Integrating the Healthcare Enterprise

IHE Radiology
Technical Framework Supplement

Manifest-based Access to DICOM Objects (MADO)

For review and comment only.

DO NOT implement this public comment version.

HL7® FHIR® R5 (R4 to be added later)

Using Resources at FMM Level 2-N

Revision 1.0 – Draft for Public Comment

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

Foreword

This IHE Public Comment version 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 EHDS 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.

Following comments from the international community and their resolution, the MADO Profile is intended to result in a trial implementation release scheduled for February 2026 before being implemented, tested, and incorporated into the volumes of the Radiology Technical Framework

This is a supplement to the IHE Radiology Technical Framework V22.0. 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 December 8, 2025 for Public Comment. Comments are invited and can be submitted at https://www.ihe.net/Radiology_Public_Comments. In order to be considered in development of the Trial Implementation version of the supplement, comments must be received by January 10, 2026.

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 Radiology Technical Framework.

CONTENTS

Introduction to this Supplement

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

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

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

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

This new 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 MHDS (or MHD) to deploy FHIR based document sharing infrastructures or XDS, 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 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.

Open Issues and Questions

#	Issue / Answer
1.	Q: Given the **two formats proposed for the imaging study manifest (DICOM KOS based and FHIR based),** which interoperability approach shall be chosen by MADO. Two approaches have been considered: 1. The Content Creator supports both formats and the consumer selects the preferred one. 2. Both the Imaging Document Consumer and the Content Creator support one format and the other format offered as an option by the Imaging Document Consumer and the Content Creator. TC: The current Public Comment has selected approach 1, assuming that there are likely more consumers than sources. A: Comments are welcome about the use of approach 2.

#	Issue / Answer
2.	**Q: Several approaches have been considered to extend the Key Object Selection (KOS) DICOM with additional information** to offer to Imaging Document Consumers more flexibility to search for relevant imaging studies, as well as to select relevant series or images. Three approaches have been considered and discussed with DICOM WG6: 1. Extend the DICOM KOS IOD with standard Data Elements. This approach is the one used in the initial draft of the MADO Profile. Although being formally allowed by the DICOM Standard, it's use has been discouraged by the DICOM WG6 as being not consistent with the design of the KOS IOD. 2. *DICOM created a CP to extend the TID2010 Template* that is used by the DICOM KOS IOD. DICOM forbids extensions to the TID 2010 Template, by profilers or implementers. This Change Proposal proposes to add the existing TID 1600 Image Library Template to TID 2010. 3. *Use a different SOP Class than an extended KOS SOP Class. The use of the DICOM Inventory IOD* has been considered and found functionally capable to support the extensions needed. However, this approach has not been selected because it breaks the backward compatibility with many existing deployments and products support of KOS Manifests per the XDS-I Profile. TC: The current Public Comment has selected approach 2, based on its backward compatibility and design consistency with the DICOM KOS despite the somewhat increased overhead of the DICOM SR based constructs. A: Comments are welcome on the use of the approach 2, versus the use of the alternative approach 1: as an alternative with less overhead. (See Volume 3 Appendix B).

3.	**Q: What Time Zone Offset-related behaviors should the profile mandate?** MADO involves Imaging Document Sources sharing data (potentially with different time zone offsets) with Imaging Document Consumers (potentially located in different time zones). This raises the risk that: • A clinician accesses an imaging study that was acquired and reported at 2:00pm on November 12 (without time zone offset). A surgery report is available for a surgery that was performed during the same hospital visit and was shared on November 12 at 12pm, Central European Time Zone. The clinician assumes that the reported surgery was performed before the acquisition of the imaging study. However, if the missing time zone offset had been applied, the imaging study had been acquired pre-surgery at 10am on Nov 12. • A CT Imaging Study was acquired in a French pacific island on May 17 at 9am and shared so that the images are retrieved by a pulmonary center in metropolitan France to be post-processed by a CT lung nodule assessment application which happened an hour later. The images resulting from the lung nodule detection were placed in a distinct imaging study. Unless the time zone in the study date and times of both studies are properly tracked the imaging study with post-processing images would appear with a local time that precedes by 2 hours the date and time of the acquired imaging study that was postprocessed. Background Information: • The DICOM Value Representation (VR) for Datetime (DT) supports (optionally) recording the time zone offset of the encoded time. • Timezone Offsets are commonly based on geographic location (time zone) and, for some regions, date (“summer time”). • Timezone Offset From UTC (0008,0201) in SOP Common (optionally) records an offset to be applied to all Date (DA) and Time (TM) attributes, and to any DT attributes that do not contain an explicitly encoded offset. • Best practice is for modalities (and other evidence creators) to record Timezone Offset From UTC in instances they create. • Many installed modalities (and other evidence creators) create and store instances without recording any offset information. • When offset information is not available, it is left to the recipient to make assumptions. Typically, such instances are assumed to be in the “local time” of the device. One might infer the time zone offset of that local time based on the installed location of the device and the date of the instances.

- Some evidence/image creators may operate in different time zones.
- Best practice is for all systems (creators, servers, and consumers) to support the IHE Consistent Time profile (which ensures they have an accurate clock setting and timezone offset)
- MADO, for various reasons, requires Imaging Document Sources, Imaging Document Consumers, and Content Creators to support the IHE CT Profile.
- Most acquisition modality and evidence creator actors support the IHE CT Profile which is critical to having accurate original data.
- Acquisition Date (0008,0022) and Time (0008,0032) record (optionally) when the data underlying an instance was acquired.
- Instance Creation Date (0008,0012) and Time (0008,0013) record (optionally) in SOP Common when the instance UID was assigned and the instance was created.
- Series Date (0008,0021) and Time (0008,0031) values are implementation dependent.
- Viewers launched via IID will likely display date/times in the time zone offset of the viewer, not the requester.

The MADO Profile currently specifies the following mandated approach:

- The Imaging Document Source
  - shall ensure that all systems that supply instances to the Imaging Document Source are all configured to use a single implicit time zone offset or include the time zone offset.
    - This implies that all instances within any given study are based on the same time zone in their date and times even if series may be created on different sources.
  - shall include Timezone Offset From UTC (0008,0201) in each imaging study manifest to represent the time zone offset for the dates and times in the manifest and those in the imaging study instances that do not include an explicit time zone offset.
  - If instances returned by WADO-RS responses (per the MADO Profile) do not contain a time zone offset in their DA, TM, and DT attribute values, these values in the retrieved instances shall be based on the time zone offset from the corresponding imaging manifest.
- The Imaging Document Consumer

- shall apply the time zone offset from the manifest to the date and time in the instances of the imaging study when there is no Time Zone Offset present when performing import in the local Image Manager/Archive or performing image display before import. At the time of import, there is less time critical constraints.

Note: For a display before import, a number of creative implementation strategies can be used taking into account the specific design of the Imaging Document Consumer. For example, when the Imaging Document Consumer intends to display, e.g., the Acquisition Time for an instance, it may use a cached value for the Time zone offset from the corresponding Manifest unless the image instance already has a Timezone Offset. The same should be performed when imaging study is imported (added to the attribute coercion process already needed for any import).

- This approach shifts some of the implementation burden from the Imaging Document Source to the Imaging Document Consumer by making sure that the needed information is provided, and offers maximum flexibility to the Imaging Document Consumer to manage the application of the time zone only when required.

Comment is sought on this mandated approach.

Comment is sought on whether the following alternative approach would be better:

- The Imaging Document Source
  - shall add Timezone Offset From UTC (0008,0201) to any instances being shared where it is missing.
    - this is likely done as a coercion step to update the stored instances when they are first received for sharing
    - this could be also done by coercing instances to add the attribute during WADO-RS responses instead if the implementation prefers
- The Imaging Document Consumer
  - shall be able to make use of timezone offset information for any time-based calculations (which they hopefully already do)
  - shall be able to make use of timezone offset information in each instance to meet local conventions or preferences for displaying imported instances showing the originating timezone offset or the local time zone offset
    - Note that instances in the same study might have different time zone offsets.

It was not proposed to include the Acquisition Modality actor in the MADO profile and include requirements that it populate the timezone offset in all DT attributes and via the Timezone Offset From UTC (0008,0201) for all DA and TM attributes. While

#	Issue / Answer
	that would address some problems, it did not seem practical to depend on updates to the full install base of modalities rather than just depending on the imaging document source. See also DICOM CP1944 which was cancelled with the dictate that the cure must not be worse than the disease. 😊 https://dicom.nema.org/medical/dicom/CP/cp1944_01_Request_to_Retire_Timezone_Offset_From_UTC_attribute.pdf Specifically refer to the rational text labelled “As a practical matter” and “Various alternative solutions”

Closed Issues

#	Issue / Answer
	None

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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.

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

New (or modified) Actor Name	Description
None	

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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

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New (or modified) Transaction Name and Number	Definition
Intra-Community WADO-RS Retrieve [RAD-1xy]	Get DICOM Instances from the Imaging Document Source at a Study, Series or Instance level by an Imaging Document Consumer within the same Community.

No new or modified glossary terms.

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 specifies actors and transactions to retrieve patient-relevant DICOM Instances from medical imaging studies being stored within a community. Each community may have multiple sources of medical image data that publish it for sharing within the community.

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.

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.

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).

The Imaging Document Consumer obtains the Imaging Manifests from the local community through grouping with an actor from an ITI profile that can provide access to the XDS / MHD

infrastructure, such as the XDS.b Document Consumer or MHD Document Consumer. The XDS.b Document Consumer and MHD Document Consumer are NOT included in this profile.

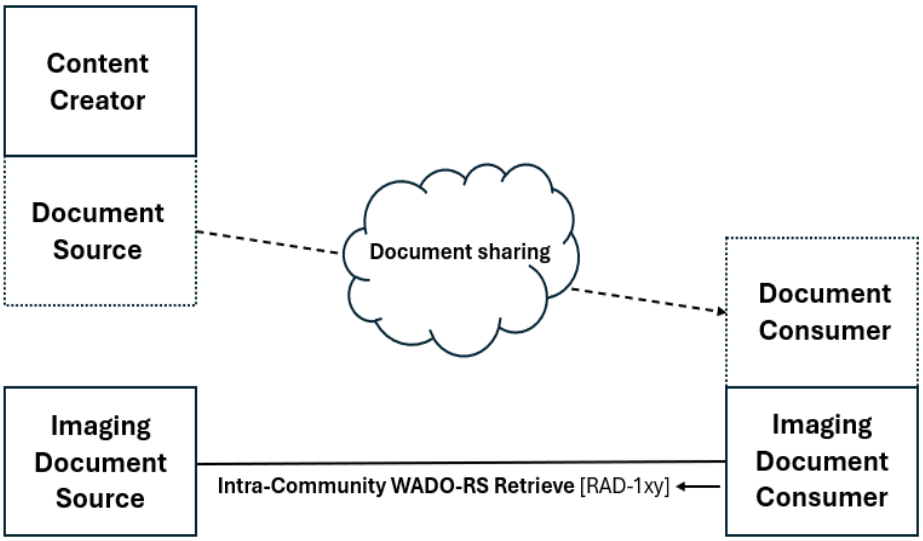

Figure X.1-1: MADO Actor Diagram

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	Intra-Community WADO-RS Retrieve [RAD-1xy]	Requester	R	RAD TF-2: 4.1xy
Imaging Document Source	Intra-Community WADO-RS Retrieve [RAD-1xy]	Responder	R	RAD TF-2: 4.1xyt

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.1

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

Note 1: The Imaging Study Manifest content is defined in two alternative formats – A DICOM KOS IOD based format and a FHIR Bundle format. The Manifest Content Creator shall support both formats and when integrated at deployment time with a Document Source Actor, it is configured to publish one of the two formats.

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 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.

Most requirements on the Intra-Community WADO-RS Retrieve are documented in RAD TF-2 Transactions. This section documents any additional requirements on profile's actors.X.1.1.1 Content Creator.

X.1.1.1 Content Creator

The Content Creator produces Imaging Study Manifest documents in both formats. The Content Creator and the Imaging Document Source are expected to ensure that the imaging study DICOM instances referenced by the Imaging Study Manifest are consistent.

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 (e.g., from other IHE Profiles such as MHD, MHDS or XDS.b) to search for and retrieve such Imaging Study Manifest(s) within the community.

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

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

The Imaging Document Consumer issues an Intra-Community WADO-RS Retrieve [RAD-1xy] transaction in the Requester role to an Imaging Document Source to retrieve the DICOM instances within its community.

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

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

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

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

X.1.1.3 Imaging Document Source

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

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	N/A
Imaging Document Consumer	DICOM KOS-based Imaging Study Manifest (Note 1)	See Section X.2.1
	FHIR-Based Imaging Study Manifest (Note 1)	See Section X.2.2
	Rendered Instances Option	See Section X.2.3
Imaging Document Source	Rendered Instances Option	See Section X.2.3

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

X.2.1 DICOM KOS-Based Imaging Study Manifest Option

A Document Consumer supporting this option is able to consume a manifest using the specification defined in IHE RAD TF-3: Chapter 6.X.1: MADO DICOM KOS-Based Imaging Study Content Definition. The manifest will be a DICOM Part 10 encapsulated DICOM Information Object.

X.2.2 HL7 FHIR-Based Imaging Study Manifest Option

A Document Consumer supporting this option can consume a manifest using the specification defined in IHE RAD TF-3: Chapter 6.X.2: MADO HL7 FHIR Based Imaging Study Manifest Content Definition.

X.2.3 Rendered Instances Option

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).

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

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	ITI TF-1: 7.1	
	ITI ATNA / Secure Node or Secure Application	ITI TF-1: 9.1	

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 is large (typically megabyte or gigabyte size) and complex (hundreds of data elements). It includes location pointers to its image content and organizes this information according to the well-established model of an imaging study made of one or more series and each series made of instances or images.

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

The mechanism by which the Imaging Document Source and Imaging Document Consumer share Imaging Study Manifests is not constrained by the MADO profile, and several models may be used, including but not limited to XDS.b, MHD or MHDS. The Imaging Document Consumer is typically an application that is grouped with an actor providing access to the Imaging Study Manifest.

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

- XDS.b Document Consumer: The MADO Content Consumer/Imaging Document Consumer is grouped with the XDS.b Document Consumer that is the initiator of the document discovery and retrieval and communicates with the XDS Document Registry/Repositories using the Registry Stored Query [ITI-18] and Retrieve Document

Set [ITI-43] transactions. The XDS.b Document Consumer then transfers that information to the Imaging Document Consumer.

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

- MHD Consumer: The MADO Content Consumer/Imaging Document Consumer is grouped with the MHD Document Consumer that is the initiator of the document 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 return the retrieved Imaging Manifests. The MHD Consumer then provides this information to the Imaging Document Consumer.

MADO defines two content formats (encodings) for the Imaging Study Manifest:

1. DICOM KOS based manifest (see TF-3: 6.X.1)
2. FHIR Imaging Study based manifest (see TF-3: 6.X.2)

and a bi-directional mapping between the two formats for transformation purposes (see TF-3: 6.X.4).

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

- Modality
- Series Number
- Series Description
- Series Date/Time
- Instance Number
- Number of Frames (in instance)
- Image flagged as a key image

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 has been identified, the Imaging Document Consumer can retrieve imaging studies from an Imaging Document Source using a consistent mechanism, regardless of whether the imaging study is published to an XDS.b or MHD environment.

The Imaging Document Consumer may reach out to an Imaging Document Source located within the same community (See Section X.4.1.2) or to 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).

X.4.1.2 Intra-community sharing infrastructure

The Imaging Document Consumer is located within the same community as the Imaging Document Source.

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

MADO defines a WADO-RS transaction for instance retrieval by the Imaging Document Consumer from the Imaging Document Source (see TF-2: 4.1xy).

The Imaging Study Manifest content includes location pointers (See Section 6.X.1.2.3.4 Hierarchical Series Reference Macro) for each series of the imaging study. Two modes of addressing are defined and shall be supported:

1. Retrieve URL based Mode. In this mode, the manifest contains a Retrieve URL location pointer to convey a base URI for the end-point that supports the WADO-RS instance retrieve service (although possibly present the Retrieve Location UID 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 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.

One of these two modes must be selected by all Imaging Document Sources and Imaging Document Consumers at the time of deployment. All Imaging Document Consumers and Imaging Document Source deployed in a specific community use the same mode of addressing.

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 requires grouping with the IHE XC-WADO Profile. This results in 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 XDS.b or MHD 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 Selecting an imaging study

This section discusses the selection of a study to set the overall context for the ability offered to the user to select imaging studies. The below two steps need to be supported by the document sharing infrastructure, which is out of scope of the MADO Profile.

The first step is to search for imaging study manifests matching search parameters for a selected patient. The search parameters used to obtain a list of matching imaging studies typically include parameters such as Modality, Anatomical Region, Study Date, and Time. These search parameters are associated with the Imaging Study Manifest and further specified in RAD TF-3: 4.3.X Imaging Study Manifest Search Metadata.

The second step is to perform a selection among the entries of this initial list of matching study manifests using the full set of document search metadata returned to identify the desired imaging study manifests and request their retrieval.

X.4.1.6 Selecting a subset of an imaging study

Retrieving an entire imaging study gives the user (and the application they are using) full access to all the data and metadata. However, if the study is large and the network bandwidth is limited, the user may wish to start by retrieving a selected subset of the study, i.e., particular series or instances.

The subset is typically based on selection metadata that describes the series and the instances in the study. Common attributes include modality, series description, body part, image number, number of frames, etc.

This selection metadata is obtained by the Imaging Document Consumer (see step 2 in X.4.5) from the MADO Imaging Study Manifest (See section X.4.1.1 Role of an imaging Study Manifest) and used by the user to select their subset of interest.

X.4.1.7 Launching a Remote Image Display

An Imaging Document Consumer may invoke or launch an image display viewer on a remote server, using a complete URL stored by the Imaging Study Manifest Creator in an Imaging Study Manifest (or in an imaging report). The invocation of such a remote image display is expected to follow a number of principles that are important to the MADO Profile:

1. The remote image display launched shall offer access only to the imaging study whose Study Instance UID is the same as the Study Instance UID referenced by its associated imaging study manifest. This principle is important to ensure the privacy of other studies that may also be stored on the same system hosting the remote image display (e.g., an Imaging Document Source). This enforcement on the remote image display is critical.
2. The consequence of the above requirement is to provide a means to track and audit the Study Instance UID upon which the web transaction that launches the remote image display. Because this transaction is uniquely identified by the URL that is included in the launch, it is recommended that the URL includes the UID associated to the study UID in a way that can be extracted from audit trail events (e.g., a parameter such as "`studies/2.999.1.59.40211.12345678.678910`").
3. The MADO Profile specifies in its imaging study manifest (both the DICOM-KOS based and the FHIR based formats) the inclusion of a complete URL without constraints (except the one stated in point 2 above). This flexibility allows to support a variety of remote image display implementations. However, it is recommended to use the URL specified by the Invoke Image Display (IID Profile – See RAD TF-1: 35).

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.

- A user on the Imaging Document Consumer uses the content of an Imaging Study Manifest to choose an entire imaging study or a subset (series, set of instances).
- The Imaging Document Consumer requests the retrieval of these selected DICOM instances from the remote Imaging Document Sources using the location information provided in the Imaging Study Manifest.

X.4.2.1.1.1 Pre-conditions

- Imaging Study Manifest is available to the Imaging Document Consumer.

X.4.2.1.1.2 Post-conditions

- Selected DICOM instances are available in the Imaging Document Consumer for viewing and/or processing.

X.4.2.1.2 Instance Retrieval Process Flow

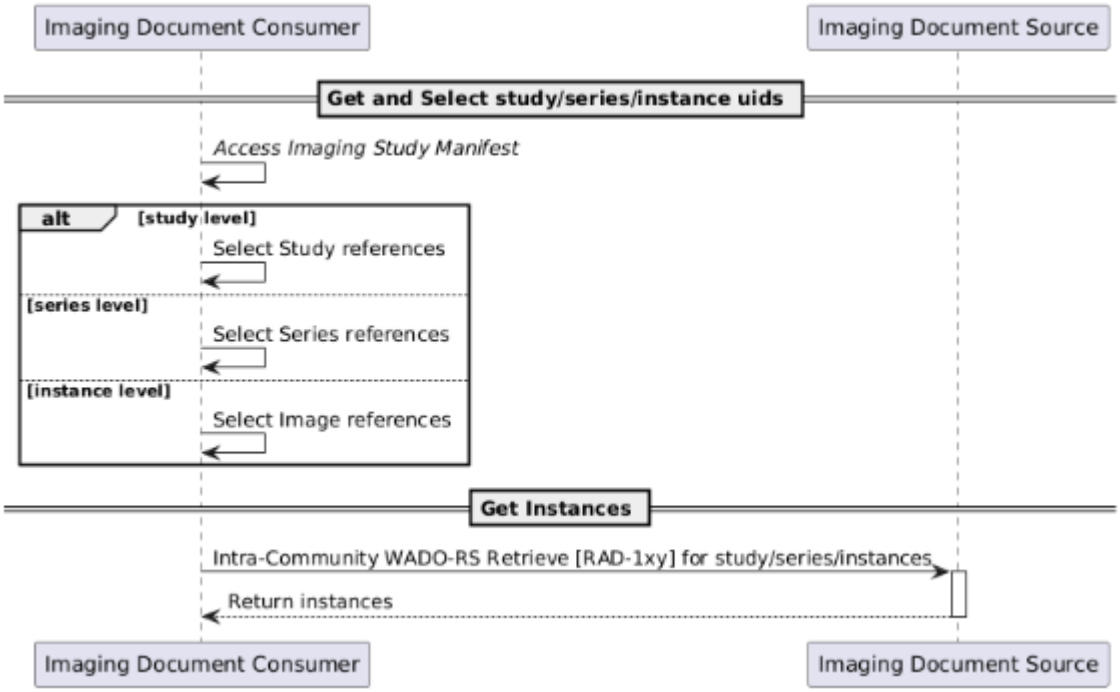

Figure X.4.2.1.2-1: Basic Process Flow in MADO Profile

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: Intra-Community WADO-RS Retrieve [RAD-1xy] for study/series/instances
activate IDS
IDS-->IDC: Return 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).

- A user on the Imaging Document Consumer uses the content of an Imaging Study Manifest to learn that key images are available and choose to retrieve only these key images flagged by one or more KIN within the imaging study. It uses the coded title and the optional description associated to the KIN to identify the key images of interest.
- The imaging document consumer requests the retrieval of these selected key DICOM instances from the remote Imaging Document Sources using the location information provided in the imaging study manifest.

X.4.2.2.1.1 Pre-conditions

- Imaging Study Manifest is available to the Imaging Document Consumer.
- The imaging Study contains one or more key images flagged by one or more KIN.

X.4.2.2.1.2. Post-conditions

- DICOM instances flagged as key images are available in the Imaging Document Consumer for viewing and/or processing.

X.4.2.2.2 Key Instances Retrieval Process Flow

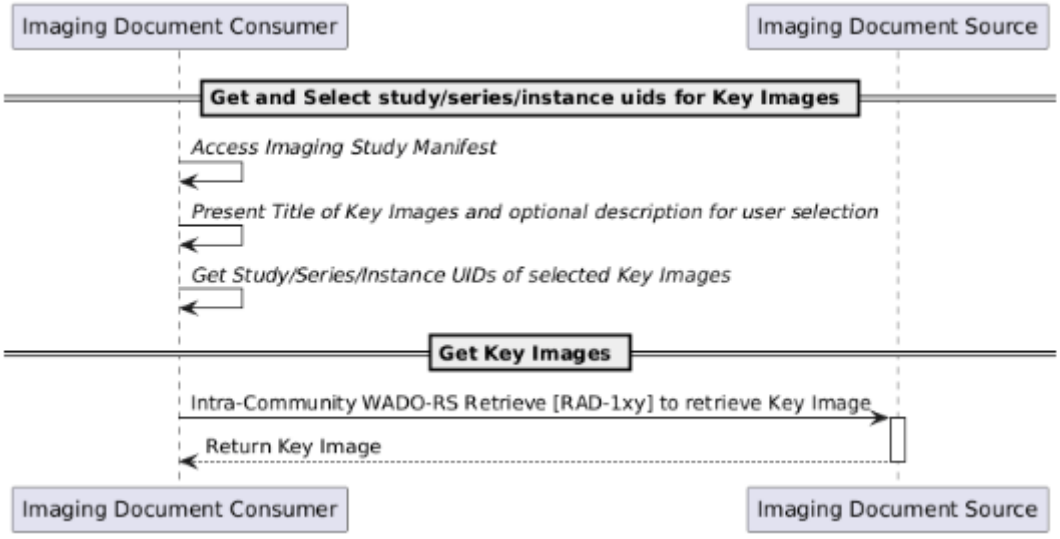

Figure X.4.2.2.2-1: Key Instances Retrieval Flow

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.

```
@startuml Key Instance Retrieval Process Flow
participant "Imaging Document Consumer" as IDC
participant "Imaging Document Source" as IDS
== Get and Select study/series/instance uids for Key Images ==
IDC->IDC: //Access Imaging Study Manifest//
IDC->IDC: //Present Title of Key Images and optional description for user selection//
IDC->IDC: //Get Study/Series/Instance UIDs of selected Key Images//
== Get Key Images ==
IDC->IDS: Intra-Community WADO-RS Retrieve [RAD-1xy] to retrieve Key Image
activate IDS
IDS-->IDC: Return Key Image
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 retrieve of the rendered transformation of corresponding DICOM instances which only need an off-the-shelf browser to be displayed (no need for a DICOM viewer).

- A user on the Imaging Document Consumer wishes to launch a remote image viewer for the display of the imaging study related to the imaging manifest.
- The Imaging Document Consumer uses a URL provided in the Imaging Study Manifest to launch a remote Image Display on the specific imaging study.
- The user navigates among the series and instances of the imaging study as desired using the remote viewer user interface.

X.4.2.3.1.1 Pre-conditions

- Imaging Study Manifest is available to Imaging Document Consumer.
- The imaging Study Manifest contains a remote Invoke Image Display URL

X.4.2.3.1.2 Post-conditions

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

X.4.2.3.2 Invoke Remote Image Display Process Flow

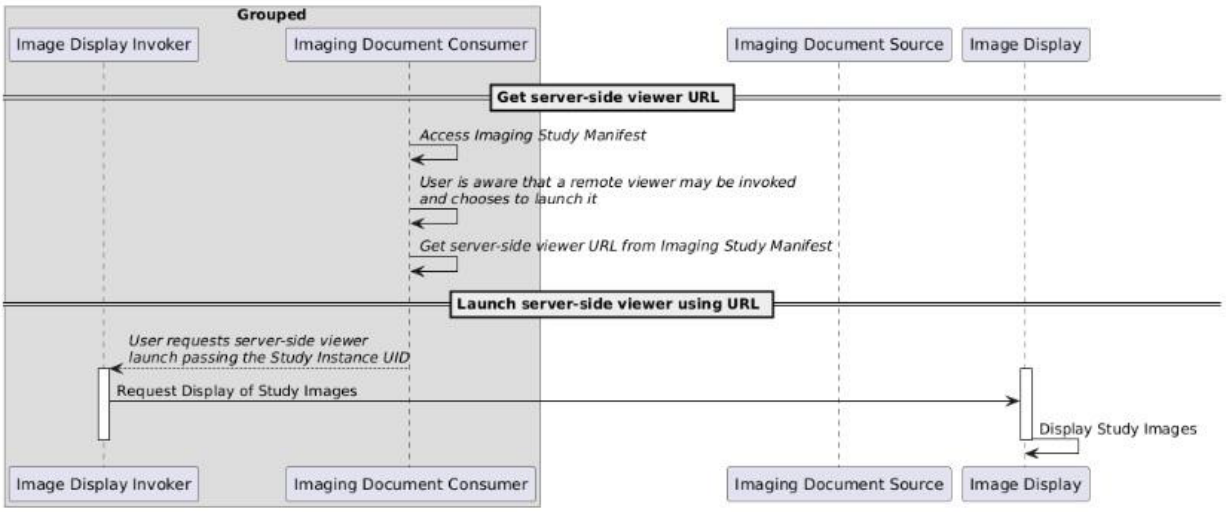

Figure X.4.2.3.2-1: Invoke Remote Image Display Process Flow

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
box "Grouped"
participant "Image Display Invoker" as IDI
participant "Imaging Document Consumer" as IDC
end box
participant "Imaging Document Source" as IDS
participant "Image Display" as ID
== Get server-side viewer URL ==
IDC->IDC: //Access Imaging Study Manifest//
IDC->IDC: //User is aware that a remote viewer may be invoked//\n//and chooses to
launch it//
IDC->IDC: //Get server-side viewer URL from Imaging Study Manifest//
== Launch server-side viewer using URL ==
IDC-->IDI: //User requests server-side viewer//\n//launch passing the Study Instance
UID//
activate IDI
activate ID
IDI->ID: Request Display of Study Images
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 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).

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.

X.6 MADO Cross Profile Considerations

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

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

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Volume 2 – Transactions

Add Section 4.1xy to Volume 2.

4.1xy Intra-Community WADO-RS Retrieve [RAD-1xy]

4.1xy.1 Scope

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

Reviewer Note: The specification below is largely based on the Cross-Community WADO-RS Retrieve [RAD-160]. Where identical, it is simply referenced, where different, specific text is provided for the [RAD-1xy] transaction.

4.1xy.2 Actor Roles

Table 4.1xy.2-1: Actor Roles

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

The transaction text specifies the behavior for each Role. When behavior goes beyond that of the general role, the behavior of specific actors may also be specified.

4.1xy.3 Referenced Standards

See section 4.160.3 Referenced Standards.

4.1xy.4 Messages

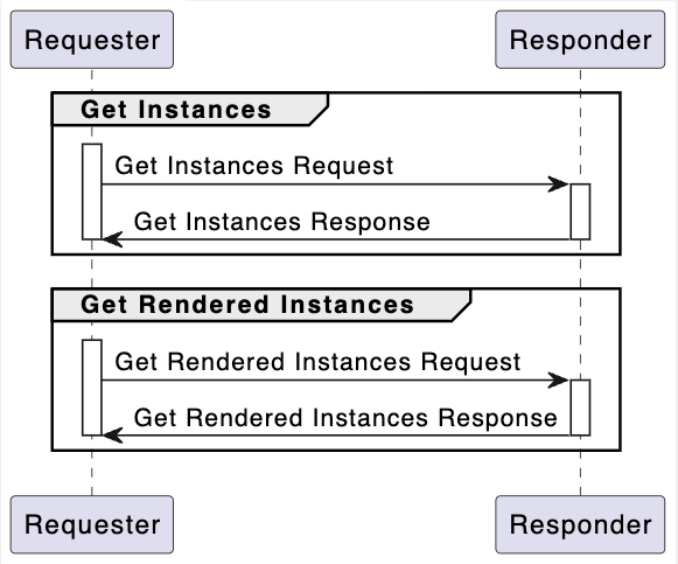

Figure 4.1xy.4-1: Interaction Diagram

This transaction defines request/response message pairs:

- Get Instances (Section 4.1xy.4.1 and 4.1xy.4.2),
- Get Rendered Instances (Section 4.1xy.4.3 and 4.1xy.4.4) when the Rendered Instances Option is supported.

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

4.1xy.4.1 Get Instances Request Message

See section 4.160.4.1 Get Instances Request Message.

4.1xy.4.1.1 Trigger Events

See section 4.160.4.1.1 Trigger Events.

4.1xy.4.1.2 Message Semantics

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

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

The message shall correspond to one of the Instance Resources in Table 4.1xy.4.1.2-1.

Table 4.1xy.4.1.2-1: Retrieve Transaction Instance Resources

Resource	Reference
Study	DICOM PS3.18 Section 10.4.1.1.1
Series	
Instance	

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

Imaging Document Consumers acting as Requester may consider replacing a study level requests by issuing multiple series level requests in order to achieve performance improvements.

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

- The value of the `<protocol>` component shall be set to `https://`.
- The `<endpoint>` component of DICOMweb Study Service Retrieve transaction URI is formed from hostname, port, and endpoint path of the RESTful service of the responder, as follows: `<hostname[:port]>/<endpoint path>/`.
- The `<resource>` component is formed from appropriate resource UIDs depending on the resource being retrieved as well as the type of the resource. The value of the `<resource>` component shall be formatted as specified in the definition of the WADO-RS Get Instances [RAD-1xy] transaction. See RAD-TF-2: 4.1xy.4.3

4.1xy.4.1.2.1 Example of a Get Instances Request message

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

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

4.1xy.4.1.3 Expected Actions

See section 4.160.4.1.3 Expected Actions.

4.1xy.4.2 Get Instances Response Message

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

4.1xy.4.2.1 Trigger Events

See Section 4.160.4.2.1 Trigger Events.

4.1xy.4.2.2 Message Semantics

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

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

The Responder shall provide a response as described in Table 4.1xy.4.2.2-1.

Table 4.1.xy.4.2.2-1: Response Message Semantics

Resource	Reference
Study	DICOM PS3.18 Section 10.4.3.3.1
Series	
Instance	

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

4.1xy.4.2.3 Expected Actions

See Section 4.160.4.2.3 Expected Actions.

4.1xy.4.3 Get Rendered Instances Request Message

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

4.1xy.4.3.1 Trigger Events

See Section 4.160.4.3.1 Trigger Events.

4.1xy.4.3.2 Message Semantics

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

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

The message shall correspond to one of the Instance Resources in Table 4.1.xy.4.3.2-1.

Table 4.1xy.4.3.2-1: Retrieve Transaction Instance Resources

Resource	Reference
Rendered Instance	DICOM PS3.18 Section 10.4.1.1.3

Note: Although DICOM also includes the Rendered Study, Rendered Series, and Rendered Frame Pixel Data resource, they are not required for this transaction.

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

- The value of the `<protocol>` component shall be set to `https://`.
- The `<endpoint>` component of DICOMweb Study Service Retrieve transaction URI is formed from the hostname, port, and endpoint path of the RESTful service of the responder, as follows: `<hostname[:port]>/<endpoint path>/`.
- The `<resource>` component is formed from the appropriate resource UIDs depending on the resource being retrieved as well as the type of the resource.

4.1xy.4.3.2.1 Example of a Get Instances Request message

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

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

4.1xy.4.3.3 Expected Actions

See Section 4.160.4.3.3 Expected Actions.

4.1xy.4.4 Get Rendered Instances Response Message

See Section 4.160.4.4 Get Rendered Instances Response Message.

4.1xy.5 Security Considerations

See Section 4.160.4.6 Security Considerations.

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.

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 depicts the case of a Community A that uses a Retrieve Location UID. Figures XA-3 and XA-4 depicts 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 DICOM web Study Service Retrieve transaction URI).

Color highlights below show important and manipulated elements 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 include or not the Retrieve URL (0008,1190) attribute into the published Imaging 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

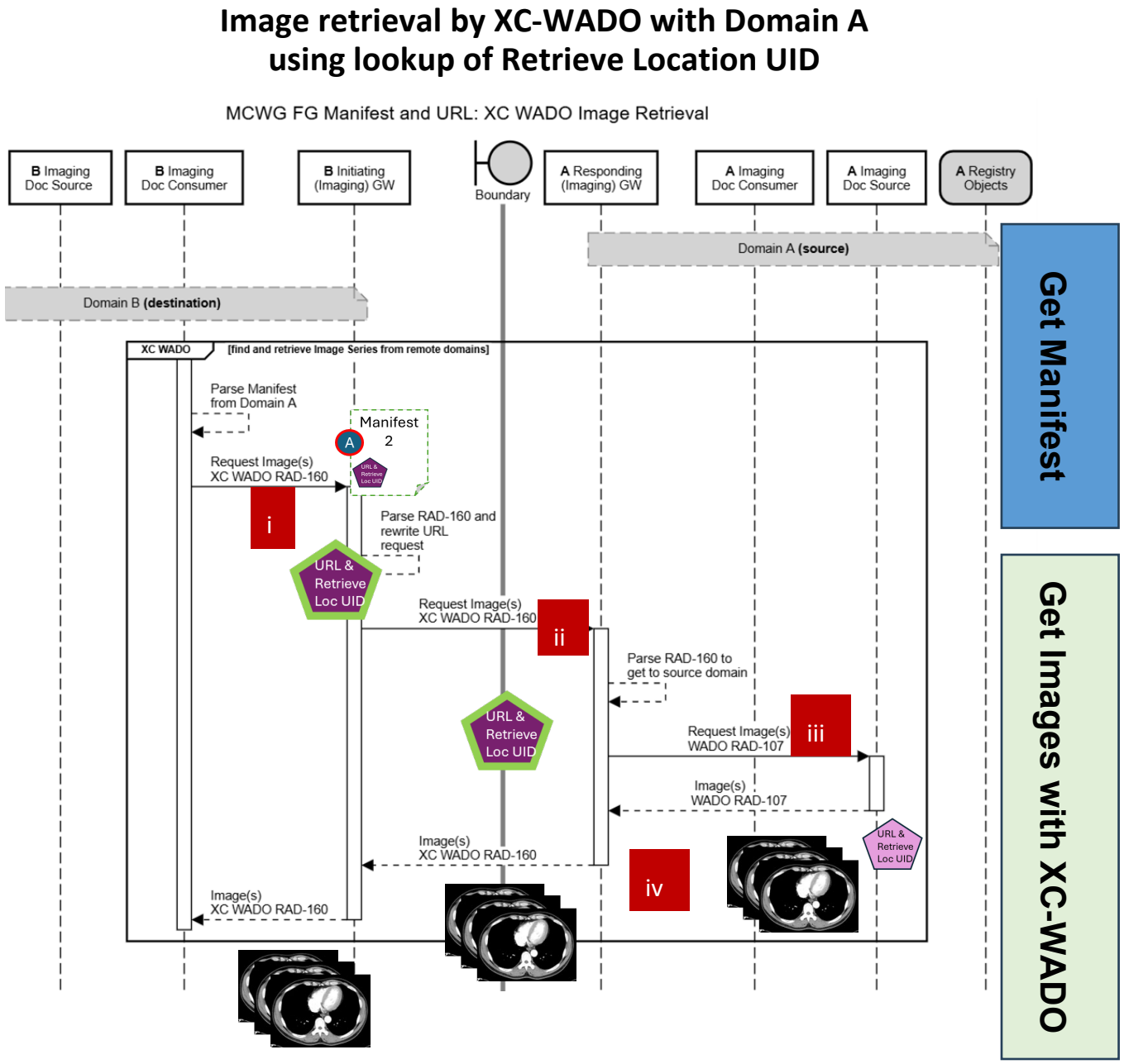

Figure XA-1: WADO-RS Retrieve URL with Domain A using lookup of Retrieve Location UID – Transaction flows

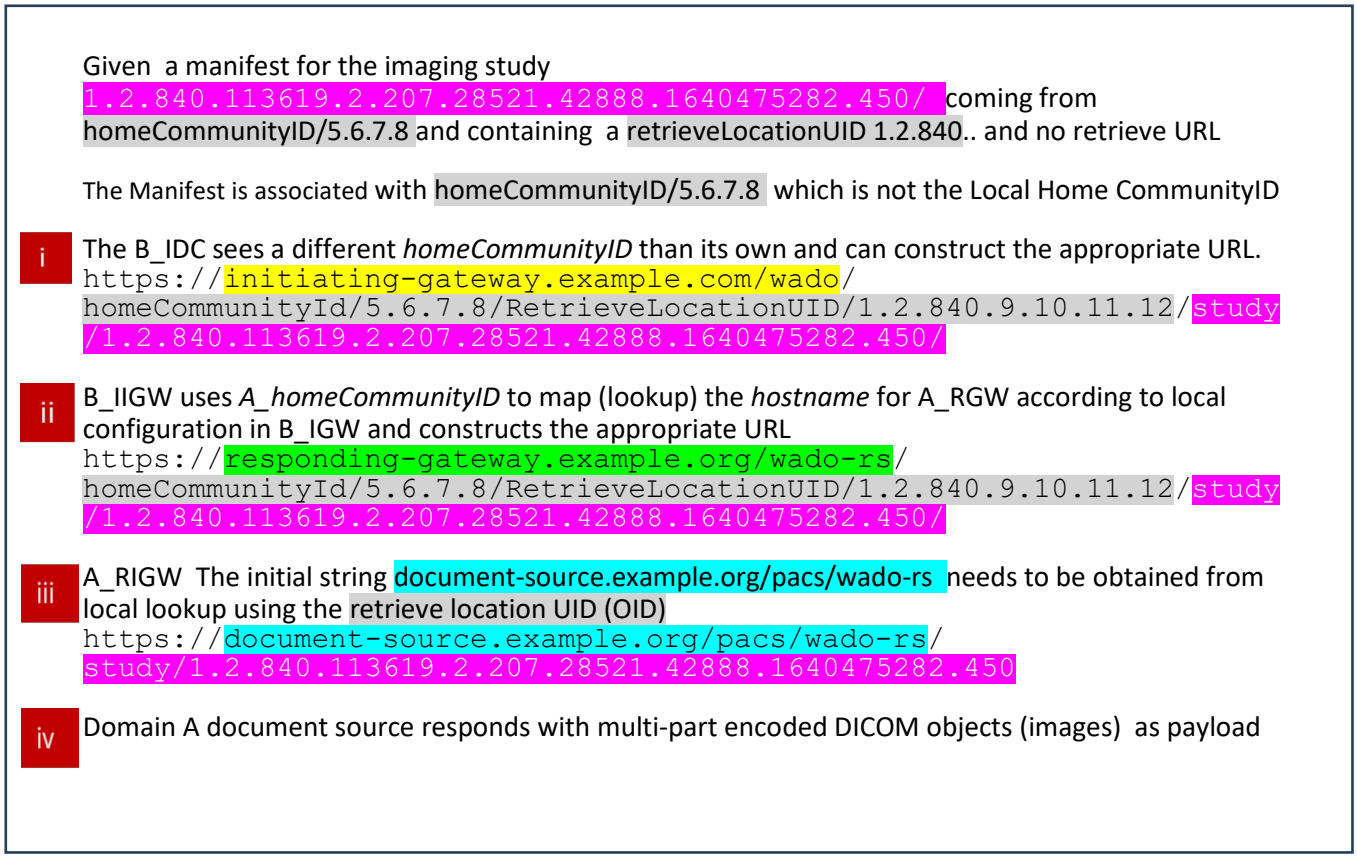

Figure XA-2: WADO-RS Retrieve URL with Domain A using lookup of Retrieve Location UID – Related URL values

Image retrieval by XC-WADO with Domain A directly using the Retrieve URL (*no Retrieve Location UID lookup*)

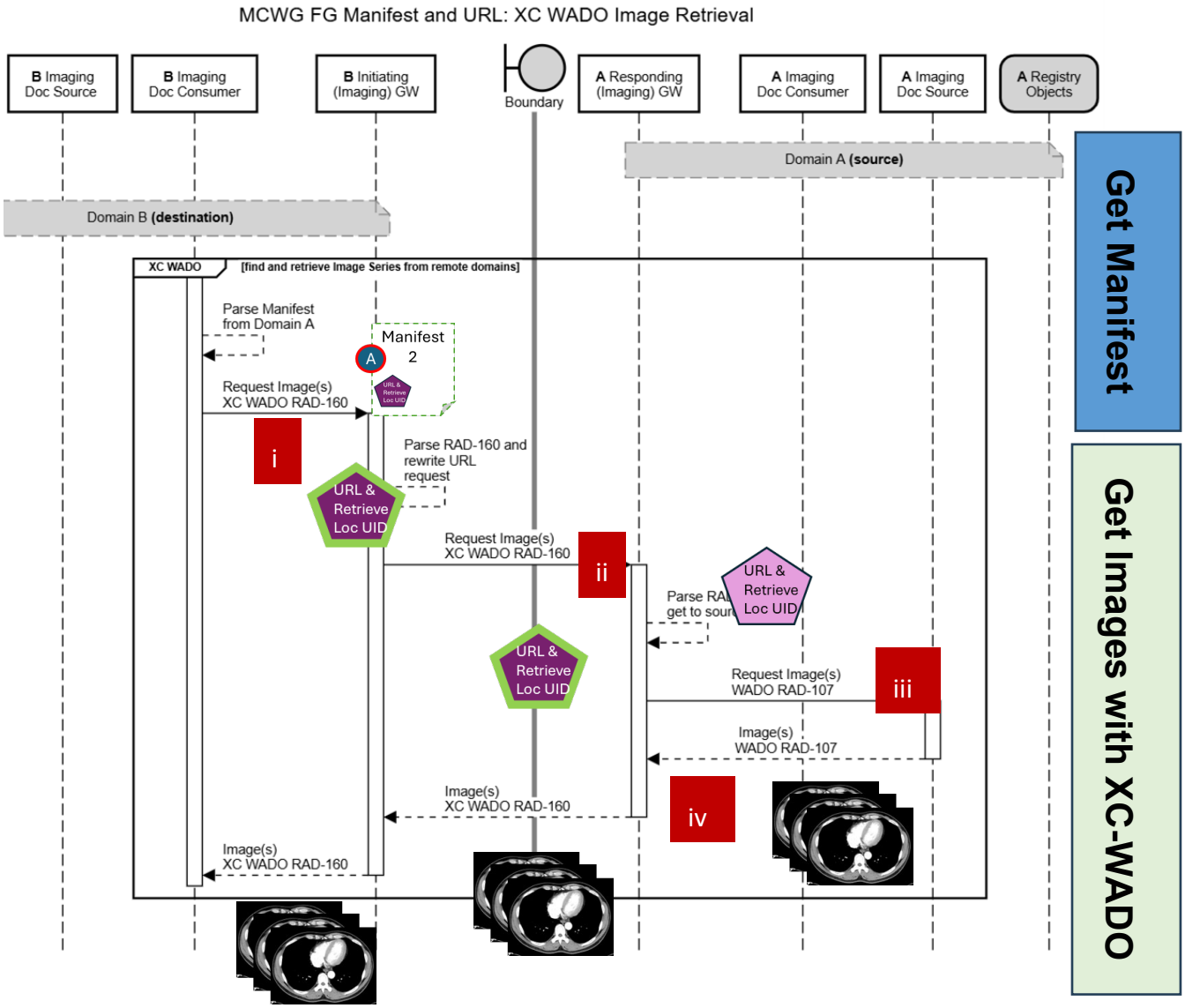

Figure XA-3: WADO-RS Retrieve URL with Domain A using the Retrieve URL – Transaction flows

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

i 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/

ii 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/

iii 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

iv Domain A document source responds with pixels 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

4.1 IHE MADO Namespaces

No new OID, UID or URN have been introduced.

4.2 IHE MADO Concept Domains

Not Applicable.

4.3 IHE MADO Format Codes and Vocabularies

4.3.1 IHE Format Codes

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

Profile	Format Code	Media Type	Template ID
Manifest Based Access to DICOM Objects (MADO)	Use the XDS-I assigned Format Code for DICOM KOS-Based Imaging Study Manifest: "1.2.840.10008.5.1.4.1.1.88.59" (DICOM KOS SOP Class UID) as the Format Code Value and "1.2.840.10008.2.6.1" (DICOM UID Registry UID) as the Format Coding Scheme OID for a DICOM Manifest document.		
Manifest Based Access to DICOM Objects (MADO)	<urn:ihe: > Request to IHE ITI (Oliver Egger). HL7 FHIR-Based Imaging Study Manifest		

4.3.X Imaging Study Manifest Search Metadata

A set of non-imaging specific and imaging specific search parameters is defined in this section for the search of imaging study manifests.

All these search parameters are expected to be available to the search Document Consumer Actors of the document sharing infrastructure grouped with MADO.

These parameters have been selected based on the experience with deployments of XDS-I and

MHD (Comprehensive Metadata option). They are directly supported by the XDS, XDS-I, XCA, XCA-I, MHD and MHDS profiles.

Note: Any given query might use only a subset of these search parameters.

4.3.X.1 Generic Search Request Parameters

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

- Patient Business Identifier – patient id
- Period – the time of service that is being documented by the DocumentReference.
- The period search parameter specifies an interval which the time of service overlaps
- Date - document date/time created
- Category – class of document (e.g., *image* for imaging manifest*)*
- Practice Setting – specialty where care documented was performed/provided (*e.g., radiology, cardiology, surgery, endoscopy for* imaging study manifest*)*

4.3.X.2 Imaging-Specific Search Request Parameters

The medical imaging search extends the generic search parameters with the following parameters:

- Modality type
- Anatomical Region - body part
- Study Instance UID
- Accession Number

4.3.X.3 Return Response Parameters

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

- Document Location URL – retrieve location (mandatory)
- Document
  - Identifier
  - Date
  - Type
  - Format

- mime type
- Author(s)
- Owner/Organization

- Category
- Practice Setting
- Order identifier
- Procedure code
- Modality type
- Anatomical Region - body part
- Study Instance UID
- Accession Number

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

4.3.X.4 Anatomical Region Value Set

This 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:

1. Only one or two values are typically needed to identify, at a high-level, the anatomies associated with most imaging procedures, thus making imaging procedure to anatomy mappings easy and reliable to implement.
2. A pull-down menu of 20, 30 or more values used by the requester to set the filter in a query is avoided.

A short set of high-level anatomical region values, combined with the more robust selection process of the meaningful anatomies (point a above) and on the reliability of the setting of the query filter (point b above) by the requester, results in avoiding false negative query matches.

Note: A possible way assigning the value(s) for anatomical regions is to automate the process at the time the imaging order is processed by the imaging department:

- When processing incoming clinical orders, one or more imaging procedure request(s) is 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 an ad-hoc or international terminology.

- The variety of terminologies used is not a barrier to map each imaging procedure code used locally to one or more anatomical region(s) as proposed by the MADO Profile (See TID 1600 in section .X.1.2.2.5 SR Document Content Module). This example may not require changes on imaging modalities.

Add to Volume 3 Section 6, Section 6.X MADO Content Definition

6.X MADO Content Definition

6.X.1 MADO DICOM KOS-Based Imaging Study Content Definition

6.X.1.1 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 to 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 Public Comment).

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

Table 6.X.1.1-1: 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.1.1-2: 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.1.2 General Definitions

None.

6.X.1.2.1 Imaging Study Manifest IOD Definition

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

6.X.1.2.1.1 Referenced Standards

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

6.X.1.2.1.2 IOD Definition

Table 6.X.1.2.1.2-1: Usage of DICOM Modules in MADO Imaging Study Manifest

IE	Module	Reference	Usage	IHE Usage
Patient	Patient	C.7.1.1	M	M See Section 6.X.1.2.2.1

IE	Module	Reference	Usage	IHE Usage
Study	General Study	C.7.2.1	M	M See Section 6.X.1.2.2.2
Series	Key Object Document Series	C.17.6.1	M	M
Equipment	General Equipment	C.7.5.1	M	M See Section 6.X.1.2.2.3
SR Document	Key Object Document	C.17.6.2	M	M See Section 6.X.1.2.2.4
	SR Document Content	C.17.3	M	M See Section 6.X.1.2.2.5
	SOP Common	C.12.1	M	M See Section 6.X.1.2.2.6

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

6.X.1.2.2 Module Definitions

This section contains the MADO specific DICOM Module specifications referenced in Section 6.X.1.2.1 IOD Definitions.

6.X.1.2.2.1 Patient Module

6.X.1.2.2.1.1 Referenced Standards

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

6.X.1.2.2.1.2 Module Definition

Table 6.X.1.2.2.1.2-1: 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.1.2.2.1.2.1.

Attributes from Table C.7-1 Patient Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Include Table 6.X.1.2.2.1.3.2-1 "Issuer of Patient ID Macro Attributes" - see section 6.X.1.2.2.1.3 Issuer of Patient ID Macro			
Patient Comments	(0010,4000)	O+	Used for national extensions (e.g., birth place) associated to patient demographics information used to validate the consistency between the patient ID and its demographic details beyond sex, birth date, and names.
Other Patient IDs Sequence	(0010,1002)	R+	A Sequence of identification numbers or codes used to identify the Patient, which may or may not be human readable, and may or may not have been obtained from an implanted or attached device such as an RFID or barcode. One or more Items shall be included in this Sequence. See Section 6.X.1.2.2.1.2.1.
>Patient ID	(0010,0020)	R+	An identifier for the Patient.
>Include Table 6.X.1.2.2.1.3.2-1 "Issuer of Patient ID Macro Attributes" - see section 6.X.1.2.2.1.3 Issuer of Patient ID Macro			

6.X.1.2.2.1.2.1 Patient Identification Attribute Descriptions

6.X.1.2.2.1.2.1.1 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 provide a globally unique patient identifier in all cases.

6.X.1.2.2.1.2.1.2 Other Patient IDs Sequence (0010,1002)

The Other Patient IDs Sequence (0010,1002) should provide a list of the national, regional and local patient identifiers. A local patient identifier is known in the imaging source at the time of the manifest creation.

Note: It is recommended that the Other Patient IDs Sequence (0010,1002) should also contain the primary patient identifier in addition to the other identifiers. This will allow primary patient identifier re-mapping from one of the Other Patient IDs Sequence identifiers without the need to continually update this sequence.

6.X.1.2.2.1.3 Issuer of Patient ID Macro

6.X.1.2.2.1.3.1 Referenced Standards

- DICOM PS 3.3: 10.18 Issuer of Patient ID Macro

6.X.1.2.2.1.3.2 Macro Definition

Table 6.X.1.2.2.1.3.2-1: 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 Patient ID (0010,0020). Only a single Item shall be included in this Sequence.
>Universal Entity ID	(0010,0032)	R+	Globally unique identifier (OID) for the Patient ID Assigning Authority. The authority identified by this attribute shall be the same as that labelled by the Issuer of Patient ID (0010,0021).
>Universal Entity ID Type	(0010,0033)	RC+	Standard defining the format of the Universal Entity ID. Required if Universal Entity ID (0040,0032) is present. Fixed value: "ISO"
>Type of Patient ID	(0010,0022)	R+	The type of identifier in the Patient ID (0010,0020). Fixed value (if present): "TEXT"

6.X.1.2.2 General Study Module

6.X.1.2.2.1 Referenced Standards

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

6.X.1.2.2.2 Module Definition

Table 6.X.1.2.2.2.2-1: 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.

Attributes from Table C.7-3 General Study Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
			See Section 6.X.1.2.2.2.2.1.
Study Time	(0008,0030)	R+	Time the Study started. See Section 6.X.1.2.2.2.2.1.
Accession Number	(0008,0050)	O+	Shall be empty when there are multiple accession numbers for the study (see Referenced Request Sequence 6.X.1.2.3.2.1).
Issuer of Accession Number Sequence	(0008,0051)	RC+	Identifier of the Assigning Authority that issued the Accession Number (0008,0050). A value shall be present. Required if Accession Number (0008,0050) is not empty. Only a single Item shall be included in this Sequence.
>Include Table 6.X.1.2.3.2.2-1 "HL7v2 Hierarchic Designator Macro Attributes" – see 6.X.1.2.3.2 HL7v2 Hierarchic Designator Macro			

6.X.1.2.2.2.2.1 Date/Time Attribute Descriptions

6.X.1.2.2.2.2.1.1 Manifest Study Date and Time

The Study Date (0008,0020) and Study Time (0008,0030) in the referenced imaging study are Type 2 attributes. When values for these attributes are not present in the referenced imaging study, it may be necessary to copy values from other date and time attribute values e.g., a Series or Instance Creation date and time.

6.X.1.2.2.2.2.1.2 Referenced imaging study Dates and Times

In a document sharing context, all date, time and datetime attribute values in the referenced imaging study should be specified in the same timezone.

However, the Timezone Offset From UTC (0008,0201) in the referenced imaging study is a Type 3 attribute in the imaging study and so a value may not be present (See Open Issue #3).

6.X.1.2.2.3 General Equipment Module

6.X.1.2.2.3.1 Referenced Standards

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

6.X.1.2.2.3.2 Module Definition

Table 6.X.1.2.2.3.2-1: 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. 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.
Institution Code Sequence	(0008,0082)	O+	Institution or organization to which the identified individual is responsible or accountable.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			Conveys same values as would be in Institution Name (0008,0080).

6.X.1.2.2.4 Key Object Document Module

6.X.1.2.2.3.1 Referenced Standards

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

6.X.1.2.2.3.2 Module Definition

Table 6.X.1.2.2.3.2-1: 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.1.2.2.3.2.1.

Attributes from Table C.17.6-2 Key Object Document Module			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
>Include Table 6.X.1.2.3.1.2-1 "Referenced Request Macro Attributes" – see section 6.X.1.2.3.1 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 Table6.X.1.2.3.3.2-1 "Hierarchical SOP Instance Reference Macro Attributes" – see section 6.X.1.2.3.3 Hierarchical SOP Instance Reference Macro			

6.X.1.2.2.3.2.1 Referenced Request Sequence Attribute Description

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

Figure 6.X.1.2.2.3.2.1-1 shows the many to many relationships between the workflow entities Clinical Order and Imaging Procedure Request 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.

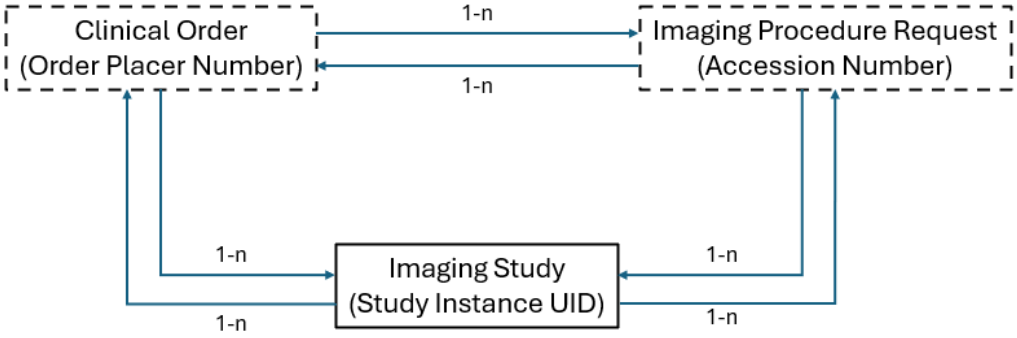

Figure: 6.X.1.2.2.3.2.1-1: Entities Identifiers and their linkages

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

The following examples are used to illustrate possible combinations:

1. An intensive care physician orders a series of portable chest x-ray for a patient, every 12 hours over 72 hours.

- 1 Clinical Order
- 6 Imaging Procedure Requests
- 6 Imaging Studies

Six Items present in the Referenced Request Sequence (0040,A370) (for the unique combinations of Accession Number and Order Placer Number).

2. An ED physician orders a chest and an abdominal CT for a patient in a tertiary care center. A combo chest/abdominal CT is carried out. The two components are read by two different radiologists.

- 2 Clinical Orders
- 1 Imaging Procedure Request
- 1 Imaging Study

Two Items present in the Referenced Request Sequence (0040,A370).

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

One Item present in the Referenced Request Sequence (0040,A370).

6.X.1.2.2.5 SR Document Content Module

Reviewers note: This Public Comment has selected approach (2) which is specified in this section, based on its backward compatibility and design consistency with the DICOM KOS despite the somewhat increased overhead of the DICOM SR based constructs. Comments are welcome on the use of this approach (2), or the use of the alternative approach (1)with less overhead. (See Volume 3 Appendix B).

6.X.1.2.2.5.1 Referenced Standards

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

6.X.1.2.2.5.2 Module Definition

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 shall include the TID 1600 "Image Library" Template and the CID 7010 "Key Object Selection Document Title shall be set to "Manifest with Description" per the DICOM Change Proposal CP-2595 (the IHE Radiology proposed variant to

that CP is found in Appendix A of this public comment document and is used until approved by DICOM WG6).

In the TID 1600 “Image Library” the following content Items shall be present in the associated Image Library Container:

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
HAS ACQ CONTEXT	CODE	EV (121139, DCM, "Modality")	1-n	R+		
HAS ACQ CONTEXT	UIDREF	EV (ddd011, DCM, “Study Instance UID”)	1	R+		
HAS ACQ CONTEXT	CODE	EV (123014, DCM, "Target Region")	1-n	R+		DCID 403X High-level anatomic regions and systems (See Note below, and see Appendix A Proposed CP on TID 2010)

Note: The High-level anatomic regions and systems value set defined by the proposed CID 403X is intended to be used for the metadata search parameter (See section 4.3.X.2 Imaging-Specific Search Request Parameters) used to support filtering queries. This value set is made of a small number of coarse-level anatomical regions and main systems, a small number that:

Optimizes the use of such filtering queries by clinicians (short pull down menus)

Simplifies the mapping from procedure codes to automate their selection for specific studies and makes implementation on existing storage systems reasonable.

Includes little overlapping values so that in most cases, any study can be correctly labelled with one or two values (e.g., a hip is classified as “lower extremity” and “lower trunk”). So queries remain very simple and filtering errors largely avoided.

The following content Items shall be present in the “Image Library Group” where each group is associated with a Series with the following Content Items per the TID 1602 “Image Library Entry Descriptors

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
HAS ACQ CONTEXT	CODE	EV (121139, DCM, "Modality")	1	R+		
HAS ACQ CONTEXT	DATE	EV (ddd003, DCM, "Series Date")	1	R+		
HAS ACQ CONTEXT	TIME	EV (ddd004, DCM, "Series Time")	1	R+		
HAS ACQ CONTEXT	TEXT	EV (ddd002, DCM, “Series Description”)	1	R+		

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
HAS ACQ CONTEXT	TEXT	EV (ddd005, DCM, "Series Number")	1	R+		The text string shall be consistent with the value of Series Number (0020,0011).
HAS ACQ CONTEXT	UIDREF	EV (ddd006, DCM, "Series Instance UID")	1	R+		

The following content Items shall be present in the "Image Library Entry" where each entry is associated with each Instance with the following Content Items per the TID 1602 "Image Library Entry Descriptors

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+	Present when the SOP Class is multiframe	
HAS ACQ CONTEXT	TEXT	EV (ddd005, DCM, "Instance Number")	1	RC+	Present when present in the referenced SOP Instance	The text string shall be consistent with the value of Instance Number (0020,0013).
CONTAINS	INCLUDE	DTID 16XX Image Library Entry Descriptors for Key Object Selection	1	RC+	Present if this instance is a KOS Object	

The following content Items shall be present in a container within the "Image Library Entry" when the related instance is a KOS Instance within the Imaging Study as described in TID 16XX "Image Library Entry Descriptors for Key Object Selection".

These content items are selected information from the referenced KOS instance, when present, in an imaging study manifest (e.g., flagging using the IHE KIN profile). The purpose is to allow the user of any Imaging Document Consumer to determine by simply processing the content of the imaging manifest:

- the presence of flagged significant images (when one or more such container is present in references to KOS instances in series of modality KO),

- accessing the title codes and associated KOS description in the manifest to offer the ability to only retrieve the significant images referenced.
- Accessing SOP instance(s) referenced by the h corresponding KOS.

Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Addtl Value Set Constraint
CONTAINS	CONTAINER	DTID 16XX Image Library Entry Descriptors for Key Object Selection	1			
HAS ACQ CONTEXT	CODE	EV (ddd008, DCM, "KOS Title Code")	1	R+		
HAS ACQ CONTEXT	TEXT	EV (ddd009, DCM, “KOS Object Description	1	RC+	Required when present in the referenced KOS instance	
HAS ACQ CONTEXT	UIDREF	EV (ddd007, DCM, “SOP Instance UID”)	1-n	R+		Instances flagged as significant by the KOS instance

The information in this container allows retrieval of key images flagged as significant without first retrieving the KOS instances.

Note: the series instance UID for each instance flagged is not present in TID 16XX, as it is present both in the Library Image TID 1600/Library Group TID 1602 as well as the Key Object Selection Module.

The data model underlying the relationship between the values conveyed by the above list of content items.

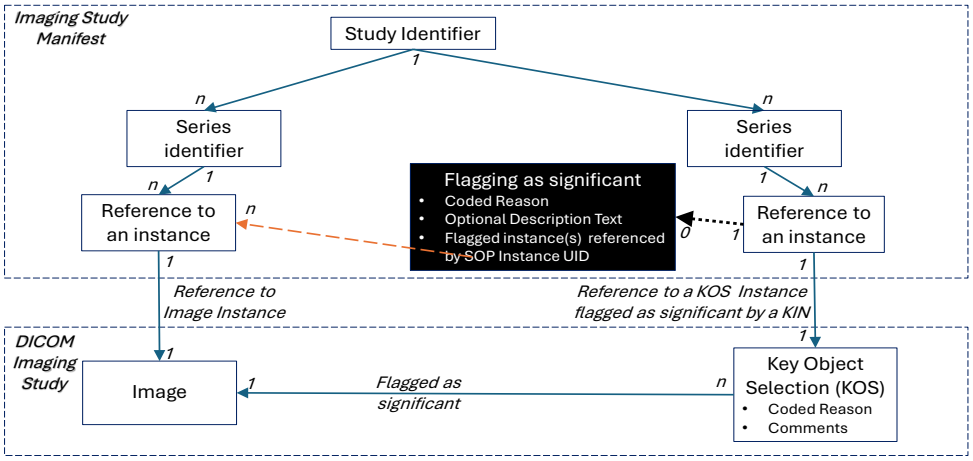

Figure 6.X.1.2.2.5.2-1: Data Model for Image Library Entry Descriptors for Key Object Selection in the Context of an Imaging Study Manifest

6.X.1.2.2.6 SOP Common Module

6.X.1.2.2.6.1 Referenced Standards

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

6.X.1.2.2.6.2 Module Definition

Table 6.X.1.2.2.6.2-1: 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 to the timezone for all DA and TM Attributes present in this SOP Instance, and for all DT Attributes present in this SOP Instance that do not contain an explicitly encoded timezone offset. See Open Issue #3.

1165 ## 6.X.1.2.3 Macro Definitions

6.X.1.2.3.1 Referenced Request Macro

6.X.1.2.3.1.1 Referenced Standards

- DICOM PS 3.3: C.17.2.8 Referenced Request Macro

6.X.1.2.3.1.2 Macro Definition

1170 **Table 6.X.1.2.3.2.1-1: 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.1.2.3.2.2-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.1.2.3.2 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.1.2.3.2.2-1 "HL7v2 Hierarchic Designator Macro Attributes" – see section 6.X.1.2.3.2 HL7v2 Hierarchic Designator Macro			

6.X.1.2.3.2 HL7v2 Hierarchic Designator Macro

6.X.1.2.3.2.1 Referenced Standards

- DICOM PS 3.3: 10.14 HL7v2 Hierarchic Designator Macro

6.X.1.2.3.2.2 Macro Definition

Table 6.X.1.2.3.2.2-1: 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 (OID) for the Accession Number (0008,0050) Assigning Authority.
Universal Entity ID Type	(0010,0033)	RC+	Standard defining the format of the Universal Entity ID. Fixed value: "ISO" Required if Universal Entity ID (0040,0032) is present.

6.X.1.2.3.3 Hierarchical SOP Instance Reference Macro

6.X.1.2.3.3.1 Referenced Standards

- DICOM PS 3.3: C.17.2.1 Hierarchical SOP Instance Reference Macro

6.X.1.2.3.3.2 Macro Definition

Table 6.X.1.2.3.3.2-1: 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.
Retrieve URI (IID use)	(0040,E010)	O	The value of this attribute is a complete URL representing the endpoint of a system supporting a study request to launch server-side viewer using for example the IHE IID profile (See the concepts described in section X.4.1.7

Attributes from Table C.17-3 Hierarchical SOP Instance Reference Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
			Launching a Remote Image Display). This URL shall include the value from the Study Instance UID (0020,000D) from this manifest..
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.1.2.3.4.2-1 "Hierarchical Series Reference Macro Attributes" – See 6.X.1.2.3.4 Hierarchical Series Reference Macro			

1185 ## 6.X.1.2.3.4 Hierarchical Series Reference Macro

6.X.1.2.3.4.1 Referenced Standards

- DICOM PS 3.3: C.17.2.1 Hierarchical Series Reference Macro

6.X.1.2.3.4.2 Macro Definition

Table 6.X.1.2.3.4.2-1: 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

Attributes from Table C.17-3a Hierarchical Series Reference Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
			XC-WADO profile.

6.X.2 MADO HL7 FHIR Based Imaging Study Manifest Content Definitions

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

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

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. In order to see all elements, select the "Snapshot Table" tab.

6.X.3 MADO Envelope Content Definitions

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

In the present draft for public comment of the MADO Profile, the MADO HL7 FHIR Envelope specification to be used in conjunction with the IHE MHD Profile may be accessed at: http://hl7.eu/fhir/imaging-manifest-r5/0.2.0-snapshot1/manifest-envelop.html.

6.X.4 MADO DICOM – FHIR Manifest Mapping Specification

Reviewers note: This mapping specification section will be completed once Open Issue #2 has been resolved. The text and sample mappings shown below give the reader an indication of the content of this section.

The purpose of such a mapping between the two imaging study manifest formats specified by the IHE MADO Profile as defined in the above section 6.X.2 and 6.X.3.

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

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

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

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

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

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

Appendices to Volume 3

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Appendix A – Updated DICOM Change Proposal for DICOM KOS in the IHE MADO Manifest specification

Reviewers note: This appendix contains the version of DICOM CP2595-01 available at the time of the development of this Public Comment version of the MADO Profile and has been used as the basis to develop the MADO DICOM KOS based Imaging Study Manifest. Where possible, the TID 2010 extensions proposed by CP-2595 have been used; however, some gaps and need for clarification have been identified. The resulting revised version of CP-2595 with the corresponding extensions are proposed in this Appendix. The original extensions proposed by DICOM in CP2595 have been left with their yellow highlight. The proposed additions/changes are highlighted in green.

IHE Radiology intends to contribute these proposals to the DICOM WG6 in order to progress this CP towards approval along with the progression of the MADO Profile to Trial Implementation.

This appendix will be removed once the formal CP2595 has been handled by DICOM.

Updated DICOM Change Proposal

Change Number CP-
Log Summary: Extend KOS to support more metadata for manifest use case
Name of Standard PS3.3, PS3.16

Rationale for Change: The KOS has been extensively utilized in the context of cross-enterprise document sharing, including for images, particularly in IHE XDS-I. There is a desire to allow selection of a subset of images described in a KOS rather than retrieving an entire set of images (such as a Study), based on metadata included in the manifest, or performing a query by some other mechanism. Though TID 2010 required for the KOS IOD and Storage SOP Class is defined as non-extensible, it is thought to be preferrable to allow its extension in a non-breaking manner, rather than to sanction the use of extension of DICOM data set attributes in a manner that would not be in keeping with the design of the KOS IOD. Inclusion of the Image Library sub-template, which is already defined for the purpose of describing referenced images in more detail, allows for sufficient but constrained extensibility in keeping with the spirit of the KOS design, albeit requiring (a) parsing of the Content Tree and (b) replication of the image references (in order to preserve compatibility with the existing flat list of image references in the TID 2010). It is proposed to add TID 1600 “Image Library” as an additional row to TID 2010, and requiring its presence if a specified (new) Document Title code is used. The Image Library sub-templates are extended to include some of the metadata proposed for the extended manifest based on experience of what is useful for selecting Series from Studies for viewing, and without harming their current use in other templates that already make use of them. The Image Library sub-templates are extensible, and their contents are mostly optional, so for specific-use cases, additional constraints may be specified in an externally defined profile (such as in IHE MADO), which might require the presence of specific Content Items, and/or the use of specific value sets. TBD. Cross-check mapping to FHIR ImagingStudy.
Change Wording:

Modify PS3.3 as indicated to expand the relationship constraints to support the Image Library

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

A.35.4 Key Object Selection Document IOD

...

A.35.4.3.1 Key Object Selection Document IOD Content Constraints

A.35.4.3.1.1 Value Type

Value Type (0040,A040) in Content Sequence (0040,A730) of the SR Document Content Module is constrained to the following Enumerated Values (see Table C.17.3-7 for Value Type definitions):

Enumerated Values:

TEXT

CODE

UIDREF

PNAME

COMPOSITE

IMAGE

WAVEFORM

CONTAINER

DATE

TIME

DATETIME

NUM

A.35.4.3.1.2 Relationship Constraints

Relationships between Content Items in the content of this IOD shall be conveyed in the by-value mode. See Table C.17.3-8 for Relationship Type definitions.

Note: Relationships by-reference are forbidden. Therefore, Referenced Content Item Identifier (0040,DB73) is not present in any of the Content Items within the SR Document Content Module.

Table A.35.4-2 specifies the relationship constraints of this IOD.

Table A.35.4-2. Relationship Content Constraints for Key Object Selection Document IOD

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
CONTAINER	CONTAINS	TEXT, IMAGE, WAVEFORM, COMPOSITE
CONTAINER	HAS OBS CONTEXT	TEXT, CODE, UIDREF, PNAME, CONTAINER
CONTAINER	HAS CONCEPT MOD	CODE
CONTAINER	**HAS ACQ CONTEXT**	
IMAGE	**HAS ACQ CONTEXT**	**CODE, DATE, TIME, DATETIME, UIDREF, NUM, TEXT, CONTAINER**
COMPOSITE	**HAS ACQ CONTEXT**	**CODE, DATE, TIME, DATETIME, UIDREF, NUM, TEXT, CONTAINER**
WAVEFORM	**HAS ACQ CONTEXT**	**CODE, DATE, TIME, DATETIME, UIDREF, NUM, TEXT, CONTAINER**

Note: The SOP Classes to which an IMAGE, WAVEFORM or COMPOSITE Value Type may refer are documented in the Conformance Statement for an application (see PS3.2 and PS3.4).

A.35.4.3.1.3 Template Constraints

The document shall be constructed from TID 2010 “Key Object Selection” invoked at the root node.

Modify PS3.16 TID 2010 as indicated, to include Image Library

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

TID 2010 Key Object Selection

The Key Object Selection Template is intended for flagging one or more significant images, waveforms, or other composite SOP Instances. Key Object Selection contains:

- coded document title stating the reason for significance of the referenced objects in the Key Object Selection,
- optional free form text comment in an explicitly identified language, and
- optional identification of the observer (device or person) that created the Key Object Selection.

Note:

1. For instance, when this Template is used to identify images rejected for quality reasons, the device or person performing the quality assessment is identified in observation context items (invoked through TID 1002 “Observer Context”). The reason for rejection can be included both as a code used as a concept modifier for the document title, and as text description.
2. The order of object references may be significant, e.g., when the title concept is "For Conference".
3. Instances referenced in a Key Object Selection Document may be securely referenced by Digital Signature or MAC mechanisms within the SR Document General Module (see PS3.3).

- **optional Image Library to further describe the reference instances**.

The Template can only be instantiated at the root node and cannot be included in other Templates. The Template is not extensible; that is, no other Content Items may be added to this Template, or the Templates that are included, recursively.

Type:	**Non-Extensible**
Order:	**Non-Significant**
Root:	**Yes**

Table TID 2010. Key Object Selection

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DCID 7010 “Key Object Selection Document Title”	1	M		Root node
2	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1-n	U		
3	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1	UC	IF Row 1 Concept Name = (113001, DCM, "Rejected for Quality Reasons") or (113010, DCM, "Quality Issue")	DCID 7011 “Rejected for Quality Reason”
4	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1	MC	IF Row 1 Concept Name = (113013, DCM, "Best In Set")	DCID 7012 “Best in Set”
5	>	HAS CONCEPT MOD	INCLUDE	DTID 1204 “Language of Content Item and Descendants”	1	U		
6	>	HAS OBS CONTEXT	INCLUDE	DTID 1002 “Observer Context”	1-n	U		
7	>	CONTAINS	TEXT	EV (113012, DCM, "Key Object Description")	1	U		
8	>	CONTAINS	IMAGE		1-n	MC	At least one of Rows 8, 9 and 10 shall be present	
9	>	CONTAINS	WAVEFORM		1-n	MC	At least one of Rows 8, 9 and 10 shall be present	
10	>	CONTAINS	COMPOSITE		1-n	MC	At least one of Rows 8, 9 and 10 shall be present	
11	**>**	**CONTAINS**	**INCLUDE**	**DTID 1600 “Image Library”**	**1**	**MC**	**IF Row 1 Concept Name = (ddd001, DCM, "Manifest with Description")**	

Content Item Descriptions

Rows 8, 9, 10	Purpose of reference shall not be present.
Row 11	**Though TID 2010 itself is non-extensible, the included TID 1600 is extensible.**

Modify PS3.16 TID 1600 and sub-templates as indicated, to add metadata needed for extended manifest

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

TID 1600 Image Library

The Image Library contains references to images and selected attributes describing them that facilitate analysis without having to retrieve the entire set of referenced images.

Type: Extensible

Order:Non-Significant

Root: No

Table TID 1600. Image Library

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (111028, DCM, "Image Library")	1	M		
1b	**>**	**HAS ACQ CONTEXT**	**CODE**	**EV (121139, DCM, "Modality")**	**1-n**	**U**		**DCID 29 "Acquisition Modality"**
1c	**>**	**HAS ACQ CONTEXT**	**UIDREF**	**EV (110181, DCM, "SOP Class UID")**	**1-n**	**U**		
1d	**>**	**HAS ACQ CONTEXT**	**CODE**	**EV (123014, DCM, "Target Region")**	**1-n**	**U**		**DCID 4031 "Common Anatomic Region" or DCID 403X High-level anatomic regions and systems (See Appendix A Proposed CP on TID 2010)**
1e	**>**	**HAS ACQ CONTEXT**	**UIDREF**	**EV (ddd011, DCM, "Study Instance UID")**	**1**	**R+**		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
2	>	CONTAINS	CONTAINER	EV (126200, DCM, "Image Library Group")	1-n	U		
3	>>	HAS ACQ CONTEXT	INCLUDE	DTID 1602 “Image Library Entry Descriptors”	1	U		
4	>>	CONTAINS	INCLUDE	DTID 1601 “Image Library Entry”	1-n	U		

Row 1b	**The Modality may be specified at the entire library level to factor out common information, such as all of the Modalities within a Study (similar to the PS3.4 Modalities in Study (0008,0061) additional Query/Retrieve Attribute).**
Row 1c	**The SOP Class UIDs may be specified at the entire library level to factor out common information, such as all of the SOP Classes within a Study (similar to the PS3.4 SOP Classes in Study (0008,0062) additional Query/Retrieve Attribute).**
Row 3	These Image Library Entry Descriptors apply to all Image Library Entries in this Image Library Group. **Though any grouping may be defined, all of the images within a single Series might be considered as a group.**

TID 1601 Image Library Entry

Each instance of the Image Library Entry Template contains the Image SOP Class and Instance UIDs, and selected attributes for an image that facilitate analysis without having to retrieve the entire set of referenced images.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1601. Image Library Entry

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			IMAGE		1	MC		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1a			COMPOSITE		1	MC	One of the rows 1, 1a and 1b shall be present.	
1b			WAVEFORM		1	MC		
2	>	HAS ACQ CONTEXT	INCLUDE	DTID 1602 “Image Library Entry Descriptors”	1	U		

Row 2	These Image Library Entry Descriptors apply to the IMAGE in Row 1 and override descriptors in Row 3 of Section TID 1600 in case of conflict.

TID 1602 Image Library Entry Descriptors

This Template contains selected attributes for an image or group of images. The descriptive information may be copied from images or derived.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1602. Image Library Entry Descriptors

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	CODE	EV (121139, DCM, "Modality")	1	U		DCID 29 “Acquisition Modality”
2		HAS ACQ CONTEXT	CODE	EV (123014, DCM, "Target Region")	1	U		DCID 4031 “Common Anatomic Region”

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
2b		**HAS ACQ CONTEXT**	**TEXT**	**EV (123014, DCM, "Target Region")**	**1**	**U**		
3		HAS ACQ CONTEXT	CODE	EV (111027, DCM, "Image Laterality")	1	U		DCID 244 “Laterality”
4		HAS ACQ CONTEXT	DATE	EV (111060, DCM, "Study Date")	1	U		
5		HAS ACQ CONTEXT	TIME	EV (111061, DCM, "Study Time")	1	U		
5a		**HAS ACQ CONTEXT**	**DATE**	**EV (ddd003, DCM, "Series Date")**	**1**	**U**		
5b		**HAS ACQ CONTEXT**	**TIME**	**EV (ddd004, DCM, "Series Time")**	**1**	**U**		
6		HAS ACQ CONTEXT	DATE	EV (111018, DCM, "Content Date")	1	U		
7		HAS ACQ CONTEXT	TIME	EV (111019, DCM, "Content Time")	1	U		
8		HAS ACQ CONTEXT	DATE	EV (126201, DCM, "Acquisition Date")	1	U		
9		HAS ACQ CONTEXT	TIME	EV (126202, DCM, "Acquisition Time")	1	U		
10		HAS ACQ CONTEXT	UIDREF	EV (112227, DCM, "Frame of Reference UID")	1	U		
11		HAS ACQ CONTEXT	NUM	EV (110910, DCM, "Pixel Data Rows")	1	U		UNITS = EV ({pixels}, UCUM, "pixels")
12		HAS ACQ CONTEXT	NUM	EV (110911, DCM, "Pixel Data Columns")	1	U		UNITS = EV ({pixels}, UCUM, "pixels")
12b		**HAS ACQ CONTEXT**	**TEXT**	**EV (ddd002, DCM, “Series Description”)**	**1**	**U**		
12c		**HAS ACQ CONTEXT**	**CODE**	**EV (ddd002, DCM, “Series Description”)**	**1**	**U**		
12d		**HAS ACQ CONTEXT**	**TEXT**	**EV (ddd005, DCM, “Series Number”)**	**1**	**U**		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
12e		HAS ACQ CONTEXT	NUM	EV (121140, DCM, "Number of Frames")	1	U		UNITS = EV ({frames}, UCUM, "frames")
12f		HAS ACQ CONTEXT	NUM	EV (ddd007, DCM, "Number of Series Related Instances")	1	U		UNITS = EV ({instances}, UCUM, "instances")
12g		HAS ACQ CONTEXT	UIDREF	EV (ddd006, DCM, "Series Instance UID")	1	U		
12h		HAS ACQ CONTEXT	TEXT	EV (ddd008, DCM, "Instance Number")	1	U		
13		HAS ACQ CONTEXT	INCLUDE	DTID 1603 "Image Library Entry Descriptors for Projection Radiography"	1	MC	IFF Row 1 is present with a value of "CR", "DX", "IO", "MG", "PX", "RF", "RG" or "XA"	
14		HAS ACQ CONTEXT	INCLUDE	DTID 1604 "Image Library Entry Descriptors for Cross-Sectional Modalities"	1	MC	IFF Row 1 is present with a value of "CT", "MR" or "PT"	
15		HAS ACQ CONTEXT	INCLUDE	DTID 1605 "Image Library Entry Descriptors for CT"	1	MC	IFF Row 1 is present with a value of "CT"	
16		HAS ACQ CONTEXT	INCLUDE	DTID 1606 "Image Library Entry Descriptors for MR"	1	MC	IFF Row 1 is present with a value of "MR"	
17		HAS ACQ CONTEXT	INCLUDE	DTID 1607 "Image Library Entry Descriptors for PET"	1	MC	IFF Row 1 is present with a value of "PT"	
18		CONTAINS	INCLUDE	DTID 160X "Image Library Entry Descriptors for Key Object Selection"	1-n	U		

Content Item Descriptions

Row 2, 2b	The Target Region may be a text value (e.g., the Value of Body Part Examined (0018,0015), and/or a code value (e.g., ~~t~~The value of Anatomic Region Sequence (0008,2218) in the Image IOD, or a code derived from Body Part Examined (0018,0015) using the mapping described in Annex L).

Row 12b, 12c	**The Series Description may be a text value (e.g., the Value of Series Description (0008,103E), and/or a code value (e.g., the Value of Series Description Code Sequence (0008,103F)).**

TID 1603 Image Library Entry Descriptors for Projection Radiography

This Template contains selected attributes for a projection radiography image or group of such images. The descriptive information may be copied from images or derived.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1603. Image Library Entry Descriptors for Projection Radiography

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	CODE	EV (111031, DCM, "Image View")	1	U		
2	>	HAS CONCEPT MOD	CODE	EV (111032, DCM, "Image View Modifier")	1-n	U		
3		HAS ACQ CONTEXT	TEXT	EV (111044, DCM, "Patient Orientation Row")	1	U		
4		HAS ACQ CONTEXT	TEXT	EV (111043, DCM, "Patient Orientation Column")	1	U		
5		HAS ACQ CONTEXT	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
6		HAS ACQ CONTEXT	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
7		HAS ACQ CONTEXT	NUM	EV (112011, DCM, "Positioner Primary Angle")	1	U		UNITS = EV (deg, UCUM, "deg")
8		HAS ACQ CONTEXT	NUM	EV (112012, DCM, "Positioner Secondary Angle")	1	U		UNITS = EV (deg, UCUM, "deg")

Content Item Descriptions

Rows 3, 4	First (row) and second (column) components of Patient Orientation (0020,0020) in the Image IOD. See Section C.7.6.1.1.1 “Patient Orientation” in PS3.3.

Row 5	The second component of Imager Pixel Spacing (0018,1164) in the Image IOD. See Section C.8.11.4 “DX Detector Module” in PS3.3.
Row 6	The first component of Imager Pixel Spacing (0018,1164) in the Image IOD. See Section C.8.11.4 “DX Detector Module” in PS3.3.

TID 1604 Image Library Entry Descriptors for Cross-Sectional Modalities

This Template contains selected attributes for a cross-sectional image or group of such images. The descriptive information may be copied from images or derived.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1604. Image Library Entry Descriptors for Cross-Sectional Modalities

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
2		HAS ACQ CONTEXT	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
3		HAS ACQ CONTEXT	NUM	EV (112226, DCM, "Spacing between slices")	1	U		UNITS = EV (mm, UCUM, "millimeter")
4		HAS ACQ CONTEXT	NUM	EV (112225, DCM, "Slice Thickness")	1	U		UNITS = EV (mm, UCUM, "millimeter")
5		HAS ACQ CONTEXT	NUM	EV (110901, DCM, "Image Position (Patient) X")	1	U		UNITS = EV (mm, UCUM, "millimeter")
6		HAS ACQ CONTEXT	NUM	EV (110902, DCM, "Image Position (Patient) Y")	1	U		UNITS = EV (mm, UCUM, "millimeter")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
7		HAS ACQ CONTEXT	NUM	EV (110903, DCM, "Image Position (Patient) Z")	1	U		UNITS = EV (mm, UCUM, "millimeter")
8		HAS ACQ CONTEXT	NUM	EV (110904, DCM, "Image Orientation (Patient) Row X")	1	U		UNITS = EV ({-1:1}, UCUM, "{-1:1}")
9		HAS ACQ CONTEXT	NUM	EV (110905, DCM, "Image Orientation (Patient) Row Y")	1	U		UNITS = EV ({-1:1}, UCUM, "{-1:1}")
10		HAS ACQ CONTEXT	NUM	EV (110906, DCM, "Image Orientation (Patient) Row Z")	1	U		UNITS = EV ({-1:1}, UCUM, "{-1:1}")
11		HAS ACQ CONTEXT	NUM	EV (110907, DCM, "Image Orientation (Patient) Column X")	1	U		UNITS = EV ({-1:1}, UCUM, "{-1:1}")
12		HAS ACQ CONTEXT	NUM	EV (110908, DCM, "Image Orientation (Patient) Column Y")	1	U		UNITS = EV ({-1:1}, UCUM, "{-1:1}")
13		HAS ACQ CONTEXT	NUM	EV (110909, DCM, "Image Orientation (Patient) Column Z")	1	U		UNITS = EV ({-1:1}, UCUM, "{-1:1}")

Content Item Descriptions

Row 1	The second component of Pixel Spacing (0028,0030) in the Image IOD. See Section 10.7.1.1 “Pixel Spacing” in PS3.3 and Section C.7.6.2 “Image Plane Module” in PS3.3.
Row 2	The first component of Pixel Spacing (0028,0030) in the Image IOD. See Section 10.7.1.1 “Pixel Spacing” in PS3.3 and Section C.7.6.2 “Image Plane Module” in PS3.3.

1370

TID 1605 Image Library Entry Descriptors for CT

This Template contains selected attributes for a CT image or group of such images. The descriptive information may be copied from images or derived.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1605. Image Library Entry Descriptors for CT

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	CODE	EV (113820, DCM, "CT Acquisition Type")	1	U		DCID 10013 “CT Acquisition Type”
2		HAS ACQ CONTEXT	CODE	EV (113961, DCM, "Reconstruction Algorithm")	1	U		DCID 10033 “CT Reconstruction Algorithm”

Content Item Descriptions

Row 1	A code derived from the Value of Acquisition Type (0018,9302) in the Image IOD. See Section C.8.15.3.2 “CT Acquisition Type Macro” in PS3.3.
Row 2	A code derived from the Value of Reconstruction Algorithm (0018,9315) in the Image IOD. See Section C.8.15.3.7 “CT Reconstruction Macro” in PS3.3.

TID 1606 Image Library Entry Descriptors for MR

This Template contains selected attributes for a MR image or group of such images. The descriptive information may be copied from images or derived. Specialized coded Content Items allow more precise description of imaging sequences used for interpretation of multiparametric prostate MRI.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1606. Image Library Entry Descriptors for MR

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	TEXT	EV (128230, DCM, "Pulse Sequence Name")	1	U		
2		HAS ACQ CONTEXT	NUM	EV (130542, DCM, "Magnetic field strength")	1	U		UNITS = (T, UCUM, "Tesla")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
3		HAS ACQ CONTEXT	NUM	EV (RID10813, RADLEX, "MR coil")	1-n	U		DCID 6349 “MR Coil Type”
4		HAS ACQ CONTEXT	NUM	EV (110852, DCM, "MR signal intensity")	1	U		BCID 6311 “MR Signal Intensity”
5		HAS ACQ CONTEXT	NUM	EV (130546, DCM, "Cross-sectional scan plane orientation")	1	U		BCID 6312 “Cross-sectional Scan Plane Orientation”
6		HAS ACQ CONTEXT	NUM	EV (113240, DCM, "Source image diffusion b-value")	1-n	U		UNITS = (s/mm2, UCUM, "s/mm2")
7		HAS ACQ CONTEXT	INCLUDE	DTID 1608 “Image Library Entry Descriptors for Prostate Multiparametric MR”	1	U		

Content Item Descriptions

1390

Row 1	The value of Pulse Sequence Name (0018,9005) or Sequence Name (0018,0024) in the Image IOD. See Section C.8.13.4 “MR Pulse Sequence Module” in PS3.3.
Row 6	Multiple values may apply when entry descriptor corresponds to a parametric map such as Apparent Diffusion Coefficient (ADC) map, which utilizes multiple b-values from a Diffusion-Weighted acquisition.

TID 1607 Image Library Entry Descriptors for PET

This Template contains selected attributes for a PET image or group of such images. The descriptive information may be copied from images or derived.

Note

The content of this Template is similar to that in TID 15101 NM/PET Protocol Context, but is in the form of an SR Template rather than a Protocol Context Template, and the Content Items are not nested as modifiers. There is also some similarity to TID 3307 NM/PET Perfusion Measurement Group.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1607. Image Library Entry Descriptors for PET

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	CODE	EV (89457008, SCT, "Radionuclide")	1	U		DCID 4020 “PET Radionuclide”
2		HAS ACQ CONTEXT	CODE	EV (349358000, SCT, "Radiopharmaceutical agent")	1	U		DCID 4021 “PET Radiopharmaceutical”
3		HAS ACQ CONTEXT	NUM	EV (304283002, SCT, "Half-life of radiopharmaceutical")	1	U		UNITS = EV (s, UCUM, "s")
3b		HAS ACQ CONTEXT	TEXT	EV (121022, DCM, "Accession Number")	1	U		
4		HAS ACQ CONTEXT	DATETIME	EV (123003, DCM, "Radiopharmaceutical Start DateTime")	1	U		
5		HAS ACQ CONTEXT	DATETIME	EV (123004, DCM, "Radiopharmaceutical Stop DateTime")	1	U		
6		HAS ACQ CONTEXT	NUM	EV (123005, DCM, "Radiopharmaceutical Volume")	1	U		UNITS = DT (cm3, UCUM, "cm3")
7		HAS ACQ CONTEXT	NUM	EV (123006, DCM, "Radionuclide Total Dose")	1	U		UNITS = DT (Bq, UCUM, "Bq")
8		HAS ACQ CONTEXT	NUM	EV (123007, DCM, "Radiopharmaceutical Specific Activity")	1	U		UNITS = DT (Bq/mol, UCUM, "Bq/mol")
9		HAS ACQ CONTEXT	CODE	EV (410675002, SCT, "Route of Administration")	1	U		BCID 11 “Administration Route”
10		HAS ACQ CONTEXT	NUM	EV (123009, DCM, "Radionuclide Syringe Counts")	1	U		UNITS = DT ({counts}/s, UCUM, "counts/s")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
11		HAS ACQ CONTEXT	NUM	EV (123010, DCM, "Radionuclide Residual Syringe Counts")	1	U		UNITS = DT ({counts}/s, UCUM, "counts/s")
12		HAS ACQ CONTEXT	NUM	EV (126203, DCM, "PET Radionuclide Incubation Time")	1	U		UNITS = EV (min, UCUM, "min")
13		HAS ACQ CONTEXT	NUM	EV (14749-6, LN, "Glucose")	1	U		UNITS = EV (mmol/l, UCUM, "mmol/l")
14		HAS ACQ CONTEXT	DATE	EV (127857, DCM, "Glucose Measurement Date")	1	MC	IF Row 13 Glucose is present and does not contain Observation DateTime (0040,A032).	
15		HAS ACQ CONTEXT	TIME	EV (127858, DCM, "Glucose Measurement Time")	1	MC	IF Row 13 Glucose is present and does not contain Observation DateTime (0040,A032).	

Content Item Descriptions

Row 3	Half-life of radiopharmaceutical	The units for half life are chosen to be seconds, to match the units used for Radionuclide Half Life (0018,1075). See Section C.8.9.2 “PET Isotope Module” in PS3.3.
Row 14	Glucose Measurement Date	In an earlier edition of the Standard, an incorrect DCM code was used for this concept, which was already assigned as (109081, DCM, "Prospective gating").
Row 15	Glucose Measurement Time	In an earlier edition of the Standard, an incorrect DCM code was used for this concept, which was already assigned as (109082, DCM, "Retrospective gating").

TID 1608 Image Library Entry Descriptors for Prostate Multiparametric MR

This Template includes attributes for image library entries that define the type of the sequence, as needed for PI-RADS interpretation of multiparametric MRI, specify most important sequence-specific attributes, and provide a location for reporting prostate imaging and sequence-specific technical characteristics of the acquisition.

Note

A descriptor specific to prostate MRI and PI-RADS is provided to record Prostate DCE temporal resolution. This term follows the conventions used in the PI-RADS guidelines.

Type: **Extensible**

Order: **Non-Significant**

Root: **No**

Table TID 1608. Image Library Entry Descriptors for Prostate Multiparametric MR

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	TEXT	EV (130544, DCM, "Endorectal coil type")	1	U		
2		HAS ACQ CONTEXT	CODE	EV (130545, DCM, "Inflatable endorectal coil fill substance")	1	U		DCID 6350 “Endorectal Coil Fill Substance”
3		HAS ACQ CONTEXT	NUM	EV (130547, DCM, "Dynamic contrast-enhanced temporal resolution")	1-n	U		UNITS = (s, UCUM, "second")

Modify PS3.16 CID 7010 as indicated, to include new concepts

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

Modify PS3.16 to add a new Image Library Entry template TID 16XX as indicated, to include new concepts for describing the properties of the flagging of instances with a key (KOS SOP Class)

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

TID 16XX Image Library Entry Descriptors for Key Object Selection

This Template includes attributes for image library entries that specify most important attributes for optimizing access to instances flagged by Key Object Selection.

Type: Extensible

Order: Non-Significant

Root: No

Table TID 16XX. Image Library Entry Descriptors for Key Object Selection

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CONTAINER	DTID 16XX Image Library Entry Descriptors for Key Object Selection	1			
2	>	HAS ACQ CONTEXT	CODE	EV (121144, DCM, "Document Title")	1	M		
3	>	HAS ACQ CONTEXT	TEXT	EV (113012, DCM, " Key Object Description	1	MC	Required when present in the referenced KOS instance	
4	>	HAS ACQ CONTEXT	IMAGE		1-n	MC	One of the rows 4, 5 and 6 shall be present.	Instances flagged as significant by the KOS instance
5	>	HAS ACQ CONTEXT	COMPOSITE		1-n	MC		
6	>	HAS ACQ CONTEXT	WAVEFORM		1-n	MC		

CID 7010 Key Object Selection Document Title

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

Keyword: KeyObjectSelectionDocumentTitle

FHIR Keyword: dicom-cid-7010-KeyObjectSelectionDocumentTitle

Type: Extensible

Version: 20190915yyyymmdd

UID: **1.2.840.10008.6.1.490**

Table CID 7010. Key Object Selection Document Title

Coding Scheme Designator	Code Value	Code Meaning
DCM	113000	Of Interest
DCM	113001	Rejected for Quality Reasons
DCM	113002	For Referring Provider
…		
DCM	113021	For Litigation
DCM	113030	Manifest
DCM	113031	Signed Manifest
DCM	**ddd001**	**Manifest with Description**
DCM	113032	Complete Study Content
…		

Modify PS3.16 to add a new Template on high-level anatomic regions and systems concepts

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

CID 403X High-Level Anatomic Regions and systems

Resources: **HTML | FHIR JSON | FHIR XML | IHE SVS XML**

Keyword: **highlevelanatomicregionssystems**

FHIR Keyword: **dicom-cid-403X- HighLevelAnatomicRegions**

Type: **Extensible**

Version: **TBD**

UID: **1.2.840.10008.6.1.TBD**

Table CID 403X. High-Level Anatomic Regions and systems

Coding Scheme Designator	Code Value	Code Meaning
SCT	63337009	Lower trunk

Coding Scheme Designator	Code Value	Code Meaning
SCT	38266002	Entire body
SCT	53120007	Upper limb
SCT	61685007	Lower limb
SCT	67734004	Upper trunk
SCT	774007	Head and neck
SCT	113257007	Cardiovascular system
SCT	80891009	Heart
SCT	76752008	Breast
SCT	737561001	Spine and/or cord

Note: The above codes and associated definitions are an extract from CID-4031. They are selected to be a short set of values optimized to facilitate a coarse filtering among large number of imaging studies performed across a wide range of treatment specialties and imaging modalities.

Modify PS3.16 Annex D as indicated, to include new concepts

(changes to existing text are bold and underlined for additions and bold and strikethrough for removals):

Table D-1: DICOM Controlled Terminology Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition	Notes
113030	Manifest	A list of objects that have been exported out of one organizational domain into another domain. Typically, the first domain has no direct control over what the second domain will do with the objects.	113030
113031	Signed Manifest	A signed list of objects that have been exported out of one organizational domain into another domain, referenced securely with either Digital	

Code Value	Code Meaning	Definition	Notes
		Signatures or MACs. Typically, the first domain has no direct control over what the second domain will do with the objects.	
ddd001	**Manifest with Description**	**A list of objects that have been exported out of one organizational domain into another domain, including additional descriptive metadata that may facilitate its use to determine relevance of the listed objects.**	
111018	Content Date	The date the data creation started.	
111019	Content Time	The time the data creation started.	
111060	Study Date	Date on which the acquisition of the study information was started.	
111061	Study Time	Time at which the acquisition of the study information was started.	
126201	Acquisition Date	The date the acquisition of data started	
126202	Acquisition Time	The time the acquisition of data started	
ddd003	**Series Date**	**Date the Series started.**	
ddd004	**Series Time**	**Time the Series started.**	
ddd002	**Series Description**	**Description of the Series.**	
ddd005	**Series Number**	**A number that identifies the Series.**	
ddd006	**Series Instance UID**	**A UID that uniquely identifies the Series**	
ddd008	**Instance Number**	**A number that identifies the Instance.**	
121139	Modality	Type of device, process or method used to acquire or derive data.	
121140	Number of Frames	Number of Frames in a multi-frame image.	
ddd007	**Number of Series Related Instances**	**The number of Composite Object Instances in a Series.**	

Code Value	Code Meaning	Definition	Notes
113030	Manifest	A list of objects that have been exported out of one organizational domain into another domain. Typically, the first domain has no direct control over what the second domain will do with the objects.	
113031	Signed Manifest	A signed list of objects that have been exported out of one organizational domain into another domain, referenced securely with either Digital Signatures or MACs. Typically, the first domain has no direct control over what the second domain will do with the objects.	
ddd001	**Manifest with Description**	**A list of objects that have been exported out of one organizational domain into another domain, including additional descriptive metadata that may facilitate its use to determine relevance of the listed objects.**	
111018	Content Date	The date the data creation started.	
111019	Content Time	The time the data creation started.	
111060	Study Date	Date on which the acquisition of the study information was started.	
111061	Study Time	Time at which the acquisition of the study information was started.	
126201	Acquisition Date	The date the acquisition of data started	

Code Value	Code Meaning	Definition	Notes
126202	Acquisition Time	The time the acquisition of data started	
ddd003	Series Date	Date the Series started.	
ddd004	Series Time	Time the Series started.	
ddd002	Series Description	Description of the Series.	
ddd005	Series Number	A number that identifies the Series.	
ddd006	Series Instance UID	A UID that uniquely identifies the Series	
ddd008	Instance Number	A number that identifies the Instance.	
121139	Modality	Type of device, process or method used to acquire or derive data.	
121140	Number of Frames	Number of Frames in a multi-frame image.	
ddd007	Number of Series Related Instances	The number of Composite Object Instances in a Series.	

Appendix B – Alternative MADO KOS Manifest format using a Standard Extended SOP Class

Reviewers note: This appendix will be removed once the Open Issue #2 has been resolved. The contents of Section 6.X.1 "MADO DICOM KOS-Based Imaging Study Content Definition" will be updated to fully describe either alternative 1 or 2.

Several approaches have been considered to extend the Key Object Selection (KOS) DICOM with additional information to offer Imaging Document Consumers more flexibility to search for relevant imaging studies, as well as to select relevant series or images. Three approaches have been considered and discussed with DICOM WG6:

1. Extend the DICOM KOS IOD with standard Data Elements. This approach is the one used in the initial draft of the MADO Profile. Although being formally allowed by the DICOM Standard, it's use has been discouraged by the DICOM WG6 as being not consistent with the design of the KOS IOD.
2. *DICOM created a CP to extend the TID2010 Template* that is used by the DICOM KOS IOD. DICOM forbids extensions to the TID 2010 Template, by profilers or implementers. This Change Proposal proposes to add the existing TID 1600 Image Library Template to TID 2010.
3. *Use a different SOP Class than an extended KOS SOP Class. The use of the DICOM Inventory IOD* has been considered and found functionally capable to support the extensions needed. However, this approach has not been selected because it breaks the backward compatibility with many existing deployments and products support of KOS Manifests per the XDS-I Profile.

The current Public Comment has selected approach 2, based on its backward compatibility and design consistency with the DICOM KOS despite the somewhat increased overhead of the DICOM SR based constructs.

This appendix specifies approach 2, as an alternative, with less overhead than approach 1, using a Standard Extended SOP Class that adds attributes into the Standard KOS (manifest) SOP Class. These extensions to the standard KOS Manifest SOP Class Modules are placed in context and summarized (highlighted in light blue) in Table B-1.

Table B-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.1.2.2.1
Study	General Study	C.7.2.1	M	M See Section 6.X.1.2.2.2
Series	Key Object Document Series	C.17.6.1	M	M
Equipment	General Equipment	C.7.5.1	M	M See Section 6.X.1.2.2.3
SR Document	Key Object Document	C.17.6.2	M	M See Sections 6.X.1.2.2.4 modified with B.1 "Extension to Hierarchical SOP Instance Reference Macro"
	SR Document Content	C.17.3	M	M
	SOP Common	C.12.1	M	M See Section 6.X.1.2.2.6

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

The KOS IOD Modules and Macros defined in Section 6.X.1.2.2 and 6.X.1.2.3 are reused with the following changes:

1. Removal of MADO SR Document Content Module (see section 6.X.1.2.2.5) with its TID1600/TID1601/TID1602 and TID/16XX nested extensions to be reverted back to the standard KOS SR Document Module - Using TID 2010 "Key Object Selection" with Document Title: (113030, DCM, Manifest).
2. Extension to Hierarchical SOP Instance Reference Macro (see section 6.X.1.2.3.4) to add the following Series level (descriptive) attributes:
   - Series Date (0008,0021)
   - Series Time (0008,0031)
   - Modality (0008,0060)
   - Series Description (0008,103E)
   - Series Number (0020,0011)

3. Extension to Hierarchical Series Reference Macro (see section 6.X.1.2.3.5) to add the following Instance level (descriptive) attributes:
   - Instance Number (0020,0013)
   - Number of Frames (0028,0008)
4. Extension to Hierarchical Series Reference Macro (see section 6.X.1.2.3.5) to add a number of Instance level attributes for the KOS SOP Instance referenced and flagging significant (Key) images Reference.

The macro extensions are all defined in the following sections highlighted in light-blue.

B.1 Extension to Hierarchical SOP Instance Reference Macro

B.1.1 Referenced Standards

- DICOM PS 3.3: C.17.2.1 Hierarchical SOP Instance Reference Macro

B.1.2 Macro Definition

Table B.1.2-1: 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.
Retrieve URI (IID use)	(0040,E010)	O	The value of this attribute is a complete URL representing the endpoint of a system supporting a study request to launch server-side viewer using for example the IHE IID profile (See the concepts described in section X.4.1.7 Launching a Remote Image Display). This URL shall include the value from the Study Instance UID (0020,000D) from this manifest.
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.1.2.3.4.2-1 "Hierarchical Series Reference Macro Attributes" – see section 6.X.1.2.3.4 Hierarchical Series Reference Macro			
>Include Table B.3.2-1 "MADO Series Metadata (Descriptive) Macro Attributes" – see section B.3 MADO Series Metadata (Descriptive) Macro			

B.2 Extension to Hierarchical Series Reference Macro

B.2.1 Referenced Standards

- DICOM PS 3.3: C.17.2.1 Hierarchical Series Reference Macro

B.2.2 Macro Definition

Table B.2.2-1: 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.
Referenced SOP Sequence	(0008,1199)	R	References to Composite Object SOP Class/SOP Instance pairs that are part of the Study defined by Study Instance UID and the Series defined by Series Instance UID (0020,000E). One or more Items shall be included in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
>Include Table B.4.2-1 "MADO SOP Instance Metadata (descriptive) Macro Attributes" – see section B.4 MADO SOP Instance Metadata (descriptive) Macro			
>Include Table B.5.2-1 "MADO Significant (Key) Image Reference Macro Attributes". This macro shall be included only if the referenced instance is a DICOM KOS SOP Class – see section B.5 MADO Significant (Key) Image Reference Macro			

B.3 MADO Series Metadata (Descriptive) Macro

B.3.1 Referenced Standards

- IHE MADO Profile

B.3.2 Macro Definition

Table B.3.2-1: Usage of DICOM Attributes in MADO Series Metadata (Descriptive) Macro

MADO Series Metadata (Descriptive) Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Series Date	(0008,0021)	R+	Date the Series started. See Section B.3.2.1.
Series Time	(0008,0031)	R+	Time the Series started. See Section B.3.2.1.
Modality	(0008,0060)	R+	Type of device, process or method that created the Instances in this Series.
Series Description	(0008,103E)	R+	Description of the Series.
Series Number	(0020,0011)	R+	A number that identifies this Series.

B.3.2.1 Series Date/Time Attribute Descriptions

The Series Date (0008,0021) and Series Time (0008,0031) in the referenced imaging study are Type 3 attributes. When values for these attributes are not present in the referenced imaging study, it may be necessary to copy values from other date and time attribute values e.g., Instance Creation date and time.

B.4 MADO SOP Instance Metadata (Descriptive) Macro

B.4.1 Referenced Standards

- IHE MADO Profile

B.4.2 Macro Definition

Table B.4.2-1: Usage of DICOM Attributes in MADO SOP Instance Metadata (Descriptive) Macro

MADO SOP Instance Metadata (Descriptive) Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Instance Number	(0020,0013)	R+	A number that identifies this SOP Instance.
Number of Frames	(0028,0008)	RC+	Number of frames in a Multi-frame Image. Required if the instance contains multi-frame pixel data.

B.5 MADO Significant (Key) Image Reference Macro

B.5.1 Referenced Standards

- IHE MADO Profile

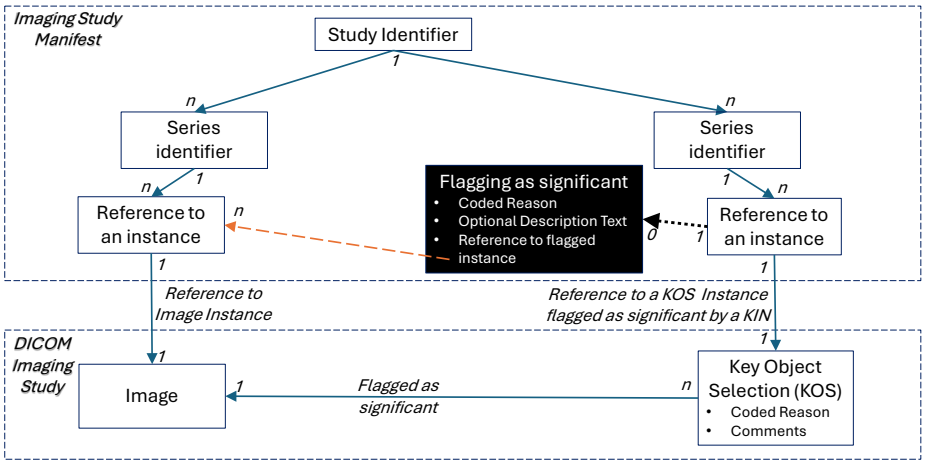
B.5.2 Macro Definition

The attributes in this Macro contain selected information from the referenced KOS instances, when present, in an imaging study (e.g., flagging using the IHE KIN profile). The purpose is to allow user of any imaging consumer to determine by simply processing the content of the imaging manifest:

- the presence of flagged significant images (when one or more such Referenced Sequence is present in references to KOS instances in series of modality KO),
- accessing the title codes and associated KOS description in the manifest to offer the ability to only retrieve such significant images to his own system.
- Accessing SOP reference to each corresponding KOS to support their retrieval.

With such information present along with the references to KOS instances within the manifest, there is no need for additional retrieve transactions to access key images flagged as significant and referenced by KOS instances which is important in large-scale image sharing.

The data model underlying the relationship between the values conveyed by the above list of content items.



1580 **Table B.5.2-1: Usage of DICOM Attributes in MADO Significant (Key) Image Reference Macro**

MADO Significant (Key) Image Reference Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Purpose of Reference Code Sequence	(0040,A170)	R+	This sequence shall contain a single item.
> Code Value	(0008,0100)	R	Shall use the Code Value "113000" if this Item (of the enclosing Referenced SOP Sequence (0008,1199)) is flagged as a significant image. May use any other code value from BCID 7010.
> Coding Scheme Designator	(0008,0102)	R	Identifier of the coding scheme in which the Code Value (0008,0100). DICOM coding scheme. Shall use a fixed value: Coding Scheme Designator "DCM".
> Code Meaning	(0008,0104)	R	Convey the code meaning as specified by BCID 7010. E.g., "Of Interest" for the code value "113000".
Text Value	(0040,A160)	R+	Contains the Concept Name (113012, DCM, "Key Object Description") Text Value copied from the KOS/KIN instance referenced. Non-formatted textual data, allowing for implementation specific display. This value may contain spaces as well as CR LF separators for one or more lines.
Expresses the fact that the Referenced KOS/KIN SOP Instance flags a number of instances from series described within the imaging study manifest. These flagged series and instances are referenced within the Reference SOP Sequence below.			

MADO Significant (Key) Image Reference Macro Attributes			
Attribute Name	**Tag**	**IHE Usage**	**Attribute Description**
Referenced SOP Sequence	(0008,1199)	R	This sequence shall contain as many Related Series Sequences (0008,1250) as there are Series with instances flagged by the above referenced KOS/KIN.
> Series Instance UID	(0020,000E)	R	Series Instance UID of the series present in the referenced KOS/KIN.
> Referenced SOP Instance UID	(0008,1155)	R	List of the SOP Instance UID of the instances flagged by the referenced KOS/KIN. This sequence shall contain as many instance UID as there are instances flagged within the above referenced Related Series Sequences (0008,1250).
>> SOP Instance UID	(0008,0018)	R	SOP Instance UID of an instance flagged by the referenced KOS/KIN.

