Integrating the Healthcare Enterprise

IHE Radiology
Technical Framework Supplement

Manifest-based Access to DICOM Objects (MADO)

HL7® FHIR® R4

Using Resources at FMM Level 1-N

Revision 1.1 – Trial Implementation

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

Foreword

This version of the MADO Profile has been prepared based on input from a draft version issued for the European Xt-EHR public consultation developed jointly as a EURIDICE specification by the IHE-HL7 Europe Working Group on Imaging. The goal is to use this new profile in the context of the European Health Data Space use case on the sharing of imaging studies and related imaging reports.

The goal of the MADO Profile is to be an internationally adopted profile that can be deployed not only in Europe.

This is a supplement to the IHE Radiology Technical Framework V23.0. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on March 16, 2026 for Trial Implementation and will be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the Radiology Technical Framework Volumes. Comments are invited and can be submitted at https://www.ihe.net/Radiology_Public_Comments.

This supplement describes changes to the existing technical framework documents.

"Boxed" instructions like the sample below indicate to the Volume Editor how to integrate the 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.net.

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

Information about the organization of IHE Technical Frameworks and Supplements and the 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 https://profiles.ihe.net/RAD/index.html.

CONTENTS

Introduction to This Supplement

This new profile addresses 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.

The access to DICOM Instances based on an imaging study manifest can be combined either with MHD (or MHDS) to deploy FHIR-based document sharing infrastructures or XDS.b, or some proprietary document sharing scheme. Such flexibility ensures a common and more effective way to access the DICOM Objects through a solid profiling of WADO-RS consistent with the XC-WADO Cross-Community profile and the IID (Invoke Image Display) profiles. The MADO Profile includes also a more robust imaging study manifest compared to the one introduced by XDS-I.b, supporting two complementary encodings based on the DICOM KOS IOD or FHIR Imaging Study resource, as well as profiling in a more precise way existing attributes and new attributes, such as those necessary to improve access to key images in a way compatible with the IHE KIN Profile.

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 for them to remain interoperable and conformant with an updated IHE profile.

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

HL7 provides a rating of the maturity of FHIR content based on the FHIR Maturity Model (FMM): level 0 (draft) through N (Normative). See http://hl7.org/fhir/versions.html#maturity.

The FMM levels for FHIR content used in this profile are:

FHIR Content (Resources, ValueSets, etc.)	FMM Level In Release 4
Bundle	N
Device	2
DocumentReference	4
Endpoint	2
ImagingStudy Resource	3
Patient	N
PratitionerRole	4
Procedure	4
ServiceRequest	4

Open Issues and Questions

#	Issue / Answer
	None

Closed Issues

#	Issue / Answer
	None

IHE Technical Frameworks General Introduction

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

9 Copyright Licenses

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.

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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.

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.
Document Source	The Document Source is the producer and publisher of documents and metadata.
Document Consumer	The Document Consumer queries for document metadata meeting certain criteria and may retrieve selected documents.
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
No new transactions	

Appendix D – Glossary

New (or modified) Glossary Term	Definition	Synonyms	Acronym/ Abbreviation
No new glossary items			

Volume 1 – Profiles

Domain-specific additions

None.

Add new Section X

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

The Manifest-based Access to DICOM Objects (MADO) Integration Profile allows a clinician exploring a remote patient record to selectively retrieve series and images of interest, based on series level information shared in an extended imaging study manifest document. This avoids having to retrieve the entire study, particularly when it is large. The MADO Profile also provides a consistent retrieve mechanism from multiple sources of medical image data that publish imaging studies for sharing within the community. This consistent retrieve mechanism is designed to be independent from the document sharing infrastructure chosen to publish, share and discover imaging study manifest objects, thus allowing the use of the MADO Profile across many national and regional eHealth infrastructures.

The MADO Profile utilizes the RESTful DICOMweb Studies Service Retrieve transaction (a.k.a WADO-RS, DICOM PS3.18 Section 10.4).

This profile discusses but does not specify cross-community access to DICOM Objects; however, it has been designed to be grouped with the XC-WADO Profile to support cross-community access (see Section X.6 MADO Cross Profile Considerations).

This profile does not address specific means of publishing into some community-level document registry, searching and retrieving the imaging study manifests that reference DICOM Instances stored in the community. The XDS.b or MHD (or MHDS) Profiles may be used to support such document sharing and combined with the MADO Profile (see Section X.6 MADO Cross Profile Considerations).

The reader of MADO is expected to understand the use of imaging study manifests. The Manifest concept is described below in Section X.4.1.1 Role of an Imaging Study Manifest.

X.1 MADO Actors, Transactions, and Content Modules

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

Figure X.1-1 shows the actors directly involved in the MADO Profile and the relevant transactions/content between them. If needed for context, other actors that may be indirectly involved due to their participation in other related profiles are shown in dotted lines. Actors which have a required grouping (if any), are shown as joined boxes (see Section X.3).

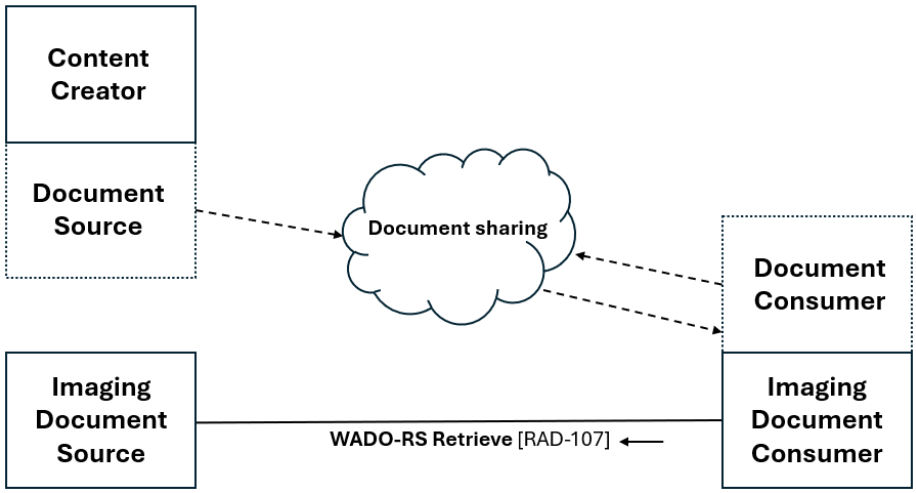

Figure X.1-1: MADO Actor Diagram

Table X.1-1 lists the transactions and Table X.1-2 lists the content for each actor directly involved in the Manifest-based Access to DICOM Objects (MADO) Profile. To claim compliance with this profile, an actor shall support all required transactions/content (labeled "R") and may support the optional transactions (labeled "O").

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

Actors	Transactions	Requester or Responder	Optionality	Reference
Imaging Document Consumer	WADO-RS Retrieve [RAD-107]	Requester	R	RAD TF-2: 4.107
Imaging Document Source	WADO-RS Retrieve [RAD-107]	Responder	R	RAD TF-2: 4.107

Table X.1-2: MADO Profile - Actors and Content

Actors	Content Modules	Requester or Responder	Optionality	Reference
Content Creator	DICOM KOS Based Imaging Study Manifest	Creator	R See Note 1	RAD TF-3: 6.X.2
	FHIR Based Imaging Study Manifest	Creator	R See Note 1	RAD TF-3: 6.X.3
Imaging Document Consumer	DICOM KOS Based Imaging Study Manifest	Consumer	O See Note 2	RAD TF-3: 6.X.2
	FHIR Based Imaging Study Manifest	Consumer	O See Note 2	RAD TF-3: 6.X.3

Note 1: The imaging study manifest content is defined in two alternative formats – a DICOM KOS IOD based format and a FHIR-Based format. The imaging study manifest Content Creator shall support both formats and when integrated at deployment, it shall support the capability to be configured to publish one of the two formats when grouped with a document source actor. See Section X.6.

The MADO profile does not require the ability to publish both imaging study manifest formats at the same time.

Note 2: The Imaging Document Consumer shall support at least one of the two formats.

X.1.1 Actor Descriptions and Actor Profile Requirements

The transactions needed to query and retrieve imaging study manifest documents whose content is specified by this profile are beyond the scope of the MADO Profile. Such transactions when needed are addressed by grouping the MADO Profile with the desired document sharing profiles. See Section X.6.

Most requirements are documented in RAD TF-2 Transactions. This section documents any additional requirements on the profile's actors.

X.1.1.1 Content Creator

The Content Creator produces the imaging study manifests.

The Content Creator shall be capable of producing imaging study manifests in both a DICOM format, to facilitate systems using primarily DICOM content, and an HL7 FHIR format, to facilitate systems using primarily FHIR content. The Content Creator shall be configurable to produce either format.

The Content Creator guarantees that imaging study DICOM instances referenced are available at the time of imaging study manifest creation or update.

If the content of an imaging study, for which an imaging study manifest has been created and shared by a Content Creator, is updated to add or remove shared instances, the Content Creator shall create and share a new imaging study manifest representing the updated imaging study and deprecate the previously shared imaging study manifest.

X.1.1.2 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 to search for and retrieve such imaging study manifest(s) within the community. These transactions are supported by ITI profiles that can provide access to an MHD/XDS.b sharing infrastructure, by a grouping with the MHD Document Consumer or XDS.b Document Consumer. The MHD Document Consumer and XDS.b Document Consumer are NOT included in this profile.

There is no Content Consumer actor in the MADO profile as this actor function is included within the Imaging Document Consumer. This simplifies the profile and aligns it with the approach used by the XDS-I.b profile. The Imaging Document Consumer acts as the consuming partner of the imaging study manifest Content Creator.

The Imaging Document Consumer shall perform three major functions:

- Parsing the imaging study manifest to access the descriptive information of the study content and the location information that provides access to the study's DICOM instances.
- Identifying DICOM instances to be retrieved based on user choice or algorithmic logic.
- Issuing a WADO-RS Retrieve [RAD-107] transaction in the Requester role to an Imaging Document Source to retrieve the selected DICOM instances within its community.

The Imaging Document Consumer may be grouped with an Image Display Invoker – see Section X.6.

Note: The MADO imaging study manifest does not include frame level information beyond the number of frames. MADO does not require WADO-RS retrieval of Metadata, Pixel Data, Bulk Data Resources. Since Frame retrieval is a form of pixel data retrieval, only study, series and instance may be retrieved as DICOM Instances. Frames may be retrieved as Rendered Instances.

The Imaging Document Consumer forms the URL endpoint in its Study Service Retrieve Request by using:

- the base URI obtained by either one of the two modes of addressing (see X.4.1.2 Intra-community sharing infrastructure in the X.4.1 Concepts Section). Both modes shall be implemented.
  Note: The Retrieve Location UID mode requires the addition of a look-up service client which is outside the scope of the MADO Profile.
- the following metadata elements from the retrieved imaging study manifest:
  - 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. Alternatively, it may choose to retrieve each Instance resource individually.

The Imaging Document Consumer shall be able to handle the case where the list of instances in a series, or list of series in a study, referenced by an imaging study manifest does not entirely match the same instances in a series, or same series in a study, retrievable from an Imaging Document Source. In this case, the number of instances retrieved by using the request for Series Instances or Study Instances resources may be larger or smaller than the number of instances expected by the Imaging Document Consumer.

X.1.1.3 Imaging Document Source

The Imaging Document Source receives WADO-RS Retrieve [RAD-107] transaction requests from Imaging Document Consumers to retrieve the requested instances and returns them to the requester. If the <resource> component of the inbound request URL indicates that the request is for the retrieval of a complete study or series, the Imaging Document Source may choose to only return those DICOM Instances that have been published in the imaging study manifest by the associated Content Creator.

X.2 MADO Actor Options

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

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

Actor	Option Name	Reference
Content Creator	No options defined	N/A
Imaging Document Consumer	DICOM KOS-based Imaging Study Manifest (Note 1)	Section X.2.1
	FHIR-Based Imaging Study Manifest (Note 1)	Section X.2.2
	Rendered Instances	Section X.2.3 RAD TF-2: 4.107.4.0.5
Imaging Document Source	Rendered Instances	Section X.2.3 RAD TF-2: 4.107.4.0.5

Note 1: At least one of these two options SHALL be supported.

X.2.1 DICOM KOS-Based Imaging Study Manifest Option

This option involves using a DICOM encoding of the imaging study manifest instead of an HL7 FHIR encoding.

A Document Consumer supporting this option shall consume imaging study manifests using the

specification defined in IHE RAD TF-3: Chapter 6.X.2: MADO DICOM KOS-Based Imaging Study Content Definition. The imaging study manifest shall be encoded in the DICOM File Format specified in Section 7 "DICOM File Format" in DICOM PS3.10.

X.2.2 HL7 FHIR-Based Imaging Study Manifest Option

This option involves using an HL7 FHIR encoding of the imaging study manifest instead of a DICOM encoding.

A Document Consumer supporting this option shall consume imaging study manifests using the specification defined in IHE RAD TF-3: Chapter 6.X.3: MADO HL7 FHIR-Based Imaging Study Manifest Content Definition.

X.2.3 Rendered Instances Option

This option adds the exchange of images rendered (e.g., JPG) from DICOM instances.

An Imaging Document Consumer supporting this option shall be able to request and receive instances in a rendered format.

An Imaging Document Source supporting this option shall be able to respond to requests for rendered instances and return them in a rendered format.

X.3 MADO Required Actor Groupings

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

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

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

Table X.3-1: MADO – Actor Groupings

MADO Actor	Actor(s) to be grouped with	Reference	Content Bindings Reference
Content Creator	ITI CT / Time Client	ITI TF-1: 7.1	
Imaging Document Consumer	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 (Note 1)	ITI TF-1: 7.1 RAD TF-3: 5.2 (CP-RAD-565)	
	ITI ATNA / Secure Node or Secure Application	ITI TF-1: 9.1	

Note 1: The Imaging Document Source, when grouped with the ITI CT / Time Client, is strongly recommended to implement the DICOM Timezone Option in the ITI CT Profile.
The DICOM Timezone Option mandates the Timezone Offset From UTC (0008,0201) attribute. This option is being introduced by CP-ITI-1329 and CP-RAD-565.

X.4 MADO Overview

X.4.1 Concepts

X.4.1.1 Role of an Imaging Study Manifest

An imaging study manifest is a document listing the key information about the content of a single imaging study. It acts as a summary for the actual imaging study that can be large (typically megabyte or gigabyte size) and complex (hundreds of data elements). It includes location pointers to its instances' content and organizes this information according to the well-established model of an imaging study containing one or more series with each series containing one or more instances (e.g., images).

The Content Creator produces an imaging study manifest that represents the shared content of an imaging study that is made available by the Imaging Document Source in the community. The Content Creator determines which part of the local imaging study to include in the imaging study manifest it publishes. This decision is based on local and community policies.

The MADO imaging study manifest extends the definition of the XDS-I.b imaging study manifest by including key information about the content of the imaging study including attributes that describe the:

- Modalities
- Anatomic Regions
- Study Instance UIDs
- Accession Numbers
- Placer Order Numbers
- Procedure Codes
- Number of Study Related Series
- Series Number
- Series Description
- Series Date/Time
- Number of Series Related Instances
- Instance Number
- Number of Frames (if a multi-frame instance)

- Key Image Notes title code and optional description flagging key images

These attributes can be used to identify the series/instances of the imaging study that are of interest and so optimize the instance retrieval to those series/instances instead of having to retrieve the whole study.

Once the selected study, series, instance have been identified, the Imaging Document Consumer can retrieve this selection from an Imaging Document Source using a consistent mechanism, regardless of whether the imaging study manifest is published to an MHD, XDS.b, XDS-I.b or any other document sharing infrastructure.

The Imaging Document Consumer may interact with an Imaging Document Source located within the same community (See Section X.4.1.2) or with an Imaging Document Source located in a different community by grouping the MADO Profile with the XC-WADO Profile (See Section X.4.1.3).

MADO defines two content formats (and corresponding encodings) for the imaging study manifest:

1. DICOM KOS-Based (see TF-3: 6.X.2)
2. HL7 FHIR-Based (see TF-3: 6.X.3)

In addition, it specifies a bi-directional mapping between the two formats for transformation purposes (see TF-3: 6.X.5).

X.4.1.2 Intra-community Sharing Infrastructure

The MADO Profile is based on certain assumptions about the sharing infrastructure such as having the Imaging Document Consumer located within the same community as the Imaging Document Source.

The Imaging Document Source may gain access to imaging studies information internally or from an Image Manager/Image Archive, via standard mechanism such as the Retrieve Images [RAD-16] transaction.

MADO uses a WADO-RS transaction for instance retrieval by the Imaging Document Consumers from the Imaging Document Sources (see TF-2: 4.107).

The imaging study manifest supports two modes of location pointers (see Section X.4.1.2 Hierarchical Series Reference Macro). Each offers a different way to determine the end-point to access each series of the imaging study:

1. Retrieve URL based Mode. In this mode, the imaging study manifest contains a Retrieve URL location pointer to convey a base URI for the end-point that supports the WADO-RS instance retrieve service (the Retrieve Location UID, although required to be present in the imaging study manifest, is not used in this addressing mode as there is no look-up service available).

2. Retrieve Location UID based Mode. In this mode, the imaging study manifest contains a Retrieve Location UID as a pointer to be used as input to a look-up service that returns the base URI for the end-point that supports the WADO-RS instance retrieve service. Such a look-up service is outside the scope of the MADO Profile and may be supported by local configuration or via a directory such as using the IHE mCSD Profile.

Note: If a study, series or instance is not available (or no longer available) from a Retrieve URL or a Retrieve Location UID, the implementation of the Imaging Document Consumer may choose to support the use of a configured value for a proxy endpoint and construct a new URL based on the UIDs of the study, series or instance.

The Imaging Document Consumers and Imaging Document Sources are configured to support one of these two modes at the time of deployment. This allows specific communities to deploy their Imaging Document Consumers and Imaging Document Source to use the same mode of addressing of their choosing.

X.4.1.3 Cross-community Sharing Infrastructure

The Imaging Document Consumer located within one community may request instances of imaging studies from an Imaging Document Source located in a different community. Each community is served by initiating and responding gateways that interconnect the communities.

Such an extension to the use of MADO in cross-community environments may be achieved by grouping with the IHE XC-WADO Profile. This is done by grouping actors from the two profiles. (See XC-WADO RAD TF-1: 58.4.2.1 Use Case #1: Image Set sharing between communities.)

The formatting of the URL used in the [RAD-160] WADO-RS transaction is specified by the XC-WADO Profile and supports communities that use different modes of addressing a) Retrieve URL based, and b) Retrieve Location UID based (see Section X.4.1.2).

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 MHD or XDS.b environment, or an XCA community.

X.4.1.4 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.4.1.5 Obtain the Manifests of Imaging Studies of Interest

The way in which an imaging study manifest is obtained using a document sharing infrastructure involves the following steps:

1. Discover one or more imaging study manifests by filtering them using search parameters for a selected patient - such as Modality, Anatomical Region, Study Date, and Time. These search parameters are further specified in RAD TF-3: 6.X.6 Imaging Study Manifest Search Metadata.

2. Perform a selection among the entries of this initial list of matching imaging study manifests using the full set of document search metadata returned to identify the desired imaging study manifests and request the retrieval of the imaging study manifest(s) of interest.

These steps are beyond the scope of MADO but could be accomplished using IHE Profiles such as MHD, XDS.b, XDS-I.b (see Section X.6).

As an example, the Imaging Document Consumer could be grouped with the MHD Document Consumer that is the initiator of the imaging study manifest discovery and retrieval and communicates with the MHD Document Responder. The MHD Document Consumer uses the Find Document References [ITI-67] and Retrieve Document [ITI-68] transactions to find and retrieve the imaging study manifests. The MHD Document Consumer then provides this information to the Imaging Document Consumer.

X.4.1.6 Selecting a Subset of an Imaging Study

Imaging studies can be very large, and it is not always necessary, or desirable, to retrieve an entire imaging study, particularly if bandwidth is limited. It is therefore useful to be able to obtain study metadata first to allow for a more selective retrieval, e.g., a particular series or instance or frame.

Though knowledge of the URL endpoint for an imaging study allows the use of QIDO or WADO metadata resource requests for any component of the entire imaging study, specific query keys may not be supported or the amount of metadata available excessive, so a selected subset of metadata made available via an imaging study manifest is a convenient alternative.

The subset is typically based on selection metadata that describes the series and the instances in the imaging study. (See the selection metadata or key information specified for the content of the imaging study listed in the middle of Section X.4.1.1)

This selection metadata is obtained by the Imaging Document Consumer from the MADO imaging study manifest (See Section X.4.1.1 Role of an Imaging Study Manifest) and made available to the user or an application (e.g., Hanging Protocols) to select their subset of interest.

X.4.1.7 Launching a Remote Image Display

Some imaging sources may provide remote viewers that can be launched. This is intended to allow image access to imaging consumers that are unable to process DICOM instances but have an off-the-shelf browser. The Content Creator needs to be aware of this viewer and signals its availability by including a complete URL in an imaging study manifest.

An Imaging Document Consumer may invoke or launch an image display viewer on a remote server, using the complete URL, to view the imaging study associated with the corresponding imaging study manifest.

The structure and content of the complete URL (in both imaging study manifest formats) is not constrained by this Profile. This is intended to offer the flexibility to support a variety of remote

image display implementations. The use of a URL as specified by the Invoke Image Display (IID Profile – See RAD TF-1: 35) is recommended (see Section X.6).

The URL is intended to invoke the remote image display for the viewing of the Study to which the imaging study manifest corresponds (Study Instance UID). It is the responsibility of the server that hosts the image display application to control and perform an audit trail of the access to images. Both access control and audit trail specifications are outside the scope of the MADO Profile (See further discussion in Section X.5 Security Considerations).

X.4.2 Use Cases

X.4.2.1 Use Case #1: DICOM Instances Retrieval

X.4.2.1.1 DICOM Instances Retrieval Use Case Description

This use case focuses on the retrieve of the DICOM encoded instances which can be displayed or processed.

- The application (e.g., Electronic Patient Record, PACS) presents the descriptive information of the study content to the clinician, as available in the selected imaging study manifest.
- From this descriptive information, the clinician selects one or more series of images or specific images of interest and requests their retrieval.
- The images are retrieved from the system where they are stored (PACS, VNA) using the location identified in the imaging study manifest. The system is acting as an Imaging Document Source.
- These images may be displayed to the clinician, processed by an application or imported into a local PACS.

X.4.2.1.2 Instance Retrieval Process Flow

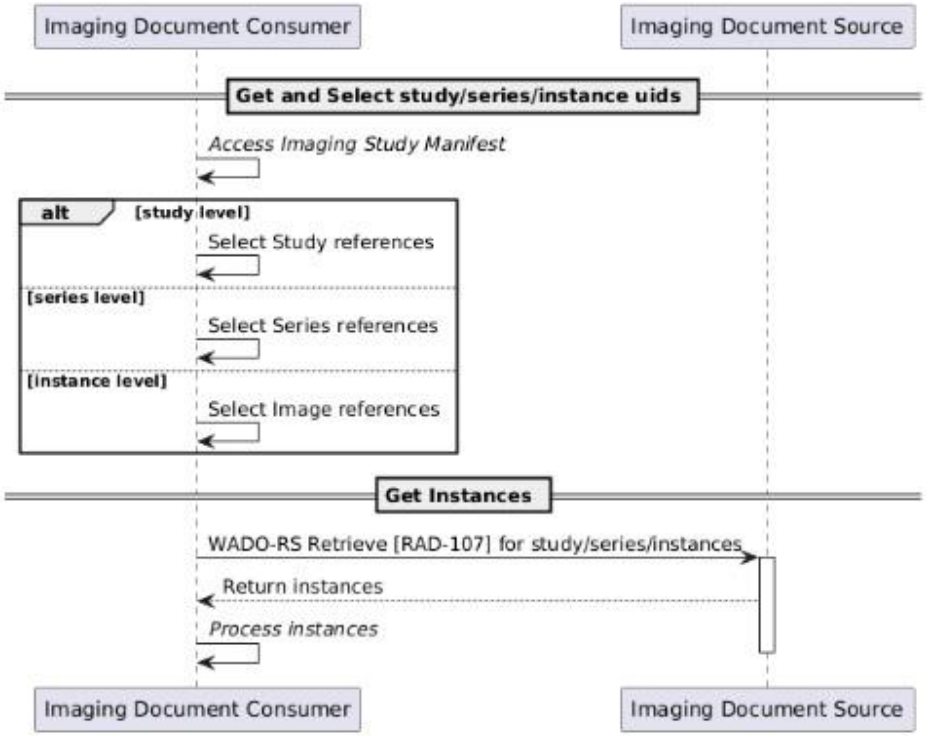

Figure X.4.2.1.2-1: Basic Process Flow in MADO Profile

The text in Figure X.4.2.1.2-2 was used to generate the diagram in Figure X.4.2.1.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.


```
@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 Retrieve [RAD-107] for study/series/instances
activate IDS
IDS-->IDC: Return instances
IDC->IDC: //Process instances //
deactivate IDS
@enduml
```

Figure X.4.2.1.2-2: Basic Process Flow in MADO Profile Pseudocode

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

X.4.2.2.1 Key Instances Retrieval Use Case Description

This use case focuses on the retrieve of the DICOM encoded instances that are flagged as key images, which can be displayed or processed. This avoids 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 (IHE KIN Profile, See RAD TF-1: 8).

- This use case starts the same as Use Case #1: DICOM Instances Retrieval.
- The imaging study manifest indicates that some images in the imaging study have been flagged by the acquiring radiologist (in a Key Object Selection or KOS) as being of significant interest expressed by a code (e.g., “Of Interest”, “For Surgery”, “For Referring Provider”) and optionally with a free format comment (e.g., “Tumor visible near the spine”).
- Based on the above information, the clinician requests that only those images flagged as significant by one or more KOS object(s) be retrieved.
- The application retrieves the selected KOS and then the images from the system where they are stored (PACS, VNA) using the location identified in the imaging study manifest.
- The application displays the images to the clinician or processes them.

590 **X.4.2.2.2 Key Instances Retrieval Process Flow**

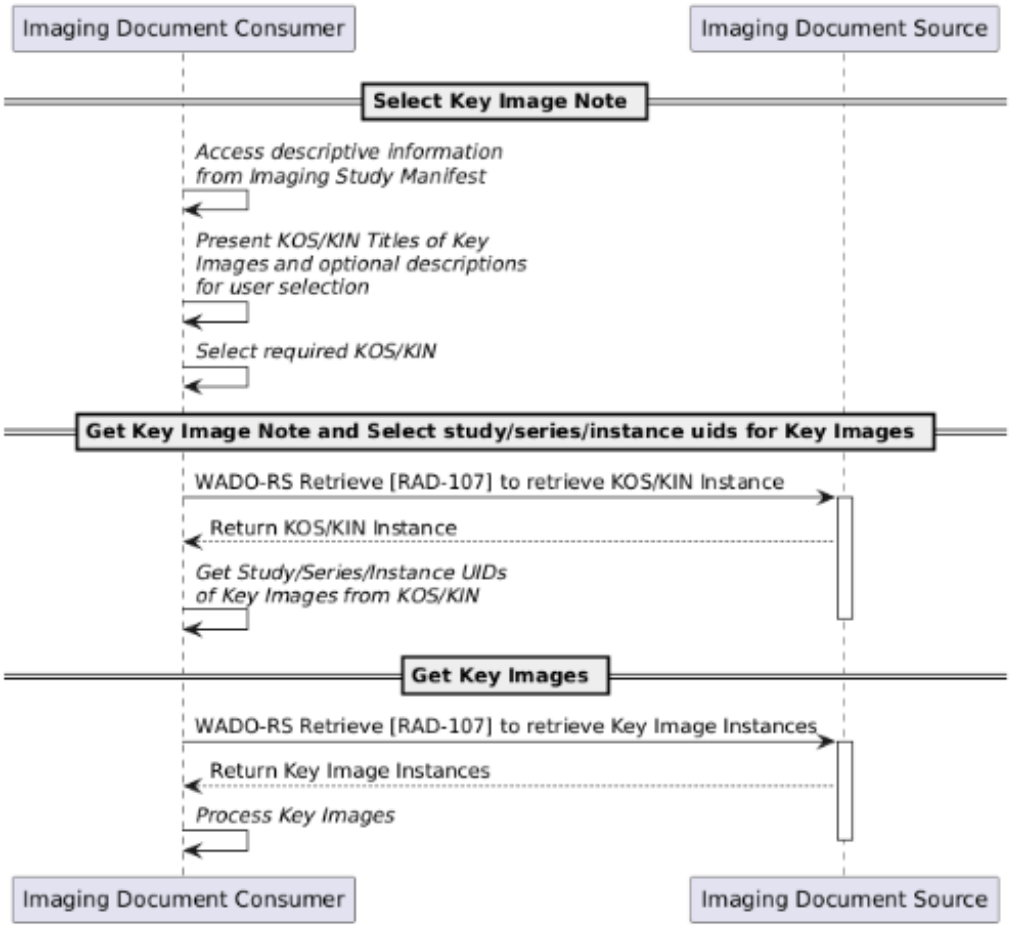

Figure X.4.2.2.2-1: Key Instances Retrieval Flow

The text in Figure X.4.2.2.2-2 was used to generate the diagram in Figure X.4.2.2.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

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```
@startuml Key Instance Retrieval Process Flow
participant "Imaging Document Consumer" as IDC
participant "Imaging Document Source" as IDS
== Select Key Image Note ==
IDC->IDC: //Access descriptive information//\n//from Imaging Study Manifest//
IDC->IDC: //Present KOS/KIN Titles of Key//\n//Images and optional
descriptions//\n//for user selection//
IDC->IDC: //Select required KOS/KIN//
== Get Key Image Note and Select study/series/instance uids for Key Images ==
IDC->IDS: WADO-RS Retrieve [RAD-107] to retrieve KOS/KIN Instance
activate IDS
IDS-->IDC: Return KOS/KIN Instance
IDC->IDC: //Get Study/Series/Instance UIDs//\n//of Key Images from KOS/KIN//
deactivate IDS
== Get Key Images ==
IDC->IDS: WADO-RS Retrieve [RAD-107] to retrieve Key Image Instances
activate IDS
IDS-->IDC: Return Key Image Instances
IDC->IDC: //Process Key Images//
deactivate IDS
@enduml
```

Figure X.4.2.2.2-2: Key Instances Retrieval Flow Pseudocode

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

X.4.2.3.1 Invoke Remote Image Display Use Case Description

This use case focuses on the launching of a display application on a remote server having access to the imaging study corresponding to the imaging study manifest. Such a remote viewer only needs an off-the-shelf browser to be launched and display the images from the study (no need for a local DICOM viewer). In this example Invoke Image Display [RAD-106] is being used to launch the remote viewer but other methods may be used.

- This use case starts the same as Use Case #1: DICOM Instances Retrieval.
- The imaging study manifest indicates that the imaging study can be viewed remotely via a Display URL link through a local browser.
- The clinician chooses to invoke the remote viewing application.
- The clinician interacts with the remote viewing application to navigate among the series and instances of the imaging study as desired, using the remote viewer user interface.

X.4.2.3.2 Invoke Remote Image Display Process Flow

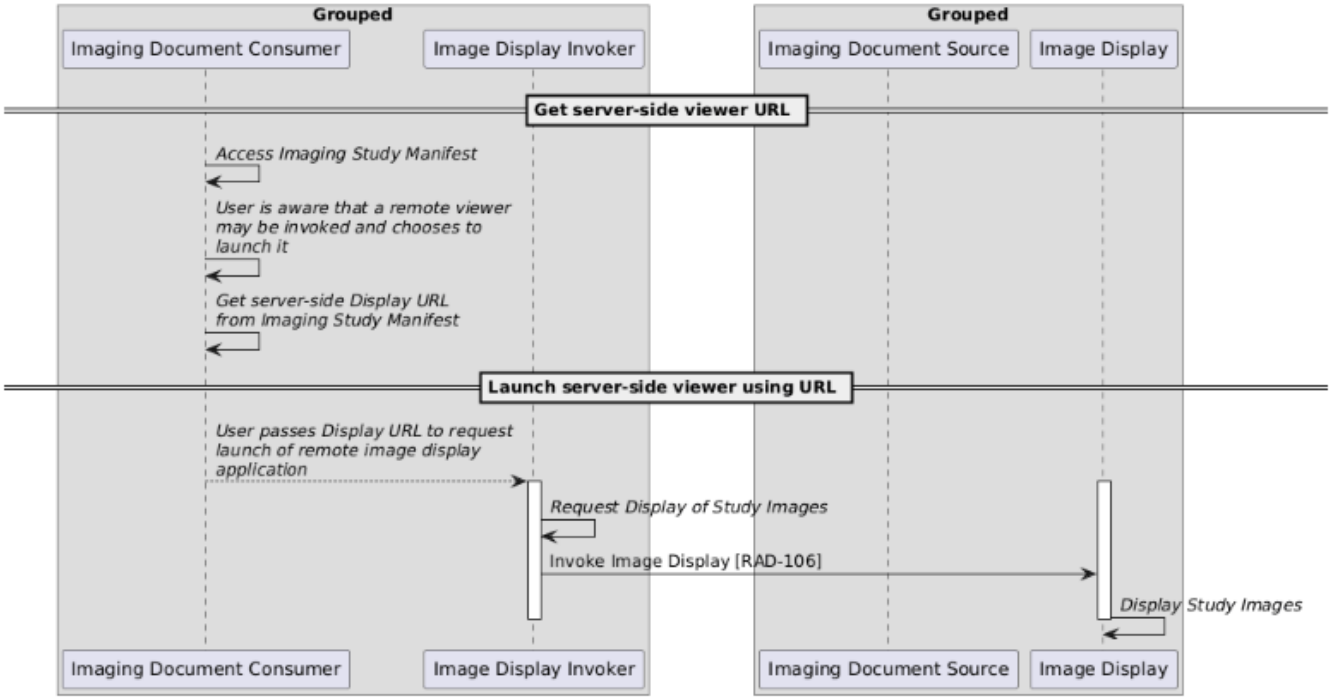

Figure X.4.2.3.2-1: Invoke Remote Image Display Process Flow

The text in Figure X.4.2.3.2-2 was used to generate the diagram in Figure X.4.2.3.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.


```
@startuml Invoke Remote Image Display Process Flow
skinparam BoxPadding 40
box "Grouped"
participant "Imaging Document Consumer" as IDC
participant "Image Display Invoker" as IDI
end box
box "Grouped"
participant "Imaging Document Source" as IDS
participant "Image Display" as ID
end box
== Get server-side viewer URL ==
IDC->IDC: //Access Imaging Study Manifest//
IDC->IDC: //User is aware that a remote viewer//\n//may be invoked and chooses
to//\n//launch it//
IDC->IDC: //Get server-side Display URL//\n//from Imaging Study Manifest//
== Launch server-side viewer using URL ==
IDC-->IDI: //User passes Display URL to request//\n//launch of remote image
display//\n//application//
activate IDI
activate ID
IDI->IDI: //Request Display of Study Images//
IDI->ID: Invoke Image Display [RAD-106]
ID->ID: //Display Study Images//
deactivate ID
deactivate IDI
@enduml
```

Figure X.4.2.3.2-2: Invoke Remote Image Display Process Pseudocode

X.5 MADO Security Considerations

The images and other study data being exchanged in this profile contain PHI which requires appropriate privacy and security measures.

The imaging study manifest contains three types of information with different security challenges:

- Patient identifying information, which must be treated as PHI.
- Imaging study descriptive information (see X.4.1.1 Role of an Imaging Study Manifest).
- Location information needed to build the URL to which the retrieve transaction of each series will be directed (see X.4.1.2 Intra-community sharing infrastructure).

The creator of the imaging study manifest determines which part of the imaging study to include in the imaging study manifest it publishes. This decision may be based in part on local and community security policies.

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

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

Deployments should consider whether or not:

- The Imaging Document Consumer performs user authentication to access patient data.
- The Imaging Document Source uses credentials or tokens supplied by the Imaging Document Consumer in the WADO-RS Retrieve transaction.
- The Imaging Document Consumer or the Imaging Document Source (or both) records access in an audit log.

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

The user authentication and authorization methods are outside the scope of the MADO Profile. Implementers should consider implementing the IHE ITI Profile such as Internet User Authorization (IUA) alongside the WADO-RS transaction.

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

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

X.6 MADO Cross Profile Considerations

This section describes optional groupings with other related profiles. It provides general guidance on the implications of such groupings and when needed, it specifies precise requirements on how they are grouped.

X.6.1 ITI MHD – Mobile Access to Health Documents

ITI MHD document sharing infrastructures can be used to distribute imaging study manifests. In this context:

- A Document Source in the MHD Profile can be grouped with a Content Creator to create and publish an imaging study manifest.

- A Document Consumer in the MHD profile can be grouped with a Imaging Document Consumer to access imaging study manifests.
- A Document Responder in the MHD Profile responds to the Document Consumers requests for imaging study manifests.

When an Imaging Document Consumer is grouped with an MHD Document Consumer, it shall be able to request in the ITI-68 Retrieve Document Transaction the media-type corresponding to the manifest format(s) it supports (i.e., as defined by the MADO DICOM KOS-based Option and/or the MADO FHIR-based Option).

The MHD Document Responder may or may not be able to provide the requested format. The MHD Document Consumer should provide an informative error message to its user when the MHD Document Responder cannot provide the requested format.

- When the MHD Document Responder implements a MADO Manifest Format mapping function it can support environments where the source provides only one manifest format and some consumers require the other.
- When the MDH Document Responder does not implement a MADO Manifest Format mapping function, the manifest format chosen for deployment by the MADO Content Creator must be the same one as the one implemented by the MADO Imaging Document Consumer in the same community (see Note 1 in Section X.1 MADO Actors, Transactions, and Content Modules).

X.6.2 ITI MHDS – Mobile Health Document Sharing

ITI MHDS document sharing infrastructures can be used to distribute imaging study manifests. In this context:

- A Document Source in the MHD Profile can be grouped with a Content Creator to create and publish an imaging study manifest.
- A Document Consumer in the MHD profile can be grouped with a Imaging Document Consumer to access imaging study manifests.
- A Document Responder in the MHD Profile responds to the Document Consumers requests for imaging study manifests.

Any additional requirements specified in Section X.6.1for the MHD Profile grouping apply.

X.6.3 ITI XDS.b – Cross-enterprise Document Sharing

ITI XDS.b document sharing infrastructure can be used to distribute imaging study manifests. In this context:

- A Document Source in the XDS.b Profile can be grouped with a Content Creator to create and publish an imaging study manifest.

- A Document Consumer in the XDS.b profile can be grouped with a Imaging Document Consumer to access imaging study manifests.
- A Document Registry and one or more Document Repositories in the XDS.b Profile respond to the Document Consumers requests for imaging study manifests.

The XDS.b Document Repository may or may not be able to provide imaging study manifests in the requested format. The XDS.b Document Consumer should provide an informative error message to its user when the XDS.b Document Repository cannot provide the requested format.

In an XDS.b deployment, the manifest format chosen for deployment by the MADO Content Creator has to be the same one as the one implemented by the MADO Imaging Document Consumer deployed in the same community (see Note 1 in Section X.1 MADO Actors, Transactions, and Content Modules). The functional search parameters defined by the MADO Profile (RAD TF-3: Section 6.X.6) shall be mapped as specified in the IHE RAD TF: 3 Appendix A – Mapping of MADO Search Parameters to MHD and XDS.b Metadata.

X.6.4 RAD XDS-I.b – Cross-enterprise Document Sharing for Imaging

RAD XDS-I.b document sharing infrastructures can be used to distribute imaging study manifests. In this context:

- An Imaging Document Source in the XDS-I.b Profile can be grouped with a Content Creator to create and publish an imaging study manifest (MADO DICOM KOS-based).
- An Imaging Document Consumer in the XDS-I.b profile can be grouped with an Imaging Document Consumer to access imaging study manifests (MADO DICOM KOS-based).
- A Document Registry and one or more Document Repositories in the XDS.b Profile respond to the Document Consumers requests for imaging study manifests.

In an XDS-I.b deployment, the manifest format chosen for deployment by the MADO Content Creator has to be the MADO DICOM KOS-based which is backward compatible with the XDS-I.b DICOM KOS based imaging study manifest. This constrains the MADO Imaging Document Source deployed in the same community to be configured with the MADO DICOM KOS-based (see Note 1 in Section X.1 MADO Actors, Transactions, and Content Modules).

The functional search parameters defined by the MADO Profile (RAD TF-3: Section 6.X.6) shall be mapped as specified in the IHE RAD TF: 3 Appendix A – Mapping of MADO Search Parameters to MHD and XDS.b Metadata.

XDS-I.b KOS-Based manifests shared with the XDS-I.b profile, may be consumed by MADO Imaging Document Consumers grouped with an XDS-I.b Imaging Document Consumer, but the enhanced features introduced by the MADO imaging study manifest will not be available.

X.6.5 RAD XC-WADO – Cross-community Web-Based Access to DICOM Objects

An XC-WADO Document Consumer can be grouped with an Imaging Document Consumer (RAD TF-1 XC-WADO Supplement) to retrieve imaging study instances from Imaging

Document Sources located in remote communities.

The XC-WADO Imaging Document Consumer when combined with an Imaging Document Consumer:

- Is aware of the endpoint of the XC-WADO Initiating Imaging Gateway and shall obtain, the homeCommunityId from the Cross-community document retrieve response and the Retrieve Location UID & Retrieve URL from the selected imaging study manifest.
- Constructs the WADO-RS retrieve URL based on the above information and issues the Cross-community WADO-RS Retrieve [RAD-160] transaction request to the XC-WADO Initiating Imaging Gateway. See RAD TF-1:X.4.1.3 (Cross-community sharing infrastructure).

Appendix XA – Managing the addresses of the sources of images to retrieve beyond a single community, provides examples of URL addressing when MADO and XC-WADO are grouped.

X.6.6 RAD IID – Invoke Image Display

The IID Invoke Imaging Display actor (RAD TF-1: 35) can be grouped with an Imaging Document Consumer to invoke a remote viewing application to display remotely the imaging study using the Display URL conveyed in the selected imaging study manifest.

The IID Image Display actor can be grouped with an Imaging Document Source to respond to a request to launch an image viewer based on the Display URL invoked by a remote web browser. Such a Display URL was previously placed in an imaging study manifest by a Content Creator associated with the imaging document source.

Other deployments where the Display URL is not formatted as an IID URL may be considered but are out of scope of the grouping with IID specified by the MADO Profile.

X.6.7 RAD KIN - Key Image Note

A KIN Evidence Creator, Modality, Image Manager/Archive Actor, when grouped with a Content Creator, shall create imaging study manifests with information resulting from one or more KOS objects that flag significant images (RAD TF-1: 8) in any associated imaging study.

X.6.8 RAD SWF.b – Scheduled Workflow

A SWF Image Manager/Archive Actor can be grouped with a Content Creator to create imaging study manifests to make available imaging studies.

A SWF Image Manager/Archive Actor can be grouped with an Imaging Document Source to respond to image retrieve requests for imaging studies.

A SWF Image Manager/Archive Actor can be grouped with an Imaging Document Consumer to provide access to remote imaging studies.

Such grouping contributes to enhance the quality and consistency of information content (e.g.,

study date and time, accession number) in the MADO imaging study manifest and MADO retrieval of DICOM Instances from imaging studies.

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Volume 2 – Transactions

Update Section 4.107 in Volume 2.

Editor Note: 4.1xy of the Public Comment version was removed and replaced by reuse of 4.107 with profile specific requirement clarifications as shown below.

[Current 4.107.4 Messages from IHE RAD TF-2: 4.107 WADO-RS Retrieve [RAD-107]:]

4.107.4 Messages

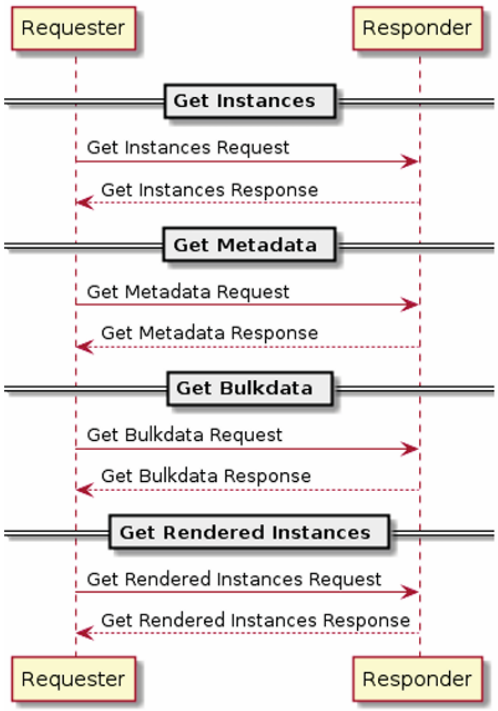

Figure 4.107.4-1: Interaction Diagram

4.107.4.0 Message Support Requirements

This transaction defines four request/response message pairs:

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

- Get Bulkdata (Section 4.107.4.5 and 4.107.4.6)
- Get Rendered Instances (Section 4.107.4.7 and 4.107.4.8)

A Requester shall support at least one of these request/response pairs~~**; a Responder shall support all four pairs, as defined in DICOM.**~~

Add the following new subsections

4.107.4.0.1 Cross-Enterprise Document Sharing for Imaging (XDS-I.b) Profile

A Responder in the XDS-I.b Profile shall support all four message pairs.

4.107.4.0.2 Web-based Image Access (WIA) Profile

A Responder in the WIA Profile shall support all four message pairs.

4.107.4.0.3 Integrated Multimedia Reporting (IMR) Profile

A Responder in the IMR Profile shall support all four message pairs.

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

A Responder in the MADO Profile shall support the 'Get Instances' message pair for Study Instances, Series Instances and Instance Resources. The Responder may support the Frame Pixel Data Resource.

Note: The Frame Pixel Data Resource is being introduced by a DICOM CP on DICOM PS3.18.

Rendered Instances Option

A Requester in the MADO Profile that claims the Rendered Instances Option shall support the 'Get Rendered Instances' message pair for the Rendered Instance Resource. The Requester may support Rendered Series and Rendered Frame resources.

A Responder in the MADO Profile that claims the Rendered Instances Option shall support the 'Get Rendered Instances' message pair for the Rendered Instance Resource. The Responder may support Rendered Series and Rendered Frame resources.

4.107.4.0.5 Cross-Community Web-Based Access to DICOM Objects (XC-WADO) Profile

A Requester and a Responder in the XC-WADO Profile shall support the 'Get Instances' message pair as defined in DICOM PS3.18. They may optionally support the 'Get Rendered Instances' message pair as defined in DICOM PS3.18.

Add Appendix XA to Volume 2x appendices

Appendix XA – Managing the addresses of the sources of images to retrieve beyond a single community

This appendix provides information about the way the addresses of image sources are handled 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.

Note: The term Community is used to consider a set of Imaging Document Sources, Content Creators and Imaging Document Consumers that are implemented by individual organizations or enterprises. The way the MADO actors are integrated within their respective individual organizations or enterprises is beyond the scope of the MADO Profile and may use IHE profiles such as IHE WIA, IHE SWF.b, ARI. Examples of such Communities are regional ehealth networks, and national ehealth infrastructures.

The term Cross-community is used to consider how one or more Communities, as defined above, may be integrated and allow actors such as Imaging Document Consumers to access Imaging Document Sources from other Communities to retrieve DICOM Instances across these Community boundaries.

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

The following four figures present an example of Cross-community handling of the retrieve URL used in the WADO-RS transactions. Figures XA-1 and XA-2 depict the case of a Community A that uses a Retrieve Location UID. Figures XA-3 and XA-4 depict the case of a Community A that uses a Retrieve URL in the imaging study manifest (See Section X.4.1.2 Intra-community sharing infrastructure).

In these examples, a Cross-community WADO-RS Retrieve transaction initiates from a Community B Imaging Document Consumer and progresses via Initiating and Responding Imaging Gateways to reach the Community A where the Imaging Document Source is located. The example focuses on the WADO-RS retrieve URL, and the value it contains, as it moves from B to A. These transformations are specified by the XC-WADO Profile using the MADO specified imaging study manifest (see Section 58.4.1.5 DICOMweb Study Service Retrieve transaction URI).

The elements manipulated during transactions used in Figures XA-1, XA-2, XA-3, XA-4 that provide examples of the URL transformation by the gateways where the responding community either includes or not the Retrieve URL (0008,1190) attribute into the published imaging study manifests:

- Initiating Imaging Gateway hostname: initiating-gateway.example.com
- Initiating Imaging Gateway endpoint_path: wado
- Responding Imaging Gateway hostname: responding-gateway.example.org
- Responding Imaging Gateway endpoint_path: wado-rs
- Initiating Community homeCommunityId: urn:oid:1.2.3.4

- Responding Community homeCommunityId: urn:oid:5.6.7.8
- RetrieveLocationUID: 1.2.840.9.10.11.12
- Retrieve URL (base URI): hostname/dicom-web-rs/
- Imaging Document Source hostname: document-source.example.org

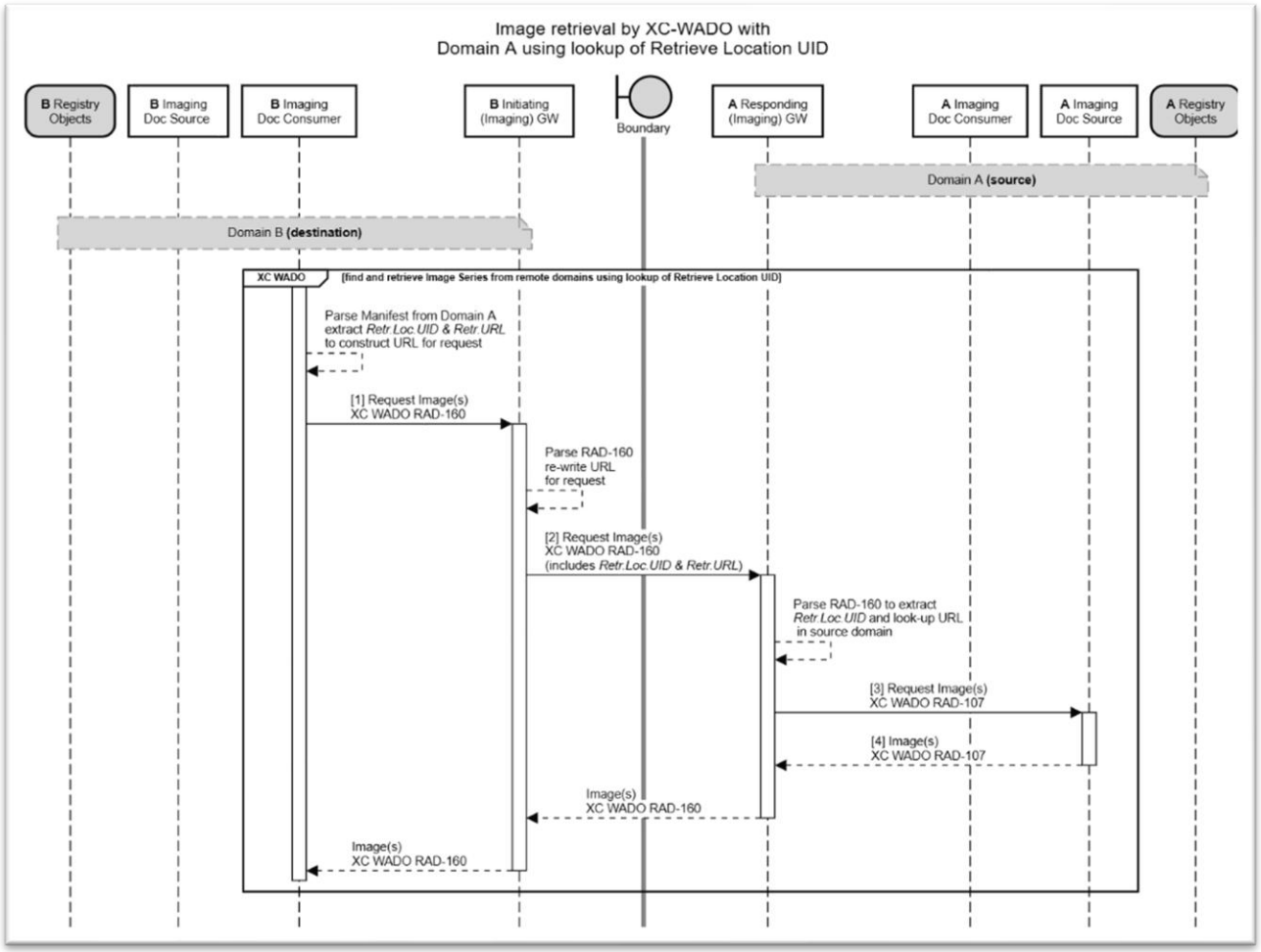

Figure XA-1: Image retrieval by XC-WADO with Domain A using lookup of Retrieve Location UID - Transactions

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Given a manifest for the imaging study 1.2.840.113619.2.207.28521.42888.1640475282.450/ coming from homeCommunityID/5.6.7.8 and containing a retrieveLocationUID 1.2.840.. and no retrieve URL

The Manifest is associated with homeCommunityID/5.6.7.8 which is not the Local Home CommunityID

[1] The B_IDC sees a different *homeCommunityID* than its own and can construct the appropriate URL.
https://initiating-gateway.example.com/wado/
homeCommunityId/5.6.7.8/RetrieveLocationUID/1.2.840.9.10.11.12/
study/1.2.840.113619.2.207.28521.42888.1640475282.450/

[2] B_IIGW uses *A_homeCommunityID* to map (lookup) the *hostname* for A_RGW according to local configuration in B_IGW and constructs the appropriate URL
https://responding-gateway.example.org/wado-rs/
homeCommunityId/5.6.7.8/RetrieveLocationUID/1.2.840.9.10.11.12/
study/1.2.840.113619.2.207.28521.42888.1640475282.450/

[3] A_RIGW The initial string document-source.example.org/pacs/wado-rs needs to be obtained from local lookup using the retrieve location UID (OID)
https://document-source.example.org/pacs/wado-rs/
study/1.2.840.113619.2.207.28521.42888.1640475282.450

[4] Domain A document source responds with multi-part encoded DICOM objects (images) as payload

Figure XA-2: WADO-RS Retrieve URL with Domain A using lookup of Retrieve Location UID – Example of related URL values

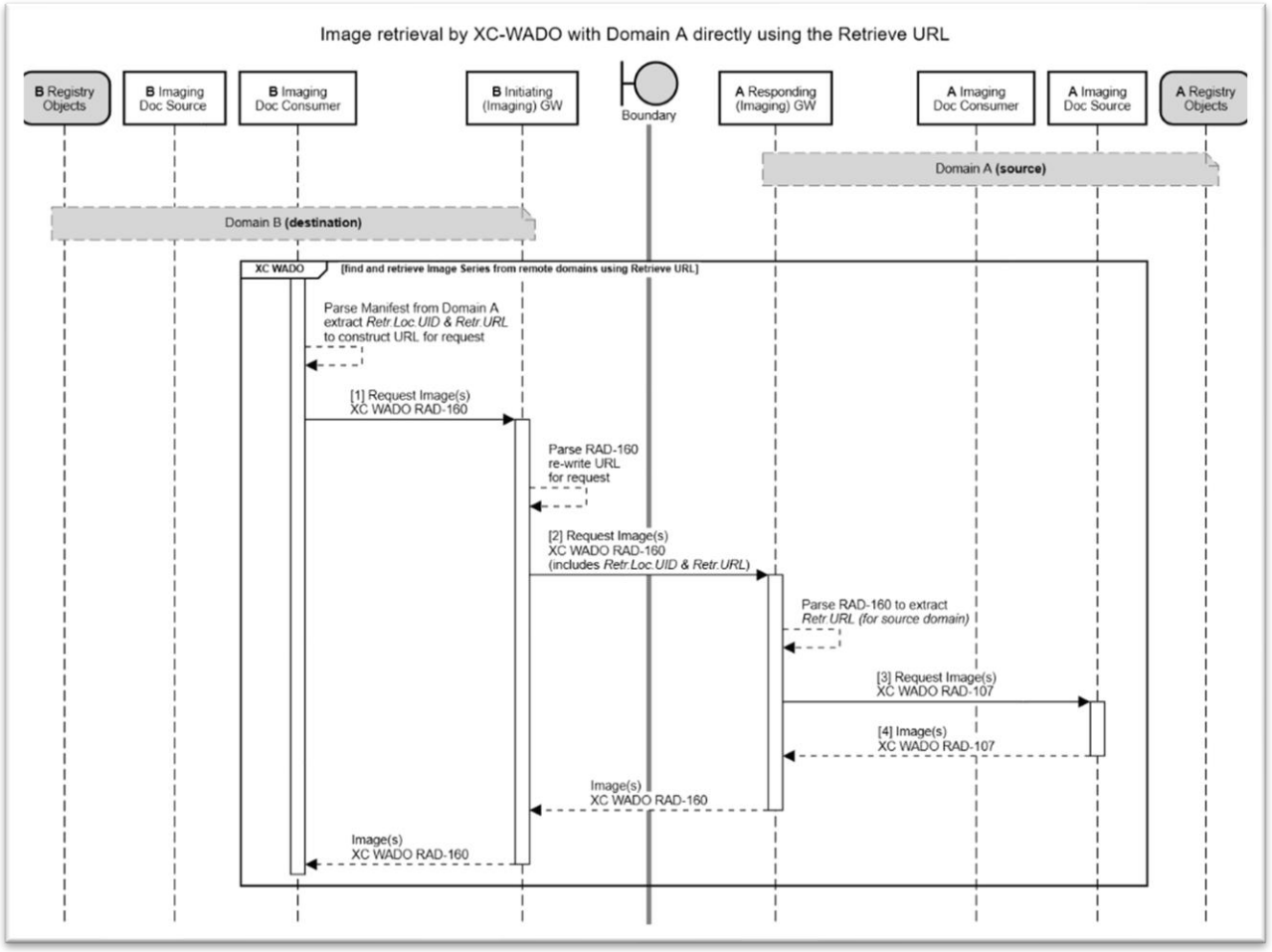

Figure XA-3: Image retrieval by XC-WADO with Domain A directly using the Retrieve URL – Transaction flows

Given a manifest for imaging study 1.2.840.113619.2.207.28521.42888.1640475282.450/ coming from homeCommunityID/5.6.7.8 and containing a retrieveLocationUID 1.2.840.. and with a retrieve URL hostname/dicom-web-rs

The Manifest is associated with a homeCommunityID/5.6.7.8 which is not the Local Home CommunityID

[1] The B_IDC sees a different *homeCommunityID* than its own and can construct the appropriate URL.
https://initiating-gateway.example.com/wado/
homeCommunityId/5.6.7.8/RetrieveLocationUID/1.2.840.9.10.11.12/
study/1.2.840.113619.2.207.28521.42888.1640475282.450
?retrieveurl=hostname/dicom-web-rs/

[2] B_IIGW uses *A_homeCommunityID* to map (lookup) the *hostname* for A_RGW according to local configuration in B_IGW and constructs the appropriate URL
https://responding-gateway.example.org/wado-rs/
homeCommunityId/5.6.7.8/RetrieveLocationUID/1.2.840.9.10.11.12/
study/1.2.840.113619.2.207.28521.42888.1640475282.450
?retrieveurl=hostname/dicom-web-rs/

[3] A_RIGW uses the URL to obtain the imaging locally. The URL used it is in this form:
https://hostname/dicom-web-rs/ study/1.2.840.113619.2.207.28521.42888.1640475282.450

[4] Domain A document source responds with multi-part encoded DICOM objects (images) as payload

Figure XA-4: WADO-RS Retrieve URL with Domain A directly using the Retrieve URL – Example of related URL values

Volume 3 – Content Modules

4 IHE Namespaces, Concept Domains and Vocabularies

Add to Section 4 IHE Namespaces, Concept Domains and Vocabularies, Section 4.3.1, the following two lines.in Table 4.3.1-1 Format Codes for IHE Radiology Profiles,

4.3 Format Codes and Vocabularies

4.3.1 IHE Format Codes

Table 4.3.1-1: Format Codes for IHE Radiology Profiles

Profile	Format Code	Coding Scheme	Description	Reference
Manifest Based Access to DICOM Objects (MADO)	1.2.840.10008.5.1.4.1.1.88.59 (same as XDS-I assigned Format Code)	1.2.840.10008.2.6.1	MADO DICOM KOS-Based Imaging Study Manifest	6.X.2
	urn:ihe:rad:MADO:fhir-manifest:2026	1.3.6.1.4.1.19376.1.2.7.1	MADO FHIR-based Imaging Study Manifest	6.X.3

Add to Volume 3 Section 6, Section 6.X MADO Imaging Study Manifest

6.X MADO Imaging Study Manifest

6.X.1 Scope

An imaging study manifest is a document listing the key information about the content of a single imaging study. It includes location pointers to its instances' content and organizes this information according to the well-established model of an imaging study containing one or more series with each series containing one or more instances (e.g., images).

MADO defines two content formats (and corresponding encodings) for the imaging study manifest:

1. DICOM KOS-Based (see TF-3: 6.X.2)
2. HL7 FHIR-Based (see TF-3: 6.X.3)

A bi-directional mapping between the two formats for transformation purposes is also specified (see TF-3: 6.X.5).

An MHD Envelope Content to be used along with the IHE MHD Profile is specified (see TF-3: 6.X.4) when Document Consumer Actors and Document Source Actors of the document sharing infrastructure are grouped with MADO (see TF-1:X.6).

Finally, a set of search parameters associated to imaging study manifests, is specified and expected to be supported by Document Consumer Actors of the document sharing infrastructure grouped with MADO (see TF-1: X.6).

6.X.2 DICOM KOS-Based Imaging Study Content Definition

This section specifies the structure and format of an Imaging Study Manifest for the MADO Profile using the DICOM standards. It is based on the DICOM Key Object Selection (KOS) Document Information Object Definition (IOD) as specified in DICOM PS3.3 Section A.35.4 Key Object Selection Document IOD.

6.X.2.1 Conventions

IHE Profiles may 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. These profiling conventions on DICOM IOD are defined in Appendix E Section E.2 of the IHE Technical Frameworks General Introduction. These conventions are copied in this section (as extracted from section E.2 of CP-RAD-562 which is not yet approved at the time of issuing this Trial Implementation).

- The IHE Technical Framework uses the following legend to specify requirements for DICOM IOD module encoding:

Table 6.X.2.1-1: 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.

- The IHE Technical Framework uses the following legend to specify requirements for DICOM attribute encoding:

Table 6.X.2.1-2: 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 shall be present with a value, 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 with a value, 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.

Specifications for constraining instances of DICOM Structured Reports follow the conventions in the tables above. In many cases, requiring the use of a specific DICOM SR Template may be sufficient.

6.X.2.2 General Definitions

Study Instance UID (0020,000D) in the Imaging Study Manifest shall use the same value as the referenced instances. Since the Imaging study manifest instance is not considered to be "shared" with the MADO specified mechanisms, it will not include itself in the list of shared instances.

When shared with MHD, MHDS, XDS.b, XDS-I.b document sharing profiles, the Imaging Study Manifest, shall be encoded as a DICOM Part 10 File format having a MIME type of "application/dicom".

Table 6.X.2.2: Imaging Study Manifest Format Code

Format Code	Coding Scheme	Description
1.2.840.10008.5.1.4.1.1.88.59 (same as XDS-I assigned Format Code)	1.2.840.10008.2.6.1	MADO DICOM KOS-Based Imaging Study Manifest

6.X.2.3 Referenced Standards

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

6.X.2.4 IOD Definition

This section builds upon the DICOM IOD specification of a Key Object Selection SOP Class

(1.2.840.10008.5.1.4.1.1.88.59) as specified by the DICOM Standard. It focusses on constraints and additions specific to the KOS-Based MADO Imaging Study Manifest.

Table 6.X.2.4-1: Usage of DICOM Modules in MADO Imaging Study Manifest

IE	Module	Reference	Usage	IHE Usage
Patient	Patient	C.7.1.1	M	M See Section 6.X.2.5
Study	General Study	C.7.2.1	M	M See Section 6.X.2.6
Series	Key Object Document Series	C.17.6.1	M	M
Equipment	General Equipment	C.7.5.1	M	M See Section 6.X.2.7
SR Document	Key Object Document	C.17.6.2	M	M See Section 6.X.2.8
	SR Document Content	C.17.3	M	M See Section 6.X.2.9
	SOP Common	C.12.1	M	M See Section 6.X.2.10

In the modules specified below only the DICOM attributes profiled by MADO are listed. The DICOM standard applies for all other attributes.

6.X.2.5 Patient Module

6.X.2.5.1 Module Definition

Table 6.X.2.5.1-1: Usage of DICOM Attributes in Patient Module

Attributes from Table C.7-1 Patient Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Patient ID	(0010,0020)	R+	Primary identifier for the patient. See Section 6.X.2.5.2.1.1.
Include Table 6.X.2.5.2.1.3-1 “Issuer of Patient ID Macro Attributes” - see section 6.X.2.5.2.1.3 Issuer of Patient ID Macro			
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.

Attributes from Table C.7-1 Patient Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
			See Section 6.X.2.5.2.1.2.
>Patient ID	(0010,0020)	R+	An identifier for the Patient.
>Include Table 6.X.2.5.2.1.3-1 "Issuer of Patient ID Macro Attributes" - see section 6.X.2.5.2.1.3 Issuer of Patient ID Macro			

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6.X.2.5.1.1 Patient Identification Attributes Descriptions

6.X.2.5.1.1.1 Patient ID (0010,0020)

The Patient ID (0010,0020), whether used as the primary patient identifier or one of the other patient ids, shall be combined with the Issuer of Patient ID Qualifiers Sequence (0010,0024) to
1055 provide a globally unique patient identifier in all cases.

6.X.2.5.1.1.2 Other Patient IDs Sequence (0010,1002)

The Other Patient IDs Sequence (0010,1002) shall also contain the patient identifier present in the Patient ID attribute (0010,0020) of the imaging study manifest. In addition, it may contain other known patient identifiers such as national, regional and local ones.

1060 This will allow an importing system to select from the Other Patient IDs sequence a value that is more locally useful and place it in the Patient ID attribute (0010,0020) without making any changes to the Other Patient IDs Sequence identifiers.

6.X.2.5.1.1.3 Issuer of Patient ID Macro

Table 6.X.2.5.1.1.3-1: Usage of DICOM Attributes in Issuer of Patient ID Macro

Attributes from Table 10-18 Issuer of Patient ID Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Issuer of Patient ID	(0010,0021)	O+	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

Attributes from Table 10-18 Issuer of Patient ID Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
			Patient ID (0010,0020). Only a single Item shall be included in this Sequence.
>Universal Entity ID	(004 0,0032)	R+	Globally unique identifier 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	(004 0,0033)	R+	Standard defining the format of the Universal Entity ID.

1065

6.X.2.6 General Study Module

Table 6.X.2.6-1: Usage of DICOM Attributes in General Study Module

Attributes from Table C.7-3 General Study Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Study Date	(0008,0020)	R+	Date the Study started. See Section 6.X.2.6.2.
Study Time	(0008,0030)	R+	Time the Study started. See Section 6.X..2.6.2.
Accession Number	(0008,0050)	O+	Identifier of the imaging (scheduled) procedure request. Present when a single value is assigned to the imaging study. When an imaging study has multiple accession numbers assigned, the Accession Number (0008,0050) shall be empty, and the originally assigned accession numbers shall be present in the Referenced Request Sequence 6.X.2.8.1. See Section 6.X.2.8.1 Accession Number Attribute Descriptions.
Issuer of Accession Number Sequence	(0008,0051)	RC+	Identifier of the Assigning Authority that issued the Accession Number (0008,0050). Required if Accession Number (0008,0050) is not empty. Only a single Item shall be included in this Sequence.
> Include Table 6.X.2.12-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.2.12 HL7v2 Hierarchic Designator Macro			

6.X.2.6.1 Accession Number Attribute Descriptions

1070 Three workflow cases shall be supported by all actors of the MADO Profile:

1. Simple Case: An imaging study is related to a single Accession Number (IHE Scheduled Workflow Profile, see RAD TF2: 4.6.4.1.2.3.1 Simple Case). The General Study Module conveys the accession number.
2. Group Case: An Imaging Study is related to more than one Accession Number (IHE Scheduled Workflow Profile, see RAD TF2: 4.6.4.1.2.3.4 Group Case). The Referenced Request Sequence 6.X.2.8.1 conveys these multiple Accession Numbers.
3. Absent Case: An imaging study is not locally stored with an Accession Number. One or more unique Accession Number(s) shall be generated by the Content Creator and placed in the Manifest. If a single accession number is generated, it is conveyed in the General Study Module, otherwise the Referenced Request Sequence is used. If Imaging Reports exist and are associated to the shared imaging study they shall also contain the appropriate generated Accession Number.

6.X.2.6.2 Date/Time Attribute Descriptions

6.X.2.6.2.1 Manifest Study Date and Time

The Study Date Date (0008,0020) and Study Time (0008,0030) in the imaging study manifest are required by the MADO Profile. They are Type 2 attributes in DICOM and are widely present in imaging studies. These attributes are among the critical search parameters (RAD TF-3: 6.X.5 Imaging Study Manifest Search Metadata) and need to be present in the imaging study manifest.

6.X.2.6.2.2 Dates and Times Timezone Offset

In a document sharing context, all date, time and datetime attribute values in the referenced imaging study should be specified in a time zone, for which it is strongly recommended to convey the Timezone Offset From UTC (0008,0201) in the retrieved referenced instances of the imaging study.

This is described by the IHE CT Profile Timezone Offset Option introduced by IHE CP-ITI-1329 and CP-RAD-565.

6.X.2.7 General Equipment Module

Table 6.X.2.7-1: Usage of DICOM Attributes in General Equipment

Attributes from Table C.7-8 General Equipment Module			
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.

Attributes from Table C.7-8 General Equipment Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
			Fixed value configured onsite at install time of the software that created the KOS Manifests. Note: It is recommended 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.

6.X.2.8 Key Object Document Module

Table 6.X.2.8-1: Usage of DICOM Attributes in Key Object Document Module

Attributes from Table C.17.6-2 Key Object Document Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Referenced Request Sequence	(0040,A370)	R+	Identifies Requested Procedures to which this Document pertains. One or more Items shall be included in this Sequence. See Section 6.X.2.8.1.
>Include Table 6.X.2.8.1-1 "Referenced Request Macro Attributes" – see section 6.X.2.8.1 Referenced Request Macro			
Current Requested Procedure Evidence Sequence	(0040,A375)	R	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.
> Include Table 6.X.2.12-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.2.12 HL7v2 Hierarchic Designator Macro			

6.X.2.8.1 Referenced Request Macro Description

Identifies Requested Procedures that are being fulfilled (completely or partially) in the imaging study referenced by the manifest.

Figure 6.X.2.2.8.1-1 shows the many to many relationships between the workflow entities Clinical Order and Imaging Procedure Request (called Scheduled Procedure Request by DICOM) and the Imaging Study. The MADO Profile is designed to handle all of these relationships to ensure interoperability even between the broadest number of existing and future Imaging Document Consumers and Sources.

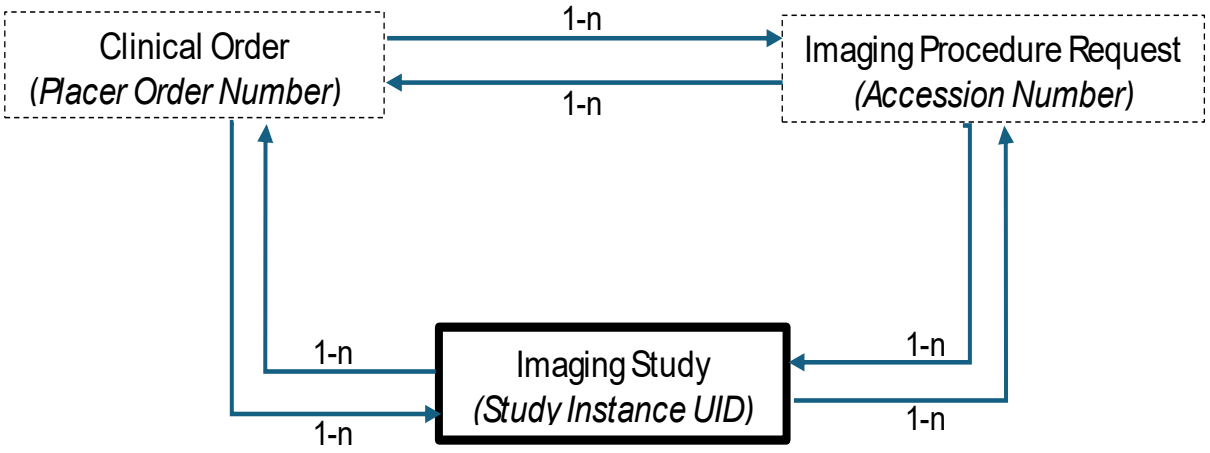

Figure: 6.X.2.2.8.1-1: Entities Identifiers and their linkages

The Referenced Request Sequence (0040,A370) contains the same number of items as the number of **unique combinations of Accession Numbers and Placer Order Numbers associated with the Imaging Study.**

The following examples illustrate some possible combinations:

1. An intensive care physician orders a series of six portable chest x-rays for a patient, every 12 hours over 72 hours.
   - 1 Clinical Order
   - 6 Imaging Procedure Requests
   - 6 Imaging Studies

   When the imaging manifest is created for each one of these 6 Imaging Studies, the Accession Number in the Study Module contains the Accession Number (corresponding to one of the Imaging Procedure Requests). In addition, if the Placer Order Number is known, the Referenced Request Sequence (0040,A370) contains one item for the unique combination of the Accession Number (corresponding to one of the Imaging Procedure Requests) and the Placer Order Number (corresponding to the clinical order).
2. An ED physician orders a chest CT and an abdominal CT for a patient in a tertiary care center. A single combined chest/abdominal CT is carried out and read by a single radiologist.
   - 2 Clinical Orders
   - 1 Imaging Procedure Request
   - 1 Imaging Study

When the imaging manifest is created for the grouped imaging study, the Referenced Request Sequence (0040,A370) contains two items, one for the first Placer Order Number with the Accession Number and the second item for the second Placer Order Number with the same Accession Number.

3. An angiography procedure is ordered by a vascular surgeon. During the course of this radiology intervention, an ultrasound exam is performed in the Angio room.
   - 1 Clinical Order
   - 1 Imaging Procedure Request
   - 2 Imaging Studies

   When the two imaging manifests are created, each manifest contains the same Accession Number in the Study Module. In addition, if the Placer Order Number is known, the Referenced Request Sequence (0040,A370) contains a single Item (Accession Number and Order Placer Number).

6.X.2.9 SR Document Content Module

Implementers Note:

DICOM CP 2595 is introducing a set of codes used by this profile. Since this IHE Radiology MADO Profile Trial Implementation text will be released before the DICOM CP becomes final text, IHE has issued temporary code values under the private coding scheme "99IHE". These temporary codes will be replaced with the finalized DICOM codes upon approval of the DICOM CP-2595.

Placeholder Code Value	Code Meaning	Temporary Code Value for IHE Trial Implementation (99IHE)
ddd001	Manifest with Description	MADOTEMP001
ddd003	Series Date	MADOTEMP003
ddd004	Series Time	MADOTEMP004
ddd002	Series Description	MADOTEMP002
ddd007	Number of Series Related Instances	MADOTEMP007
ddd009	Number of Study Related Series	MADOTEMP009

The SR Document Content Module shall be constructed from TID 2010 "Key Object Selection" invoked at the root node.

The TID 2010 "Key Object Selection" Template may include one or more Content Item of Value Type CODE and identified by EV (121023, DCM "Procedure Code").

The TID 2010 “Key Object Selection” Template shall include the TID 1600 “Image Library” Template. CID 7010 “Key Object Selection Document Title shall be set to: (MADOTEMP001, 99IHE, "Manifest with Description").

The MADO Profile relies on the DICOM Change Proposal CP-2595 that specifies the extension to the TID 2010 and the introduction of TID 1600.

Reviewers Note: Until the above DICOM CP-2595 issued for March 2026 Voting Packet is approved by DICOM, IHE Radiology relies on this Voting Packet version of CP2595 for this Trial Implementation document. When approved by DICOM, the MADO TI version will be updated by removing this note.

The TID 1600 “Image Library” Content Items shall be present as specified in Table 6.X.2.9-1: TID 1600 Template for SR Document Content Module of Manifest.

Table 6.X.2.9-1: TID 1600 Template for SR Document Content Module of Manifest

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
HAS ACQ CONTEXT	CODE	EV (121139, DCM, "Modality")	1-n	R+		DCID 29 “Acquisition Modality” Non-acquisition Modality from DCID 32 “Non-Acquisition Modality” may be included.
HAS ACQ CONTEXT	CODE	EV (123014, DCM, "Target Region")	1-n	R+		Code value for target region selected. See 6.X.6.4.1 High-Level Anatomic Regions and Systems Value Set (See Note below).
HAS ACQ CONTEXT	NUM	EV (MADOTEMP009, 99IHE, “Number of Study Related Series”)	1	R+		UNITS = EV ({series}, UCUM, "series") This value shall reflect the number of series in the study as referenced by the Current Requested Procedure Evidence Sequence (0040,A375).

Note: The High-level anatomic regions and systems value set defined in Section 6.X.6.4.1 High-Level Anatomic Regions and Systems Value Set is intended to be used for the metadata search parameter (See section 6.X.6.2 Imaging-Specific Search Request Parameters) used to support filtering queries.

Within the TID 1600 Image Library, each shared Series in the Manifest shall be represented by a distinct Image Library Group container. Within this container, the TID1602 "Image Library Entry Descriptors" Content Items shall be present as specified in Table 6.X.2.9-2: TID 1602 Template for SR Document Content Module of Manifest

Table 6.X.2.9-2: TID 1602 Template for SR Document Content Module of Manifest

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
HAS ACQ CONTEXT	CODE	EV (121139, DCM, "Modality")	1	R+		DCID 33 "Modality"
HAS ACQ CONTEXT	DATE	EV (MADOTEMP003, 99IHE, "Series Date")	1	RC+	Shall be populated if the corresponding attribute is populated in the relevant instance(s).	
HAS ACQ CONTEXT	TIME	EV (MADOTEMP004, 99IHE, "Series Time")	1	RC+	Shall be populated if the corresponding attribute is populated in the relevant instance(s).	
HAS ACQ CONTEXT	TEXT	EV (MADOTEMP002, 99IHE, "Series Description")	1	RC+	Shall be populated if the corresponding attribute is populated in the relevant instance(s).	
HAS ACQ CONTEXT	TEXT	EV (113607, DCM, "Series Number")	1	RC+	Shall be populated if the corresponding attribute is populated in the relevant instance(s).	The text string shall be consistent with the value of Series Number (0020,0011) of the referenced series.
HAS ACQ CONTEXT	UIDREF	EV (112002, DCM, "Series Instance UID")	1	R+		
HAS ACQ CONTEXT	CODE	EV (123014, DCM, "Target Region")	1	RC+		This is a fine-grained series level anatomical region recommended to use DCID 4031 or CID4

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
HAS ACQ CONTEXT	TEXT	EV (123014, DCM, "Target Region")	1	RC+		This is a fine-grained series level anatomical region
HAS ACQ CONTEXT	TEXT	EV (MADOTEMP007, 99IHE, "Number of Series Related instances")	1	R+		UNITS = EV ({instances}, UCUM, "instances") This value shall reflect the number of instances in the series of the study as referenced in the Current Requested Procedure Evidence Sequence (0040,A375).

Within the Image Library Group container, each shared Instance shall be represented by a distinct invocation of the TID 1601 Image Library Entry Template. Within each TID 1601 invocation, the Template TID 1602 is included.

The TID 1602 "Image Library Entry Descriptors" Content Items shall be present as specified in Table 6.X.2.9-3: TID 1602 Template for SR Document Content Module of Manifest.

Table 6.X.2.9-3: TID 1602 Template for SR Document Content Module of Manifest

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Addtl Value Set Constraint
HAS ACQ CONTEXT	NUM	EV (121140, DCM, "Number of Frames")	1	RC+	Required when the SOP Class is multiframe	
HAS ACQ CONTEXT	TEXT	EV (113609, DCM, "Instance Number")	1	RC+	Required when present in the referenced SOP Instance	The text string shall be consistent with the value of Instance Number (0020,0013) of the referenced instance (See Note).
HAS ACQ CONTEXT	INCLUDE	DTID 16XX Image Library Entry Descriptors for Key Object Selection	1	RC+	Present if this instance is a KOS Object	

Note: It is important to note that no instance ordering semantics may be assumed from:

- The ordering of Sequence Items in Referenced SOP Sequence (0008,1199),
- The ordering of SOP Instances in Content Items of the SR Document Module under template TID 2010,

- The ordering of SOP Instances in Content Items of the SR Document Module under template TID 1600
- The order in which DICOM instances are received by the Imaging Document Consumer.

Instance number(s), when present in the referenced SOP Instance of the imaging study manifest, offer a basic way to order images when displayed without actually having retrieved all instances to gain access to image orientation and image position attributes in the image headers.

When a Key Object Selection instance is referenced, the TID 16XX "Image Library Entry Descriptors for Key Object Selection" Content Items shall be present as specified in Table 6.X.2.9-4: TID 16XX Template for SR Document Content Module of Manifest.

The Content Items contain information from the referenced KOS instance that allows the user of any Imaging Document Consumer to determine:

- The presence of flagged significant images by a KOS instance (in a series of modality KO).
- If a KOS flagging significant images, is relevant using the KOS Title code and if present, an associated description

  For each KOS selected as relevant, retrieve the KOS instance to identify the flagged images and retrieve them.

Table 6.X.2.9-4: TID 16XX Template for SR Document Content Module of Manifest

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Addtl Value Set Constraint
HAS ACQ CONTEXT	CODE	EV (121144, DCM, "Document Title")	1	R+		
HAS ACQ CONTEXT	TEXT	EV (113012, DCM, " Key Object Description	1	RC+	Required when present in the referenced KOS instance	

The information allows retrieval of key images flagged as significant without first having to retrieve the list of KOS instances within the imaging study.

6.X.2.10 SOP Common Module

Table 6.X.2.10-1: Usage of DICOM Attributes in SOP Common Module

Attributes from Table C.12-1 SOP Common Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Timezone Offset From UTC	(0008,0201)	R+	Contains the offset from UTC for the timezone in which the manifest was created. It applies to all DA and TM Attributes of the Manifest.

1215 ### 6.X.2.11 Referenced Request Macro

Table 6.X.2.11-1: Usage of DICOM Attributes in Referenced Request Macro

Attributes from Table C.17-3c Referenced Request Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
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.
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. Only a single Item shall be included in this Sequence.
>Include Table 6.X.2.12-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.2.12 HL7v2 Hierarchic Designator Macro			
Placer Order Number / Imaging Service Request	(0040,2016)	R+	The order number assigned to the Imaging Service Request by the party placing the order. 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). Required if Placer Order Number / Imaging Service Request (0040,2016) is not empty. Only a single Item shall be included in this Sequence.
>Include Table 6.X.2.12-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.2.12 HL7v2 Hierarchic Designator Macro			

6.X.2.12 HL7v2 Hierarchic Designator Macro

Table 6.X.2.12-1: Usage of DICOM Attributes in HL7v2 Hierarchic Designator Macro

Attributes from Table 10-17 HL7v2 Hierarchic Designator Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Universal Entity ID	(0010,0032)	R+	Globally unique identifier for the Assigning Authority.
Universal Entity ID Type	(0010,0033)	RC+	Standard defining the format of the Universal Entity ID. (e.g. value: "ISO" for an OID format) Required if Universal Entity ID (0010,0032) is present.

6.X.2.13 Hierarchical SOP Instance Reference Macro

Table 6.X.2.13-1: Usage of DICOM Attributes in Hierarchical SOP Instance Reference Macro

Attributes from Table C.17-3 Hierarchical SOP Instance Reference Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
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.
Display URI	(gggg.eeee) (See Note for temporary TI private tag)	O	The value of this attribute is an opaque URI that results in launching a remote viewing application for the imaging study summarized by the imaging study manifest (See the concepts described in section X.4.1.7 Launching a Remote Image Display).
Referenced Series Sequence	(0008,1115)	R	Sequence of Items where each item includes the Attributes of a Series containing referenced Composite Object(s)
> Include Table 6.X.2.12-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.2.12 HL7v2 Hierarchic Designator Macro			

1225 Note: Since the IHE Radiology MADO Profile Trial Implementation has been released prior to the CP 2595 reaching approval in DICOM WG 6, a temporary DICOM Private Tag will be used in lieu of "DICOM Display URI Tag (gggg,eeee)".

Tag	Private Creator	VR	VM	Attribute Name	Attribute Description
(000D,00xx)	IHE_MADO_PRIVATE	LO	1	IHE MADO Private Creator ID	Private Creator ID
(000D,xx01)	IHE_MADO_PRIVATE	UR	1	Display URI	URI specifying the access path to a remote image display service for the Study. Temporary until DICOM CP2595 is approved (June 2026).

This IHE Private tag is a temporary tag value to be replaced with the DICOM assigned Tag for Display URI upon approval of the CP 2595 by DICOM.

6.X.2.14 Hierarchical Series Reference Macro

1230 **Table 6.X.2.14-1: Usage of DICOM Attributes in Hierarchical Series Reference Macro**

Attributes from Table C.17-3a Hierarchical Series Reference Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Retrieve Location UID	(0040,E011)	R+	Unique identifier of the system where the Composite Object(s) may be retrieved on the network. 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 (See concept section X.4.1.2 Intra-community sharing infrastructure). WADO-RS retrieval URLs can be composed by the consumer using this Base URI and the study/series/instance UIDs from this manifest.
Retrieve URL	(0008,1190)	O	URL specifying the location of the referenced Instance(s). The value of this attribute is a Base URI representing the endpoint for the corresponding WADO-RS service (See concept section X.4.1.2 Intra-community sharing infrastructure). WADO-RS retrieval URL can be composed by the consumer using this Base URI and the study/series/instance UIDs from this manifest. 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.

6.X.3 HL7 FHIR Based Imaging Study Manifest Content Definitions

This section specifies the structure and format of an Imaging Study Manifest for the MADO

Profile using the HL7 FHIR standard. It is based on the FHIR Imaging Study resource as specified by the FHIR Release 4 and other related FHIR Release 4 resources in the form of a FHIR Implementation Guide, which is an integral part of the MADO Profile.

The MADO HL7 FHIR Imaging Study Manifest specification is under finalization and the development version may be accessed at:
https://build.fhir.org/ig/IHE/RAD.MADO/branches/master/fhir-imaging-manifest.html

Note: To focus on the imaging manifest go to the “Artifacts tab” in the top bar. Then, when accessing the different resource profiles, it automatically selects the "Key Elements" tab which does not show all elements in the resource.

When shared with MHD, MHDS, or XDS.b document sharing profiles, the Imaging Study Manifest, shall use the following Format Code.

Format Code	Coding Scheme	Description
urn:ihe:rad:MADO:fhir-manifest:2026	1.3.6.1.4.1.19376.1.2.7.1	MADO FHIR-based Imaging Study Manifest

6.X.4 MHD Envelope Content Definitions

This section specifies the structure and content of an envelope based on a FHIR Document Reference resource as specified by the FHIR Release 4 in the form of a FHIR Implementation Guide, which is an integral part of the MADO Profile. This MADO HL7 FHIR Envelope specification shall be used in conjunction with the IHE MHD or MHDS Profiles when the imaging study manifest is shared in a FHIR-Based Format or a DICOM KOS-Based Format (See X.6.1 and X.6.2).

This envelope specification is under finalization and the development version may be accessed at: https://build.fhir.org/ig/IHE/RAD.MADO/branches/master/manifest-envelope.html.

6.X.5 DICOM – FHIR Manifest Format Mapping Specification

This section specifies the mapping between the two imaging study manifest formats specified in section 6.X.2 and 6.X.3. It enhances the ability to bridge between infrastructures that may have chosen to deploy different imaging study manifest formats. This mapping is under finalization and the development version may be accessed at:
https://build.fhir.org/ig/IHE/RAD.MADO/branches/master/mapping.html.

Such mapping is not currently required by the MADO Profile.

6.X.6 Imaging Study Manifest Search Metadata

A set of search parameters is defined in this section for the search of imaging study manifests. These functional requirements ensure a uniform access to imaging study manifest irrespective of the document sharing infrastructure used.

It is expected that the search Document Consumer Actors of the document sharing infrastructure grouped with MADO, will support these search parameters.

These parameters have been selected based on the experience with deployments of XDS-I.b and MHD (Comprehensive Metadata option). They are directly supported by the XDS.b, XDS-I.b, XCA, XCA-I, MHD and MHDS profiles. Any given query might use only a subset of these search parameters.

6.X.6.1 Generic Search Request Parameters

The following search request parameters are generic (not specific to imaging):

- Patient Business Identifier – patient id
- Period – the time of service. As a search parameter, it matches when the requested interval overlaps with the period or time of service.

  Note: The time of service for an Imaging Manifest Doc is the Study Date and Time.
- Document Creation Date/Time - date/time the imaging study manifest was created. . This is intended to facilitate finding manifest published or revised after a certain date and time.
- Category – class of document (e.g., *images or reports)*
- Practice Setting – specialty where care was performed/provided (*e.g., radiology, cardiology, surgery, endoscopy for* imaging study manifest*)*

6.X.6.2 Imaging-Specific Search Request Parameters

The following search request parameters are specific to imaging:

- Modality
- Anatomical Region - body part
- Study Instance UID
- Accession Number (include Issuer of Accession Number to ensure uniqueness)
- Placer Order Number

6.X.6.3 Return Response Parameters

For each matching entry, a response will be returned to the consumer. It is expected that this response contains not only the values of the search parameters conveyed by the query request, but the complete list of values for all supported search parameters, plus some additional parameters that are returned. These returned parameter values may be used by the Health Professional or an application to select any relevant imaging study manifest of interest which can then be retrieved through the document sharing infrastructure. The list of returned parameters are:

- Repository Location Unique Identifier - The document repository from which the document can be retrieved.
- Document Identifier
- Document Creation Date/Time
- Document Type
- Document Format
- Document Mime Type
- Document Author(s)
- Document Organization Name and ID
- Document Category (high-level type)
- Practice Setting (high-level specialty)
- Order identifier(s)
- Procedure code(s)
- Modality type(s)
- Anatomical Regions (high-level value set)
- Study Instance UID
- Accession Number(s) (include Issuer of Accession Number to ensure uniqueness)
- Placer Order Number(s)

6.X.6.4 Anatomical Region Value Set

The Anatomical Region Value Set is defined as a short set of anatomical region values optimized for use as a search parameter, to facilitate a coarse grain filtering among large numbers of imaging studies, performed across a wide range of treatment specialties and imaging modalities. Coarse grain filtering on anatomical regions needs to rely on a short classification set, meaning:

- Typically, only one or two values, rarely more, are needed to identify, at a high-level, the anatomies associated with most imaging procedures, thus making the mapping of imaging procedure to such high-level anatomy easy and simple to check for correctness when deployed across many sites.
- When expressing a query filter, one should avoid a long pull-down menu of 20, 30 or more values to be presented to the Health Professional to scroll through, to set the filter in a query.

- Deploying such a shared short set is simple even with large numbers of local imaging procedures (point 1 above) and it lends itself to a robust selection process (point 2 above) by the requester, resulting in avoiding false negative query matches

Example of mapping process: A possible way to select the right value(s) of anatomical regions is to automate the mapping at the time the imaging order is processed by the imaging department:

1. Today, it is typical that when processing incoming clinical orders, one or more imaging procedure request(s) are created with a corresponding imaging procedure code selected. Such an imaging procedure code comes from a value set (typically around a thousand values) that may be locally defined or nationally standardized, based on ad-hoc or international terminologies.
2. This variety of terminologies used for imaging procedure codes is not a barrier to define a mapping for each imaging procedure codes used locally to one or more anatomical region(s) from the high-level Anatomical Regions and Systems value set defined in Table 6.X.6.4-1: CID IHE-MADO1 High-Level Anatomic Regions and Systems.
3. This process could be automated by the order processing application at the departmental level. The imaging modalities may continue to manage anatomical codes as they do today.

Table 6.X.6.4-1: CID IHE-MADO1 High-Level Anatomic Regions and Systems

Type:	**Extensible**
FHIR Keyword:	**IHE-MADO1-HighLevelAnatomicRegionsAndSystems**
Keyword:	**HighLevelAnatomicRegionsAndSystems**
Version:	**20260227**
UID:	**1.3.6.1.4.1.19376.1.1.86.1**
Context Group ID:	**CID IHE-MADO1**

Coding Scheme Designator	Code Value	Code Meaning	Corresponding DICOM Body Part Examined
SCT	63337009	Lower trunk	LOWERTRUNK
SCT	38266002	Entire body	WHOLEBODY
SCT	53120007	Upper limb	UPPERLIMB
SCT	61685007	Lower limb	LOWERLIMB
SCT	67734004	Upper trunk	UPPERTRUNK
SCT	774007	Head and neck	HEADNECK

Coding Scheme Designator	Code Value	Code Meaning	Corresponding DICOM Body Part Examined
SCT	113257007	Cardiovascular system	CARDIOVASCSYS
SCT	80891009	Heart	HEART
SCT	76752008	Breast	BREAST
SCT	1141981001	Vertebral Column	SPINE

Note: The above codes and associated definitions are an extract from DICOM CID-4031, except (1141981001, SCT, ”Vertebral Column”) which is defined as a region in SNOMED CT replaces (421060004, SCT, “Spine”) which technically only covers the bony structure of the spine. The DICOM Body Part Examined retains the value of SPINE because it is common usage.

Appendices to Volume 3

Appendix A – Mapping of MADO Search Parameters to MHD and XDS.b Metadata

This appendix provides information on the mappings between the named MADO Search & Return parameters (see RAD TF-3: Section 6.X.6 Imaging Study Manifest Search Metadata) and:

1. MHD FHIR DocumentReference metadata
2. XDS.b DocumentEntry metadata

These mappings are not intended to be used as MHD FHIR DocumentReference to/from XDS.b DocumentEntry mappings although they are based on the IHE MHD – "XDS-on-FHIR" Comprehensive DocumentReference Mappings.

The Cardinality and Value Sets are not defined but left to the detailed Implementation Guides (to be defined).

Table A-1 defines the general search request parameter mappings to MHD and XDS.b.

Table A-1: MADO Generic Search Request Parameters

MADO Name	MHD FHIR DocumentReference	XDS.b DocumentEntry
Patient Business Identifier	patient.identifier	patientId
Period	period.start	serviceStartTime
	period.end	serviceStopTime
Document Creation Date/Time	creation	creationTime
Category	category	classCode
Practice Setting	setting	practiceSettingCode

Table A-2 defines the imaging specific search request parameter mappings to MHD and XDS.b.

Table A-2: MADO Imaging Specific Search Request Parameters

MADO Name	MHD FHIR DocumentReference	XDS.b DocumentEntry
Modality Type	context.event *[Modality]*	eventCodeList *[Modality]*
Anatomical Region	context.event *[Atomic Region/Body Part]*	eventCodeList *[Atomic Region/Body Part]*
Study Instance UID	related *[referenced ImagingStudy.identifier (Study Instance UID)]*	referenceIdList *[urn:ihe:iti:xds:2016:studyInstanceUID]*

MADO Name	MHD FHIR DocumentReference	XDS.b DocumentEntry
Accession Number	related *[referenced ImagingStudy.identifier (Accession Number)]*	referenceIdList *[urn:ihe:iti:xds:2013:accession]*
Order identifier	related *[referenced ServiceRequest.identifier (Order Identifier)]*	referenceIdList *[urn:ihe:iti:xds:2013:order]*

Table A-3 defines the return response parameter mappings to MHD and XDS.b.

Table A-3: MADO Return Response Parameters

MADO Name	MHD FHIR DocumentReference	XDS.b DocumentEntry
Repository Location Unique Identifier	content.attachment.url	repositoryUniqueId + uniqueId or URI
Document Identifier	masterIdentifier	uniqueId
Document Type	type	typeCode
Document Format	content.format	formatCode
Document Mime Type	content.attachment.contentType	mimeType
Document Author(s)	author	author.authorPerson
Document Organization Name and ID	custodian	author.authorInstitution
Order identifier(s)	related *[referenced ServiceRequest.identifier (Order Identifier)]*	referenceIdList *[urn:ihe:iti:xds:2013:order]*
Procedure code(s)	related *[referenced ImagingStudy.procedureCode]*	eventCodeList *[DICOM Imaging Procedure Code – DisplayName]*

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Table A-4 defines some additional technical return response parameter mappings to MHD and XDS.b. The parameters are not explicitly named in the MADO Profile.

Table A-4: Additional Technical Return Response Parameters

MADO Name	MHD FHIR DocumentReference	XDS.b DocumentEntry
	identifier:entryUUID	entryUUID
	status	availabilityStatus
	authenticator	legalAuthenticator

MADO Name	MHD FHIR DocumentReference	XDS.b DocumentEntry
	description	comments
	securityLabel	confidentialityCode
	content.attachment.language	languageCode
	content.attachment.size	size
	content.attachment.hash	hash
	content.attachment.title	title
	context.encounter	referenceIdList *[ihe:iti:xds:2015:encounterId]*
	context.facilityType	healthcareFacilityTypeCode
	context.sourcePatientInfo.reference	sourcePatientInfo
	context.sourcePatientInfo.identifier	sourcePatientId

