

**Integrating the Healthcare Enterprise**



5

**IHE Radiology  
Technical Framework Supplement**

10

**Invoke Image Display  
(IID)**

15

**Rev. 1.3 - Trial Implementation**

20 Date: September 9, 2016  
Author: IHE Radiology Technical Committee  
Email: radiology@ihe.net

25

**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

30 This is a supplement to the IHE Radiology Technical Framework V15.0. 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 September 9, 2016 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 can be submitted at  
35 [http://www.ihe.net/Radiology\\_Public\\_Comments](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.

<i>Amend Section X.X by the following:</i>
--

40 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.

45 General information about IHE can be found at: [www.ihe.net](http://www.ihe.net).

Information about the IHE Radiology domain can be found at: [ihe.net/IHE\\_Domains](http://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](http://ihe.net/IHE_Process) and <http://ihe.net/Profiles>.

50 The current version of the IHE Radiology Technical Framework can be found at: [http://www.ihe.net/Technical\\_Frameworks](http://www.ihe.net/Technical_Frameworks).

55

**CONTENTS**

Introduction to this Supplement..... 4  
     Open Issues and Questions ..... 4  
 60    Closed Issues ..... 4  
 General Introduction ..... 6  
 Appendix A – Actor Summary Definitions ..... 6  
 Appendix B – Transaction Summary Definitions..... 6  
 Glossary ..... 6  
 65    **Volume 1 – Profiles** ..... 7  
     Copyright Licenses..... 7  
     Domain-specific additions ..... 7  
     2.1 Integration Profiles Overview ..... 7  
         2.1.35 Invoke Image Display ..... 7  
 70    2.3 Actor Descriptions ..... 7  
     2.4 Transaction Descriptions..... 8  
 35    Invoke Image Display (IID) Profile..... 9  
     35.1 Invoke Image Display (IID Actors, Transactions, and Content Modules) ..... 9  
         35.1.1 Actor Descriptions and Actor Profile Requirements..... 10  
 75    35.2 IID Actor Options ..... 10  
     35.3 IID Actor Required Groupings..... 10  
     35.4 IID Overview ..... 10  
         35.4.1 Concepts ..... 10  
         35.4.2 Use Case #1: Review Studies..... 14  
 80    35.5 IID Security Considerations ..... 16  
     35.6 IID Cross-Profile Considerations..... 17  
     **Volume 3 – Transactions (cont.)** ..... 19  
         4.106 Invoke Image Display [RAD-106]..... 19  
             4.106.1 Scope ..... 19  
 85          4.106.2 Use Case Roles ..... 19  
             4.106.3 Referenced Standards..... 19  
             4.106.4 Interaction Diagram..... 20  
             4.106.5 Security Considerations..... 26

## 90 Introduction to this Supplement

The Invoke Image Display Profile allows the user of an Image Display Invoker, typically a non-image-aware system like an EHR, PHR or RIS, to request the display of studies for a patient, and have the display performed by an image-aware system like an Image Display (PACS).

## Open Issues and Questions

### 95 Closed Issues

1. Should a SOAP-based version of the transaction be provided in addition to the HTTP GET URL request?

No. Demand for SOAP not expressed. Do this first.

- 100 2. What about viewer automatically showing relevant priors?

No. Don't burden the Image Display. Reports may or may not contain references to relevant priors (which could be put in the study message by the Invoker).

- 105 IdentifyRelevantPriors would be a good service to which you could send various context details and get back a list of relevant studyUIDs.

3. Is there value in including a "requesting physician" or similar parameter to constrain the patient request studies provided?

- 110 No. Redundant with security/access control mechanisms and does not work with teams (e.g., would need role rather than individual, etc.)

4. Should modality be an optional parameter for the patient request?

Yes. Useful to be able to ask just give me the latest CT instead of pulling a list and looking for CTs.

- 115 5. What baseline security mechanisms should the profile specify that the "server" be required to support?

Mention the server can request the user's credentials itself rather than attempting single sign on or delegated trust. Otherwise leave it out of scope.

- 120 6. How should the invoker choose the right root when multiple providers are possible in the same environment?

- 125 Current silence of the text is adequate. For a single service provider, a hardwired or configurable URL root suffices. Can query a list of multiple configured roots. Could receive appropriate root from the host (e.g., EMR), etc.

7. Is there a need to forbid caching?

OK to remain silent.

130 8. Should implementations be required to record various details in the Integration Statement?

No. IS references other documents where such information could be recorded. Should raise the issue with Domain Coord Cmte for further discussion.

135 9. Should "optional" parameters be explicitly required by the server?

Yes. They are optional only for the client, and were documented in the same manner as ITI RID but this may be confusing. Should submit a CP to ITI perhaps.

10. Should machine readable definitions of the interface be provided?

140 Yes. WSDL has been found useful for IHE SOAP interfaces, is familiar to some IHE implementers and WSDL is apparently appropriate for an http GET request even if there is no SOAP binding ("http://www.w3.org/TR/wsdl.html#\_http"). WADL is more typically used for this type of interface. Both will be provided as files in the ftp folder and referenced from the supplement.

145

## General Introduction

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

### 150 Appendix A – Actor Summary Definitions

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

Actor	Definition
Image Display Invoker	Requests display of DICOM image studies.

### Appendix B – Transaction Summary Definitions

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

Transaction	Definition
Invoke Image Display [RAD-106]	Invokes the display of DICOM image studies.

## Glossary

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

160 No new glossary items.

# Volume 1 – Profiles

## Copyright Licenses

N/A

## Domain-specific additions

165 *Add the new profile to Section 2 dependencies table*

**Table 2-1: Integration Profiles Dependencies**

Integration Profile	Depends on	Dependency Type	Comments
...	...	...	...
<u>Invoke Image Display</u>	<u>None</u>	<u>None</u>	=

*Add the new profile to Section 2.1*

170 **2.1 Integration Profiles Overview**

...

**2.1.35 Invoke Image Display**

175 The Invoke Image Display Profile allows the user of an Image Display Invoker, typically a non-image-aware system like an EHR, PHR or RIS, to request the display of studies for a patient, and have the display performed by an image-aware system like an Image Display (PACS).

*Add the following actors to Section 2.3*

**2.3 Actor Descriptions**

...

180 **Image Display Invoker** – An actor that requests that DICOM<sup>®1</sup> image studies be displayed by another actor (e.g., an Image Display Invoker might be an Electronic Health Record (EHR), Personal Health Record (PHR) or Departmental Information System (such as a Radiology Information System)).

...

---

<sup>1</sup> DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

185 *Add the following transactions to Section 2.4*

## **2.4 Transaction Descriptions**

...

**Invoke Image Display [RAD-106]** – An Image Display Invoker invokes the display of DICOM image studies by an Image Display.

190 ...



### 35 Invoke Image Display (IID) Profile

195 The Invoke Image Display Profile allows the user of an Image Display Invoker, typically a non-image-aware system like an EHR, PHR or RIS, to request the display of studies for a patient, and have the display performed by an image-aware system like an Image Display (PACS).

#### 35.1 Invoke Image Display (IID Actors, Transactions, and Content Modules)

200 Figure 35.1-1 shows the actors directly involved in the IID 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 that have a mandatory grouping are shown in conjoined boxes.

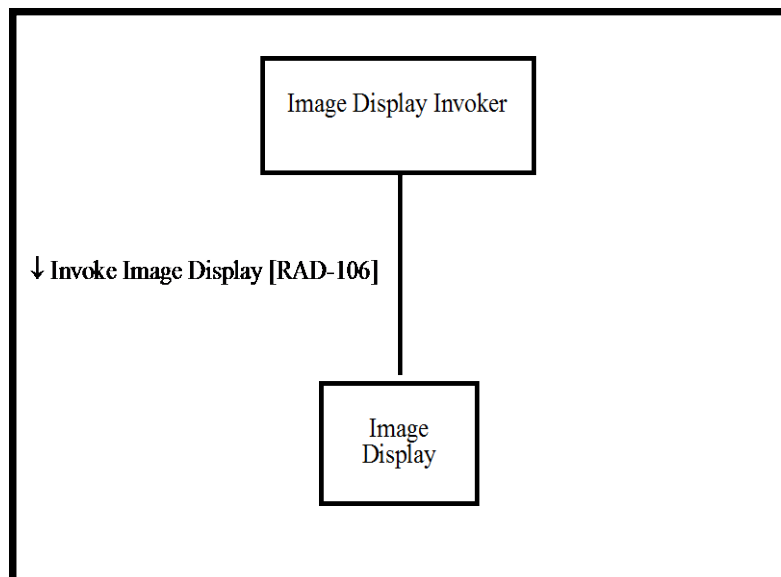


Figure 35.1-1: IID Actor Diagram

205

Table 35.1-1 lists the transactions for each actor directly involved in the IID profile. In order to claim compliance with this profile, an actor shall support all required transactions (labeled “R”) and may support the optional transactions (labeled “O”). Actor groupings are further described in Section 35.3.

210

Table 35.1-1: IID Profile - Actors and Transactions

Actors	Transactions	Optionality	TF Reference
Image Display Invoker	Invoke Image Display [RAD-106]	R	RAD TF-3: 4.106
Image Display	Invoke Image Display [RAD-106]	R	RAD TF-3: 4.106

### 35.1.1 Actor Descriptions and Actor Profile Requirements

#### 35.1.1.1 Image Display Invoker

215 This profile specifies only the interoperability requirements of the Image Display Invoker immediately associated with requesting the display of images.

#### 35.1.1.2 Image Display

220 In the absence of a claim of support for another profile that specifies requirements for Image Display, the Integration Statement for the Image Display shall include a link to documentation describing either explicitly, or by reference to its DICOM Conformance Statement, the type of images supported, such as the variants of DICOM images and evidence objects (which may include Presentation States, Evidence Documents, Key Image Notes).

The Image Display shall be able to provide both review and diagnostic quality. See RAD-TF-3: 4.106.4.2.2.2.

225 In the context of this profile, how the Image Display obtains the images to display based on the parameters provided, is not specified.

Note: E.g., it may be integrated with an Image Manager/Archive, Imaging Document Source or Imaging Document Consumer, or it might retrieve images from an Image Manager/Archive, etc.

### 35.2 IID Actor Options

230 Options that may be selected for each actor in this profile, if any, are listed in the Table 35.2-1. Dependencies between options when applicable are specified in notes.

**Table 35.2-1: Invoke Image Display - Actors and Options**

Actor	Options	TF Reference
Image Display Invoker	<i>No options defined</i>	--
Image Display	<i>No options defined</i>	--

### 235 35.3 IID Actor Required Groupings

None

### 35.4 IID Overview

#### 35.4.1 Concepts

240 The IID request to display a patient’s studies is implemented as a single HTTP request with the appropriate parameters identifying the patient or one or more studies, and accompanying

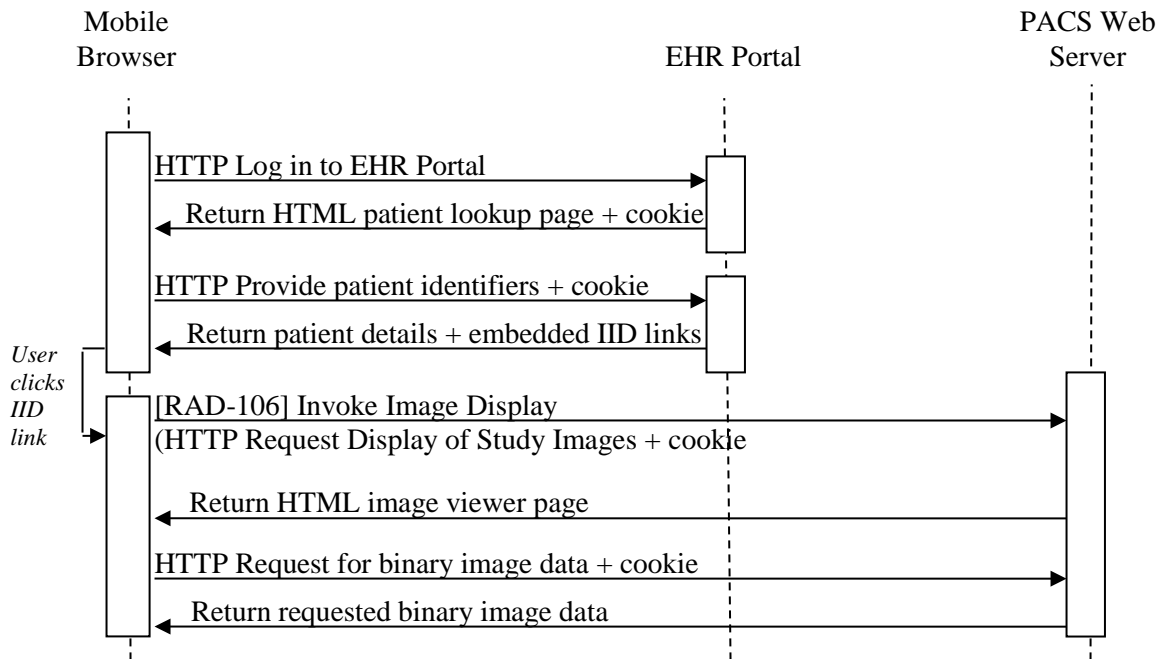
parameters describing the desired display behavior. The request is implemented as a simple HTTP GET with the parameters in the URL.

245 The Image Display is responsible for somehow displaying the images to the user. This may be via a current or new window hosted in a browser that shares a screen with, or is embedded in, the IDI, or it might be via a separate co-located hardware device that is driven directly by the Image Display, or it might be via a plug-in provided by the Image Display but executed on the IDI system, or it might be by some other means.

250 This profile does not specify what mechanism, browser or platform is necessary to actually execute the display software, or how to identify the user and control their access; these are matters of local IT infrastructure configuration, customization of software, or even configuration of software other than the browser +/- consumer plugins. An Image Display that complies with this profile will not necessarily be able to display images for an IDI actor that complies with this profile, due to such technical details that are not constrained or specified by this profile.

The following sections outline several conceptual scenarios where IID can be used.

255 **35.4.1.1 Mobile Web EHR Invoking Mobile Web Image Viewer**



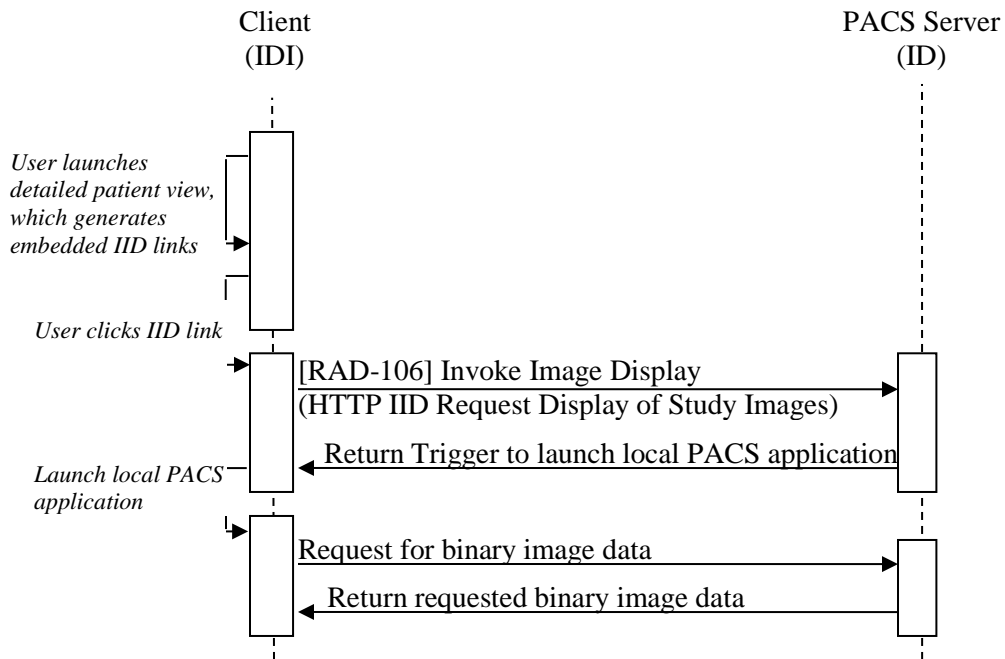
**Figure 35.4.1.1-1: Mobile Web EHR Invoking Mobile Web Image Viewer**

260 In this scenario, a user reviewing data on their mobile EHR application would like to review associated images to a report. Using IID, hyperlinks are generated by the EHR and displayed to the user; when clicked, it will launch a mobile web image viewer. The Image Display Invoker is the system which is responsible for the contents of the IID message string (in this scenario the

265 EHR which embeds the string as a link in the HTML that it provides to the Browser) even though the message is transmitted to the Image Display by another device (in this scenario the Mobile Browser).

Only the IID transaction is standardized within the scope of this profile; in particular, the “cookie” referenced in Figure 35.4.1.1-1 is a placeholder for any form of authentication session state information supported by the actors.

### 35.4.1.2 Desktop EHR Invoking Desktop Image Viewer

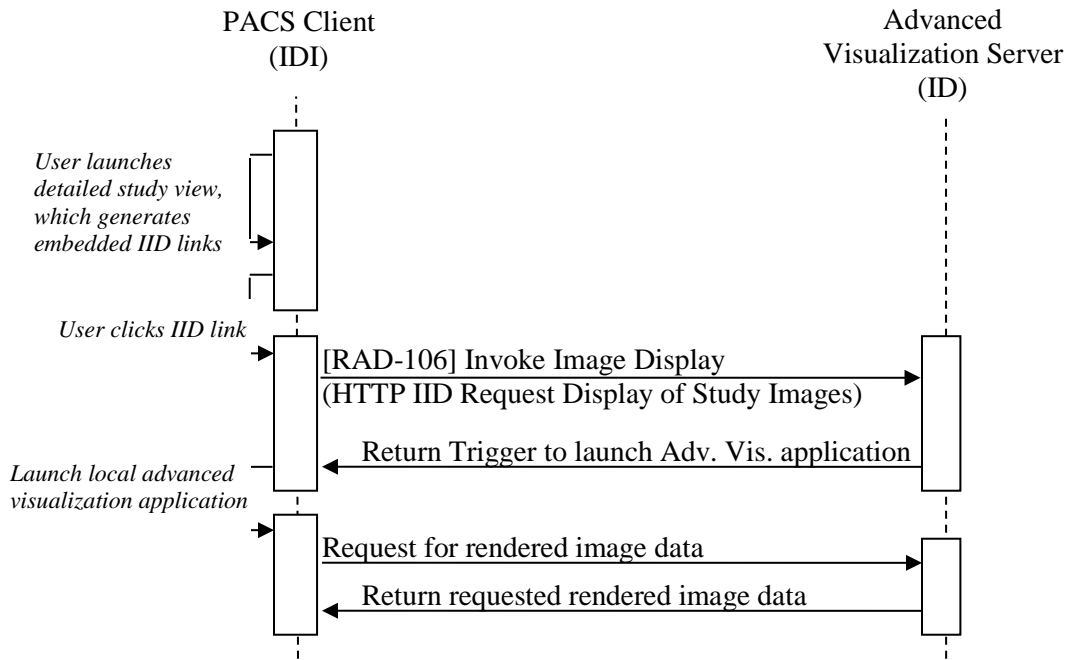


270

**Figure 35.4.1.2-1: Desktop EHR Invoking Desktop Image Viewer**

275 In this scenario, a user reviewing data on their EHR desktop application requires access to diagnostic quality images for treatment decision-making. Using IID, buttons are generated in the desktop application, and when clicked, will launch a transient popup page that triggers the startup of a local PACS viewing application and then commands that application to display the selected study.

### 35.4.1.3 Advanced Image Display



280

**Figure 35.4.1.3-1: Advanced Image Display**

285 Similar to 35.4.1.2, this scenario demonstrates how this profile applies not only to traditional EHR to PACS launches, but also to any application that triggers the launch of any other application with an image-specific context, such as an advanced visualization tool. Note that in this scenario the PACS Client is the Image Display Invoker, not the Image Display.

### 35.4.1.4 Launching Image Viewer on Adjacent Workstation

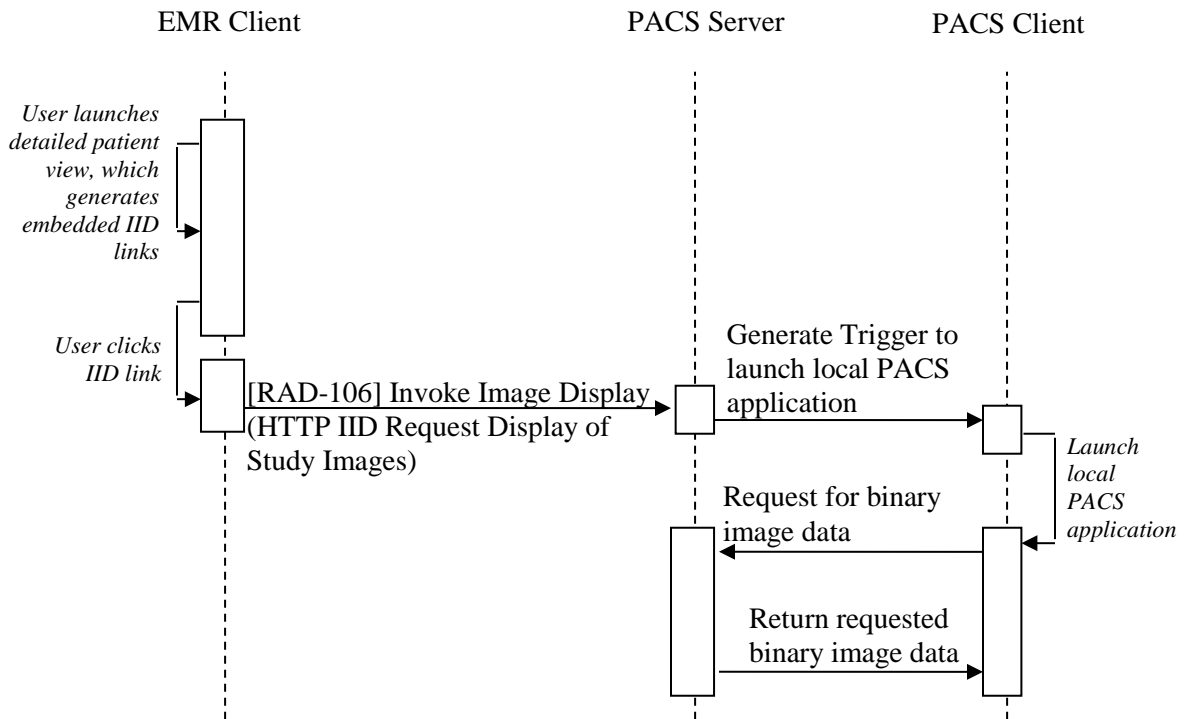


Figure 35.4.1.4-1: Launching Image Viewer on Adjacent Workstation

290 This scenario demonstrates how IID can be extended beyond traditional platforms. In this case, IID is used to trigger a launch on another physical device; for example, a regular workstation running an EMR Client side-by-side with a specialized PACS workstation.

## 35.4.2 Use Case #1: Review Studies

### 35.4.2.1 Review Studies Use Case Description

295 The user of an EHR, PHR or RIS computer or mobile device application can open a link to review the study data on that device using the Invoke Image Display transaction.

Note: The Image Display may support a full functionality image review client that can be hosted on the EHR/PHR/RIS. Such a client application may or may not be an Image Display (in other IHE profiles) using DICOM transactions with the Image Manager/Image Archive.

300 Specific variants of this use case include:

1. A nurse practitioner, physician assistant or physician not expert in imaging is using the EHR and wants to review only key images on mobile device; the user clicks on a "key image review" button or a hyperlink in the radiology report, for a dated study entry for a patient in the web application; the web browser tab switches to one that contains adequate review quality (not diagnostic) key images.

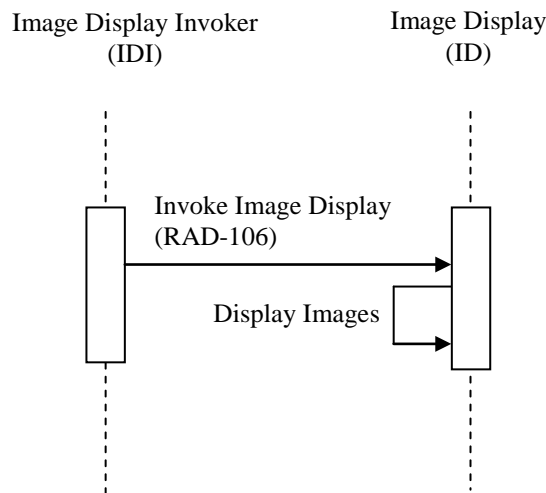
305

2. A physician or surgeon expert in imaging is called to consult on an emergency patient and is using an EHR application on a desktop computer (with a high speed connection to the local network and with diagnostic quality displays); the user is reviewing the patient's status and results, and wants to see the diagnostic quality images for treatment decision making; the user clicks on "diagnostic image review" (or a hyperlink in the preliminary or final radiology report, if one has been issued already) in a dated study entry for the patient in EHR web portal; a new web browser page executing a zero footprint viewer displays a complete set of diagnostic quality images for the selected study.  
310
3. The same situation as 2, but when the user clicks on "diagnostic image review", a transient popup page opens that triggers startup of local PACS viewing application and then commands that application to display the selected study.  
315
4. The same situation as 2, but when the user clicks on "diagnostic image review", an already running local PACS viewing application is commanded to display the entire study selected.  
320
5. The same situation as 2, but when the user clicks on "diagnostic image review", a separate workstation with specialized hardware running PACS workstation software, physically co-located with the EHR workstation, is commanded to display the entire study selected.  
325
6. A physician or surgeon expert in imaging is located in another enterprise (a trauma center) than where the patient is currently physically located (the emergency department of a rural community hospital), and is evaluating whether the patient needs to be transferred for treatment; the user has credentials on the EHR and PACS portals of the remote site, with restricted access to transfer candidate patients only; the user interacts with the remote EHR and thence the remote PACS using their mobile device with review quality images, decides that diagnostic quality images are required, and repeats the review using a diagnostic quality workstation, again interacting first with the remote EHR and then invoking display by the remote PACS of the studies from the EHR application; the patient is not yet registered in the local enterprise, and only remote applications are executed, displaying on local hardware.  
330
7. A physician or surgeon expert in imaging is consulting on a new patient referred from an outside facility, either as an inpatient or in an ambulatory setting; the patient's history (including radiology reports) has been previously loaded into the local EHR and the patient's images are available on the external regional image repository, where they are indexed by an identifier different from the local medical record number, but known to the EHR; the user has credentials to view images in the external regional image repository (also known to the EHR); the user clicks on a hyperlink in a prior radiology report displayed in the EHR, and a viewer supplied by external regional image repository but running on the local hardware displays a complete set of diagnostic quality images for the selected study.  
335  
340
8. The same situation as 7, except that the EHR has not stored the user's credentials for access to the external regional image repository, hence the user is prompted for their  
345

username and password by the remote external regional image repository before they are permitted to view the images.

- 350 9. A patient's relative/friend/neighbor who is a specialist radiologist is asked by the patient to review their images; together, using the patient's credentials to login to the patient portal of the hospital EHR, they read the radiology report and then click on a hyperlink to display their images; the patient portal of the hospital PACS, recognizing that the patient is permitted access to their own images (only) displays a complete set of diagnostic quality images for the selected study on the radiologist's teleradiology hardware that is
- 355 being used for the session.
10. The same situation as in 9, except that the patient's record being reviewed is in the patient's own PHR, provided by their insurance company, and the images are stored in a regional image repository, provided by the regional government.
- 360 11. The same situation as in 2, but the basic image viewer user wants to invoke a separate advanced visualized application for the same studies as they were already looking at, so requests the viewer software to invoked the more advanced application on the same studies.

### 35.4.2.2 Review Studies Process Flow



365 **Figure 35.4.2.2-1: Basic Process Flow in IID Profile**

## 35.5 IID Security Considerations

370 The Invoke Image Display Profile may be used in a variety of environments, from small ambulatory practices, to large enterprises or cross-enterprise. The threat models for those environments may vary widely, and hence the IID Profile does not mandate any specific security protections.

Deployments should consider whether or not:



- The Image Display Invoker requires user authentication to access patient data.
- The Image Display uses credentials supplied by the Image Display Invoker in the Invoke Image Display transaction, or whether the Image Display requires its own user logon authentication
- Whether the Image Display Invoker or the Image Display (or both) records access in an audit log.

375  
380 The form and granularity (patient or study level) of any audit logging by the Image Display Invoker and the Image Display are outside the scope of the IID Profile. The ITI Audit Trail and Node Authentication (ATNA) Profile is recommended if appropriate to the deployment environment.

385 How the Image Display Invoker supplies credentials to the Image Display in order to provide the user with a seamless "single sign on" experience, if it does, is not defined in this profile. The HTTP GET URL transaction allows for a range of authentication mechanisms including HTTP basic authentication (over a secure connection to protect the cleartext credentials), digest authentication, client certificate based authentication, provision of a SAML assertion in an authentication header, or other mechanisms that are suitable for stateless atomic single phase transactions.

390 Whether the Image Display requires that the Image Display Invoker identify the user individually in order to perform access control, or whether it trusts the Image Display Invoker regardless of the user, or uses some delegated authority mechanism, is outside the scope of the IID Profile.

395 Not all approaches to deployment and management of security credentials will support sufficiently restrictive access control to support all use-cases, particularly those involving access by patients themselves, and cross-enterprise access.

### 35.6 IID Cross-Profile Considerations

400 Some uses cases for invoking image display involve access only to locally acquired images, others are to allow the review of images that have been acquired in other locations, and to share images acquired locally with other institutions. Each institution thus needs to be able to either provide remote access or to exchange images with other institutions' EHR and image management systems.

405 The IID Profile considers only the manner of requesting that images be displayed if they are known to the system, regardless of whether they were acquired locally, imported, or reside in remote systems.

The Image Display Invoker may be faced with the need to determine what endpoint (URL root) they need to connect to in order to choose the right Image Display.

In the absence of a service to look up the endpoints, a hardwired or configurable (set of) URL roots may be required.

410 **SWF – Scheduled Workflow**

An Image Display in SWF that also claims IID can use query/retrieve to access images for display.

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

415 An Imaging Document Source in XDS-I.b might be grouped with an Image Display to respond to requests from outside IDIs, and no XDS-I.b transactions are required.

420 Alternatively, an Imaging Document Consumer in XDS-I.b might be grouped with an Image Display to locate and access remote study data for presentation to local Image Display Invokers. The Image Display might use the assigning authority provided in the invocation request to get guidance on the affinity domain to search. The Imaging Document Consumer retrieves the images using XDS-I.b transactions from the Imaging Document Source, for use by the Image Display.

**IRWF – Import Reconciliation Workflow**

An Importer in IRWF might be grouped with an Image Display to display images that have been imported and adjusted to match local identifiers.

425 **CPI – Consistent Presentation of Images**

An Image Display in CPI that also claims IID can apply presentation states during display, and to use a calibrated display. Note that the presentations states in question may have been created in the context of the Presentation of Grouped Procedures (PGP) Profile.

**KIN – Key Image Note**

430 An Image Display in KIN that also claims IID can apply Key Object Selection documents that may be present in the study as appropriate.

**IOCM – Image Object Change Management**

435 An Image Display in IOCM that also claims IID can suppress the display of rejected images in the requested studies. An Image Display that only supports KIN might present the images along with the KOS describing their rejection

## Volume 3 – Transactions (cont.)

Add Section 4.106

### 4.106 Invoke Image Display [RAD-106]

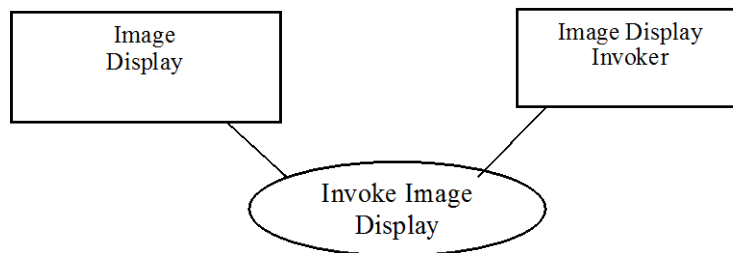
440 This section corresponds to Transaction RAD-106 of the IHE Radiology Technical Framework. Transaction RAD-106 is used by the Image Display and Image Display Invoker actors.

This transaction is derived from CARD-15 and ITI-11.

#### 4.106.1 Scope

In the Invoke Image Display Transaction, the Image Display provides an HTTP interface to command display of stored DICOM images and evidence in one or more studies.

#### 445 4.106.2 Use Case Roles

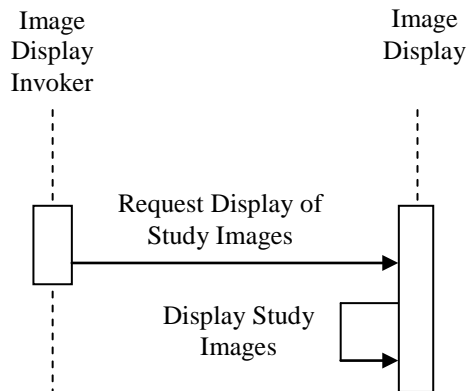


<b>Actor:</b>	Image Display Invoker
<b>Role:</b>	Requests display of DICOM image studies.
<b>Actor:</b>	Image Display
<b>Role:</b>	Displays DICOM image studies.

#### 4.106.3 Referenced Standards

- IETF RFC1738, Uniform Resource Locators (URL), <http://www.ietf.org/rfc/rfc1738.txt>
- 450 IETF RFC2616 HyperText Transfer Protocol HTTP/1.1, <http://www.ietf.org/rfc/rfc2616.txt>
- Extensible Markup Language (XML) 1.0 (Second Edition). W3C Recommendation 6 October 2000. <http://www.w3.org/TR/REC-xml>.
- Web Services Description Language (WSDL) 1.1. W3C Note 15 March 2001. <http://www.w3.org/TR/wsdl>.

455 **4.106.4 Interaction Diagram**



**4.106.4.1 Request Display of Study Images Message**

**4.106.4.1.1 Trigger Events**

The following event will trigger a Request Display of Study Images – Patient-based:

- 460
- User of the Image Display Invoker needs to review imaging studies for a specific patient (optionally in a specific date range).

The following event will trigger a Request Display of Study Images – Study-based:

- User of the Image Display Invoker needs to review specific imaging studies, using identifiers of the study as keys.

465 **4.106.4.1.2 Message Semantics**

These messages are implemented as an HTTP request and response.

The Image Display Invoker shall support both Patient-based and Study-based requests.

Table 4.106.4.1.2-1 specifies the HTTP request parameters for the patient-based request.

Table 4.106.4.1.2-2 specifies the HTTP request parameters for the study-based request.

470

The Image Display shall support all parameters, including those that are optional, except that the viewerType may not be recognized. The Image Display shall return at least all exact matches to the query parameters sent by the Image Display Invoker; IHE does not further specify matching requirements.

475 All parameter names and values are case-sensitive (except for patientName values).

**Table 4.106.4.1.2-1: HTTP Request Parameters – Patient-based**

Parameter Name	REQ	Description	Notes
requestType	R	Specifies what type of information shall be provided.	Shall have the value PATIENT
patientID	R	Identifies the subject of the studies being requested. Its value shall include identification of assigning authority.	Shall be formatted as HL7 <sup>®2</sup> CX data type according to the requirements specified for the Patient Identity Feed transaction (see ITI TF-2a: 3.8.4.1.2.3)
patientName	O	Assists in the identification of the subject of the studies being requested, in case the patientID is unrecognized.	Shall be encoded in the DICOM PN format.
patientBirthDate	O	Assists in the identification of the subject of the studies being requested, in case the patientID is unrecognized	Shall be encoded in the XML primitive dateTime format.
lowerDateTime	O	Used to constrain the earliest study date/time.	Shall be encoded in the XML primitive dateTime format.
upperDateTime	O	Used to constrain the latest study date/time.	Shall be encoded in the XML primitive dateTime format.
mostRecentResults	O	The number of most recent studies to be included into the response.	Omitting this parameter means the server will decide how many or how few results to return.
modalitiesInStudy	O	This attribute identifies one or more modalities being requested, by comma-delimited DICOM Modality values.	Selects any study that contains a series with any one of the specified modality values
viewerType	O	The type or name or family of viewer requested	The value of viewerType may be implementation defined or a well-known value; see Section 4.106.4.2.2.1
diagnosticQuality	O	The quality of display requested.	Value of "true" indicates that diagnostic quality is requested; value of "false" indicates that diagnostic quality is not requested; see Section: 4.106.2.2.2
keyImagesOnly	O	Whether or not only key images are displayed	Value of "true" indicates that only key images are requested; value of "false" indicates that a complete set of images is requested; see Section 4.106.4.2.2.3

480

- Notes:
1. The patientID, lowerDateTime, upperDateTime, and mostRecentResults parameters are identical to those of the Retrieve Specific Information for Display [ITI-11] SUMMARY request.
  2. If subcomponents of the CX data type are used for the patientID (such as in the Assigning Authority component), the HL7 subcomponent delimiter '&' must be escaped to '%26', as & is the delimiter for the HTTP parameters.

<sup>2</sup> HL7 is the registered trademark of Health Level Seven International.

485

**Table 4.106.4.1.2-2: HTTP Request Parameters – Study-based**

Parameter Name	REQ	Description	Notes
requestType	R	Specifies what type of information shall be provided.	Shall have the value STUDY
studyUID	C	Identifies one or more DICOM studies being requested	Shall contain a comma-delimited list of Study Instance UID values. Required if accessionNumber is not present. Shall not be present otherwise.
accessionNumber	C	Identifies one or more DICOM studies being requested.	Shall contain a comma-delimited list of Accession Number values. Required if studyUID is not present. Shall not be present otherwise.
viewerType	O	The type or name or family of viewer requested	The value of viewerType may be implementation defined or a well-known value; see Section.4.106.4.2.2.1
diagnosticQuality	O	The quality of display requested.	Value of "true" indicates that diagnostic quality is requested; value of "false" indicates that diagnostic quality is not requested; see Section 4.106.4.2.2.2
keyImagesOnly	O	Whether or not only key images are displayed	Value of "true" indicates that only key images are requested; value of "false" indicates that a complete set of images is requested; see Section 4.106.4.2.2.3

Formal definition of the HTTP Request in WSDL and in WADL is provided on the IHE FTP site: [ftp://ftp.ihe.net/TF\\_Implementation\\_Material/Rad/](ftp://ftp.ihe.net/TF_Implementation_Material/Rad/).

490 The only binding required for both the Image Display Invoker and Image Display is the binding to the HTTP-GET. In this binding, messages are formatted as in the following examples, in which the normative components are indicated in bold, the deployment-specific components are in normal text, and the instance-specific parameter values are in italics:

**http://<location>/IHEInvokeImageDisplay?requestType=PATIENT&patientID=99998410^^AcmeHospital&mostRecentResults=1**

495 **http://<location>/IHEInvokeImageDisplay?requestType=STUDY&studyUID=1.2.840.11388.3.19.110.4.1.2.840.113883.19.110.5&viewerType=IHE\_BIR&diagnosticQuality=true**

500 The <location> part of the URL is configurable by the implementation, and must contain the host name, an optional port address, and may be followed by an optional path. The path, if present, may not contain a '?' character. The remainder of the URL, including IHEInvokeImageDisplay and the following request parameters, are specified by the message semantics and may not be changed. See the discussion about <location> in ITI TF-2a: 3.11.4.1.2.

The Image Display Invoker may perform the request utilizing the HTTPS protocol.

505 Image Display Invoker Actors can expect to receive an error response, or the data requested, or a request to look elsewhere for the data. An Image Display Invoker must follow redirects (responses with values of 301, 302, 303 or 307), but if a loop is detected, it may report an error.

**4.106.4.1.3 Expected Actions**

The Image Display shall support the HTTPS protocol.

The Image Display shall return an HTTP response.

510 The Image Display shall return HTTP response code 404 (Not Found) if it cannot locate the requested identifiers, or if no studies meet the parameters, or the studies contain no images.

The Image Display may return HTTP redirect responses (responses with values of 301, 302, 303 or 307) in response to a request.

515 If there are no errors, the contents of the DICOM Study or Studies matching the request parameters shall be displayed by the Image Display, as specified in Section 4.106.4.2. If there are errors, any previously displayed images of a different Patient or Study shall be closed, to prevent incorrect interpretation.

520 The Image Display shall provide a mechanism to handle the case where multiple studies satisfy the request parameters. For example, this might involve letting the user select from the set of matching studies, or providing side-by-side display for comparison, or providing sequential display of the matching studies.

**4.106.4.2 Display Study Images**

The Image Display displays the contents of the requested studies.

**4.106.4.2.1 Trigger Events**

The Request Display of Study Images message initiates this action by the Image Display.

525 **4.106.4.2.2 Message Semantics**

**4.106.4.2.2.1 Viewer Type**

A parameter in the request specifies whether a particular type of viewer is requested.

530 The Image Display is not required to support this parameter, but may do so if it is able to provide different types of viewer. If the value of the parameter is not recognized by the Image Display, it shall ignore it and use any viewer it wants and not return an error.

The value of viewerType may be implementation defined or a well-known value.

Well-known viewer types are defined in Table 4.106.4.2.2.1-1.

**Table 4.106.4.2.2.1-1: Well-Known Values for Viewer Type Parameter**

Parameter Value	Description	Notes
IHE_BIR	Viewers compliant with the IHE Basic Image Review (BIR) Profile.	

535

#### **4.106.4.2.2.2 Diagnostic Quality**

A parameter in the request specifies whether or not diagnostic quality is requested.

Diagnostic quality is display of a complete set of images with the quality required to make a diagnosis or clinical decision.

540 The Image Display shall be able to provide diagnostic quality, assuming that the display hardware and viewing environment are appropriate.

When diagnostic quality is not requested, a lower quality display may be provided, sufficient for review, for the purpose of providing sufficient quality but faster, if it is necessary to sacrifice quality for adequate interactive performance.

545 The Image Display shall be able to provide review quality.

Factors that affect quality include the capabilities of the viewer, and whether or not irreversible compression, spatial or contrast down-sampling or other forms of image processing have been applied.

550 It is beyond the scope of this transaction to specify more detail, but regulatory authorities hold manufacturers to standards of performance according to a claim of diagnostic quality in the labeling of the device. The intent is that when the user requires and requests diagnostic quality, the quality should not be limited by the software, storage or transmission mechanisms used by the Image Display.

If the parameter is not supplied, the default shall be review quality.

#### **555 4.106.4.2.2.3 Key Images Only**

A parameter in the request specifies whether or not only key images are requested.

560 Key images in this context are those that have been designated within the information about the Study that is available to the Image Display as being key from the perspective of being relevant clinically. The radiologist may have designated them during authoring of the report, or at some other time. The designation of key images in the Image Display may use the Key Image Note Profile, or may use the DICOM Key Object Selection SOP Class, or some other mechanism.

If key images only are requested (the parameter has a value of true), the Image Display shall initially display only those images. It may provide a means of navigation to other images subsequently.

565 If key images only are not requested (the parameter is absent or has a value of false), or if there are no key images specified for a study, then the complete set of images shall be displayed.

#### **4.106.4.2.3 Expected Actions**

570 The Image Display shall display all requested DICOM objects for which it claims compliance in any IHE Content or Workflow profile or DICOM Conformance Statement. This includes images (single frame and multi-frame), DICOM SR (including Evidence Documents and Key Image Notes), and Presentation State objects with their referenced images. All supported DICOM



575 information objects included in the selected studies shall be displayable, except images identified as “for processing”, raw data instances, and instances of private SOP Classes. It is permissible to display “for processing”, raw data instances, and instances of private SOP Classes. There are no specific requirements placed on the manner in which non-image objects are displayed.

Note: Grouping with other profiles, such as CPI, SINR, and KIN, may require more specific behavior for non-image objects.

580 The required behavior for display of images is specified in the Retrieve Images transaction View Images Behavior section (RAD TF-2: 4.16.4.2); any additional behavior defined by other profiles claimed in conjunction with this transaction (such as the Mammography Image Profile) is defined therein.

585 The Image Display shall provide interactive viewing. Interactive viewing in the context of this transaction is defined to be the ability to navigate within the requested studies (including change studies, series, and scroll between images and frames), and manipulate the appearance of the displayed image (window, zoom and pan).

Note: A more complete definition of interactive viewing capability in other contexts is provided in the Basic Image Review (BIR) Profile, but support of the BIR Profile is NOT a baseline requirement of the Image Display in this transaction, though it may be requested using the optional viewerType parameter.

590 Display may be (but is not required to be) in the form of a web-based client interaction to one or more windows opened, or already open, on the Image Display Invoker. Any necessary plug-ins shall be automatically downloaded from the Image Display, if not already installed on the Image Display Invoker client.

There is no requirement that the image be displayed on the same device hardware as the Image Display Invoker is running on.

595 The specific viewer technology used is outside the scope of this transaction, but the IHE Integration Statement for the Image Display and the Image Display Invoker shall include a link to documentation describing the technology required.

600 Note: The area of web interaction technologies is rapidly evolving, and the producers of Image Display products with web interfaces are very cognizant of the need to display properly on the variety of platforms that are used for EHR systems. The IHE Cardiology and Radiology Technical Committees have decided that over-specification of this interaction would be counter-productive to innovation in implementation of effective user interfaces. This transaction therefore specifies only the initial HTTP invocation, and the functional requirement for display of all study information objects. During Trial Implementation, the committee will monitor whether this approach is achieving the requisite level of interoperability.

605 As an example, the provider of the interactive display may provide an HTML page that does whatever is necessary, including, but not limited to, such methods as:

- HTML5/Canvas zero footprint viewer
- traditional HTML +/- JavaScript JPEG/PNG viewer or plugin (Flash, Silverlight) embedded (in-browser) viewer
- 610 • Java WebStart or ActiveX viewer
- triggers proprietary installed plugin to feed or launch local viewer application

**4.106.5 Security Considerations**

615 User access control is managed outside of the specification of this transaction. This transaction makes few assumptions about the security environment (see RAD TF-1: 35.5 - IID Security Considerations).

**4.106.5.1 Security Audit Considerations**

The Image Display may record in an audit log the requesting client network address and the identifiers of the patient and studies displayed, together with any additional information (such as authenticated user identity).

620 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.

*Editor: Add the following row to RAD TF-3: Table 5.1-2*

625 **Table 5.1-2: IHE Radiology transactions and resulting ATNA trigger events**

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Patient Registration [RAD-1]	Patient-record-event	ADT Order Placer, DSS/OF – when PHI is presented
...		
<b><u>Invoke Image Display [RAD-106]</u></b>	<b><u>Study-used</u></b>	<b><u>Image Display Invoker</u></b> <b><u>Image Display</u></b>