Integrating the Healthcare Enterprise

IHE Radiology
Technical Framework Supplement

Web-based Image Capture (WIC)

Trial Implementation

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Foreword

This is a supplement to the IHE Radiology Technical Framework V13.0. 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 April 21, 2015 for trial implementation and may be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the Radiology Technical Framework. Comments are invited and may be submitted at http://www.ihe.net/Radiology_Public_Comments.

This supplement describes changes to the existing technical framework documents.

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

Amend Section X.X by the following:

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

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

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

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

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

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Introduction to this Supplement

There is an increasing use of mobile devices such as smartphones or tablets for image capture or viewing in healthcare. For example, a clinician can use a tablet to launch an image viewer via the EMR. The camera on the mobile device can capture high quality still images and videos. However, there is no standard way for these devices to upload captured images or evidence documents directly to the Image Manager.

The Web-based Image Capture (WIC) Profile provides a simple, lightweight, mobile-friendly mechanism to encode and send captured images, videos and evidence documents from the mobile device to the Image Manager so that these objects can be easily integrated into the rest of the imaging workflow.

Open Issues and Questions

No open issues.

Closed Issues

1	Should the Receiver be required to convert QuickTime (.mov) into MPEG-4 (.mp4)? iOS can only create QuickTime video encoded as H.264 video stream. QuickTime is not a DICOM supported video container format. Ans: Closed. Named option in Image Manager.
2	Should the Receiver be required to convert .3GP into MPEG-4? Other devices (e.g., Blackberry) use .3GP container for its MPEG-4 encoded video stream. It is used in older version of mobile SDKs, but newer version supports MP4 container directly. Ans: Closed. Named option in Image Manager.
3	Should the Receiver be required to convert PNG into lossless JPEG (.70) Most mobile SDK supports creation of images using JPEG (lossy) or PNG (lossless). JPEG is compatible with DICOM while PNG is not. Ans: Closed. Named option in Image Manager.
4	Should a Receiver be added that doesn't have to convert to binary instances? Ans: No. The Receiver must support returning binary instances upon request.
5	Should each media type be a separate transaction? Currently there is only one transaction and each media type is a named option. Ans: Keep one transaction.

6	Do we need to add H.265 video? Newer mobile SDK (e.g., iOS 8) supports creating video encoded in H.265 which is not yet supported by DICOM. Ans: Closed. Do not support H.265 encoding now. Feedback is still welcome.
7	Are specific details needed for the AVC / H.264 video bit stream to be compatible with the DICOM Transfer Syntax? Ans: Closed. WIC does not specify any more specific details other than the use of AVC/H.264. Feedback is still welcome.
8	Should there be more specific details about the PNG encoding? Ans: Closed. Added 8-bit per channel.
9	Should WIC also support audio or waveform capture? Ans: Closed. No suitable SOP Class in DICOM for general audio capture. If business case exists, then perhaps a new encapsulated audio IOD can be introduced. Feedback is still welcome.
10	Should the different contents be named options or defer to product documents? Ans: Closed. Named option.
11	For evidence document with bulk data, should the media type of the payload be generic application/octet-stream or more specific application/pdf for PDF and text/xml for CDA®? Currently STOW-RS expects using the generic octet-stream. Ans: Specific for PDF and CDA®. Submit CP to DICOM WG-27.
12	Should support for encapsulated PDF and CDA® be in scope or not? Ans: In scope.
13	What should the Receiver use in the response message body (JSON or XML)? Currently STOW-RS allows either XML or JSON in the response message body. The Receiver should honor the HTTP Accept field. What if it accepts both? Match what was used in the Request? Ask WG-27 about 6.6.1.3. Intention is to stay compatible with STOW-RS Ans: Closed. Add note in Expected Action on Receiver to honor HTTP Accept field.

General Introduction

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

Appendix A - Actor Summary Definitions

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

Actor	Definition
Image Capturer	A creator of DICOM composite instances

Appendix B - Transaction Summary Definitions

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

Transaction	Definition
Store Instances over the Web [RAD-108]	Store one or more DICOM instances using DICOMweb STOW-RS.

Glossary

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

Glossary Term	Definition

Volume 1 – Profiles

38 Web-based Image Capture (WIC) Profile

There is an increasing use of mobile devices such as smartphones or tablets for image capture or viewing in healthcare. For example, a clinician can use a tablet to launch an image viewer via the EMR. The camera on the mobile device can capture high quality still images and videos. However, there is no standard way for these devices to upload captured images or evidence documents directly to the Image Manager.

The Web-based Image Capture (WIC) Profile provides a simple, lightweight, mobile-friendly mechanism to encode and send captured images, videos and evidence documents from the mobile device to the Image Manager so that these objects can be easily integrated into the rest of the imaging workflow.

38.1 WIC Actors, Transactions, and Content Modules

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

Figure 38.1-1 shows the actors directly involved in the WIC Profile and the relevant transactions between them. If needed for context, other actors that may be indirectly involved due to their participation in other related profiles are shown in dotted lines. Actors which have a mandatory grouping are shown in conjoined boxes.

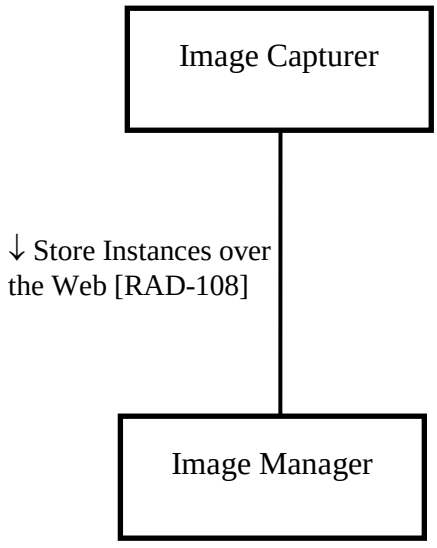


Figure 38.1-1: WIC Actor Diagram

Table 38.1-1 lists the transactions for each actor directly involved in the WIC Profile. To claim compliance with this profile, an actor shall support all required transactions (labeled "R") and may support the optional transactions (labeled "O").

Table 38.1-1: WIC Profile - Actors and Transactions

Actors	Transactions	Optionality	Reference
Image Capturer	Store Instances over the Web	R	RAD TF-3: 3.108.1
Image Manager	Store Instances over the Web	R	RAD TF-3: 3.108.1

38.1.1 Actor Descriptions and Actor Profile Requirements

Most requirements are documented in Transactions (Volume 2 and 3). This section documents any additional requirements on this profile's actors.

38.1.1.1 Image Manager

The Image Manager is required to support JPEG, MPEG4, DICOM Instance and Evidence Document Storage.

38.2 WIC Actor Options

Options that may be selected for each actor in this profile, if any, are listed in the Table 38.2-1. Dependencies between options when applicable are specified in notes.

Table 38.2-1: WIC - Actors and Options

Actor	Option Name	Reference
Image Capturer	JPEG Storage Option (See Note 1)	RAD TF-3: 3.108.4.1
	MPEG4 Storage Option (See Note 1)	RAD TF-3: 3.108.4.2
	Evidence Document Storage Option (See Note 1)	RAD TF-3: 3.108.4.3
	DICOM Instance Storage Option (See Note 1)	RAD TF-3: 3.108.4.4
	PNG Storage Option (See Note 1)	RAD TF-3: 3.108.4.1.3.1
	QuickTime Storage Option (See Note 1)	RAD TF-3: 3.108.4.2.3.1
	3GPP Storage Option (See Note 1)	RAD TF-3: 3.108.4.2.3.2
Image Manager (See Note 2)	PNG Storage Option	RAD TF-3: 3.108.4.1.3.1
	QuickTime Storage Option	RAD TF-3: 3.108.4.2.3.1
	3GPP Storage Option	RAD TF-3: 3.108.4.2.3.2

Note 1: The Image Capturer shall support at least one option.

Note 2: The Image Manager is required to support JPEG, MPEG4, DICOM Instance and Evidence Document Storage.

38.2.1 JPEG Storage Option

The Image Capturer captures still images in baseline JPEG format (i.e., DICOM Transfer Syntax 1.2.840.10008.1.2.4.50) and stores to the Image Manager using the DICOM PS3.18 metadata and bulk data.

38.2.2 MPEG4 Storage Option

The Image Capturer captures video stream encoded in AVC/H.264 format using a MP4 container and stores to the Image Manager using the DICOM PS3.18 metadata and bulk data.

38.2.3 Evidence Document Storage Option

The Image Capturer supports creation of DICOM instances using DICOM Native XML Format or JSON Metadata format for evidence documents such as GSPS, SR, KOS, and DICOM Encapsulated PDF/CDA®.

38.2.4 DICOM Instance Storage Option

The Image Capturer supports creation or transmissions of DICOM instances encoded in DICOM binary format.

38.2.5 PNG Storage Option

The Image Capturer supports creation of images in lossless PNG format.

The Image Manager supports storing images in lossless PNG format and conversion of PNG images to an appropriate standard uncompressed or lossless (reversible) compressed Transfer Syntax.

38.2.6 QuickTime Storage Option

The Image Capturer supports creation of video encoded in AVC / H.264 using the QuickTime container.

The Image Manager supports storing videos in AVC/H.264 video stream contained in a QuickTime (.mov) container and conversion of the video stream from a QuickTime container to a MP4 container.

38.2.7 3GPP Storage Option

The Image Capturer supports creation of video encoded in AVC / H.264 using the 3GPP container.

The Image Manager supports storing videos in AVC/H.264 video stream contained in a 3GPP (.3gp) container and conversion of the video stream from a 3GPP container to a MP4 container.

38.3 WIC 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 transactions required for the grouped actor (Column 2).

Section 38.5 describes some optional groupings that may be of interest for security considerations and Section 38.6 describes some optional groupings in other related profiles.

Table 38.3-1: WIC - Required Actor Groupings

WIC Actor	Actor to be grouped with	Reference
Image Capturer	None	--
Image Manager	None	--

38.4 WIC Overview

38.4.1 Concepts

The Web-based Image Capture Profile enables an imaging-enabled client application running on a wide variety of devices (ranging from workstation to lightweight mobile devices) to transmit DICOM instances to the server using HTTP(S).

Instead of creating a DICOM PS3.10 binary instance, WIC supports DICOM PS3.18 which defines the Native DICOM Model in XML and a DICOM JSON Object Model. This enables non-traditional imaging clients (such as the clients might be used in wound care department, dermatology, etc.) to create proper DICOM instances using common tools like XML and JSON.

38.4.2 Use Cases

38.4.2.1 Use Case #1: Image Upload to a New Study

38.4.2.1.1 Image Upload to a New Study Use Case Description

Clinical Use Case: A nurse in the wound care department sees patients in the ward. She photographs the wounds to track the healing process. She uses one of the department's photo cameras, a departmental tablet or her mobile phone to take a series of pictures of a patient. She immediately imports the images in the imaging system under the correct patient name and adds an appropriate report note in the patient chart.

Technical Use Case: The Image Capturer acquires new images. The Image Capturer uses the ITI PDQm Profile or some other means to obtain the correct patient demographics. The Image Capturer interacts with the user or some other means (such as using the HL7® FHIR® standard) to fill in the study context as well as other required details (e.g., mark the object as a key image). The Image Capturer then uploads the acquired objects to an Image Manager. Upon receiving the objects, the Image Manager creates a new study with the provided patient and study context. The

Image Manager also converts the received objects into the corresponding DICOM binary format such that downstream systems such as an Image Display (not part of this profile) can access the objects as usual.

38.4.2.1.2 Image Upload to a New Study Process Flow

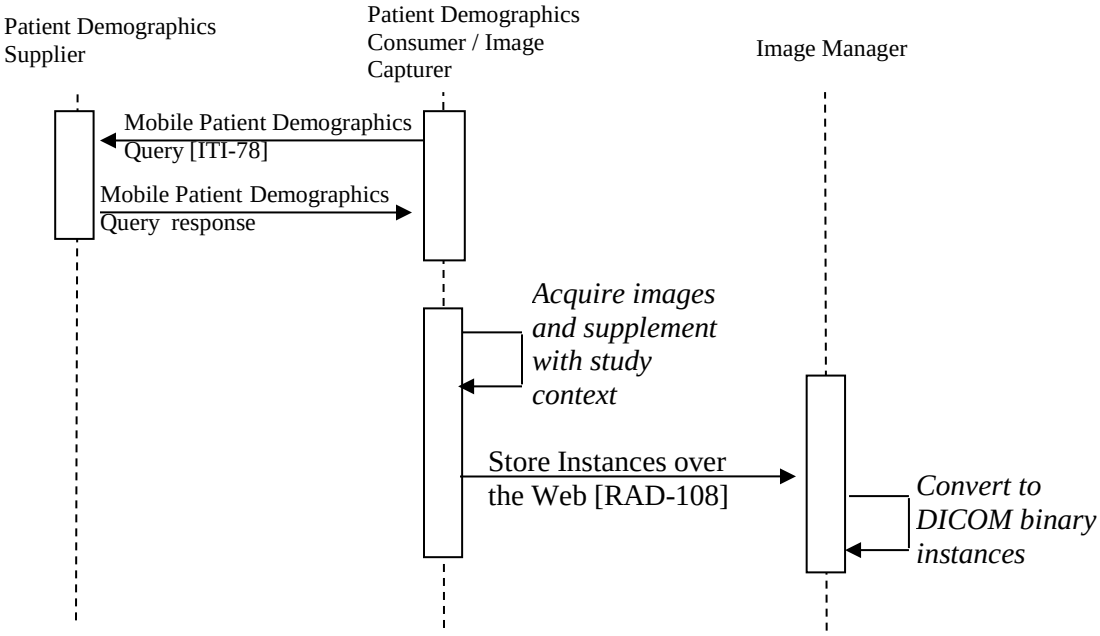


Figure 38.4.2.1.2-1: Image Upload to a New Study with PDQm Process Flow in WIC Profile

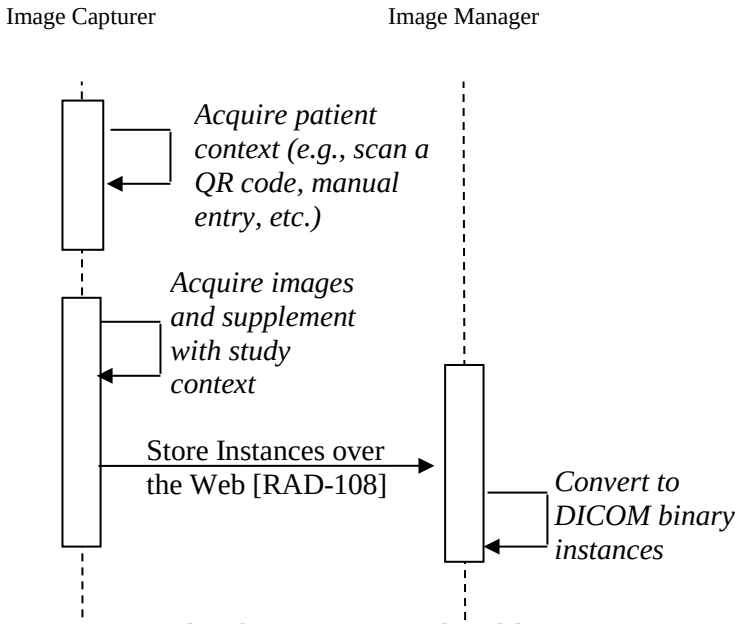


Figure 38.4.2.1.2-2: Image Upload to a New Study without PDQm Process Flow in WIC Profile

38.4.2.2 Use Case #2: Image Upload to an Existing Study

38.4.2.2.1 Image Upload to an Existing Study Use Case Description

Clinical Use Case: A radiologist uses a tablet to retrieve a study from the central repository. While viewing the study, she identifies certain key images and adds some markup indicating the region of interest. Finally she creates a report. When she saves the changes, the application sends the markups, key objects and reports to the central repository for persistent storage.

Technical Use Case 1: The Imaging Document Consumer retrieves and views a study from the Imaging Document Source using the MHD-I Profile. The Imaging Document Consumer, grouped with the Image Capturer, creates new evidence documents (e.g., Key Image Notes, screen captures as Secondary Capture, etc.) using the same patient and study context. The Image Capturer then uploads the created evidence documents to the Image Manager.

38.4.2.2.2 Image Upload to an Existing Study Process Flow

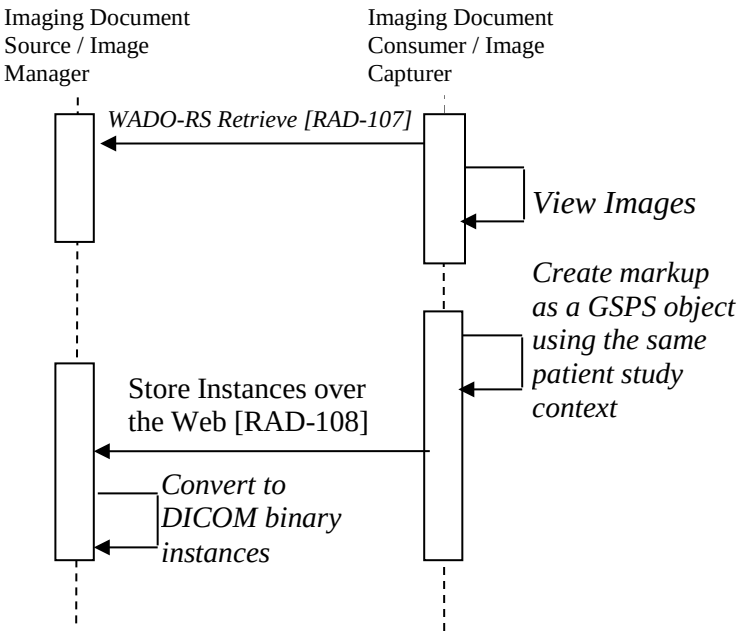


Figure 38.4.2.2.2-1: Image Upload to an Existing Study Process Flow in WIC Profile

Technical Use Case 2: Similarly, using the Invoke Image Display (IID) Profile, an EMR, as an Image Display Invoker, launches an Image Display to view a patient's study. Using the markup tools and key image tools provided by the Image Display, the user creates new markups and tag certain images as key images. The IID Image Display, grouped with the Image Capturer, stores the markup and key images in the same patient and study context to the Image Manager using DICOM JSON Object Model. The Image Manager receives the instances and converts them into DICOM binary format. Another Image Display (not part of this profile), which is a traditional PACS workstation, retrieves the study and presents the markup as well as key images.

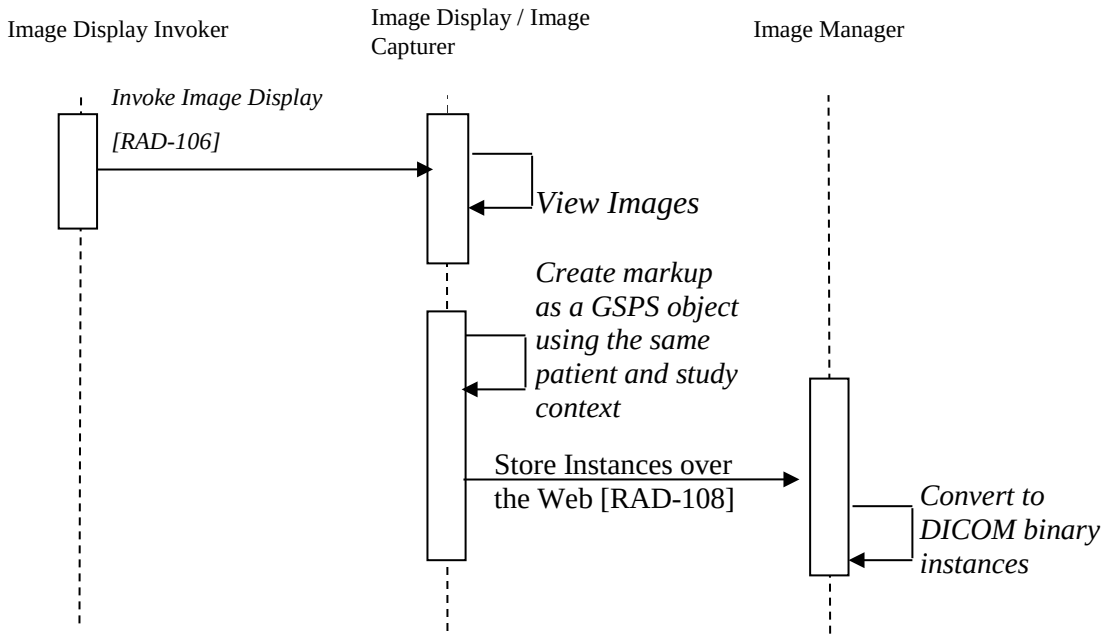


Figure 38.4.2.2.2-2: Image Upload to an Existing Study Process Flow in WIC Profile

38.5 WIC Security Considerations

Since the Image Capturer may be running in a mobile device outside of the hospital private network, it is important to ensure that the communication between the Image Capturer and the Image Manager is secure. ITI ATNA encryption can provide secure data transport. ITI ATNA audit messages can ensure audit trails for private health information are captured.

It is recommended that the Image Manager will be grouped with the ITI ATNA Secure Node or Secure Application to record audit messages for the transactions performed. It is not expected that the Image Capturer will record audit messages.

The Image Manager may want to restrict which users are authorized to upload. The ITI Internet User Authorization (IUA) Profile provides OAuth-based user authorization.

The Image Manager may want to restrict which devices are authorized to upload. ITI ATNA provides certificate-based node authentication.

Since the Image Capturer may be running in a mobile device that can easily be lost, it is important to consider how much information should be retained in the mobile device. This includes patient demographics as well as the images, videos or reports.

38.6 WIC Cross Profile Considerations

IID – Invoke Image Display

An Image Capturer might be grouped with an Image Display in the Invoke Image Display Profile to create and store evidence documents back to the associated Image Manager based on images being viewed and their associated patient and study context.

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

An Image Capturer might be grouped with an XDS-I.b Imaging Document Consumer to create and store new objects back to the Image Manager based on study objects it is viewing.

An Image Manager might be grouped with an XDS-I.b Imaging Document Source to receive objects sent from an Image Capturer and publish a new manifest.

MHD-I – Mobile access to Health Documents for Imaging

An Image Capturer might be grouped with a MHD-I Imaging Document Consumer to create and store new objects back to the Image Manager based on study objects it is viewing.

An Image Manager might be grouped with a MHD-I Imaging Document Source to receive objects sent from an Image Capturer.

PDQm – Patient Demographics Query for Mobile

An Image Capturer might be grouped with a PDQm Patient Demographics Consumer to retrieve reliable patient demographics from the Patient Demographics Supplier.

Volume 3 – Transactions

Add Section 3.108

3.108 Store Instances over the Web [RAD-108]

3.108.1 Scope

This transaction is used by the Sender to send well-formed DICOM composite objects in either DICOM binary format, or in metadata and bulk data format to the Receiver for storage.

The instances may be images, video, DICOM evidence documents (such as Key Image Notes, or Presentation States) or binary DICOM objects. Typically the instances will have been newly created by the Sender. The instances may be sent as part of an existing DICOM Study, or part of a new Study.

3.108.2 Actor Roles

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

Table 3.108.2-1: Actor Roles

Role:	**Sender**: Creates and sends well-formed DICOM composite objects
Actor(s):	The following actors may play the role of Sender: Image Capturer
Role:	**Receiver**: Receives objects from the Sender
Actor(s):	The following actors may play the role of Receiver: Image Manager

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

3.108.3 Referenced Standards

DICOM PS3.3: Information Object Definitions

DICOM PS3.4: Service Class Specifications

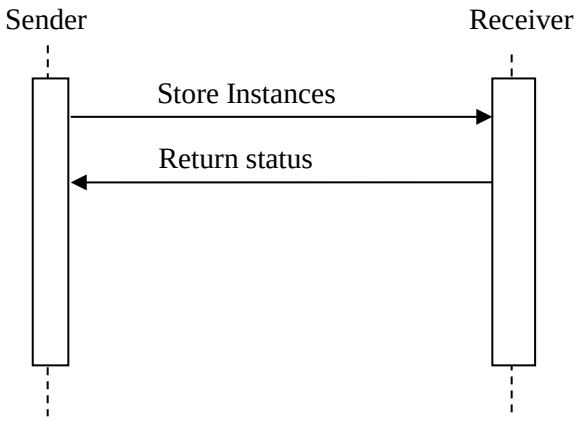
DICOM PS3.5 Section B.2: UUID Derived UID (http://medical.nema.org/medical/dicom/current/output/chtml/part05/sect_B.2.html)

DICOM PS3.18 Section 6.6: STOW-RS Request/Response (http://medical.nema.org/medical/dicom/current/output/html/part18.html#sect_6.6)

DICOM PS3.19 Section A.1: Native DICOM Model

ISO/IEC 14496-14:2003: MPEG-4 Part 14

3.108.4 Interaction Diagram



3.108.4.1 Store Instances Message

The Sender creates one or more instances and sends these instances to the Receiver for storage.

There may be one or more Senders storing instances to the same Receiver at any given time.

3.108.4.1.1 Trigger Events

User or application initiates transfer of the acquired or created instances to the Receiver.

3.108.4.1.2 Message Semantics

This message is a DICOM STOW-RS request. The Sender is the User-Agent. The Receiver is the Origin-Server.

The Sender shall use the Store Instances action type.

The Sender shall encode the instances using either the binary DICOM method or the DICOM PS3.18 metadata and bulk data method.

The Sender shall encode the metadata and bulk data request in one of the following two manners:

- Array of DICOM JSON Model Object as defined in DICOM PS3.18 Annex F
- XML request messages as defined in the Native DICOM Model defined in DICOM PS3.19 with one message part per XML object

Note: STOW-RS specifies Native DICOM Model as a baseline and JSON Model Object is optional. In WIC, the Sender may support either one.

When sending metadata, patient demographics shall be populated by the Sender according to Table 3.108.4.1.2-1 in order to provide the appropriate patient context for the created DICOM Instances. Additional patient demographics can be populated by the Sender according to DICOM PS3.3 C.7.1.1. The specific values may be populated using the ITI PDQm Profile, or extracting the patient demographics from the integrated viewer, or via the user interface provided by the Sender, or via some other means.

Table 3.108.4.1.2-1: Critical Patient Demographics Attributes

DICOM Attribute	New Study Case (RAD TF-1: 38.4.2.1)	Existing Study Case (RAD TF-1: 38.4.2.2)
Patient's Name (0010,0010)	Shall be populated (Note 1)	Equal to existing study
Patient ID (0010,0020)	Shall be populated (Note 1)	Equal to existing study
Issuer of Patient ID (0010,0021)	Shall be populated (Note 2)	Equal to existing study
Issuer of Patient ID Qualifier Sequence (0010,0024)	Shall be populated (Note 2)	Equal to existing study
Patient's Birth Date (0010,0030)	Shall be populated (Note 3)	Equal to existing study
Patient's Sex (0010,0040)	Shall be populated (Note 3)	Equal to existing study

Note 1: Pre-registered values for Patient ID and Patient's Name will be used in the Unidentified Patient cases.

Note 2: A default value will be provided if it is not known.

Note 3: Attribute may be zero length if reliable value cannot be obtained.

When sending metadata, required study attributes shall be populated by the Sender. If a reliable source of metadata attributes is available, values from that source shall be used; otherwise the Sender shall populate study attributes according to Table 3.108.4.1.2-2. The Sender populates additional study attributes according to DICOM PS3.3 C.7.2.1 and C.7.3.1. The study attributes may be populated by either extracting the study attributes from the integrated viewer, or via the user interface provided by the Sender.

Table 3.108.4.1.2-2: Critical Study Attributes

DICOM Attribute	New Study Case (RAD TF-1: 38.4.2.1)	Existing Study Case (RAD TF-1: 38.4.2.2)
Study Instance UID (0020,000D)	Internally generated	Equal to existing study
Accession Number (0008,0050)	May be empty (Note 1)	Equal to existing study
Issuer of Accession Number Sequence (0008,0051)	Shall be populated (Note 2)	Equal to existing study
Performed Procedure Step	Internally generated	Internally generated

DICOM Attribute	New Study Case (RAD TF-1: 38.4.2.1)	Existing Study Case (RAD TF-1: 38.4.2.2)
ID (0040,0253)		
Performed Procedure Step Start Date (0040,0244)	Acquisition date	Acquisition date
Performed Procedure Step Start Time (0040,0245)	Acquisition time	Acquisition time
Performed Procedure Step Description (0040,0254)	Shall be populated (Note 3)	Shall be populated
Reason for Requested Procedure (0040,1002)	Shall be populated (Note 3)	Shall be populated
Reason for Requested Procedure Code Sequence (0040,100A)	May be populated	May be populated

Note 1: Accession Number may be populated if appropriate value can be obtained. For example, an appropriate value may be obtained from a reliable source such as Modality Worklist, or automatically generated based on a well-defined method (e.g., A unique ID with a site code prefix).

Note 2: The Sender will provide a default value if it is not otherwise known.

Note 3: The Sender will use pre-configured values or user input if it is not otherwise known.

If the Sender needs to create new unique identifiers (e.g., for Study Instance UID, Series Instance UID or SOP Instance UID), it shall do so using UUID Derived UID mechanism specified in DICOM PS3.5 Section B.2.

Details about when it is appropriate to trigger the creation of a new Study/Series/SOP Instance are described in RAD TF-2: 4.8.4.1.1.1 “Study UIDs and Series UIDs”.

3.108.4.1.2.1 Single-frame Image

The Sender shall encode compressed single-frame image pixel data elements in one message part per instance.

The Sender shall include all required attributes in the Native DICOM Model or DICOM JSON Model Object according to DICOM PS3.4 Section B.5 for the appropriate DICOM SOP Class.

Table 3.108.4.1.2.1-1 identifies recommended SOP Classes for commonly captured single-frame image types. DICOM defines more specific SOP Classes that may be used if applicable (see DICOM PS3.3).

Table 3.108.4.1.2.1-1: Recommended SOP Classes for Single-frame Images

Captured Image Type	SOP Class Name	SOP Class UID	IOD Specification defined in DICOM PS3.3
Photographs	VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image IOD
Screenshots	Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image IOD

The Image Pixel Module is mandatory according to DICOM PS3.3. However, due to the limitation to obtain the image pixel information by certain mobile SDK or mobile clients (e.g., zero footprint browser client), this transaction relaxes the requirement for the Sender such that the type of the following attributes is changed from Type 1 to Type 2, meaning that the Sender shall include these attributes, but the values can be empty.

Table 3.108.4.1.2.1-2: Image Pixel Macros Attributes

Attribute Name	Tag
Samples per Pixel	(0028,0002)
Photometric Interpretation	(0028,0004)
Rows	(0028,0010)
Columns	(0028,0011)
Bits Allocated	(0028,0100)
Bits Stored	(0028,0101)
High Bit	(0028,0102)
Pixel Representation	(0028,0103)

3.108.4.1.2.1.1 JPEG Storage Option

A Sender that supports the JPEG Storage Option shall be capable of sending images that are created using JPEG compression.

If the Sender knows the Transfer Syntax of the JPEG image, the Sender shall encode the compressed pixel data using single-frame Media Types described in Media Type Mapping to Transfer Syntax in DICOM PS3.18 Table 6.5-1.

If the Sender does not know the Transfer Syntax of the JPEG image, the Sender shall use media type of image/jpeg.

Note: Sending images with Media Type image/jpeg is currently not supported in DICOM PS3.18. This is pending DICOM CP xxxx.

3.108.4.1.2.1.2 PNG Storage Option

A Sender that claims the PNG Storage Option shall be capable of creating images using lossless PNG compression with 8-bit per channel.

The Sender shall use a media type of image/png.

Note: Sending images with Media Type image/png is currently not supported in DICOM PS3.18. This is pending DICOM CP xxxx.

3.108.4.1.2.2 Multi-frame Video

The Sender shall encode compressed multi-frame video pixel data elements in one message part per instance.

The Sender shall include all required attributes in the Native DICOM Model or DICOM JSON Model Object according to DICOM PS3.4 Section B.5 for the appropriate DICOM SOP Class.

Table 3.108.4.1.2.2-1 identifies recommended SOP Classes for commonly captured multi-frame video types. DICOM defines more specific SOP Classes that may be used if applicable (see DICOM PS3.3).

Table 3.108.4.1.2.2-1: Recommended SOP Classes for Multi-frame Videos

Captured Video Type	SOP Class Name	SOP Class UID	IOD Specification defined in DICOM PS3.3
Video Photographs	Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	Video Photographic Image IOD

The Image Pixel Module is mandatory according to DICOM PS3.3. However, due to the limitation to obtain the image pixel information by certain mobile SDK or mobile clients (e.g., zero footprint browser client), this transaction relaxes the requirement for the Sender such that the types of the following attributes are changed from Type 1 to Type 2, meaning that the Sender shall include these attributes, but the values can be empty.

Table 3.108.4.1.2.2-2: Image Pixel Macro Attributes

Element Name	Tag
Samples per Pixel	(0028,0002)
Photometric Interpretation	(0028,0004)
Rows	(0028,0010)
Columns	(0028,0011)
Bits Allocated	(0028,0100)
Bits Stored	(0028,0101)
High Bit	(0028,0102)
Pixel Representation	(0028,0103)

3.108.4.1.2.2.1 MPEG4 Storage Option

A Sender that supports the MPEG4 Storage Option shall be capable of sending videos that are encoded using AVC/H.264.

If the Sender knows the Transfer Syntax of the created video, the Sender shall encode the compressed video stream using a multi-frame Media Types described in Media Type Mapping to Transfer Syntax as defined in DICOM PS3.18 Table 6.5-1.

If the Sender does not know the Transfer Syntax of the created video and the created video is using a MPEG or MPEG4 container, then the Sender shall use one of the following media types:

Table 3.108.4.1.2.2.1-1: Generic Video Media Type Support by the Receiver

Media Type	Required in Named Option
video/mpeg (Note 1)	MPEG4 Storage
video/mp4 (Note 1)	MPEG4 Storage

Notes: 1. These video media types are commonly used for encoding videos in mobile devices. Sending videos with Media Type video/mpeg or video/mp4 is currently not supported in DICOM PS3.18 STOW-RS. This is pending DICOM CP xxxx.

The Sender shall support at least one of video/mpeg or video/mp4 media types. When using the video/mp4 media type, MPEG-4 video stream shall be encoded using AVC/H.264 encoding scheme and stored in MP4 container format (ISO/IEC 14496-14:2003).

3.108.4.1.2.2.2 QuickTime Storage Option

A Sender that supports the QuickTime Storage Option shall be capable of creating video stream encoded using AVC/H.264 encoding scheme and stored in QuickTime container format.

The Sender shall use media type of video/quicktime.

Notes: 1. Sending videos with Media Type video/quicktime is currently not supported in DICOM PS3.18 STOW-RS. This is pending DICOM CP xxxx.

3.108.4.1.2.2.3 3GPP Storage Option

A Sender that supports the 3GPP Storage Option shall be capable of creating video stream encoded using AVC/H.264 encoding scheme and stored in 3GPP container format.

The Sender shall use media type of video/3gpp.

Notes: 1. Sending videos with Media Type video/3gpp is currently not supported in DICOM PS3.18 STOW-RS. This is pending DICOM CP xxxx.

3.108.4.1.2.3 Evidence Document Storage Option

The Sender shall encode the complete evidence document metadata in the first part of the multipart request.

The Sender shall include all required attributes in the Native DICOM Model or DICOM JSON Model Object according to DICOM PS3.4 Section B.5 for the appropriate DICOM SOP Class that is used for the evidence document.

Table 3.108.4.1.2.3-1 identifies recommended SOP Classes for commonly created evidence documents. DICOM defines more specific SOP Classes that may be used if applicable (see DICOM PS3.3).

Table 3.108.4.1.2.3-1: Recommended SOP Classes for Evidence Document

Captured Evidence Document Type	SOP Class Name	SOP Class UID	IOD Specification defined in DICOM PS3.3
Presentation State	Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Grayscale Softcopy Presentation State IOD
	Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	Color Softcopy Presentation State IOD
	Pseudo-Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.3	Pseudo-color Softcopy Presentation State IOD
Structured Report	Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Basic Text SR IOD
	Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Enhanced SR IOD
	Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Comprehensive SR IOD
	Comprehensive 3D SR	1.2.840.10008.5.1.4.1.1.88.34	Comprehensive 3D SR IOD
Key Object Selection	Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Key Object Selection Document IOD
Encapsulated Document	Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Encapsulated PDF IOD
	Encapsulated CDA® Storage	1.2.840.10008.5.1.4.1.1.104.2	Encapsulated CDA® IOD

The Sender shall include each encapsulated document in its own separate message part in the DICOM Request Message Body with the following HTTP headers:

- Encapsulated PDF document
  - Content-Type: application/pdf
  - Content-Location: {BulkDataURI}
- Encapsulated CDA® document
  - Content-Type: text/xml
  - Content-Location: {BulkDataURI}
- Other encapsulated document
  - Content-Type: application/octet-stream
  - Content-Location: {BulkDataURI}

Note: Sending encapsulated document such as PDF or CDA® are currently not supported in DICOM PS3.18 STOW-RS. This is pending DICOM CP xxxx.

The expected endpoint for DICOM Encapsulated PDF / CDA® documents is a DICOM server. For transmission of plain PDF or CDA® documents that are not intended to be DICOM encapsulated and stored to a DICOM server, ITI Mobile Access to Health Document (MHD) provides a more appropriate mechanism for uploading electronic health records.

3.108.4.1.2.4 DICOM Instance Storage Option

The Image Capturer shall encode each DICOM instance as a separate message part.

The Image Capturer shall send the DICOM instances using DICOM binary format.

3.108.4.1.3 Expected Actions

The Receiver shall accept and process the message payload.

The Receiver shall accept metadata and bulk data encoded in either Native DICOM Model or DICOM JSON Model Object. The Receiver shall at least support the SOP Classes defined in Tables 3.108.4.1.2.1-1, 3.108.4.1.2.2-1 and 3.108.4.1.2.3-1.

If the message contents are not binary DICOM instances, the Receiver shall convert the DICOM metadata and bulk data into DICOM binary instances according to the SOP Class UID specified in the metadata.

If the received object includes empty Image Pixel Macro Attributes (see Table 3.108.4.1.2-1), the Receiver shall populate them according to the Image Pixel Attribute Descriptions specified in DICOM PS3.3 Section C.7.6.3.1.

The Receiver shall store the DICOM binary instances (either received or converted) such that they can be later queried or retrieved in a fashion meeting the requirements defined for a DICOM Level 2 Storage SCP (refer to DICOM PS3.4 Section B.4.1).

If the received object includes the Transfer Syntax in the media type parameter, then the Receiver shall use the same Transfer Syntax when converting the DICOM metadata and bulk data into DICOM binary instances.

If the media type of the received object is image/jpeg, then the Receiver shall use the Transfer Syntax 1.2.840.10008.1.2.4.50 when converting the DICOM metadata and bulk data into DICOM binary instances.

If the media type of the received object is video/mpeg or video/mp4, then the Receiver shall use the appropriate Transfer Syntax for the received object as defined in the following table:

Table 3.108.4.1.3-1: Transfer Syntaxes for Video

Media Type	Eligible Transfer Syntax	Description
video/mpeg	1.2.840.10008.1.2.4.100	MPEG2 Main Profile @ Main Level
	1.2.840.10008.1.2.4.101	MPEG2 Main Profile @ High Level
video/mp4	1.2.840.10008.1.2.4.102	MPEG-4 AVC/H.264 High Profile / Level 4.1
	1.2.840.10008.1.2.4.103	MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1
	1.2.840.10008.1.2.4.XXX (See Note)	MPEG-4 AVC/H.264 High Profile / Level 4.2
	1.2.840.10008.1.2.4.YYY (See Note)	MPEG-4 AVC/H.264 Stereo High Profile up to Level 4.2

Note: These Transfer Syntaxes are defined in DICOM Supplement 180, which is currently available as public comment. The final Transfer Syntaxes will be defined when the supplement is balloted.

3.108.4.1.3.1 PNG Storage Option

A Receiver that supports the PNG Storage Option shall convert the encoded lossless PNG image into DICOM binary format with an appropriate standard uncompressed or lossless (reversible) compressed Transfer Syntax.

Table 3.108.4.1.3.1-1: Eligible Transfer Syntaxes for PNG Storage

Media Type	Eligible Transfer Syntax	Description
image/png	1.2.840.10008.1.2	Implicit VR Little Endian: Default Transfer Syntax for DICOM
	1.2.840.10008.1.2.1	Explicit VR Little Endian
	1.2.840.10008.1.2.1.99	Deflated Explicit VR Little Endian
	1.2.840.10008.1.2.4.57	JPEG Lossless, Non-Hierarchical (Process 14)
	1.2.840.10008.1.2.4.70	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression
	1.2.840.10008.1.2.4.80	JPEG-LS Lossless Image Compression
	1.2.840.10008.1.2.4.90	JPEG 2000 Image Compression (Lossless Only)
	1.2.840.10008.1.2.4.92	JPEG 2000 Part 2 Multi-component Image Compression (Lossless Only)
	1.2.840.10008.1.2.5	RLE Lossless

3.108.4.1.3.2 QuickTime Storage Option

A Receiver that supports this QuickTime Storage Option shall convert the encoded QuickTime video into DICOM binary format with the pixel data encoding using appropriate Transfer Syntax defined in Table 3.108.4.1.3-1.

3.108.4.1.3.3 3GPP Storage Option

A Receiver that supports this 3GPP Storage Option shall convert the encoded 3GPP video into DICOM binary format with the pixel data encoding using appropriate Transfer Syntax defined in Table 3.108.4.1.3-1.

3.108.4.2 Return Status Message

The Receiver reports the outcome of the Store Instances Message.

3.108.4.2.1 Trigger Events

The Receiver receives a Store Instances Message.

3.108.4.2.2 Message Semantics

This message is a DICOM STOW-RS response. The Sender is the User-Agent. The Receiver is the Origin-Server.

The Receiver shall return a response to the Sender according to DICOM PS3.18 Section 6.6.1.3.

Note: The Receiver may return a response before all processing is complete for the received object; for example, performing required image conversion asynchronously after sending the response. Sender implementers should be aware that such post-response processing may fail.

Note: The Receiver will honor the HTTP Accept header field for encoding of the response message. However, if the Sender accepts both XML and JSON, then the Receiver can choose either format for the response message.

3.108.4.2.3 Expected Actions

The Sender has no expected actions.

3.108.5 Security Considerations

3.108.5.1 Security Audit Considerations

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

Table 3.108.5.1-1: Audit Message for Store Instances over the Web [RAD-108]

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Store Instances over the Web [RAD-108]	Instances-stored	Receiver: Image Manager

3.108.5.2 Transport Security

In order to avoid unauthorized interception of private health information, the communication over HTTP may be secured by using HTTPS.

