result, the Imaging Document Consumer can find imaging studies from an Imaging Document Responder using a consistent mechanism, regardless of whether the imaging study is published to an XDS or non-XDS environment.

Similarly, the Imaging Document Source returns imaging studies in response to retrieve requests. The source of the imaging studies is not constrained, and several models are possible. The Imaging Document Source can retrieve imaging studies from sources such as:

- Image Manager/Image Archive: The Imaging Document Source 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 the Retrieve Images [RAD-16] transaction.

- XDS-I Imaging Document Source: The Imaging Document Source can have direct access to the XDS-I Imaging Document Source, or it can communicate with one or more XDS-I Imaging Document Sources via retrieval mechanisms defined in XDS-I.

As a result, the Imaging Document Consumer can retrieve imaging studies from an Imaging Document Source using a consistent mechanism, regardless of whether the imaging study is published to an XDS-I or non-XDS-I environment.

42.4.1.2 Imaging Reports

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, XDS Profile, or other means.

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 enabling the MHD Document Consumer to interact with imaging studies. For details, see Section 42.2.2.

42.4.1.3 QIDO-RS and WADO-RS URL

When the Imaging Document Responder returns a QIDO-RS response, the Retrieve URL (0008,1190) specifies the WADO-RS URL that the Imaging Document Consumer can use for subsequent retrieval. The WADO-RS URL is expected to be a base WADO-RS URL (i.e., without any sub-resources or parameters) that enables the Imaging Document Consumer to retrieve the content. The Imaging Document Consumer may want to modify the WADO-RS

URL. For example, it may modify the URL to retrieve a rendered object instead of the DICOM object itself, provided the Imaging Document Source supports the optional rendering transaction.

42.4.2 Use Cases
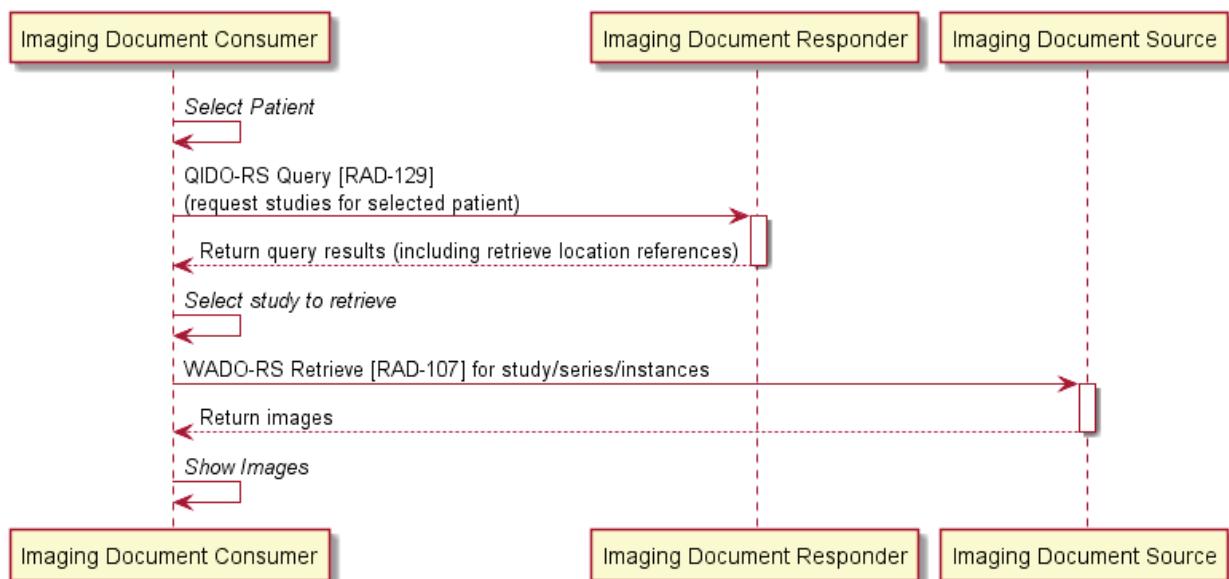
42.4.2.1 Use Case #1: Image Study Sharing

42.4.2.1.1 Image Study Sharing Use Case Description

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A radiologist, using a mobile or desktop device, has been asked to have a quick review of some images of a patient. In her EMR client, she looks up the patient details. She would like to discover what studies are available for her patient within and across the enterprises. The Imaging Document Consumer embedded in the EMR client queries the Imaging Document Responder for

380 her patient using the patient's identifier provided by the EMR client. The Imaging Document Responder returns a response with multiple entries, one per matching study. She then selects one study; her device retrieves the instances via WADO-RS and renders them for display.

Examples for QIDO-RS and WADO-RS are in WIA_Profile_Examples.docx. See https://drive.google.com/drive/folders/1GGwVV6cFzFiYlZT4YZg7loBs6sXEGGM0.

385 **42.4.2.1.2 Image Study Sharing Process Flow**

Figure 42.4.2.1.2-1: Image Study Sharing Diagram

390 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.

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```
@startuml
'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-129]\n(request studies for selected patient)
activate IDR
IDR-->IDC: Return query results (including retrieve location references)
deactivate IDR

IDC->IDC: //Select study to retrieve//

IDC->IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
activate IDS
IDS-->IDC: Return images
deactivate IDS

IDC->IDC: //Show Images//
@enduml
```

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Figure 42.4.2.1.2-2: Imaging Study Sharing Diagram Pseudocode

42.4.2.2 Use Case #2: Interactive Viewing
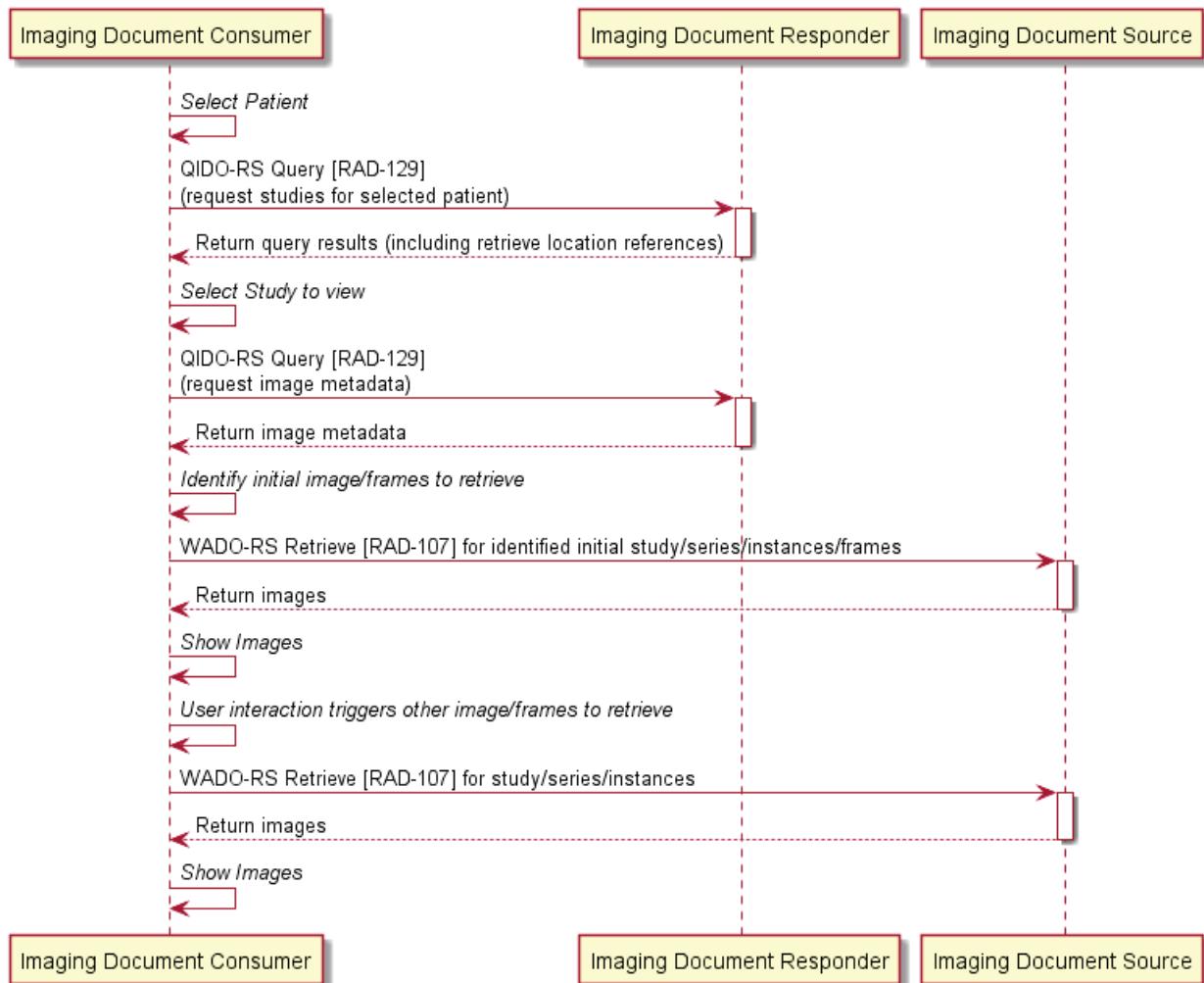
42.4.2.2.1 Interactive Viewing Use Case Description

A radiologist, using a mobile or desktop device, has been asked to have a quick review of some
420   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.

The Imaging Document Consumer embedded in the EMR client queries the Imaging Document
Responder for his patient using the patient's identifier provided by the EMR client. To view the
study, the viewer uses QIDO-RS to query for additional image metadata in order to determine
425   which objects to retrieve for the initial view. In some cases, the viewer also uses WADO-RS to
retrieve full object metadata for advanced image viewing. Once the viewer determines what
images to retrieve based on the metadata, it 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.

430 **42.4.2.2.2 Interactive Viewing Process Flow**

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
435 will generally find the diagram more informative. The text is included here to facilitate editing.

```
@startuml
'title Interactive Viewing

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-129]\n(request studies for selected patient)
activate IDR
IDR-->IDC: Return query results (including retrieve location references)
deactivate IDR

IDC->IDC: //Select Study to view//
IDC->IDR: QIDO-RS Query [RAD-129]\n(request image metadata)
activate IDR
IDR-->IDC: Return image metadata
deactivate IDR

IDC->IDC: //Identify initial image/frames to retrieve//
IDC->IDS: WADO-RS Retrieve [RAD-107] for identified initial
study/series/instances/frames
activate IDS
IDS-->IDC: Return images
deactivate IDS
IDC->IDC: //Show Images//

IDC->IDC: //User interaction triggers other image/frames to retrieve//
IDC->IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
activate IDS
IDS-->IDC: Return images
deactivate IDS

IDC->IDC: //Show Images//
@enduml
```

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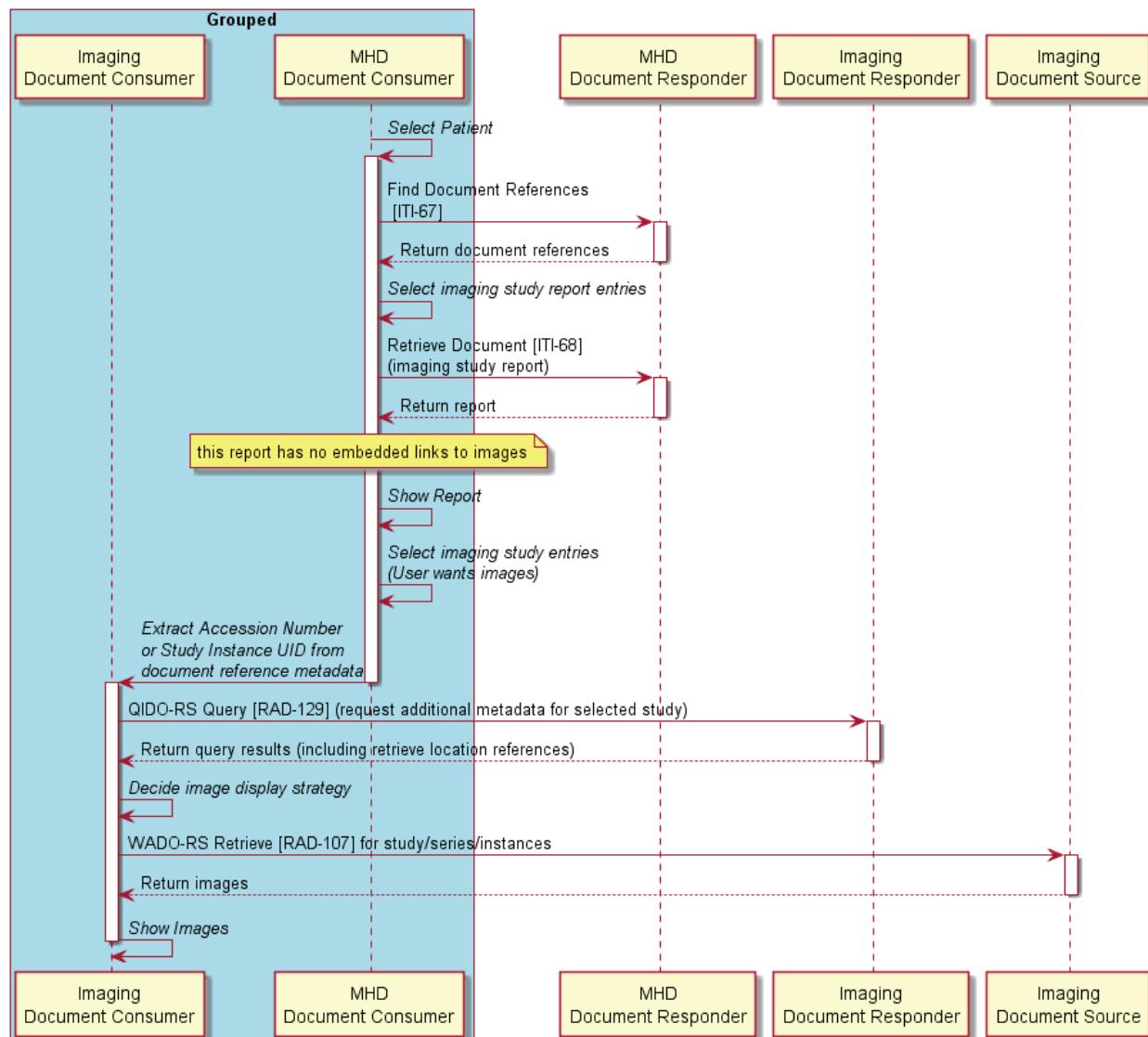
Figure 42.4.2.2.2-2: Interactive Viewing Diagram Pseudocode

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

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A radiologist, using a mobile or desktop device, has been asked to have a quick review of some clinical documents of a patient. In her EMR client, she looks up the patient details to discover what documents are available for her patient. The Imaging Document Consumer embedded in the EMR client queries the Imaging Document Responder for her patient using the patient's identifier and discovers several document references, some of them corresponding to imaging studies (e.g., XDS-I Imaging Manifests). She then selects one of the imaging study references which trigger her device to query for additional imaging study metadata that includes the retrieve

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location references. With this information, her device is able to retrieve the instances via WADO-RS and render them for display.

485   In this use case, the report has no embedded links to the relevant images. In other cases, if the report includes embedded links to relevant images, then the viewer can execute those links (may be WADO-RS or may be proprietary) to retrieve the images.

42.4.2.3.2 MHD Document Consumer Accessing Imaging Study Process Flow

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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.

```
@startuml
'title MHD Document Consumer accessing imaging study

box "Grouped" #LightBlue
participant "Imaging\nDocument Consumer" as IDC
participant "MHD\nDocument Consumer" as MDC
end box

participant "MHD\nDocument Responder" as MDR
participant "Imaging\nDocument Responder" as IDR
participant "Imaging\nDocument Source" as IDS

MDC->MDC: //Select Patient//

activate MDC
MDC->MDR: Find Document References\n [ITI-67]
activate MDR
MDR-->MDC: Return document references
deactivate MDR

MDC->MDC: //Select imaging study report entries//

MDC->MDR: Retrieve Document [ITI-68]\n(imaging study report)
activate MDR
MDR-->MDC: Return report
deactivate MDR

note over MDC: this report has no embedded links to images
MDC->MDC: //Show Report//

MDC->MDC: //Select imaging study entries//\n//(User wants images)//
MDC->IDC: //Extract Accession Number//\n//or Study Instance UID
from//\n//document reference metadata//
deactivate MDC

activate IDC
IDC->IDR: QIDO-RS Query [RAD-129] (request additional metadata for selected
study)
activate IDR
IDR-->IDC: Return query results (including retrieve location references)
deactivate IDR

IDC->IDC: //Decide image display strategy//

IDC->IDS: WADO-RS Retrieve [RAD-107] for study/series/instances
activate IDS
IDS-->IDC: Return images
deactivate IDS

IDC->IDC: //Show Images//
deactivate IDC
@enduml
```

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

### 42.4.2.4.1 Interactive Viewing in XDS-I environment 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 and discovers what imaging studies are available for his patient. The Imaging Document Consumer embedded in the EMR client queries the Imaging Document Responder for his patient using the patient's identifier provided by the EMR client. The Imagining Document Responder queries the XDS environment for imaging manifest, composes the results, and returns them to the client. He then selects one or more imaging studies and starts interactive viewing as defined in Use Case #2.
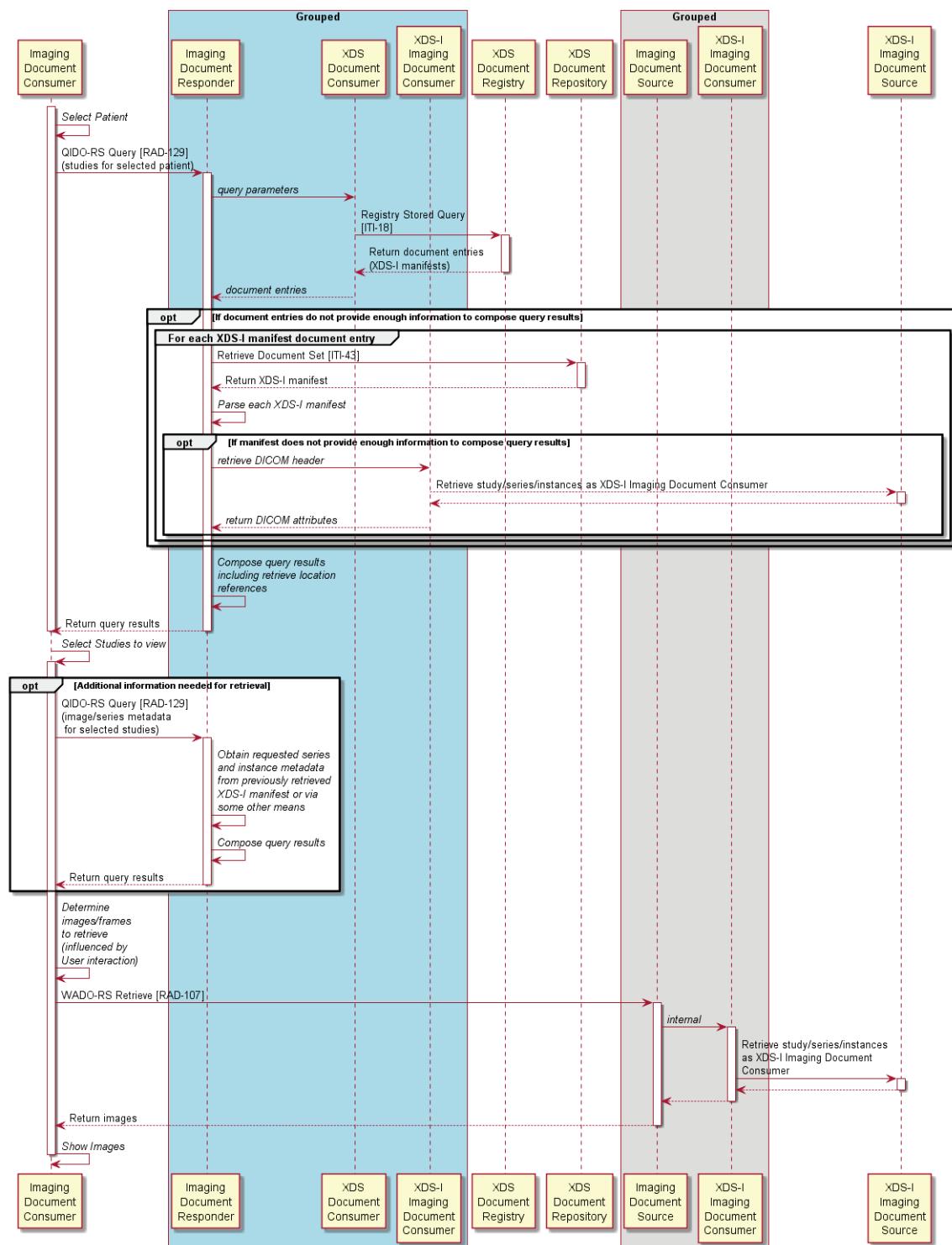
In order to support this use case, the Imaging Document Responder is required to support the XDS-I Backend Option. This allows the Imaging Document Responder to access the XDS environment to query for the imaging study metadata and process the XDS-I Imaging Manifest used in the workflow.

Note: In some cases, the Imaging Document Responder may retrieve the XDS-I Imaging Manifest and/or DICOM header to obtain the necessary information to respond to the query.

The Imaging Document Source may optionally implement the XDS-I Backend Option. This grouping with the optional XDS-I Imaging Document Consumer allows the Imaging Document Source to retrieve imaging studies from an XDS-I Imaging Document Source.

Alternatively, the Imaging Document Source may be grouped with an XDS-I Imaging Document Source (not shown in the diagram). As a result, the Imaging Document Source has direct access to the imaging studies without relying on the grouped XDS-I Imaging Document Consumer to retrieve the studies.

570   **42.4.2.4.2 Interactive Viewing in XDS-I environment 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.

575

```
@startuml

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

participant "Imaging\nDocument\nConsumer" as IDC

box "Grouped" #LightBlue
participant "Imaging\nDocument\nResponder" as IDR
participant "XDS\nDocument\nConsumer" as DCon
participant "XDS-I\nImaging\nDocument\nConsumer" as XIDC0
end box

participant "XDS\nDocument\nRegistry" as DReg
participant "XDS\nDocument\nRepository" as DRepo

box "Grouped"
participant "Imaging\nDocument\nSource" as IDS
participant "XDS-I\nImaging\nDocument\nConsumer" as XIDC
end box

participant "XDS-I\nImaging\nDocument\nSource" as XIDS

activate IDC
IDC->IDC: //Select Patient//
IDC->IDR: QIDO-RS Query [RAD-129]\n(studies for selected patient)
activate IDR
IDR->DCon: //query parameters//
DCon->DReg: Registry Stored Query\n[ITI-18]
activate DReg
DReg-->DCon: Return document entries\n(XDS-I manifests)
deactivate DReg
DCon-->IDR: //document entries//

opt If document entries do not provide enough information to compose query
results
group For each XDS-I manifest document entry
IDR->DRepo: Retrieve Document Set [ITI-43]
activate DRepo
DRepo-->IDR: Return XDS-I manifest
deactivate DRepo
IDR->IDR: //Parse each XDS-I manifest//

opt If manifest does not provide enough information to compose query results
IDR->XIDC0: //retrieve DICOM header//
XIDC0-->XIDS: Retrieve study/series/instances as XDS-I Imaging Document
Consumer
activate XIDS
XIDS-->XIDC0
deactivate XIDS
XIDC0-->IDR: //return DICOM attributes//
end
end
end
```

```
      IDR->IDR: //Compose query results//\n//including retrieve
      location//\n//references//
      IDR-->IDC: Return query results
      deactivate IDR
635   deactivate IDC


      IDC->IDC: //Select Studies to view//
      activate IDC
640   opt Additional information needed for retrieval
      IDC->IDR: QIDO-RS Query [RAD-129]\n(image/series metadata\n for selected
      studies)
      activate IDR
      IDR->IDR: //Obtain requested series//\n//and instance metadata//\n//from
645   previously retrieved//\n//XDS-I manifest or via//\n//some other means//
      IDR->IDR: //Compose query results//
      IDR-->IDC: Return query results
      deactivate IDR
      end
650
      IDC->IDC: //Determine//\n//images/frames//\n//to retrieve//\n//(influenced
      by//\n//User interaction)//
      IDC->IDS: WADO-RS Retrieve [RAD-107]
      activate IDS
655   IDS->XIDC: //internal//
      activate XIDC
      XIDC->XIDS: Retrieve study/series/instances\nas XDS-I Imaging
      Document\nConsumer
      activate XIDS
660   XIDS-->XIDC:
      deactivate XIDS
      XIDC-->IDS:
      deactivate XIDC
      IDS-->IDC: Return images
665   deactivate IDS

      IDC->IDC: //Show Images//
      deactivate IDC

670   @enduml
```

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

42.5 WIA Security Considerations

The WIA Profile has similar security considerations to other IHE profiles that are based on HTTP or REST. See ITI TF-2: Appendix Z.8 for recommendations for secure transportation, authentication, authorization, and securing patient identifiers in URLs. Implementers are encouraged to review that section for applicability to their product environment.

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

680   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.

685   - The Imaging Document Responder and Imaging Document Source use credentials or tokens 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.

690   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,
695   provision of a SAML assertion in an authentication header, or other mechanisms that are suitable for stateless atomic transaction.

The user authentication and authorization methods are outside the scope of the WIA Profile. Implementers should consider the use of the IHE ITI Profiles Enterprise User Authentication (EUA) and Internet User Authorization (IUA) in their implementations.

700   Implementations should also consider how availability and integrity will be protected including intentional attacks such as a maliciously crafted query that interfere with service availability.

Both the WADO-RS and QIDO-RS transactions may include in their response a URL 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 these URL's to a location of
705   suspect origin. An Imaging Document Consumer should verify that any received URL is valid and corresponds to a known secure location.

42.6 WIA Cross Profile Considerations

42.6.1 XDS.b – Cross-Enterprise Document Sharing

An Imaging Document Responder that implements the XDS-I Backend Option will be grouped
710   XDS Document Consumer to locate imaging manifest in an XDS environment (see Section 42.4.2.4: Use Case #4).

If an Imaging Document Consumer wants to retrieve documents other than imaging manifests, it may be grouped with an XDS Document Consumer to access clinical documents published in an XDS environment.

42.6.2 XDS-I.b – Cross-Enterprise Document Sharing for Imaging

715

An Imaging Document Source that implements the XDS-I Backend Option will be grouped with an XDS-I Imaging Document Consumer to satisfy a WADO-RS Retrieve [RAD-107] request for the retrieval of object or metadata from an XDS-I.b Imaging Document Source (see Section 42.4.2.4: Use Case #4).

720

An Imaging Document Responder may be grouped with an XDS-I.b Imaging Document Consumer to satisfy a QIDO-RS Query [RAD-129] request for additional metadata from an XDS-I.b Imaging Document Source. (see Section 42.4.2.4: Use Case #4.)

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

725

An Imaging Document Consumer that supports the XDS-I Backend Option is recommended to be grouped with a Patient Identifier Cross-Reference Consumer to identify the affinity domain patient id before issuing the QIDO-RS Query [RAD-129] transaction.

42.6.4 PDQ or PDQv3 or PDQm – Patient Demographics Query

730

An Imaging Document Consumer that supports the XDS-I Backend Option is recommended to be grouped with a Patient Demographics Consumer to identify the affinity domain patient id before issuing the QIDO-RS Query [RAD-129] transaction.

Volume 2 – Transactions

Add Section 4.107

4.107 WADO-RS Retrieve [RAD-107]

4.107.1 Scope

735　The WADO-RS Retrieve [RAD-107] transaction accesses DICOM SOP Instances via an HTTP interface.

4.107.2 Actor Roles

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

740　**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.

4.107.3 Referenced Standards

745　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

RFC7540 Hypertext Transfer Protocol Version 2 (HTTP/2), https://tools.ietf.org/html/rfc7540

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

750　Extensible Markup Language (XML) 1.0 (Second Edition). W3C Recommendation 6 October 2000, http://www.w3.org/TR/REC-xml
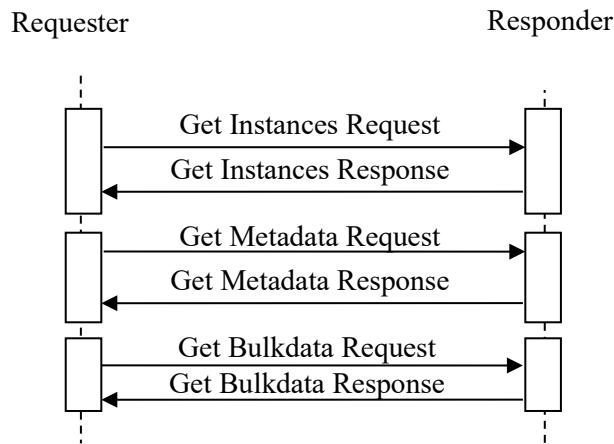
DICOM PS3.18 Section 10.4: Web Services – Retrieve Transaction of the DICOM Studies Service

DICOM PS3.18 Annex F: DICOM JSON Model

755 DICOM PS3.19 Annex A.1: Native DICOM Model

DICOM PS3.19 Annex B: Interfaces Definition (WSDL and Schema)

4.107.4 Messages

Figure 4.107.4-1: Interaction Diagram

This transaction defines three request/response message pairs:

- Get Instances (Section 4.107.4.1 and 4.107.4.2)
- Get Metadata (Section 4.107.4.3 and 4.107.4.4)
- Get Bulkdata (Section 4.107.4.5 and 4.107.4.6)

765 Normally, all message pairs in an IHE transaction are required. In this transaction, a Requester shall support at least one; a Responder shall support all three, as defined in DICOM.

4.107.4.1 Get Instances Request Message

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 messages from more than one Requester.

4.107.4.1.1 Trigger Events

The Requester wishes to retrieve DICOM instances.

4.107.4.1.2 Message Semantics

775 The Get Instances Request message is a Retrieve transaction of the DICOM Studies Service. See DICOM PS3.18 Section 10.4.

The Requester is the User Agent, and the Responder is the Origin Server.

The message shall correspond to one of the Instance Resources in Table 4.107.4.1.2-1. The only binding required for both the Requester and Responder is HTTP-GET.

Table 4.107.4.1.2-1: Retrieve Transaction Instance Resources

Resource	URI Template	Expected Response
Study Instances	http://<location>/studies/{study}	All instances within the specified study.
Series Instances	http://<location>/studies/{study}>/series/{series}	All instances within the specified series.
Instance	http://<location>/studies/{study}/series/{series}/instances/{instance}	Specified instance.
Frame Pixel Data	http://<location>/studies/{study}/series/{series}/instances/{instance}/frames/{frames}	Specified frames within the specified instance.

780

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

Table 4.107.4.1.2-2: Retrieve Transaction Request Parameters

Parameter Name	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-2: 3.11.4.1.2 Message Semantics.
{study}	Study Instance UID of the study from which series or instances are to be returned.	
{series}	Series Instance UID of the series from which instances are to be returned.	
{instance}	SOP Instance UID of the instance to be returned.	
{frames}	Frame numbers of the frames to be returned from the SOP instance.	

785 The message may include query parameters as described in DICOM PS3.18 Section 10.4.1.2.

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

Table 4.107.4.1.2-3: Retrieve transaction Header Parameters

Header Name	REQ	Description
Accept	R	The representation scheme being requested from the RESTful service. Accepted values depend on the request made; refer to DICOM PS3.18 Section 10.4.1.3 for accepted types.

4.107.4.1.2.1 Example of a Get Instances Request message

The following is an example of an HTTP Request URI for retrieving a composite DICOM object. This example uses an Accept header to request the DICOM SOP Instance returned in the Native DICOM binary format.

```
https://www.hospital.com/studies/2.999.1.59.40211.12345678.678910/serie
s/2.999.1.59.40211.789001276.14556172.67789/instances/2.999.1.59.40211.
2678810.87991027.899772.2
Accept: multipart/related; type=application/dicom
```

4.107.4.1.3 Expected Actions

The Responder shall parse the request, prepare representation(s) of the Instance Resource in the Selected Media Type (see DICOM PS3.18 Section 10.4.2), and return a response as described in Section 4.107.4.2.

4.107.4.1.3.1 XDS-I Backend Option

The Responder shall use the grouped XDS-I Imaging Document Consumer to retrieve the requested imaging objects.

4.107.4.2 Get Instances Response Message

The Responder reports the outcome of the Get Instances Request Message.

4.107.4.2.1 Trigger Events

The Responder completes processing of the Get Instances Request Message.

4.107.4.2.2 Message Semantics

The message is a Response to a Retrieve Transaction as specified in DICOM PS3.18 Section 10.4.3.

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.

The Responder shall provide a response as described in DICOM PS3.18 Section 10.4.3.3.1 for Instance Resources and Section 10.4.3.3.6 for Frame Pixel Data, including the appropriate status code indicating success, warning, or failure as described in DICOM PS3.18 Section 10.4.3.1.

4.107.4.2.3 Expected Actions

The Requester shall accept the response.

820   The Requester shall follow redirects (responses with values of 301, 302, 303 or 307. See https://tools.ietf.org/html/rfc7231#section-6.4 for details) unless a loop or security policy violation is detected.

4.107.4.3 Get Metadata Request Message

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

825   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

The Requester wishes to retrieve metadata regarding DICOM instances.

4.107.4.3.2 Message Semantics

830   The Get Metadata Request message is a Retrieve transaction of the DICOM Studies Service. See DICOM PS3.18 Section 10.4.

The Requester is the User Agent, and the Responder is the Origin Server.

The message shall correspond to one of the Metadata Resources in Table 4.107.4.3.2-1. It is implemented as an HTTP request. The only binding required for both the Requester and
835   Responder is HTTP-GET.

Table 4.107.4.3.2-1: Retrieve Transaction Metadata Resources

Resource	URI Template	Expected Response
Study Metadata	http://<location>/studies/{study}/metadata	All metadata within the specified study.
Series Metadata	http://<location>/studies/{study}/series/{series}/metadata	All metadata within the specified series.
Instance Metadata	http://<location>/studies/{study}/series{series}/instances/{instance}/metadata	All metadata for a specified instance.

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

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

4.107.4.3.2.1 Example of a Get Metadata Request message

The following is an example of an HTTP Request URI for retrieving metadata for a study. This example uses an Accept header to request the metadata be returned in the Native DICOM Model in XML.

```
https://www.hospital.com/studies/2.999.1.2.250.1.59.40211.12345678.6789
10/metadata
Accept: multipart/related; type=application/dicom+xml
```

4.107.4.3.3 Expected Actions

The Responder shall parse the request, prepare representation of the Metadata Resource in the Selected Media Type (see DICOM PS3.18 Section 10.4.2), and return response described in Section 4.107.4.4.

4.107.4.3.3.1 XDS-I Backend Option

The Responder shall use the grouped XDS-I Imaging Document Consumer to retrieve the requested imaging metadata.

4.107.4.4 Get Metadata Response Message

The Responder reports the outcome of the Get Metadata Request Message.

4.107.4.4.1 Trigger Events

The Responder completes processing of the Get Metadata Request Message.

4.107.4.4.2 Message Semantics

The message is a Response to a Retrieve Transaction as specified in DICOM PS3.18 Section 10.4.3.

The Requester is the User Agent, and the Responder is the Origin Server.

The Responder shall provide a response as described in DICOM PS3.18 Section 10.4.3.3.2, including the appropriate status code indicating success, warning, or failure as described in DICOM PS3.18 Section 10.4.3.1.

4.107.4.4.3 Expected Actions

The Requester shall accept the response.

The Requester shall follow redirects (responses with values of 301, 302, 303 or 307. See https://tools.ietf.org/html/rfc7231#section-6.4 for details) unless a loop or security policy violation is detected.

4.107.4.5 Get Bulkdata Request Message

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

The Requester wishes to retrieve bulk data using a URI reference contained in a previously received Native DICOM Model in XML or DICOM JSON Model document.

4.107.4.5.2 Message Semantics

The Get Bulkdata Request message is a Retrieve transaction of the DICOM Studies Service. See DICOM PS3.18 Section 10.4.

The Requester is the User Agent, and the Responder is the Origin Server.

The message shall correspond to one of the Bulkdata Resources in Table 4.107.4.5.2-1. The message is implemented as an HTTP request. The only binding required for both the Requester and Responder is HTTP-GET.

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

Table 4.107.4.5.2-1: Retrieve Transaction Bulkdata Resources

Resource	URI Template	Expected Response
Bulkdata	http://< bulkdataURL>	The data contained by the bulk data reference

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

Table 4.107.4.5.2-2: Retrieve Bulkdata Header Parameters

Header Name	REQ	Description
Accept	R	The representation scheme being requested from 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

4.107.4.5.2.1 Example of a Get Bulkdata Request message

The following is an example of HTTP Request URI for retrieving all bulkdata for the resource. This example uses an Accept header to request uncompressed bulkdata.

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

4.107.4.5.3 Expected Actions

900 The Responder shall parse the request, prepare representation of the Metadata Resource in the Selected Media Type (see DICOM PS3.18 Section 10.4.2), and return response as described in Section 4.107.4.6.

4.107.4.5.3.1 XDS-I Backend Option

The Responder shall use the grouped XDS-I.b Imaging Document Consumer to retrieve the requested bulk data.

905 ### 4.107.4.6 Get Bulkdata Response Message

The Responder reports the outcome of the Get Bulkdata Request Message.

4.107.4.6.1 Trigger Events

The Responder completes processing of the Get Bulkdata Request Message.

4.107.4.6.2 Message Semantics

910 The message is a Response to a Retrieve Transaction as specified in DICOM PS3.18 Section 10.4.3.

The Requester is the User Agent, and the Responder is the Origin Server.

The Responder shall include a multipart/related media type with one or more parts containing DICOM instance bulkdata according to DICOM PS3.18 Section 10.4.3.3.5.

915 The Responder shall provide a response message header containing the appropriate status code indicating success, warning, or failure as described in DICOM PS3.18 Section 10.4.3.1.

4.107.4.6.3 Expected Actions

The Requester shall accept the response.

The Requester shall follow redirects (responses with values of 301, 302, 303 or 307. See
920 https://tools.ietf.org/html/rfc7231#section-6.4 for details) unless a loop or security policy violation is detected.

4.107.5 Security Considerations

Additional security considerations that may apply are discussed in RAD TF-1: 42.5 - WIA Security Considerations.

925 ### 4.107.5.1 Security Audit Considerations

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

930 | *Add RAD-129 QIDO-RS Query transaction*

4.129 QIDO-RS Query [RAD-129]

4.129.1 Scope

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

935 ### 4.129.2 Use Case Roles

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

Table 4.129.2-1: Actor Roles

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

940 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.

4.129.3 Referenced Standards

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

945 RFC2616 Hypertext Transfer Protocol HTTP/1.1, http://www.ietf.org/rfc/rfc2616.txt

RFC7540 Hypertext Transfer Protocol Version 2 (HTTP/2), https://tools.ietf.org/html/rfc7540

RFC4627 The application/json Media Type for JavaScript Object Notation (JSON), http://www.ietf.org/rfc/rfc4627.txt
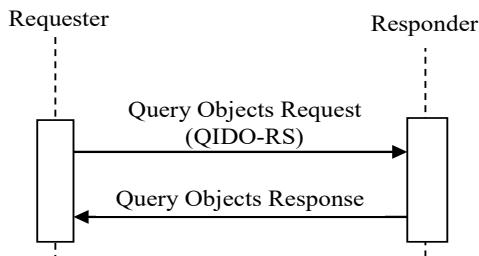
Extensible Markup Language (XML) 1.0 (Second Edition). W3C Recommendation 6 October
950 2000, http://www.w3.org/TR/REC-xml

DICOM PS3.4 Annex C: Query/Retrieve Service Class

DICOM PS3.18 Section 10.6: Web Services - Search Transaction of the DICOM Studies Service

4.129.4 Messages

955

Figure 4.129.4-1: Interaction Diagram

4.129.4.1 Query Objects Request Message

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

The Requester shall support making requests to more than one Responder. The Responder shall
960 support handling request from more than one Requester.

4.129.4.1.1 Trigger Events

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

4.129.4.1.2 Message Semantics

965 The Query Objects Request message is a Search transaction of the DICOM Studies Service. See DICOM PS3.18 Section 10.6.

The Requester is the User Agent. The Responder is the Origin Server.

The Requester shall issue the Query Objects Request using the QIDO-RS Query endpoint provided by the Responder.

970   Note: A Responder that supports that XDS-I Backend Option will have two endpoints, one for QIDO-RS and one for the XDS-I Backend Option. The Requester will determine which endpoint to use for a given query request.

The message shall correspond to one of the Target Resources listed in Table 4.129.4.1.2-1. The only binding required for both the Requester and Responder is HTTP-GET.

The Requester shall support at least one Target Resource; a Responder shall support all Target
975 Resources in Table 4.129.4.1.2-1.

Table 4.129.4.1.2-1: Search Transaction Target Resources

Resource	URI Template	Expected Response
All Studies	http://<location>/studies{?search*}	All studies that satisfy the query parameters
Study's Series	http://<location>/studies/{study}/series{?search*}	All series that satisfy the query parameters
All Series	http://<location>/series{?search*}	
Study's Series' Instances	http://<location>/studies/{study}/series/{series}/instances{?search*}	All instances that satisfy the query parameters
Study's Instances	http://<location>/studies/{study}/ instances{?search*}	
All Instances	http://<location>/instances{?search*}	

Note: Support of the fuzzy semantic matching parameter by the Responder as defined in DICOM PS3.18 Section 8.3.4.2 is optional.

980   The parameters of the message are defined in Table 4.129.4.1.2-2.

Table 4.129.4.1.2-2: Search Query Parameters

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-2: 3.11.4.1.2 Message Semantics.
{study}	Study Instance UID of the study from which series or instances are to be returned.	
{series}	Series Instance UID of the series from which instances are to be returned.	
{?search*}	A set of attribute/value pairs for matching keys, or a set of 'includefield' attributes for return keys, or 'all' for all available attributes. This parameter may include 'limit' and 'offset' attributes to paginate a search response.	See DICOM PS3.18 Section 8.3.4 for syntax details.

The message shall include the header parameters defined in Table 4.129.4.1.2-3 to indicate the media type of the response.

985   **Table 4.129.4.1.2-3: Search transaction Header Parameters**

Header Name	REQ	Description
Accept	R	The representation scheme being requested from the RESTful service. Refer to DICOM PS3.18 Section 8.3.3.1.

The Requester uses one or more matching keys as search criteria to obtain the list of matching entries in the Responder using a selected Resource (Table 4.129.4.1.2-1).

The Requester shall support all keys required for the SCU as defined in RAD TF-2: Table 4.14-1.

990 In addition, the Requester shall be capable of using the following attributes as matching key and return key:

- Issuer of Patient ID (0010,0021)

  Note: Issuer of Patient ID is used in conjunction with Patient ID (0010,0010).

- Issuer of Accession Number Sequence (0008,0051)

995
  Note: Issuer of Accession Number Sequence is used in conjunction with Accession Number (0008,0050). Issuer of Accession Number Sequence is useful when the Requester is dealing with multiple domains.

  Note: For XDS-I Backend Option related requirements on accession number, see Table 4.129.4.1.3.1-1.

The Requester may implement one or more of the following sets of matching or return keys for the Query SCU:

1000 **Table 4.129.4.1.2-4: Additional SCU Query Keys**

Query Key Specifications	Type of Objects
RAD TF-2: Table 4.15-1	Presentation State Objects
RAD TF-2: Table 4.26-1	DICOM Structured Report Objects
RAD TF-2: Table 4.30-1	Key Image Notes

4.129.4.1.2.1 XDS-I Backend Option

The Requester shall issue the Query Objects Request message (Section 4.129.4.1) using the endpoint designated by the Responder for the XDS-I Backend Option.

1005 If the Requester does not specify Patient ID (0010,0020) and Issuer of Patient ID (0010,0021) as query matching keys, the Responder will be unable to perform a Registry Stored Query [ITI-18] that returns any matches.

For Requesting Service Code Sequence (0032,1034) as a matching key, the Requester may use values from DICOM PS3.16 Context Group CID 7030 "Institutional Departments, Units and 1010 Services".

4.129.4.1.2.2 Example of a Search transaction

The following is an example HTTP Request URI for querying DICOM instance level attributes for all instances in the study with Study Instance UID `2.999.1.59.40211.12345678.678910`:

```
https://www.hospital.com/studies/2.999.1.59.40211.12345678.678910/insta
nces
```
1015

This example does not specify an Accept header. Therefore, the results will be encoded in the DICOM JSON format by default.

4.129.4.1.3 Expected Actions

1020 The Responder shall parse the request, perform the search indicated using the matching rules in DICOM PS3.18 Section 8.3.4, and return a response.

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

For requests sent to the QIDO-RS endpoint, the response shall be a Query Objects Response message (Section 4.129.4.2).

1025 The Responder shall support all Query and Matching keys for the SCP as defined in the sections referenced in Table 4.129.4.1.3-1:

Table 4.129.4.1.3-1: SCP Query Matching and Return Keys

Query Key Specifications	Type of Objects
RAD TF-2: Table 4.14-1	Image Objects
RAD TF-2: Table 4.15-1	Presentation State Objects
RAD TF-2: Table 4.26-1	DICOM Structured Report Objects
RAD TF-2: Table 4.30-1	Key Image Notes

1030 In addition, the Responder shall support Issuer of Patient ID (0010,0021) and Issuer of Accession Number Sequence (0008,0051) as both matching and return keys.

4.129.4.1.3.1 XDS-I Backend Option

A Responder that claims the XDS-I Backend Option shall also support the following requirements for requests sent to the XDS-I Backend Option endpoint.

1035 The Responder shall support the Registry Stored Query [ITI-18] transaction as an XDS Document Consumer using the FindDocuments query in ITI TF-2: 3.18.4.1.2.3.7.1 and FindDocumentsByReferenceId query in ITI TF-2: 3.18.4.1.2.3.7.14. The Responder may support other stored queries defined in [ITI-18].

A Responder executes the following general steps:

- Receives the Query Objects Request message (Section 4.129.4.1)

1040 - Maps the query parameters into Registry Stored Query [ITI-18] request parameters

- Receives the Registry Stored Query response

- Maps the Registry Stored Query response into a Query Objects Response message (Section 4.129.4.2)

The Responder shall populate Registry Stored Query Parameters as defined in Table
1045 4.129.4.1.3.1-1.

The following attributes have no direct correspondences in the Registry Stored Query but are required to be supported by Responder as matching keys. These attributes may be available in the XDS-I manifest or the instances referenced by the manifest.

- Patient's Name (0010,0010)
1050
- Referring Physician's Name (0008,0090)
- Study ID (0020,0010)

Table 4.129.4.1.3.1-1: Populating Registry Stored Query Parameters

Registry Stored Query Parameter	QIDO-RS Matching Keys	Details
Required Parameters for FindDocuments and FindDocumentsByReferenceId Stored Queries		
$XDSDocumentEntryPatientId	Patient ID (0010,0020) and Issuer of Patient ID (0010,0021)	This Patient ID and Issuer of Patient ID shall correspond to the XDS Affinity Domain Patient ID. Otherwise, the Responder shall return no matches.
$XDSDocumentEntryStatus	N/A	$XDSDocumentEntryStatus will usually have the value of "urn:oasis:names:tc:ebxml-regrep:StatusType:Approved" in order to return the active version of the manifest.
$XDSDocumentEntryFormatCode	N/A	The Responder 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 Value) as the Format Coding Scheme OID. The target of all QIDO-RS Queries that are mapping to Registry Stored Query [ITI-18] in an XDS-I environment are studies represented as XDS-I Manifest documents.
Parameters for FindDocumentsByReferenceId Stored Query Only (Note 1)		
$XDSDocumentEntryReferenceIdList	Accession Number (0008,0050) and Issuer of Accession Number Sequence (0008,0051)	If Accession Number is defined as a matching key in the QIDO-RS query, then the Responder shall use the FindDocumentsByReferenceId query. If the Requester specifies Accession Number but does not include Issuer of Accession Number Sequence in the QIDO-RS query as a matching key, then the Responder shall return no matches.
$XDSDocumentEntryReferenceIdList	Study Instance UID (0020,000D)	Study Instance UID is available in the XDS-I Manifest if not available in the ReferencedIdList.

Registry Stored Query Parameter	QIDO-RS Matching Keys	Details
Optional Parameters Available for Both Stored Queries		
$XDSDocumentEntryServiceStartTimeFrom $XDSDocumentEntryServiceStopTimeTo	Study Date (0008,0020) and Study Time (0008,0030)	Study Date and Study Time are specified as two single value matching keys. The Responder shall map both values to $XDSDocumentEntryServiceStartTimeFrom. See ITI TF-2: 3.18.4.1.2.3.3. If only Study Date is specified as a matching key, then Responder shall set the time to be the midnight (00:00:00) when creating the UTC time. QIDO-RS supports range matching for Study Date and Study Time, while Registry Stored Query [ITI-18] 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 $XDSDocumentEntryServiceStopTimeTo. Note: The Search transaction uses Combined Datetime matching semantics. See DICOM PS3.18 Section 8.3.4.1.1.
$XDSDocumentEntryEventCodeList	Modalities in Study (0008,0061)	Only a single modality can be specified as a matching key. Unlike Registry Stored Query [ITI-18], the QIDO-RS Query [RAD-129] does not support query semantics with multiple values. The Responder shall return records that match any one of the modalities found in the eventCodeList. 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. If both Modalities in Study and Anatomic Regions in Study Code Sequence are specified as matching keys, then the Responder shall combine them using the logical AND semantics (see ITI TF-2: 3.18.4.1.2.3.5).

Registry Stored Query Parameter	QIDO-RS Matching Keys	Details
$XDSDocumentEntryEventCodeList	Anatomic Regions in Study Code Sequence (0008,0063)	If both Modalities in Study and Anatomic Regions in Study Code Sequence are specified as matching keys, then the Responder shall combine them using the logical AND semantics (see ITI TF-2: 3.18.4.1.2.3.5).
$XDSDocumentEntryTypeCode	Procedure Code Sequence (0008,1032)	
$XDSDocumentEntryPracticeSettingCode	Requesting Service Code Sequence (0032,1034)	$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). There is no direct correspondence in DICOM. The Responder may be able to use Requesting Service Code Sequence to map to the appropriate practice setting code defined by the affinity domain. See Section 4.129.4.1.2.1 for Requester behavior.
Other Optional Stored Query Parameters With No Mapping		
$XDSDocumentEntryConfidentialityCode	N/A	The Responder may include values for this parameter based on local policy requirements.
$XDSDocumentEntryClassCode	N/A	The Responder may use an appropriate value for imaging study defined by the affinity domain.
$XDSDocumentEntryHealthcareFacilityType Code	N/A	The Responder may use an appropriate value to limit the imaging study returned as defined by the Affinity Domain.
$XDSDocumentEntryType	N/A	The Responder may use an appropriate value to limit the imaging study returned as defined by the Affinity Domain. If no value is specified, then only Stable Document Entries will be returned. See ITI TF-2: 3.18.4.1.2.3.6.2 for details.
$XDSDocumentEntryAuthorPerson	N/A	No mapping is provided for these parameters because the Requester cannot provide meaningful input from a QIDO-RS query. The Responder is not required to support these parameters.
$XDSDocumentEntryCreationTimeFrom $XDSDocumentEntryCreationTimeTo	N/A	
$XDSDocumentEntryServiceStartTimeTo $XDSDocumentEntryServiceStopTimeFrom	N/A	

Note 1: Only an XDS Document Registry that supports the Reference Id Option is able to respond to FindDocumentsByReferencedId queries.

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The Responder shall obtain the necessary information to populate the Query Objects Response message.

When populating QIDO-RS Return Keys using Document Sharing metadata, the Responder shall follow the requirements in RAD TF-2: 4.68.4.1.2.3.2 and 4.68.4.1.2.3.3.

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> Note: If it is necessary to obtain additional information to populate the QIDO-RS response, the Responder may consider using a combination of the metadata provided by the Registry Stored Query, retrieved XDS-I manifest, retrieving instances referenced by the manifest from the Imaging Document Source, or some other source (e.g., PDQ to resolve Patient's Name to Affinity Domain Patient ID), etc.

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4.129.4.2 Query Objects Response Message

The Responder returns the information about matching DICOM studies, series or instances.

4.129.4.2.1 Trigger Events

The Responder completes processing of the Query Objects Request message.

4.129.4.2.2 Message Semantics

1070 The message is a response to a Search transaction as specified in DICOM PS3.18 Section 10.6.3.

The Requester is the User Agent, and the Responder is the Origin Server.

The Responder shall support the return keys as specified in Table 4.129.4.1.3-1.

4.129.4.2.3 Expected Actions

The Requester shall accept the response.

1075 The Requester shall follow redirects (responses with values of 301, 302, 303 or 307. See https://tools.ietf.org/html/rfc7231#section-6.4 for details) unless a loop or security policy violation is detected.

4.129.5 Security Considerations

Additional security considerations that may apply are discussed in RAD TF-1: 42.5 - WIA
1080 Security Considerations.

4.129.5.1 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.