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Integrating the Healthcare Enterprise

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IHE Radiology
Technical Framework Supplement

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Manifest-based Access to DICOM Objects (MADO)

For review and comment only.

DO NOT implement this public comment version.

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HL7® FHIR® R5 (R4 to be added later)

Using Resources at FMM Level 2-N

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Revision 0.6 – Draft in Preparation for Public Comment

22

Date: September 23, 2025

Author: IHE-HL7 Europe Sub-team on imaging manifest

Email:

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Foreword

This document is prepared to become a future supplement to the IHE Radiology Technical Framework. It is fully aligned with the new profile proposal submitted on July 20th 2025 to the IHE Radiology 2025-2026 Cycle. It has been initially developed jointly as a EURIDICE specification by the IHE-HL7 Europe Working Group on Imaging with the goal to use this new profile in the context of the EHDS use case on the sharing of imaging studies and related imaging reports. It is a goal that the MADO profile be an internationally adopted profile that can be deployed not only in Europe.

This is why this draft is intended to become a supplement to the IHE Radiology Technical Framework V22.0. IHE supplements undergo a process of public comment which starts with an Xt-EHR public consultation (scheduled between September 28, 2025 and November 15th, 2025) overlapping with an IHE Radiology Public Comment (scheduled for November 2025. It is intended to result in a trial implementation release scheduled for early February 2026 before being incorporated into the volumes of the Technical Frameworks.

This supplement describes proposed 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.

Amend section X.X by the following:

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.

General information about IHE can be found at IHE.

Information about the IHE <domain name> domain can be found at IHE Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the 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.

<Comments may be submitted on IHE Technical Framework templates any time at http://ihe.net/Templates_Public_Comments. Please enter comments/issues as soon as they are found. Do not wait until a future review cycle is announced.>

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Introduction to this Supplement

Whenever possible, IHE profiles are based on established and stable underlying standards. However, if an IHE domain determines that an emerging standard has high likelihood of industry adoption, and the standard offers significant benefits for the use cases it is attempting to address, the domain may develop IHE profiles based on such a standard. During Trial Implementation, the IHE domain will update and republish the IHE profile as the underlying standard evolves.

Product implementations and site deployments may need to be updated in order for them to remain interoperable and conformant with an updated IHE profile.

This MADO Profile (or This Technical Framework Supplement) incorporates content from Release 4 and Release 5 of the HL7® FHIR® specification. HL7 describes FHIR Change Management and Versioning at https://www.hl7.org/fhir/versions.html.

FHIR Content (Resources, ValueSets, etc.	FMM Level
Bundle	N
Device	2
DocumentReference	4
Endpoint	2
ImagingSelection Resource	1
ImagingStudy Resource	4
Patient	N
PratitionerRole	4
Procedure	4
ServiceRequest	4

This new work item proposal aims to define a new IHE profile to address the *access to DICOM Instances based on an imaging study manifest.*

The need for this profile was identified as part of the sharing of imaging studies and related reports as required under the EHDS Regulation (see discussion below). It has since been accepted by IHE Radiology to undergo the development of an IHE Profile in the 2025-2026 cycle.

138 Such an access was initially introduced by a part of the XDS-I.b profile almost 20 years ago.
139 The XDS-I profile has introduced the concept of a manifest, a document that summarizes the
140 content of an imaging study, its structure with the identification and the location where various
141 instances that belong to the study may be retrieved. The XDS-I.b profile leverages the XDS
142 profile to support the discovery of such manifest documents through a document registry query
143 and its retrieval from a document repository.

144 With the introduction of a FHIR based document sharing infrastructure with the MHD and
145 MHDS Profiles, there is a demand to close the gap for the sharing of imaging data by supporting
146 the combination of MHD and/or MHDS along with a profile that covers the access to DICOM
147 Instances leveraging the information contained in shared imaging study manifests.

148 The need for such a new profile that addresses the ***access to DICOM Instances based on an***
149 ***imaging study manifest*** could be combined either with MHDS (or MHD) to deploy FHIR based
150 document sharing infrastructures or XDS, or some proprietary document sharing scheme. Such
151 flexibility ensures a common and more effective way to access the DICOM Objects through a
152 solid profiling of WADO-RS consistent with the XC-WADO Cross-Community profile and the
153 IID (Invoke Image Display) profiles. The MADO Profile includes also a more robust Imaging
154 Study Manifest supporting two complementary encodings based on the DICOM KOS IOD or
155 FHIR Imaging Study resource, as well as profiling in a more precise way existing attributes and
156 new attributes, such as those necessary to improve the access to key images in a way compatible
157 with the IHE KIN Profile.

158   Note: The reviewer may skip the open issues mentioned below, as these are identified within
159   the body of this draft supplement.

160 ## Open Issues and Questions

#	Issue / Answer
1.	Q: In the specification of extensions to a DICOM Key Object Selection SOP Class as proposed in this draft it has been considered important to ensure backward compatibility with the KOS Manifests widely used in many existing deployments. Such extensions may require some relaxation in the DICOM Standard. This needs to be addressed jointly with the DICOM Committee. TC: A:

#	Issue / Answer
	Q: Given the two formats proposed for the imaging manifest, which interoperability approach shall be chosen by MADO: 1. Either format may be implemented depending on the deployment (two distinct optional transactions) 2. The source supports both formats and the consumer selects the preferred one. 3. The consumer supports both. TC: A:

Closed Issues

#	Issue / Answer
1.	Q: TC: A:

IHE Technical Frameworks General Introduction

The IHE Technical Frameworks General Introduction is shared by all of the IHE domain technical framew rks. Each technical framework volume contains links to this document where appropriate.

9 Copyright Licenses

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, Section 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.

10 Trademark

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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.

> *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](#).*

Appendix A – Actors

> *Add the following **new or modified** actors to the [IHE Technical Frameworks General Introduction Appendix A](#):*

New (or modified) Actor Name	Description
None	

The table below lists *existing* actors that are utilized in this profile.

Complete List of Existing Actors Utilized in this Profile

Existing Actor Name	Definition
Content Creator	The Content Creator Actor creates content and transmits to a Content Consumer.
Content Consumer	The Content Consumer Actor views, imports, or performs other processing of content created by a Content Creator Actor.
Imaging Document Consumer	A system that makes use of imaging data.
Imaging Document Source	Publishes imaging data and makes it available for retrieval.

Appendix B – Transactions

New (or modified) Transaction Name and Number	Definition
WADO-RS Get Instances [RAD-1xy]	Get DICOM Instances from the Imaging Document Source at a Study, Series or Instance level. Note: This transaction may be documented either as a new transaction or as a reframing of an existing transaction (e.g. RAD-107 or RAD-160).

200
201

Appendix D – Glossary

203

204   No new or modified glossary terms.

205 # Volume 1 – Profiles

206 ## Domain-specific additions

207 None.
208

209   *Add new Section X*

210

X   Manifest-based Access to DICOM Objects (MADO) Profile

213   The Manifest-based Access to DICOM Objects (MADO) Integration Profile specifies actors and
214   transactions to retrieve patient-relevant DICOM Instances from medical imaging studies being
215   held within a community. Each community may have multiple sources of medical image data
216   that publish it for sharing within the community. It may be combined with XC-WADO for
217   cross-community access.

218   The XDS.b or MHD (or MHDS) profiles define specific means of retrieving the Imaging Study
219   Manifests that reference DICOM Instances stored in the community and that were "published"
220   by their holders into the community-level document registry.

221   The MADO profile utilizes the RESTful DICOMWeb Studies Service Retrieve transaction (a.k.a
222   WADO-RS, DICOM [PS3.18 Section 10.4](#)).

223   The reader of MADO is expected to understand the use of Imaging Study Manifests.

X.1 MADO Actors, Transactions, and Content Modules

225   This section defines the actors, transactions, and/or content modules in this profile. General
226   definitions of actors are given in the Technical Frameworks General Introduction Appendix A.
227   IHE Transactions can be found in the Technical Frameworks General Introduction Appendix B.
228   Both appendices are located at https://profiles.ihe.net/GeneralIntro/index.html.

229

230   Figure X.1-1 shows the actors directly involved in the MADO Profile and the relevant
231   transactions/content between them.

232   The Imaging Document Consumer obtains the Imaging Manifests from the local community
233   through grouping with different actors in the ITI profiles that can provide access to the XDS /
234   MHD infrastructure, such as the XDS.b Document Consumer or MHD Document Consumer.
235   The XDS.b Document Consumer and MHD Document Consumer are NOT included in this
236   profile.
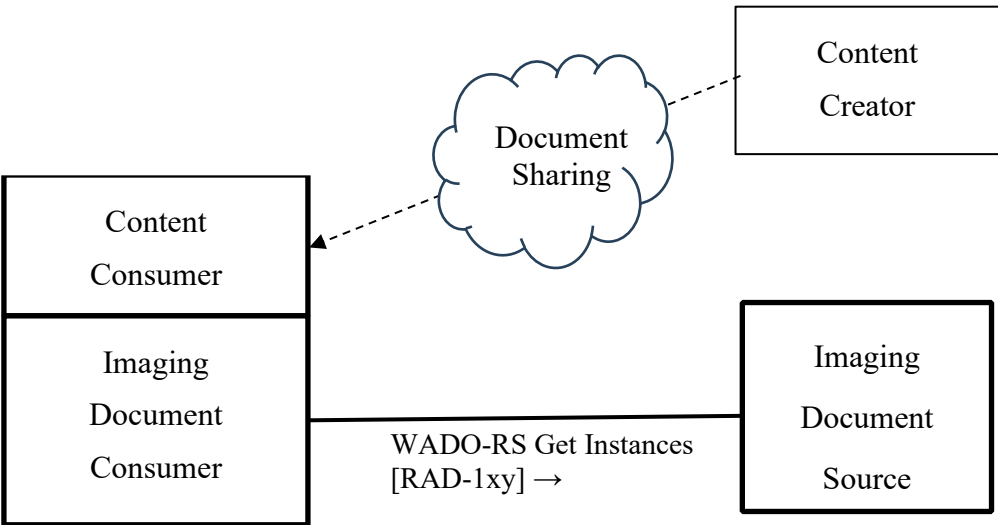
237
238 **Figure X.1-1: MADO Actor Diagram**

239

240 Table X.1-1 lists the transactions/content for each actor directly involved in the Manifest-based
241 Access to DICOM Objects (MADO) Profile. To claim compliance with this profile, an actor
242 shall support all required transactions/content (labeled "R") and may support the optional
243 transactions (labeled "O").

244

245 **Table X.1-1: MADO Profile - Actors and Transactions**

Actors	Transactions	Content Modules	Requestor or Responder	Optionality	Reference
Content Creator		DICOM KOS Based Imaging Study Manifest		R See Note 1	RAD TF-3: 7(See Volume 3 below)
		FHIR Based Imaging Study Manifest		R See Note 1	RAD TF-3-8 (See Volume 3 below)
Content Consumer		DICOM KOS Based Imaging Study Manifest		C See Note 2	RAD TF-3: 7 (See Volume 3 below)

Actors	Transactions	Content Modules	Requestor or Responder	Optionality	Reference
Content Consumer		FHIR Based Imaging Study Manifest		C See Note 2	RAD TF-3-8 (See Volume 3 below)
Imaging Document Consumer	WADO-RS Get Instances [RAD-1xy]		Requestor	R	RAD TF-2: 3.1xy
Imaging Document Source	WADO-RS Get Instances [RAD-1xy]		Responder	R	RAD TF-2: 3.1xyt

246 Note 1: The Imaging Study Manifest content is defined in two alternative formats – A DICOM KOS IOD based format and a
247 FHIR Bundle format. It is proposed to have the Requestor (Content Creator) support both formats and the Content
248 Consumer support at least one of the two formats.

249 **Open Issue:** a number of interoperability approaches may be considered:

250 **1.** Either format may be implemented depending on the deployment (two distinct transactions)

251 2. The source supports both formats and the consumer selects the preferred one

252 3. The consumer supports both formats

253 Note 2 : The Content Consumer shall support at least one of the two formats

254 X.1.1 Actor Descriptions and Actor Profile Requirements

255 The transactions needed to query and retrieve Imaging Manifest Documents whose content is
256 specified by this profile are beyond the scope of the MADO Profile. Such transactions when
257 needed shall be addressed by grouping the MADO Profile with the desired Document sharing
258 profiles.

259 X.1.1.1 Content Creator

260 The Content Creator produces Imaging Study Manifests documents that are shared through a
261 document sharing infrastructure, not specified by this profile.

262 The Content Creator Actor shall ensure the Imaging Document Source Actor has access to the
263 corresponding imaging study DICOM instances referenced by the Imaging Study Manifest.

264 The Creator should have the ability to ensure that the Imaging Study Manifest is made accessible
265 to the Content Consumer in a manner which is not within the scope of the MADO Profile. For
266 example, it may be grouped with the Document Source of the MHD Profile.

267 X.1.1.2 Content Consumer

268 The Content Consumer consumes information provided by Imaging Study Manifests documents
269 that are shared through a document sharing infrastructure, not specified by this profile.

X.1.1.3 Imaging Document Consumer

The Imaging Document Consumer requests and receives DICOM instances from an Imaging Document Source.

The Imaging Document Consumer obtains the Imaging Study Manifest(s) identifying DICOM Studies of interest from the grouped Document Consumer that uses appropriate transactions (e.g. from other IHE Profiles such as MHD, MHDS or XDS.b) to search for and retrieve such Imaging Study Manifest(s) within the community.

Using the information from an Imaging Study Manifest the Imaging Document Consumer determines which DICOM Instance(s) it will retrieve.

Note: The Imaging Study Manifests do not identify individual frames within multi-frame objects, and as such, there is no possibility to retrieve individual frames using the MADO profile.

The Imaging Document Consumer issues a WADO-RS Get Instances [RAD-1xy] transaction in the Requestor role to the Imaging Document Source to retrieve the DICOM instances from Imaging Document Sources within that community.

The Imaging Document Consumer forms the URL endpoint in its Study Service Retrieve Request by using the following metadata elements from the retrieved Imaging Study Manifests:

- Study Instance UID
- Series Instance UID, as needed
- SOP Instance UID, as needed

The Imaging Document Consumer will typically retrieve all DICOM instances listed in the Imaging Study Manifest that belong to the same series from a specific Imaging Document Source within the community, by retrieving a Series Instances resource. Alternatively, it may choose to retrieve each Instance resource individually.

The Imaging Document Consumer shall not return an error if the list of instances within one series or the list of series within a study referenced in an Imaging Study Manifest is not be the same as all the instances of that series or study available at an Imaging Document Source and published by it for sharing within the community. In this case, the number of instances retrieved by using the request for Series Instances or Study Instances resource may be larger or smaller than the number of instances expected by the Imaging Document Consumer.

X.1.1.4 Imaging Document Source

The Imaging Document Source receives a WADO-RS Get Instances [RAD-1xy] transaction request from an Imaging Document Consumer to retrieve the requested instances and returns them to the requestor. If the <resource> component of the inbound request indicates the request for retrieval of a complete study or series, Imaging Document Source may select to only return those DICOM Instances that have been published by it in an Imaging Study Manifest.

306 **X.2 MADO Actor Options**

307 Options that may be selected for each actor in this profile, if any, are listed in the Table X.2-1.
308 Dependencies between options, when applicable, are specified in notes.

309 **Table X.2-1: MADO – Actors and Options**

Actor	Option Name	Reference
Content Creator	No Options (Note 2)	See X.2.1
Content Consumer	DICOM KOS-based Imaging Study Manifest (Note 1)	See X.2.1
Content Consumer	FHIR-Based Imaging Study Manifest (Note 1)	See X.2.2
Imaging Document Consumer	Rendered Instances Option	See X.2.3
Imaging Document Source	Rendered Instances Option	See X.2.3

310 Note 1: at least one of these two options shall be supported.

311 Note 2: **Open Issue:** a number of interoperability approaches may be considered:

312   **1.** Either manifest format may be implemented depending on the deployment (two distinct transactions)

313   2. The source supports both formats and the source selects the preferred one

314   3. The consumer supports both formats

315

316 **X.2.1 DICOM KOS-Based Imaging Study Manifest Option**

317 In this option the manifest consumed by the Content Consumer Actor uses the specification
318 from IHE RAD TF3: Chapter 7: MADO DICOM KOS-Based Imaging Study Content Definition.
319 The manifest will be a DICOM Part 10 encapsulated DICOM Information Object.

320 **X.2.2 HL7 FHIR-Based Imaging Study Manifest Option**

321 In this option the manifest consumed by the Content Creator Actor uses the specification from
322 IHE RAD TF3: Chapter 8: MADO HL7 FHIR Based Imaging Study Manifest Content
323 Definition..

324 **X.2.3 Rendered Instances Option**

325 In this option, the Document Consumer supports the ability to request and receive instances in a
326 rendered format.

327 In this option, the Document Source supports the ability to respond to request for rendered
328 instance and return them in a rendered format.

329 X.3 MADO Required Actor Groupings

330 An actor from this profile (Column 1) shall implement all of the required transactions and/or
331 content modules in this profile *in addition to __all__* of the requirements for the grouped actor
332 (Column 2).

333 If this is a content profile, and actors from this profile are grouped with actors from a workflow
334 or transport profile, the Reference column references any specifications for mapping data from
335 the content module into data elements from the workflow or transport transactions.

336 In some cases, required groupings are defined as at least one of an enumerated set of possible
337 actors; this is designated by merging column one into a single cell spanning multiple potential
338 grouped actors. Notes are used to highlight this situation.

339 Section X.5 describes some optional groupings that may be of interest for security considerations
340 and Section X.6 describes some optional groupings in other related profiles.

341

MADO Actor	Actor(s) to be grouped with	Reference	Content Bindings Reference
Content Consumer	Imaging Document Consumer	RAD TF-1:59	RAD TF-3: 7 or RAD TF-3-8
Imaging Document Consumer	Content Consumer	RAD TF-1:59	RAD TF-3: 7 or RAD TF-3-8
	ITI CT / Time Client	ITI TF-1: 7.1	
	ITI ATNA / Secure Node or Secure Application	ITI TF-1: 9.1	
Imaging Document Source	ITI CT / Time Client	ITI TF-1: 7.1	
	ITI ATNA / Secure Node or Secure Application	ITI TF-1: 9.1	

342

343 X.4 MADO Overview

344 X.4.1 Concepts

345 X.4.1.1 Intra-community sharing infrastructure

346 MADO enables retrieval of imaging studies shared within an enterprise and across enterprises
347 using RESTful services. The Imaging Document Consumer is typically an application that is
348 grouped with an actor providing access to the Imaging Study Manifest that contains a list of
349 DICOM Instances published by an Imaging Document Source in the community. The
350 mechanism of obtaining the Imaging Study Manifest is not constrained, and several models may
351 be used in conjunction with the MADO Profile, including but not limited to XDS.b, MHD,
352 MHDS.

353 As an example, the Imaging Document Consumer can discover and retrieve Imaging Study
354 Manifests across community lines by grouping with one of the following actors:

355 ● XDS.b Document Consumer: The MADO Content Consumer/Imaging Document
356 Consumer is grouped with the XDS.b Document Consumer that is the initiator of the
357 document discovery and retrieval and communicates with the XDS Document
358 Registry/Repositories using the Registry Stored Query [ITI-18] and Retrieve Document
359 Set [ITI-43] transactions. The XDS.b Document Consumer then transfers that
360 information to the Imaging Document Consumer.

361 Note: An XDS-I.b Document Consumer may also be grouped with a MADO
362 Imaging Document Consumer to support the use of the MADO Imaging Study
363 Manifest which is richer than the XDS-I.b Imaging Manifest and relies on a more
364 basic WADO-RS retrieve transaction that the RAD [107] transaction.

365 ● MHD Consumer: The MADO Content Consumer/Imaging Document Consumer is
366 grouped with the MHD Document Consumer that is the initiator of the document
367 discovery and retrieval and communicates with the MHD Document Responder. The
368 MHD Document Consumer uses the Find Document References [ITI-67] and Retrieve
369 Document [ITI-68] transactions to find and return the retrieved Imaging Manifests. The
370 MHD Consumer then provides this information to the Imaging Document Consumer.

371

372 The Imaging Study Manifests retrieved by an actor with which the Imaging Document Consumer
373 is grouped are documents formatted either as a DICOM KOS based or a FHIR Imaging Manifest
374 based document.

375 Once the Imaging Document Consumer has access to an Imaging Study Manifest, it forms the
376 request to retrieve selected DICOM instances from the target Imaging Document Source.

377 As a result, the Imaging Document Consumer can retrieve imaging studies from an Imaging
378 Document Source using a consistent mechanism, regardless of whether the imaging study is
379 published to an XDS.b or MHD environment.

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

383 ● Image Manager/Image Archive: The Imaging Document Source can have direct access to
384 the Image Manager/Image Archive, or it can communicate with one or more Image
385 Managers/Image Archives via standard mechanism such as the Retrieve Images [RAD-
386 16] transaction.

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

390

X.4.1.1 Cross-community sharing infrastructure

MADO may be grouped with the IHE XC-WADO for extending its use in cross-community environments. To perform such cross-community retrieval of imaging studies shared by a remote community, the MADO Imaging Document Consumer will be grouped with an XC-WADO Imaging Document Consumer. Such grouped actors shall be configured with the HomeCommunityId(s) of the community within which they operate. When these grouped actors operate on an imaging manifest coming from a remote community with a different HomeCommunityId, the XC-WADO Imaging Document Source will issue the Cross-Community Retrieve WADO-RS transaction [RAD-160] to the Cross-Community Imaging GW Actor that provides access to remote communities (See XC-WADO 58.4.2.1 Use Case #1: Image Set sharing between communities).

The mechanism of obtaining the Imaging Study Manifest is not constrained, and several models may be used in conjunction with the MADO and the XC-WADO Profile, for cross-community document sharing profiles such but not limited to XCA-I. In this case, the XCA-I Initiating Gateway can proxy image retrieve request to other communities or imaging source actors that are not available to imaging document consumers within the initiating community. See Appendix A in this supplement where cross-community addressing is discussed.

The Document Consumer that retrieve the Imaging Study Manifests is an actor with which the Imaging Document Consumer is grouped. Retrieved Imaging Study Manifest are documents formatted either as a DICOM KOS based, or a FHIR Imaging Manifest based document.

Once the Imaging Document Consumer has accessed to an Imaging Study Manifest, it forms the request to retrieve selected DICOM instances from the target Imaging Document Source if the Imaging Manifest is from its own community (same HomeCommunityId), or otherwise through the Initiating Imaging Gateway that serves its community for cross-community access.

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.b or MHD environment, or an XCA community.

X.4.1.2 Imaging Reports

MADO focuses on retrieving DICOM Instances using RESTful services. Other imaging study-related documents, such as radiology reports in CDA or FHIR based formats are outside the scope of the MADO Profile and may be retrieved using the ITI MHD Actors or the XDS.b Actors.

X.4.1.3 DICOMweb Study Service Retrieve transaction URI

The DICOMweb Study Service Retrieve transaction URI used in the [RAD-1xy] transaction between Imaging Document Consumer and Imaging Document Source is formed as described for transaction [RAD-107] in the IHE WIA profile (See X.4.1.5 WADO-RS URL).

X.4.2 Use Cases

X.4.2.1 Use Case #1: DICOM Instances Retrieval

X.4.2.1.1 Instances Retrieval Use Case Description

The Manifest-Based Access to DICOM Objects corresponds to a subset of a broader use case scenario from the user perspective.

- A system acting as an imaging document consumer has access to imaging study manifests (the way manifests are accessed and exchanged is out of scope of the use case).

- A user on this system uses the content of any such imaging study manifest to choose an entire imaging study or a subset (series, set of instances).

- The imaging document consumer requests the retrieval of these selected DICOM instances from the remote imaging sources using the location information provided in the imaging study manifest.

- This request retrieval is received by an imaging source and the corresponding DICOM instances are accessed from its internal storage and returned to the requesting imaging document consumer.

- The imaging document consumer receives the DICOM Instances, in the format requested, and processes them.

X.4.2.1.1.1 Pre-conditions

- Imaging Study Manifest is accessible by Imaging Document Consumer.
- Relevant DICOM instances have been selected from the Imaging Study Manifest.

X.4.2.1.1.2 Post-conditions

- DICOM instances are available in the Imaging Document Consumer for processing.

451 **X.4.2.1.2 Instance Retrieval Process Flow**
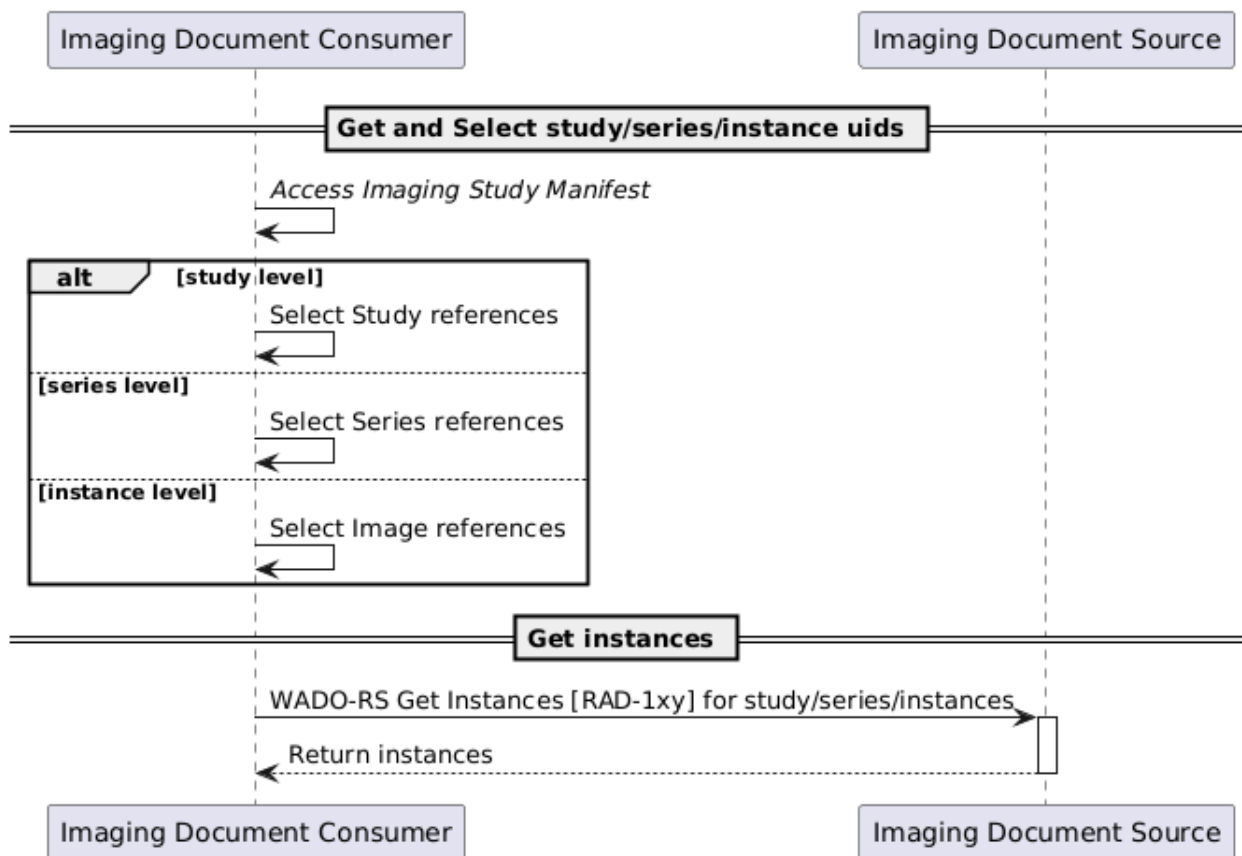
452

453 **Figure X.4.2.2-1: Basic Process Flow in MADO Profile**

454 The text in Figure X.4.2.2-2 was used to generate the diagram in Figure X.4.2.2-1. Readers will
455 generally find the diagram more informative. The text is included here to facilitate editing.

456

```
@startuml Basic Process Flow in MADO
participant "Imaging Document Consumer" as IDC
participant "Imaging Document Source" as IDS
== Get and Select study/series/instance uids ==
IDC->IDC: //Access Imaging Study Manifest//
alt study level
IDC->IDC: Select Study references
else series level
IDC->IDC: Select Series references
else instance level
IDC->IDC: Select Image references
end
== Get instances ==
IDC->IDS: WADO-RS Get Instances [RAD-1xy] for study/series/instancesactivate IDS
IDS-->IDC: Return instances
```

```
472  deactivate IDS
473  @enduml
```

Figure X.4.2.2-2: Basic Process Flow in MADO Profile Pseudocode

X.4.2.1.3 Main Flow

Imaging Document Consumer *wants to retrieve the DICOM instances of the imaging study referenced in the Imaging Study Manifests:*

- The Imaging Document Consumer initiates a WADO-RS Get Instances [RAD-1xy] request to the Imaging Document Source to get the selected DICOM instances.

- Remote Imaging Document Source accesses the requested DICOM instances and generates the response to the inbound WADO-RS Retrieve [RAD-1xy] request from the Imaging Document Consumer. The response contains either requested DICOM instances or an error code indicating that some or all requested instances are not accessible.

X.4.2.2 Use Case #2: Key DICOM Instances Retrieval

X.4.2.2.1 Key Instances Retrieval Use Case Description

The Manifest-Based Access to DICOM Objects facilitates access to key images, without having to selectively retrieve all DICOM Key Object Selection instances to identify which images have been flagged as key by one or more Key Image Note (See IHE KIN Profile):

- A system acting as an imaging document consumer has access to imaging study manifests (the way manifests are accessed and exchanged is out of scope of the use case).

- A user on this system uses the content of any such imaging study manifest to learn that key images have been selected and choose to retrieve only these key images flagged by one or more KIN created by the source of the imaging study. It relies on the coded reason and the optional comments associated to the KIN to identify the key images of interest.

- The imaging document consumer requests the retrieval of these selected DICOM instances from the remote imaging sources using the location information provided in the imaging study manifest.

- This request retrieval is received by an imaging source and the corresponding DICOM instances are accessed from its internal storage and returned to the requesting imaging document consumer.

- The imaging document consumer receives the DICOM Instances flagged by one or more KIN, in the format requested, and processes them.

X.4.2.2.1.1 Pre-conditions

- Imaging Study Manifest is accessible by Imaging Document Consumer.

- The imaging Study contains one or more KIN and the user chooses to select the retrieval of the corresponding DICOM instances from the Imaging Study Manifest.

X.4.2.2.1.2. Post-conditions

- DICOM instances flagged as significant are available in the Imaging Document Consumer for processing.

X.4.2.2.2 Key Instances Retrieval Process Flow
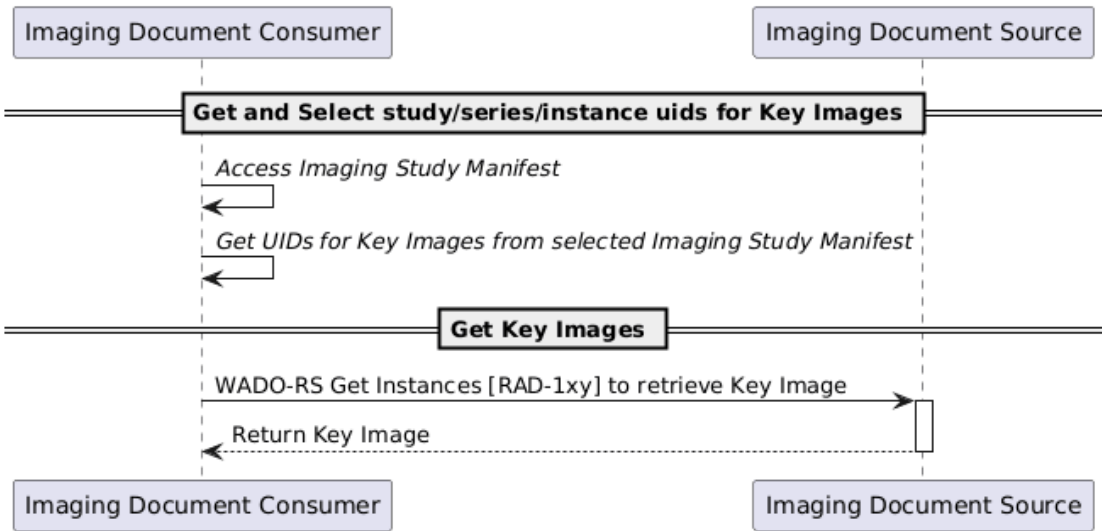
Figure X.4.2.2-1: Key Instances Retrieval Flow

The text in Figure X.4.2.2-2 was used to generate the diagram in Figure X.4.2.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```
@startuml Key Instance Retrieval Process Flow
participant "Imaging Document Consumer" as IDC
participant "Imaging Document Source" as IDS
== Get and Select study/series/instance uids for Key Images ==
IDC->IDC: //Access Imaging Study Manifest//
IDC->IDC: //Get UIDs for Key Images from selected Imaging Study Manifest//
== Get Key Images ==
IDC->IDS: WADO-RS Get Instances [RAD-1xy] to retrieve Key Image
activate IDS
IDS-->IDC: Return Key Image
deactivate IDS
@enduml
```

Figure X.4.2.2-2: Key Instances Retrieval Flow Pseudocode

X.4.2.2.3 Main Flow

Imaging Document Consumer *wants to retrieve the selected instances that have been flagged as significant within the Imaging Study Manifests:*

- The Imaging Document Consumer initiates a WADO-RS Get Instances [RAD-1xy] request to the Imaging Document Source to get the selected DICOM instances flagged as significant.

- Remote Imaging Document Source accesses the requested DICOM instances and generates the response to the inbound WADO-RS Retrieve [RAD-1xy] request from the Imaging Document Consumer. The response contains either requested DICOM instances or an error code indicating that some or all requested instances are not accessible.

X.4.2.3 Use Case #3: Invoke Remote Image Display

X.4.2.3.1 Invoke Remote Image Display Use Case Description

The Manifest-Based Access to DICOM Objects also supports the invocation of a remote viewer that has access to the specific imaging study without having to support a DICOM capable image viewer locally, but simply a web browser.

- A system acting as an imaging document consumer has access to imaging study manifests (the way manifests are accessed and exchanged is out of scope of the use case).

- A user on this system wishes to launch a remote image viewer for the display of the imaging study related to the imaging manifest.

- The imaging document consumer uses a URL provided in the imaging study manifest to launch a remote image display on the specific imaging study.

- The user navigates among the series and instances of the imaging study as desired using the remote viewer user interface.

X.4.2.3.1.1 Pre-conditions

- Imaging Study Manifest is accessible by Imaging Document Consumer.

- The imaging Study Manifest contains a remote Invoke Image Display URL and the user chooses to launch such a remote image viewer for the corresponding imaging study

X.4.2.3.1.2 Post-conditions

- The imaging study is displayed without the need for a requester side DICOM viewer

564 ### X.4.2.3.2 Invoke Remote Image Display Process Flow
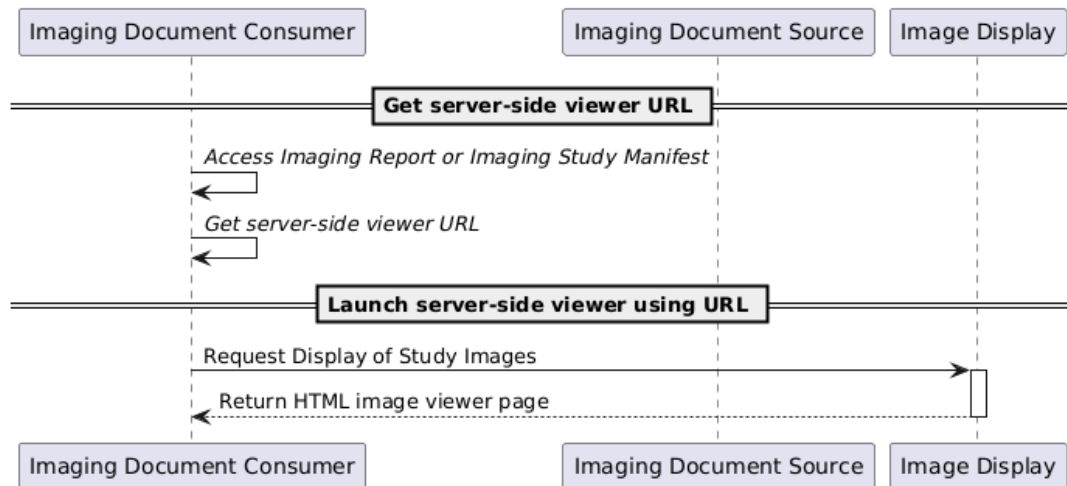
565
566 **Figure X.4.2.3-1: Invoke Remote Image Display Process Flow**

567 The text in Figure X.4.2.3-2 was used to generate the diagram in Figure X.4.2.3-1. Readers will
568 generally find the diagram more informative. The text is included here to facilitate editing.

569
```
570  @startuml Invoke Remote Image Display Process Flow
571  participant "Imaging Document Consumer" as IDC
572  participant "Imaging Document Source" as IDS
573  participant "Image Display" as ID
574  == Get server-side viewer URL ==
575  IDC->IDC: //Access Imaging Report or Imaging Study Manifest//
576  IDC->IDC: //Get server-side viewer URL//
577  == Launch server-side viewer using URL ==
578  IDC->ID: Request Display of Study Images
579  activate ID
580  ID-->IDC: Return HTML image viewer page
581  deactivate ID
582  @enduml
```
583 **Figure X.4.2.3-2: Invoke Remote Image Display Process Pseudocode**

584 ### X.4.2.3.3 Main Flow

585 **Image Display Invoker** *wants to launch a remote imaging viewer using a URL within the*
586 *Imaging Study Manifests:*

587 ● The Image Display Invoker Actor grouped with the Imaging Document Consumer Actor
588 initiates the invoke imaging display [RAD-2xy] request to the Display Actor to launch a
589 remote display.

590   ● Display Actor accesses the requested DICOM instances (may be available locally or
591   remotely through the MADO profile) and displays them for the benefit of the Image
592   Display Invoker.

593

X.5 MADO Security Considerations

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

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

603 Deployments should consider whether or not:

604   ● The Imaging Document Consumer performs user authentication to access patient data.

605   ● The Imaging Document Source uses credentials or tokens supplied by the Imaging
606   Document Consumer in the WADO-RS Retrieve transaction.

607   ● The Imaging Document Consumer or the Imaging Document Source (or both) records
608   access in an audit log.

609

610 This profile does not define how the Imaging Document Consumer supplies credentials to the
611 Imaging Document Source to provide the user with a seamless "single sign-on" experience. The
612 HTTP GET URL transaction allows for a range of authentication mechanisms, including use of
613 mTLS authentication, digest authentication, client certificate-based authentication, provision of a
614 SAML assertion in an authentication header, or other mechanisms suitable for stateless atomic
615 transactions.

616 The user authentication and authorization methods are outside the scope of the MADO Profile.
617 Implementers should consider implementing the IHE ITI Profile such as Internet User
618 Authorization (IUA).

619 Implementations should also consider how availability and integrity will be protected, including
620 intentional attacks such as maliciously crafted queries that interfere with service availability.

621 The WADO-RS transactions may include in their response a URL specifying where the
622 corresponding instances can be retrieved. In the absence of protection, such as TLS, a malicious
623 attacker may intercept the response and rewrite these URLs to a location of suspect origin. An
624 Imaging Document Consumer should verify that any received URL is valid and corresponds to a
625 known secure location.

626 The security considerations for a content module are dependent upon the security provisions
627 defined by the grouped actor(s).

628

629 X.6 MADO Cross Profile Considerations

630 The table below describes some optional groupings in other related profiles.

631

MADO Actor	Actor(s) may be grouped with	Reference	Content Bindings Reference
Content Consumer	ITI XDS.b / Document Consumer OR ITI MHD / Document Consumer	ITI TF-1: 10.1 ITI TF-1: 33	
Content Consumer	RAD XDS-I / Imaging Consumer (See Note 1)	RAD TF:1-18	
Content Consumer grouped with Imaging Document	RAD XC-WADO Imaging Document Consumer	RAD XC-WADO Supplement	
Content Consumer	RAD IID Image Display Invoker	RAD TF-1 Section 35	
Content Creator	ITI XDS.b / Document Consumer OR ITI MHD / Document Consumer	ITI TF-1: 10.1 ITI TF-1: 33	
	RAD XDS-I / Imaging Source (See Note2)		
	ITI CT / Time Client	ITI TF-1: 7.1	
	ITI ATNA / Secure Node or Secure Application	ITI TF-1: 9.1	

632

633 Note 1 : The grouping of the Content Consumer Actor from the XDS-I profile with the Content Consumer of the MADO profile
634 may require further analysis for a clear specification

635 Note 2 : The grouping of the Content Creator Actor from the XDS-I profile with the Content Creator of the MADO profile may
636 require further analysis for a clear specification

637

638

639

Volume 2 – Transactions

640

641

642   *Add Section 3.1xy*

3.1xy WADO-RS Get Instances [RAD-1xy]

643

3.1xy.1 Scope

644

This transaction is used to retrieve DICOM instances in an imaging study based on information extracted from the imaging study manifest.

645
646

3.1xy.2 Actor Roles

647

648   **Table 3.1xy.2-1: Actor Roles**

Role:	Requester: Submit retrieve DICOM instance requests
Actor(s):	The following actor plays the role of Requester: Imaging Document Consumer
Role:	Responder: Returns the requested DICOM instance(s)
Actor(s):	The following actor plays the role of Responder: Imaging Document Source

649

650

3.1xy.3 Referenced Standards

651

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

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

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

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

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

660   ● DICOM PS3.18 Section 10.4: Web Services – Retrieve Transaction of the DICOM
661   Studies Service

662   ● DICOM PS3.18 Annex F: DICOM JSON Model

663   ● DICOM PS3.19 Annex A.1: Native DICOM Model

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

665 **3.1xy.4 Messages**

666
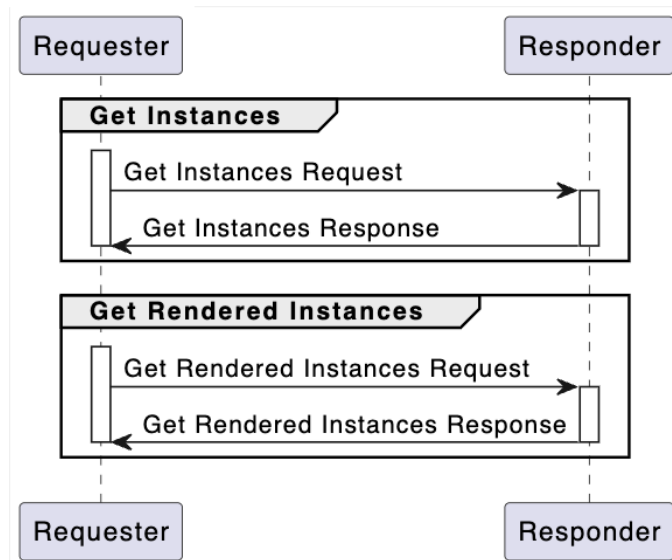
667
668 **Figure 3.1xy.4-1: Interaction Diagram**

669 This transaction defines request/response message pairs:

670   ● Get Instances (Section x.x.4.1 and x.x.4.2),

671   ● Get Rendered Instances (Section x.x.4.3 and x.x.4.4) when the Rendered Instances
672   Option is supported.

673 A Requester and a Responder shall support Get Instances request/response message pair as
674 defined in DICOM. They may optionally implement Get Rendered Instances request/response
675 message pair as defined in DICOM.

676 **3.1xy.4.1 Get Instances Request Message**

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

678 **3.1xy.4.1.1 Trigger Events**

679 The Requester wishes to retrieve DICOM instances.

3.1xy.4.1.2 Message Semantics

680

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

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

684 The message shall correspond to one of the Instance Resources in Table 3.1xy.4.1.2-1.

685 **Table 3.1xy.4.1.2-1: Retrieve Transaction Instance Resources**

Resource	Reference
Study	
Series	DICOM PS3.18 Section 10.4.1.1.1
Instance	

686 Although DICOM also includes the Frame Pixel Data resource, it is not required for this
687 transaction.

688 Imaging Document Consumers acting as Requester should consider replacing a study level
689 requests by issuing multiple series level requests in order to improve overall performance.

690 The HTTP Request URI for the DICOMweb Retrieve Transaction of the Studies Service is
691 formed from the `<protocol>` component, `<endpoint>` component, `<resource>` component.

692 ● The value of the `<protocol>` component shall be set to `https://`.

693 ● The `<endpoint>` component of DICOMweb Study Service Retrieve transaction URI is
694 formed from hostname, port, and endpoint path of the RESTful service of the responder,
695 as follows: `<hostname[:port]>/<endpoint path>/`.

696 ● The `<resource>` component is formed from appropriate resource UIDs depending on the
697 resource being retrieved as well as the type of the resource. The value of the `<resource>`
698 component shall be formatted as specified in the definition of the WADO-RS Get
699 Instances [RAD-1xy] transaction. See RAD-TF2: 4.1xy.4.3

700

3.1xy.4.1.2.1 Example of a Get Instances Request message

701

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

```
705  https://www.imaging-document-source.org/
706  studies/2.999.1.59.40211.12345678.678910/series/2.999.1.59.40211.789001
707  276.14556172.67789/instances/2.999.1.59.40211.2678810.87991027.899772.2
708  Accept: multipart/related; type=application/dicom
```

709

3.1xy.4.1.3 Expected Actions

The Responder shall parse the request and redirect it to a destination from which the appropriate representation of the Resource in the Selected Media Type (see DICOM PS3.18 Section 10.4.2) shall be retrieved, and return a response as described in Section 4.160.4.2.

3.1xy.4.2 Get Instances Response Message

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

3.1xy.4.2.1 Trigger Events

The Responder completes the processing of the Get Instances Request Message and receives complete or partial response from the destination it forwarded the request to.

3.1xy.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.

The Responder shall provide a response as described in Table 3.1xy.4.2.2-1.

Table 3.1.xy.4.2.2-1: Response Message Semantics

Resource	Reference
Study	
Series	DICOM PS3.18 Section 10.4.3.3.1
Instance	

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.

3.1xy.4.2.3 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.

3.1xy.4.3 Get Rendered Instances Request Message

The Requester retrieves one or more representations of a DICOM Resource, rendered as appropriate images or other representations, from the Responder.

737 **3.1xy.4.3.1 Trigger Events**

738 The Requester wishes to retrieve rendered instances.

739 **3.1xy.4.3.2 Message Semantics**

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

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

743 The message shall correspond to one of the Instance Resources in Table 3.1.xy.4.3.2-1.

744 **Table 3.1xy.4.3.2-1: Retrieve Transaction Instance Resources**

Resource	Reference
Rendered Instance	DICOM PS3.18 Section 10.4.1.1.3

745 Although DICOM also includes the Rendered Study, Rendered Series, and Rendered Frame Pixel Data resource, it is not
746 required for this transaction.

747 The HTTP Request URI for the DICOMweb Retrieve Transaction of the Studies Service is
748 formed from the `<protocol>` component, `<endpoint>` component, `<resource>` component.

749 ● The value of the `<protocol>` component shall be set to `https://`.

750 ● The `<endpoint>` component of DICOMweb Study Service Retrieve transaction URI is
751 formed from hostname, port, and endpoint path of the RESTful service of the responder,
752 as follows: `<hostname[:port]>/<endpoint path>/`.

753 ● The `<resource>` component is formed from appropriate resource UIDs depending on the
754 resource being retrieved as well as the type of the resource. The value of the `<resource>`
755 component shall be formatted as specified in the definition of the WADO-RS Get
756 Instances [RAD-1xy] transaction. See RAD-TF2: 4.1xy.4.3

757

758 **3.1xy.4.3.2.1 Example of a Get Instances Request message**

759 The following is an example of an HTTP Request URI for retrieving a rendered composite
760 DICOM Instance. This example uses an Accept header to request the DICOM Instance returned
761 in the JPEG format.

762 ```
763 https://www.imaging-document-source.org/
764 studies/2.999.1.59.40211.12345678.678910/series/2.999.1.59.40211.789001
765 276.14556172.67789/instances/2.999.1.59.40211.2678810.87991027.899772.2
766 /rendered
     Accept: multipart/related; type=image/jpeg
```

### 3.1xy.4.3.3 Expected Actions

The Responder shall parse the request and redirect it to a destination from which the appropriate representation of the Resource in the Selected Media Type (see DICOM PS3.18 Section 10.4.2) shall be retrieved, and return a response as described in Section 4.160.4.2.

The Responder is not expected to prepare the rendered instances but rather to request that to be prepared by the destination.

### 3.1xy.4.4 Get Rendered Instances Response Message

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

### 3.1xy.4.4.1 Trigger Events

The Responder completes the processing of the Get Instances Request Message and receives a complete or partial response from the destination it forwarded the request to.

### 3.1xy.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 Table 3.1xy.4.2.2-1.

**Table 3.1xy.4.4.2-1: Response Message Semantics**

| Resource | Reference |
|---|---|
| Rendered Instance | DICOM PS3.18 Section 10.4.3.3.3 |

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.

### 3.1xy.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.

### 3.1xy.6 Security Considerations

Additional security considerations that may apply are discussed in RAD TF-1: X.5 – MADO Security Considerations.

### 3.1xy.6.1 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.

### 3.1xy.6.(z) <Actor> Specific Security Considerations

*<This section should specify any specific security considerations on an actor-by-actor basis.>*

# Appendix A – Addressing the sources of images to retrieve beyond a single community

This appendix provides information about the way image sources are addressed both within a community where the DICOM instances are accessed through the MADO Profile, as well as cross-community where the MADO Profile is grouped with the XC-WADO Profile.

In particular, the way the WADO-RS Request conveys addressing information in such a mixed environment is addressed.

This Appendix will be completed for the trial implementation version of this Profile.

---

818 # Volume 3 – Content Modules

819 ## 5 IHE Namespaces, Concept Domains and
820 ## Vocabularies

821 *Add to Section 5 IHE Namespaces, Concept Domains and Vocabularies*

822

823 ### 5.1 IHE MADO Namespaces

824 *No new OID, UID or URN have been introduced.*

825 *<**For Public Comment publication**, please explicitly identify all **new** OIDs, UIDs, URNs, etc.,*
826 *defined specifically for this profile. These items should be collected from the sections within this*
827 *supplement and listed here as additions to the applicable domain OID Registry. The tables*
828 *within this section will be deleted prior to inclusion into the Technical Framework as Final Text,*
829 *but should be present for publication for Public Comment.>*

830 ### 5.2 IHE MADO Concept Domains

831 *Not Applicable.*

832 *<Concept Domains are named categories of things that are used when it isn't possible to bind to*
833 *a specific set of codes. There are a number of reasons you might not be able to define and bind*
834 *to a specific set of codes, one of the most common being that the codes set needs to vary*
835 *depending on locale or context.>*

836 For a listing of the <Domain Name> Concept Domains see *<enter location of the domains*
837 *Concept Domains or NA if none>*

838

| conceptDomain | conceptDomainName | Description |
|---|---|---|
| <oid or uid> | <code system name> | <short description or pointer to more detailed description> |
| <oid or uid> | <code system name> | <short description or pointer to more detailed description> |
| <oid or uid> | <code system name> | <short description or pointer to more detailed description> |

839

840 ## 5.3 IHE MADO Format Codes and Vocabularies

841 ### 5.3.1 IHE Format Codes

842

843 *List in the table below any **new** format codes to be added to the IHE Format Codes wiki page at*
844 *http://wiki.ihe.net/index.php/IHE_Format_Codes. For public comment, the additions must be*
845 *listed in the table below. The domain technical committee must ensure any new codes are also*
846 *added to the wiki page prior to publication for trial implementation.*

847

| Profile | Format Code | Media Type | Template ID |
|---|---|---|---|
| Manifest Based Access to DICOM Objects (MADO) | &lt;urn:ihe: &gt; TBC<br>DICOM KOS-Based Imaging Study Manifest | | &lt;oids&gt; |
| Manifest Based Access to DICOM Objects (MADO) | &lt;urn:ihe: &gt; TBC<br>HL7 FHIR-Based Imaging Study Manifest | | |
| | | | |

848

849 ### 5.3.4 Imaging Study Manifest Search Metadata

850 A set of generic search parameters is defined in this section for the search of imaging study manifests.

851 Note: The search parameters defined below should all be supported by the search consumer and
852 search source. However any given query may use a subset of these search parameters.

853 #### 5.3.4.1 Generic Search Parameters
854 The generic document search supports the following search request parameters:
855 - Patient Business Identifier – patient id
856 - Period – the time of service that is being documented by the DocumentReference.
857 - The period search parameter specifies an interval which the time of service overlaps
858 - Date - document date/time created
859 - Category – class of document (e.g. *image* for imaging manifest*)*
860 - Practice Setting – specialty where care documented was performed/provided (*e.g., radiology,*
861 *cardiology, surgery, endoscopy for* imaging study manifest*)*

862 #### 5.3.4.2 Specific Medical Imaging Search Parameters
863 The medical imaging search extends the generic search parameters with the following parameters:
864 - Modality type
865 - Anatomical Region - body part

866 **5.3.4.3 Return Parameters**

867 The search parameters defined in the query will be used by the receiver to match against any known
868 records in the source. For each matching entry, a response will be returned to the consumer defining
869 some of the following :

870    ● Document Location URL – retrieve location (mandatory)
871    ● Document
872       o Identifier
873       o Date
874       o Type
875       o Format – mime type
876       o Author(s)
877       o Owner/Organisation
878    ● Category
879    ● Practice Setting
880    ● Order identifier
881    ● Procedure code
882    ● Modality type
883    ● Anatomical Region - body part

884 The Health Professional can then use the returned parameter values to filter out any relevant imaging
885 study manifest of interest which can then be retrieved individually.

886 # 6 Chapter left blank

887

888

# 7 MADO DICOM KOS-Based Imaging Study Content Definition

DICOM Content Definitions constrain the use of instances of specific DICOM IODs (also referred to as DICOM objects). This typically means placing requirements on the creators of those instances, although requirements may also be placed on the receivers and users.

The most common such requirements are to:

- Make a module that is optional (U) in a DICOM IOD be required or conditional,
- Make an attribute that is optional (Type 3) in a DICOM Module be required or conditional,
- Require that an attribute that is optional (Type 3) in a DICOM Module be absent
- Constrain the content of an attribute to be empty
- Constrain the content of an attribute to be populated in a certain way, such as:
  - Constraining the value to be taken from a specific table
  - Constraining the value to be copied from a specific source
  - Constraining the value to encode certain information
- Require that an attribute be displayed/accessible to the operator

Reiterating DICOM requirements is kept to a minimum sufficient to provide context for the IHE requirements. Implementers are still required to be familiar with, and conform to, the underlying DICOM specification.

Content Definitions may be referenced from a Profile independent of transactions to constrain content without specifying the transport. Content Definitions may also be referenced from within a Transaction specification to constrain the content without duplicating the same constraint text across multiple related transactions.

For attributes that are optional, the creator is permitted but not required to include them, and the receiver is permitted but not required to ignore them.

## 7.1 Conventions

DICOM Conventions are defined in [Appendix E](#) to the *IHE Technical Frameworks General Introduction*.

**Table 7.1.2-1: Usage of DICOM Modules in IHE**

| M / C / U | As defined in DICOM PS 3.3 |
|---|---|
| R | The Module is defined as Conditional (C) or User Option (U) in DICOM. The Requirement is an IHE extension of the DICOM requirements, and the module shall be present. |

---

| | |
|---|---|
| RC | The Module is defined as Conditional (C) or User Option (U) in DICOM. The Requirement is an IHE extension of the DICOM requirements, and the module shall be present when the specified conditions apply. |

918
**Table 7.1.2-2: Usage of DICOM Attributes in IHE**

| | |
|---|---|
| O | The attribute or its value is optional, i.e., in DICOM it is Type 2 or 3. |
| O+* | The attribute is optional, but additional constraints have been added. Note: The specification approach does not force a Type 2 or Type 3 value to become a Type 1 by stating O+. |
| R | The attribute is required, and is not an IHE extension of the DICOM requirements; i.e., it is already Type 1 in DICOM, but additional constraints are placed by IHE, for example on the value set that may be used for the attribute. |
| R+ | The Requirement is an IHE extension of the DICOM requirements, and the attribute shall be present, i.e., is Type 1, whereas the DICOM requirement may be Type 2 or 3. |
| RC+ | The Requirement is an IHE extension of the DICOM requirements, and the attribute shall be present when the condition is satisfied, i.e., is Type 1C, whereas the DICOM requirement may be Type 2 or 3. If the condition is not fulfilled, the DICOM definitions apply. Note, that this means that the attribute may be present / have a value also in case the condition does not apply. |
| D | The requirements of DICOM apply unchanged, but the attribute needs to be displayed. |
| - | No IHE extension of the DICOM requirements is defined. The attribute is listed for better readability or similar purpose. |
| X+ | The attribute information is required to be absent. DICOM Type 2 attributes shall be present with no value. DICOM Type 3 attributes shall be absent. |

919

# 7.2    General Definitions

921   None.

# 7.3    Imaging Study Manifest IOD Definitions

923   This section contains a DICOM IOD specification referenced in the IHE MADO profile
924   specifying the parts of the DICOM Standard used and the extended IHE requirements.

## 7.3.1  Referenced Standards

926   ● DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

927 ## 7.3.2 IOD Definition

928 **Table 7.3.2-1: Usage of DICOM Modules in MADO Imaging Study Manifest**

| IE | Module | Reference | Usage | IHE Usage |
|---|---|---|---|---|
| Patient | Patient | C.7.1.1 | M | M<br>See Section 7.4.1.1.1 |
| Study | General Study | C.7.2.1 | M | M<br>See Section 7.4.1.2.1 |
| Series | Key Object Document Series | C.17.6.1 | M | M<br>See Section 7.4.1.4.1 |
| Equipment | General Equipment | C.7.5.1 | M | M<br>See Section 7.4.1.5.1 |
| SR Document | Key Object Document | C.17.6.2 | M | M<br>See Section 7.4.3.1.1 |
| | SR Document Content | C.17.3 | M | M<br>See Section 7.4.3.2.2 |
| | SOP Common | C.12.1 | M | M<br>See Section 7.4.1.6.1 |

929

930 ## 7.3.3 Key Object Module Definitions

931 This section contains DICOM Module specifications referenced in Section 7.3.2 IOD Definitions
932 for the MADO DICOM KOS Based imaging study manifest.

933 The following color coding is used in the module tables to highlight the attributes added to the
934 standard KOS IOD.

| IHE Usage (Value Types) |
|---|
| Standard DICOM KOS IOD attribute Value Type. |
| Extension to DICOM KOS IOD. These extensions are based on the MCWG Extensions to Imaging Study Manifest recommendations.<br><br>Issue: Allowing such extensions in a Key Object Selection SOP Class is important to allow backward compatibility with the KOS Manifests widely used in many deployments. It requires some relaxation in the DICOM Standard. This needs to be addressed with the DICOM Committee. |

935 ### 7.3.3.1 Patient Module

936 ### 7.3.3.1.1 Referenced Standards

937 ● DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

938    **7.3.3.1.2    Module Definition**

939                    **Table 7.3.3.1.2-1: Usage of DICOM Attributes in Patient Module**

| Excerpt from **DICOM PS3.3 Table C.7-1 Patient Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |
| Patient's Name | (0010,0010) | 2 | Patient's full name. |
| Patient ID | (0010,0020) | R+ | Primary identifier for the patient. Value: National Patient Id. |
| Issuer of Patient ID | (0010,0021) | 3 | Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID. If present should contain a label that corresponds to the authority identified by the Universal Entity ID (0010,0032) in the Issuer of Patient ID Qualifiers Sequence (0010,0024). |
| Issuer of Patient ID Qualifiers Sequence | (0010,0024) | R+ | Attributes specifying or qualifying the identity of the Issuer of the Patient ID (0010,0021), or scoping the Patient ID (0010,0020). Only a single Item shall be included in this Sequence. |
| > Universal Entity ID | (0010,0032) | R+ | Globally unique identifier (OID) for the Patient ID Assigning Authority. The authority identified by this attribute shall be the same as that labelled by the Issuer of Patient ID (0010,0021). |
| > Universal Entity ID Type | (0010,0033) | 1C | Standard defining the format of the Universal Entity ID. Required if Universal Entity ID (0040,0032) is present. Fixed value: "ISO" |
| > Type of Patient ID | (0010,0022) | 3 | The type of identifier in the Patient ID (0010,0020). Fixed value (if present): "TEXT" |

| Patient's Birth Date | (0010,0030) | 2 | Birth date of the patient. |
|---|---|---|---|
| Patient's Sex | (0010,0040) | 2 | Sex of the named patient. Enumerated Values: <ul><li>"M" - male</li><li>"F" - female</li><li>"O" - other</li></ul> |
| Patient Comments | (0010,4000) | 3 | Used for national extensions (e.g. birth place) associated to patient demographics information used to validate the consistency between the patient ID and its demographic traits beyond sex, birth date, and names. |
| Other Patient IDs Sequence | (0010,1002) | R+ | A Sequence of identification numbers or codes used to identify the Patient, which may or may not be human readable, and may or may not have been obtained from an implanted or attached device such as an RFID or barcode. One or more Items shall be included in this Sequence. Values: National, Regional and Local Patient Ids. Note: This attribute should provide a list of the national, regional and local patient identifiers. The local patient identifiers are those known in the imaging source at the time of the manifest creation. |
| > Patient ID | (0010,0020) | 1 | An identifier for the Patient. |
| > Issuer of Patient ID | (0010,0021) | 3 | Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID (0010,0020). If present should contain a label that corresponds to the authority identified by the Universal Entity ID (0010,0032) in the Issuer of Patient ID Qualifiers Sequence (0010,0024). |
| > Issuer of Patient ID Qualifiers Sequence | (0010,0024) | R+ | Attributes specifying or qualifying the identity of the Issuer of the Patient ID (0010,0021), or scoping the Patient ID (0010,0020). Only a single Item shall be included in this Sequence. |
| >> Universal Entity ID | (0010,0032) | R+ | Globally unique identifier (OID) for the Patient ID Assigning Authority. |

| | | | |
|---|---|---|---|
| | | | The authority identified by this attribute shall be the same as that labelled by the Issuer of Patient ID (0010,0021). |
| >> Universal Entity ID Type | (0010,0033) | 1C | Standard defining the format of the Universal Entity ID. Required if Universal Entity ID (0040,0032) is present. Fixed value: "ISO" |
| >> Type of Patient ID | (0010,0022) | 1 | The type of identifier in the Patient ID (0010,0020) in this Item. Fixed value: "TEXT" Note: This attribute is mandatory (type 1) in this item. |

940

### 7.3.3.2    General Study Module

#### 7.3.3.2.1    Referenced Standards

943
- DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

#### 7.3.3.2.2    Module Definition

945
**Table 7.3.3.2..2-1: Usage of DICOM Attributes in General Study Module**

| Excerpt from **DICOM PS3.3 Table C.7-3 General Study Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |
| Study Instance UID | (0020,000D) | 1 | Unique identifier for the Study. Copy of the referenced study's Study Instance UID (0020,000D). Note: There is a 1 to 1 relationship between this KOS manifest and the study that this KOS manifest references. |
| Study Date | (0008,0020) | R+ | Date the Study started. Note: The study date needs to be defined and, although Type 2 in the referenced imaging study, is by experience always quasi-present. |
| Study Time | (0008,0030) | 2 | Time the Study started. |

| | | | |
|---|---|---|---|
| Referring Physician's Name | (0008,0090) | 2 | Name of the Patient's referring physician. |
| Study ID | (0020,0010) | 2 | User or equipment generated Study identifier. |
| Accession Number | (0008,0050) | 2 | A departmental IS generated number that identifies the order for the Study.<br><br>The Accession Number (0008,0050) is associated with a departmental IS (RIS) request. There is no departmental IS (RIS) request for a KOS manifest and so this attribute must be present with no value defined.<br><br>Note: As there is a need to associate several RIS requests to a single study, the RIS request accession number(s) are placed in the Referenced Request Sequence (0040,A370). |
| Issuer of Accession Number Sequence | (0008,0051) | 2C | Identifier of the Assigning Authority that issued the Accession Number (0008,0050). A value shall be present.<br><br>Only a single Item shall be included in this Sequence. |
| > Universal Entity ID | (0040,0032) | 1 | Globally unique identifier (OID) for the Accession Number (0008,0050) Assigning Authority. |
| > Universal Entity ID Type | (0040,003) | 1C | Standard defining the format of the Universal Entity ID. Required if Universal Entity ID (0040,0032) is present.<br><br>Fixed value: "ISO" |
| Study Description | (0008,1030) | 3 | Institution-generated description or classification of the Study performed. |

946

## 7.3.3.3    Key Object Document Series Module

**7.3.3.3.1    Referenced Standards**

● DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

950 **7.3.3.3.2    Module Definition**

951          **Table 7.3.3.3..2-1: Usage of DICOM Attributes in Key Object Document Series**

| Excerpt from **DICOM PS3.3 Table C.17.6-1 Key Object Document Series Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |
| Modality | (0008,0060) | 1 | Fixed value: "KO" |
| Series Instance UID | (0020,000E) | 1 | Unique Identifier for the Series. DICOM Series Instance UID assigned by KOS Manifest creator for the series where the KOS Manifest is placed. |
| Series Number | (0020,0011) | 1 | A number that is not already used by another series in the study that identifies the Series. Recommendation to assign a value of 59 if unused. |
| Series Date | (0008,0021) | 3 | Date the Series started. If the KOS Manifest is the first one assigned to a new series, the date value should be the same as the date of the KOS Manifest creation. |
| Series Time | (0008,0031) | 3 | Time the Series started. If the KOS Manifest is the first one assigned to a new series, the time value should be the same as the time of the KOS Manifest creation. |
| Referenced Performed Procedure Step Sequence | (0008, 1111) | 2 | Uniquely identifies the Performed Procedure Step SOP Instance for which the Series is created. No items shall be included in this Sequence. |

952

953 **7.3.3.4    General Equipment Module**

954 **7.3.3.4.1    Referenced Standards**

955    ● DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

956 **7.3.3.4.2     Module Definition**

957 **Table 7.3.3.4.2-1: Usage of DICOM Attributes in General Equipment**

| Excerpt from **DICOM PS3.3 Table C.7-8 General Equipment Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |
| Manufacturer | (0008,0070) | R+ | Manufacturer of the equipment that produced the KOS manifest. This attribute is required to facilitate the discovery of errors' sources in the creation of KOS Manifests. |
| Institution Name | (0008,0080) | R+ | Defines the institution that created the KOS manifest.  This information is important to trace back any content error in a KOS Manifest.<br><br>Fixed value configured onsite at install time of the software that created the KOS Manifests.<br><br>Note: It is recommended by IHE MCWG to format this attribute according to the HL7 V2.5 XON data type so that it contains, in addition to the institution name, its globally unique identifier. This format is identical to the format of the authorInstitution Attribute of the MHD, XDS and XCA metadata. |
| Institution Code Sequence | (0008,0082) | RC+ | Institution or organization to which the identified individual is responsible or accountable.<br><br>Required if Institution Name (0008,0080) is not present. May be present otherwise.<br><br>Only a single Item shall be included in this Sequence.<br><br>Note: It is recommended by IHE MCWG to format this attribute according to the HL7 V2.5 XON data type so that it contains, in addition to the institution name, its globally unique identifier. This format is identical to the format of the authorInstitution Attribute of the MHD, XDS and XCA metadata. |
| > Code Value | (0008,0100) | 1C | The identifier of the Coded Entry. |
| > Coding Scheme Designator | (0008,0102) | 1C | The identifier of the coding scheme in which the Coded Entry is defined. |

| | | | |
|---|---|---|---|
| > Code Meaning | (0008,0104) | 1 | Text that conveys the meaning of the Coded Entry.<br><br>Conveys same value as would be in Institution Name (0008,0080) as coded entry. |

958

### 7.3.3.5    Key Object Document Module

#### 7.3.3.5.1    Referenced Standards

961    ● DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

#### 7.3.3.5.2    Module Definition

963    **Table 7.3.3.5.2-1: Usage of DICOM Attributes in Key Object Document Module**

| Excerpt from **DICOM PS3.3 Table C.17.6-2 Key Object Document Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |
| Instance Number | (0020,0013) | 1 | A number that identifies the Document. |
| Content Date | (0008,0023) | 1 | The date the document content creation started. |
| Content Time | (0008,0033) | 1 | The time the document content creation started. |
| Referenced Request Sequence | (0040,A370) | 1C | Identifies Requested Procedures that are being fulfilled (completely or partially).<br><br>This sequence will contain the same number of items as the number of **unique combinations of accession numbers and order placer numbers associated with this Study**.<br><br>Each element shall have an Accession Number and an Order Placer Number corresponding to and associated with this Study. |
| > Study Instance UID | (0020,000D) | 1 | Unique Identifier for the Study.<br><br>Copy of the referenced study's Study Instance UID (0020,000D).<br><br>Note: There is a 1 to 1 relationship between this KOS manifest and the study that this KOS manifest references. |

| | | | |
|---|---|---|---|
| > Referenced Study Sequence | (0008,1110) | 2 | Uniquely identifies the Study SOP Instance.<br><br>No items shall be included in this Sequence. |
| > Accession Number | (0008,0050) | R+ | A departmental IS generated number that identifies the imaging order for the Study.  Shall contain a value associated with the Placer Order Number (0040,2016) in the sequence item. |
| > Issuer of Accession Number Sequence | (0008,0051) | R+ | Identifier of the Assigning Authority that issued the Accession Number (0008,0050). A value shall be present.<br><br>Only a single Item shall be included in this Sequence. |
| >> Universal Entity ID | (0010,0032) | R+ | Globally unique identifier (OID) for the Accession Number (0008,0050) Assigning Authority. |
| >> Universal Entity ID Type | (0010,0033) | 1C | Standard defining the format of the Universal Entity ID. Required if Universal Entity ID (0040,0032) is present.<br>Fixed value: "ISO" |
| > Filler Order Number / Imaging Service Request | (0040,2017) | 2 | The order number assigned to the Imaging Service Request by the party performing the order.<br>This attribute may be empty.  If a value is present it may be ignored. |
| Requested Procedure ID | (0040,1001) | 2 | This attribute may be empty.  If a value is present it may be ignored. |
| Requested Procedure Description | (0032,1060) | 2 | This attribute may be empty.  If a value is present it may be ignored. |
| Requested Procedure Code Sequence | (0032,1064) | 2 | A Sequence that conveys the requested procedure.<br>Zero or more Items shall be included in this Sequence. |
| > Placer Order Number / Imaging Service Request | (0040,2016) | 2 | The order number assigned to the Imaging Service Request by the party placing the order.<br>Shall contain a value associated with the Accession Number (0008,0050) in the sequence item. |

| | | | |
|---|---|---|---|
| > Order Placer Identifier Sequence | (0040,0026) | RC+ | Identifier of the Assigning Authority that issued the Placer Order Number (0040,2016). Shall be present if Placer Order Number / Imaging Service Request (0040,2016) is not empty. Only a single Item shall be included in this Sequence. |
| >> Universal Entity ID | (0010,0032) | R+ | Globally unique identifier (OID) for the Placer Order Number (0040,2016) Assigning Authority. |
| >> Universal Entity ID Type | (0010,0033) | 1C | Standard defining the format of the Universal Entity ID. Required if Universal Entity ID (0040,0032) is present. Fixed value: "ISO" |
| Current Requested Procedure Evidence Sequence | (0040,A375) | 1 | List of all Composite SOP Instances references in Content Sequence (0040,A730), including all presentation states, real world value maps and other accompanying composite instances that are referenced from the content items. |
| > Study Instance UID | (0020,000D) | R | Unique identifier for the Study. Copy of the referenced study's Study Instance UID (0020,000D). Note: There is a 1 to 1 relationship between this KOS manifest and the study that this KOS manifest references. |
| > Retrieve URI (IID use) Note: This is a suggested standard attribute to be used for this purpose. It may require a new more specific attribute to the added to DICOM. | (0040,E010) | RC+ | The value of this attribute is a complete URL representing the endpoint of a system supporting a study request to launch server-side viewer using for example the IHE IID profile. This URL shall convey the Study Instance UID (0020,000D) from this manifest.(See (0020,000D).and ensure that only the imaging study referenced by the manifest may be viewed through the server-side viewer. |
| > Referenced Series Sequence | (0008,1115) | R | Sequence of Items where each item includes the Attributes of a Series containing referenced Composite Object(s) |
| For each series in referenced PACS study { | | | |

| >> Series Date | (0008,0021) | RC+ | Date the Series started.<br><br>Fallback to fill this value from an instance date of the first referenced image in the corresponding series within the imaging study. |
|---|---|---|---|
| >> Series Time | (0008,0031) | RC+ | Time the Series started. |
| >> Modality | (0008,0060) | R+ | Type of device, process or method that created the Instances in this Series. |
| >> Series Description | (0008,103E) | RC+ | Description of the Series. |
| >> Series Instance UID | (0020,000E) | R | Unique Identifier of a Series that is part of this Study and contains the referenced Composite Object(s) |
| >> Retrieve AE Title | (0008,0054) | RC+ | Title of the DICOM Application Entity where the Composite Object(s) may be retrieved on the network.<br><br>This attribute may be present but shall be ignored. |
| >> Retrieve Location UID | (0040,E011) | R+ | Unique identifier of the system where the Composite Object(s) may be retrieved on the network.<br><br>The value of this attribute is an OID that may be used as a reference to obtain the endpoint of the corresponding WADO-RS service returned as a Base URI.<br><br>The WADO-RS retrieval URL should then be composed by the consumer using this Base URI and the study/series/instance UIDs of the resources selected for retrieval from this manifest. |
| >> Retrieve URL | (0008,1190) | O | URL specifying the location of the referenced Instance(s).<br><br>The value of this attribute is a Base URI representing the endpoint for the corresponding WADO-RS service.<br><br>The WADO-RS retrieval URL should then be composed by the consumer using this Base URI and the study/series/instance UIDs of the resources selected for retrieval from this manifest.<br><br>Note: The definition of this Retrieve URL being a Base URI aligns with its use in the IHE XDS-I.b profile (DICOM |

| | | | |
|---|---|---|---|
| | | | Retrieve by WADO-RS option) and the IHE XC-WADO profile. |
| >> Referenced SOP Sequence | (0008,1199) | R | References to Composite Object SOP Class/SOP Instance pairs that are part of the Study defined by Study Instance UID and the Series defined by Series Instance UID (0020,000E). One or more Items shall be included in this Sequence. |
| For each instance in referenced PACS series { | | | |
| >>> Referenced SOP Class UID | (0008,1150) | R | Uniquely identifies the referenced SOP Class. |
| >>> Referenced SOP Instance UID | (0008,1155) | R | Uniquely identifies the referenced SOP Instance. |
| >>> Instance Number | (0020,0013) | RC+ | A number that identifies this SOP Instance. |
| >>> Number Of Frames | (0028,0008) | RC+ | Number of frames in a Multi-frame Image. Required if the instance contains multi-frame pixel data. |
| Significant Images – see "Sharing imaging studies with images marked as significant" (MCWG extension). Expresses the fact that the Reference SOP Instance is flagged by a KOS/KIN and links to the Referenced SOP Instance associated with the KOS/KIN instance that marks the SOP instance as being significant. For an overview see RAD-TF:3 Appendix A (see below). | | | |
| >>> Related Series Sequence | (0008,1250) | RC+ | Sequence of Items identifying Series that contain a KOS/KIN marking the SOP Instance in this Item (of the enclosing Referenced SOP Sequence (0008,1199)) as being significant. Required if the SOP Instance in this Item (of the enclosing Referenced SOP Sequence (0008,1199) is marked as significant in a KOS/KIN. One or more Items shall be present in this Sequence. Note: If multiple KOS/KIN tag a specific SOP Instance in a given study, those KOS/KIN may be assigned to the same series or to different series. |
| >>>> Series Instance UID | (0020,000E) | 1 | Series Instance UID of the series to which a KOS/KIN instance belongs. |

| | | | This attribute facilitates traversing the KOS Manifest through the series in which is located a KOS/KIN in the corresponding Reference SOP Sequence (0008,1199). This helps when accessing the content of the KOS/KIN comment, if any. |
|---|---|---|---|
| >>>> Referenced SOP Sequence | (0008,1199) | 1 | The set of KOS/KIN SOP Instances in this Item of Related Series Sequence (0008,1250).<br><br>One or more Items shall be included in this Sequence.<br><br>Note: If multiple KOS/KIN tag a specific SOP Instance in a given study, those KOS/KIN may be assigned to the same series or to different series. |
| >>>>> Referenced SOP Class UID | (0008,1150) | 1 | SOP Class UID of the referenced KOS/KIN instance.<br><br>Fixed value: KOS SOP Class UID. |
| >>>>> Referenced SOP Instance UID | (0008,1155) | 1 | SOP Instance UID of the referenced KOS/KIN instance. |
| >>>>> Purpose of Reference Code Sequence | (0040,A170) | R+ | |
| >>>>>> Code Value | (0008,0100) | 1 | Shall use the Code Value "113000" if this Item (of the enclosing Referenced SOP Sequence (0008,1199)) is flagged as a significant image.<br><br>May use any other code value from BCID 7010. |
| >>>>>> Coding Scheme Designator | (0008,0102) | 1 | Identifier of the coding scheme in which the Code Value (0008,0100).<br><br>DICOM coding scheme. Shall use a fixed value: Coding Scheme Designator "DCM". |
| >>>>>> Code Meaning | (0008,0104) | 1 | Convey the code meaning as specified by BCID 7010.<br><br>E.g., "Of Interest" for the code value "113000". |

| Significant Images – see "Sharing imaging studies with images marked as significant" (MCWG extension). Add a copy of the comment ("Key Object Description") in every reference to a KOS/KIN SOP instance that is used to flag one or more SOP instances. | | | |
|---|---|---|---|
| >>> Content Sequence | (0040,A730) | RC+ | Sequence of Text Values providing the Key Object Description of a KOS/KIN. Required if this Item (of the enclosing Referenced SOP Sequence (0008,1199)) references a KOS/KIN instance with a title code "Of Interest". May be present if this Item (of the enclosing Referenced SOP Sequence (0008,1199)) references a KOS/KIN instance with a title code other than "Of Interest". Zero or one Item shall be included in this Sequence. |
| >>>> Text Value | (0040,A160) | R+ | Contains the Concept Name (113012, DCM, "Key Object Description") Text Value copied from the KOS/KIN instance referenced. Non-formatted textual data, allowing for implementation specific display. This value may contain spaces as well as CR LF separators for one or more lines. |
| } | | | |
| } | | | |

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## 7.3.3.6    SR Document Content Module

### 7.3.3.6.1    Referenced Standards

967    ● DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

### 7.3.3.6.2    Module Definition

969      **Table 7.3.3.6.2-1: Usage of DICOM Attributes in SR Document Content Module**

| Excerpt from **DICOM PS3.3 Table C.17-4 SR Document Content Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |

| Value Type | (0040,A040) | 1 | Fixed value: "CONTAINER" |
|---|---|---|---|
| Concept Name Code Sequence | (0040,A043) | R+ | Code describing the concept represented by this Content Item. Also conveys the value of Document Title and section headings in documents.<br>Required to indicate that this KOS instance is an imaging study manifest.<br>Only a single Item shall be included in this Sequence.<br><br>Use TID 2010 "Key Object Selection" to populate the remaining attribute values. Coded Document Title: (113030, DCM, Manifest) |
| > Code Value | (0008,0100) | 1 | Fixed value: "113030" |
| > Coding Scheme Designator | (0008,0102) | 1 | Fixed value: "DCM" |
| > Code Meaning | (0008,0104) | 1 | Fixed value: "Manifest" |
| Continuity of Content | (0040,A050) | 1 | Fixed value: "SEPARATE" |
| Content Template Sequence | (0040,A504) | 1 | Template that describes the content of this Content Item and its subsidiary Content Items.<br><br>Only a single Item shall be included in this Sequence. |
| > Mapping Resource | (0008,0105) | 1 | Fixed value: "DCMR" |
| > Template Identifier | (0040,DB00) | 1 | Fixed value: "2010" |
| Content Sequence | (0040,A730) | R+ | A Sequence of Items that conveys content that is the Target of Relationships with the enclosing Source Content Item.<br><br>One or more Items shall be included in this Sequence:<br>- One item shall contain a TEXT Value Type (container description)<br>- As many items as there are instances to reference in referenced study. |
| > Relationship Type | (0040,A010) | 1 | Fixed value: "CONTAINS" |
| > Value Type | (0040,A040) | 1 | Fixed value (one of): "IMAGE", "WAVEFORM" or "COMPOSITE".<br><br>Note: The Value Type depends on the SOP Class UID of the referenced object. |

| | | | |
|---|---|---|---|
| > Referenced SOP Sequence | (0008,1199) | R+ | References to Composite Object SOP Class Instance pairs. Only a single Item shall be included in this Sequence. |
| >> Referenced SOP Class UID | (0008,1150) | 1 | Uniquely identifies the referenced SOP Class. |
| >> Referenced SOP Instance UID | (0008,1155) | 1 | Uniquely identifies the referenced SOP Instance. |

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## 7.3.3.7    SOP Common Module

### 7.3.3.7.1    Referenced Standards

- DICOM 2025c PS 3.3: A.35.4 Key Object Selection Document IOD

### 7.3.3.7.2    Module Definition

**Table 7.3.3.7.2-1: Usage of DICOM Attributes in SOP Common Module**

| Excerpt from **DICOM PS3.3 Table C.12-1 SOP Common Module** © NEMA | | | |
|---|---|---|---|
| **Attribute Name** | **Tag** | **IHE Usage** | **Attribute Description** |
| SOP Class UID | (0008,0016) | 1 | Uniquely identifies the SOP Class. |
| SOP Instance UID | (0008,0018) | 1 | Uniquely identifies the SOP Instance. |
| Specific Character Set | (0008,0005) | R+ | Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used. Preferred repertoires for use in Western and Eastern Europe:<br>• "ISO-IR 100" - Latin alphabet No. 1<br>• "ISO-IR 101" - Latin alphabet No. 2<br>• "ISO-IR 144" - Cyrillic<br>• "ISO-IR 126" – Greek<br>• "ISO_IR 192" - Unicode in UTF-8 |
| Instance Creation date | (0008,0012) | 3 | Same as Study Date (0008,0020) |
| Instance Creation Time | (0008,0013) | 3 | Same as Study Time (0008,0030) |

| Timezone Offset From UTC | (0008,0201) | R+ | Contains the offset from UTC to the time zone for all DA and TM Attributes present in this SOP Instance, and for all DT Attributes present in this SOP Instance that do not contain an explicitly encoded time zone offset. |
|---|---|---|---|

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# 8 MADO HL7 FHIR Based Imaging Study Manifest Content Definitions

The MADO HL7 FHIR Imaging Study Manifest Implementation Guide is an integral part of the MADO Profile.

In the present draft of the MADO Profile, the MADO HL7 FHIR Imaging Study Manifest specification may be accessed for the purpose of the EHDS Public Consultation at: http://hl7.eu/fhir/imaging-manifest-r5/0.2.0-snapshot1

# 9  MADO Envelope Content Definitions

The MADO HL7 FHIR Envelope is an integral part of the MADO Profile.

In the present draft of the MADO Profile, the MADO HL7 FHIR Envelope specification may be accessed for the purpose of the EHDS Public Consultation at: http://hl7.eu/fhir/imaging-manifest-r5/0.2.0-snapshot1/manifest-envelop.html.

# 10  MADO DICOM – FHIR Manifest Mapping Specification

The purpose of such a mapping between the two imaging study manifest formats specified by the IHE MADO Profile as defined in the above section 7 and 8.

Ensuring that such a mapping supports the transformation of a manifest in one format into the other one enhances the ability to bridge between infrastructures that may have chosen to deploy different imaging study manifest formats.

In this draft of the MADO Profile, two mapping table extracts are proposed to the reviewers to preview what a complete mapping would be when completed.

Sample 1: Extract of the DICOM General Study Module Mapping to FHIR

| General Study Module | | | | EHDS IM Imaging Study |
|---|---|---|---|---|
| Attribute Keyword | Tag | VT (temp) | Cardinality | Elements |
| StudyInstanceUID <uid> | (0020,000D) | 1 | 1..1 | ImagingStudy.identifier:studyInstanceUid.value 'urn:oid:<uid>' |
| | | | | ImagingStudy.identifier:studyInstanceUid.system Fixed: 'urn:dicom:uid' |
| StudyDate<br>Format: "YYYYMMDD" | (0008,0020) | 1 | 1..1 | ImagingStudy.started<br>Format: "YYYY-MM-DDThh:mm:ss+zz:zz" |
| StudyTime<br>Format: "HHMMSS.ffffff" | (0008,0030) | 2 | 0..1 | Concatenate DICOM StudyDate and StudyTime (if present in DICOM) |
| ReferringPhysicianName | (0008,0090) | 2 | 0..0 | ImagingStudy.referrer (Practitioner \| PractitionerRole) |
| StudyID | (0020,0010) | 2 | 0..1 | ImagingStudy.identifier.value |
| | | | | ImagingStudy.identifier.system |

Sample 2: Extract of the DICOM Key Object Module Mapping to FHIR

| Key Object Document Module | | | | EHDS IM Imaging Study and IM Order (ImagingStudy.basedOn) |
|---|---|---|---|---|
| Attribute Keyword | Tag | VT (temp) | Cardinality | Elements |
| CurrentRequestedProcedureEvidenceSequence | (0040,A375) | 1 | | |
| > StudyInstanceUID <uid> | (0020,000D) | 1 | 1..1 | ImagingStudy.identifier:studyInstanceUid.value 'urn:oid:<uid>' |
| | | | | ImagingStudy.identifier:studyInstanceUid.system Fixed: 'urn:dicom:uid' |
| > RetrieveURI (for IHE IID Study RequestType) | (0040,E010) | ? | 0..1 | ImagingStudy.endpoint:iid |
| > ReferencedSeriesSequence | (0008,1115) | 1 | 1..1 | ImagingStudy.numberOfSeries = number of items in  DICOM ReferencedSeriesSequence |
| For each series in referenced PACS study { | | | | |
| >> SeriesDate | (0008,0021) | 2 | 0..1 | ImagingStudy.series.started |
| >> SeriesTime | (0008,0031) | 2 | 0..1 | Concatenate DICOM SeriesDate and SeriesTime (if present in DICOM) |
| >> Modality | (0008,0060) | 1 | 1..1 | ImagingStudy.series.modality.coding.code |
| | | | | ImagingStudy.series.modality.coding.system |
| >> SeriesDescription | (0008,103E) | 2 | 0..1 | ImagingStudy.series.description |
| >> SeriesInstanceUID <uid> | (0020,000E) | 1 | 1..1 | ImagingStudy.series.uid.value 'urn:oid:<uid>' |
| | | | | ImagingStudy.series.uid.system Fixed: 'urn:dicom:uid' |
| >> RetrieveAETitle | (0008,0054) | 3 | | |
| >> RetrieveLocationUID | (0040,E011) | 1 | 1..1 | ImagingStudy.series.endpoint:RetrieveLocationUID (OID) |
| >> RetrieveURL | (0008,1190) | 1 | | ImagingStudy.series.endpoint:wado |
| >> ReferencedSOPSequence | (0008,1199) | 1 | 1..1 | ImagingStudy.series.numberOfInstances = number of items in  DICOM ReferencedSOPSequence |
| For each instance in referenced PACS series { | | | | |
| >>> ReferencedSOPClass UID | (0008,1150) | 1 | 1..1 | ImagingStudy.series.instance.sopClass.coding.code |
| | | | | ImagingStudy.series.instance.sopClass.coding.system |
| >>> ReferencedSOPInstanceUID <uid> | (0008,1155) | 1 | 1..1 | ImagingStudy.series.instance.uid.value 'urn:oid:<uid>' |
| | | | | ImagingStudy.series.instance.uid.system Fixed: 'urn:dicom:uid' |
| >>> InstanceNumber | (0020,0013) | 2 | 0..1 | ImagingStudy.series.instance.number |
| >>> NumberOfFrames | (0028,0008) | 1C | | |

# Appendices to Volume 3

## Appendix A – Enhancement to the support of Key Images in the Imaging Study Manifest

The need for flagging significant images in an imaging exam is widely accepted, but lacks actual usage.

Contemporary imaging exams may consist of thousands of images and clinically significant information can sometimes be present in only a few of them.  Flagging them as significant by the source of the imaging exam (during acquisition, interpretation, or post processing) may facilitate the review of the imaging study downstream (referring physician, surgeon, etc.).

Not all imaging studies have images flagged as significant for good or bad reasons (the source chose to not perform the flagging, the study was performed to rule out potential issues and none were identified, etc.).  When images are flagged as significant, there is a needed to track the associated reason (multiple if multiple sets).

In today's image sharing deployment the use of significant images is not consistent:

- Reasonably common within a PACS, using the IHE Key Image Note (KIN) within the imaging study
- Uncommon in national or regional deployments (lack of agreed clinical practice, lack of consistent technical solution, GPs complain but imaging specialists do the work.

Several countries have reached the conclusion (Multi-country Working Group) that having a single way, nation-wide to flag significant images is critical and absolutely necessary for its adoption (the source of studies need to be sure that its effort will be appreciated by the consumers of studies).  A number of critical factors have been takin into account:

- Priming effect: It is necessary to leverage the IHE KIN profile, because it is already supported by many existing PACS and the imaging specialists are already accustomed to its use within a number of hospitals.
- Scaling KIN: KIN needs to be extended to facilitate remote access only to significant images (focus and speed for the consuming professional).
- KIN Alignment with Typical RIS/PACS implementations:
  - The KIN profile addresses the flagging of significant images within an imaging study (distinct from the imaging report thus making them accessible without access to an imaging report).
  - KIN is aligned with the fact that significant images are typically an image viewer creation/display function.
  - In KIN, each set of flagged images has a coded reason (extensive DICOM vocabulary) and an associated free form text comment. Multiple KIN may be present

1047        for different reasons within a study and can be added independently from the
1048        imaging report creation.

## 1049 A.1 Technical analysis for the proposed enhancements to the imaging 1050 study manifest

1051 The IHE Key Image Note (KIN) profile describes an interoperable way to flag such images and
1052 store such flagging in a way that allows them to be quickly visualized when the imaging exam is
1053 subsequently displayed.

1054 The KIN profile standardizes how references to flagged images are recorded in a specific Key
1055 Object Selection (KOS) which is stored as any other DICOM objects within the same study tree
1056 structure (study/series/image).

1057 The exam (the images and the KOS/KIN for that exam) can move from one system to another,
1058 and the receiving system will also be able to read the KOS/KIN and show the significant images.

1059 Challenges in remote access to key images in shared imaging study:

1060     ● How can an imaging consumer determine that an imaging study contains significant
1061        images and decides if the reason(s) and comment(s) makes them relevant to the user ?
1062     ● To retrieve the significant images one needs first to retrieve all KOS objects from all KO
1063        series, to answer question 1 and identify the corresponding significant images.

1064 From the information contained in a KOS-based imaging study manifest, the above will require
1065 additional transactions:

1066     ● If no KO Modality Series: No significant images are flagged.
1067     ● Otherwise, one needs one WADO-RS request/response per KO Modality Series, then
1068        receive and parse all retrieved KOS Objects.
1069     ● When the purpose is to give to the user a quick access to the significant images
1070        (minimizing transfer volume) adding such transactions is not reasonable and adds
1071        complexity.

1072 It is therefore proposed in the MADO profile to extend the content of the imaging study
1073 manifest with selected information from the significant images KIN, to allow any imaging
1074 consumer to determine easily the presence of flagged significant images, the reason and
1075 associated comment and then to only retrieve such significant images to his own system.

1076 It is generally easy for source systems creating a KOS Manifest to add the above KIN
1077 information, without too much complexity, into the extended KOS Manifest while leaving the
1078 corresponding KIN within the Imaging study.

1079 This should be supported in the context of large-scale image sharing, to simplify the
1080 implementation and overhead on the imaging consumers by simply retrieving the Imaging Study
1081 (KOS) manifest.

1082

1083 ## A.2 Depiction of enhancements to the DICOM KOS Manifest for a
1084 study with a KOS/KIN of Title code « of interest »

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1089 **A.3 Depiction of enhancements to the FHIR-based Imaging Manifest**
1090 **document Manifest for a study with a KOS/KIN of Title code « of**
1091 **interest »**
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