Integrating the Healthcare Enterprise

IHE Radiology Technical Framework

Volume 3

(IHE RAD TF-3)

Transactions (continued)

Revision 11.0 Final Text

July 24, 2012

CONTENTS

1 Introduction

Integrating the Healthcare Enterprise (IHE) is an initiative that promotes the use of standards to achieve interoperability of health information technology (HIT) systems and effective use of electronic health records (EHRs). IHE provides a forum for volunteer committees of care providers, HIT experts and other stakeholders in several clinical and operational domains to reach consensus on standards-based solutions to critical interoperability issues. IHE publishes the implementation guides they produce (called *IHE profiles*), first to gather public comment and then for trial implementation by HIT vendors and other system developers.

IHE provides a process for developers to test their implementations of IHE profiles, including regular testing events called Connectathons. After a committee determines that a profile has undergone sufficient successful testing and deployment in real-world care settings, it is incorporated in the appropriate IHE Technical Framework, of which the present document is a volume. The Technical Frameworks provide a unique resource for developers and users of HIT systems: a set of proven, standards-based solutions to address common interoperability issues and support the convenient and secure use of EHRs.

Purchasers can specify conformance with appropriate IHE profiles as a requirement in requests for proposal. Vendors who have successfully implemented IHE profiles in their products can publish conformance statements (called IHE Integration Statements) in the IHE Product Registry (http://product-registry.ihe.net).

The current versions of this and all IHE Technical Framework documents are available at http://www.ihe.net/Technical_Framework/index.cfm/. Comments may be submitted at http://www.ihe.net/radiology/radiologycomments.cfm.

IHE domain committees are responsible for developing and publishing Technical Framework documents. This document is published by the IHE Radiology committees. Information on the activities of this domain, including its committee rosters and how to participate, is available at http://wiki.ihe.net/index.php?title=Domains.

General information about IHE, including its governance structure, sponsorship, member organizations and work process, is available at www.ihe.net.

1.1 Overview of Technical Framework

This document, the IHE Technical Framework, defines specific implementations of established standards to achieve integration goals that promote appropriate sharing of medical information to support optimal patient care. It is expanded annually, after a period of public review, and maintained regularly through the identification and correction of errata. The latest version of the document is always available via the Internet at http://www.ihe.net/Technical_Framework/index.cfm/.

The IHE Technical Framework defines a subset of the functional components of the healthcare enterprise, called IHE Actors, and specifies their interactions in terms of a set of coordinated, standards-based transactions. It defines this body of transactions in progressively greater depth. Volume 1 provides a high-level view of IHE functionality, showing the transactions organized

4into functional units called Integration Profiles that highlight their capacity to address specific clinical needs. Volume 2 provides detailed technical descriptions of IHE transactions RAD-1-31, defined and implemented in the first three years of the IHE initiative (1999-2001), along with a description of the conventions used to define IHE transactions and an overview of the concepts of IHE Actors and transactions. The present volume provides detailed technical descriptions of IHE transactions RAD-32-69, defined and implemented in the 2002-2012 cycle of work.

1.2 Overview of Volume 3

The body of this volume is a continuation of section 4 of volume 2. It defines transactions RAD-32-69 in detail, specifying the roles for each actor, the standards employed, the information exchanged, and in some cases, implementation options for the transaction. For a description of the conventions used to define the standards-based transactions implemented under IHE and an overview of the concepts of IHE actors and transactions, see volume 2 of the Technical Framework. The appendices following the main body of this volume provide clarification of technical details of the IHE data model and transactions. The final section of the volume is a glossary of terms and acronyms used in the IHE Technical Framework, including those from relevant standards (such as HL7, DICOM, IETF, W3C, ISO/CCITT, etc.).

4 IHE Transactions

This section continues the definition of each IHE transaction in detail, specifying the standards used, the information transferred, and the conditions under which the transaction is required or optional. **See Volume 2, section 4 of the IHE Radiology Technical Framework for description of Transactions RAD-1 through RAD-31.**

4.32 Authenticate Node - Deprecated

This transaction is identical to, and has been superseded by the Authenticate Node as part of the ITI Audit Trail and Node Authentication Profile (ITI TF-2a: 3.19).

4.33 Maintain Time - Deprecated

This transaction is identical to, and has been superseded by the Maintain Time as part of the ITI Consistent Time Profile (ITI TF-2a: 3.1).

4.34 Record Audit Event - Deprecated

This transaction has been superseded by the Record Audit Event as part of the ITI Audit Trail and Node Authentication Profile (ITI TF-2b: 3.20) and the Radiology Audit Trail Option described in RAD TF-3: 5.1. While the Record Audit Event ITI-20 transaction extends this deprecated transaction, it is still backward compatible.

4.35 Charge Posted

This section corresponds to Transaction RAD-35 of the IHE Technical Framework. Transaction RAD-35 is used by the Department System Scheduler/Order Filler and Charge Processor actors.

4.35.1 Scope

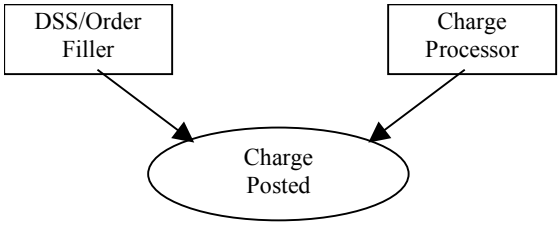
The Charge Posted Transaction specifies a message from the Department System Scheduler/Order Filler to the Charge Processor. This HL7 Financial Transaction message contains procedure data typically needed to generate a claim.

The Department System Scheduler/Order Filler provides the procedure data that is used by the Charge Processor. The Charge Processor may or may not expect the actual transaction fees associated with the procedures included in the transaction. In some situations, the Department System Scheduler/Order Filler is best able to match the procedure details to the appropriate fees. In other situations, the Charge Processor performs this function. In either case, the Charge Processor can override the fees provided by the Department System Scheduler/Order Filler.

The ways and means of ensuring the required data is complete is the responsibility of the Charge Processor and is outside the scope of IHE.

Note: although IHE specifies real-time charge posted transactions, batch processing can be accommodated as per the batch specifications defined in HL7 Chapter 2, sec. 2.23.2.

4.35.2 Use Case Roles



Actor: Department System Scheduler/Order Filler

Role: Collects information relevant to the posting of charges and submits it to the Charge Processor.

Actor: Charge Processor

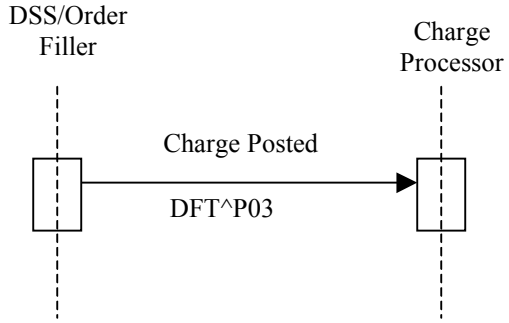
Role: Receives the information from the Department System Scheduler/Order Filler. Processes and combines charges in order to issue an insurance claim or patient's billing statement.

4.35.3 Referenced Standards

Health Level Seven, Version 2.3.1: Chapter 6 - Financial Management

DICOM 2011 PS 3.4 Modality Performed Procedure Step SOP Class

4.35.4 Interaction Diagram



4.35.4.1 Financial Transaction Message

The Detailed Financial Transaction (DFT) message is used to describe a financial transaction transmitted between the Department System Scheduler/Order Filler and the Charge Processor.

Note that sometimes the DFT does not actually result in a financial transaction.

4.35.4.1.1 Trigger Events

The Department System Scheduler/Order Filler determines when the charge posted transactions are to be sent to the Charge Processor. There are two types of financial billing transactions – Technical and Professional. Each can be triggered at a separate time or both can be sent at the same time - depending on the site configuration.

- Technical Billing

Charge posting of the Technical Billing for a procedure is typically triggered when the procedure is completed. The Performed Procedure Step Manager sends the MPPS Completed message to the Department System Scheduler/Order Filler. The Department System Scheduler/Order Filler is now aware that the procedure has been completed and sends the technical charge information to the Charge Processor.
Technical Billing for certain post-processing operations, such as Mammography CAD, is triggered when the Department System Scheduler/Order Filler receive confirmation from the Post-processing Manager that the step has been completed. The Department System Scheduler receives this confirmation by grouping with Post-Processing Manager; if Post-Processing Manager is grouped with Image Manager, Charge Posting of the Professional Billing will be triggered by the Performed Work Status Update message to the Department System Scheduler/Order Filler that specifies completion of the post-processing operation.

- Professional Billing

  Charge posting of the Professional Billing is triggered when a report is completed/verified by the radiologist. When the Department System Scheduler/Order Filler is aware that the report is completed it sends the professional charge information to the Charge Processor.
  The Department System Scheduler/Order Filler may receive confirmation from the Report Manager that the report has been completed and verified. Department System Scheduler receives this confirmation by grouping with Report Manager. If Report Manager implements the Reporting Workflow Profile, Charge Posting of the Professional Billing will be triggered by the Performed Work Status Update transaction that specifies completion of the report.

4.35.4.1.2 Message Semantics

The Department System Scheduler/Order Filler uses the DFT message to convey necessary charge posting information to the Charge Processor. The Charge Processor shall obtain the related Patient Demographic information from the ADT Patient Registration transaction generally received earlier.

The Department System Scheduler/Order Filler uses information from the Modality Performed Procedure Step Completed/Discontinued transaction to verify the procedure has been completed. This information can also include the DICOM Billing and Material Management Code Module which provides procedure, materials and devices information.

The Charge Posted Transaction will transmit Detailed Financial Transactions (DFT) messages using the P03 event.

One or more PR1 segments shall be present if additional procedures, materials or devices are present. It may be absent otherwise.

Note: Additional qualifications to the level of specification and HL7 profiling are stated in RAD TF-2: 2.3.

Required segments are defined below. Other segments are optional

DFT Segment	Detailed Financial Transaction Message	Chapter in HL7 2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[PV1]	Patient Visit	3 (see note)
{FT1}	Financial Transaction	6
[{PR1}]	Procedure	6

Note: PV1 is required if use of PV1-19 Visit Number is required per the applicable regional or national appendices to the IHE Technical framework (See RAD TF-4)

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of the DFT message to its sender. See RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the ACK message.

4.35.4.1.2.1 MSH Segment

The MSH segment shall be constructed as defined in RAD TF-2: 2.4.2.2.2 "Message Control".

Field *MSH-9 Message Type* shall have at least two components. The first component shall have a value of "DFT"; the second component shall have value of P03.

4.35.4.1.2.2 EVN Segment

The EVN segment is used to communicate necessary trigger event information to receiving applications. See RAD TF-2: 4.1.4.1.2.1.2 for required and optional fields of the EVN segment.

4.35.4.1.2.3 PID Segment

All of the fields in PID segment are optional, except those listed in table 4.35-1. See RAD TF-2: 4.1.4.1.2.1.3 for the list of all fields of the PID segment.

Table 4.35-1: IHE Profile - PID segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
3	20	CX	R		00106	Patient Identifier List
5	48	XPN	R		00108	Patient Name
18	20	CX	C		00121	Patient Account Number

Adapted from the HL7 standard, version 2.3.1

4.35.4.1.2.4 PV1 Segment

Most of the fields in PV1 segment are optional, except those listed in table 4.35-2. See RAD TF-2: 4.1.4.1.2.1.4 for the list of all fields of the PV1 segment.

Table 4.35-2: IHE profile - PV1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
2	1	IS	R	0004	00132	Patient Class
19	20	CX	C		00149	Visit Number
51	1	IS	C	0326	01226	Visit Indicator

Adapted from the HL7 standard, version 2.3.1

At least one of the fields *PID-18 Patient Account Number* or *PV1-19 Visit Number* shall be valued. Additional requirements for the presence of value in these fields may be documented in regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Field *PV1-51 Visit Indicator* shall be valued with value "V" if the field *PV1-19 Visit Number* is present. May be omitted otherwise.

4.35.4.1.2.5 FT1 Segment

The FT1 segment is used to post charges, credits, payments, and adjustments to patient accounting records.

Table 4.35-3: IHE Profile - FT1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
1	4	SI	O		00355	Set ID - FT1
2	12	ST	O		00356	Transaction ID
3	10	ST	O		00357	Transaction Batch ID
4	26	TS	R		00358	Transaction Date
5	26	TS	R		00359	Transaction Posting Date
6	8	IS	R	0017	00360	Transaction Type
7	80	CE	R	0132	00361	Transaction Code
8	40	ST	O		00362	Transaction Description
9	40	ST	O		00363	Transaction Description - Alt
10	6	NM	O		00364	Transaction Quantity
11	12	CP	O		00365	Transaction Amount - Extended
12	12	CP	O		00366	Transaction Amount - Unit
13	60	CE	O	0049	00367	Department Code
14	60	CE	O	0072	00368	Insurance Plan ID
15	12	CP	O		00369	Insurance Amount
16	80	PL	O		00133	Assigned Patient Location
17	1	IS	O	0024	00370	Fee Schedule
18	2	IS	O	0018	00148	Patient Type
19	60	CE	O	0051	00371	Diagnosis Code - FT1
20	120	XCN	R	0084	00372	Performed By Code
21	120	XCN	R		00373	Order By Code
22	12	CP	O		00374	Unit Cost
23	22	EI	R		00217	Filler Order Number

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
24	120	XCN	O		00765	Entered By Code
25	80	CE	R	0088	00393	Procedure Code
26	80	CE	O	0340	01316	Procedure Code Modifier

Adapted from the HL7 standard, version 2.3.1

4.35.4.1.2.6 PR1 Segment – Procedures

The PR1 segment contains information relative to various types of procedures that can be performed on a patient. The PR1 segment can be used to send procedure information, for example: Surgical, Nuclear Medicine, X ray with contrast, etc. The PR1 segment is used to send multiple procedures, for example, for medical records encoding or for Charge Processors.

Table 4.35-4 PR1 Attributes

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R		00391	Set ID - PR1
2	2	IS	R	0089	00392	Procedure Coding Method
3	80	CE	R	0088	00393	Procedure Code
4	40	ST	O		00394	Procedure Description
5	26	TS	R		00395	Procedure Date/Time
6	2	IS	R	0230	00396	Procedure Functional Type
7	4	NM	O		00397	Procedure Minutes
8	120	XCN	O	0010	00398	Anesthesiologist
9	2	IS	O	0019	00399	Anesthesia Code
10	4	NM	O		00400	Anesthesia Minutes
11	120	XCN	O	0010	00401	Surgeon
12	230	XCN	O	0010	00402	Procedure Practitioner
13	60	CE	O	0059	00403	Consent Code
14	2	NM	O		00404	Procedure Priority
15	80	CE	O	0051	00772	Associated Diagnosis Code
16	80	CE	O	0340	01316	Procedure Code Modifier

Adapted from the HL7 standard, version 2.3.1

Note: Each PR1 segment will contain only one procedure code or one modifier code.

4.35.4.2 Sources of Information

The Charge Posted Transaction derives its data from three sources which are described below. Table 4.35-5 describes the mapping of the fields in the FT1 segment and the PR1 segment.

- Order Management

  The Order Placer General Order Message provides the Department System Scheduler/Order Filler with the required Charge Posted Transaction fields to be used in the PID Segment. See RAD TF-2: 4.2 and 4.3 for required and optional fields.

- Modality Performed Procedure Step

  The Modality General Order Message provides the Department System Scheduler/Order Filler with the required Charge Posted Transaction fields to be used in the FT1 segment and the PR1 segment. There may be additional procedures, or supplies information contained in the DICOM Billing Materials and Management message. See RAD TF-2; 4.7 (Modality Procedure Step Completed/Discontinued) for required and optional fields.

The message semantics are defined in the DICOM Service Class section of the DICOM 2011 Modality Performed Procedure Step SOP Class. It is the responsibility of the Acquisition Modality to ensure that the procedure information is sent to the Department System Scheduler/Order Filler.

- Manual Posting / Department System Scheduler/Order Filler

  Manual entry of Charge Posted Transaction information is also supported. This enables the Department System Scheduler/Order Filler to collect information that is not being provided by the Modality or the Order Placer and is required by the Charge Processor. This data can be manually entered into or is a function of the Department System Scheduler/Order Filler.

Table 4.35-5: Mapping of the FT1 Message

FT1 Field	Field Definition	OPT	HL7 – ADT and ORM Segments	Modality Performed Procedure Step	Manual Input / Department System Scheduler/Order Filler
Transaction Date	Date of the transaction. For example, this field would be used to identify the date a procedure, item, or test was conducted or used. It may be defaulted to today's date.	R		Performed Procedure Step End Date (0040,0004) + Performed Procedure Step End Time (0040,0005)	Generated by Department System Scheduler/Order Filler if there is no MPPS
Transaction Posting Date	Date of the transaction that was sent to the financial system for posting.	R			Generated by Department System Scheduler/Order Filler Use today's date.
Transaction Type	Code that identifies the type of transaction. Values: CG – Charge CD – Credit PY – Payment AJ – Adjustment	R			Generated by Department System Scheduler/Order Filler

FT1 Field	Field Definition	OPT	HL7 – ADT and ORM Segments	Modality Performed Procedure Step	Manual Input / Department System Scheduler/Order Filler
Transaction Code	Code assigned by the institution for the purpose of uniquely identifying the transaction. For example, this field would be used to uniquely identify a procedure, supply item, or test for charging purposes.	R		Billing Item Sequence (0040, 0296) Note: If the Billing Item Sequence is blank then use Procedure Code Sequence (0008, 1032)	
Transaction Quantity	Quantity of items associated with this transaction	O		Quantity Sequence (0040,0293)	Generated by Department System Scheduler/Order Filler if there is no MPPS.
Transaction Amount - Extended	The amount of a transaction. It may be left blank if the transaction is automatically priced. Total price for multiple items.	O			Generated by Department System Scheduler/Order Filler
Transaction Amount - Unit	Unit price of a transaction. Price of a single item.	O			Generated by Department System Scheduler/Order Filler.
Department Code	The department code that controls the transaction code described above.	O			Generated by Department System Scheduler/Order Filler.
Insurance Plan ID	The identifier of the primary insurance plan with which this transaction shall be associated	O			Generated by Department System Scheduler/Order Filler.
Insurance Amount	The amount to be posted to the insurance plan referenced above.	O			Generated by Department System Scheduler/Order Filler.
Assigned Patient Location	This field contains the current patient location. This can be the location of the patient when the charge item was ordered or when the charged service was rendered.	O	PV1-3 – Assigned Patient Location (ADT)		
Fee Schedule	This field contains the code used to select the appropriate fee schedule to be used for this transaction posting.	O			
Patient Type	This field contains the type code assigned to the patient for this episode of care (visit or stay).	O			

FT1 Field	Field Definition	OPT	HL7 – ADT and ORM Segments	Modality Performed Procedure Step	Manual Input / Department System Scheduler/Order Filler
Diagnosis Code – FT1	This field contains the primary diagnosis code for billing purposes. ICD9 CM is assumed for all diagnosis codes. This is the most current diagnosis code that has been assigned to the patient. ICD10 can also be used. The name of coding system (third component) indicates which coding system is used.	O			
Performed By Code	This field contains the composite number/name of the person/group that performed the test/procedure/transaction, etc. This is the service provider.	R		Performing Physician's Name (0008,1050) Note: May be repeated.	Generated by Department System Scheduler/Order Filler if there is no MPPS.
Order By Code	This field contains the composite number/name of the person/group that ordered the test/ procedure/transaction, etc.	R	ORC-12 Ordering Provider (ORM)		
Unit Cost	This field contains the unit cost of transaction. The cost of a single item.	O			Generated by Department System Scheduler/Order Filler.
Filler Order Number	This field is used when the billing system is requesting observational reporting justification for a charge. This is the number used by a filler to uniquely identify a result.	R	ORC-3 Filler Order Number (ORM)		
Entered By Code	This field identifies the composite number/name of the person who entered the insurance information.	O	ORC-10 Entered By (ORM)		
Procedure Code	This field contains a unique identifier assigned to the procedure, if any, associated with the charge.	R		Procedure Code Sequence (0008, 1032)	

FT1 Field	Field Definition	OPT	HL7 – ADT and ORM Segments	Modality Performed Procedure Step	Manual Input / Department System Scheduler/Order Filler
Procedure Code Modifier	This field contains the procedure code modifier to the procedure code reported in field 25, when applicable. Procedure code modifiers are defined by regulatory agencies such as HCFA and the AMA.	O			Generated by Department System Scheduler/Order Filler. Use "TC" for Technical Component. Use "26" for Professional Component Other modifiers may be included as repetitions of the field.

Table 4.35-6: Mapping of the PR1 Segment

PR1 Field	Field Definition	OPT	HL7 – ADT and ORM Segments	MPPS – Modality Perform Procedure Step	Manual Input / Department System Scheduler/Order Filler
Set ID - PR1	A number that identifies this transaction. For the first occurrence of the segment the sequence number shall be 1, for the second occurrence it shall be 2, etc.	R			Generated by Department System Scheduler/Order Filler
Procedure Code	This field contains a unique identifier assigned to the procedure.	R		Billing Procedure Step Sequence (0040,0320)	Generated by Department System Scheduler/Order Filler if there is no MPPS.
Procedure Date/Time	This field contains the date/time that the procedure was performed	R		Performed Procedure Step End Date (0040,0004) + Performed Procedure Step End Time (0040,0005) Note: Use the last MPPS of the Procedure	Generated by Department System Scheduler/Order Filler if there is no MPPS.
Procedure Functional Type	The optional code that further defines the type of procedure. Values: A – Anesthesia	R			Generated by Department System Scheduler/Order Filler.

PR1 Field	Field Definition	OPT	HL7 – ADT and ORM Segments	MPPS – Modality Perform Procedure Step	Manual Input / Department System Scheduler/Order Filler
	P – Procedure for treatment I – Invasive procedure not classified D – Diagnostic procedure				
Procedure Code Modifier	This field contains the procedure code modifier to the procedure code reported in field 3, when applicable.	O			Generated by Department System Scheduler/Order Filler or Charge Processor. Use "TC" for Technical Component. Use "26" for Professional Component. Other modifiers may be included as repetitions of the field. Modifier may be absent in a case of global billing.

4.35.4.2.1.1 Expected Actions

It is expected that the Department System Scheduler/Order Filler will be sending the Charge Posted Transaction to the Charge Processor when one of the trigger events has occurred. This can be either the technical billing or the professional billing financial transaction.

4.36 Account Management

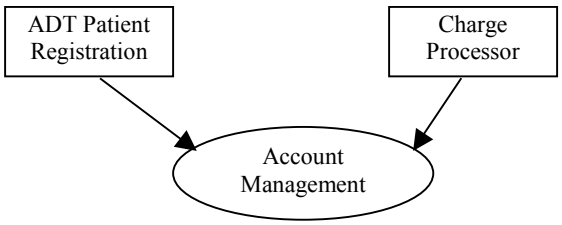
This section corresponds to Transaction RAD-36 of the IHE Technical Framework. Transaction RAD-36 is used by the ADT Patient Registration and Charge Processor actors.

4.36.1 Scope

The Account Management Transaction specifies messages from the ADT Patient Registration to the Charge Processor. These messages are sent when the account for the patient is set-up, updated, or closed.

Use of this transaction minimizes the information needed to be sent to the Department System Scheduler/Order Filler such as insurance or guarantor information. The Charge Processor receives this information directly from the ADT system.

4.36.2 Use Case Roles



Actor: ADT Patient Registration

Role: Collects information relevant to the account patient and submits it to the Charge Processor.

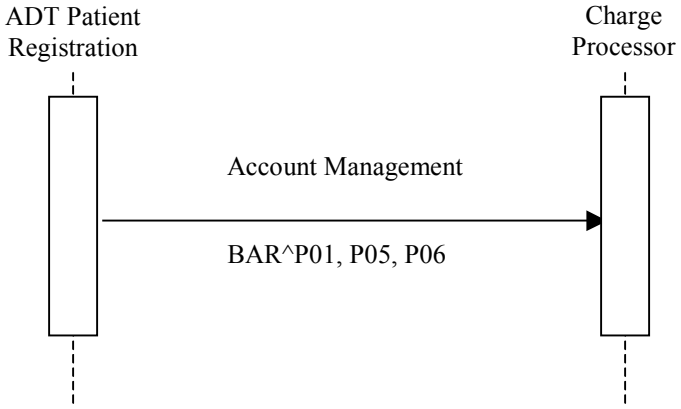
Actor: Charge Processor

Role: Receives the information from Patient Registration. Processes and combines charges in order to issue an insurance claim or patient's billing statement.

4.36.3 Referenced Standards

Health Level Seven, Version 2.3.1: Chapter 6 - Financial Management

4.36.4 Interaction Diagram



4.36.4.1 Account Management - New Account

The Account Management message is used to describe a patient account information transaction transmitted between the ADT Patient Registration and the Charge Processor. Data is sent from the ADT Patient Registration application to the patient accounting or financial system to establish an account for a patient's billing/accounts receivable record. This message enables the Charge Processor to process the patient claim after the procedure charge is received.

4.36.4.1.1 Trigger Events

Creation of a new account will typically occur as a result of one of the following ADT Patient registration events:

- Admission of an in-patient into a facility
- Registration of an outpatient for a visit of the facility
- Pre-admission of an in-patient (i.e., registration of patient information ahead of actual admission).

Creation of an account will result in the following Account Management message:

- P01 – Add Patient Account.

4.36.4.1.2 Message Semantics

The Account Management transaction is conducted by the HL7 BAR message. The ADT Actor shall generate the message whenever a patient is admitted, pre-admitted or registered. The P01 event shall only be used to add a new account that did not exist before, not to update an existing account. The new P05 (update account) event shall be used to update an existing account. The new P06 (end account) event shall be used to close an account.

One or more DG1 segments shall be present if patient's diagnosis is known at the time of Account creation. It may be absent otherwise.

One or more GT1 segments shall be present if Guarantor (even if it is patient itself) is known at the time of Account creation. It may be absent otherwise.

One or more IN1 segments shall be present if insurance information about patient is known at the time of Account creation. It may be absent otherwise.

Note: Additional qualifications to the level of specification and HL7 profiling are stated in RAD TF-2: 2.3.

The segments of the **Add Patient Account** message listed below are required, and the detailed description of messages is provided in the following subsections.

BAR Segment	Billing Account	Chapter in HL7 2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[PV1]	Patient Visit	3 (see note)
[{DG1}]	Diagnosis	6
[{GT1}]	Guarantor	6
[{IN1}]	Insurance	6

Note: PV1 is required if use of *PV1-19 Visit Number* is required per the applicable regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of the BAR message to its sender. See RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the ACK message.

4.36.4.1.2.1 MSH Segment

The MSH segment shall be constructed as defined in RAD TF-2: 2.4.2.2.2 "Message Control".

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of "BAR"; the second component shall have the value of P01.

4.36.4.1.2.2 EVN Segment

The EVN segment is used to communicate necessary trigger event information to receiving applications. See RAD TF-2: 4.1.4.1.2.1.2 for required and optional fields of the EVN segment.

4.36.4.1.2.3 PID Segment

All of the fields in PID segment are optional, except those listed in table 4.36-1. See RAD TF-2: 4.1.4.1.2.1.3 for the list of all fields of the PID segment.

Table 4.36-1: IHE Profile - PID segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
3	20	CX	R		00106	Patient Identifier List
5	48	XPN	R		00108	Patient Name
18	20	CX	C		00121	Patient Account Number

Adapted from the HL7 standard, version 2.3.1

4.36.4.1.2.4 PV1 Segment

Most of the fields in PV1 segment are optional, except those listed in table 4.36-2. See RAD TF-2: 4.1.4.1.2.1.4 for the list of all fields of the PV1 segment.

Table 4.36-2: IHE profile - PV1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
2	1	IS	R	0004	00132	Patient Class
19	20	CX	C		00149	Visit Number
51	1	IS	C	0326	01226	Visit Indicator

Adapted from the HL7 standard, version 2.3.1

At least one of the fields *PID-18 Patient Account Number* or *PV1-19 Visit Number* shall be valued. Additional requirements for the presence of value in these fields may be documented in regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Field *PV1-51 Visit Indicator* shall be valued with value "V" if the field *PV1-19 Visit Number* is present. May be omitted otherwise.

4.36.4.1.2.5 DG1 Segment

The DG1 segment contains patient diagnosis information of various types, for example, admitting, primary, etc. The DG1 segment is used to send multiple diagnoses (for example, for medical records encoding). It is also used when the FT1-19-diagnosis code does not provide sufficient information for a billing system. This diagnosis coding shall be distinguished from the clinical problem segment used by caregivers to manage the patient. Table 4.36-3 lists the required and optional attributes of the DG1 segment.

Table 4.36-3: IHE Profile - DG1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R		00375	Set ID - DG1
2	2	ID	O	0053	00376	Diagnosis Coding Method
3	60	CE	O	0051	00377	Diagnosis Code - DG1
4	40	ST	O		00378	Diagnosis Description
5	26	TS	O		00379	Diagnosis Date/Time
6	2	IS	R	0052	00380	Diagnosis Type

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
7	60	CE	O	0118	00381	Major Diagnostic Category
8	60	CE	O	0055	00382	Diagnostic Related Group
9	2	ID	O	0136	00383	DRG Approval Indicator
10	2	IS	O	0056	00384	DRG Grouper Review Code
11	60	CE	O	0083	00385	Outlier Type
12	3	NM	O		00386	Outlier Days
13	12	CP	O		00387	Outlier Cost
14	4	ST	O		00388	Grouper Version And Type
15	2	ID	O		00389	Diagnosis Priority
16	60	XCN	O		00390	Diagnosing Clinician
17	3	IS	O	0228	00766	Diagnosis Classification
18	1	ID	O	0136	00767	Confidential Indicator
19	26	TS	O		00768	Attestation Date/Time

4.36.4.1.2.6 GT1 Segment

The GT1 segment contains guarantor (e.g., the person or the organization with financial responsibility for payment of a patient account) data for patient and insurance billing applications. Table 4.36-4 lists the required and optional attributes of the GT1 segment.

Table 4.36-4: IHE Profile - GT1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R		00405	Set ID - GT1
2	59	CX	O		00406	Guarantor Number
3	48	XPN	R		00407	Guarantor Name
4	48	XPN	O		00408	Guarantor Spouse Name
5	106	XAD	O		00409	Guarantor Address
6	40	XTN	O		00410	Guarantor Ph Num-Home
7	40	XTN	O		00411	Guarantor Ph Num-Business
8	26	TS	O		00412	Guarantor Date/Time Of Birth
9	1	IS	O	0001	00413	Guarantor Sex
10	2	IS	O	0068	00414	Guarantor Type
11	80	CE	O	0063	00415	Guarantor Relationship
12	11	ST	O		00416	Guarantor SSN
13	8	DT	O		00417	Guarantor Date - Begin
14	8	DT	O		00418	Guarantor Date - End
15	2	NM	O		00419	Guarantor Priority
16	130	XPN	O		00420	Guarantor Employer Name
17	106	XAD	O		00421	Guarantor Employer Address
18	40	XTN	O		00422	Guarantor Employer Phone Number

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
19	20	CX	O		00423	Guarantor Employee ID Number
20	2	IS	O	0066	00424	Guarantor Employment Status
21	130	XON	O		00425	Guarantor Organization Name
22	1	ID	O	0136	00773	Guarantor Billing Hold Flag
23	80	CE	O	0341	00774	Guarantor Credit Rating Code
24	26	TS	O		00775	Guarantor Death Date And Time
25	1	ID	O	0136	00776	Guarantor Death Flag
26	80	CE	O	0218	00777	Guarantor Charge Adjustment Code
27	10	CP	O		00778	Guarantor Household Annual Income
28	3	NM	O		00779	Guarantor Household Size
29	20	CX	O		00780	Guarantor Employer ID Number
30	80	CE	O	0002	00781	Guarantor Marital Status Code
31	8	DT	O		00782	Guarantor Hire Effective Date
32	8	DT	O		00783	Employment Stop Date
33	2	IS	O	0223	00755	Living Dependency
34	2	IS	O	0009	00145	Ambulatory Status
35	80	CE	O	0171	00129	Citizenship
36	60	CE	O	0296	00118	Primary Language
37	2	IS	O	0220	00742	Living Arrangement
38	80	CE	O	0215	00743	Publicity Code
39	1	ID	O	0136	00744	Protection Indicator
40	2	IS	O	0231	00745	Student Indicator
41	80	CE	O	0006	00120	Religion
42	48	XPN	O		00746	Mother's Maiden Name
43	80	CE	O	0212	00739	Nationality
44	80	CE	O	0189	00125	Ethnic Group
45	48	XPN	O		00748	Contact Person's Name
46	40	XTN	O		00749	Contact Person's Phone Number
47	80	CE	O	0222	00747	Contact Reason
48	2	IS	O	0063	00784	Contact Relationship
49	20	ST	O		00785	Job Title
50	20	JCC	O	0327/ 0328	00786	Job Code/Class
51	130	XON	O		01299	Guarantor Employer's Organization Name
52	2	IS	O	0295	00753	Handicap
53	2	IS	O	0311	00752	Job Status
54	50	FC	O	0064	01231	Guarantor Financial Class
55	80	CE	O	0005	01291	Guarantor Race

4.36.4.1.2.7 IN1 Segment

415 The IN1 segment contains insurance policy coverage information necessary to produce properly pro-rated and patient and insurance bills. Table 4.36-5 lists the required and optional attributes of the IN1 segment.

Table 4.36-5: IHE Profile - IN1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R		00426	Set ID - IN1
2	60	CE	R	0072	00368	Insurance Plan ID
3	59	CX	R		00428	Insurance Company ID
4	130	XON	O		00429	Insurance Company Name
5	106	XAD	O		00430	Insurance Company Address
6	48	XPN	O		00431	Insurance Co Contact Person
7	40	XTN	O		00432	Insurance Co Phone Number
8	12	ST	O		00433	Group Number
9	130	XON	O		00434	Group Name
10	12	CX	O		00435	Insured's Group Emp ID
11	130	XON	O		00436	Insured's Group Emp Name
12	8	DT	O		00437	Plan Effective Date
13	8	DT	O		00438	Plan Expiration Date
14	55	CM	O		00439	Authorization Information
15	3	IS	O	0086	00440	Plan Type
16	48	XPN	O		00441	Name Of Insured
17	80	CE	O	0063	00442	Insured's Relationship To Patient
18	26	TS	O		00443	Insured's Date Of Birth
19	106	XAD	O		00444	Insured's Address
20	2	IS	O	0135	00445	Assignment Of Benefits
21	2	IS	O	0173	00446	Coordination Of Benefits
22	2	ST	O		00447	Coord Of Ben. Priority
23	1	ID	O	0136	00448	Notice Of Admission Flag
24	8	DT	O		00449	Notice Of Admission Date
25	1	ID	O	0136	00450	Report Of Eligibility Flag
26	8	DT	O		00451	Report Of Eligibility Date
27	2	IS	O	0093	00452	Release Information Code
28	15	ST	O		00453	Pre-Admit Cert (PAC)
29	26	TS	O		00454	Verification Date/Time
30	60	XCN	O		00455	Verification By
31	2	IS	O	0098	00456	Type Of Agreement Code
32	2	IS	O	0022	00457	Billing Status
33	4	NM	O		00458	Lifetime Reserve Days
34	4	NM	O		00459	Delay Before L.R. Day

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
35	8	IS	O	0042	00460	Company Plan Code
36	15	ST	O		00461	Policy Number
37	12	CP	O		00462	Policy Deductible
38	12	CP	O		00463	Policy Limit - Amount
39	4	NM	O		00464	Policy Limit - Days
40	12	CP	O		00465	Room Rate - Semi-Private
41	12	CP	O		00466	Room Rate - Private
42	60	CE	O	0066	00467	Insured's Employment Status
43	1	IS	O	0001	00468	Insured's Sex
44	106	XAD	O		00469	Insured's Employer's Address
45	2	ST	O		00470	Verification Status
46	8	IS	O	0072	00471	Prior Insurance Plan ID
47	3	IS	O	0309	01227	Coverage Type
48	2	IS	O	0295	00753	Handicap
49	12	CX	O		01230	Insured's ID Number

4.36.4.1.3 Expected Actions

It is expected that after receiving Add Patient Account message the receiving system will create and maintain the account information for the patient for purpose of utilizing it when processing charges.

4.36.4.2 Account Management – Update Account

4.36.4.2.1 Trigger Events

Changes to patient account information (e.g., change in patient name, patient address, guarantor, insurance, etc.) shall trigger the following Update Account message:

P05 – Update Account Information

4.36.4.2.2 Message Semantics

The Account Management transaction is conducted by the HL7 BAR message. The ADT Actor shall generate the message whenever patient account information changed. The P05 (update account) event shall only be used to update an existing account. The new P06 (end account) event shall be used to close an account.

All of the required (R and R2) information for a patient record shall be re-sent in a P05 message. Any information received as NULL (i.e. transmitted as two double quote marks "") in the P05 message shall be removed from the receiving system's database for that patient record. If no value is sent (i.e. omitted) in the P05 message, the old value shall remain unchanged in the receiving system's database for that patient record.

Note: Additional qualifications to the level of specification and HL7 profiling are stated in RAD TF-2: 2.3.

The segments of the **Update Account Information** message listed below are required, and the detailed description of the message is provided in 4.36.4.1.2.5. One or more DG1 segments shall be present if a patient's diagnosis is changed. One or more GT1 segments shall be present if Guarantor information is updated. One or more IN1 segments shall be present if insurance information is added or modified.

BAR Segment	Billing Account	Chapter in HL7 2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[PV1]	Patient Visit	3 (see note)
[{DG1}]	Diagnosis	6
[{GT1}]	Guarantor	6
[{IN1}]	Insurance	6

Note: PV1 is required if use of *PV1-19 Visit Number* is required per the applicable regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of the BAR message to its sender. See RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the ACK message.

4.36.4.2.2.1 MSH Segment

The MSH segment shall be constructed as defined in RAD TF-2: 2.4.2.2.2 "Message Control".

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of "BAR"; the second component shall have the value of P05.

4.36.4.2.2.2 EVN Segment

The EVN segment is used to communicate necessary trigger event information to receiving applications. See 4.1.4.1.2.1.2 for required and optional fields of the EVN segment.

4.36.4.2.2.3 PID Segment

All of the fields in PID segment are optional, except those listed in table 4.36-6. See RAD TF-2: 4.1.4.1.2.1.3 for the list of all fields of the PID segment.

Table 4.36-6: IHE Profile - PID segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
3	20	CX	R		00106	Patient Identifier List
5	48	XPN	R		00108	Patient Name
18	20	CX	C		00121	Patient Account Number

Adapted from the HL7 standard, version 2.3.1

4.36.4.2.2.4 PV1 Segment

470 Most of the fields in PV1 segment are optional, except those listed in table 4.36-7. See RAD TF-2: 4.1.4.1.2.1.4 for the list of all fields of the PV1 segment.

Table 4.36-7: IHE profile - PV1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
2	1	IS	R	0004	00132	Patient Class
19	20	CX	C		00149	Visit Number
51	1	IS	C	0326	01226	Visit Indicator

Adapted from the HL7 standard, version 2.3.1

475 At least one of the fields *PID-18 Patient Account Number* or *PV1-19 Visit Number* shall be valued. Additional requirements for the presence of value in these fields may be documented in regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Field *PV1-51 Visit Indicator* shall be valued with value "V" if the field *PV1-19 Visit Number* is present. May be omitted otherwise.

480 #### 4.36.4.2.2.5 DG1 Segment

See sec.4.36.4.1.2.5 for required and optional fields of the DG1 segment.

4.36.4.2.2.6 GT1 Segment

See sec.4.36.4.1.2.6 for required and optional fields of the GT1 segment.

4.36.4.2.2.7 IN1 Segment

485 See sec. 4.36.4.1.2.7 for required and optional fields of the IN1 segment.

4.36.4.2.3 Expected Actions

It is expected that after receiving Update Account Information message the receiving system will update its local patient demographic, diagnosis, guarantor, and/or insurance information. Any information received as null in the new P05 message shall be removed locally.

4.36.4.3 Account Management – End Account

4.36.4.3.1 Trigger Events

Ending or closing of an account will typically occur as a result of patient discharge or visit end and will result in the following Account Management message:

P06 – End Account.

4.36.4.3.2 Message Semantics

The Account Management transaction is conducted by the HL7 BAR message. The ADT Actor shall generate the message whenever a patient is closed. The new P06 (end account) event shall be used to close an account.

Note: Additional qualifications to the level of specification and HL7 profiling are stated in RAD TF-2: 2.3.

The segments of the **End Account** message listed below are required, and the detailed description of messages is provided in the following subsections.

BAR Segment	Billing Account	Chapter in HL7 2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[PV1]	Patient Visit	3 (see note)

Note: PV1 is required if use of *PV1-19 Visit Number* is required per the applicable regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of ADT message to its sender. See RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the ACK message.

4.36.4.3.2.1 MSH Segment

The MSH segment shall be constructed as defined in RAD TF-2: 2.4.2.2.2 "Message Control".

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of "BAR"; the second component shall have value of P06.

4.36.4.3.2.2 EVN Segment

The EVN segment is used to communicate necessary trigger event information to receiving applications. See RAD TF-2: 4.1.4.1.2.1.2 for required and optional fields of the EVN segment.

4.36.4.3.2.3 PID Segment

All of the fields in PID segment are optional, except those listed in table 4.36-8. See RAD TF-2: 4.1.4.1.2.1.3 for the list of all fields of the PID segment.

520

Table 4.36-8: IHE Profile - PID segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
3	20	CX	R		00106	Patient Identifier List
5	48	XPN	R		00108	Patient Name
18	20	CX	C		00121	Patient Account Number

Adapted from the HL7 standard, version 2.3.1

4.36.4.3.2.4 PV1 Segment

Most of the fields in PV1 segment are optional, except those listed in table 4.36-9. RAD TF-2:
525 4.1.4.1.2.1.4 for the list of all fields of the PV1 segment.

Table 4.36-9: IHE profile - PV1 Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
2	1	IS	R	0004	00132	Patient Class
19	20	CX	C		00149	Visit Number
51	1	IS	C	0326	01226	Visit Indicator

Adapted from the HL7 standard, version 2.3.1

At least one of the fields *PID-18 Patient Account Number* or *PV1-19 Visit Number* shall be
530 valued. Additional requirements for the presence of value in these fields may be documented in regional or national appendices to the IHE Radiology Technical Framework (See RAD TF-4)

Field *PV1-51 Visit Indicator* shall be valued with value "V" if the field *PV1-19 Visit Number* is present. May be omitted otherwise.

4.36.4.3.3 Expected Actions

535 It is expected that after receiving End Account message (P06) the receiving system will update its local patient account information to reflect the fact that the account has been closed.

4.37 Query Post-Processing Worklist

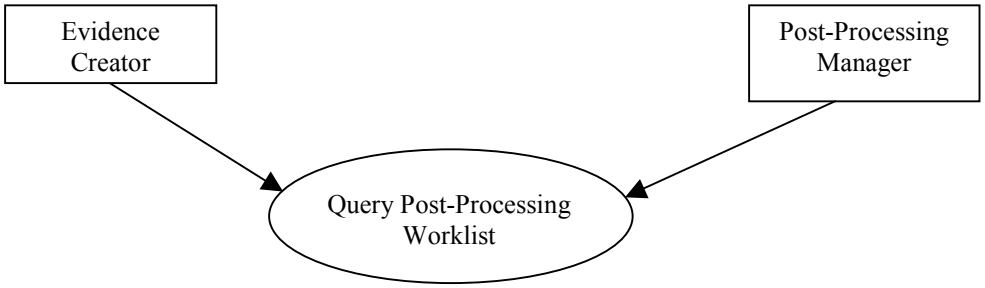
This section corresponds to Transaction RAD-37 of the IHE Technical Framework. Transaction RAD-37 is used by Post-Processing Manager and Evidence Creator.

4.37.1 Scope

This transaction is used during post-processing by the Evidence Creator to find out what tasks have been scheduled by the Post-Processing Manager. The transaction describes generically the worklist being provided for post-processing related workitem codes for Image Processing, Computer Aided Diagnosis, and Computer Aided Detection.

The Post-Processing Manager is the provider of the worklist. It obtains the necessary information with either grouping with the Department System Scheduler or the Image Manager. The Evidence Creator retrieves the worklist and includes received information in the resulting instances, which are stored through instance stored transactions such as Evident Document Stored, Image Stored, etc.

4.37.2 Use Case Roles



Actor: Evidence Creator

Role: Query the Post-Processing Manager for post-processing Scheduled Procedure Steps.

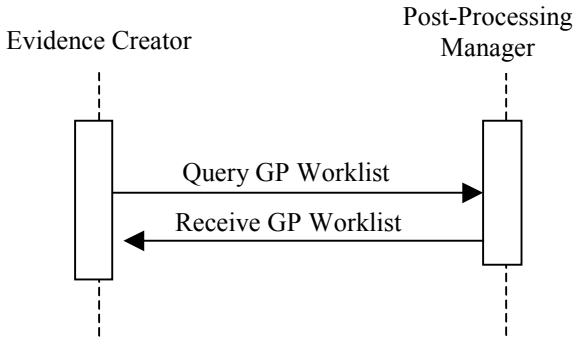
Actor: Post-Processing Manager

Role: Schedule post-processing procedure steps for the workitems of Image Processing, Computer Aided Diagnosis, and Computer Aided Detection; accept requests for Worklist items, perform the query and return response.

4.37.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Worklist SOP Class

4.37.4 Interaction Diagram



4.37.4.1 Query General Purpose Worklist Message

This is the worklist query sent to the Post-Processing Manager.

4.37.4.1.1 Trigger Events

A user or an automated function on the Evidence Creator queries for scheduled post-processing worklist items.

4.37.4.1.2 Message Semantics

C-FIND request of the DICOM General Purpose Worklist SOP Class is used to query for the general purpose worklist. Evidence Creator performs the SCU role, and the Post-Processing Manager performs the SCP role.

4.37.4.1.2.1 Matching Keys and Return Keys

The Evidence Creator is required to query for specific attributes (return keys) that will be inserted into the instances created as a result of post-processing. See Appendix D for more details.

The Evidence Creator shall support individually each one of the required query keys listed in Table 4.37-4 - Return and Matching Keys For Post-Processing Worklist Queries. In addition, at least one of the following three combinations shall be implemented by the Evidence Creator:

1. Patient Oriented Query: Query for a worklist for a specific patient/procedure. The SCU shall support all (31) combinations of the matching key attributes listed in table 4.37-1 by including 1 or more keys. The sequence attributes denoted in the italics are not matching keys on their own but have to be included in a query to convey the value of the attributes contained within them. Thus, the SCU shall support any combination of Patient's Name, Patient ID, Accession Number, Requested Procedure ID, and Scheduled Workitem Code.

Table 4.37-1: GPWL Keys for Patient Oriented Query

Matching Key Attributes	Tag
Patient's Name	(0010,0010)

Matching Key Attributes	Tag
Patient ID	(0010,0020)
Referenced Request Sequence	*(0040,A370)*
>Accession Number	(0008,0050)
>Requested Procedure ID	(0040,1001)
Scheduled Workitem Code Sequence	*(0040,4018)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)

2. Station-oriented Query: Query for a broad worklist for particular workstation. The SCU shall support all (15) combinations of the matching key attributes listed in table 4.37-2 by including 1 or more keys. The sequence attributes denoted in the italics are not matching keys on their own but have to be included in a query to convey the value of the attributes contained within them. Code Value of the Scheduled Station Name Code Sequence, if valued, shall be set to the AE Title of the workstation's General Purpose Worklist SCU.

Table 4.37-2: GPWL Keys for Station-Oriented Queries

Matching Key Attributes	Tag
General Purpose Scheduled Procedure Step Status	(0040,4001)
Scheduled Station Name Code Sequence	*(0040,4025)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
Scheduled Procedure Step Start Date and Time	(0040,4005)
Scheduled Workitem Code Sequence	*(0040,4018)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)

3. The Class-oriented Query: Query for a broad worklist for a particular class of workstations. The SCU shall support all (15) combinations of the matching key attributes listed in table 4.37-3 by including 1 or more keys. The sequence attributes denoted in the italics are not matching keys on their own but have to be included in a query to convey the value of the attributes contained within them.

Table 4.37-3: GPWL Keys for Class-Oriented Worklist Queries

Matching Key Attributes	Tag
General Purpose Scheduled Procedure Step Status	(0040,4001)
Scheduled Station Class Code Sequence	*(0040,4026)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
Scheduled Procedure Step Start Date and Time	(0040,4005)
Scheduled Workitem Code Sequence	*(0040,4018)*

Matching Key Attributes	Tag
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)

4.37.4.1.2.2 Examples for the Use of Matching Key Attributes

- Using the Scheduled Procedure Step Start Date and Time key: query for all the post-processing tasks scheduled for today.
- Using the Scheduled Workitem Code key: query for all computer-aided detection (CAD) tasks.
- Using Scheduled Station Name key: query for all the post-processing tasks that are scheduled for this workstation.
- Using the Scheduled Procedure Step Start Date and Time, Scheduled Workitem Code and Scheduled Station Class Code keys: query for all the Image Processing tasks that are scheduled for today on CT 3D reconstruction workstations.

Note: Applications are recommended to append a wildcard "*" at the end of each component of the structured Patient Name to facilitate matching with both structured and unstructured Patient Names.

4.37.4.1.2.3 Matching Keys and Return Keys

The Evidence Creator is required to query for specific attributes (return keys), many of which will be required in the objects it creates. The requirements for the attributes in the stored objects are defined in Appendix C. There are additional attributes that may be queried.

Table 4.37-4 summarizes the matching key requirements and lists the optional and required attributes that may be requested and shall be returned in order to make these available to the user at the Evidence Creator. See RAD TF-2: 2.2 for more information on conventions used in this table.

Table 4.37-4: Matching and Return Keys for Post-Processing Worklist Queries

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
SOP Common					
Specific Character Set	(0008,0005)	O	O	O	R
SOP Class UID	(0008,0016)	O	O	R+*	R
SOP Instance UID	(0008,0018)	O	R	R+*	R
General Purpose Scheduled Procedure Step Information					
General Purpose Scheduled Procedure Step Status	(0040,4001)	R+	R	R+	R
Input Availability Flag	(0040,4020)	O	R	R+	R
General Purpose Scheduled Procedure Step Priority	(0040,4003)	O	R	R+	R
Scheduled Procedure Step ID	(0040,0009)	O	O	O	R
Scheduled Workitem Code	(0040,4018)				

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Sequence					
>Code Value	(0008,0100)	R+	R	R+*	R
>Coding Scheme Designator	(0008,0102)	R+	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+	R
Scheduled Processing Applications Code Sequence	(0040,4004)				
>Code Value	(0008,0100)	O	R	R+*	R
>Coding Scheme Designator	(0008,0102)	O	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+	R
Scheduled Station Name Code Sequence	(0040,4025)				
>Code Value	(0008,0100)	R+	R	R+*	R
>Coding Scheme Designator	(0008,0102)	R+	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+*	R
Scheduled Station Class Code Sequence	(0040,4026)				
>Code Value	(0008,0100)	R+	R	R+*	R
>Coding Scheme Designator	(0008,0102)	R+	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+*	R
Scheduled Station Geographic Location Code Sequence	(0040,4027)				
>Code Value	(0008,0100)	O	R	O	R
>Coding Scheme Designator	(0008,0102)	O	R	O	R
>Code Meaning	(0008,0104)	-	-	O	R
Scheduled Procedure Step Start Date and Time	(0040,4005)	R+	R	R+	R
Expected Completion Date and Time	(0040,4011)	O	R	O	R
Scheduled Human Performers Sequence	(0040,4034)				
>Human Performer Code Sequence	(0040,4009)				
>>Code Value	(0008,0100)	O	R	O	R
>>Coding Scheme Designator	(0008,0102)	O	R	O	R
>>Code Meaning	(0008,0104)	-	-	O	R
>Human Performer's Name	(0040,4037)	O	O	O	R+
>Human Performer's Organization	(0040,4036)	O	O	O	R+
Referenced Study Component Sequence	(0008,1111)				
>Referenced SOP Class UID	(0008,1150)	O	O	O	R
>Referenced SOP Instance UID	(0008,1155)	O	O	O	R
Input Information Sequence	(0040,4021)				

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>Study Instance UID	(0020,000D)	O	O	R+*	R
>Referenced Series Sequence	(0008,1115)				
>>Series Instance UID	(0020,000E)	O	O	R+*	R
>>Retrieve AE Title	(0008,0054)	O	O	O	R
>>Storage Media File-Set ID	(0088,0130)	O	O	O	O
>>Storage Media File-Set UID	(0088,0140)	O	O	O	O
>>Referenced SOP Sequence	(0008,1199)				
>>>Referenced SOP Class UID	(0008,1150)	O	O	R+*	R
>>>Referenced SOP Instance UID	(0008,1155)	O	O	R+*	R
Relevant Information Sequence	(0040,4022)				
>Study Instance UID	(0020,000D)	O	O	O	R
>Referenced Series Sequence	(0008,1115)				
>>Series Instance UID	(0020,000E)	O	O	O	R
>>Retrieve AE Title	(0008,0054)	O	O	O	O
>>Storage Media File-Set ID	(0088,0130)	O	O	O	O
>>Storage Media File-Set UID	(0088,0140)	O	O	O	R
>>Referenced SOP Sequence	(0008,1199)				
>>>Referenced SOP Class UID	(0008,1150)	O	O	O	R
>>>Referenced SOP Instance UID	(0008,1155)	O	O	O	R
Resulting General Purpose Performed Procedure Step Sequence	(0040,4015)				
>Referenced SOP Class UID	(0008,1150)	O	O	O	R
>Referenced SOP Instance UID	(0008,1155)	O	O	O	R
Actual Human Performers Sequence	(0040,4035)				
>Human Performer Code Sequence	(0040,4009)	O	O	O	R
>>Code Value	(0008,0100)	O	O	O	R
>>Coding Scheme Designator	(0008,0102)	O	O	O	R
>>Code Meaning	(0008,0104)	-	-	O	R
>Human Performer's Name	(0040,4037)	O	O	O	R+
>Human Performer's Organization	(0040,4036)	O	O	O	R+
Study Instance UID	(0020,000D)	O	O	R+*	R
Multiple Copies Flag	(0040,4006)	O	O	O	R
All other Attributes from the General Purpose Scheduled Procedure Step Information Module		O	O	O	O

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
General Purpose Scheduled Procedure Step Relationship					
Referenced Request Sequence	(0040,A370)				
>Study Instance UID	(0020,000D)	O	O	R+*	R
>Referenced Study Sequence	(0008,1110)				
>>Referenced SOP Class UID	(0008,1150)	O	O	R+*	R
>>Referenced SOP Instance UID	(0008,1155)	O	O	R+*	R
>Requested Procedure ID	(0040,1001)	R+	R+	R+	R
>Requested Procedure Description	(0032,1060)	O	O	O	R
>Requested Procedure Code Sequence	(0032,1064)				
>>Code Value	(0008,0100)	O	O	O	R
>>Coding Scheme Designator	(0008,0102)	O	O	O	R
>>Code Meaning	(0008,0104)	-	-	O	R
>Accession Number	(0008,0050)	R+	R	R+	R
>Requesting Physician	(0032,1032)	O	O	O	R
>All other Attributes relating to the Requested Procedure and the Imaging Service Request in the General Purpose Scheduled Procedure Step Relationship Module		O	O	O	O
Patient Relationship					
All Attributes from the Patient Relationship Module		O	O	O	O
Patient Identification					
Patient's Name	(0010,0010)	R+	R	R+	R
Patient ID	(0010,0020)	R+	R	R+	R
All other Attributes from the Patient Identification Module		O	O	O	O
Patient Demographic					
Patient's Birth Date	(0010,0030)	O	O	R+	R
Patient's Sex	(0010,0040)	O	O	R+	R
All other Attributes from the Patient Demographic Module		O	O	O	O
Patient Medical					
All Attributes from the Patient Medical Module		O	O	O	O

4.37.4.1.3 Expected Actions

The Post-Processing Manager performs the query and sends the matching General Purpose Worklist items to the Evidence Creator.

4.37.4.2 Receive General Purpose Worklist Message

This is the message the Post-Processing Manager sends containing post-processing General Purpose Worklist information as a response to the Evidence Creator query.

4.37.4.2.1 Trigger Events

The Post-Processing Manager receives a query for a Post-Processing Worklist.

4.37.4.2.2 Message Semantics

C-FIND Response from the DICOM General Purpose Worklist SOP Class will be used for this message. Some of the attributes queried through the worklist originate from other sources during previous steps in the workflow, and are made available to the Post-Processing Manager (grouped with Department System Scheduler or Image Manager) through other transactions such as MPPS. It is up to the Post-Processing Manager to determine the Input Information, e.g. study, series, etc. appropriate to be used in a workitem Scheduled Procedure Step, i.e. it is independent of the acquisition process and resulting MPPS.

The Post-Processing Manager shall specify the type of task to be performed in the content of the Scheduled Workitem Code Sequence (0040,4018) using one of the following values from DCMR CID 9231:

Table 4.37-5: Post-Processing Workitem Definition

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	110001	Image Processing
DCM	110002	Quality Control
DCM	110003	Computer Aided Diagnosis
DCM	110004	Computer Aided Detection
DCM	110008	Print
DCM	110009	No subsequent Workitems

4.37.4.2.3 Expected Actions

An automated Evidence Creator uses the worklist to start post-processing or the user is provided with the worklist to start work.

4.38 Workitem Claimed

This section corresponds to Transaction RAD-38 of the IHE Technical Framework. Transaction RAD-38 is used by Post-Processing Manager, Report Manager, Report Creator and Evidence Creator.

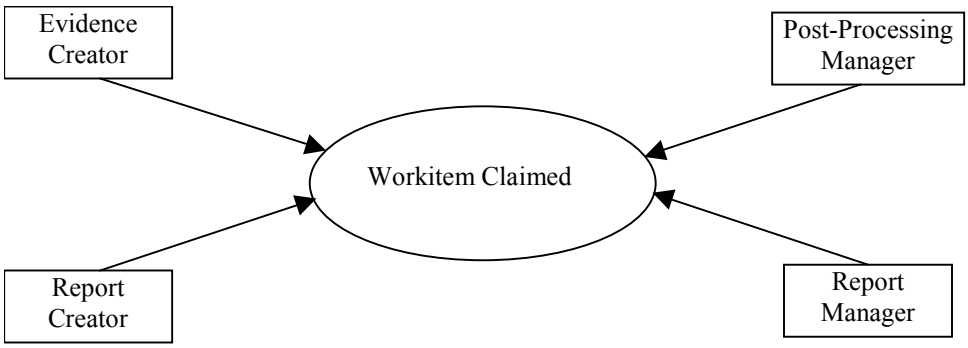
4.38.1 Scope

Upon selecting a post-processing workitem, the Evidence Creator takes ownership of the item by telling the Post Processing Manager to change the status of the SPS to IN PROGRESS. This allows the Post-Processing Manager to update its worklist and permits other worklist users to detect that this SPS has been claimed and is possibly already being worked on.

Similarly during the reporting workflow, upon selecting a Reporting workitem, the Report Creator takes ownership of the item by telling the Reporting Manager to change the status of the SPS to IN PROGRESS. This allows the Report Manager to update its worklist and permits other worklist users to detect that this SPS has been claimed and is possibly already being worked on.

In both workflow cases, the SCU can also set the status to SUSPEND.

4.38.2 Use Case Roles



Actor: Evidence Creator

Role: Updates the Post-Processing Manager of the new status of the post-processing SPS when the Evidence Creator claims the post-processing SPS.

Actor: Post-Processing Manager

Role: Accepts post-processing GP-SPS update information from the Evidence Creator.

Actor: Report Creator

Role: Updates Report Manager with status of the Reporting SPS when the Report Creator claims the reporting SPS.

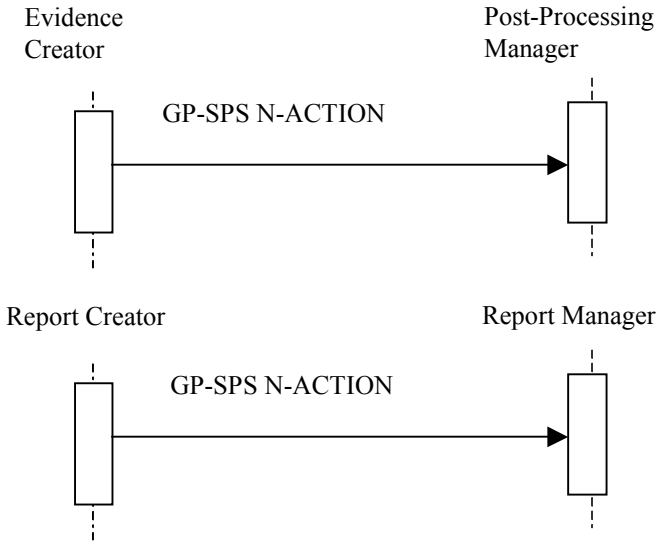
Actor: Report Manager

Role: Accepts GP-SPS update information from the Report Creator.

4.38.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Scheduled Procedure Step SOP Class.

4.38.4 Interaction Diagram



4.38.4.1 General Purpose Scheduled Procedure Step In Progress/Suspend Message

4.38.4.1.1 Trigger Events

For a post-processing workitem, a user or an automated function on the Evidence Creator begins to act on a post-processing scheduled procedure step, or stops acting on it without completing it.

For the reporting workitem, the user begins to act on the scheduled procedure step at the Report Creator, or stops acting on it without completing it.

4.38.4.1.2 Message Semantics

The Evidence Creator uses the N-ACTION request of the DICOM General Purpose Scheduled Procedure Step SOP Class to inform the Post-Processing Manager that a specific SPS has been started, and its status is IN PROGRESS. The Evidence Creator performs the SCU role, and the Post-Processing Manager performs the SCP role. An SPS may also be suspended or resumed, and the associated status of SUSPENDED or SCHEDULED will be set (see the DICOM 2011, Part 4, section F.1.6 for additional information).

The Report Creator and Report Manager utilize the same mechanism, where the Report Creator performs the SCU role, and the Report Manager performs the SCP role.

If a human is performing the Post-Processing scheduled procedure step, then the N-ACTION request may include the Actual Human Performers Sequence.

In a case of the reporting scheduled procedure step, the Report Creator shall send the Actual Human Performer Sequence to the Reporting Manager, who shall then check if the person is allowed to perform the workitem. The Report Creator application shall ensure that the correct user information is filled in the sequence.

4.38.4.1.3 Expected Actions

The Post-Processing Manager updates the status of the SPS to IN PROGRESS, which is an indication that the SPS is already being working on, and other Evidence Creators shall not perform any action on it. Attempts by any Evidence Creator without the current Transaction UID to update the SPS will be rejected.

When Post-Processing Manager updates the status of the SPS to SUSPENDED or SCHEDULED, the SPS has now been released from the control of the Evidence Creator.

In the same way, the Report Manager updates the status of the SPS to IN PROGRESS, which is an indication that the SPS is already being working on, and other Report Creators shall not perform any action on it. Attempts by any other Report Creator to update the SPS will be rejected by the Report Manager.

When the Report Manager updates the status of the SPS to SUSPENDED or SCHEDULED, the SPS has now been released from the control of the Report Creator.

4.39 Workitem Performed Procedure Step In Progress

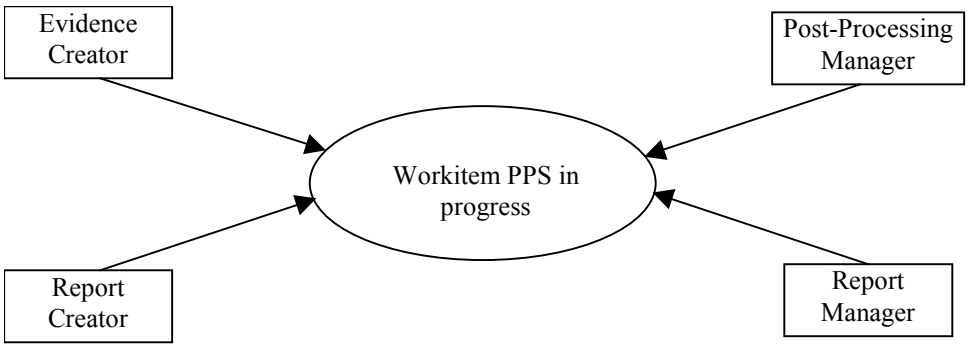
This section corresponds to Transaction RAD-39 of the IHE Technical Framework. Transaction RAD-39 is used by Post-Processing Manager and Evidence Creator as well as Report Manager and Report Creator.

4.39.1 Scope

Upon starting to work on the claimed post-processing scheduled procedure step, Evidence Creator sends a message to the Post-Processing Manager to create a Performed Procedure Step (PPS).

Upon starting to work on the claimed reporting scheduled procedure step, Report Creator sends a message to the Report Manager to create a Performed Procedure Step (PPS).

4.39.2 Use Case Roles



Actor: Evidence Creator

Role: Update the Post-Processing Manager with creation of a post-processing PPS when the **Evidence** Creator starts the work.

Actor: Report Manager

Role: Accept PPS information from Report Creator.

Actor: Report Creator

Role: Updates the Report Manager with the creation of a Reporting Workitem PPS, when the Report Creator starts the work.

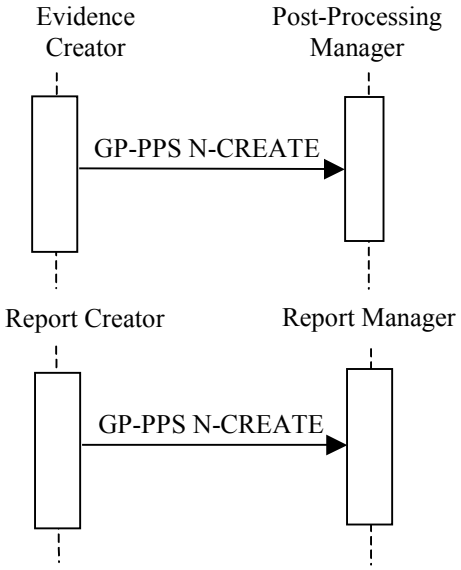
Actor: Post-Processing Manager

Role: Accept post-processing PPS information from the Evidence Creator.

4.39.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Performed Procedure Step SOP Class

4.39.4 Interaction Diagram



4.39.4.1 General Purpose Performed Procedure Step In Progress Message

4.39.4.1.1 Trigger Events

For a post-processing workitem, a user or an automated function on the Evidence Creator begins a post-processing performed procedure step.

For a reporting workitem, a user begins to perform the scheduled procedure step at the Report Creator.

4.39.4.1.2 Message Semantics

The Evidence Creator as SCU uses the N-CREATE request of the DICOM General Purpose Performed Procedure Step SOP to inform the Post-Processing Manager as SCP that a specific PPS has been started and its status is IN PROGRESS.

4.39.4.1.3 Expected Actions

The Post-Processing Manager or the Report Manager creates the PPS with status IN PROGRESS.

If a Referenced General Purpose Scheduled Procedure Step Sequence (0040,4016) item is present in the N-CREATE request, the Post-Processing Manager or the Report Manager shall update the Attribute Resulting General Purpose Performed Procedure Steps Sequence (0040,4015) in the identified General Purpose Scheduled Procedure Step SOP Instance.

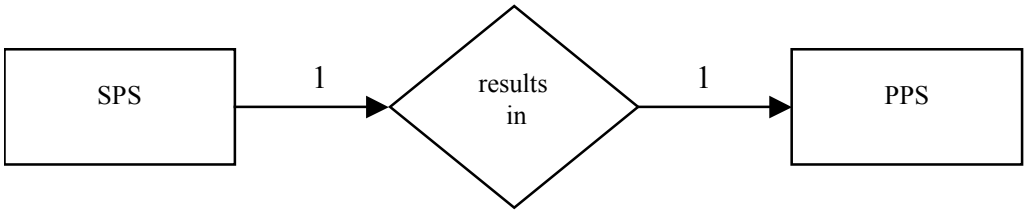
The Post-Processing Manager may use the Performed Work Status Update transaction to notify the interested recipients about the received GP-PPS.

The Report Manager may use the Performed Work Status Update transaction to notify the interested recipients about the received GP-PPS using for this purpose.

4.39.4.1.3.1 Relationship between Scheduled and Performed Procedure Steps

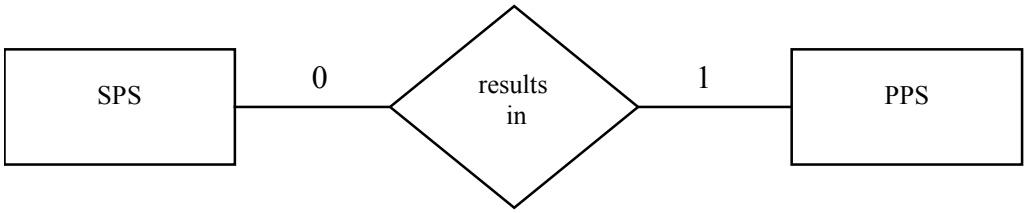
The relationship between Scheduled and Performed Procedure Step information is shown in the following cases. Refer to Appendix C for details of forming attributes in each of these cases.

4.39.4.1.3.1.1 Simple Case



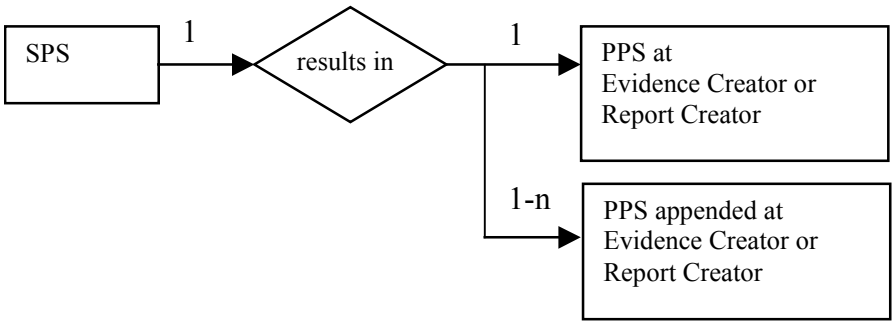
This case indicates a 1-to-1 relationship between SPS and PPS. Information about the Scheduled Procedure Step and Requested Procedure shall be copied from the Scheduled Procedure Step object to the Performed Procedure Step Relationship Module.

4.39.4.1.3.1.2 Unscheduled Case



This case indicates a 0-to-1 relationship between SPS and PPS. Information about the Scheduled Procedure Step and, possibly, Requested Procedure is not available to the Evidence Creator or Report Creator due to different reasons, e.g. General Purpose Worklist SCP not available, unplanned post-processing during reporting.

4.39.4.1.3.1.3 Append Case

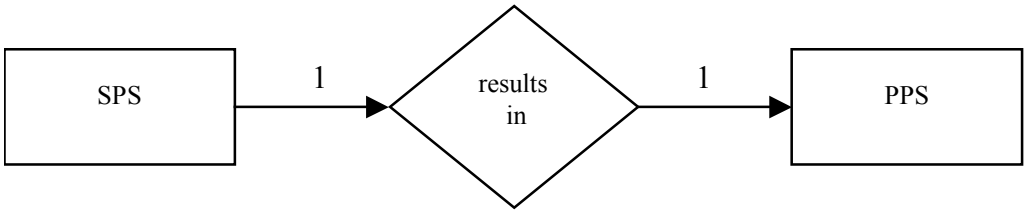


This case indicates a 1-to-N relationship between SPS and PPS where first the PPS is generated in response to an SPS. Other Performed Procedure Steps are added sequentially at a later time. All Performed Procedure Steps shall refer back to the same Requested Procedure and to the original SPS. All Requested Procedure and Scheduled Procedure Step attributes shall be copied

from the Scheduled Procedure Step Object to the Performed Procedure Step Relationship Module and to the Request Attribute Sequence of the resulting composite instance.

No PPS can be appended if the SPS status is COMPLETED or DISCONTINUED.

4.39.4.1.3.1.4 Abandoned Case



This case indicates a 1-to-1 relationship between SPS and PPS, even though the PPS may or may not have associated Evidence Documents Images or other data objects. A procedure step may have to be abandoned for clinical reasons before it is complete. If SOP instances are sent by the Evidence Creator to the Image Archive or from the Report Creator to Report Manager, then they shall be identified in the PPS N-SET. This is a means to explicitly communicate this information to the Post-Processing Manager. All Requested Procedure and Scheduled Procedure Step attributes shall be copied from the Scheduled Procedure Step Object to the Performed Procedure Step Relationship Module.

4.40 Workitem Performed Procedure Step Completed

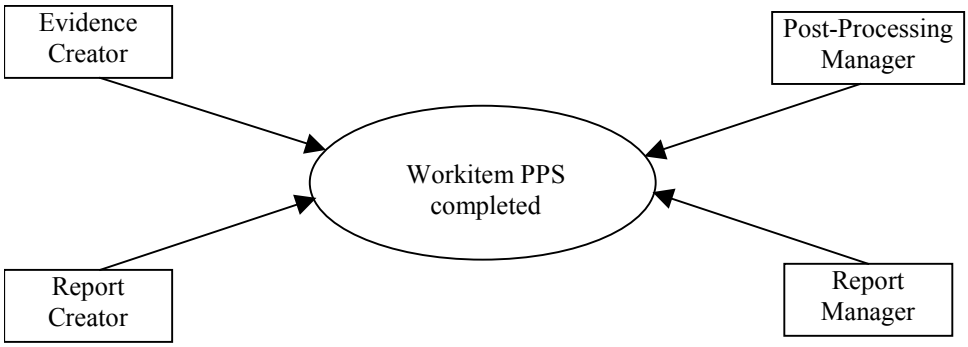
This section corresponds to Transaction RAD-40 of the IHE Technical Framework. Transaction RAD-40 is used by Post-Processing Manager and Evidence Creator as well as Report Manager and Report Creator.

4.40.1 Scope

After completing or discontinuing a post-processing performed procedure step, the Evidence Creator sends a message to the Post-Processing Manager to update the PPS status to COMPLETED or DISCONTINUED and references any results that have been created and sent to the Image Manager/Archive.

Report Creator behaves similarly to update the Report Manager with the PPS status and the references to the result that was created and sent to the Report Manager, e.g. an SR object, or an external ID of an object outside of IHE scope.

4.40.2 Use Case Roles



Actor: Evidence Creator

Role: Update the Post-Processing Manager with status of the post-processing PPS when the Evidence Creator finishes or discontinues work.

Actor: Post-Processing Manager

Role: Accept post-processing PPS information from the Evidence Creator.

Actor: Report Creator

Role: Updates Report Manager with status of the Reporting Workitem PPS, when it finishes or discontinues work.

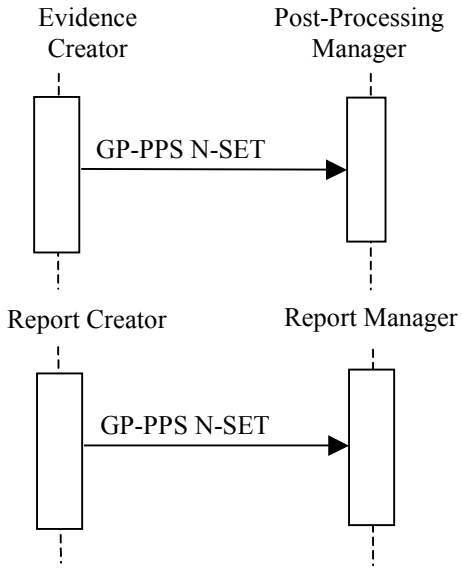
Actor: Report Manager

Role: Accepts PPS information from Report Creator.

4.40.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Performed Procedure Step SOP Class

4.40.4 Interaction Diagram



4.40.4.1 General Purpose Performed Procedure Step Completed Message

4.40.4.1.1 Trigger Events

For a post-processing workitem, automated Evidence Creator, or a user finishes the post-processing scheduled procedure step.

For a reporting Workitem, a user finishes the work on the scheduled procedure step.

4.40.4.1.2 Message Semantics

The Evidence Creator as SCU uses the N-SET request of the DICOM General Purpose Performed Procedure Step SOP Class to inform the Post-Processing Manager as SCP that a specific performed procedure step has been done and its status is COMPLETED. The Evidence Creator may use N-SET to send intermediate updates of the PPS information. The final N-SET has either the status of COMPLETED or DISCONTINUED. The Report Manager acts in the same way as SCU with the Report Manger as SCP. The Report Manager notifies the DSS about the PPS status through either the Performed Work Status Update or by grouping with it.

When the status is set to COMPLETED or DISCONTINUED, the Evidence Creator shall send to the Post-Processing Manager a list of all Composite SOP Instances, if any, created in the Output Information Sequence (0040,4033). Similarly, the Report Creator shall send the list of all SOP Instances in the Output Information Sequence (0040,4033) or identify non-DICOM output in the Non-DICOM Output Code Sequence (0040,4032).

4.40.4.1.3 Reporting Message Semantics

After the workitem has been completed, the Report Creator shall provide the Report Manager with the details of the reporting task that has been performed. This information shall be included into the Performed Work Item Code Sequence in the General Purpose Performed Procedure Step N-SET message. The Report Creator shall also reference any results created during the reporting task performed. The output information is part of the General Purpose Performed Procedure Step Results Module. The output data must be stored to an appropriate data repository. Which data repository is used will depend on the type of the output data that might be a report, an audio file, an Evidence Document or other objects.

The Report Creator may also suggest subsequent work items to the Report Manager. The requested subsequent work items are included in the General Purpose Performed Procedure Step Results Module.

4.40.4.1.4 Expected Actions

The Post-Processing Manager or Report Manager updates the status of the PPS to COMPLETED or DISCONTINUED.

4.41 Workitem Completed

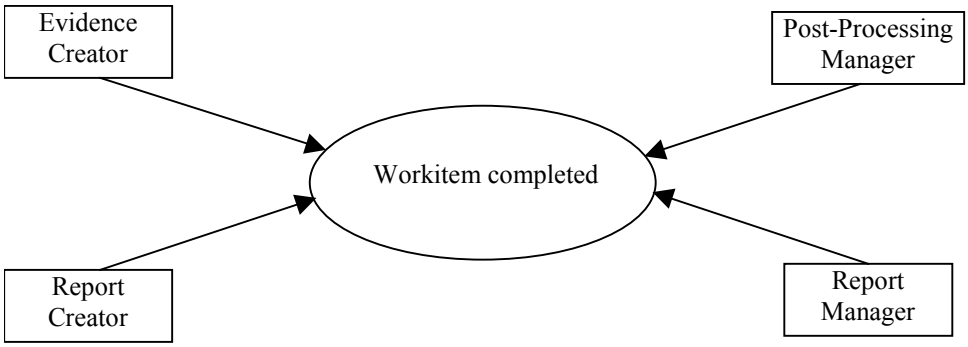
This section corresponds to Transaction RAD-41 of the IHE Technical Framework. Transaction RAD-41 is used by Post-Processing Manager and Evidence Creator as well as Report Manager and Report Creator.

4.41.1 Scope

After completing or discontinuing a post-processing scheduled procedure step, the Evidence Creator sends a message to the Post-Processing Manager to update the SPS status to COMPLETED or DISCONTINUED. This allows the Post-Processing Manager to update its worklist.

After completing or discontinuing a reporting scheduled procedure step, the Report Creator sends a message to the Report Manager to update the SPS status to COMPLETED or DISCONTINUED. This allows the Report Manager to update its worklist.

4.41.2 Use Case Roles



Actor: Evidence Creator

Role: Update the Post-Processing Manager with status of the post-processing SPS when the Evidence Creator finishes work.

Actor: Post-Processing Manager

Role: Accept post-processing GP-SPS information from Evidence Creator.

Actor: Report Creator

Role: Updates Report Manager with status of the Reporting Workitem SPS, when it finishes the work.

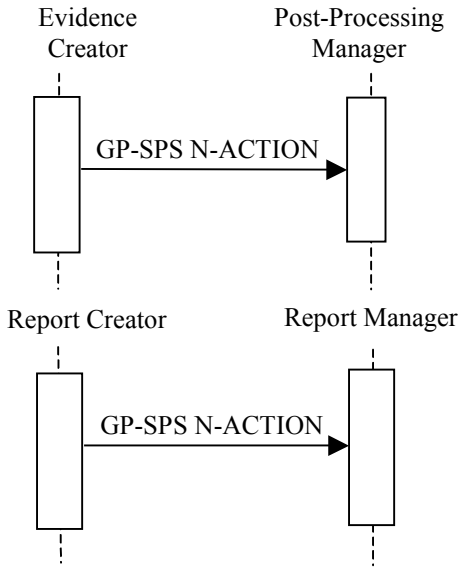
Actor: Report Manager

Role: Accepts reporting GP-SPS information from Report Creator.

4.41.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Scheduled Procedure Step SOP Class

4.41.4 Interaction Diagram



4.41.4.1 General Purpose SPS Completed Message

4.41.4.1.1 Trigger Events

For a post-processing workitem, a user or automated function on the Evidence Creator finishes the post-processing scheduled procedure step.

For the reporting workitem, a user finishes the work on the scheduled procedure step at the Report Creator.

4.41.4.1.2 Message Semantics

The Evidence Creator as SCU uses the N-ACTION request of the DICOM General Purpose Scheduled Procedure Step SOP Class to inform the Post-Processing Manager as SCP that a specific scheduled procedure step has been finished and its status is COMPLETED. This message informs the Post-Processing Manager that the SPS is complete and that further PPS will not be created for this SPS. The Evidence Creator may also discontinue a SPS with a status of DISCONTINUED.

In the same way, the Report Creator uses the N-ACTION request of the DICOM General Purpose Scheduled Procedure Step SOP Class to inform the Report Manager as SCP that a specific scheduled procedure step has been finished and its status is COMPLETED. This message informs the Report Manager that the workitem SPS is complete and that further PPS will not be created for this SPS. The Report Creator may also discontinue a SPS with a status of DISCONTINUED.

4.41.4.1.3 Expected Actions

The Post-Processing Manager or the Report Manager updates the status of the SPS to COMPLETED or DISCONTINUED.

In addition, the Post-Processing Manager or Report Manager informs the DSS and Image Manager using the Performed Work Status Update transaction.

4.42 Performed Work Status Update

This section corresponds to Transaction RAD-42 of the IHE Technical Framework. Transaction RAD-42 is used by the Department System Scheduler, Report Manager and Image Manager.

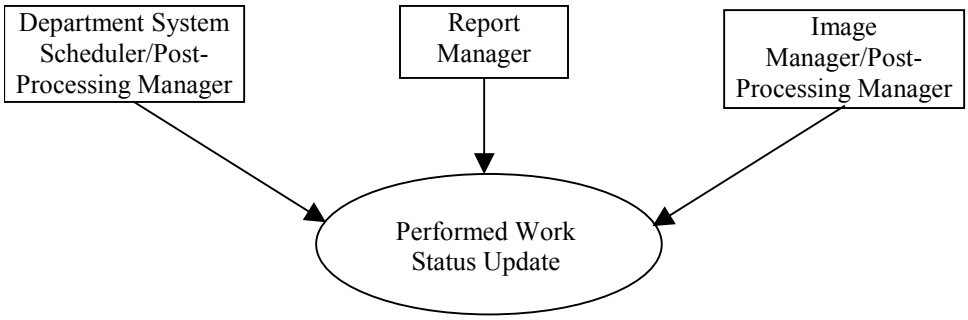
4.42.1 Scope

This transaction is used by the Department System Scheduler, Report Manager or the Image Manager to inform the others of the status of performed work being managed. This transaction allows the system not managing the performed work to stay in sync with the status.

How or whether the non-managing system uses this information is at the discretion of implementers and customers. Some examples are given below:

- The Department System Scheduler is grouped with the Post-Processing Manager and manages all post-processing tasks. This transaction enables the Department System Scheduler to notify the Image Manager about the Post-Processing work that has been performed, e.g. CAD has been performed on a set of images and an evidence document has been stored.
- The Image Manager is grouped with the Post-Processing Manager and manages some post-processing tasks. This transaction enables the Image Manager to notify the Department System Scheduler about the post-processing work that has been performed.
- The Report Manager is implemented as a standalone system and manages reporting tasks. This transaction enables Report Manager to notify Department System Scheduler and Image Manager that report has been completed.

4.42.2 Use Case Roles



Actor: Department System Scheduler

Role: When managing tasks (i.e. is grouped with a Post-processing Manager), it must send task status notifications to the Image Manager and Report Manager. When monitoring the status of tasks managed by the Image Manager or Report Manager it must be ready to receive task status notifications.

Actor: Image Manager

Role: When managing tasks (i.e. is grouped with a Post-processing Manager), it must send task status notifications to the Department System Scheduler and Report Manager. When monitoring the status of tasks managed by the Department System Scheduler or Report Manager it must be ready to receive task status notifications.

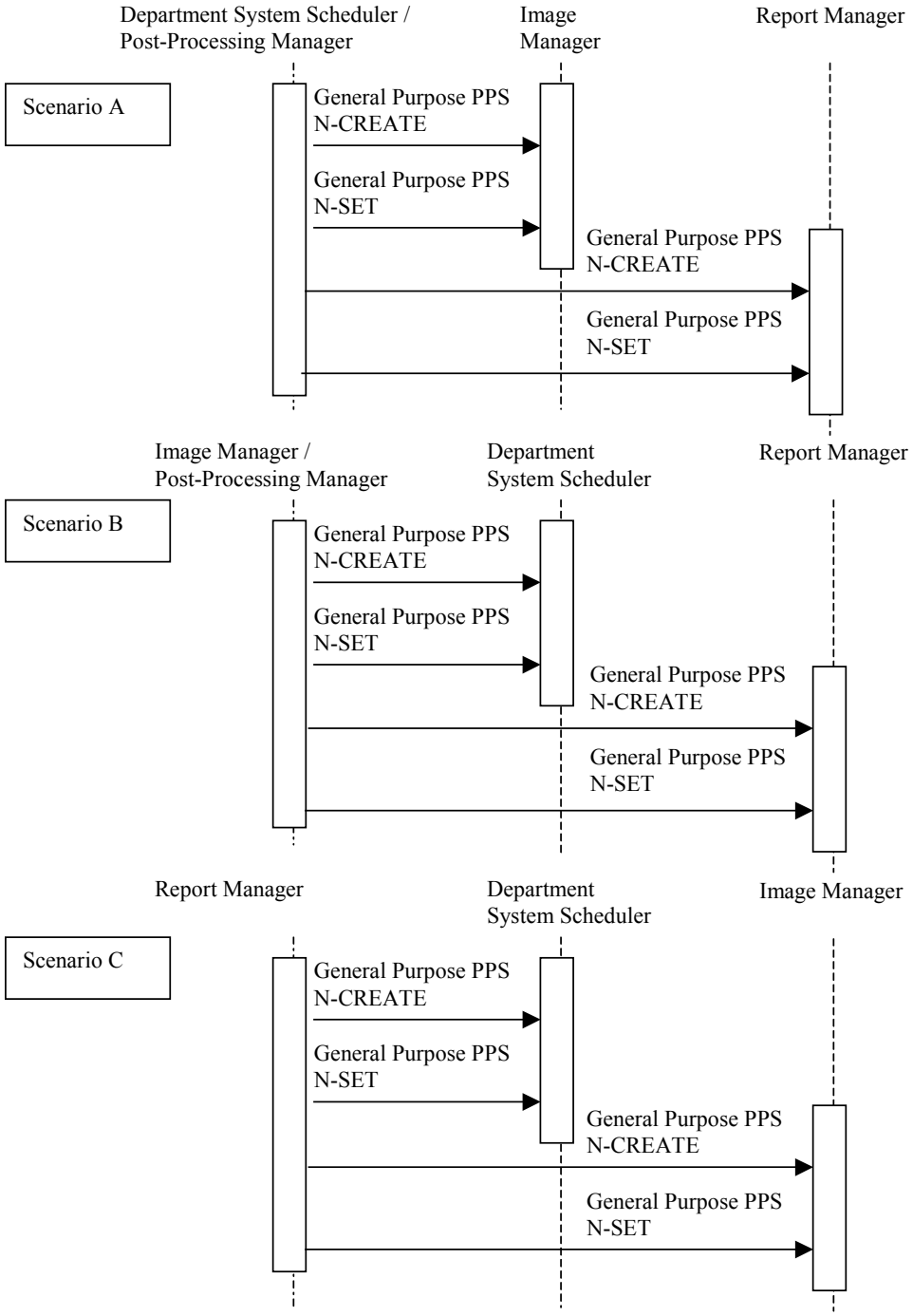
Actor: Report Manager

Role: When managing tasks (i.e. implementing Reporting Worklist, Workitem Claimed, Workitem Completed, Workitem Performed Procedure Step In Progress, Workitem Performed Procedure Step Completed), it must send task status notifications to the Department System Scheduler and Image Manager. When monitoring the status of tasks managed by the Department System Scheduler or Image Manager it must be ready to receive task status notifications.

4.42.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Performed Procedure Step SOP Class

4.42.4 Interaction Diagram



960

4.42.4.1 Post-Processing Performed Procedure Step Created/Updated Message

4.42.4.1.1 Trigger Events

In scenario A, the Department System Scheduler is grouped with a Post-Processing Manager and receives status creation or update on tasks it manages. In scenario B, the Image Manager, due to being grouped with a Post-Processing Manager, receives status creation or updates on tasks it manages, e.g. from an Evidence Creator. In Scenario C, Report Manager receives status creation or updates on tasks it manages from Report Creator. In either scenario, for example, a GP-PPS Completed message received by the Post-Processing Manager or Report Manager shall trigger the Work Status Update message to be sent.

4.42.4.1.2 Message Semantics

In scenario A, the Department System Scheduler uses the N-CREATE and N-SET requests of the DICOM General Purpose Performed Procedure Step SOP to inform the Image Manager and Report Manager when work has been started and when it is complete. The Department System Scheduler performs the SCU role, and the Image Manager and Report Manager perform the SCP role.

In scenario B, the Image Manager uses the N-CREATE and N-SET requests of the DICOM General Purpose Performed Procedure Step SOP to inform the Department System Scheduler and Report Manager when work has been started and when it is complete. The Image Manager performs the SCU role, and the Department System Scheduler and Report Manager perform the SCP role.

In scenario C, the Report Manager uses the N-CREATE and N-SET requests of the DICOM General Purpose Performed Procedure Step SOP to inform the Department System Scheduler and Image Manager when work has been started and when it is complete. The Report Manager performs the SCU role, and the Department System Scheduler and Image Manager performs the SCP role.

"Performed work" may consist of one or more related sub-workitems managed by the SCU, who is acting as the workflow manager for these workitems. As the SCU receives status information about each sub-workitem, it will in turn update the SCP. The SCU sends N-CREATE with GP-PPS status of "IN PROGRESS" after the sub-workitem has been claimed, but no later than the first workitem performed procedure step in progress transaction for that sub-workitem has been performed. In the N-CREATE, the SCU uses the Performed Workitem Code Sequence (0040,4019) to communicate the sub-workitem. The SCU may use N-SET to send intermediate updates. The final N-SET with GP-PPS status of "COMPLETED" is sent after the sub-workitem GP-SPS is completed. If there are further sub-workitems managed by the SCU, N-SET will contain the Requested Subsequent WorkItem Code Sequence, indicating the next workitem it will be updating. When the SCU finishes updating all sub-workitems it manages, this attribute will be sent with the workitem of "No Subsequent Workitems," signifying the end of this set of performed work. This means that another workflow manager may take over managing subsequent set of work.

Post-Processing Manager and Report Manager shall generate unscheduled GP-PPS to use in the Performed Work Status transaction; they cannot simply re-transmit the GP-PPS received from the Evidence Creator or Report Creator. To populate Performed WorkItem Code Sequence, they shall use appropriate codes from DCMR Context Group 9231 (see table 4.42-1).

Table 4.42-1: Context ID 9231 – General Purpose Workitem Definition

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	110001	Image Processing
DCM	110002	Quality Control
DCM	110003	Computer Aided Diagnosis
DCM	110004	Computer Aided Detection
DCM	110005	Interpretation
DCM	110006	Transcription
DCM	110007	Report Verification
DCM	110008	Print
DCM	110009	No subsequent Workitems

4.42.4.1.3 Expected Actions

The Department System Scheduler or Image Manager records and uses the information as appropriate to its responsibilities.

4.43 Evidence Document Stored

This section corresponds to Transaction RAD-43 of the IHE Technical Framework. Transaction RAD-43 is used by the Acquisition Modality and Evidence Creator actors.

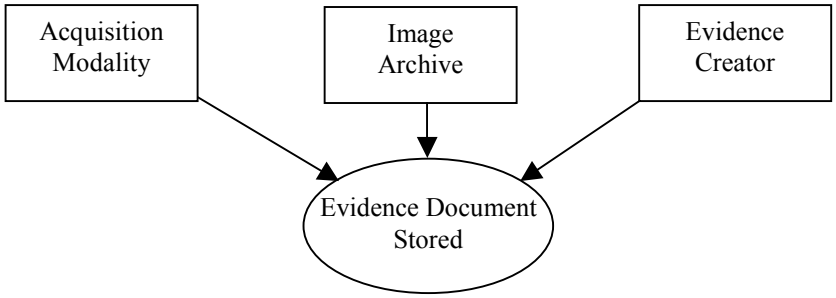
4.43.1 Scope

In the Evidence Documents Stored transaction, the Acquisition Modality or the Evidence Creator transmits an Evidence Document, which is stored in the Image Archive.

Evidence Documents are DICOM composite objects that are produced as a result of performing procedure steps such as image acquisition, image processing or computer-aided detection.

These objects are intended to serve as evidence for diagnostic interpretation; however, they are not images but rather DICOM Structured Reporting documents. Evidence Documents represent the uninterpreted information which is primarily managed and used inside imaging department, although distribution outside Radiology is not precluded. Such objects are not expected to be managed by the Report Manager. Objects encoded as SOP Instances of such SOP classes as Mammography CAD are examples of Evidence documents.

4.43.2 Use Case Roles



Actor: Acquisition Modality

Role: Records non-imaging evidence information in the Evidence Documents and stores them to the Image Archive.

Actor: Evidence Creator

Role: Records non-imaging evidence information in the Evidence Documents and stores them to the Image Archive.

Actor: Image Archive

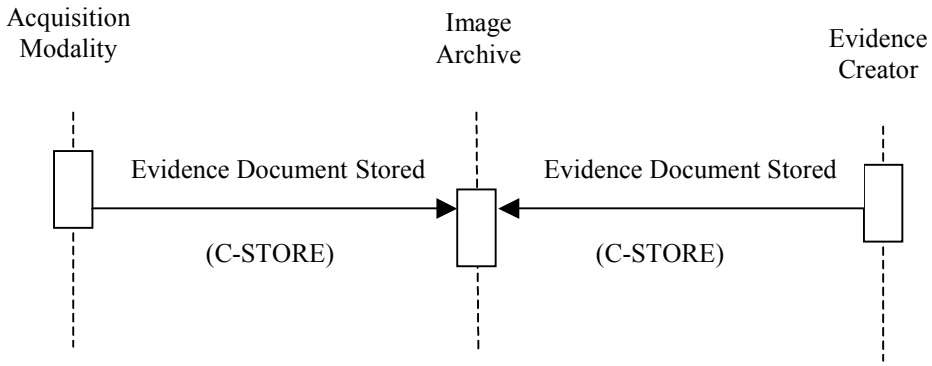
Role: Accepts and Stores Evidence Document Instances received from the Acquisition Modality or Evidence Creator.

4.43.3 Referenced Standards

DICOM 2011 PS 3.4: Storage Service Class; Basic Text SR SOP Class; Enhanced SR SOP Class; Comprehensive SR SOP Class; Chest CAD SR SOP Class; Mammography CAD SR SOP Class; OB-GYN Ultrasound Procedure Reports; Catheterization Lab SR; Vascular Ultrasound SR.

This list is intended to provide a base list of examples. It is expected that DICOM will continue to publish additional SR SOP Classes and Templates appropriate for Evidence Documents.

4.43.4 Interaction Diagram



4.43.4.1 Evidence Document Stored

This transaction relates to the "DICOM C-STORE" event between the Acquisition modality or the Evidence Creator and the Image Archive in the above interaction diagram.

4.43.4.1.1 Trigger Events

The Acquisition Modality or the Evidence Creator generates Evidence Documents that need to be archived.

4.43.4.1.2 Message Semantics

The Acquisition Modality or the Evidence Creator uses the DICOM C-STORE message to transfer the Evidence Documents (as SR objects) to the Image Archive for storage. The Acquisition Modality or the Evidence Creator is the DICOM Storage SCU and the Image Archive is the DICOM Storage SCP.

It is a requirement that certain information be recorded in the Evidence Document header. The details of mapping such information to DICOM SOP instances are specified in Appendix C, Table C.1-1.

4.43.4.1.3 Expected Actions

The DICOM Standard (2011) defines a number of non-image storage SOP classes that may be used for creation of Evidence Documents. It is expected that the Image Archive will support

multiple storage SOP classes as defined in table 4.43-1 below.

Table 4.43-1: Suggested Evidence Document SOP Classes

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.88.50	Mammography CAD SR
1.2.840.10008.5.1.4.1.1.88.11	Basic Text SR
1.2.840.10008.5.1.4.1.1.88.22	Enhanced SR
1.2.840.10008.5.1.4.1.1.88.33	Comprehensive SR
1.2.840.10008.5.1.4.1.1.88.65	Chest CAD SR

It is also expected that the Image Archive will support one or more Templates that are defined to be used with the Evidence Documents, as specified in the Table 4.43-2.

Table 4.43-2: Suggested Evidence Document Templates

Template ID	Template Name
TID 4000	Mammography CAD Document Root Template
TID 5000	OB-GYN Ultrasound Procedure Report
TID 3500	Hemodynamics Report
TID 4100	Chest CAD SR Document Root Template
TID 5100	Vascular Ultrasound Procedure Report Template

The Image Archive must support storage level 2: i.e., all type 3 attributes must be supported.

1.2.1.1.1.14.43.4.1.3.1 Mammography Image Profile

Evidence Creator and Image Manager/Image Archive actors supporting the Mammography Image Profile shall support the Mammography CAD SR SOP Class.

In particular, CAD systems (acting as Evidence Creators) performing analysis on Mammography images shall be able to return their results in Mammography CAD SR SOP Class instances. This does not preclude them from additionally creating Presentation States and/or Secondary Capture or Mammography images.

Also, Image Manager/Image Archive actors shall not only be able to receive Mammography CAD SR SOP Class objects from the Evidence Creator, but also be able to return them in response to queries (i.e., they must actually be stored intact for later retrieval, not merely processed or burned in to images dynamically). See Retrieve Evidence Transaction Section 4.45.4.2.3.1.

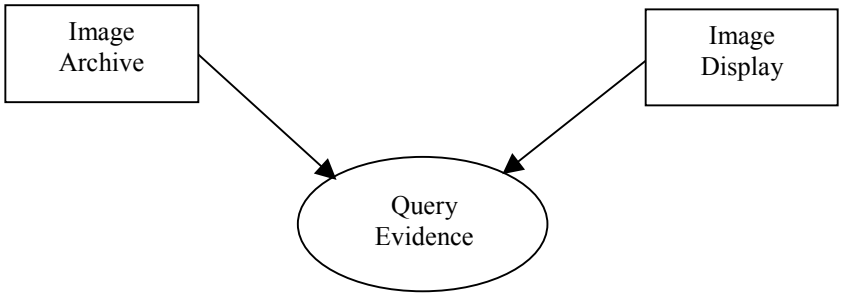
4.44 Query Evidence Documents

This section corresponds to Transaction RAD-44 of the IHE Technical Framework. Transaction RAD-44 is used by the Image Archive and Image Display actors.

4.44.1 Scope

This section describes the sequence of Transactions required for the Image Display to query the Image Archive for instances of Evidence Documents.

4.44.2 Use Case Roles



Actor: Image Display

Role: Query for Evidence Documents objects (generally in order to retrieve them).

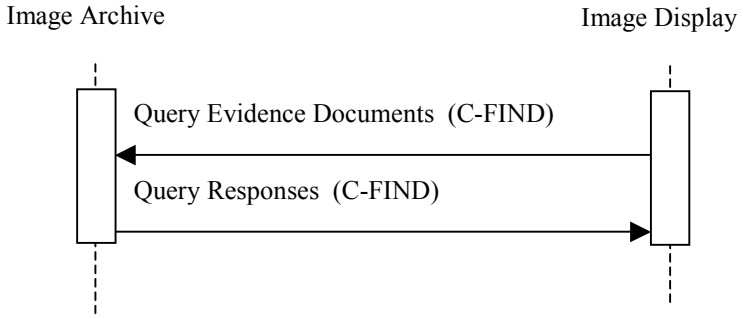
Actor: Image Archive

Role: Respond to queries from the Image Display for Evidence Documents objects.

4.44.3 Referenced Standards

DICOM 2011 PS 3.4: Query/Retrieve Service Class

4.44.4 Interaction Diagram



4.44.4.1 Query Evidence Documents

The Query (Study Root – FIND and optionally Patient Root – FIND) SOP Classes shall be supported. Refer to DICOM 2011 PS 3.4: Query/Retrieve Service Class for detailed descriptive semantics.

4.44.4.1.1 Trigger Events

Image Display needs to obtain information about Evidence Documents.

4.44.4.1.2 Message Semantics

The message semantics are defined by the DICOM Query/Retrieve SOP Classes.

A C-FIND Request from the DICOM Study Root Query/Retrieve Information Model – FIND SOP Class or the DICOM Patient Root Query/Retrieve Information Model – FIND SOP Class shall be sent from the Image Display to the Image Archive.

The Image Display uses one or more matching keys as filter criteria to obtain the list of matching entries in the Image Archive at the selected level (Patient & Study/Series/Instance).

In addition to the required and unique keys defined by the DICOM Standard, the IHE Technical Framework has defined matching and return keys to be supported by query SCUs and SCPs. The keys are defined in RAD TF-2: 4.14.4.1.2 and table 4.14-1. The conventions for key usage are defined in RAD TF-2: 2.2. For the Image Display (SCU) and the Image Archive (SCP) the additional Evidence Document Instances specific keys are defined in table 4.44-1.

Table 4.44-1: Evidence Document Instance Specific Query Matching and Return Keys

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Evidence Document Instance Specific Level					
Content Date	(0008,0023)	O	O	O	R+
Content Time	(0008,0033)	O	O	O	R+
Referenced Request Sequence	(0040,A370)				
>Study Instance UID	(0020,000D)	O	O	R+*	R+
>Accession Number	(0008,0050)	O	O	R+	R+
>Requested Procedure ID	(0040,1000)	O	O	R+	R+
>Requested Procedure Code Sequence	(0032,1064)				
>>Code Value	(0008,0100)	O	O	O	R+
>>Coding Scheme Designator	(0008,0102)	O	O	O	R+
>>Coding Scheme Version	(0008,0103)	O	O	O	R+
>>Code Meaning	(0008,0104)	O	O	O	R+
Content Template Sequence	(0040,A504)				
>Template Identifier	(0040,DB00)	O	O	R+	R+
Concept Name Code Sequence	(0040,A043)				

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>Code Value	(0008,0100)	O	O	R+*	R+
>Coding Scheme Designator	(0008,0102)	O	O	R+*	R+
>Coding Scheme Version	(0008,0103)	O	O	O	R+
>Code Meaning	(0008,0104)	O	O	R+	R+

4.44.4.1.3 Expected Actions

The Image Archive receives the C-FIND request, performs the matching on the provided keys and sends the list of matching records back to the Image Display via C-FIND responses.

The Image Display is expected to use the Template ID to select Evidence Documents for retrieval that it supports.

4.44.4.1.3.1 Mammography Image Profile

Image Display and Image Manager/Image Archive actors supporting the Mammography Image Profile shall support the Mammography CAD SR SOP Class.

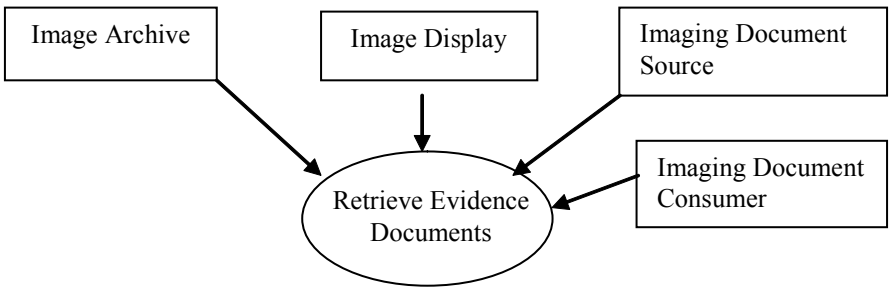
4.45 Retrieve Evidence Documents

This section corresponds to Transaction RAD-45 of the IHE Technical Framework. Transaction RAD-45 is used by the Image Archive, Image Display, Imaging Document Source and Imaging Document Consumer.

4.45.1 Scope

In the Retrieve Evidence Documents Transaction, the requested DICOM Evidence Documents are transferred from the Image Archive to the Image Display or from the Imaging Document Source to the Imaging Document Consumer.

4.45.2 Use Case Roles



Actor: Image Archive:

Role: Sends requested Evidence Documents to the Image Display Actor.

Actor: Imaging Document Source

Role: Sends requested Evidence Documents to the Imaging Document Consumer.

Actor: Image Display

Role: Receives requested Evidence Documents from the Image Archive Actor.

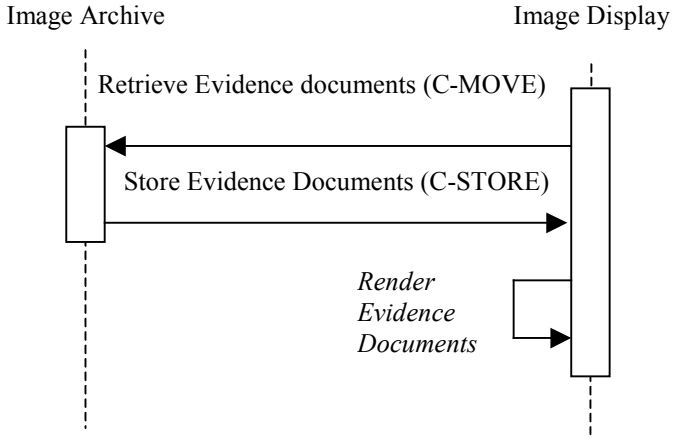
Actor: Imaging Document Consumer

Role: Receives requested Evidence Documents from the Imaging Document Source

4.45.3 Referenced Standards

DICOM 2011 PS 3.4: Query/Retrieve Service Class, Storage SOP Class

4.45.4 Interaction Diagram



4.45.4.1 Retrieve Evidence Documents

The Retrieve (Study Root – MOVE and optionally Patient Root - MOVE) SOP Classes shall be supported. The Image Archive as an SCU shall support DICOM Storage SOP Classes that may be used as Evidence Documents. The Imaging Document Source as an SCU shall support DICOM Storage SOP Classes that may be used as Evidence Documents it published for sharing. Refer to DICOM 2011 PS 3.4, Annex C, for detailed descriptive semantics (see table 4.38-1).

In the case of retrieving Evidence Documents in a Cross-Enterprise, imaging document sharing (XDS-I.b) network environment, a configuration of mapping the AE Titles to DICOM AE Network Addresses (IP Address and Port number) is needed to be exchanged between the Imaging Document Source and the Imaging Document Consumer. Appendix G describes in details the AE Title mapping to the DICOM AE Network Addresses.

4.45.4.1.1 Trigger Events

The Image Display or the Imaging Document Consumer selects specific Evidence Document objects to retrieve from the Image Archive or the Imaging Document Source.

4.45.4.1.2 Message Semantics

The message semantics are defined in the DICOM Query/Retrieve Service Class section of the DICOM 2011 PS 3.4: Query/Retrieve Service Class. It is the responsibility of the Image

Manager or Imaging Document Source to assure that the patient and procedure information is current in the Evidence Document objects when they are retrieved from the Image Archive or Imaging Document Source.

4.45.4.1.3 Expected Actions

The Image Archive or the Imaging Document Source receives the C-MOVE request, establishes a DICOM association with the Image Display or the Imaging Document Consumer, and uses the DICOM C-STORE command to transfer the requested Evidence Document objects.

Since the Image Display or the Imaging Document Consumer can select compatible documents based on the Template IDs returned in the query, the Image Display or the Imaging Document Consumer is required not to return an error to the Image Archive or the Imaging Document Source due to the retrieved document content. The retrieved results may simply be discarded instead.

4.45.4.2 Render Evidence Documents

This transaction relates to the "Render Evidence Documents" event of the above interaction diagram.

4.45.4.2.1 Trigger Events

The Image Display or the Imaging Document Consumer receives Evidence Document instances from the Image Archive or the Imaging Document Source.

4.45.4.2.2 Invocation Semantics

This is a local invocation of functions resident within the Image Display or the Imaging Document Consumer. Evidence Documents shall be displayed to the user of the Image Display or the Imaging Document Consumer. The method used by the Image Display or the Imaging Document Consumer to present Evidence Documents for viewing by the user is outside the scope of the IHE Technical Framework. For example, in the case when an Image Display or an Imaging Document Source is grouped with an Evidence Creator, the Evidence Document may be rendered as input for further processing by the Evidence Creator.

4.45.4.2.3 Expected Actions

The Image Display or the Imaging Document Consumer renders the Evidence Documents retrieved. If the Image Display or the Imaging Document Consumer is unable to handle parts of the document, it may inform the user and offer the choice of doing a "low-grade" rendering or ignoring the data.

Evidence Documents may contain references to other types of evidence objects. The Image Display or the Imaging Document Consumer shall always be able to render (or "low-grade" render) referenced Evidence Documents or to invoke other rendering display functionality.

If the Image Display also supports the Consistent Presentation of Images Profile, it is also required to apply any presentation states referenced in the Evidence Document for application to the relevant images.

If the Image Display also supports the Key Image Notes Profile, it is also required to render any Key Image Notes referenced in the Evidence Document.

Note: It is recommended to use the just retrieved instance of the Evidence Document to ensure that the most recent patient data be displayed to reflect possible patient merge and patient update in the Image Manager/Image Archive. This patient data may be inconsistent with patient data contained in a previously retrieved copy of the same Evidence Document instance.

4.45.4.2.3.1 Mammography Image Profile

Image Display and Image Manager/Image Archive actors supporting the Mammography Image Profile shall support the Mammography CAD SR SOP Class.

Image Display actors shall be able to apply Mammography CAD SR information to displayed images; see RAD TF-2:4.16.4.2.2.1.1.8 Display of CAD Marks. It is not permitted to ignore data that has a rendering intent of presentation required; there is no such thing as a “low-grade” rendering for Mammography CAD SR.

4.46 Query Reporting Worklist

This section corresponds to Transaction RAD-46 of the IHE Technical Framework. Transaction RAD-46 is used by Report Manager and Report Creator.

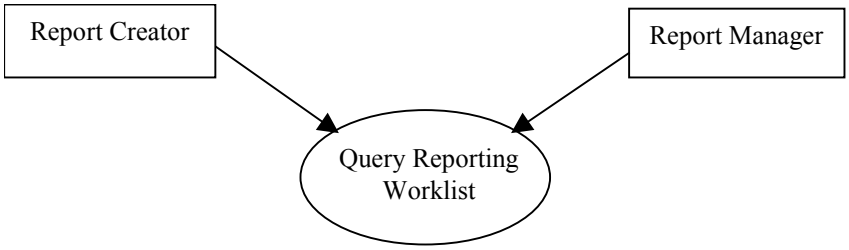
4.46.1 Scope

This transaction is used during Reporting work done by the Report Creator to find out what tasks have been scheduled or assigned to it by the Report Manager. This transaction allows the Report Manager to provide the Report Creator with a worklist that shall contain Reporting-related workitem codes for conducting Interpretation of Images, Dictation, Transcription and Verification of the report.

The Report Manager is the provider of the worklist. It obtains the necessary information about the patient and type of a procedure through the Procedure Scheduled transaction from the Department System Scheduler. It is being notified about the existence of images and other evidence objects through the Modality Procedure Step completed transaction from Performed Procedure Step Manager, and may confirm their availability through the Images Available Query.

The Report Creator retrieves the worklist and includes received information such as patient demographics, Study Instance UID, etc., in the resulting instances (see Appendix D), which are stored through instance stored transactions such as Evidence Document Stored, Image Stored, etc.

4.46.2 Use Case Roles



Actor: Report Creator

Role: Queries the Report Manager for Reporting Scheduled Procedure Steps.

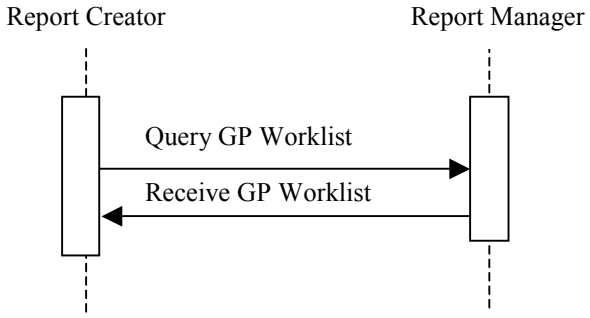
Actor: Report Manager

Role: Schedules Reporting procedure steps for the workitems of Interpretation, Dictation, Transcription and Verification as applicable; accepts query requests for Worklist items and returns responses.

4.46.3 Referenced Standards

DICOM 2011 PS 3.4: General Purpose Worklist SOP Class

4.46.4 Interaction Diagram



4.46.4.1 Query General Purpose Worklist Message

This is the worklist query sent to the Report Manager.

4.46.4.1.1 Trigger Events

A user or an automated function on the Report Creator queries for scheduled Reporting worklist items.

4.46.4.1.2 Message Semantics

C-FIND request of the DICOM General Purpose Worklist SOP Class is used to query for the general purpose worklist. Report Creator performs the SCU role, and the Report Manager performs the SCP role.

4.46.4.1.2.1 Matching Keys and Return Keys

The Report Creator is required to query for specific attributes (return keys) that will be inserted into the instances created as a result of creation of a diagnostic report. See Appendix D for more details.

The Report Creator shall support individually each one of the required query keys listed in Table 4.46-3 - Return and Matching Keys For Reporting Worklist. In addition, at least one of the following two combinations shall be implemented by the Report Creator:

1. Patient Oriented Query: Query for a worklist for a specific patient/procedure. The SCU shall support all combinations (31) of the matching key attributes listed in table 4.46-1 by including 1 or more keys. The sequence attributes denoted in the italics are not matching keys on their own but have to be included in a query to convey the value of the attributes contained within them. Thus, the SCU shall support any combination of Patient's Name, Patient ID, Accession Number, Requested Procedure ID, and Scheduled Workitem Code.

Table 4.46-1: GPWL Keys for Patient Oriented Query

Matching Key Attributes	Tag
Patient's Name	(0010,0010)

Matching Key Attributes	Tag
Patient ID	(0010,0020)
Referenced Request Sequence	*(0040,A370)*
>Accession Number	(0008,0050)
>Requested Procedure ID	(0040,1001)
Scheduled Workitem Code Sequence	*(0040,4018)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)

2. User-oriented Query: Query for a broad worklist for particular user being logged in on a particular station. The SCU shall support all (63) combinations of the matching key attributes listed in table 4.46-2 by including 1 or more keys. The sequence attributes denoted in the italics are not matching keys on their own but have to be included in a query to convey the value of the attributes contained within them. Code Value of the Scheduled Station Name Code Sequence, if valued, shall be set to the AE Title of the workstation's General Purpose Worklist SCU.

Table 4.46-2: GPWL Keys for User-Oriented Queries

Matching Key Attributes	Tag
General Purpose Scheduled Procedure Step Status	(0040,4001)
Scheduled Station Name Code Sequence	*(0040,4025)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
Scheduled Procedure Step Start Date and Time	(0040,4005)
Scheduled Workitem Code Sequence	*(0040,4018)*
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
Scheduled Human Performers Sequence	*(0040,4034)*
>Human Performer Code Sequence	*(0040,4009)*
>>Code Value	(0008,0100)
>>Coding Scheme Designator	(0008,0102)
>Human Performer's Name	(0040,4037)

4.46.4.1.2.2 Examples for the Use of Matching Key Attributes

- Using the Scheduled Procedure Step Start Date and Time key: query for all the Reporting tasks scheduled for today.
- Using the Scheduled Workitem Code key: query for all Transcription tasks.
- Using Scheduled Human Performer Name key: query for all the Reporting tasks that are scheduled for this radiologist.
- Using the Scheduled Procedure Step Start Date and Time, Scheduled Workitem Code and Scheduled Human Performer Name keys: query for all the report verification tasks that are scheduled for today on for this radiologist.

Note: Applications are recommended to append a wildcard "*" at the end of each component of the structured Patient Name to facilitate matching with both structured and unstructured Patient Names.

4.46.4.1.2.3 Matching Keys and Return Keys

The Report Creator is required to query for specific attributes (return keys), many of which will be required in the objects it creates. The requirements for the attributes in the stored objects are defined in Appendix D. There are additional attributes that may be queried but might not be used elsewhere.

Table 4.46-3 summarizes the matching key requirements and lists the optional and required attributes that may be requested and shall be returned in order to make these available to the user at the Report Creator. See RAD TF-2: 2.2 for more information on the requirements expressed in this table.

Table 4.46-3: Matching and Return Keys for ReportWorklist Queries

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
SOP Common					
Specific Character Set	(0008,0005)	O	O	O	R
SOP Class UID	(0008,0016)	O	O	R+*	R
SOP Instance UID	(0008,0018)	O	R	R+*	R
General Purpose Scheduled Procedure Step Information					
General Purpose Scheduled Procedure Step Status	(0040,4001)	R+	R	R+	R
Input Availability Flag	(0040,4020)	O	R	R+	R
General Purpose Scheduled Procedure Step Priority	(0040,4003)	O	R	R+	R
Scheduled Procedure Step ID	(0040,0009)	O	O	O	R
Scheduled Workitem Code Sequence	(0040,4018)				
>Code Value	(0008,0100)	R+	R	R+*	R
>Coding Scheme Designator	(0008,0102)	R+	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+	R
Scheduled Processing Applications Code Sequence	(0040,4004)				
>Code Value	(0008,0100)	O	R	O	R
>Coding Scheme Designator	(0008,0102)	O	R	O	R
>Code Meaning	(0008,0104)	-	-	O	R
Scheduled Station Name Code Sequence	(0040,4025)				
>Code Value	(0008,0100)	R+	R	R+*	R
>Coding Scheme Designator	(0008,0102)	R+	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+	R

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Scheduled Station Class Code Sequence	(0040,4026)				
>Code Value	(0008,0100)	O	R	O	R
>Coding Scheme Designator	(0008,0102)	O	R	O	R
>Code Meaning	(0008,0104)	-	-	O	R
Scheduled Station Geographic Location Code Sequence	(0040,4027)				
>Code Value	(0008,0100)	O	R	O	R
>Coding Scheme Designator	(0008,0102)	O	R	O	R
>Code Meaning	(0008,0104)	-	-	O	R
Scheduled Procedure Step Start Date and Time	(0040,4005)	R+	R	R+	R
Expected Completion Date and Time	(0040,4011)	O	R	O	R
Scheduled Human Performers Sequence	(0040,4034)				
>Human Performer Code Sequence	(0040,4009)				
>>Code Value	(0008,0100)	R+	R	R+*	R
>>Coding Scheme Designator	(0008,0102)	R+	R	R+*	R
>>Code Meaning	(0008,0104)	-	-	R+	R
>Human Performer's Name	(0040,4037)	R+	R+	R+	R+
>Human Performer's Organization	(0040,4036)	O	O	O	R+
Referenced Study Component Sequence	(0008,1111)				
>Referenced SOP Class UID	(0008,1150)	O	O	O	R
>Referenced SOP Instance UID	(0008,1155)	O	O	O	R
Input Information Sequence	(0040,4021)				
>Study Instance UID	(0020,000D)	O	O	R+*	R
>Referenced Series Sequence	(0008,1115)				
>>Series Instance UID	(0020,000E)	O	O	R+*	R
>>Retrieve AE Title	(0008,0054)	O	O	O	R
>>Storage Media File-Set ID	(0088,0130)	O	O	O	O
>>Storage Media File-Set UID	(0088,0140)	O	O	O	O
>>Referenced SOP Sequence	(0008,1199)				
>>>Referenced SOP Class UID	(0008,1150)	O	O	R+*	R
>>>Referenced SOP Instance UID	(0008,1155)	O	O	R+*	R
Relevant Information Sequence	(0040,4022)				
>Study Instance UID	(0020,000D)	O	O	O	R
>Referenced Series Sequence	(0008,1115)				

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>>Series Instance UID	(0020,000E)	O	O	O	R
>>Retrieve AE Title	(0008,0054)	O	O	O	O
>>Storage Media File-Set ID	(0088,0130)	O	O	O	O
>>Storage Media File-Set UID	(0088,0140)	O	O	O	R
>>Referenced SOP Sequence	(0008,1199)				
>>>Referenced SOP Class UID	(0008,1150)	O	O	O	R
>>>Referenced SOP Instance UID	(0008,1155)	O	O	O	R
Resulting General Purpose Performed Procedure Step Sequence	(0040,4015)				
>Referenced SOP Class UID	(0008,1150)	O	O	O	R
>Referenced SOP Instance UID	(0008,1155)	O	O	O	R
Actual Human Performers Sequence	(0040,4035)				
>Human Performer Code Sequence	(0040,4009)				
>>Code Value	(0008,0100)	O	O	O	R
>>Coding Scheme Designator	(0008,0102)	O	O	O	R
>>Code Meaning	(0008,0104)	-	-	O	R
>Human Performer's Name	(0040,4037)	O	O	O	R+
>Human Performer's Organization	(0040,4036)	O	O	O	R+
Study Instance UID	(0020,000D)	O	O	R+*	R
Multiple Copies Flag	(0040,4006)	O	O	O	R
All other Attributes from the General Purpose Scheduled Procedure Step Information Module		O	O	O	O
General Purpose Scheduled Procedure Step Relationship					
Referenced Request Sequence	(0040,A370)				
>Study Instance UID	(0020,000D)	O	O	R+*	R
>Referenced Study Sequence	(0008,1110)				
>>Referenced SOP Class UID	(0008,1150)	O	O	R+*	R
>>Referenced SOP Instance UID	(0008,1155)	O	O	R+*	R
>Requested Procedure ID	(0040,1001)	R+	R+	R+	R
>Requested Procedure Description	(0032,1060)	O	O	O	R
>Requested Procedure Code Sequence	(0032,1064)				
>>Code Value	(0008,0100)	O	O	O	R
>>Coding Scheme Designator	(0008,0102)	O	O	O	R
>>Code Meaning	(0008,0104)	-	-	O	R

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>Accession Number	(0008,0050)	R+	R	R+	R
>Requesting Physician	(0032,1032)	O	O	O	R
>All other Attributes relating to the Requested Procedure and the Imaging Service Request in the General Purpose Scheduled Procedure Step Relationship Module		O	O	O	O
Patient Relationship					
All Attributes from the Patient Relationship Module		O	O	O	O
Patient Identification					
Patient's Name	(0010,0010)	R+	R	R+	R
Patient ID	(0010,0020)	R+	R	R+	R
All other Attributes from the Patient Identification Module		O	O	O	O
Patient Demographic					
Patient's Birth Date	(0010,0030)	O	O	R+	R
Patient's Sex	(0010,0040)	O	O	R+	R
All other Attributes from the Patient Demographic Module		O	O	O	O
Patient Medical					
All Attributes from the Patient Medical Module		O	O	O	O

4.46.4.1.3 Expected Actions

The Report Manager performs the query and sends the matching General Purpose Worklist items to the Report Creator.

4.46.4.2 Receive General Purpose Worklist Message

This is the message the Report Manager sends containing General Purpose Worklist information as a response to the Report Creator query.

4.46.4.2.1 Trigger Events

The Report Manager receives a query for a Worklist.

4.46.4.2.2 Message Semantics

C-FIND Response from the DICOM General Purpose Worklist SOP Class will be used for this message. Some of the attributes queried through the worklist originate from other sources during previous steps in the workflow, and are made available to the Report Manager through other transactions such as MPPS. It is up to the Report Manager to determine the Input Information,

e.g. study, series, etc. appropriate to be used in a workitem Scheduled Procedure Step, i.e. it is independent of the acquisition process and resulting MPPS.

The Post-Processing Manager shall specify the type of task to be performed in the content of the Scheduled Workitem Code Sequence (0040,4018) using one of the following values from DCMR CID 9231:

Table 4.46-4: Reporting Workitem Definition

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	110005	Interpretation
DCM	110006	Transcription
DCM	110007	Report Verification
DCM	110009	No subsequent Workitems

4.46.4.2.3 Expected Actions

A Report Creator displays the worklist to the user who might then select the item to work on. When the user selects the workitem and performs the report creation work, the Report Creator will notify the Report Creator of the work progress as defined in the Workitem Claimed and Workitem Completed transactions.

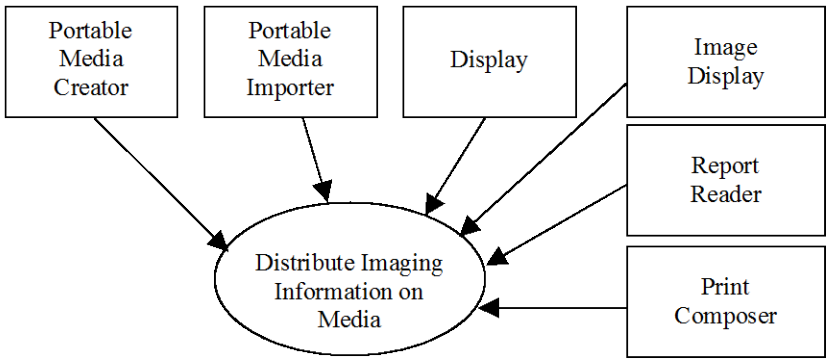
4.47 Distribute Imaging Information on Media

This section corresponds to Transaction RAD-47 of the IHE Technical Framework. Transaction RAD-47 is used by the Portable Media Creator and by media reading actors (Portable Media Importer, Image Display, Report Reader, Display and Print Composer).

4.47.1 Scope

In the Distribute Imaging Information on Media transaction the Portable Media Creator sends information to media reading actors by means of Interchange Media where it stores the information.

4.47.2 Use Case Roles



Actor: Portable Media Creator

Role: Assemble the media content and store it on the media to be distributed.

Actor: Portable Media Importer

Role: Read the DICOM content of distributed media in order to access information stored in the DICOMDIR file and its referenced instances (DICOM FSR) and perform import of media data.

Actor: Image Display

Role: Read the DICOM content of distributed media in order to access information stored in the DICOMDIR file (DICOM FSR) and display its referenced evidence objects.

Actor: Report Reader

Role: Read the DICOM content of distributed media in order to access information stored in the DICOMDIR file (DICOM FSR) and read its referenced diagnostic reports.

Actor: Print Composer

Role: Read the DICOM content of distributed media in order to access information stored in the DICOMDIR file (DICOM FSR) and send print data (images) to the Print Server.

Actor: Display (from ITI TF)

Role: Read the web-viewable content of distributed media in order to access information stored in the INDEX.HTM file and display its referenced data (XHTML files and JPEG images).

4.47.3 Referenced Standard

DICOM 2011 PS 3.10: Media Storage and File Format for Data Interchange

DICOM 2011 PS 3.11: Media Storage Application Profiles

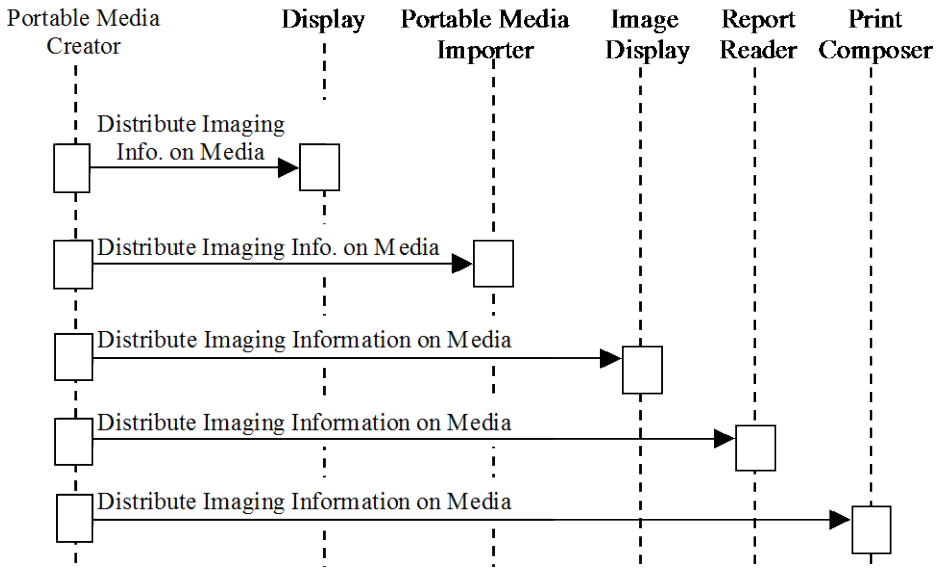
DICOM 2011 PS 3.12: Media Formats and Physical Media for Data Interchange

DICOM Supplement 80 (final text): DVD Media Application Profiles

XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition). A Reformulation of HTML 4 in XML 1.0. W3C Recommendation 26 January 2000, revised 1 August 2002. http://www.w3.org/TR/xhtml1.

XHTML™ Basic. W3C Recommendation 19 December 2000. http://www.w3.org/TR/xhtm-basic.

4.47.4 Interaction Diagram



4.47.4.1 Distribute Imaging Information on Media

This transaction consists of the interchange of information on media by way of the physical transport of the created media from the Portable Media Creator to a media-reading actor.

4.47.4.1.1 Trigger Events

The user at the Portable Media Creator wishes to transport information by the creation and transport of interchange media. The Portable Media Creator assembles the Interchange Media content and stores it on the media.

4.47.4.1.2 Message Semantics

The message semantics of this transaction are described in terms of content specifications for the media.

The Portable Media Creator shall be able to include all DICOM objects supported by the IHE actors with which it is grouped. If not grouped with any IHE actors, it shall be able to include all DICOM Storage objects listed in its DICOM Conformance Statement.

4.47.4.1.2.1 Media Filesystem and File Naming Restrictions

Since the DICOM content on the media is required to conform to the DICOM standard, some of the requirements specified in PS 3.10, 3.11 and 3.12 are reiterated here for emphasis:

- Strict ISO 9660 Level 1 compliance
- No packet writing
- File and folder names referenced by the DICOMDIR file restricted to 8 characters, uppercase letters, digits and underscore only, with no extension

Specifically, it is not permitted to name DICOM files based on their SOP Instance UID, since that would exceed the 8 character limit and use the illegal period character, and it is not permitted to add a ".dcm" extension or similar. Filenames should not be in lower case, nor have lower case equivalent file names encoded as Joliet or Rockridge extensions to the ISO 9660 filesystem.

Refer to Appendix E of this supplement for a reference to common implementation misinterpretations and/or errors that are detrimental to interoperability.

Non-DICOM data is restricted to ISO 9660 Level 1 compliance, but without the restrictions on file extensions and characters imposed by DICOM; i.e. a 3 character extension is permitted.

4.47.4.1.2.2 Content Organization Overview

The following diagram illustrates the content organization principles (see Appendix F for examples):

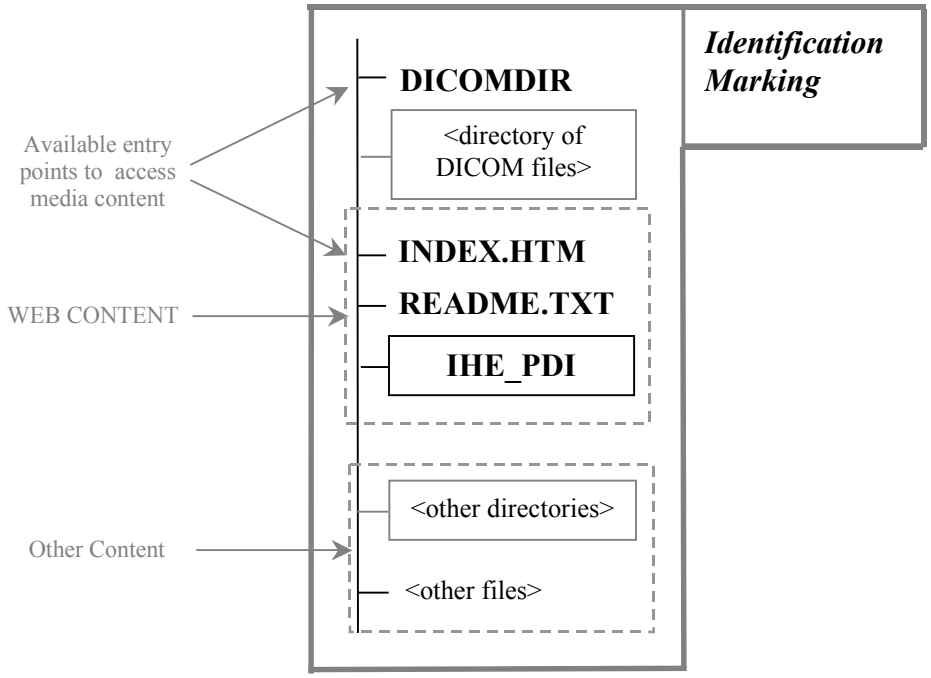


Figure 4.47.4.1.2.2-1: Media Content Organization

Description of the content to be contained in the media file system:

4.47.4.1.2.2.1 DICOM Content

The ***DICOMDIR*** file shall be located in the root directory and shall reference all DICOM instances contained in the media.

The DICOM instance files shall not be in the root directory or in the IHE_PDI sub-directory, instead they shall reside in a sub-directory whose name is not otherwise constrained. No other DICOM instance files shall be placed on the media.

It is recommended, though not required, to include the README.TXT file described below, even if the Web Content Option is not supported.

4.47.4.1.2.2.2 Web Content Option

Portable Media Creators implementing the Web Content option shall meet the following requirements:

- ***INDEX.HTM*** file located in the root directory, which shall portray the exact content of the interchange media. The file shall present:
  - An informative header containing:
    - Identification of the institution that created the interchange media
    - Optionally, a disclaimer statement about privacy/security from the institution that created the interchange media
  - a link to an entry point for accessing the web content of the *IHE_PDI* directory

- a link to the *README.TXT* file
- a link to additional non-constrained data (if it exists) - See 4.47.4.1.2.2.3
- a manifest which lists the data that can be imported by a Portable Media Importer Actor. (i.e., all DICOM content on the media)
- a manifest which lists any patient-related data contained on the CD that cannot be imported (i.e., additional non-constrained content that doesn't have an importable DICOM equivalent on the media).
- a link to a launch point for a DICOM viewer, if present on the interchange media

Note: The file INDEX.HTM is required to present the content defined above to the user. This does not imply that the information must necessarily be contained in INDEX.HTM. Instead, INDEX.HTM might also open a frame set consisting of additional XHTML files that in total contains the information specified above.

- ***README.TXT*** file located in the root directory, that shall contain:
  - Contact information regarding the Institution that created the media.
  - Information regarding the Application that created the media.
    - Name of the product application and software version
    - Contact information of the vendor of the application that created the media
  - General information about the overall organization of the interchange media. This is not intended to be specific to the content stored on this instance of interchange media, which if necessary should be placed in the *INDEX.HTM* file.
  - Information regarding the Media Viewer application (if a Media Viewer is contained)
    - Operating system(s) supported
    - Name of the product application and software version
    - Contact information of vendor that provided the Media Viewer application
    - Disclaimer statement about the intended usage of the application
    - List of minimum requirements
    - Additional information regarding the usage of the application

Note that generally the README.TXT file is independent of the clinical content of the media, i.e. the same README.TXT may be included on all media created by that application at that institution.

It is recommended that information is included in the README.TXT file about web browsers (including version number) that are known to be capable of displaying the web content as intended.

- ***IHE_PDI*** directory located in the root directory of the interchange media which shall contain:
  - Web-viewable objects in XHTML, JPEG, PNG and/or GIF derived from the DICOM encoded objects or used for web page navigation.
  - The web content shall faithfully represent the patient's clinical condition.

- It is not allowed to place any other data in the *IHE_PDI* directory.
- It is allowed to have sub-directories within the *IHE_PDI* directory

Note that these are IHE requirements (not DICOM requirements) that are intended to facilitate the overall organization of the media and make easier the access to the INDEX.HTM file, especially for non-expert users like patients and referring physicians.

Note: There is a recognized need for cine/video data, however a standardized method (format) has not yet been identified for endorsement by IHE and inclusion in this transaction.

4.47.4.1.2.2.3 Optional Content

It is permitted to place other data on the media outside the *IHE_PDI* directory. Any additional content shall take into account all constraints listed above especially:

- No DICOM instance files are allowed.
- This data shall be described or referenced as defined in 4.47.4.1.2.2.2.

Furthermore any additional directory in the root directory cannot begin with "IHE".

Additional files (files other than mandatory files) in the root directory are not expressly prohibited however their inclusion is discouraged.

Note that it cannot be assumed that any automatically launching application will run on the receiving device.

4.47.4.1.2.2.3.1 DICOM Media Viewer

If a DICOM media viewer is present on the media, it is recommended that:

- the media viewer be capable of correctly rendering all DICOM objects stored on the medium
- a user manual in PDF format be included on the medium, in the root directory
- a short manual in hardcopy be provided within the CD jewel case

4.47.4.1.2.2.4 Media Identification

The Portable Media Creator actor shall support a user in adding human-readable identification information on the outside of the physical medium. The method of media marking is outside the scope of this integration profile.

It is recommended that the Patient Name, patient ID, birthdate, media creation date, the study dates for the studies on the medium and the name of the originating institution be marked on the medium. It is also recommended that the type of content ("DICOM ONLY" or "DICOM PLUS WEB") be marked on the medium.

4.47.4.1.2.3 Content Organization Detail

4.47.4.1.2.3.1 DICOM Content

The DICOM portion of the media content is defined by the current DICOM standard. It is required that created file-sets be correctly formatted in order to grant maximum interoperability.

All DICOM data shall be referenced by the *DICOMDIR* file.

In order to assure interoperable use of the created media, a "widely-used" general purpose DICOM Media Application Profile is required. The Portable Media Creator, Portable Media Importer, Image Display, Report Reader and Print Composer shall use the STD-GEN-CD Media Storage Application Profile to interchange DICOM information on interchange media.

The Portable Media Creator is not required to be able to create media containing data from multiple patients. However, all media reading actors shall be able to import media containing multiple patients' data.

While the Portable Media Creator is not required to correct DICOM SOP instances from a source that incorrectly encodes the DICOM data, it is expected that the DICOM Media Creator will store the DICOM files in Explicit VR Little Endian. The DICOMDIR, whose content is entirely the responsibility of the Portable Media Creator, shall be correctly encoded regardless of the correctness of any referenced SOP Instances.

The Portable Media Creator may be requested to include DICOM SOP Instances that do not contain sufficient information to encode mandatory DICOMDIR information. For example, Patient ID and Study ID are Type 2 and may be zero length in image SOP Instances, but are Type 1 in the Patient and Study Directory Records. The complete list of attributes which fall into this category are listed in Table 4.47.4-1

Table 4.47.4-1: Optional DICOM SOP Instance Attributes required in DICOMDIR

Directory Record Type	Attribute Name	Tag
PATIENT	Patient ID	(0010,0020)
STUDY	Study ID	(0020,0010)
	Study Date	(0008,0020)
	Study Time	(0008,0030)
SERIES	Modality	(0008,0060)
	Series Number	(0020,0011)
IMAGE	Instance Number	(0020,0013)

The Portable Media Creator is required to synthesize appropriate values for all such mandatory attributes. No specific guidance is given as to from whence appropriate values should be obtained or what default values are appropriate, except that different patients, studies, and series must remain distinct (e.g., two different Studies with differing Study Instance UIDs shall not be assigned the same synthesized Study ID). There is no firm requirement that a synthesized

Patient ID must be globally unique as it is not a UID. However, it is the only Type 1 attribute for Patient Directory Records and is a key index value for searching. Any synthesized Patient ID values shall be unique, at least in the context of the DICOMDIR on the media being created, so that each corresponding Patient Directory Record will be guaranteed to be unique. Implementers must also be careful to ensure that multiple Patient Directory Records do not link to Study Directory Records with the same Study Instance UID. The requirements for synthesizing new Study ID values are less rigid as Study Directory Records are still guaranteed to have unique Study UID values. The Portable Media Creator is not required to add these synthesized values to the instances to be stored on media.

4.47.4.1.2.3.1.1 DICOM Instances Content

There are no additional requirements specified here on the Attributes contained within DICOM Instances on the media.

If the Portable Media Creator Actor is grouped with an Acquisition Modality (or other) Actor within the Scheduled Workflow Integration Profile, then the attributes may effectively be constrained beyond the normative requirements of the DICOM standard. For example certain attribute values in the Modality Worklist query shall be included.

However, since such grouping is not required under this profile, actors receiving created media such as the Portable Media Importer, Image Display, Report Reader and Print Composer may not assume that the DICOM Instance Attributes are constrained beyond the definitions of the IODs in the DICOM Standard.

The instances on the Interchange Media generated by a Portable Media Creator shall all be DICOM Composite IODs. Therefore the Interchange Media shall not contain instances from the following SOP Classes:

- Detached Patient Management SOP Class
- Detached Study Management SOP Class
- Detached Visit Management SOP Class
- Study Component Management SOP Class
- Modality Performed Procedure Step SOP Class
- Detached Result Management SOP Class
- Detached Interpretation Management SOP Class
- Stored Print Storage SOP Class

4.47.4.1.2.3.1.2 DICOMDIR Directory Content

There are no additional DICOMDIR keys required beyond those required by the DICOM STD-GEN-CD specification.

No private elements shall be included in the standard directory records and no private directory records shall be present.

The following types of Directory shall not be used in the Basic Directory object (DICOMDIR File):

- VISIT

- RESULTS
- INTERPRETATION
- STUDY COMPONENT
- STORED PRINT
- TOPIC
- PRIVATE

The PATIENT, STUDY, SERIES Directory Records shall follow the following rules:

- Only one Directory Record per Patient ID shall be present in the DICOMDIR.
- Only one STUDY Directory Record per Study Instance UID shall be present in the DICOMDIR; this implies that a study belongs to a single patient.
- Only one SERIES Directory Record per Series Instance UID shall be present in the DICOMDIR; this implies that a series belongs to a single study.
- Only one composite instance level Directory Record shall be present per SOP Instance UID; this implies that an instance belongs to only a single series.
- Only one HL7 STRUC DOC Directory Record shall be present per SOP Instance UID; this implies that an instance belongs to only a single Patient.
- Only one HANGING PROTOCOL Directory Record shall be present per SOP Instance UID

Users should review the supported Media Storage SOP Classes in the Conformance Statements of media creators and readers to ensure interoperability in the interchange of media objects.

4.47.4.1.2.3.1.3 DICOM Report Content

It is highly recommended to place diagnostic reports on the media.

The Portable Media Creator actor, if grouped with a Report Creator actor, shall support the ability to create a diagnostic imaging report. A Basic Text DICOM SR, according to a proper subset of the Simple Image Report Pattern as defined by the SINR Integration profile, can be created and this kind of diagnostic report can be imported by a Portable Media Importer.

Additional optional diagnostic reports in non-DICOM formats (such as HL7 CDA) are not defined by this transaction and may be placed on the media without the need to create DICOM SRs, but they will be non-importable data.

Note: This requirement may be met with other DICOM SR SOP Classes that are used for diagnostic or therapeutic reports. For the most basic radiology report, a simple pattern with one or more sections including a paragraph of text meets this requirement. Image references do not have to be included, but may be if so desired.

4.47.4.1.2.3.2 Web Content Option

Portable Media Creators claiming the Web Content option shall meet the following requirements:

End-users should be able to access information at a minimum using a web browser to view content on media. In order to grant maximum interoperability using the stored XHTML files,

they shall be formatted according to the XHTML Basic and W3C HTML Compatibility Guidelines provided in Appendix C of the W3C XHTML 1.0 Recommendation.

The web-viewable data that is generated by Portable Media Creators claiming the Web Content option shall:

- contain the web representation of a subset of the media's DICOM information, using only XHTML files, JPEG referenced images, and PNG and/or GIF files used for navigation,
- contain hyperlinks within XHTML files which contain only lowercase letters to promote interoperability across O/S Platforms,
- reside in the *IHE_PDI,* while the corresponding DICOM data from which it is derived is located in a different sub-directory (see 4.47.4.1.2.2.1), and
- be completely referenced in the *INDEX.HTM* file

The web-viewable data included shall be a set or subset that was considered at the time of creation to faithfully represent the patient's clinical condition.

If the Portable Media Creator supports Presentation States, it shall have the capability to apply them to the relevant images when including web-viewable content. The user of the application may choose not to make use of this capability.

The constraints placed by DICOM on the ISO 9660 file system are not required for web-viewable content, i.e. a 3-character extension is permitted.

To ensure interoperability, JPEG means a file with a JFIF header and encoded using the sequential Huffman DCT 8bit per component process (baseline), and the progressive variant thereof.

To ensure interoperability the use of XHTML shall be limited to static and restricted forms of dynamic web content. At this time Dynamic Web Content such as DHTML and most Scripting Languages are explicitly prohibited as no single established Standard exists to ensure interoperability between web browsers. The use of JavaScript is explicitly permitted, recognizing that there may be issues with different browsers. Portable Media Creators should make every effort to use portable constructs or use JavaScript that works with or adapts to all known portable browsers; further, the failure of JavaScripts should not make the resulting web pages unusable.

Because XHTML rather than legacy HTML is required, it is necessary to provide information about appearance using either embedded styles or an external stylesheet, since legacy attributes controlling appearance are not permitted in XHTML Strict. The use of Cascading Stylesheets (CSS) is explicitly permitted, recognizing that there may be issues with different browsers. Portable Media Creators should make every effort to use portable constructs or use CSS that works with or adapts to all known portable browsers; further, the failure of CSS should not make the resulting web pages unusable.

Additional optional web-viewable content not derived from DICOM objects may be stored on the media, but not in the *IHE_PDI* directory.

4.47.4.1.3 Expected Actions

The receiving/reading actors read the patient's data from the media and act upon it as specified below. The receiving actor shall document which DICOM objects it supports in its Conformance

Statement. If a SOP Class on the media is not supported, the actor shall present the user with a summary of the data that could not be acted upon, containing the Patient Name(s) and ID(s), Study ID(s), Study Date(s), Study and Series Description(s) and Modality as obtained (if present) from the *DICOMDIR* file.

The automatic launching of applications is not expressly prohibited on media interchanged within this profile; its use is discouraged, however.

To facilitate avoidance of malicious software, receiving actors (Portable Media Importer, Image Display, Report Reader, Print composer and Display) are not required to launch automatically running applications present on media.

4.47.4.1.3.2 Image Display

The Image Display reads the DICOM image data from the media and provides the user with the ability to view all studies (that it supports) contained on the media. GSPS objects and Key Image Notes are read from the media and applied if the Consistent Presentation of Images and the Key Image Notes IHE Integration Profiles are supported. The Image Display actor may optionally be grouped with other actors which view other evidence objects.

4.47.4.1.3.3 Report Reader

The Report Reader reads the DICOM SR Reports from the media and may process them (based on the SR object classes it supports). At a minimum, it provides the user with the ability to view all reports per the DICOM SR SCP requirements.

4.47.4.1.3.4 Portable Media Importer

The Portable Media Importer reads DICOM data from the media. Together with the actor with which it is grouped (see vol. 1), it shall be able to perform key attribute reconciliation. Reconciliation may not be required in all cases (e.g., within the same importing institution/enterprise). Refer to Table 4.47.4-2 for key attributes to be reconciled. Import Reconciliation Workflow provides a workflow to reconcile key attributes (See IRWF.b Trial Implementation Supplement). Note that the Referenced Study Sequence and Requested Attributes Sequence are removed for consistency with behavior of the unscheduled cases in SWF and PIR.

The grouped actors provide the capability of storing the supported DICOM objects to an Image Manager/ Image Archive (for image objects like Images, Presentation States, Key Image Notes, Evidence Documents), or to a Report Repository (for Diagnostic Reports).

Table 4.47.4-2: Media instances - Key attributes to be reconciled

Attribute from Media	Updating action
Patient Name	Replace with value from ADT (See note 1)
Patient ID	Replace with value from ADT (See note 1)
Patient's Birth Date	Replace with value from ADT (See note 1)
Patient's Sex	Replace with value from ADT (See note 1)

Attribute from Media	Updating action
Study Instance UID	Remains unchanged
Series Instance UID	Remains unchanged
SOP Instance UID	Remains unchanged
Workflow-related Identifying Attributes (e.g. Order, Requested Procedure, Scheduled and Performed IDs and UIDs).	Values from such identifying attributes of media information • remain unchanged, • are replaced with a value from the local environment, or • are removed (zero length value). The exact method of reconciliation depends on the importing institution's procedures, and goes beyond the IHE scope.
Descriptive performed procedure information (this is information that pertains to the manner in which the information was created (e.g. acquisition context) or it may be payload of the instance (e.g. image structure, document content))	Remains unchanged (see Note 2)

Note 1: The manner in which the Portable Media Importer receives the ADT value is beyond the scope of this transaction.

Note 2: Handling of Coded information is beyond the scope of this transaction.

4.47.4.1.3.5 Print Composer

The Print Composer reads the DICOM image data from the media and provides a means to print it.

4.47.4.1.3.6 Display

The Display actor (defined in the IT Infrastructure TF) reads the web-viewable information from the media and displays it. Note that the web-viewable content will only be present if the Portable Media Creator involved supports the Web Content Option.

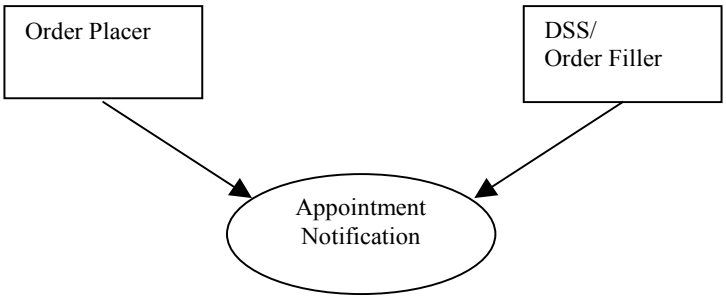
4.48 Appointment Notification

This section corresponds to Transaction RAD-48 of the IHE Technical Framework. Transaction RAD-48 is used by the Order Placer and Department System Scheduler/Order Filler actors.

4.48.1 Scope

In the Appointment Notification Transaction, a Department System Scheduler/Order Filler sends to an Order Placer actor new appointment bookings and appointment rescheduling which contains the date(s) and time(s) of the Scheduled Procedures Steps. It may also notify an Order Placer of the cancellation of appointment bookings.

4.48.2 Use CaseRoles



Actor: Department System Scheduler/Order Filler

Role: Generates Appointment Notification messages and sends them to the corresponding Order Placer actor.

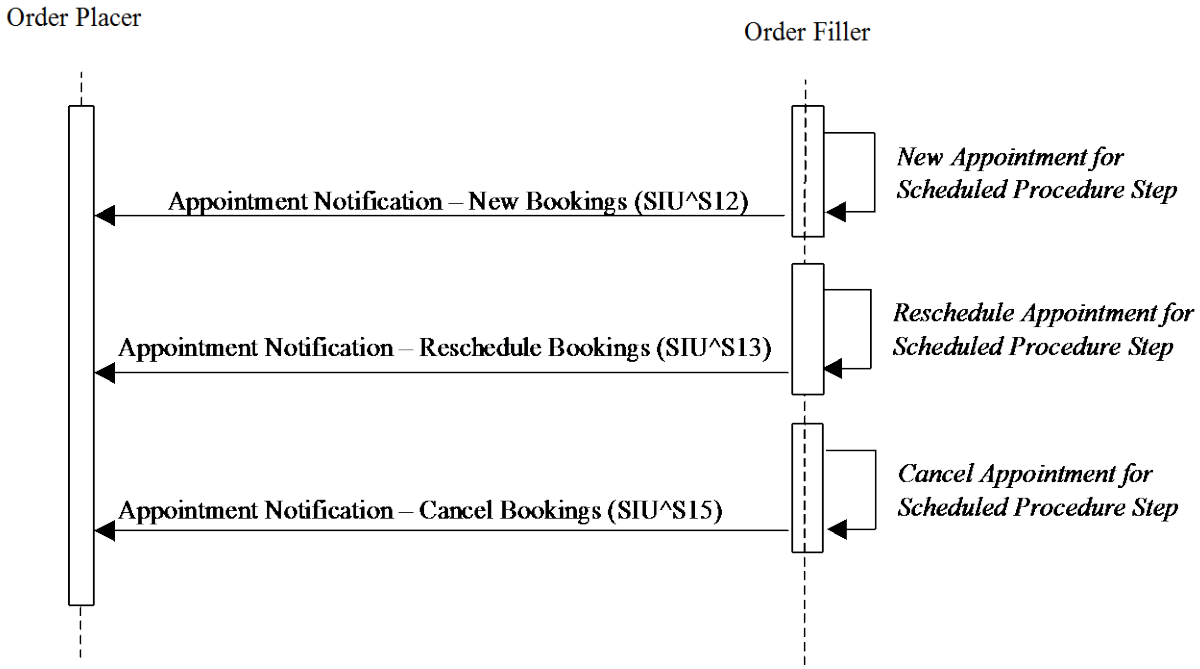
Actor: Order Placer

Role: Receives Appointment Notification messages and internally processes them.

4.48.3 Referenced Standard

HL7 V2.4, chapter 10.

4.48.4 Interaction Diagram



4.48.4.1 Appointment Notification -New Bookings

4.48.4.1.1 Trigger Events

SIU^S12 - Notification of New Appointment Booking

The DSS/Order Filler receives an order from an Order Placer actor. The DSS/Order Filler determines what procedure steps need to be scheduled. After scheduling the corresponding appointment(s), the DSS/Order Filler may send the Order Placer an Appointment Notification - New Appointment Booking message. Each appointment may satisfy zero or more Scheduled Procedure Steps. Information in the AIS segment describes the date(s) and time(s) of the appointment(s) that has been booked.

4.48.4.1.2 Message Semantics

The message semantics follow the SIU^S12 message as specified in HL7 V2.4 Chapter 10. Refer to HL7 Standard for general message semantics. The cardinality of each segment is given within square brackets (minimum and maximum number of repetitions authorized).

SIU^S12	Schedule Information Unsolicited	Chapter in HL7 V2.4
MSH	Message Header	2
SCH	Schedule Activity Information	10
{ RGS	Resource Group Segment	10

SIU^S12	Schedule Information Unsolicited	Chapter in HL7 V2.4
{ AIS	Appointment Information - Service	10
[{ NTE }]	Notes and Comments	2
}		

There is one group (RGS, AIS) per appointment booking. It is repeated when several appointment bookings have been made for the same Order. There must be at least one AIS segment (and therefore one RGS segment) since it contains timing information of the appointment.

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of the SIU message to its sender. See section RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the HL7 ACK message.

4.48.4.1.2.1 MSH Segment

The MSH segment shall be constructed as defined in section RAD TF-2: 2.4.2.2 "Message Control".

Field *MSH-9 Message Type* shall have at least two components. The first component shall have a value of SIU; the second component shall have a value of S12. The third component is optional; however, if present, it shall have a value of SIU_S12.

4.48.4.1.2.2 SCH Segment

The following table identifies required and optional fields of the SCH segment.

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM#	ELEMENT NAME
1	75	EI	O			00860	Placer Appointment ID
2	75	EI	R			00861	Filler Appointment ID
4	22	EI	C			00218	Placer Group Number
6	250	CE	R			00883	Event Reason
11	200	TQ	R	Y		00884	Appointment Timing Quantity
16	250	XCN	R	Y		00885	Filler Contact Person
20	250	XCN	O	Y		00878	Entered by Person
26	22	EI	R	Y		00216	Placer Order Number
27	22	EI	R	Y		00217	Filler Order Number

Adapted from the HL7 Standard, version 2.4

Field *SCH-1 Placer Appointment ID* contains the placer application's permanent identifier for the appointment request. This field is not used.

Field *SCH-2 Filler Appointment ID* contains the filler application's permanent identifier for the appointment request. This field is required to be sent.

Field *SCH-4 Placer Group Number* shall be valued only if the Order Placer and the Order Filler utilize concept of Order Groups. Shall not be present otherwise.

Field *SCH-6 Event Reason* is mandatory in HL7 V2.4 but not used by the Order Placer in this IHE transaction. In order to keep the compatibility with HL7 V2.4, it shall be sent by the Order Filler with the value `^APT`.

Field *SCH-11 Appointment Quantity Timing* is mandatory in HL7 V2.4 but not used by the Order Placer in this IHE transaction. Dates and Times are set in the AIS segment. In order to keep the compatibility with HL7 V2.4, it shall be sent with a value set to `1`.

Field *SCH-16 Filler Contact Person* identifies the person responsible for the scheduling of the requested appointment. Most often, this person will be the same person responsible for maintaining the schedule or for reviewing appointment requests. This is the person to call if the appointment needs to be rescheduled or cancelled.

Field *SCH-20 Entered by Person* identifies the person responsible for entering the request for the scheduling of an appointment. It is included to trace the persons responsible for the request.

Field *SCH-26 Placer Order Number* is the order number assigned by the placer application for the order associated with this scheduling filler response. In the context of IHE Radiology Scheduled Workflow, this field is required to be sent.

Field *SCH-27 Filler Order Number* is the order number assigned by the filler application for the order associated with this scheduling filler response. In the context of IHE Radiology Scheduled Workflow, this field is required to be sent.

4.48.4.1.2.3 RGS Segment

The RGS segment is used to identify relationships between resources (date and time, location, medical staff) identified for a scheduled event. Related resources are defined in a group of resources. Each group starts with a RGS segment, followed by an AIS segment (for the date and time). The use of other segments (AIG, AIL, AIP) is beyond the scope of this integration profile. There must be one group per set of Scheduled Procedure Steps that are scheduled to take place during the same appointment.

RGS segment shall be constructed as defined in section 10.6.3 “RGS – Resource Group Segment” of HL7 V2.4 chapter 10 “Scheduling”. The following table identifies required and optional fields of the RGS segment.

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R			01203	Set ID – RGS
2	3	ID	C		0206	00763	Segment Action Code
3	250	CE	O			01204	Resource Group ID

Adapted from the HL7 Standard, version 2.4

4.48.4.1.2.4 AIS Segment

The AIS segment contains the date and time of a Scheduled Procedure. There is only one AIS segment per group of resources.

AIS segment shall be constructed as defined in section 10.6.4 "AIS – Appointment Information – Service Segment" of HL7 V2.4 chapter 10 "Scheduling". The following table identifies required and optional fields of the AIS segment.

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R			00890	Set ID – AIS
2	3	ID	R		0206	00763	Segment Action Code
3	250	CE	R			00238	Universal Service Identifier
4	26	TS	R			01202	Start Date/Time
5	20	NM	O			00891	Start Date/Time Offset
6	250	CE	O			00892	Start Date/Time Offset Units
7	20	NM	O			00893	Duration
8	250	CE	O			00894	Duration Units
9	10	IS	C		0279	00895	Allow Substitution Code
10	250	CE	C		0278	00889	Filler Status Code
11	250	CE	O	Y	0411	01474	Placer Supplemental Service Information
12	250	CE	O	Y	0411	01475	Filler Supplemental Service Information

Adapted from the HL7 Standard, version 2.4

Field *AIS-2 Segment Action Code* contains the action to be taken when adding, updating or modifying information in this segment. All AIS segments in the same RGS group shall contain the same action code. This field is required and is valued with: `A` (Add/Insert).

Field *AIS-3 Universal Service Identifier* contains an identifier for the Scheduled Procedure Steps to be scheduled and the associated Requested Procedure Components. The 3 first components ("identifier", "text", "name of coding system") contain the Requested Procedure Code (Code Value, Meaning and Coding Scheme). The fifth component ("alternate text") shall contain a concatenated text description of the Scheduled Procedure Step(s) which can be understood at the Order Placer level. The fourth ("identifier") and sixth ("name of coding system") components are not used.

Field *AIS-4 Start Date/Time* contains the date and time of the appointment. Both date and time are required. A time zone offset (from UTC) may be included. If the offset is not included the time zone is understood to be the local time zone of the sender. For example, 09:00 AM US Central Time on October 22, 2004 could be represented as: 200410220900-0600 or 200410220900 for a sender within the US Central time zone

4.48.4.1.2.5 NTE Segment

Any information relative to the examination can be sent in NTE segments like Patient instructions (empty stomach, full or empty bladder), pre-medication (preliminary injection, biological examination), etc.

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R			00096	Set ID – NTE
2	8	ID	R			00097	Source of Comment
3	65536	FT	R			00098	Comment
4	250	CE	R			01318	Comment Type

Adapted from the HL7 Standard, version 2.4

Field *NTE-2 Source of Comment* identifies the source of the comment. This field is required but may be empty. Valid values are:

Value	Description
L	Order Filler is the source of the comment
O	Other system is the source of comment

Field *NTE-3 Comment* contains the text of the comment. To delete a previously sent comment, the field shall contain empty quotation mark “”.

Field NTE-4 Comment Type contains a value to identify the type of comment. Valid values are:

Value	Description
PI	Patient Instruction
AI	Ancillary Instruction
GI	General Instruction
RE	Remark

4.48.4.1.3 Expected Actions

The Order Placer shall accept the appointment bookings as scheduled and shall return an HL7 ACK message.

4.48.4.2 Appointment Notification - Reschedule Bookings

4.48.4.2.1 Trigger Events

SIU^S13 - Appointment Notification - Reschedule Bookings

In some cases, appointments may be rescheduled in the Radiology Department. This message is sent by the DSS/Order Filler to notify the Order Placer that an existing appointment has been rescheduled. The information in the AIS segment describes the new date(s) and time(s) to which the previously booked appointment has been moved. Additionally, it describes the unchanged information in the previously booked appointments.

4.48.4.2.2 Message Semantics

The message semantics follow the SIU^S13 message as specified in HL7 V2.4 Chapter 10. Refer to HL7 Standard for general message semantics.

SIU^S13	Schedule Information Unsolicited	Chapter in HL7 V2.4
MSH	Message Header	2
SCH	Schedule Activity Information	10
{ RGS	Resource Group Segment	10
{ AIS	Appointment Information - Service	10
[{ NTE }]	Notes and Comments	2
}		

There is one group (RGS, AIS) per appointment booking. It is repeated when several appointment bookings have been made for the same Order. There must be at least one AIS segment (and therefore one RGS segment) since it contains timing information of the appointment.

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of the SIU message to its sender. See section RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the HL7 ACK message.

4.48.4.2.2.1 MSH Segment

MSH segment shall be constructed as defined in section RAD TF-2: 2.4.2.2 "Message Control".

Field *MSH-9 Message Type* shall have at least two components. The first component shall have a value of SIU; the second component shall have a value of S13. The third component is optional; however, if present, it shall have a value of SIU_S13.

4.48.4.2.2.2 SCH, RGS, NTE Segments

SCH, RGS and NTE segments shall be constructed as defined in section 4.48.4.1.2 "Message Semantics" of the current proposition.

4.48.4.2.2.2 AIS Segment

The segment shall be constructed as defined in section 4.48.4.1.2.4 except for Field *AIS-2 Segment Action Code* which is valued with: U (Update).

4.48.4.2.3 Expected Actions

The Order Placer shall accept the appointment information for rescheduling and shall return an HL7 ACK message.

4.48.4.3 Appointment Notification - Cancel Bookings

4.48.4.3.1 Trigger Events

SIU^S15 - Appointment Notification - Cancel Booking

This event is triggered when existing appointment bookings have been cancelled by an Order Filler actor.

4.48.4.3.2 Message Semantics

The message semantics follow the SIU^S15 message as specified in HL7 V2.4 Chapter 10. Refer to HL7 Standard for general message semantics.

SIU^S15	Schedule Information Unsolicited	Chapter in HL7 V2.4
MSH	Message Header	2
SCH	Schedule Activity Information	10
{ RGS	Resource Group Segment	10
{ AIS	Appointment Information – Service	10
[{ NTE }]	Notes and Comments	2
}		

There is one group (RGS, AIS) per appointment booking. It is repeated when several appointment bookings have been made for the same Order. There must be at least one AIS segment (and therefore one RGS segment).

Each message shall be acknowledged by the HL7 ACK message sent by the receiver of the SIU message to its sender. See section RAD TF-2: 2.4.3 "Acknowledgement Modes" for definition and discussion of the HL7 ACK message.

4.48.4.3.2.1 MSH Segment

MSH segment shall be constructed as defined in section RAD TF-2: 2.4.2.2 "Message Control".

Field *MSH-9 Message Type* shall have at least two components. The first component shall have a value of SIU; the second component shall have a value of S15. The third component is optional; however, if present, it shall have a value of SIU_S15.

4.48.4.3.2.2 SCH, RGS, NTE Segments

SCH, RGS and NTE segments shall be constructed as defined in section 4.48.4.1.2 "Message Semantics"**.**

4.48.4.2.2.3 AIS Segment

The segment shall be constructed as defined in section 4.48.4.1.2.4 except for:

- Field *AIS-2 Segment Action Code* is valued with: D (Delete).

4.48.4.3.3 Expected Actions

The Order Placer shall accept the appointment information for cancellation and shall return an HL7 ACK message. This message shall not be sent when the Order Filler or the Order Placer cancel an order. It is assumed that appointments are automatically cancelled by the Order Filler and that the Order Placer will take the same action.

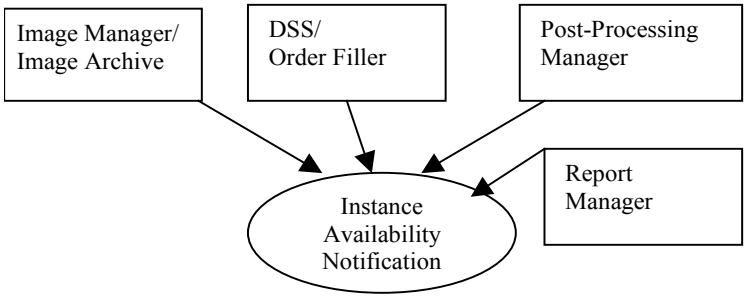
4.49 Instance Availability Notification

This section corresponds to Transaction RAD-49 of the IHE Radiology Technical Framework. Transaction RAD-49 is used by the Image Manager/Image Archive, DSS/Order Filler, Post-Processing Manager and Report Manager Actors.

4.49.1 Scope

In the Instance Availability Notification Transaction, an Image Manager/Image Archive sends a message to relevant actors to inform them of the availability status of newly stored DICOM objects. Actors being notified are known to need these objects for fulfilling scheduled workflow processes and can retrieve and use the objects referenced in this message. This allows for supporting a variety of workflow conditions in imaging departments.

4.49.2 Use Case Roles



Actor: Image Manager/Image Archive

Role: Generate an Instance Availability Notification message and send it to the DSS/Order Filler and optionally to other workflow managing actors (Post-Processing Manager, Report Manager).

Actor: DSS/Order Filler

Role: Receive an Instance Availability Notification message and internally process it.

Actor: Post-Processing Manager

Role: Receive an Instance Availability Notification message and internally process it.

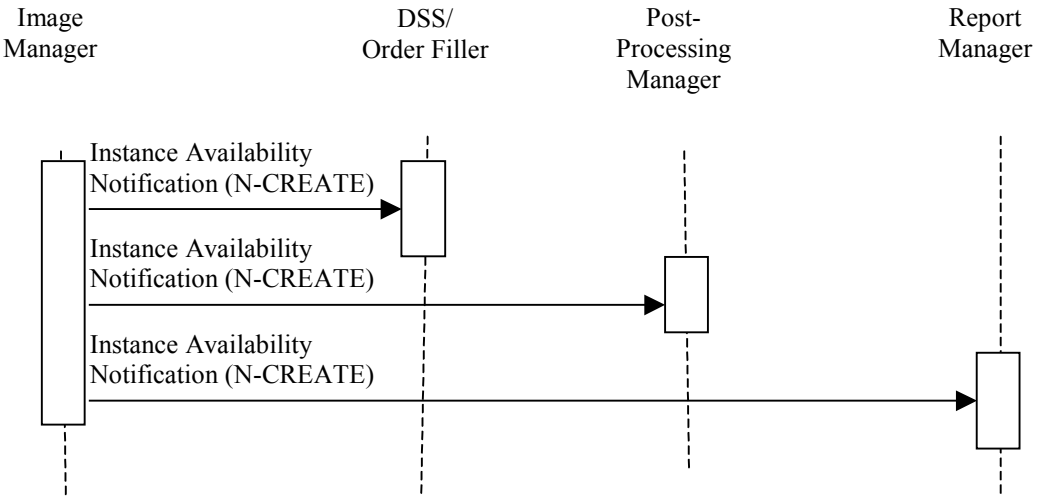
Actor: Report Manager

Role: Receive an Instance Availability Notification message and internally process it.

4.49.3 Referenced Standard

DICOM 2011 PS 3.4: Instance Availability Notification Service Class

4.49.4 Interaction Diagram



4.49.4.1 Instance Availability Notification

This message uses the DICOM Instance Availability Notification Service from an Image Manager/Image Archive to inform other workflow managing actors about the availability of DICOM instances they may be waiting for in order to be able to schedule or start procedure steps.

4.49.4.1.1 Trigger Events

During image acquisition, an MPPS-capable Acquisition Modality creates a set of instances and stores them to an Image Manager/Image Archive. Alternatively as a part of importing Evidence Objects, an MPPS capable Importer imports instances and stores them to an Image Manager/Image Archive. The Image Manager/Image Archive, after having received the last instance of the instance set referenced in the MPPS, shall send an Instance Availability Notification to the DSS/Order Filler that has also received the related MPPS. It may also decide to send the Instance Availability Notification to other instance managing actors in the workflow to inform them that all instances referenced in the related MPPS are available.

One Instance Availability Notification shall be sent for each MPPS that contains references to instances. MPPS without references to instances shall not trigger the sending of an Instance Availability Notification. This applies to all the MPPS cases described in transaction RAD-6 (Rad TF-2, 4.6: Simple Case, Unscheduled Case, Group Case, Append Case (Normal and Group Case), Abandoned Case) and in transaction RAD-7 (Rad TF-2: 4.7: MPPS DISCONTINUED, except the case of incorrect worklist entry selected, Rad TF-2: 4.7.4.1.3.1). It also applies to the Import PPS cases described in transaction RAD TF-3: 4.59.4.1.2. (Unscheduled Import and Unscheduled Import Cases) and the Import PPS Discontinued (RAD TF-3:4.60.4.1.2.2).

4.49.4.1.2 Message Semantics

The end of the image acquisition is indicated to the Department System Scheduler/Order Filler and Image Manager/ Image Archive by an MPPS message from the Acquisition Modality referencing the DICOM instances that were created and are to be stored in the Image Manager/Image Archive. The end of the DICOM object import is indicated to the Department System Scheduler/Order Filler and Image Manager/ Image Archive by an Import MPPS message from the Importer referencing the DICOM instances that were created and are to be stored in the Image Manager/Image Archive.

Note that the MPPS and Instance Availability Notification inform about different events. Thus, depending on the total volume of the images stored and characteristics of the local system environment, the MPPS may arrive considerably earlier at the DSS/OF than the Instance Availability Notification. The dependency of the IAN transaction on the MPPS Completed transaction may result in delayed notification to the DSS/OF of available instances, if the MPPS is not sent from the Acquisition Modality or Importer to the Image Manager/Image Archive in a timely fashion.

The Image Manager/Image Archive shall act as an Instance Notification SOP Class SCU and create an Instance Availability Notification SOP Class. It shall populate the Reference SOP Instance UID in the Referenced Performed Procedure Step Sequence. It shall include references to all instances that are referenced in the corresponding MPPS. The other attributes of the SOP Class are used as specified in DICOM Suppl. 93.

The Image Manager/Image Archive shall be able to send the Instance Availability Notification to multiple actors. The Image Manager/Image Archive shall send the Instance Availability Notification to the DSS/Order Filler and may be configured to also send it to other actors described in this transaction.

The DSS/Order Filler, Post-Processing Manager or the Report Manager shall understand that the receipt of this notification message implies that a complete set of instances is available at the Image Manager/Image Archive that is identified by the Retrieve AE Title attribute.

Due to transient error conditions (e.g. corrupted storage media, Query/Retrieve SCP not running) that may occur within the Image Manager/Image Archive, an actor may not be able to retrieve instances for which it has received availability notifications. If an actor is uncertain about the availability status of instances referenced by the Instance Availability Notification, it can use the Image Availability Query [RAD-11] to confirm the status as a supplementary method. Additionally, the Image Manager/Image Archive is assumed to be able to handle exceptions in instance storage or provision internally, based on local policy.

4.49.4.1.3 Expected Actions

The Department System Scheduler/Order Filler, Post-Processing Manager and Report Manager shall act as an Instance Notification SOP Class SCP. As a result of receiving the notification, the Department System Scheduler/Order Filler (or other actors) shall take appropriate action knowing that the referenced instances are available for further use in the workflow. Examples of such actions can be:

- The Department System Scheduler/Order Filler updates the procedure status internally, indicating that images for the procedure have been stored.
- The Post-Processing Manager adds items to a corresponding worklist.
- The Report Manager adds items to a corresponding worklist.
- The Report Manager adds items to a list of relevant priors for use within Reporting.

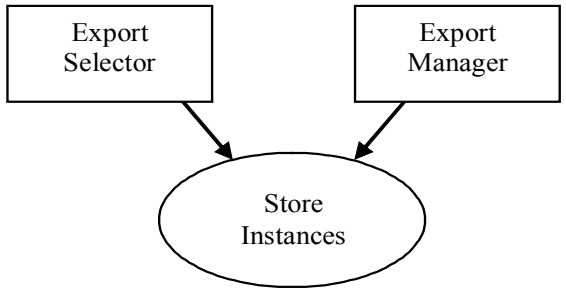
4.50 Store Instances

This section corresponds to Transaction RAD-50 of the IHE Technical Framework. The Export Selector and Export Manager actors use transaction RAD-50.

4.50.1 Scope

In the Store Instances transaction, the Export Selector sends the selected composite instances to the Export Manager.

4.50.2 Use Case Roles



Actor: Export Selector

Role: Transmit instances to Export Manager.

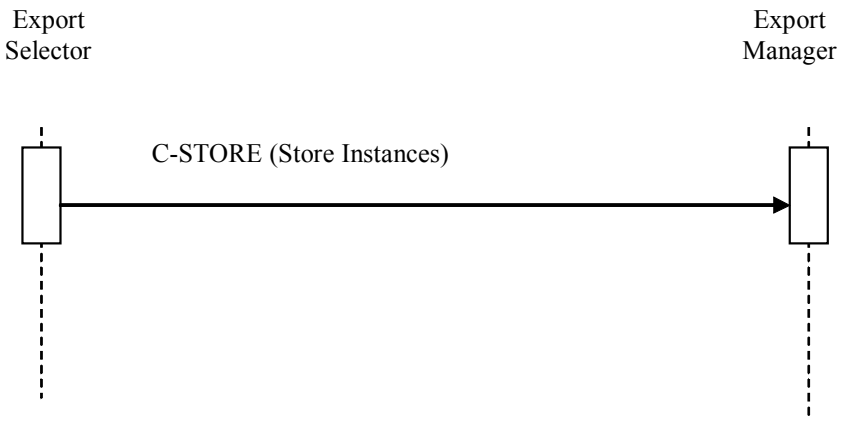
Actor: Export Manager

Role: Accept instances from Export Selector and queue them for de-identification, pseudonymization and export

4.50.3 Referenced Standard

DICOM 2011 PS 3.4: Storage Service Class.

4.50.4 Interaction Diagram



4.50.4.1 Store Instances

4.50.4.1.1 Trigger Events

The Export Selector can transfer instances to the Export Manager sequentially within one or more DICOM associations.

4.50.4.1.2 Message Semantics

The Export Selector uses the DICOM C-STORE message to transfer the instances. The Export Selector is the DICOM Storage SCU and the Export Manager is the DICOM Storage SCP.

4.50.4.1.3 Expected Actions

The Export Manager will queue the received DICOM objects, until ready to process them.

The DICOM Standard (2011) defines a number of composite storage SOP classes. The Export Manager Actor shall support at least one composite storage SOP class, such as Images (see RAD TF-2; Table 4.8-1 for suggestions), Evidence Documents, Structured Reports, Presentation States and Radiotherapy objects.

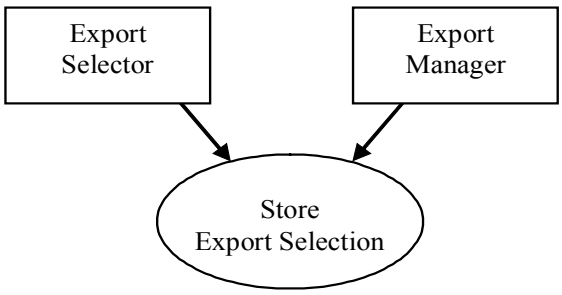
4.51 Store Export Selection

This section corresponds to Transaction RAD-51 of the IHE Technical Framework. The Export Selector and Export Manager actors use transaction RAD-51.

4.51.1 Scope

In the Store Export Selection transaction, the Export Selector sends a Key Object Selection document acting as a manifest of a collection of selected composite instances to the Export Manager.

4.51.2 Use Case Roles



Actor: Export Selector

Role: Transmit manifest to Export Manager.

Actor: Export Manager

Role: Accept manifest from Export Selector and queue the manifest and the referenced composite instances for processing (de-identification, pseudonymization and export)

4.51.3 Referenced Standard

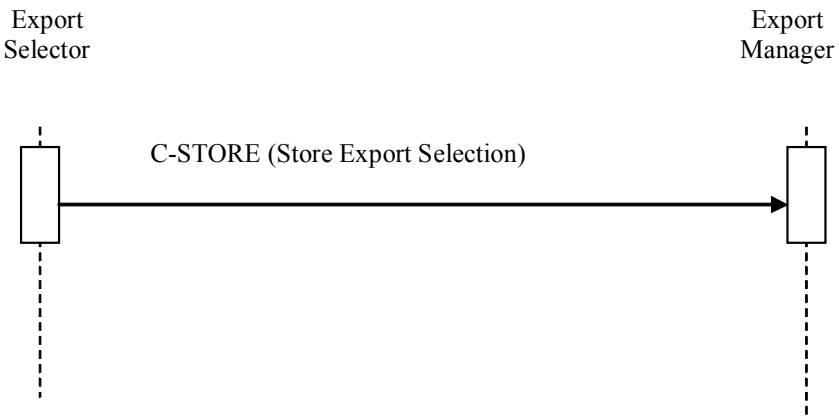
DICOM 2011 PS 3.4: Storage Service Class.

DICOM 2011 PS 3.15: Basic Application Level Confidentiality Profile.

DICOM 2011 PS 3.3: Information Object Definitions

DICOM 2011 PS 3.16: Content Mapping Resource

4.51.4 Interaction Diagram



4.51.4.1 Store Export Selection

4.51.4.1.1 Trigger Events

The Export Selector can transfer a manifest to the Export Manager with a DICOM association.

The timing of the transfer is not coupled to the timing of any Store Instances transaction, in that they may occur over the same or different associations, and the manifest may be received before, during or after the instances referred to by the manifest.

4.51.4.1.2 Message Semantics

The Export Selector uses the DICOM C-STORE message to transfer the manifest. The Export Selector is the DICOM Storage SCU and the Export Manager is the DICOM Storage SCP.

The manifest (Export Selection) is an instance of the Key Object Selection SOP Class constructed according to the template defined in Table 4.51.4-1, which is a specialization of TID 2010 defined in DICOM 2011 PS 3.16, and is itself non-extensible.

Table 4.51.4-1: Export Selection ("Manifest") Template – Specializes DICOM TID 2010

	NL	Rel with parent	Value Type	Concept Name	VM	Req Type	Cond	Value Set Constraint
1			CONTAINER	EV (TCE001, IHERADTF, "For Teaching File Export") or (TCE002, IHERADTF, "For Clinical Trial Export") or (TCE007, IHERADTF, "For Research Collection Export") or (TCE008, IHERADTF, "For	1	M		Root node

	NL	Rel with parent	Value Type	Concept Name	VM	Req Type	Cond	Value Set Constraint
				Publication Export")				
2	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1	U		DCID Table 4.51.4-2 Delay Reasons
3	>	HAS CONCEPT MOD	INCLUDE	DTID(1204) Language of Content Item and Descendants	1	U		
4	>	HAS OBS CONTEXT	INCLUDE	DTID (1002) Observer Context	1-n	U		
5	>	CONTAINS	TEXT	EV(113012, DCM, "Key Object Description")	1	U		Disposition
6	>	CONTAINS	IMAGE	Purpose of Reference shall not be present	1-n	MC	At least one of Rows 6 or 7 shall be present.	
7	>	CONTAINS	COMPOSITE	Purpose of Reference shall not be present	1-n	MC	At least one of Rows 6 or7 shall be present.	

The Document Title shall be either (TCE001, IHERADTF, "For Teaching File Export") or (TCE002, IHERADTF, "For Clinical Trial Export") or (TCE007, IHERADTF, "For Research Collection Export") or (TCE008, IHERADTF, "For Publication Export").

The Key Object Description TEXT content item, if present, shall describe the disposition of the selection. The use of this value requires coordination between the Export Selector and the Export Manager that is beyond the scope of this transaction to define.

- In the case of teaching files, this value could contain the identifier of a user to whom the case is to be routed for authoring, or it could be more generic and reference a role, a department, or a category of teaching file.
- In the case of clinical trials, this value could contain the identifier of clinical trial protocol, and may affect behavior of the Remap Identifiers Option.
- In the case of research collections, this value could contain the identifier of a research collection.

A single Document Title Modifier content item may be present and specify a value that may be one of those listed in Table 4.51.4-2.

Table 4.51.4-2: Delay Reason Values

Coding Scheme Designator	Code Value	Code Meaning
IHERADTF	TCE011	Delay export until final report is available
IHERADTF	TCE012	Delay export until clinical information is available
IHERADTF	TCE013	Delay export until confirmation of diagnosis is available

Coding Scheme Designator	Code Value	Code Meaning
IHERADTF	TCE014	Delay export until histopathology is available
IHERADTF	TCE015	Delay export until other laboratory results is available
IHERADTF	TCE016	Delay export until patient is discharged
IHERADTF	TCE017	Delay export until patient dies
IHERADTF	TCE018	Delay export until expert review is available

No additional information describing the collection of referenced instances is contained in the manifest. Any such additional content, such as pre-formatted information to be conveyed to the teaching file authoring system, may be conveyed in separate SR documents referenced by the manifest; see 4.52 Store Additional Teaching File Information.

The manifest shall not contain references to Additional Teaching File Information alone; hence any SR documents containing Additional Teaching File Information shall be referenced by the original export selection, and may not be added or sent in a separate manifest.

Note that if the manifest does not include the DICOM TID 1003 Person Observer Identifying Attributes within the DICOM TID 1002 Observer Context, then it will not be possible to identify which individual assembled the collection. Accordingly it may not be possible for the Export Manager and subsequent Actors to route the collection to that individual, other than as specified by the disposition encoded in the Key Object Description TEXT content item.

Only instances of a single patient may be referenced by the manifest, but there may be instances of multiple studies.

A common use-case involving multiple studies occurs when the selection references current and prior images. When the selection references more than one study, DICOM requires that multiple instances of the Key Object Selection Document be created, one for each Study Instance UID and cross-referenced by the Identical Documents Sequence (see DICOM 2011 PS 3.3 C.17.6.2.1). IHE therefore requires that there be multiple copies of the same manifest sent in this transaction, one for each study.

4.51.4.1.3 Expected Actions

The Export Manager will queue the manifest until it has received all DICOM instances referenced therein, and is ready to process them.

The instances shall not be processed until the manifest has been received, since it dictates the form of processing required. The Delay for Reason option may require the processing to be further delayed; see 4.51.4.1.5.

Note that in the case of multiple manifests to handle the multiple study case, since the lists of referenced instances therein are identical, the Export Manager need not wait until all copies of the manifest have been received before commencing processing. In the multiple study case, receipt of only a single manifest shall not be considered as an error condition and normal processing shall occur. The Export Manager shall examine the Identical Documents Sequence in

each manifest to detect the multiple study case and to prevent the same export from being repeated.

No export shall be performed if instances are received but no referencing manifest is received within a configurable time.

If all the instances in the manifest are not received within a configurable time, the Export Manager shall proceed with an incomplete set and create an updated manifest. If the missing instances are received later, either they shall not be exported or a separate export and manifest shall be exported containing only those instances.

Instances referenced by the manifest may be of a SOP Class not supported by the Export Manager as a Storage SCP and hence will never be received. The SOP Class UIDs are encoded in the manifest. The Export Manager shall proceed with an incomplete set and create an updated manifest.

If the Export Manager is grouped with an Image Manager/Archive and already has all referenced DICOM instances, it may begin processing upon receipt of the manifest.

The Export Manager shall de-identify and pseudonymize all the DICOM instances referenced by the manifest, as defined in Section 4.51.4.1.4, before forwarding them all by initiating RAD-53 Export Instances transactions.

4.51.4.1.4 De-identification and Pseudonymization

4.51.4.1.4.1 Baseline De-identification and Pseudonymization Requirements

There is considerable variation in what attributes need to be removed to achieve sufficient de-identification and pseudonymization for any particular purpose. See the discussion in Appendix I.1.

Accordingly, this transaction does not require the removal of all text attribute values, nor the removal of all private attribute values.

Rather, it requires that the implementation provide a mechanism to allow the user to configure those attributes that will be removed or replaced. The transaction requires that at minimum, the implementation support the ability to configure removal and replacement of all those attributes listed in the Basic Application Level Confidentiality Profile in DICOM PS 3.15. Further, it shall be configurable to perform no de-identification at all.

When de-identification has been performed, the Export Manager shall add to the DICOM dataset of each instance the Patient Identity Removed (0012,0062) attribute with a value of YES, and add a value for De-identification Method (0012,0063) or De-identification Method Code Sequence (0012,0064).

In some scenarios, it will be desirable to configure the Export Manager to perform no de-identification at all, such as when all de-identification will be performed in the Teaching File Receiver, or not at all. In such cases, if the Patient Identity Removed (0012,0062) attribute is present in the dataset it shall not be changed; if it is absent it shall not be added.

In some de-identification scenarios, the UIDs need to be replaced. This transaction does not require that UIDs be replaced, but does require that if UIDs are replaced, internal consistency within the exported set of instances be maintained; the implementation shall be configurable to support both. This entails adherence to the following rules:

- The same replacement UID is used for all composite instances of the same entity within the set, e.g., the same Study Instance UID for all instances within the same original study.
- References by UID to other instances or entities within the set are updated, e.g., references to the SOP Instance UIDs of predecessor documents, reference images and source images.
- References by UID to other instances or entities not included within the set are removed or replaced with consistent, well-formed, dummy references.

If the same instances are exported multiple times on different occasions, the identifying attributes and UIDs therein may or may not be replaced with the same values on each occasion. That is, this transaction does not require deterministic behavior for replacement of identifying attributes and UIDs, except as specified for the Remap Identifiers option. See also the discussion in Appendix I.2.

The actions of the de-identification and pseudonymization must not create invalid IODs. Specifically:

- Mandatory and conditional attributes may not be removed, but rather must be replaced.
- Type 1 attributes must be given a value.
- Type 2 attributes may be encoded zero length, but it is often advisable to encode a value, especially for attributes likely to be used in browsers such as Patient Name, Patient ID, Study ID and Accession Number.

4.51.4.1.4.2 Manifest Coercion

The manifests received from the Export Selector will be Key Object Selection Documents that references instances of a single patient, but possibly from multiple studies. If multiple studies are referenced there will be multiple copies of the Key Object Selection Document.

The manifest(s) will contain the original identifying information, and hence need to undergo de-identification and pseudonymization prior to export, in accordance with the same requirements as the instances to which it refers.

The Export Manager shall update the UIDs in the references in the manifest(s) to the studies, series and instances, if the UIDs in the referenced instances have been changed.

If the Export Manager has not received all the instances in the set referenced by the manifest(s), and will not transmit them to the Receiver, then they shall be removed from the forwarded manifest(s).

Any Document Title Modifier specifying a Delay for Reason shall be removed.

A manifest shall always be included in the export from the Export Manager to the Receiver.

In the multiple study case, the correct number of manifests shall be exported to the Receiver, regardless of what was received from the Export Selector.

4.51.4.1.4.3 Remap Identifiers Option

The purpose of this option and its requirements are described in RAD TF-1:17.2.2. The DICOM Clinical Trials attributes are further discussed in Appendix I.3.

Table 4.51.4-3 below lists the attributes that shall be used as keys to select which values to use for remapping of identifiers, and which attributes shall be replaced.

If the same instances are exported multiple times, the attributes in Table 4.51.4-3 shall be remapped to the same values. Other attributes, including UIDs, may or may not be replaced with the same values on each occasion. That is, this option only requires deterministic behavior for the attributes in Table 4.51.4-3.

Table 4.51.4-3 uses the following conventions:

- M – Match means that the attribute is used as the key value to match at the specified level, and hence to select new values for mapping other attributes at that level
- C – Change means that any value shall be replaced by a non-zero value, or the attribute shall be inserted with a value if not present
- D – Deletion means either removal of the attribute if it is Type 3, or replacement with zero length if it is Type 2, or replacement with a dummy value if it is Type 1
- L – Leave means do not change the existing value of the attribute

Table 4.51.4-3: Remap Identifiers Option Attributes

Attributes Name	Tag	Match	Delete, Change or Leave	Notes
Clinical Trial Protocol Level				
Clinical Trial Protocol ID			C	Note 1
Clinical Trial Site Level				
Institution Name		M	C	Note 2
Clinical Trial Site ID			C	
Clinical Trial Subject Level				
Patient ID		M	C	Note 2
Patient Name			C	Note 2
Other Patient IDs			D	
Patient's Birth Date			L or C or D	Note 4
Patient's Age			L or C or D	Note 4
Patient's Sex			L or C or D	Note 4
Clinical Trial Subject ID			C	
Clinical Trial Study Level				
Study Date		M	L or C	Notes 3, 4
Study Time			L or C	Notes 3, 4
Study Description			L or C	Note 4
Clinical Trial Timepoint ID			C	

Attributes Name	Tag	Match	Delete, Change or Leave	Notes
Accession Number			D	
Clinical Trial Series Level				
Series Description		M	L or C	Note 4
Series Number			L or C	Note 4

Note 1: No matching of the Clinical Trial Protocol level based on attributes in the instances is specified, since the clinical trial protocol that is the target of the export will be conveyed in the disposition specified in the manifest.

Note 2: The delete option is not provided for these attributes; replacement is required. This is because these attributes are important for the correct operation of conventional databases and browsers, hence null or dummy values are not acceptable. Typically, for example, the same value inserted in Clinical Trial Subject ID will also be duplicated in Patient ID and Patient Name. Likewise, the same value inserted in Clinical Trial Site ID will also be duplicated in Institution Name.

Note 3: Whether or not the Study Date and Time need to be left or replaced depends on the requirements of the clinical trial; the implementation shall support both.

Note 4: The presence of more than one option means that the application shall be configurable to allow for any of the options.

4.51.4.1.4.4 De-identify Pixel Data Option

The removal of identifying information that is burned into the pixel data of single or multi-frame images is a non-trivial task. With image sources from multiple modalities and multiple vendors it is difficult to predict *a priori* within which pixels such identification is contained. Hence this task is difficult to automate and in the majority of instances requires intervention by a human operator acting through a user interface with what is essentially a pixel data editor.

An Export Manager claiming this option shall provide a method of de-identification of the pixel data. The manner in which this is performed is not specified. De-identification is generally considered successful if patient-identifying information can no longer be read or recovered from the pixel data.

Whether or not de-identification of the pixel data of a particular image is required may be difficult to determine, and may require human intervention. This option requires that the Export Manager provide a mechanism for categorizing those images that are at risk, and requiring confirmation by a human operator that the identification has been removed.

If an instance already contains the Burned In Annotation (0028,0301) attribute with a value of NO, then pixel data de-identification is not required. When de-identification of pixel data has been performed, the Export Manager shall add to the DICOM dataset of each instance the Burned In Annotation (0028,0301) attribute with a value of NO.

This option neither requires nor prohibits changing the SOP Instance UIDs; the implementation shall be configurable to support both.

4.51.4.1.4.5 De-identification of Non-Image Instances

There are no specific requirements or named options for the removal of identification information that may be contained within the payload of non-image instances. For example, an

SR object that contains a plain text report or an evidence document, or an encapsulated PDF document, could contain identifying information within the payload that is difficult to detect and remove in an automated manner, and operator intervention may be required. It is beyond the scope of this profile to define the mechanisms for the removal of such information. It suffices to say that the subset of DICOM composite storage SOP instances supported by the Export Manager as an SCP should take this factor into consideration.

4.51.4.1.5 Delay for Reason

When the Exporter supports the Delay for Reason option, and the Document Title Modifier of a manifest specifies a coded reason for delay, and the Exporter supports that coded reason, then processing shall not begin until the reason for the delay has been satisfied, or the delay condition is not satisfied within a configurable time.

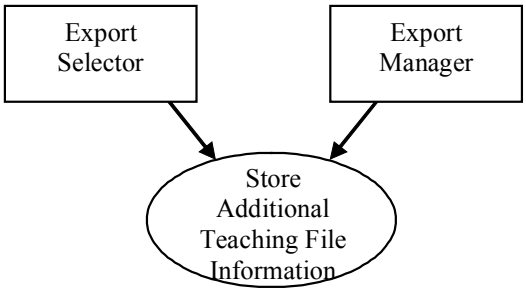
4.52 Store Additional Teaching File Information

This section corresponds to Transaction RAD-52 of the IHE Technical Framework. The Export Selector and Export Manager actors use transaction RAD-52.

4.52.1 Scope

In the Store Additional Teaching File Information transaction, the Export Selector sends an SR document containing additional teaching file information to the Export Manager.

4.52.2 Use Case Roles



Actor: Export Selector

Role: Transmit information to Export Manager.

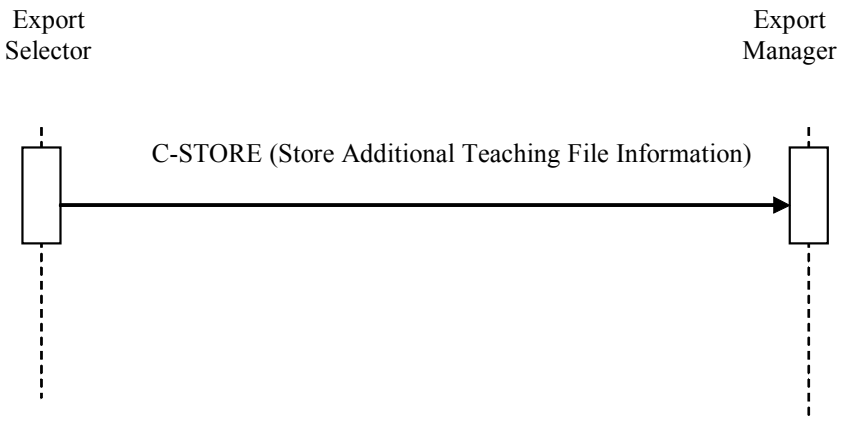
Actor: Export Manager

Role: Accept information from Export Selector and queue it for de-identification, pseudonymization and export

4.52.3 Referenced Standard

DICOM 2011 PS 3.4: Storage Service Class.

4.52.4 Interaction Diagram



2260

4.52.4.1 Store Additional Teaching File Information

4.52.4.1.1 Trigger Events

The Export Selector can transfer information to the Export Manager sequentially within one or more DICOM associations.

2265 The timing of the transfer is not coupled to the timing of any Store Instances or Store Export Selection transactions, in that they may occur over the same or different associations, and the manifest may be received before, during or after the instances referred to by the manifest.

4.52.4.1.2 Message Semantics

The Export Selector uses the DICOM C-STORE message to transfer the additional information
2270 encoded as one or more Enhanced SR SOP Class instances. The Export Selector is the DICOM Storage SCU and the Export Manager is the DICOM Storage SCP.

This information is separate from the manifest summarizing the collection of referenced instances is contained.

More than one instance may be present.

2275 To be included in the material to be exported, the instances of this transaction must be referenced by the manifest(s) in the Store Export Selection transaction.

The Document Title shall be (TCE006, IHERADTF, “Additional Teaching File Information”).

An example template for an SR describing a typical Radiology Teaching File collection is described in Appendix H.

2280 ##### 4.52.4.1.3 Expected Actions

The Export Manager will queue the received DICOM objects, until ready to process them.

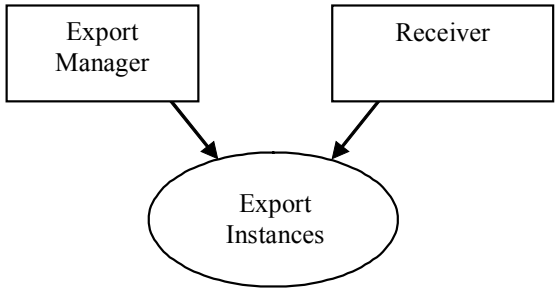
4.53 Export Instances

This section corresponds to Transaction RAD-53 of the IHE Technical Framework. The Export Manager and Receiver actors use transaction RAD-53.

4.53.1 Scope

In the Export Instances transaction, the Export Manager sends the de-identified and pseudonymized composite instances and a Key Object Selection document acting as a manifest of the collection to a Receiver. The purpose of the manifest is to retain the information that the referenced instances constitute the collection that it is being exported.

4.53.2 Use Case Roles



Actor: Export

Role: Transmit de-identified and pseudonymized instances and manifest to Receiver.

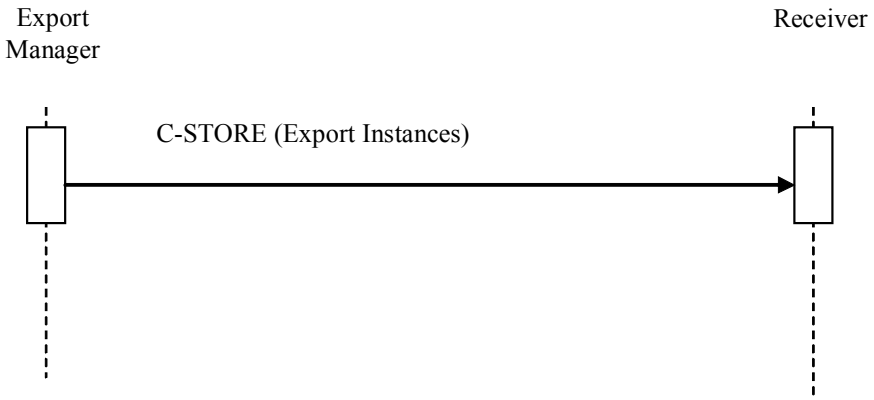
Actor: Receiver

Role: Accept instances from the Export Manager

4.53.3 Referenced Standard

DICOM 2011 PS 3.4: Storage Service Class.

4.53.4 Interaction Diagram



4.53.4.1 Export Instances

4.53.4.1.1 Trigger Events

The Export Manager initiates this transaction when it has de-identified and pseudonymized all the instances referenced within an Export Selection, as well as any instances of Additional Teaching File Information and the manifest.

4.53.4.1.2 Message Semantics

The Export Manager uses the DICOM C-STORE message to transfer the instances and the manifest. The Export Manager is the DICOM Storage SCU and the Receiver is the DICOM Storage SCP.

The Export Manager can transfer the instances and the manifest to the Receiver within one or more DICOM associations.

The timing of the transfer of the manifest and the instances to which it refers is not defined, in that they may occur over the same or different associations, and the manifest may be received before, during or after the instances referred to by the manifest.

The manifest is an instance of the Key Object Selection SOP Class.

4.53.4.1.3 Expected Actions

A receiver shall support the Key Object Selection SOP Class as an SCP.

The Receiver may support any composite storage SOP class, including Images, Evidence Documents, Structured Reports, Presentation States, and Radiotherapy objects.

If the Receiver does not support all the SOP Classes of the instances to be exported, then the transfer will partially or completely fail.

A Receiver claiming the Additional Teaching File Information option shall be able to receive Enhanced SR SOP Class instances. No specific semantics are defined for receipt of the Additional Teaching File Information.

Unless grouped with other Actors, the further behavior of the Receiver on receiving the instances and manifests is beyond the scope of the transaction to define. Typically:

- In the case of teaching files, such a device might store the received instances whilst awaiting a manifest prior to queuing the instances for authoring by the user.
- In the case of clinical trials, such a device might store the received instances whilst awaiting a manifest prior to queuing for entry into the clinical trial workflow

A Receiver grouped with an Image Manager/Archive shall make the received instances available for use in the normal manner as defined by other Profiles. If the Image Manager/Archive claims the Key Image Note Profile, then the manifests shall be made available as Key Image Notes.

A Receiver grouped with a Portable Media Creator shall store the received instances whilst awaiting a manifest prior to burning the referenced instances and manifests to media, as defined by the requirements in the Portable Data for Imaging Profile.

4.54 Provide and Register Imaging Document Set - DEPRECATED

This transaction has been deprecated and is superseded by the Provide and Register Imaging Document Set – MTOM/XOP (RAD TF-3: 4.68) as part of the Cross-Enterprise Document Sharing for Imaging (XDS-I.b) Profile.

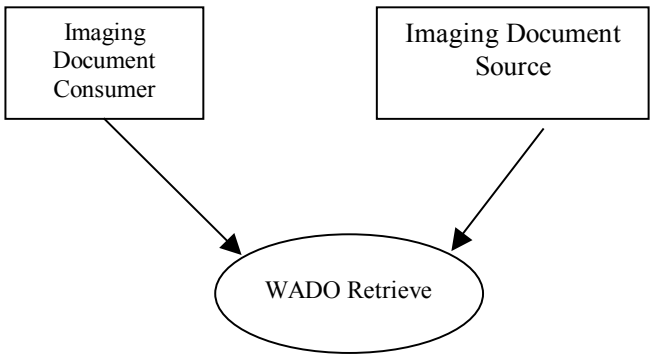
4.55 WADO Retrieve

This section corresponds to Transaction RAD-55 of the IHE Technical Framework. Transaction RAD-55 is used by the Imaging Document Consumer and the Image Manager/ Image Archive actors.

4.55.1 Scope

The WADO Retrieve transaction enables an Imaging Document Consumer to access DICOM SOP Instances with a web-based service through HTTP/HTTPS protocol.

4.55.2 Use Case Roles



Actor: Imaging Document Consumer

Role: Issues an HTTP Get Request to access a DICOM instance.

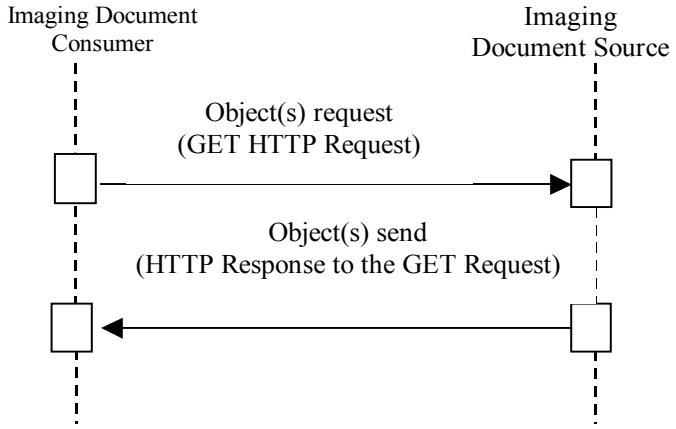
Actor: Imaging Document Source

Role: Receives an HTTP Get Request for accessing a DICOM instance and generates the HTTP response with the appropriate content.

4.55.3 Referenced Standard

DICOM 2011 PS 3.18: Web Access to DICOM Persistent Objects (WADO)

4.55.4 Interaction Diagram



4.55.4.1 WADO Retrieve

The Imaging Document Consumer issues an HTTP Get to request a specific DICOM instance from the Imaging Document Source. The Imaging Document Source receives the request, generates the response with the appropriate content and sends an HTTP Response to the Imaging Document Consumer.

4.55.4.1.1 Trigger Events

The Imaging Document Consumer wishes to retrieve a DICOM instance that is referenced within a DICOM Manifest.

4.55.4.1.2 Message Semantics

The message semantics are defined by the DICOM Web Access to DICOM Persistent Objects (WADO), PS 3.18.

The WADO Retrieve transaction is performed by the Imaging Document Consumer to send a HTTP Request-URI to the web server of the Imaging Document Source. The Imaging Document Consumer generates the HTTP Request-URI to retrieve a DICOM instance. The DICOM instance shall be specified with its Study Instance UID, Series Instance UID, and SOP Instance UID in the HTTP Request-URI. The Imaging Document Consumer must obtain the host information (e.g., web server location, and script language) of the web server to perform this transaction. The Imaging Document Consumer can map the Retrieve AE Title of the SOP Instance to the web server host information based on its local configuration (see Appendix G).

In addition, the Imaging Document Consumer shall support the following fields in the HTTP request:

Table 4.55-1: WADO HTTP Request Fields

HTTP Field	REQ	Description	Values
Accept	R	This field is used to specify MIME types which are acceptable for the response	At least one of the following values: application/dicom image/jpeg application/text application/html */* Other values may be included as well
Accept-Language	O	This field specifies the language of the object to be retrieved.	Any valid value according to RFC2616

2385 The Imaging Document Source shall list all media types it supports in the Accept field of the HTTP request, and shall use WADO HTTP parameter contentType to request the desired media type of the object to be retrieved in the HTTP response (see Table 4.55-2).

The Imaging Document Source and the Imaging Document Consumer are required to support a number of parameters in the WADO HTTP Request-URI, as described in the following table.

2390

Table 4.55-2: WADO HTTP Request Parameters

Parameter Name	Parameter Description	Requirement		Note
		Imaging Document Source	Imaging Document Consumer	
requestType	Type of the HTTP request performed. It must be "WADO"	R	R	
studyUID	Unique identifier of the study	R	R	
seriesUID	Unique identifier of the series	R	R	
objectUID	Unique identifier of the object	R	R	
contentType	MIME type of the response	R+	R+	IHE-1 IHE-2
charset	Charset of the response	O	O	
anonymize	Anonymize object	O	O	
annotation	Annotation of the object	O	O	IHE-3
rows	Number of pixel rows	O	O	IHE-3
columns	Number of pixel columns	O	O	IHE-3
region	Region of image	O	O	IHE-3
windowCenter	Window center of the image	O	O	IHE-3
windowWidth	Window width of the image	O	O	IHE-3
frameNumber	Frame number of the single frame in a multi-frame image	O	O	IHE-3
imageQuality	Image quality factor	O	O	IHE-3

Parameter Name	Parameter Description	Requirement		Note
		Imaging Document Source	Imaging Document Consumer	
presentationUID	Unique identifier of the presentation object	O	O	IHE-3
presentationSeriesUID	Unique identifier of the series containing the presentation object	O	O	IHE-3
transferSyntax	Transfer syntax UID used with DICOM image object returned in the response	O	O	IHE-3

IHE-1: The Imaging Document Consumer must use the value "application/dicom" to retrieve a DICOM SOP Instance in the DICOM Part 10 File Format. This allows the Imaging Document Consumer to receive a SOP Instance in the native DICOM format for full data manipulation.

The Imaging Document Consumer can also use the value "application/jpeg" to retrieve an image encoded in JPEG baseline format if it is a single frame DICOM image object or a single frame image encoded in a multi-frame DICOM image object.

The Imaging Document Consumer can also use the values "application/text" or "application/html" to retrieve a DICOM SR object represented in the text or html format.

The Imaging Document Consumer can also use other values for this parameter as specified in DICOM 2011 PS 3.18, if they are supported by the Imaging Document Source.

This parameter is optional in DICOM PS 3.18. Because the default format of the DICOM persistent object returned in the HTTP Get response in the absence of a value in this parameter varies depending on the SOP Class of the retrieved object, this transaction requires that the parameter be supported, to improve interoperability.

IHE-2: This parameter must be compatible to the value(s) that the Imaging Document Consumer placed in the Accept field of the HTTP Request-URI.

IHE-3: The parameter applies only to a DICOM SOP Instance if it is an image object.

4.55.4.1.2.1 Example of WADO Request-URI

The following is an example of HTTP Request-URI for retrieving a persistent DICOM object using WADO:

http://www.hospital/radiology/wado.php?requestType=WADO&studyUID=1.2.250.1.59.40211.12345678.678910&seriesUID=1.2.250.1.59.40211.789001276.14556172.67789&objectUID=1.2.250.1.59.40211.2678810.87991027.899772.2&contentType=application%2Fdicom

This example uses response MIME type application/dicom to request the DICOM SOP Instance returned in the native DICOM Part 10 file format.

4.55.4.1.3 Expected Actions

Upon reception of the WADO HTTP Request, the Imaging Document Source shall parse the request and if there are no errors, shall construct an HTTP Get Response with the requested DICOM instance content and return the response as specified by the DICOM WADO standard, with HTTP response code 200 (OK).

The Imaging Document Source shall return HTTP response code 406 (Not Acceptable), if it cannot serve the requested response MIME type(s) in parameter contentType and/or Accept Field.

The Imaging Document Source shall return HTTP response code 404 (Not Found) if it cannot locate the requested DICOM SOP Instance or cannot recognize the UID values specified in the received HTTP Request-URI.

The Imaging Document Source shall return HTTP response code 400 (Bad Request) if any required HTTP field or required WADO HTTP parameters are missing in the received HTTP Request-URI, or any other syntactic error is detected in the HTTP Request-URI (e.g., media type in contentType parameter conflicts with media types in Accept field).

4.55.4.1.4 Audit Trail Trigger Events

IHE specifies a number of events that shall be reportable by means of the IHE Audit Trail (ITI TF-2a: 3.20). IHE Radiology Audit Trial Option further defines a subset of these events, which are particularly applicable to the radiology transactions.

Table 4.55-3 lists all the radiology audit trial trigger events applied to transaction RAD-55. The last column specifies whether the sender or receiver side of the transaction is required to audit the event.

Table 4.55-3: Audit Record Trigger Events

IHE Radiology Transaction	ATNA Trigger Event(s)	Audit Recording Requirements
WADO Retrieve [55]	Instance-Stored	Imaging Document Source shall audit
	Study Used	Imaging Document Consumer shall audit

4.59 Import Procedure Step In Progress

This section corresponds to Transaction RAD-59 of the IHE Technical Framework. Transaction RAD-59 is used by the Department System Scheduler/Order Filler, Image Manager, Performed Procedure Step Manager, Report Manager, and Importer actors.

4.59.1 Scope

This transaction includes a message from the Importer to the Performed Procedure Step Manager, which in turn issues the message to the Department System Scheduler/Order Filler, the Image Manager and the Report Manager that the Performed Procedure Step is in progress.

The receiving Performed Procedure Step Manager is grouped with the Image Manager or the Department System Scheduler/Order Filler, and shall support forwarding messages to two other destinations besides the Actor it is grouped with. It shall start issuing messages to the configured destinations immediately after it accepts the corresponding messages from the Importer.

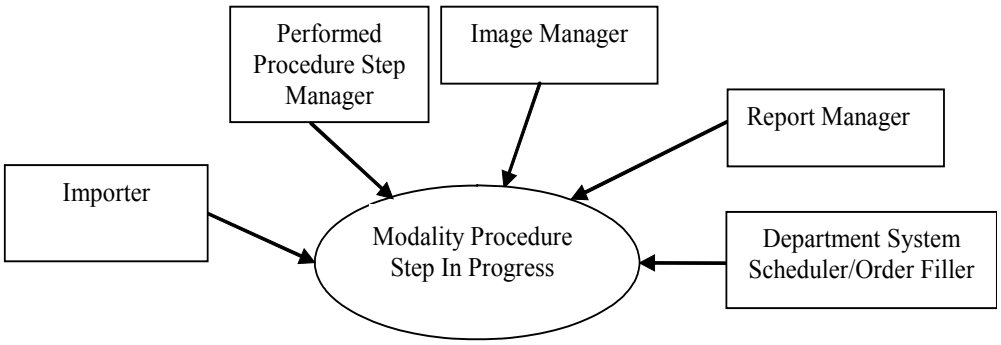
To allow for proper integration, the following considerations must be taken into account:

The Performed Procedure Step Manager must maintain PPS objects and then store them until corresponding N-CREATE and N-SET messages are transmitted to the Actor it is grouped with, and the two other Actors. If transmission to a destination fails, the Performed Procedure Step Manager shall try to repeat transmission periodically until it succeeds. The Performed Procedure Step Manager must not use failure of one or more of these transmissions as a reason for rejecting the initial transmission from the Importer;

Because both the Image Manager and the Department System Scheduler/Order Filler incorporate the Performed Procedure Step Manager function, an infinite redistribution of PPS messages is possible. The Image Manager and the Department System Scheduler/Order Filler systems that provide the Performed Procedure Step Manager function shall be configurable to disable this function;

Transfer of the information to the system that the receiving Performed Procedure Step Manager is integrated with is outside the scope of the IHE Technical Framework (i.e., internal to an implementation).

4.59.2 Use Case Roles



Actor: Department System Scheduler/Order Filler.

Role: Receives the PPS information forwarded by the PPS Manager.

Actor: Image Manager.

Role: Receives the PPS information forwarded by the PPS Manager.

Actor: Report Manager.

Role: Receives the PPS information forwarded by the PPS Manager.

Actor: Importer.

Role: Informs the Performed Procedure Step Manager that a particular Performed Procedure Step has started.

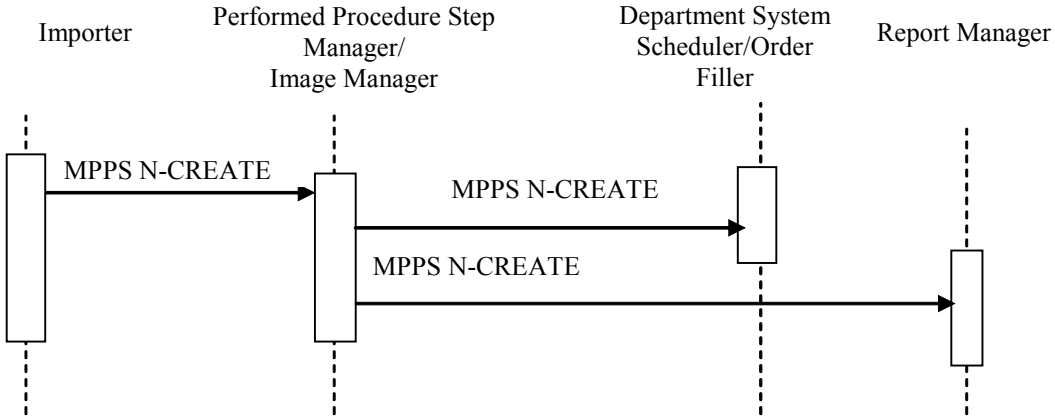
Actor: Performed Procedure Step Manager.

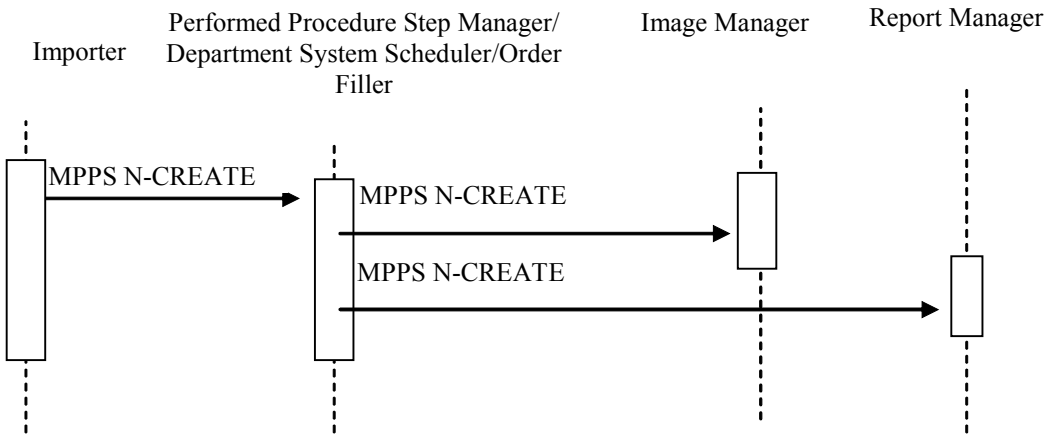
Role: Accepts Performed Procedure Step information from an Importer and transmits it to the Department System Scheduler/Order Filler, Image Manager and Report Manager.

4.59.3 Referenced Standards

DICOM 2011 PS 3.4: Modality Performed Procedure Step SOP Class.

4.59.4 Interaction Diagram





4.59.4.1 Procedure Step In Progress Message

4.59.4.1.1 Trigger Event

The User begins the import procedure step from the Importer.

4.59.4.1.2 Message Semantics

The Importer importing Evidence Objects into the Enterprise uses a Modality Performed Procedure Step SOP Class (N-CREATE Service) to inform the Performed Procedure Step Manager that a specific Procedure Step has been started and is in progress. In turn, the Performed Procedure Step Manager uses the N-CREATE service to forward the information to the Department System Scheduler/Order Filler, Image Manager and Report Manager. The Performed Procedure Step Manager shall use the same Performed Procedure Step SOP Instance UIDs during this interchange. The following aspects shall be taken into account during implementation of this step:

4.59.4.1.2.1 Patient/Procedure/Scheduled Procedure Step Information

The Importer shall ensure that the critical Patient information is valid and correct (See RAD TF-2: Appendix A.5). Additionally, if a Procedure Step has been scheduled for the importation it is also necessary to validate the Procedure information. Due to the fact that the Evidence Objects or Hardcopy to be imported are not native to the Enterprise, the validation process (by the User) of ensuring that the correct Patient is associated with the imported data is critical.

4.59.4.1.2.2 Required Attributes

RAD TF–2: Appendix A.5 lists a number of attributes that shall be coerced by the Importer to ensure consistency between the information included in the imported SOP instances, the Performed Procedure Step attributes, the Patient Demographic Information and the Scheduled Procedure Step information, if applicable.

4.59.4.1.2.3 Relationship between Scheduled and Performed Procedure Steps and the Imported DICOM Composite Object

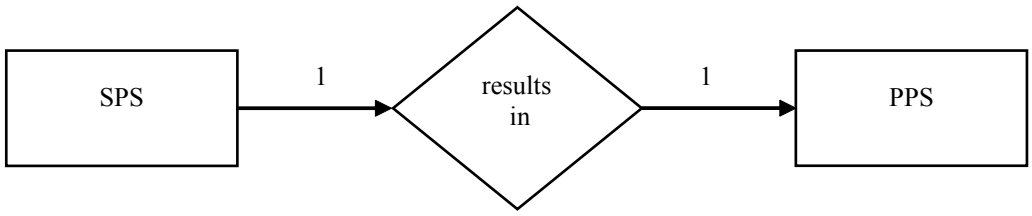
When importing a DICOM Composite Object (e.g. from CD), the DICOM header information must either be preserved to ensure the integrity of the Study or coerced to fit within the local Enterprise. RAD TF-2: Appendix A.5 defines specific coercion requirement. For example, the Study Instance UID is one of the elements which must be maintained.

The original scheduling and performing of the studies to be imported is outside of the venue of the Enterprise. For this reason, the association of Evidence Objects from a study to be imported may have relationships which are not easily described.

When digitizing Hardcopy and creating a new DICOM Composite Object, some of the original patient and study details may be derived from manual entry, OCR, configuration, etc. or may not be available. RAD TF-2: Appendix A.5 defines specific requirements.

The relationship between Scheduled and Performed Procedure Step information for an importation is shown in the following 2 cases. Refer to RAD TF-2: Appendix A.5 for details of filling other attributes (Procedure ID, Accession Number, etc.) in each of these cases. In each case a MPPS N-Create Message is sent to notify the system that the performed procedure import is in progress

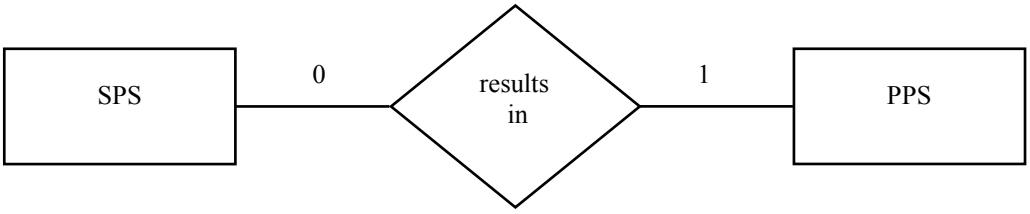
4.59.4.1.2.3.1 Scheduled Import



In the SCHEDULED IMPORT option, the Scheduled Procedure Step information is provided by a Modality Worklist. There exists a 1-to-1 relationship between SPS and PPS. Information about the Scheduled Procedure Step and Requested Procedure shall be copied from the Scheduled Procedure Step object to the Performed Procedure Step Relationship Module (see RAD TF-2: Appendix A.5).

Examples: A Procedure Step was performed exactly as scheduled. It could also be that a Procedure Step was not exactly performed as scheduled, but without being rescheduled, e.g. multiple Portable Media exist for a single Patient Study.

4.59.4.1.2.3.2 Unscheduled Import



In the UNSCHEDULED IMPORT option the Importer does not receive Scheduled information. There is a 0-to-1 relationship between SPS and PPS. The Patient information is received through a Patient Demographics Query and no Scheduled Procedure Step or Requested Procedure information is available.

4.59.4.1.2.3.3 Performed Protocol Sequence for Import

The Performed Protocol Code Sequence (0040,0260) shall be present in the Import Modality Performed Procedure Step. It is used to provide information on how the import should be handled (e.g. Interpret the Evidence Objects, Destroy the associated Media).

The Performed Protocol Code Sequence shall always contain one item with the value of (IRWF001, IHETFRAD, "Import").

In addition, if the Scheduled Protocol Code Sequence (0040,0008) exists, it shall be copied to the Performed Protocol Code Sequence (0040,0260), unless modified by the operator. For both the Scheduled and Unscheduled Import, the Importer may have the ability to add/modify the Import Instructions (see RAD TF-2:4.5-4).

4.59.4.1.3 Expected Actions

The Department System Scheduler/Order Filler, Report Manager and the Image Manager/Image Archive receive information from the Performed Procedure Step Manager and in the scheduled case, link it with the Requested Procedure and Scheduled Procedure Step.

How the Performed Procedure Step Manager, Department System Scheduler/Order Filler, Report Manager and the Image Manager/Image Archive uses the information contained within the Performed Protocol Sequence is currently undefined.

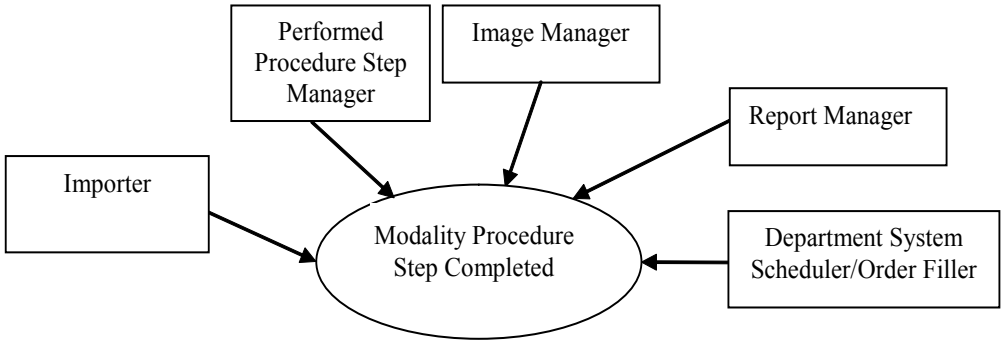
4.60 Import Procedure Step Completed/Discontinued

This section corresponds to Transaction RAD-60 of the IHE Technical Framework. Transaction RAD-60 is used by the Department System Scheduler/Order Filler, Image Manager, Report Manager, Performed Procedure Step Manager and Importer actors.

4.60.1 Scope

This transaction includes a message from the Importer to the Performed Procedure Step Manager, which forwards the messages to the DSS/Order Filler, the Report Manager and the Image Manager that the Performed Procedure Step and importation has been completed. The Image Manager may need the information to co-locate Evidence Objects of the same study. The Modality Procedure Step Completed message does not necessarily mean that the set of Evidence Objects is complete or available for retrieval.

4.60.2 Use Case Roles



Actor: Department System Scheduler/Order Filler.

Role: Receives the PPS information forwarded by the PPS Manager.

Actor: Image Manager.

Role: Receives the PPS information forwarded by the PPS Manager.

Actor: Report Manager.

Role: Receives the PPS information forwarded by the PPS Manager.

Actor: Importer.

Role: Informs the Performed Procedure Step Manager that a particular Performed Procedure Step and Importation is completed.

Actor: Performed Procedure Step Manager.

Role: Accepts Performed Procedure Step information from a Portable Media Importer or Evidence Creator and transmits it to the Department System Scheduler/Order Filler, Image Manager and Report Manager.

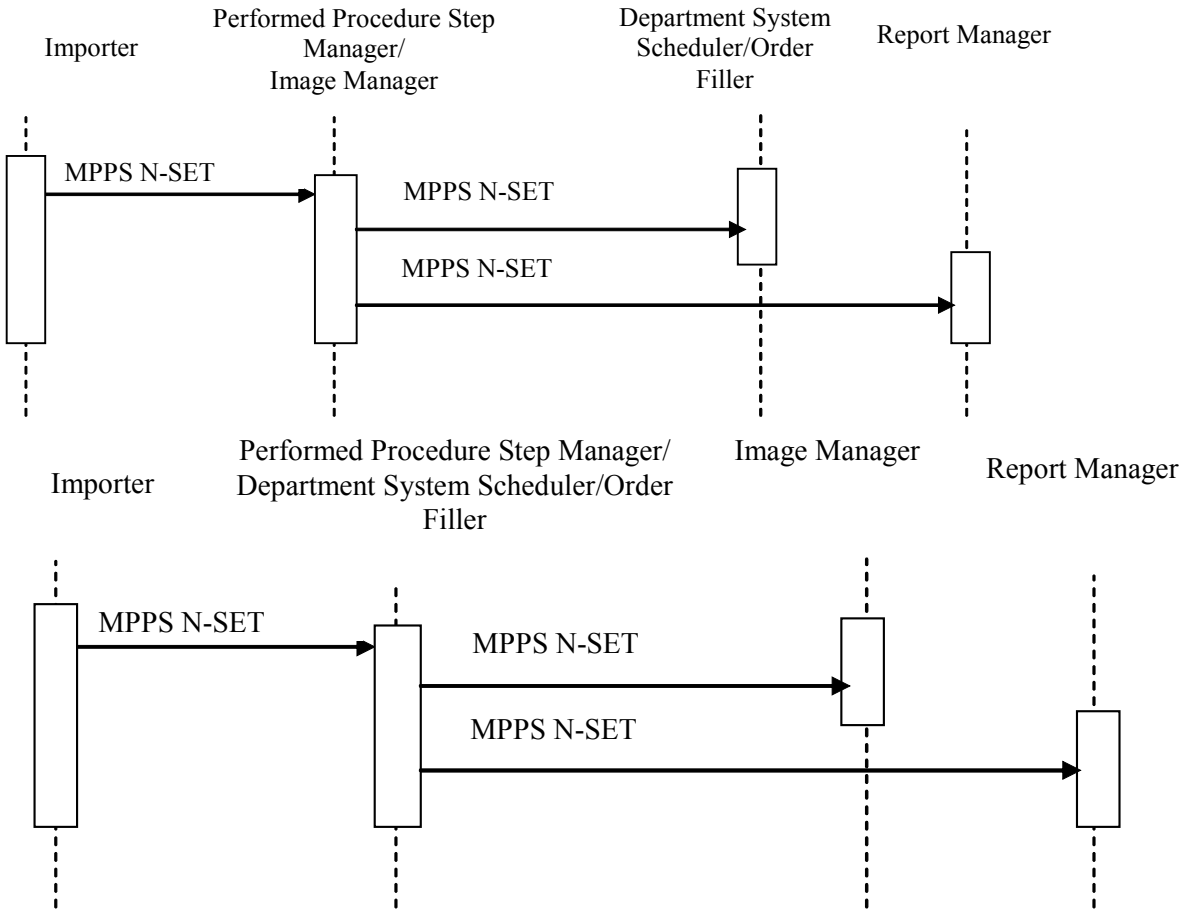
2600

4.60.3 Referenced Standards

DICOM 2011 PS 3.4: Modality Performed Procedure Step SOP Class.

DICOM 2011 PS 3.16: DCMR Context Groups (Normative)

2605 ### 4.60.4 Interaction Diagram



2610 Note: The diagram above shows the sequencing of messages for the Modality Performed Procedure Step SOP Class. Importers will also implement the Storage and Storage Commitment classes. The timing relationship between PPS messages and Storage and Storage Commitment messages is not specified. That is, PPS messages may occur before or after storage requests.

4.60.4.1 Procedure Step Completed/Discontinued

4.60.4.1.1 Trigger Event

User completes procedure step on the Importer.

4.60.4.1.2 Message Semantics

The Importer shall send Modality Performed Procedure Step SOP Class (N-SET service) to inform the Performed Procedure Step Manager that a specific Performed Procedure Step has been completed or discontinued.

The final N-SET has either the MPPS status of "COMPLETED" or "DISCONTINUED". The Performed Procedure Step Manager forwards N-SETs to the Department System Scheduler/Order Filler, Image Manager and Report Manager.

When an N-SET is issued with a "DISCONTINUED" status, one or more Series of Instances may be referenced, if Evidence Objects were created and sent.

Note: DICOM specifies that when attributes are allowed to be set by an N-SET, the value provided by the last N-SET overrides any value set by an earlier N-CREATE or N-SET.

4.60.4.1.2.1 Retrieve AE Title

According to the DICOM Standard, the Importer has the ability to include the Retrieve AE Title attribute (0008,0054) in the Performed Series Sequence (0040,0340). This is an AE Title where the referenced SOP instances for the series may be retrieved. This Retrieve AE Title will often be zero length or be of short-term validity, due to the following situations:

- If an Importer supports a Retrieve SOP Class in an SCP Role, the Importer's Retrieve AE Title may be included; however, the Importer does not guarantee long-term availability.
- A Retrieve AE Title of the Image Manager can be configured on the Importer. Otherwise, this field shall be sent zero length. Importer implementers shall not assume that the destination AE Title used for the Storage SCP or Storage Commitment SCP is the same as that for Image Retrieval.
- An Importer may receive the Retrieve AE Title in a Storage Commitment Message (N-EVENT REPORT). However, this information may be received well after the MPPS N-SET (Complete) was performed.

4.60.4.1.2.2 Import PPS Exception Management

When the Modality Procedure Step is sent with the Status DISCONTINUED, the Procedure Step Discontinuation Reason Code Sequence (0040,0281) shall be sent with values defined in DICOM 2011 PS 3.16 Annex B Context ID 9300 or Table 4.60-1 (additional codes that are in the process of being added by DICOM).

Table 4.60-1: Context ID 9300 – Procedure Discontinuation Reasons Excerpt

Most Restrictive Use: Defined

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
...		
DCM	110521	Objects incorrectly formatted
DCM	110522	Object Types not supported
DCM	110523	Object Set incomplete
DCM	110524	Media Failure

The Reason Code when communicated to the DSS/Order Filler and Image Manager/Image Archive may imply canceling an order. It may also facilitate more accurate charge posting.

The Reason Code: "Incorrect Worklist Entry Selected" is used by the Importer to convey that the wrong Patient Demographics and/or Scheduled Procedure Step has been selected (incorrect patient or incorrect Requested procedure/order for the same patient). In this case some or all of the incorrectly imported Evidence Objects (for example the ones assigned to the wrong patient) may already have been stored to the Image Manager (see section 4.60.4.1.3.1).

Importer implementers are left free to decide how to correct the resultant evidence objects. The Importer shall include within the MPPS the list of imported objects that are or will be included in the Import Stored Transaction(s).

Note: When a PPS DISCONTINUED is sent with the reason code "incorrect worklist entry selected", evidence objects referenced in this PPS DISCONTINUED are Evidence Objects that may have been sent to the Image Manager/Archive. The IHE Technical Framework does not specify whether or not the Importer Actor needs to perform a Storage Commitment for these instances.

The Reason Codes "Equipment Failure", Objects incorrectly formatted", "Object Types not Supported", "Object Set incomplete" and "Media Failure" will be used to indicate that the expected Evidence Objects have been imported.

4.60.4.1.2.3 Billing and Material Management Option

The message semantics are defined in the DICOM Service Class section of the DICOM Modality Performed Procedure Step SOP Class. It is the responsibility of the Importer to ensure that the patient and procedure information is sent to the Department System Scheduler/Order Filler.

The Attributes defined in Table 4.60-2 provide a means to transmit material management codes from the importer to the DSS/Order Filler that uses them for calculation of charges to be posted to the Charge Processor.

An importer that supports the BILLING AND MATERIAL MANAGEMENT option shall be able to provide content within the Billing Procedure Step Sequence and the Billing Supplies and Devices Sequence. If the Billing Procedure Step is used, the Import Billing Code Table shall be configured on the Importer. This table shall be synchronized with the Department System Scheduler/Order Filler. The codes provided by the Importer might not be the same as the code

the Department System Scheduler/Order Filler is required to use when posting Charges to the Charge Processor.

The Billing Item Sequence provides the mechanism to track the number of media imported. See Table 4.60.3 for the list of Coded Values that may be specified in the Billing Item sequence when there are charges associated with importing items such as a CD or digitizing a Radiological Film. Multiple codes may be present.

Table 4.60-2: Billing and Material Management Code Module Attributes Excerpt

Attribute name	Tag	Attribute Description
Billing Procedure Step Sequence	(0040,0320)	Contains billing codes for the Procedure Type performed within the Procedure Step. The sequence may have zero or more Items. It may be zero-length if the Billing Supplies and Devices Sequence is populated.
> Code Value	(0008,0100)	
> Coding Scheme Designator	(0008,0102)	
> Code Meaning	(0008,0104)	
…		
Billing Supplies and Devices Sequence	(0040,0324)	Contains billing codes for chemicals, supplies and devices for billing used in the Performed Procedure Step. The sequence may have one or more Items.
>Billing Item Sequence	(0040,0296)	Codes values of chemicals, supplies or devices required for billing. The sequence may have zero or one Items.
>> Code Value	(0008,0100)	
>> Coding Scheme Designator	(0008,0102)	
>> Code Meaning	(0008,0104)	
>Quantity Sequence	(0040,0293)	Sequence containing the quantity of used chemicals or devices. The sequence may have zero or one Items.
>>Quantity	(0040,0294)	Numerical quantity value. Specifies the number of media imported or digitized.
…		

Table 4.60-3: Context ID 7008 – Import Device Media

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	110020	Sheet Film Scanned
DCM	110021	Cine Film Scanned
DCM	110022	Video Tape Scanned
DCM	110023	Page Digitized
DCM	110024	CD Imported
DCM	110025	DVD Imported
DCM	110026	MOD Imported
DCM	110027	Studies Imported

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	110028	Instances Imported

4.60.4.1.3 Expected Actions

The Image Manager, Report Manager and Department System Scheduler/Order Filler receive information about the Performed Procedure Step being complete or discontinued. The Image Manager, Report Manager and Department System Scheduler are not required to act on intermediate N-SET messages with the MPPS Status "IN PROGRESS".

In the case of the Scheduled Import, the Requested Procedure may be considered complete if all Performed Procedure Steps related to all Scheduled Procedure Steps have been completed or properly discontinued.

4.60.4.1.3.1 Import PPS Exception Management

When an import exception occurs, the DSS/Order Filler or Image Manager/Archive shall use the reason codes in the final N-SET sent with the status of DISCONTINUED.

When the Modality Procedure Step is received with the Status DISCONTINUED, the receiver shall interpret the Performed Procedure Step Discontinuation Reason Code Sequence (0040,0281) values as defined in DICOM (see section 4.60.4.1.2.2). When received by the Department System Scheduler/Order Filler and the Image Manager/Archive, the Reason Code may indicate the necessity for modification or canceling of an order. With the Reason Code: "Incorrect Worklist Entry Selected", the Importer Actor conveys that the wrong SPS or Patient has been selected (e.g. incorrect patient or incorrect Requested procedure/order for the same patient). In this case the Image Manager and Department System Scheduler shall take the appropriate action to ensure that already received incorrect instances (i.e. SOP Instances referenced by this Discontinued PPS) are not mistakenly used. If the images, presentation states, or key image notes are not actually deleted, the Image Manager shall:

- not return SOP Instance UIDs for the images in query responses,
- not return such images in Patient, Study, Series, or Instance level retrievals,

On the DSS and Image Manager, the Order/Requested Procedure status shall be corrected to indicate that the discontinued PPS (with wrong worklist entry selected) is not valid. Therefore the Order Filler/Department System Scheduler shall not query for those instances with an Image Availability Notification transaction [RAD-49].

When the Modality Procedure Step is received with the Status DISCONTINUED, it shall include a Reason Code from the enumerated list (see Table 4.60-1). The Reason Code indicates that all of the Evidence Objects could not be imported. Typically this will be because some of the DICOM Composite Objects are not supported by the local Enterprise. How the local Enterprise deals with this situation is up to local policies and is out of scope of the Technical Framework.

4.60.4.1.3.2 Billing and Material Management Option

When a DSS/Order Filler supports the BILLING AND MATERIAL MANAGEMENT option, it shall use the billing codes and/or material usage information provided in the final N-SET for calculation of charges that it will eventually post to the Charge Processor. It is recommended that DSS/Order Filler verifies the consistency of provided billing codes with Requested Procedure Code and Performed Procedure Step Protocol codes supplied in the same N-SET.

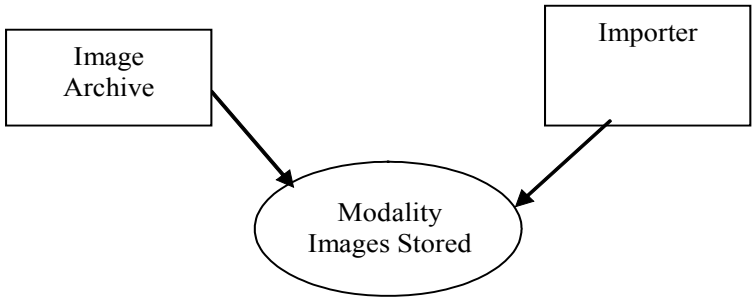
4.61 Imported Objects Stored

This section corresponds to Transaction RAD-61 of the IHE Technical Framework. Transaction RAD-61 is used by the Image Archive and the Importer actors.

4.61.1 Scope

In the Imported Objects Stored transaction, the Importer sends the Evidence Objects to the Image Archive. The reconciled information provided from the Modality Worklist transaction (see RAD TF-2: 4.5) or the Patient Demographics Query (see ITI TF-2a:4.21) shall be included in the headers of the generated images.

4.61.2 Use Case Roles



Actor: Image Archive

Role: Accept and store DICOM Composite Objects from the Portable Media Importer.

Actor: Importer

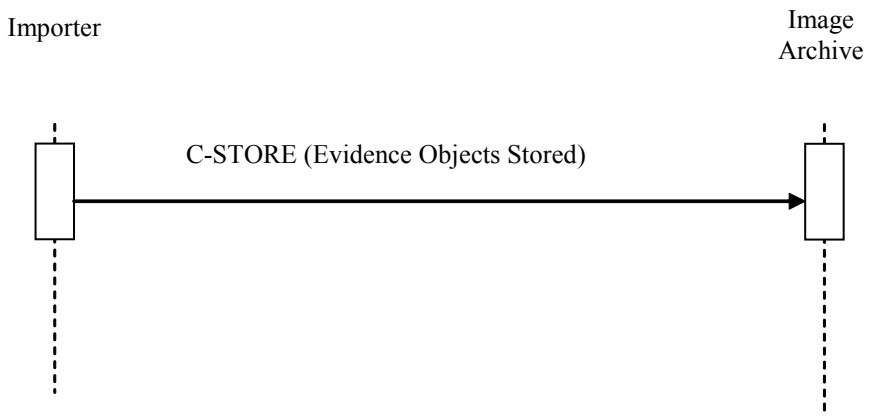
Role: Transmit imported DICOM object data to Image Archive

4.61.3 Referenced Standards

DICOM 2011 PS 3.4: Storage Service Class, Section B.4.1 Conformance as an SCP

DICOM 2011 PS 3.3 SOP Information Objects, Common Module Attribute

4.61.4 Interaction Diagram



4.61.4.1 Evidence Objects Stored

4.61.4.1.1 Trigger Events

The Importer can transfer Evidence objects to the Image Archive sequentially within one or more DICOM associations, as the Evidence objects become available or collectively.

4.61.4.1.1.1 UIDs

Valid DICOM UIDs are universally unique, so there should be no risk of collision with local UIDs. When a valid set of DICOM UIDs is present, the importer shall use this set and not change them. If the importer detects incorrect UIDs or an inconsistent set of UIDs, then it may correct or re-generate UIDs. The UIDs are used as references between objects, and if they are altered, the Importer shall maintain referential integrity. Additional details about when it is appropriate for an Importer to trigger the creation of a new Study/Series/Image Instance are described in RAD TF-2: 4.8.4.1.1.1 "Study UIDs and Series UIDs".

4.61.4.1.2 Message Semantics

The Importer uses the DICOM C-STORE message to transfer the DICOM Composite Objects. The Importer is the DICOM Storage SCU and the Image Archive is the DICOM Storage SCP.

If the import was scheduled, the User validates the available information for the patient and the Scheduled Procedure Step/Requested Procedure and coerces the Patient/Order Information as required (See Section RAD TF-2: Appendix A.5).

If the import was not scheduled, the User validates the available information for the patient and coerces the Patient Information as required (See Section RAD TF-2: Appendix A.5).

It is a requirement that certain information be recorded in the image header. The details of the mapping to DICOM instances are specified in RAD TF-2: Appendix A.5.

Per the DICOM Standard, the Importer shall create a new series for its created images (e.g. Digitization of Films) and not extend series containing source images.

4.61.4.1.2.1 Original Attributes Sequence

When coercing (i.e. replacing or deleting attributes) from the original Evidence Objects, the Importer shall create or add to the "Original Attributes Sequence" (See Table 4.61.4.1.2-1) at the top level and store the original values of those altered DICOM elements underneath it as defined in RAD TF-2: Appendix A.5.

The Importer shall use the "Original Attribute Sequence" to preserve information about the original non-digitized data (e.g. Originating Institution, Time of the import, specific attributes from the originating Institution). The mechanism and values which are preserved is out of scope for the Technical Framework.

Table 4.61.4.1.2-1: Original Attributes Sequence

Attribute Name	Tag	Type	Attribute Description
…			
Original Attributes Sequence (Note 1,2)	(0400,0561)	R+	Sequence of Items containing all attributes that are specified by the User from the Original dataset. One or more Items may be permitted in this sequence.
>Source of Previous Values	(0400,0564)	R+	Identification of the Enterprise which originated the Films or Documents.
>Attribute Modification Datetime	(0400,0562)	R	Date and Time of the hardcopy scan
>Modifying System	(0400,0563)	R	Identification of the local Enterprise
>Reason for the Attribute Modification	(0400,0565)	R	Reason for the attribute modification. Defined terms are: COERCE = Replace values of attributes such as Patient Name, ID, Accession Number, for example, during import of media from an external institution, or reconciliation against a master patient index. CORRECT = Replace incorrect values, such as Patient Name or ID, for example, when incorrect worklist item was chosen or operator input error.
>Modified Attribute Sequence	(0400,0550)	R	Sequence containing a single item that contains all the Attributes that supplied by the User from the Original Films or Documents.
>>Any Attribute from the main data set that was modified			

Note 1: A new original attribute sequence is added every time the DICOM Objects are imported.

Note 2: For digitized hardcopy the "old values" would be information the operator manually enters. It is expected that there would be only one sequence in this case.

4.61.4.1.2.2 Contributing Equipment Sequence

In order to preserve the fact that these Evidence Objects have been imported into the Enterprise, the Contributing Equipment Sequence shall be used (See Table 4.61.4.1.2-2). This will allow the local Institution to make decisions based upon the fact that a set of Evidence Objects has been imported (e.g. Schedule an over-read based upon an import, delete the imported Evidence Objects after a prescribed amount of time). The behavior of how Imported Evidence Objects are used and maintained is out of scope of the Technical Framework.

Table 4.61.4.1.2-2: Contributing Equipment Sequence

Attribute Name	Tag	Type	Attribute Description
Contributing Equipment Sequence	(0018,A001)	R+	See Notes 1,2
>Purpose of Reference Code Sequence	(0040,A170)	R	See Table 4.61.4.1.2-3
>>Include 'Code Sequence Macro' Table 8.8-1			Defined Context ID 7005.
>Manufacturer	(0008,0070)	R	
>Institution Name	(0008,0080)	R+	
>Station Name	(0008,1010)	R+	
>Contribution DateTime	(0018,A002)	R+	

Note 1: For imported objects, a new item shall be added to the Contributing Equipment Sequence every time a DICOM Object is imported. Each item in the Contributing Equipment Sequence describes a particular piece of importing equipment. The Equipment Module attributes describe the original creator of the instances.

Note 2: For digitized hardcopy, the Contributing Equipment Sequence shall contain a single item describing the original acquisition equipment. Since the digitizer is the equipment creating the original DICOM instance, the Equipment Module attributes describe the hardcopy digitizer.

The following table should be used to provide describe the equipment that has done the import. This information may be used by an Institution at a later time to take actions specific to data imported into the Enterprise.

Table 4.61.4.1.2-3: Context ID 7005 – Contributing Equipment

Most Restrictive Use: Defined

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	MEDIM	Portable Media Importer Equipment
DCM	FILMD	Film Digitizer Equipment
DCM	DOCD	Document Digitizer Equipment
DCM	VIDD	Video Tape Digitizer Equipment

4.61.4.1.3 Expected Actions

The Image Archive will store the received DICOM objects.

The DICOM Images, Evidence Documents and Diagnostic Reports shall be stored such that they can be later retrieved (See RAD TF- 2:4.16, RAD TF-2:4.17, RAD TF-2:4.27 and RAD TF-2:4.3) in a fashion meeting the requirements defined for a DICOM Level 2 Storage SCP (Refer to DICOM PS 3.4 B.4.1).

4.61.4.1.3.1 DICOM Storage SOP Classes

The DICOM Standard defines a number of image specific storage SOP classes, as well as other DICOM SOP Classes for DICOM SR, encapsulated pdfs, etc. All standard attributes and private elements shall be stored.

It is expected that the product's DICOM Conformance Statement will state which DICOM Storage SOP Classes it claims to support. Non-supported SOP Classes shall be rejected by the Image Manager/ Image Archive in the C-Store association. How the Institution deals with situations where DICOM Objects from the Importer cannot be stored is out of scope of the Technical Framework.

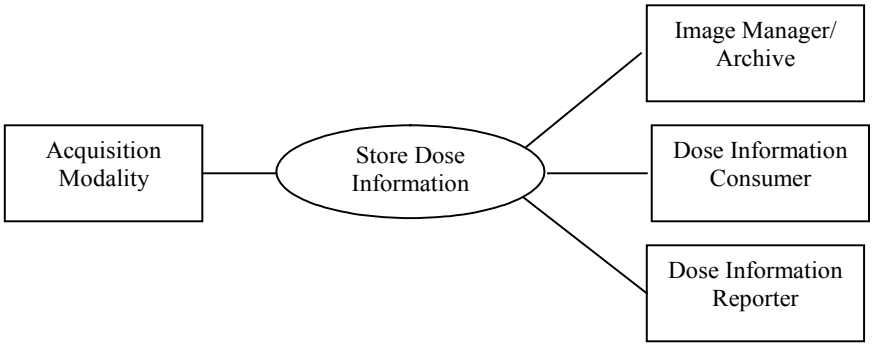
4.62 Store Dose Information

This section corresponds to Transaction RAD-62 of the IHE Technical Framework. Transaction RAD-62 is used by the Acquisition Modality, Image Manager/Archive, Dose Information Reporter and Dose Information Consumer actors.

4.62.1 Scope

This section describes DICOM Storage requests of Structured Report objects containing Dose objects which detail irradiation events. An Acquisition Modality sends Dose objects to an Image Manager/Archive for storage so they can be later used for monitoring or analysis of patient radiation exposure.

4.62.2 Use Case Roles



Actor: Acquisition Modality

Role: Generate Dose objects describing irradiation events performed by the Acquisition Modality and store them to one or more receiving actors.

Actor: Image Manager/Archive

Role: Accept and Store Dose objects received from the Acquisition Modality.

Actor: Dose Information Consumer

Role: Accept and process Dose objects received from the Acquisition Modality.

Actor: Dose Information Reporter

Role: Accept and process Dose objects received from the Acquisition Modality.

4.62.3 Referenced Standard

DICOM 2011 PS 3.3: A.35.8 X-Ray Radiation Dose SR IOD

DICOM 2011 PS 3.4: Storage Service Class

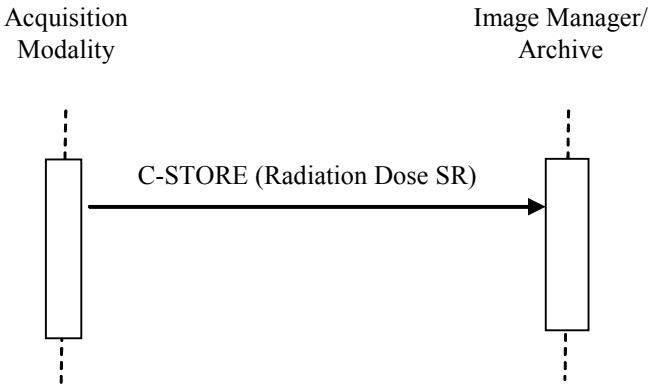
DICOM 2011 PS 3.4: Structured Reporting Storage SOP Classes

DICOM 2011 PS 3.16: X-Ray Radiation Dose SR IOD Templates

DICOM 2011 PS 3.16: CT Radiation Dose SR IOD Templates

DICOM 2011 PS 3.17: Annex AA: Radiation Dose Reporting Use Cases

4.62.4 Interaction Diagram



Note: In the above diagram, the Dose Information Consumer and the Dose Information Reporter may also receive the C-STORE message.

4.62.4.1 Store Dose Information

The Acquisition Modality actor shall implement the X-ray Radiation Dose SR Storage SOP Class in the role of SCU. The Image Manager/Archive actor, Dose Information Reporter actor and Dose Information Consumer actor shall implement the Dose Storage SOP Class in the role of SCP.

Table 4.62-1: Dose Storage SOP Classes

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.88.67	X-Ray Radiation Dose SR

4.62.4.1.1 Trigger Events

An irradiation event is a single continuous exposure of radiation. For a more precise definition including details relating to pulsed acquisition, dose modulation, dual source systems, etc. refer to DICOM 2011 PS 3.16.

An Acquisition Modality shall record the relevant details for each irradiation event. These details will be included in Dose objects as described below.

Upon completion or discontinuation of a procedure step where irradiation events occurred, the Acquisition Modality shall compose an appropriate Dose Object containing all the irradiation events for the procedure step and send the Dose object to the configured destinations.

Note: The Dose Object is a DICOM Instance created in the context of the procedure step, and thus is expected to appear in the list of instances in the corresponding MPPS.

In addition to composing Dose objects upon completion or discontinuation of a procedure step, the Acquisition Modality may also compose and send a Dose object upon completion of an irradiation event. If such behavior is supported, the actor shall provide a configuration method to disable it. Such objects could enable applications like dose mapping by a workstation during a procedure. The irradiation events will duplicate events reported in the Dose object for the procedure step, but this can be detected by receiving systems since the same irradiation event UID will appear in both Dose objects.

In addition to composing Dose objects upon completion or discontinuation of a procedure step, the Acquisition Modality may also compose and send a Dose Object summarizing an entire study or series. Such objects might be preferred by systems wanting a summary of several procedure steps. If such behavior is supported, the actor shall provide a configuration method to disable it. The irradiation events will duplicate events reported in the Dose object for the procedure step, but this can be detected by receiving systems since the same irradiation event UID will appear in both Dose objects. If the Acquisition Modality does compose such additional Dose objects, it is appropriate to record the prior reports in the Predecessor Documents Sequence (0040,A360).

The Acquisition Modality shall clearly document in its DICOM Conformance Statement its capabilities for grouping irradiation events into Dose objects.

4.62.4.1.1.1 Digitization

In the case of a system digitizing a film produced locally for which a Dose object has not been generated, it would be appropriate to create and store a Dose object along with the digital images. The digitizing system might create the report based on manual entry. An adjacent system might create the report based on information in the generated images and/or the MPPS from the film-based modality.

Digitizing films for external priors shall be handled differently. The location where the prior was originally created is responsible for recording the original dose. The digitizing system shall be configurable/controllable to digitize external films and not produce a Dose object.

4.62.4.1.2 Message Semantics

The Acquisition Modality actor shall use the DICOM C-STORE message to send Dose objects encoded as DICOM SR objects. These objects serve as a record of irradiation performed by the device.

The Acquisition Modality shall be capable of sending the Dose object to multiple destinations. The primary storage destination is generally an Image Manager/Archive, however Dose Information Reporters or Dose Information Consumers may also appear as configured destinations when they need to receive timely Dose objects without having to repeatedly poll the Image Manager/Archive.

The Acquisition Modality is responsible for delivery of Dose objects to the destination in spite of intermittent connections (e.g., due to mobile modalities, network trouble, or the destination being down).

The contents of the X-Ray Radiation Dose SR objects are generally based on Baseline Template TID 10001 "Projection X-ray Radiation Dose" or Baseline Template TID 10011 "CT Radiation Dose", but it should be noted that those templates are extensible, and the use of additional templates is not prohibited.

Note: DICOM has extended these templates (and the templates they contain) several times since they were originally introduced and further enhancements are possible. Implementers are reminded that they are responsible for monitoring such changes and keeping their implementations current.

Acquisition Modality actors which report on irradiation events for Modalities of type CT shall be capable of producing an SR compliant with TID 10011.

Acquisition Modality actors which report on irradiation events for Modalities of type XR, XA, RF, MG, CR, or DX shall be capable of producing an SR compliant with TID 10001.

The Irradiation Event UID in the template allows receiving systems to recognize duplicate events. For example, the same dose event might appear in both an SR summarizing a procedure and an SR summarizing the whole study.

The following attributes are Type 2 and Type 3. Although not required, Acquisition Modalities which do not fill them in will make their Dose objects more difficult to process and analyze. If present with a value in the Dose object, these attributes shall be populated as described in Table 4.62-2:

Table 4.62-2: Dose Context Attributes

Attribute Name	Tag	Requirement
Series Description	(0008,103E)	Shall have a value in the appropriate language for local use that means the equivalent of “Radiation Dose Information”, or similar.

Attribute Name	Tag	Requirement
Referenced Performed Procedure Step Sequence	(0008,1111)	Shall list the SOP Class UID and Instance UID of the image acquisition PPS. Typically, only a single PPS is associated with a Dose object. Since DICOM only permits a single value in this sequence, in the case where a Dose object summarizes several PPS (e.g., of a whole multi-step study), this attribute shall be left empty.
Performed Procedure Code Sequence	(0040,A372)	Shall contain the codes for the acquisition procedures performed by the modality (i.e., not a code for "Create Dose Report"). Creation of the Dose object is to be considered part of the imaging procedure, not a separate procedure in itself.
Requested Procedure Description	(0032,1060)	Shall be copied from the relevant acquisition SPS (Modality Worklist entry)
Admitting Diagnoses Description	(0008,1080)	Shall be copied from the relevant acquisition SPS (Modality Worklist entry). This can facilitate checking compliance to indication-based dose policies.
Admitting Diagnoses Code Sequence	(0008,1084)	
Reason for the Requested Procedure	(0040,1002)	
Reason for Requested Procedure Code Sequence	(0040,100A)	
Patient's Weight	(0010,1030)	Shall be copied from the relevant acquisition SPS (Modality Worklist entry), if present, else obtained by operator entry and may be approximate. This may facilitate future dose estimation and analysis.
Patient's Size	(0010,1020)	I.e., height. Shall be copied from the relevant acquisition SPS (Modality Worklist entry), if present, else obtained by operator entry, and may be approximate. This may facilitate future dose estimation and analysis.
Patient's Age	(0010,1010)	Shall be filled from any valid source (e.g., computed from Patient's Birthdate and Study Date, copied from the relevant acquisition SPS (Modality Worklist entry), if present, else obtained by operator entry) and may be approximate. This may facilitate future dose estimation and analysis.
Patient's Sex	(0010,0040)	Shall be copied from the relevant acquisition SPS (Modality Worklist entry), if present, else obtained by operator entry.

In the event of a Group Case acquisition (see RAD TF-2: 4.6.4.1.2.3) a Dose object shall be generated, reflecting the single acquisition procedure step performed, and should take its attribute values from that image set. The procedure type would reflect the combined acquisition. Allocating subsets of the dose to the pseudo-sub-procedures of the group is not required. If the modality chooses to replicate the dose object under each component accession of the group case it shall set the Identical Documents Sequence appropriately. In either case the DIR can recognize the duplication based on the Irradiation Event UIDs.

If the Dose object is not being created by the equipment which actually administered the radiation, the equipment creating the report shall reference itself in the Contributing Equipment Sequence (0018,A001) and reference the irradiating equipment in the four Type 1 attributes in the Enhanced General Equipment Module (DICOM 2011 PS 3.3: C.7.5.3).

The Acquisition Modality shall be capable of creating Dose objects for patient scans and for phantom/calibration scans.

4.62.4.1.2.1 Cross-referencing Dose Objects and Image Objects

See RAD TF-2: 4.8.4.1.2.4, which requires Acquisition Modalities to record the Irradiation Event UID (0008,3010) in related image instances.

The Projection X-Ray Dose Template (TID 10003) mandates that UID references be recorded in the Acquired Image element for image instances created from the irradiation event. The CT Dose Template does not include references to images since the instances sent to the Image Manager/Archive are typically generated some time after the irradiation is complete.

Note that it is possible for a study to have dose objects but no image objects. For example, due to poor quality images not being stored, or fluoroscopy images not being captured.

4.62.4.1.3 Expected Actions

The Image Manager/Archive shall support Level 2 (Full) storage, which means all DICOM Type 1, 2 and 3 attributes (public and private) are stored. It shall accept the Dose objects, store them, and make them available for query/retrieval.

The Dose Information Reporter and Dose Information Consumer shall accept the Dose objects. The Dose objects shall be processed according to the features, configuration, and business logic of the Dose Information Reporter or Dose Information Consumer product. Possibilities include display, processing, analysis, printing, export, etc. At a minimum, the Dose Information Reporter shall provide the capability to the review and do summary analysis of the dose data.

Dose Information Reporter actors shall be capable of processing both TID 10001 and TID 10011.

When multiple Dose objects are received, the same Irradiation Event (as identified by its Irradiation Event UID) may be referenced in multiple Dose objects. It is the responsibility of the recipient to recognize such duplicate Irradiation Events when processing or generating reports based on the retrieved data.

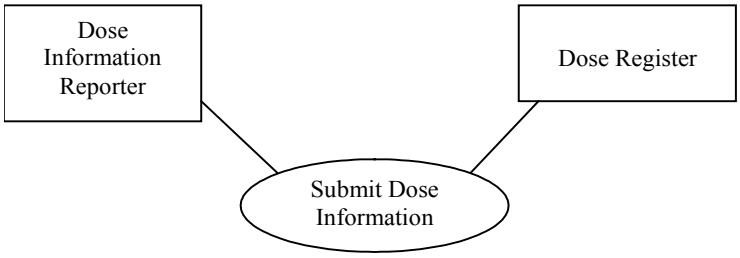
4.63 Submit Dose Information

This section corresponds to Transaction RAD-63 of the IHE Technical Framework. Transaction RAD-63 is used by the Dose Information Reporter and Dose Registry actors.

4.63.1 Scope

This section describes secure FTP transfers of DICOM Structured Report objects which detail irradiation events. A Dose Information Reporter sends Dose objects to a Dose Registry for subsequent compilation, monitoring and analysis of population and individual radiation exposure and current practices. Dose objects will often be de-identified prior to submission for the population use case.

4.63.2 Use Case Roles



Actor: Dose Information Reporter

Role: Submit (de-identified) Dose objects describing irradiation events performed by Acquisition Modalities in its facility.

Actor: Dose Registry

Role: Accept and store Dose objects received from Dose Information Reporters.

4.63.3 Referenced Standard

DICOM 2011 PS 3.3: A.35.8 X-Ray Radiation Dose SR IOD

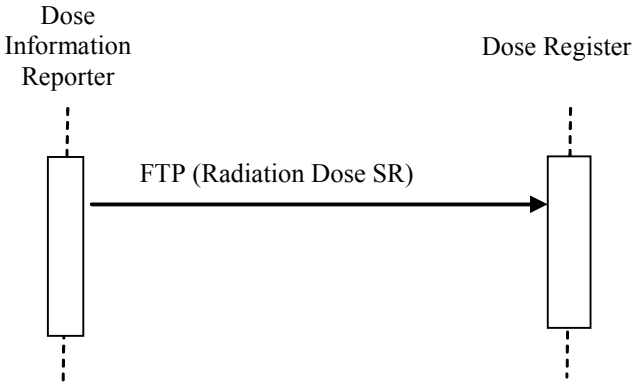
DICOM 2011 PS 3.10: Media Storage and File Format

DICOM 2011 PS 3.16: X-Ray Radiation Dose SR IOD Templates

DICOM 2011 PS 3.16: CT Radiation Dose SR IOD Templates

IETF RFC-4217 Securing FTP with TLS

4.63.4 Interaction Diagram



4.63.4.1 Submit Dose Information

4.63.4.1.1 Trigger Events

A Dose Information Reporter shall be capable of periodically submitting Dose objects accumulated since the last submission.

The Dose Information Reporter shall support submitting at a configurable interval, or upon a manual trigger, or both.

Local site policy and preferences will dictate whether periodic submissions take place, at what frequency, whether the Dose objects are first de-identified, and which Dose objects are submitted (e.g., the site might submit a random sample, or just reports for certain types of procedures, etc.)

4.63.4.1.2 Message Semantics

Except for de-identification, the Dose objects submitted by the Dose Information Reporter will generally be copies of reports received via the Store Dose Information or Retrieve Dose Information transactions.

The Dose Information Reporter shall ensure that the attributes described in RAD-62 in Table 4.62-2 Dose Context Attributes are populated (i.e., not empty and not zero or some other dummy value), even if this requires a quality control step with additional manual data entry by an operator.

It may also be desirable to send the localizer images to the registry, since size estimates can be produced from these by image processing or manual measurement. An individual registry might require this, so a Dose Information Reporter may have the capability to obtain and include images with a Modality of CT and an Image Type (0008,0008) value 3 of LOCALIZER (for either non-enhanced and enhanced SOP classes).

The Dose Information Reporter shall initiate a (Secure) FTP (File Transfer Protocol) session as a client as specified by IETF RFC-4217 “Securing FTP with TLS”.

When initiating the FTP session, the Dose Information Reporter:

1. Shall use the "firewall-friendly" connection method
2. Shall negotiate TLS first, before any other FTP commands
3. Shall require a protection level of "Private" (i.e., the connection shall fail if a level of “Private” is not successfully negotiated)
4. Shall support AES, although it is acceptable for an alternative encryption to be dynamically negotiated as part of TLS.
5. Shall support and accept certificate authentication. User authentication shall not be required.
6. Shall support X.509 based certificates.
7. Shall disconnect when TLS fails.

Note: Certificate Management by the Dose Information Reporter and the Dose Registry is outside the scope of the REM Profile. Dose Registries may find it convenient to make their public certificate available on their web server. Hospitals with Dose Information Reporters might have their public certificate available in a file they could email to the Dose Registry administrator when joining such a project. A detailed discussion of certificate management can be found in the "Management of Machine Authentication Certificates" Whitepaper developed by the NEMA Security and Privacy Committee, available on the NEMA Websiteathttp://www.medicalimaging.org/wp-content/uploads/2011/02/CertificateManagement-2007-05-Published.pdf

The Dose Registry shall be capable of accepting a secure FTP session as documented above.

The Dose Registry may require the Dose Information Reporter to identify itself (for audit purposes) by providing a descriptive string either in the USER login (with no password) or in the PASS of an anonymous USER login. The Dose Information Reporter shall support configuring such details.

The Dose Information Reporter shall use the FTP session to submit Dose objects encoded in DICOM SR and formatted as DICOM Part 10 media files with a Transfer Syntax of Explicit VR Little Endian.

The Dose objects may be transferred as either:

- individual files, or
- composed into Zip File Media as described in DICOM 2011 PS 3.12 Annex V.

DICOM Zip File Media requires a valid DICOMDIR be present.

The Dose Information Reporter shall be capable of sending the Dose objects to multiple configured destinations.

The Dose Information Reporter is responsible for delivery of Dose objects in spite of intermittent connections (network trouble, or the destination system being down).

4.63.4.1.2.1 De-identification

The Dose Information Reporter shall be capable of de-identifying Dose objects before submitting them.

There is considerable variation in what attributes need to be removed to achieve sufficient de-identification for any particular purpose. See the discussion in RAD TF-3: Appendix I and DICOM 2011 PS 3.15 Annex E.

Accordingly, this transaction does not require the removal of all text attribute values, nor the removal of all private attribute values.

The Dose Information Reporter may provide a mechanism to allow the user to configure those attributes that will be removed or replaced. At minimum the Dose Information Reporter shall support the ability to configure removal and replacement of all those attributes listed in the Basic Application Level Confidentiality Profile in DICOM 2011 PS 3.15. It shall be configurable to use:

- the Retain Longitudinal Option
- Retain Patient Characteristics Option
- Retain Device Information Option

- Retain UIDs Option

This configurability is particularly important since details such as patient sex, approximate age and weight, anatomy imaged and type of procedure are typically part of population dose analysis and such analysis would be severely limited without the ability to leave such information in submitted data. If the value in the Patient Birth Date (0010,0030) is removed from a Dose object during de-identification, then the Patient Age (0010,1010) attribute shall be included with an appropriate value.

When de-identification has been performed, the Dose Information Reporter shall add to the DICOM dataset of each instance the Patient Identity Removed (0012,0062) attribute with a value of YES, and add a value for De-identification Method (0012,0063) or De-identification Method Code Sequence (0012,0064).

The Dose Information Reporter shall be configurable to perform no de-identification at all.

In some scenarios, it may be appropriate to perform no de-identification, such as when the Dose Registry is doing a longitudinal study for specific patients (and necessary consents and/or privacy agreements have been taken care of). In such cases, if the Patient Identity Removed (0012,0062) attribute is present in the dataset it shall not be changed before submitting the dataset; if the attribute is absent it shall be added with a value of NO.

The Dose Information Reporter shall be capable of different de-identification configuration settings for each submission destination.

In some de-identification scenarios, the UIDs might need to be replaced. This transaction does not require that the Dose Information Reporter have the ability to replace UIDs, but if UIDs are replaced, internal consistency within the exported set of instances and across multiple exports over time shall be maintained. This entails adherence to the following rules:

- The same replacement UID is used for all composite instances of the same entity within the set, e.g., if the Study Instance UID is replaced, it is replaced with the same value in all dose objects within the same original study.
- References by UID to other instances or entities within the set are updated, e.g., references to the SOP Instance UIDs of predecessor documents, reference images and source images.
- References by UID to other instances or entities not included within the set are removed or replaced with consistent, well-formed, dummy references.

If the same instances are exported multiple times on different occasions, the identifying attributes and UIDs therein shall be replaced with the same values on each occasion. That is, this transaction requires deterministic behavior for replacement of identifying attributes and UIDs. This assures that the receiving Dose Registry can detect duplicate submissions and not accumulate the same dose multiple times. The safest way to assure detection of duplicate submissions from a single or multiple sites is not to replace the UIDs in the first place, but local regulations or policy may not permit this.

The Dose Information Reporter performing de-identification shall not create invalid IODs. Specifically:

- Mandatory and conditional attributes may not be removed, but rather must be replaced.

- Type 1 attributes must be given a value.
- Type 2 attributes may be encoded zero length, but it is often advisable to encode a value, especially for attributes likely to be used in browsers such as Patient Name, Patient ID, Study ID and Accession Number.
- UIDs shall have valid roots and be genuinely globally unique.

The Dose Information Reporter is not required to be able to pseudonymize Dose objects. For a description of pseudonymization, see RAD TF-3: 4.51.4.1.4.

4.63.4.1.3 Expected Actions

The Dose Registry shall accept the received Dose objects. What it does with the Dose objects will depend on the features, configuration, and business logic of the product. Some details of several Dose Registry projects are discussed in RAD TF-1: Appendix I – Deployment of Dose Registries.

Although the Dose Information Reporter may keep track of which Dose objects have been previously submitted to avoid duplicates or missing objects, the Dose Registry cannot depend on every object being sent, and should also be prepared to check for duplicates (by checking the Irradiation Event UIDs, though these may have been affected by de-identification during the current and previous submission, particularly if the same information is received multiple times from different Dose Information Reporters).

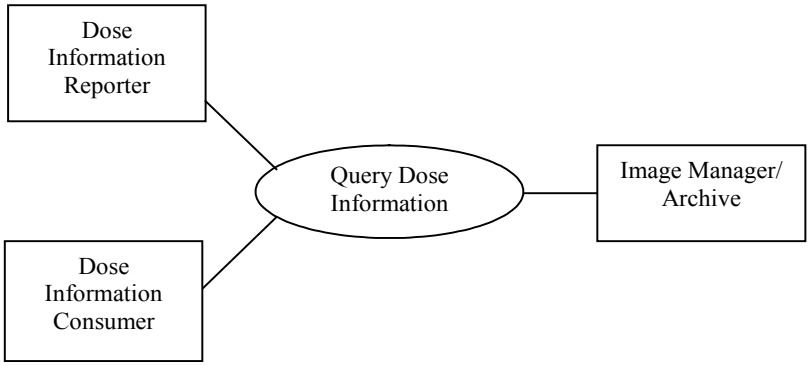
4.64 Query Dose Information

This section corresponds to Transaction RAD-64 of the IHE Technical Framework. Transaction RAD-64 is used by the Dose Information Reporter, Dose Information Consumer and Image Manager/Archive actors.

4.64.1 Scope

A Dose Information Reporter or Dose Information Consumer requests and receives from the Image Manager/Archive a list of instance metadata describing Dose objects matching a specified filter.

4.64.2 Use Case Roles



Actor**:** Dose Information Reporter

Role: Query for a list of Dose objects (generally in order to retrieve them).

Actor: Dose Information Consumer

Role: Query for a list of Dose objects (generally in order to retrieve them).

Actor: Image Manager/Archive

Role: Respond to queries from Dose Information Reporters and Dose Information Consumers for Dose objects matching the specified filter.

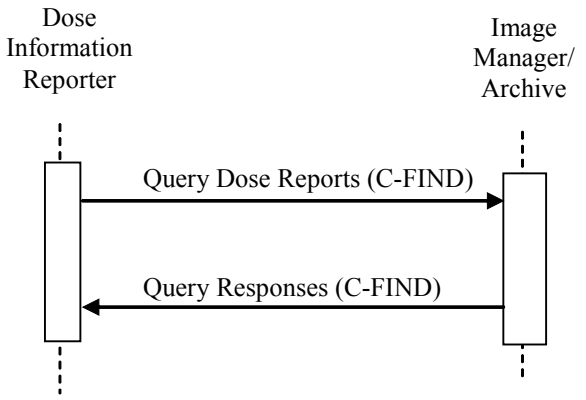
4.64.3 Referenced Standard

DICOM 2011 PS 3.4: Query/Retrieve Service Class

DICOM 2011 PS 3.4: Structured Reporting Storage SOP Classes

DICOM 2011 PS 3.3: A.35.8 X-Ray Radiation Dose SR IOD

4.64.4 Interaction Diagram



Note: In the above diagram, the Dose Information Consumer may also receive and respond to the C-FIND message.

4.64.4.1 Query Dose Information

The Query (Study Root – FIND and optionally Patient Root – FIND) SOP Classes shall be supported. Refer to DICOM 2011 PS 3.4: Query/Retrieve Service Class for detailed descriptive semantics.

4.64.4.1.1 Trigger Events

The Dose Information Reporter needs to obtain information about Dose objects.

Often this will be triggered by the Dose Information Reporter preparing to produce reports, preparing to perform analyses or preparing to submit data to a dose registry based on local policies. Examples of such triggers might include generating a daily report of procedures exceeding Diagnostic Reference Levels for certain procedure types, producing a summary of dose to a particular patient over the past year, or submitting reports for all procedures performed in the past week to a national dose registry.

The Dose Information Consumer needs to obtain information about Dose objects.

Often this will be triggered by the Dose Information Consumer preparing to display or further process the contents of one or more Dose objects. Examples of such triggers might include processing the contents of a dose object together with the generated images in order to produce a dose map. Refer to the Use Cases in RAD TF-1: 22.3 Radiation Exposure Monitoring Process Flow for more details.

4.64.4.1.2 Message Semantics

The message semantics are defined by the DICOM Query/Retrieve SOP Classes.

The Dose Information Reporter and Dose Information Consumer actors shall implement the Query/Retrieve SOP Classes in the role of SCU. The Image Manager/Archive actor shall implement the Query/Retrieve SOP Classes in the role of SCP.

A C-FIND Request from the DICOM Study Root Query/Retrieve Information Model – FIND SOP Class or the DICOM Patient Root Query/Retrieve Information Model – FIND SOP Class shall be sent from the Dose Information Reporter or Dose Information Consumer to the Image Manager/Archive.

The Dose Information Reporter or Dose Information Consumer uses one or more matching keys as filter criteria to obtain the list of matching entries in the Image Manager/Archive at the selected level (Patient & Study/Series/Instance).

In addition to the required and unique keys defined by the DICOM Standard, the Dose Report Query SCU and SCP shall support the matching and return keys defined for Study, and Series level queries as defined in RAD TF-2: 4.14.4.1.2 and Table 4.14-1.

The Dose Information Reporter (SCU), the Dose Information Consumer (SCU) and the Image Manager/Archive (SCP) shall also support the Dose Report Instance-specific keys defined in Table 4.64-1.

Table 4.64-1: Dose Report Instance Specific Query Matching and Return Keys

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Dose Report Instance Specific Level					
SOP Class UID	(0008,0016)	O	R+	O	R+
SOP Instance UID	(0008,0018)	O	R	O	R
Content Date	(0008,0023)	O	O	O	R+
Content Time	(0008,0033)	O	O	O	R+
Referenced Request Sequence	(0040,A370)				
>Study Instance UID	(0020,000D)	O	O	R+*	R+
>Accession Number	(0008,0050)	O	O	R+	R+
>Requested Procedure ID	(0040,1000)	O	O	R+	R+
>Requested Procedure Code Sequence	(0032,1064)				

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>>Code Value	(0008,0100)	O	O	O	R+
>>Coding Scheme Designator	(0008,0102)	O	O	O	R+
>>Coding Scheme Version	(0008,0103)	O	O	O	R+
>>Code Meaning	(0008,0104)	O	O	O	R+
Content Template Sequence	(0040,A504)				
>Template Identifier	(0040,DB00)	O	O	R+	R+
Concept Name Code Sequence	(0040,A043)				
>Code Value	(0008,0100)	O	O	R+*	R+
>Coding Scheme Designator	(0008,0102)	O	O	R+*	R+
>Coding Scheme Version	(0008,0103)	O	O	O	R+
>Code Meaning	(0008,0104)	O	O	R+	R+

The requirement conventions for key usage in the above table are defined in RAD TF-2: 2.2.

4.64.4.1.2.1 Filtering Strategies

Since it may not be immediately obvious how to perform certain dose object filtering based on the available matching keys, return keys and object content, some suggestions are provided here.

Filtering can occur at three points. Matching keys allow filtering on the server side; only instances that pass the filter have metadata returned. Return keys allow filtering on the client side; only instances whose metadata passes the filter are subsequently retrieved. Finally object attributes or content tree elements allow further client side filtering; only retrieved instances that pass the filter are processed further.

Client-side filtering of the object attributes and content is the most flexible, but to avoid retrieving an unnecessarily large number of objects, the use of matching and return keys is very helpful.

To filter for Dose objects:

- Matching key - SOP Class UID (0008,0016) allows selection of the X-ray Radiation Dose SR Storage SOP Class.

To filter for a specific date range:

- Matching key – Study Date (0008,0020) and/or Performed Procedure Step Start Date (0040,0244) allows selection of a particular date or range.

To filter for specific modalities:

- Matching key - Modalities in Study (0008,0061) allows selection of a desired modality (e.g., CT, XA, DR, DX, CR, MX)

  Note: Some studies might have multiple irradiating modalities so it will still be necessary to confirm the modality in the dose report. Note also that the series level Modality attribute will always be SR for dose reports.

- Return key - Template ID (0040,DB00) allows identification of either CT or Projection X-Ray dose reports. Future dose reports will also be identifiable by new Template ID

values, making this a potentially valuable attribute for the Archive to support as a matching key.

- Object Content Tree - Procedure Reported allows differentiation of Mammography from other types of projection x-ray

To filter for specific procedure types:

- Object Attribute - Performed Procedure Code Seq. (0040,A372) is Type 2, but if filled in the Dose object, will contain the acquisition procedures performed, allowing identification of the procedure. Since these are local codes and tend to change, systems will likely need to use a lookup table to map the variety of procedure/anatomy codes to a smaller set for performing analysis and reporting.
- Object Content Tree – Acquisition Protocol, if present, may also help identify the procedure type.

Note: Series Description (0008,103E) is a Type 3 attribute which, if present, in a Dose object will have a value of "Radiation Dose Information".

To filter for specific body regions:

- Object Content Tree – Target Region allows identification of body regions.

Note: Some implementations may provide a very specific region and the filter will want to generalize; other implementations may be unable to identify the exact region and will provide an overly generalized region instead.

- Object Content Tree – Anatomical Structure, if present, may also identify body regions in projection x-ray dose reports.

To filter for patient age category:

- Return key – Patient's Birth Date (0010,0030) allows identification of patients in an age range.
- Return key - Patient's Age (0010,1010) is a Type 3 attribute and an optional return key but may allow identification of some patients in an age range.

To filter for patient weight category:

- Return key - Patient's Weight (0010,1030) is a Type 3 attribute and an optional return key but may allow identification of some patients in a weight range.

To filter for patient sex:

- Return key – Patient's Sex (0010,1040) allows identification of patients sex (e.g., for monitoring policies relating to women of childbearing age).

4.64.4.1.3 Expected Actions

The Image Manager/Archive receives the C-FIND request, performs the matching on the provided keys and sends the list of matching records back to the Dose Information Reporter or Dose Information Consumer via C-FIND responses.

The Dose Information Reporter or Dose Information Consumer may use the value of certain return keys to identify specific Dose objects for subsequent retrieval. See 4.64.4.1.2.1 for details. Some details are only available by first retrieving and then parsing the dose objects.

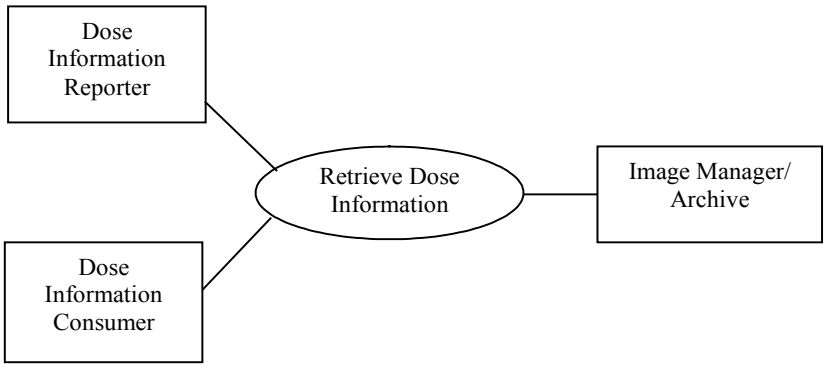
4.65 Retrieve Dose Information

This section corresponds to Transaction RAD-65 of the IHE Technical Framework. Transaction RAD-65 is used by the Dose Information Reporter, Dose Information Consumer and Image Manager/Archive actors.

4.65.1 Scope

A Dose Information Reporter or Dose Information Consumer requests and receives from the Image Manager/Archive specified instances of Dose objects.

4.65.2 Use Case Roles



Actor: Dose Information Reporter

Role: Request and receive specific Dose objects from the Image Manager/Archive.

Actor: Dose Information Consumer

Role: Request and receive specific Dose objects from the Image Manager/Archive.

Actor: Image Manager/Archive

Role: Provide specified Dose objects requested by Dose Information Reporters and Dose Information Consumers.

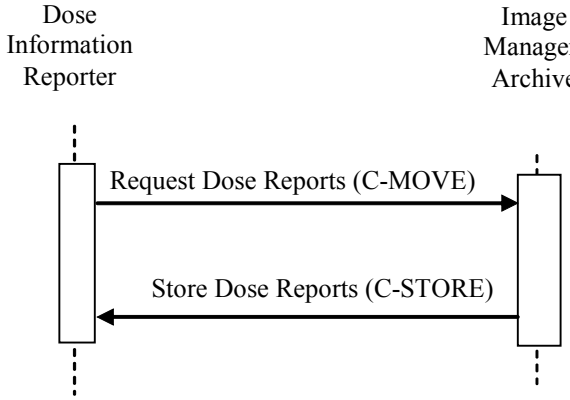
4.65.3 Referenced Standard

DICOM 2011 PS 3.4: Query/Retrieve Service Class

DICOM 2011 PS 3.4: Structured Reporting Storage SOP Classes

DICOM 2011 PS 3.3: A.35.8 X-Ray Radiation Dose SR IOD

4.65.4 Interaction Diagram



Note: In the above diagram, the Dose Information Consumer may also submit a C-MOVE request and receive a C-STORE message.

4.65.4.1 Retrieve Dose Information

The Retrieve (Study Root – MOVE and optionally Patient Root – MOVE) SOP Classes shall be supported. This requires that C-MOVE also be supported at the Series Level. Refer to the DICOM 2011 PS 3.4 Annex C for detailed descriptive semantics.

The Image Manager/Archive, Dose Information Reporter and Dose Information Consumer actors shall support the SOP Classes shown in Table 4.65-1 below.

Table 4.65-1: Dose Storage SOP Classes

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.88.67	X-Ray Radiation Dose SR

4.65.4.1.1 Trigger Events

The Dose Information Reporter or Dose Information Consumer decides it needs a specific Dose object.

4.65.4.1.2 Message Semantics

The message semantics are defined in the DICOM Query/Retrieve Service Class section of the DICOM 2011 PS 3.4: Query/Retrieve Service Class. The Dose Information Reporter or Dose Information Consumer is the DICOM C-Move SCU and DICOM Storage SCP and the Image Manager/Archive is the DICOM C-Move SCP and DICOM Storage SCU.

The contents of the X-Ray Radiation Dose SR objects are generally based on Baseline Template TID 10001 "Projection X-ray Radiation Dose" or Baseline Template TID 10011 "CT Radiation Dose" but it should be noted that those templates are extensible, and the use of additional templates is not prohibited.

It is the responsibility of the Image Manager/Archive to assure that the patient and procedure information is current in the Dose objects when they are retrieved from the Image Manager/Archive.

The Image Manager/Archive receives the C-MOVE request, establishes a DICOM association with the Dose Information Reporter or Dose Information Consumer, and uses the DICOM C-STORE command to transfer the requested Dose objects.

4.65.4.1.3 Expected Actions

The Dose Information Reporter and Dose Information Consumer shall accept the Dose objects. The Dose objects shall be processed according to the features, configuration, and business logic of the Dose Information Reporter or Dose Information Consumer product. Possibilities include display, processing, analysis, printing, export, etc.

Dose Information Reporter actors shall be capable of processing both TID 10001 and TID 10011.

The Dose Information Reporter or Dose Information Consumer shall not return an error to the Archive due to not recognizing the template used or the retrieved document content. The retrieved results may simply be discarded instead.

The same Irradiation Event (as identified by its Irradiation Event UID) may be referenced in multiple Dose objects. For example, the same dose event might appear in both an SR summarizing a procedure and an SR summarizing the whole study.

The Dose Information Reporter and Dose Information Consumer shall recognize duplicate Irradiation Events based on the Irradiation Event UIDs in the Dose object.

The Dose Information Reporter shall be capable of presenting some form of report to the user based on the retrieved dose information. The format, contents and analysis of such reports are not defined by the REM profile. Such details should be worked out as part of the product design.

4.68 Provide and Register Imaging Document Set – MTOM/XOP

This section corresponds to Transaction RAD-68 of the IHE Technical Framework. "Provide and Register Imaging Document Set – MTOM/XOP" is used by the Imaging Document Source to provide a set of XDS imaging documents to the Document Repository, and to request that the repository store these documents and then register them with the Document Registry. This transaction is derived from the Transaction ITI-41 of the IHE IT Infrastructure Technical Framework. It adds new document content types as well as additional semantics and constraints on the metadata defined in Transaction ITI-41.

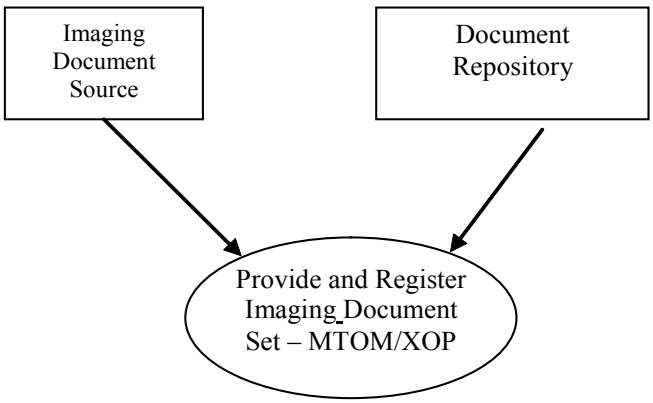
4.68.1 Scope

The Provide and Register Imaging Document Set – MTOM/XOP transaction passes a Repository Submission Request from an Imaging Document Source to a Document Repository.

A Provider and Register Document Set – MTOM/XOP transaction carries:

- Metadata describing zero or more new documents (e.g., metadata describing zero documents may be used to describe folders containing references to documents that were previously submitted)
- Within metadata, one XDSDocumentEntry object per document
- Submission Set definition along with the linkage to new documents and references to existing documents
- Zero or more XDS Folder definitions along with linkage to new or existing documents.
- Zero or more documents

4.68.2 Use Case Roles



Actor: Imaging Document Source

Role: Submits document(s) with associated metadata to a Document Repository.

Actor: Document Repository

Role: receives documents and associated metadata and:

- Stores the documents
- Augments submitted metadata with repository information to enable later retrieval of documents
- Forwards the enhanced metadata to the Document Registry.

4.68.3 Referenced Standards

For a list of the standards inherited from the underlying ITI-41 Provide and Register Document Set-b, see ITI TF-2b: 3.41.3.

In addition, the following standards are used to define the radiology-specific content:

DICOM 2011 PS 3.3: Key Object Selection Document (KOS)

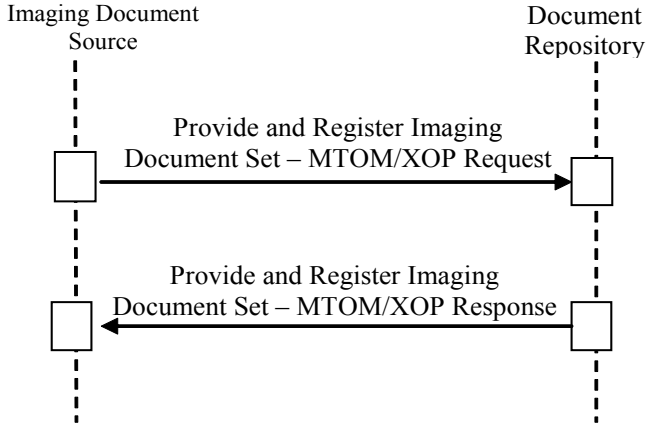
DICOM 2011 PS 3.16: Content Mapping Resource

DICOM 2011 PS 3.18: Web Access to DICOM Persistent Objects (WADO)

PDF/A ISO 19005-1. Document management - Electronic document file format for long-term preservation - Part 1: Use of PDF (PDF/A)

HL7 CDA Release 2.0 (denoted HL7 CDA R2, or just CDA, in subsequent text)

4.68.4 Interaction Diagram



4.68.4.1 Provide and Register Imaging Document Set – MTOM/XOP Request message

An Imaging Document Source Actor sends documents and associated metadata to a Document Repository Actor. This message is an extension of the Provide and Register Document Set-b transaction as defined in ITI TF-2b: 3.41.

4.68.4.1.1 Trigger Events

The triggers for this transaction are:

- The Imaging Document Source Actor is instructed to submit a set of one or more new imaging documents for sharing, or
- A previously submitted document or the contents of a previously submitted manifest changes, requiring the Imaging Document Source to submit an update.

4.68.4.1.2 Message Semantics

This transaction extends the message semantics of the ITI-41 Provide and Register Document Set-b by specifying additional document content types, to allow the sharing of the following types of documents:

1. Sets of DICOM SOP instances
2. Imaging diagnostic reports

To support these content types and their usage, additional requirements and constraints on the XDS document metadata are specified.

The Provide and Register Imaging Document Set – MTOM/XOP Request message semantics are specified in the following subsections:

1. Sharing of Persistent DICOM Instances via a Manifest document
2. Sharing of radiology diagnostic report in PDF or Text formats
3. XDS-I.b document metadata specification
4. Use of XDS Submission Set concept in sharing of radiology imaging information.

The wsdl definition for this Provide-and-Register transaction sent by the Imaging Document Source is no different than the Provide-and-Register transaction sent by the XDS.b Document Source in ITI-41. The wsdl definition for the Provide-and-Register transaction can be found on the IHE FTP server at:
ftp://ftp.ihe.net/TF_Implementation_Material/ITI/wsdl/XDS.b_DocumentRepository.wsdl

4.68.4.1.2.1 Sharing of Set of DICOM Instances

The Imaging Document Source creates a manifest that describes and collects references to DICOM SOP instances that are intended for sharing. The manifest, a Key Object Selection (KOS) Document Instance, is the actual document provided to the Document Repository and registered at the Document Registry.

As specified in IHE ITI XDS.b Integration Profile, the structure of the message between the Document Source and the Document Repository is an MTOM/ XOP formatted message. In this transaction, the source actor is the Imaging Document Source, but the above requirement still applies. The KOS Document Instance is encoded in the message as a DICOM Part 10 File format having a MIME type of "application/dicom".

The Imaging Document Source shall ensure that the DICOM SOP Instances referenced from within the manifest are available to be retrieved. If the Imaging Document Source makes one or more SOP Instances unavailable that are referenced in a published manifest, then it shall submit a new manifest as a replacement for the published manifest already in the Document Repository and Document Registry (IHE ITI TF-3:4.1.6). The new manifest shall have the updated list of DICOM SOP Instances with the unavailable instances removed. If the Imaging Document Source makes all referenced DICOM SOP Instances unavailable in a published manifest, then it shall deprecate the published manifest without any replacement (IHE ITI XDS Metadata Update Supplement).

4.68.4.1.2.1.1 Manifest KOS Document

The references to the DICOM SOP Instances shall be included in the Current Requested Procedure Evidence Sequence (0040,A375) attribute of the KOS Manifest Document.

The Imaging Document Source shall support a number of attributes in Current Requested Procedure Evidence Sequence (0040,A375), which are represented in the Hierarchical SOP Instance Reference Macro, as described in the following table:

Table 4.68.4.1.2.1-1: Attributes of Hierarchical SOP Instance Reference Macro in KOS Manifest Document

Attribute Name	Tag	Imaging Document Source
Study Instance UID	(0020,000D)	R
Referenced Series Sequence	(0008,1115)	R
> Series Instance UID	(0020,000E)	R
> Retrieve AE Title	(0008,0054)	R+
> Retrieve Location UID	(0040,E011)	R+
> Storage Media File-Set ID	(0088,0130)	O
> Storage Media File-Set UID	(0088,0140)	O
> Referenced SOP Sequence	(0008,1199)	R
>> Referenced SOP Class UID	(0008,1150)	R
>> Referenced SOP Instance UID	(0008,1155)	R

Some of these requirements build on attributes which are Type 2 or Type 3 in DICOM (such attributes are indicated with R+). Specifically, the Imaging Document Source shall include its own identification in the Retrieve AE Title (0008,0054) and Retrieve Location UID (0040,E011) attributes. These attributes will enable subsequent retrieval of the DICOM objects referenced within the KOS manifest.

4.68.4.1.2.2 Sharing of Report

Since text reports address many of the weaknesses of PDF reports and vice versa, it is required that the Imaging Document Source shall support shared reports in at least one of the following two different formats:

- CDA wrapped Text, or
- PDF

To maximize interoperability of the chosen formats, the following restrictions shall be required:

- For PDF documents:
  - We are not requiring a particular PDF version but we recommend the use of the PDF/A (ISO 19005-1)
- For CDA wrapped Text Documents:
  - Text shall be encoded with UTF-8 UNICODE format. Refer to section 4.68.4.1.2.3.5 for constraints on the CDA wrapper. To the extent possible, the specification for the CDA wrapper for the report text has been made consistent with the CDA metadata specified in the ITI XDS Scanned Documents (XDS-SD) Profile (see also ITI TF-3: 5.2.2 and 5.2.3).

A report (no matter what document format is chosen) can be shared with or without image reference(s).

If a shared report includes image reference(s), it can embed selected images in its PDF format or it can include fully resolved hyperlinks that point to the selected images; these hyperlinks can be interactively clickable (e.g., PDF) or can be processed or copied (e.g., text).

The Imaging Document Source that provides and registers the shared report is responsible for formatting the hyperlink to reference relevant images. The referenced images within a shared imaging report are meant to be accessed without the need for specialized (e.g., DICOM) viewing applications.

The hyperlink that references the selected image shall be formatted as a DICOM WADO URI. Since the sharing environment is inherently cross-enterprise, the secured version of HTTP (i.e., HTTPs) shall be used when formatting the hyperlink.

The Imaging Document Source is required to ensure that image references are valid links.

Even though significant images can be shared as non-DICOM format (embedded picture in PDF report or hyperlinks in PDF or Text report), it is required that sharing of a large set of DICOM images be achieved by sharing a set of DICOM SOP instances by providing and registering a manifest document. This is to avoid registration of a large number of individual documents in the XDS Document Registry.

4.68.4.1.2.3 Metadata

The Provide and Register Imaging Document Set – MTOM/XOP Request message shall include the metadata attributes that will be forwarded by the XDS Document Repository Actor to the XDS Registry Actor using the Register Document Set-b Transaction (ITI-42).

The Imaging Document Source supplies all necessary registry object attributes of an XDSDocumentEntry.

4.68.4.1.2.3.1 Metadata Attributes: Author Information and Document Creation Time

In XDS, a registered document directly contains the clinical information of interest for sharing. Therefore, its metadata for registration can be populated directly from the document content. For example, a discharge letter is submitted to the Document Repository, so its author and creation information is populated into the XDS Document metadata.

In XDS-I.b, the Manifest document submitted to the Document Repository usually does not directly constitute clinical information of interest for sharing, but rather is a set of references to such clinical information. Thus, the metadata of the Manifest document shall be related to the referenced source content or its creation process, to reflect the clinical nature of the shared information. This affects the metadata attributes including, but not limited to, authorSpecialty, authorInstitution, authorPerson, authorRole, creationTime, and title.

If the manifest references source data from multiple authors, then one primary author, source data creation time and document title shall be chosen. Note that this metadata shall be populated from the part of the source data that most closely represents the main content for sharing in order to best support a user query to the Registry for finding this data. For example, a manifest

referencing a current report, a current study as well as a prior report and study, will register metadata populated from the current report (which is the clinical content of interest for sharing).

In cases where the data to be shared is transformed from its original format (e.g., DICOM) to another format (e.g., PDF) in advance of sending it to the Repository, the metadata of such newly generated shared information shall be populated from the original source data (e.g., DICOM data)

In summary, XDS-I.b metadata always reflects the main clinical content of a shared document, which may be described directly in the document, or in the source data referenced within the document, or in the source data from which the document is transformed.

4.68.4.1.2.3.2 XDSDocumentEntry Metadata

Table 4.68.4.1.2.3-1 lists XDS document metadata elements that are either further constrained by XDS-I.b, or have XDS-I.b specific instructions for how the Imaging Document Source is expected to populate them. Unless otherwise specified, the "optionality" of the attributes listed in the table below is the same as what is required by XDS for the source actor.

For a full description of all the metadata attributes associated with an XDS document, see Table 4.1-5 in ITI TF-2b: 4.1.7.

Table 4.68.4.1.2.3-1: XDS-I.b-specific Metadata Requirements

XDSDocumentEntry Attribute	XDS-I.b-specific Requirements
creationTime	This attribute value shall be populated by the Imaging Document Source actor to record the date and time at which the clinical content conveyed in the shared document is created. If the published document is a DICOM object or is transformed from a DICOM information object, this attribute value should be taken from the tags Instance Creation Date (0008,0012) and Instance Creation Time (0008,0013) of the DICOM object.
eventCodeList	This attribute is required to be included in the metadata if known by the Imaging Document Source. In other words, it is "promoted" from an optional (O) attribute in XDS to a "required if known" (R2) attribute in XDS-I.b. This attribute shall be populated by the Imaging Document Source from code(s) in DCMR Context Group CID 29 for Acquisition Modality and from code(s) in DCMR Context Group CID 4 for Anatomic Region. See DICOM 2011 PS 3.16 for DICOM Context Group definitions. This attribute can contain multiple codes and there is not any specific ordering assumed in these codes.
eventCodeDisplayNameList	This attribute is required to be included in the metadata if the eventCodeList attribute is present. This attribute contains the Code Meaning text(s) of the code(s) for Acquisition Modality and for Anatomic Region valued in eventCodeList, from DCMR Context Group CID 29 and from DCMR Context Group CID 4, respectively. See DICOM 2011 PS 3.16 for DICOM Context Group definitions. Note that the ordering of the Code Meaning texts populated in this attribute shall be sorted in the same order of the corresponding codes in eventCodeList.
formatCode	This attribute shall be populated by the Imaging Document Source from one of the following values:

XDSDocumentEntry Attribute	XDS-I.b-specific Requirements
	"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. "urn:ihe:rad:TEXT" for a TEXT report wrapped into a CDA document "urn:ihe:rad:PDF" for a PDF report document
mimeType	This attribute shall be populated by the Imaging Document Source from one of the following values: "application/dicom" for a DICOM Manifest document "text/xml" for a TEXT report wrapped into a CDA document. "application/pdf" for a PDF report
practiceSettingCode	This attribute shall be populated by the Imaging Document Source by taking a fixed code defined by the XDS Affinity Domain to designate "Radiology"
serviceStartTime	This attribute shall be populated by the Imaging Document Source for a date and time that indicates the imaging service start time. As an example, the Imaging Document Source could take the value of Study Date (0008,0020) and Study Time (0008,0030) from the associated DICOM study
sourcePatientInfo	This attribute shall represent the Patient demographics information used in the Imaging Document Source actor system to identify the patient. This attribute allows multiple values for different pieces of patient demographics, see metadata specification of the IHE ITI XDS Integration Profile (Table 4.1-5 in ITI TF-3:4.1.7). As an example, this information can be transformed from DICOM Patient's Name (0010,0010), Patient's Birth Date (0010,0030), and Patient's Sex (0010,0040).
typeCode	This attribute shall be populated by the source actor from a coding system of the Requested Procedure Code of the Requested Procedure, to which the document is associated. In certain special cases previously defined in other IHE Profiles some sort of user intervention will be necessary to select the single Procedure Code used to populate this attribute. For example, handling the "Group Case" as defined in Scheduled Workflow will require the user to select a single, pre-coordinated procedure code that represents the multiple Requested Procedures that were acquired as a single study. The coding system of the Radiology Imaging Requested Procedure Code will be designated by the XDS Affinity Domain and shared by all Imaging Document Sources in the XDS Affinity Domain.
typeCodeDisplayName	This attribute shall be filled by the source actor using the code meaning text of the corresponding Requested Procedure Code valued in typeCode.
uniqueId	This attribute shall contain the Document unique ID generated by the source actor. It shall be an ISO OID. For a DICOM Manifest document, this attribute value shall be the same as the SOP Instance UID of the corresponding DICOM KOS object. In the event that **any** information in the manifest changes and it needs to be resubmitted from the Imaging Document Source to the Document Repository, the Imaging Document Source shall generate a new SOP Instance UID for the DICOM KOS object to ensure that its submission to the Repository will succeed. For a CDA wrapped text report, this value shall be formulated from the HL7 CDA R2 header as follows: ClinicalDocument/id@root.ClinicalDocument/id@extension

4.68.4.1.2.3.3 Transformation of DICOM VR to XDS Document Metadata Data Types

A number of XDS document metadata attributes use HL7 data types for value representation. Some of the metadata attributes may be transformed from data elements of the corresponding DICOM SOP Instance. In this section, transformations of DICOM VR (Value Representation) to the HL7 data types used in XDS metadata are described.

Note that term HL7 Data Type in the following transformations refers to their specified usage in XDS document metadata as defined in IHE ITI XDS Integration Profile.

4.68.4.1.2.3.3.1 CX – Extended Composite ID

Table 4.68.4.1.2.3-2 describes the transformation of data element of DICOM VR to CX data type as specified in IHE XDS Integration Profile:

Table 4.68.4.1.2.3-2: CX Data type mapping

CX Data Component	Component Name	DICOM VR	Comment
1	ID Number	LO	This attribute represent the value of Patient ID issued by an Assigning Authority as indicated in component 3. In DICOM, it is data element (0010,0020).
4.2	Assigning Authority – Universal ID		Assigning Authority information is not required in DICOM instance. The Imaging Document Source must use its local configuration to populate this subcomponent, to indicate the Patient ID Domain, from which the Patient ID value in component 1 has been issued. This must be an ISO OID
4.3	Assigning Authority – Universal ID Type		This must be "ISO"
5	Identifier Type		Patient ID Type information is not required in DICOM instance. The Imaging Document Source can use its local configuration to populate this component, to indicate the type of the Patient ID value in component 1.

HL7 CX data components not listed in the table are not used in XDS document metadata and shall be left empty.

4.68.4.1.2.3.3.2 DTM – Date / Time

HL7 DTM Data Type can be represented in the following regular expression:

YYYY[MM[DD[HH[MM[SS]]]]]

This can be transformed from DICOM elements of VR DA (format: YYYYMMDD) and TM (format: HHMMSS.fraction).

4.68.4.1.2.3.3.3 XCN – Extended Composite ID Number and Name for Person

Table 4.68.4.1.2.3-3 describes the transformation of DICOM VR to XCN data type as specified in IHE XDS Integration Profile:

Table 4.68.4.1.2.3-3: XCN Data type mapping

XCN Data Component	Component Name	DICOM Data Element	Comment
1	ID Number		This attribute component is not required in DICOM. The Imaging Document Source must use its local configuration or personnel directory service to populate this component.
2	Family Name	1st Component of PN	A data element of VR PN, like (0010,0010) for Patient Name
3	Given Name	2nd Component of PN	
4	Second or Further Given Names or Initials thereof	3rd Component of PN	
5	Suffix	5th Component of PN	
6	Prefix	4th Component of PN	
7	Degree		This attribute component is not included in DICOM.

HL7 XCN data components not listed in the table are not used in XDS document metadata and shall be left empty.

4.68.4.1.2.3.3.4 XON – Extended Composite Name and Identification Number for Organization

Table 4.68.4.1.2.3-4 describes the transformation of DICOM VR to XON data type as specified in IHE XDS Integration Profile:

Table 4.68.4.1.2.3-4: XON Data type mapping

XON Data Component	Component Name	DICOM Data Element	Comment
1	Organization Name	LO	A data element of VR LO, like (0008,0080) for institution name

HL7 XON data components not listed in the table are not used in XDS document metadata and shall be left empty.

4.68.4.1.2.3.4 XDS/XDS-I.b Metadata Values represented as HL7 v2.5 Data Types

XDS/ XDS-I.b Metadata that is represented as an HL7 v2.5 data type will require transformation from its corresponding HL7 CDA R2 header component. The following table (4.68.4.1.2.3-5) guides this transformation and indirectly imposes requirements on the configuration of and/or user interaction with implementations supporting this transaction. Additionally, this table further

restricts the HL7 CDA R2 specification. IDs in metadata that correspond to IDs in the CDA header (as II types) are required to have both a root and an extension attribute.

3550 **Table 4.68.4.1.2.3-5: HL7 v2.5 and CDA Data type mapping**

XDS/ XDS-I.b Metadata			HL7 CDA Header	
HL7 v2.5 Data Type	**Subcomponent index**	**Subcomponent name**	**HL7 CDA R2 Data element**	**HL7 CDA R2 Sub-element or attribute**
CX (SEE NOTE 1)			II	
	1	Id number	II	@extension
	4.1	AssigningAuthority. namespace	II	@assigningAuthorityName
	4.2	AssigningAuthority. uid	II	@root
DTM	1 (only)	Date/Time	TS or IVL_TS	@value (NOTE: format is compatible with DTM)
XCN			II and PN	
	1	Id number	II	@extension
	2.1	FamilyName.surnName	PN	Family
	3	Given Name	PN	Given
	4	Second (middle) Name	PN	Given
	5	Suffix	PN	Suffix
	6	Prefix	PN	Prefix
	9.1	AssigningAuthority. namespace	II	@assigningAuthorityName
	9.2	AssigningAuthority. uid	II	@root
XON			II and ON	
	1	Organization Name		
	3	Id number	II	@extension
	5.1	AssigningAuthority. namespace	II	@assigningAuthorityName
	5.2	AssigningAuthority. uid	II	@root

Note 1: XDS restricts the formatting of the CX datatype. See ITI TF-2x: Appendix E.

4.68.4.1.2.3.5 CDA Wrapper – Text Report [CDA] Option

This section outlines the content of the HL7 CDA R2 wrapper for the text content. We note here that requirements specified below are to ensure the presence of a minimum amount of wrapper data in order to enhance description and facilitate sharing of the document. It should be noted that the "nullFlavor" value expresses missing values in the CDA, e.g., it may be appropriate if such information cannot be derived from DICOM objects.

Implementers of the "Text Report [CDA]" Profile Option can and should make use of additional annotation within the CDA header to provide richer context. The examples in the following sections contain the minimal amount of wrapper data, as specified, and in many cases do make use of additional CDA header elements for enriched context.

To the extent possible, the specification for the CDA wrapper for the report text has been made consistent with the CDA metadata specified in the ITI XDS Scanned Documents (XDS-SD) Profile (see ITI TF-3: 5.2.3) and has be replicated here for the readers' convenience.

Elements and attributes that apply to the XDS-SD use case(s) but not to the use case of sharing an electronically transmitted radiology report have been omitted, where allowed by the CDA R2 specification. Descriptions for how to populate certain elements and attributes consistent with the "sharing a text-based radiology report" use case have been included.

4.68.4.1.2.3.5.1 Wrapper Format – HL7 CDA R2

The CDA metadata wrapper for plain text reports is the same as defined in the ITI XDS-SD Profile (see the metadata specification table in ITI TF-3: 5.2.3) with the exceptions described below and in the following subsections:

- The ClinicalDocument/dataEnterer element, as it is defined in XDS-SD, does not apply to the report sharing use case and thus may be omitted.

4.68.4.1.2.3.5.1.1 ClinicalDocument Child-less Elements

The requirements for the ClinicalDocument Child-less elements for CDA-wrapped plain text reports is the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.1), with the following exceptions/ clarifications:

- The ClinicalDocument/templateId element shall be 1.3.6.1.4.1.19376.1.2.21
- The ClinicalDocument/code element shall be set with the following attribute values:
  - code="11528-7"
  - codeSystem="2.16.840.1.113883.6.1"
  - codeSystemName="LOINC"
  - displayName="Radiology Report"/>
- The ClinicalDocument/effectiveTime shall denote the time at which the CDA text document was recorded. At a minimum, the time shall be precise to the day and shall include the time zone offset from GMT.

Example:

```
<ClinicalDocument xmlns="urn:hl7-org:v3">
  <typeId extension="POCD_HD000040" root="2.16.840.1.113883.1.3"/>
  <templateId root="1.3.6.1.4.1.19376.1.2.21">
  <id root="1.3.6.4.1.4.1.2835.2.7777"/>
  <code code="11528-7"  codeSystem="2.16.840.1.113883.6.1"
     codeSystemName="LOINC" displayName="Radiology Report"/>
  <title>Chest X-Ray</title>
  <effectiveTime value="20050329224411+0500"/>
  <confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25"/>
  <languageCode code="en-US"/>
```

4.68.4.1.2.3.5.1.2 ClinicalDocument/recordTarget

The requirements and example for the ClinicalDocument/recordTarget element for CDA-wrapped plain text reports is the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.2).

4.68.4.1.2.3.5.1.3 ClinicalDocument/author (original)

The requirements and example for the ClinicalDocument/author element (that represents the original author of the report) for CDA-wrapped plain text reports is the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.3).

4.68.4.1.2.3.5.1.4 ClinicalDocument/author (reporting system)

The requirements for the ClinicalDocument/author element (that represents the reporting system and software used to produce the report content) for CDA-wrapped plain text reports is the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.4), with the following exceptions/ clarifications:

- When reading the XDS-SD specification, references to scanned, scanning, scanned content etc. refer to reporting, report content etc. in this context.
- When reading the XDS-SD specification concerning the ClinicalDocument/author/assignedAuthor/assignedAuthoringDevice/code element references to CDA-wrapped PDF can be ignored since they do not apply to the radiology report sharing use case.

Example:


```
<author>
  <time value="20050329224411+0500"/>
  <assignedAuthor>
     <templateId root="1.3.6.1.4.1.19376.1.2.20.2"/>
    <id root="1.3.6.4.1.4.1.2835.2.1234"/>
    <assignedAuthoringDevice>
    <code code="WSD" displayName="Workstation" codeSystem="
    1.2.840.10008.2.16.4" />
       <manufacturerModelName>SOME REPORTING NAME AND MODEL
       </manufacturerModelName>
        <softwareName> REPORTING SOFTWARE NAME v0.0</softwareName>
    </assignedAuthoringDevice>
    <representedOrganization>
       <id root="1.3.6.4.1.4.1.2835.2"/>
       <name>SOME REPORTING Facility</name>
        <addr>
          <streetAddressLine>21 North Ave</streetAddressLine>
          <city>Burlington</city>
          <state>MA</state>
          <postalCode>01803</postalCode>
          <country>USA</country>
        </addr>
     </representedOrganization>
  </assignedAuthor>
</author>
```

4.68.4.1.2.3.5.1.5 ClinicalDocument/custodian

The requirements and example for the ClinicalDocument/custodian element for CDA-wrapped plain text reports are the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.6). Its context is left up to the reporting facility to define in accordance with local policies and to reflect the entity responsible for the report content. In most cases this will be the reporting facility.

4.68.4.1.2.3.5.1.6 ClinicalDocument/legalAuthenticator

The requirements and example for the ClinicalDocument/legalAuthenticator element for CDA-wrapped plain text reports are the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.7) and its context is left up to the reporting facility to define in accordance with local policies.

4.68.4.1.2.3.5.1.7 ClinicalDocument/documentationOf

The requirements and example for the ClinicalDocument/documentationOf element for CDA-wrapped plain text reports are the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.8).

4.68.4.1.2.3.5.1.8 ClinicalDocument/component/nonXMLBody

This ClinicalDocument/component/nonXMLBody element shall be present and used to wrap the text content. The requirements for the nonXMLBody are the same as defined in the ITI XDS-SD Profile (see ITI TF-3: 5.2.3.9), with the following exceptions/ clarifications:

- When reading the XDS-SD specification, references to scanned, scanning, scanned content etc. refer to reporting, report content etc. in this context.
- When reading the XDS-SD specification concerning the ClinicalDocument/component/nonXMLBody element, references to CDA-wrapped PDF can be ignored since they do not apply to the radiology report sharing use case.

Example (report text content is in the same language as the wrapper):

```
  <component>
    <nonXMLBody>
      <text mediaType="text/plain" representation="B64">
JVBERi0xLjMKJcfsj6IKNSAwIG9iago8PC9MZW5ndGggNiAwIFIvRmlsdGVyIC9GbGF
0ZURlY29kZT4+CnN0cmVhbQp4nGWPMWsDMQyFd/8KjfJwqmVbkr0GQqFbg7fQoSRNWu
hBQ/4/1L67TEEYme+9J1s3CMQQRm39NLuXg8H17gK89nN1N8eLAbZ2mmHXuql2QDVUh
nZxa5iBcyQtoMIUM7TZHbH5KZEVDgm//SSUswbFHx/JzBLeu5yYxOIzE8bPcRWqdaGD
mcZOBWc/9bfUNOPfOte44O9jxtcIKskqp0JZouJ5deYqeBn58ZmKtIU+2ptjqWQRJpG
yrHDuK7CXIe2be+/1DzXQP+RlbmRzdHJlYW0KZW5kb2JqCjYgMCBvYmoKMjAxCmVuZG
9iago0
    </text>
  </nonXMLBody>
</component>
</ClinicalDocument>
```

4.68.4.1.2.4 Use of XDS Submission Set

4.68.4.1.2.4.1 Linking Report to Set of DICOM Instances

Figure 4.68.4.1.2.4-1 shows examples of three Submission Sets:

- Submission Set 1 includes a report and a Manifest that are stored in the Document Repository. The manifest references DICOM instances that are archived in the IM/IA.
- Submission Set 2 includes one single manifest.
- Submission Set 3 includes a report and references the manifest from Submission Set 2 since it was generated by interpreting the images referenced by that manifest. Submission Set 3 also references the report and the manifest from Submission Set 1 since that report and images that are referenced by that manifest were used for the interpretation.

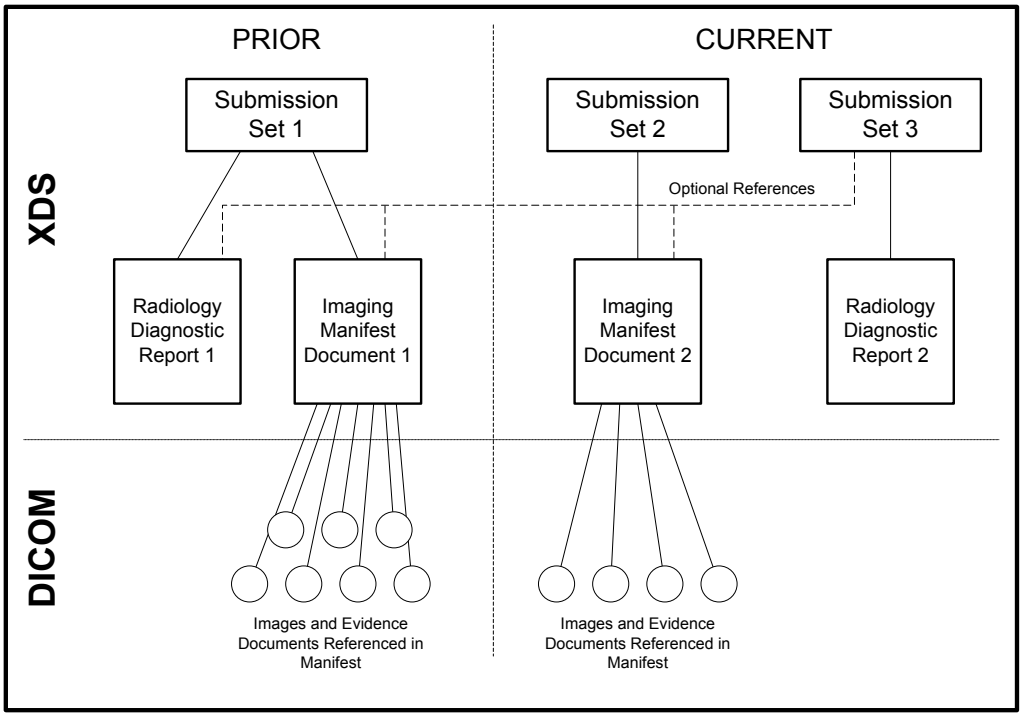


Figure 4.68.4.1.2.4-1: Imaging Information Sharing Submission Set

4.68.4.1.2.4.2 Linking Report to prior report

The Report Submission Set can reference the manifest for a set of prior images published if the prior images were used in creating the interpretation. Likewise the report submission set can reference a report from a previous submission.

4.68.4.1.3 Expected Actions

The Document Repository Actor will receive this message and will process it according to the requirements specified in ITI TF-2b: 3.41.4.1.3.

4.68.4.2 Provide and Register Imaging Document Set – MTOM/XOP Response message

The Document Repository sends a Provide and Register Imaging Document Set – MTOM/XOP Response message when the processing of a Provide and Register Imaging Document Set – MTOM/XOP Request message is complete. The specification of the trigger events, message semantics and expected actions are the same as those specified in ITI TF-2b: 3.41.4.2.

The conditions of failure and possible error messages are given in the ebRS standard. The Imaging Document Source shall handle all error messages detailed for the Provide and Register transaction in ITI TF-3: 4.1.13 “Error Reporting”.

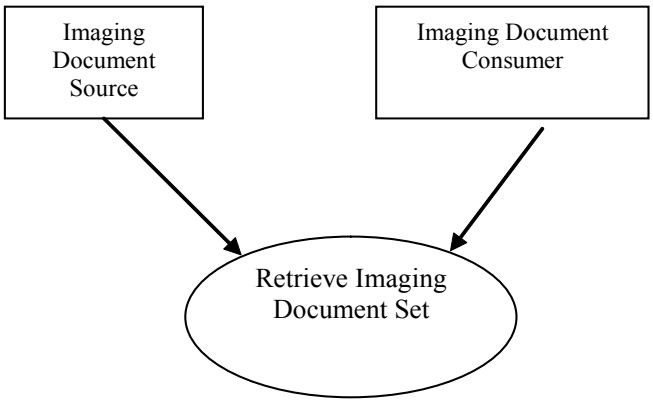
4.69 Retrieve Imaging Document Set

This section corresponds to Transaction RAD-69 of the IHE Technical Framework. "Retrieve Imaging Document Set" is used by the Imaging Document Consumer to retrieve DICOM objects from an Imaging Document Source. The objects retrieved are those that are referenced within an XDS-I.b manifest document as described in RAD TF-3: 4.68. This transaction is derived from, and is nearly identical to, the "Retrieve Document Set" Transaction (ITI-43) of the IHE IT Infrastructure Technical Framework. It adds minor additional semantics and constraints on the requirements defined in Transaction ITI-43.

4.69.1 Scope

This transaction is used by the Imaging Document Consumer to retrieve a set of DICOM objects from the Imaging Document Source. The Imaging Document Consumer gains access to the manifest object (KOS) previously retrieved from the Document Repository by the grouped Document Consumer Actor via the Retrieve Document Set transaction. The Imaging Document Consumer extracts the XDSDocumentEntry.uniqueId and a repositoryUniqueId associated with the Imaging Document Source from the manifest (KOS) object for use in creating the retrieval request.

4.69.2 Use Case Roles



Actor: Imaging Document Consumer

Role: Issues a web service request to retrieve a set of DICOM instances.

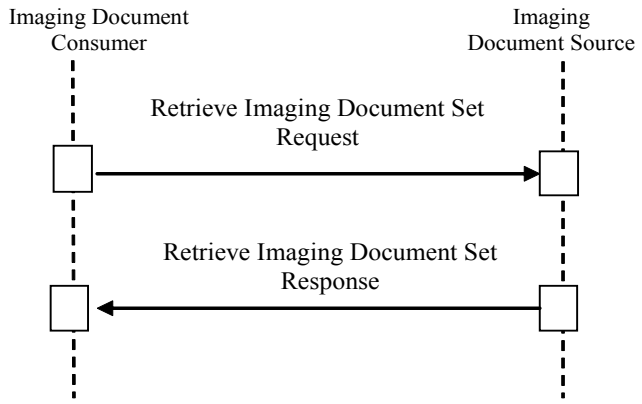
Actor: Imaging Document Source

Role: Receives a web service request for retrieval of a set of DICOM instances and generates the web service response with the appropriate content.

4.69.3 Referenced Standards

For a list of the standards inherited from the underlying ITI-43 Retrieve Document Set, see ITI TF-2b: 3.43.3.

4.69.4 Interaction Diagram



4.69.4.1 Retrieve Imaging Document Set Request message

An Imaging Document Consumer sends a request to an Imaging Document Source to retrieve the set of images referenced within a manifest object. This message is an extension of the Retrieve Document Set transaction as defined in ITI TF-2b: 3.43.

4.69.4.1.1 Trigger Events

The Imaging Document Consumer wishes to retrieve a set of DICOM instances that are referenced within a DICOM Manifest that was previously retrieved by the grouped Document Consumer Actor. The Imaging Document Consumer obtains the documents' uniqueIds (i.e., the SOP Instance UIDs referenced within the DICOM manifest) along with the associated study and series instance UIDs. The Imaging Document Consumer will either compute the repositoryUniqueId(s) from the Retrieve AE Title attribute(s) within the DICOM manifest or populate the repositoryUniqueId(s) using the Retrieve Location UID attribute(s) within the DICOM manifest. The Imaging Document Consumer also maps the repositoryUniqueId(s) to web services endpoint(s) which are the targets of the message.

Once the documents' uniqueIds and repositoryUniqueId(s) have been obtained, the Imaging Document Consumer will send the Retrieve Imaging Document Set Request to the Imaging Document Source.

4.69.4.1.2 Message Semantics

The Retrieve Imaging Document Set Request shall carry the following information:

- A required repositoryUniqueId that identifies the Imaging Document Source from which the DICOM instance is to be retrieved. This value shall either be "computed" based on the Retrieve AE Title (0008, 0054) attribute(s) present in the DICOM manifest or be populated from the Retrieve Location UID (0040,E011) attribute(s) that is present in the DICOM manifest. For a description of how this "computation" can be achieved, see IHE RAD TF-3: Appendix G.3.

- A required list of one or more documentUniqueIds that identify the documents within the Imaging Document Source. These values correspond to the SOP Instance UIDs referenced within the DICOM manifest.
- A required list of one or more DICOM transfer syntax UIDs that the Imaging Document Consumer is capable of processing.
- A required Study Instance UID value that identifies the study containing the DICOM images/ objects to be retrieved. The Study Instance UID is extracted from the KOS manifest.
- A required Series Instance UID value that identifies the series containing the DICOM images/ objects to be retrieved. The Series Instance UID is extracted from the KOS manifest.

The message shall be structured as described in section 4.69.5 Protocol Requirements.

4.69.4.1.3 Expected Actions

When receiving a Retrieve Imaging Document Set Request, an Imaging Document Source shall generate a Retrieve Document Set Response.

4.69.4.2 Retrieve Imaging Document Set Response message

4.69.4.2.1 Trigger Events

This message will be triggered by receipt of a Retrieve Imaging Document Set Request Message.

4.69.4.2.2 Message Semantics

The semantics of the Retrieve Imaging Document Set Response Message are identical to those inherited from the ITI-43 transaction and are specified in ITI TF-2b: 3.43.4.2.2.

4.69.4.2.3 Expected Actions

An Imaging Document Source shall provide the document(s) indicated in the request. The Imaging Document Source shall return the document(s) or an error code in case the document could not be returned. The pixel data shall be encoded using one of the DICOM transfer syntaxes included in the Retrieve Imaging Document Set Request Message. If the Imaging Document Source cannot encode the pixel data using any of the provided transfer syntaxes then an error status shall be returned.

If the Imaging Document Consumer specifies a transfer syntax field of 1.2.840.10008.1.2.4.94 (DICOM JPIP Referenced Transfer Syntax) or 1.2.840.10008.1.2.4.95 (DICOM JPIP Referenced Deflate Transfer Syntax), the following behavior is expected:

- If the DICOM Image Object(s) have a transfer syntax(es) that match the requested transfer syntax, the Retrieve Imaging Document Set Response shall include the DICOM Image Objects unchanged.
- If the DICOM Image Object(s) have a transfer syntax that differs from that of the request, the Retrieve Imaging Document Set Response shall include the DICOM image with the

transfer syntax changed to the requested transfer syntax. In addition, the pixel data Attribute (7Fe0,0010 tag) will have been removed and replaced with a Pixel Data Provider URL (0028,7FE0 tag). The URL represents the JPIP request and will include the specific target information.

- Upon receipt of this Retrieve Imaging Document Set Response, the Imaging Document Consumer may request the pixel data from the pixel data provider using the supplied URL. Additional parameters required by the application may be appended to the URL when accessing the pixel data provider.
- For example, a JPIP request for a 200 by 200 pixel rendition of the entire image can be constructed from the Pixel Data Provider URL as follows:
  - Pixel Data Provider URL (0028,7FE0) = https://server.xxx/jpipserver.cgi?target=imgxyz.jp2,
  - URL Generated by the application = https://server.xxx/jpipserver.cgi?target=imgxyz.jp2&fsiz=200,200

The conditions of failure and possible error messages are given in the ebRS standard and detailed in ITI TF-3: 4.1.13 “Error Reporting”.

4.69.5 Protocol Requirements

Implementors of this transaction shall comply with all requirements described in ITI TF-2x: Appendix V: Web Services for IHE Transactions.

The Retrieve Imaging Document Set transaction shall use SOAP12 and MTOM with XOP encoding (labeled MTOM/XOP in this specification). See ITI TF-2x: Appendix V for details. The Imaging Document Source shall:

- Accept the Retrieve Document Set Request message in MTOM/XOP format.
- Generate the Retrieve Document Set Response message in MTOM/XOP format

The Imaging Document Consumer shall:

- Generate the Retrieve Document Set Request message in MTOM/XOP format.
- Accept the Retrieve Document Set Response message in MTOM/XOP format.

WSDL Namespace Definitions

iherad	urn:ihe:rad:xdsi-b:2009
ihe	urn:ihe:iti:xds-b:2007
rs	urn:oasis:names:tc:ebxml-regrep:xsd:rs:3.0
lcm	urn:oasis:names:tc:ebxml-regrep:xsd:lcm:3.0
query	urn:oasis:names:tc:ebxml-regrep:xsd:query:3.0

These are the requirements for the Retrieve Imaging Document Set transaction presented in the order in which they would appear in the WSDL definition:

- The following types shall be imported (xsd:import) in the /definitions/types section:

- namespace="urn:ihe:rad:xdsi-b:2009", schema=" XDSI.b_ImagingDocumentSource.xsd"
- The baseline XDS.b schema (namespace="urn:ihe:iti:xds-b:2007", schema=" XDS.b_DocumentRepository.xsd")

- The /definitions/message/part/@element attribute of the Retrieve Imaging Document Set Request message shall be defined as "iherad:RetrieveImagingDocumentSetRequest"
- The /definitions/message/part/@element attribute of the Retrieve Imaging Document Set Response message shall be defined as "ihe:RetrieveDocumentSetResponse"
- The /definitions/portType/operation/input/@wsaw:Action attribute for the Retrieve Imaging Document Set Request message shall be defined as "urn:ihe:rad:2009:RetrieveImagingDocumentSet"
- The /definitions/portType/operation/output/@wsaw:Action attribute for the Retrieve Imaging Document Set Response message shall be defined as "urn:ihe:iti:2007:RetrieveDocumentSetResponse"
- The /definitions/binding/operation/soap12:operation/@soapAction attribute shall be defined as "urn:ihe:rad:2009:RetrieveImagingDocumentSet"

These are the requirements that affect the wire format of the SOAP message. The other WSDL properties are only used within the WSDL definition and do not affect interoperability. Full sample request and response messages are in section 4.69.5.1 Sample SOAP Messages.

For informative WSDL for the Imaging Document Source actor see example on the IHE FTP server at: ftp://ftp.ihe.net/TF_Implementation_Material/RAD.

The <iherad:RetrieveImagingDocumentSetRequest/> element for use with the Retrieve Imaging Document Set Request Message is defined as:

- One or more <iherad:StudyRequest/> elements each of which includes a "studyInstanceUID" attribute identifying the study associated with the DICOM images/ objects being retrieved. Each <iherad:StudyRequest/> element shall contain:
  - One or more <iherad:SeriesRequest/> elements each of which includes a "seriesInstanceUID" attribute identifying the series associated with the DICOM images/ objects being retrieved. Each <iherad:SeriesRequest/> element shall contain:
    - One or more <ihe:DocumentRequest/> elements, each one representing an individual document that the Imaging Document Consumer wants to retrieve from the Imaging Document Source. Each <ihe:DocumentRequest/> element contains:
    - A required <ihe:RepositoryUniqueId/> element that identifies the Imaging Document Source from which the document is to be retrieved. This value corresponds to XDSDocumentEntry.repositoryUniqueId.
    - A required <ihe:DocumentUniqueId/> element that identifies the document within the Imaging Document Source. This value corresponds to the SOP Instance UID referenced within the DICOM manifest.
    - An optional <ihe:HomeCommunityId/> element that corresponds to the home attribute of the Identifiable class in ebRIM.

- A required <iherad:TransferSyntaxUIDList/> element which contains a list of one or more <ihe:TransferSyntaxUID> elements. Each of the <iherad:TransferSyntaxUID> elements represent one of the transfer syntax encodings that the Imaging Document Consumer is capable of processing.

This allows the Imaging Document Consumer to specify one or more documents to retrieve from the Document Repository.

The <ihe:RetrieveDocumentResponse/> element for use with the Retrieve Imaging Document Set Response Message is defined as::

- A required /ihe:RetrieveDocumentSetResponse/rs:RegistryResponse element
- An optional sequence of <ihe:DocumentResponse/> elements containing
  - A <ihe:HomeCommunityId/> element. The value of this element shall be the same as the value of the /RetrieveImagingDocumentSetRequest/StudyRequest/SeriesRequest/DocumentRequest/HomeCommunityId element in the Retrieve Document Set Request Message. If the <ihe:HomeCommunityId/> element is not present in the Retrieve Document Set Request Message, this value shall not be present.
  - A required <ihe:RepositoryUniqueId/> that identifies the Imaging Document Source from which the document is to be retrieved. The value of this element shall be the same as the value of the /RetrieveImagingDocumentSetRequest/StudyRequest/SeriesRequest/DocumentRequest/RepositoryUniqueId element in the original Retrieve Imaging Document Set Request Message. This value corresponds to XDSDocumentEntry.repositoryUniqueId.
  - A required <ihe:DocumentUniqueId/> that identifies the document within the Imaging Document Source. The value of this element shall be the same as the value of the /RetrieveImagingDocumentSetRequest/StudyRequest/SeriesRequest/DocumentRequest/DocumentUniqueId element in the original Retrieve Imaging Document Set Request Message. This value corresponds to the SOP Instance UID referenced within the DICOM manifest.
  - A required <ihe:Document/> element that contains the retrieved document in base64binary encoded format
  - A required <ihe:mimeType/> element that indicates the MIME type of the retrieved document

The /RetrieveDocumentSetResponse/rs:RegistryResponse/@status attributes provides the overall status of the request: It shall contain one of the following values:

```
urn:oasis:names:tc:ebxml-regrep:ResponseStatusType:Success
urn:ihe:iti:2007:ResponseStatusType:PartialSuccess
urn:oasis:names:tc:ebxml-regrep:ResponseStatusType:Failure
```

See ITI TF-3: 4.1.13 Error Reporting for the interpretation of these values.

For each document requested in a /RetrieveImagingDocumentSetRequest/StudyRequest/SeriesRequest/DocumentRequest element:

- If a warning is reported when retrieving the document, then a /RetrieveDocumentSetResponse/rs:RegistryResponse/rs:RegistryErrorList/ rs:RegistryError element shall be returned with:
  - @severity is urn:oasis:names:tc:ebxml-regrep:ErrorSeverityType:Warning
  - @errorCode is specified
  - @codeContext contains the warning message
  - @location contains the DocumentUniqueId of the document requested
- The document shall be returned in an instance of /RetrieveDocumentSetResponse/DocumentResponse/Document as base64binary encoded data. The returned document and warning are correlated via the DocumentUniqueId.
- If an error is reported when retrieving a document, then a /RetrieveDocumentSetResponse/rs:RegistryResponse/rs:RegistryErrorList/ rs:RegistryError element shall be returned with:
  - @severity is urn:oasis:names:tc:ebxml-regrep:ErrorSeverityType:Error
  - @errorCode is specified
  - @codeContext contains the error message
  - @location contains the DocumentUniqueId of the document requested
- No corresponding RetrieveDocumentSetResponse/DocumentResponse element shall be returned
- If the document is successfully retrieved (without warning) then no /RetrieveDocumentSetResponse/rs:RegistryResponse/rs:RegistryErrorList/ rs:RegistryError element shall be present and a /RetrieveDocumentSetResponse/DocumentResponse/Document element shall be returned containing the document as base64binary encoded data.

The /RetrieveDocumentSetResponse/rs:RegistryResponse/rs:ResponseSlotList element is not used in this transaction.

The /RetrieveDocumentSetResponse/rs:RegistryResponse/@requestId attribute is not used in this transaction.

A full XML Schema Document for the XDS.b and XDS-I.b types is available online on the IHE FTP site at: ftp://ftp.ihe.net/TF_Implementation_Material/RAD (for XDS-I.b) and ftp://ftp.ihe.net/TF_Implementation_Material/ITI (for XDS.b).

4.69.5.1 Sample SOAP Messages

The samples in the following two sections show a typical SOAP request and its relative SOAP response. The sample messages also show the WS-Addressing headers <Action/>, <MessageID/>, <ReplyTo/>…; these WS-Addressing headers are populated according to the IHE ITI TF-2x: Appendix V: Web Services for IHE Transactions. The body of the SOAP

message is omitted for brevity; in a real scenario the empty element will be populated with the appropriate metadata.

Samples presented in this section are also available online on the IHE FTP site, see ftp://ftp.ihe.net/TF_Implementation_Material/RAD.

4.69.5.1.1 Sample Retrieve Imaging Document Set SOAP Request

```
<s:Envelope
    xmlns:s="http://www.w3.org/2003/05/soap-envelope"
    xmlns:a="http://www.w3.org/2005/08/addressing">
  <s:Header>
    <a:Action s:mustUnderstand="1">urn:ihe:rad:2009:RetrieveImagingDocumentSet </a:Action>
    <a:MessageID>urn:uuid:0fbfdced-6c01-4d09-a110-2201afedaa02</a:MessageID>
    <a:ReplyTo s:mustUnderstand="1">
      <a:Address>http://www.w3.org/2005/08/addressing/anonymous</a:Address>
    </a:ReplyTo>
    <a:To >http://localhost:2647/XdsService/IHEXDSIDocSource.svc</a:To>
  </s:Header>
  <s:Body>
    <RetrieveImagingDocumentSetRequest xmlns:iherad="urn:ihe:rad:xdsi-b:2009"
xmlns:ihe="urn:ihe:iti:xds-b:2007">
      <StudyRequest studyInstanceUID="1.3.6.1.4...101">
          <SeriesRequest seriesInstanceUID="1.3.6.1.4...201">
              <ihe:DocumentRequest>
                       <ihe:RepositoryUniqueId>1.3.6.1.4...1000</ihe:RepositoryUniqueId>
                       <ihe:DocumentUniqueId>1.3.6.1.4...2300</ihe:DocumentUniqueId>
              </ihe:DocumentRequest>
              <ihe:DocumentRequest>
                       <ihe:RepositoryUniqueId>1.3.6.1.4...1000</ihe:RepositoryUniqueId>
                       <ihe:DocumentUniqueId>1.3.6.1.4...2301</ihe:DocumentUniqueId>
              </ihe:DocumentRequest>
          </SeriesRequest>
      </StudyRequest>
      <TransferSyntaxUIDList>
          <TransferSyntaxUID> 1.2.840.10008.1.2.1</TransferSyntaxUID>
          <TransferSyntaxUID> 1.2.840.10008.1.2.4.57</TransferSyntaxUID>
          <TransferSyntaxUID> 1.2.840.10008.1.2.4.70</TransferSyntaxUID>
      </TransferSyntaxUIDList>
    </RetrieveImagingDocumentSetRequest>
  </s:Body>
</s:Envelope>
```

4.69.5.1.2 Sample Retrieve Document Set SOAP Response

```
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope"
xmlns:a="http://www.w3.org/2005/08/addressing">
  <s:Header>
    <a:Action s:mustUnderstand="1">urn:ihe:iti:2007:RetrieveDocumentSetResponse</a:Action>
    <a:RelatesTo>urn:uuid:0fbfdced-6c01-4d09-a110-2201afedaa02</a:RelatesTo>
  </s:Header>
  <s:Body>
    <RetrieveDocumentSetResponse
        xmlns="urn:ihe:iti:xds-b:2007"
        xmlns:lcm="urn:oasis:names:tc:ebxml-regrep:xsd:lcm:3.0"
        xmlns:query="urn:oasis:names:tc:ebxml-regrep:xsd:query:3.0"
        xmlns:rim="urn:oasis:names:tc:ebxml-regrep:xsd:rim:3.0"
        xmlns:rs="urn:oasis:names:tc:ebxml-regrep:xsd:rs:3.0">
      <rs:RegistryResponse status="urn:oasis:names:tc:ebxml-regrep:ResponseStatusType:Success"/>
      <DocumentResponse>
        <RepositoryUniqueId>1.3.6.1.4...1000</RepositoryUniqueId>
        <DocumentUniqueId>1.3.6.1.4...2300</DocumentUniqueId>
        <mimeType>application/dicom</mimeType>
        <Document>UjBsR09EbGhjZ0dTQUxNQUFBUUNBRU1tQ1p0dGUXhEUzhi</Document>
      </DocumentResponse>
```

```
      <DocumentResponse>
        <RepositoryUniqueId>1.3.6.1.4...1000</RepositoryUniqueId>
        <DocumentUniqueId>1.3.6.1.4...2301</DocumentUniqueId>
        <mimeType>application/dicom</mimeType>
        <Document>UjBsR09EbGhjZ0dTQUxNQUFBUUNBRU1tQ1p0dU1GUCx4hu</Document>
      </DocumentResponse>
    </RetrieveDocumentSetResponse>
  </s:Body>
</s:Envelope>
```


5 Transaction Options on Other Domain Profiles

This section lists all the IHE Radiology options on transactions of other domains' integration profiles. Transactions from other domains that are reused in Radiology integration profiles are not listed here, but rather referenced within those profiles. References to the other domains' technical frameworks we are creating options on are listed here as well.

References:

IT Infrastructure Technical Framework Volume-2 Section 3.20 (ITI TF-2a: 3.20)

5.1 ITI-20 Record Audit Event

The Radiology Audit Trail Option defines the specific requirements of the IHE Radiology transactions for supporting the IHE ITI Audit Trail and Node Authentication profile. This option deals largely with the details of the Record Audit Event transaction in the IHE ITI Technical Framework. The option details the required audit events for each of the IHE Radiology transactions, based on the different trigger events. Refer to the ITI-ATNA Profile [ITI TF-2a: 3.20] for the full definition of this transaction.

Note: No new triggers have been added beyond those previously defined in the Radiology Basic Security Integration Profile. No new coded values have been added to extend the IHE Audit Message dictionary.

5.1.1 Trigger Events and Message semantics

An Audit Log is a record of actions performed on data by users. Actions are queries, views, additions, deletions and changes. The IHE actor shall be able to create an Audit Record when an IHE transaction-related event occurs or when a non-IHE transaction (e.g. application functionality outside the IHE scope) event occurs.

IHE specifies that events defined in Table 5.1-1 shall be reportable by means of the IHE Audit Trail. The deprecated SEC Provisional Audit Message name is only included here for reference, as well as the new IHE Audit Message EventId (code meaning) along with the specialized EventTypeCode (code meaning) as needed (from DICOM supplement 95).

Table 5.1-1 lists all the trigger events for the generation of Audit Records. This is the table of trigger events specified in ATNA [ITI TF-2a: 3.20], with the exceptions noted below, and is included here to further define the specific Audit Message contents.

The following trigger events from ATNA are not applicable to the Radiology actors and transactions so they are not included in table 5.1-1.

- Health-service-event
- Medication
- Patient-care-assignment
- Patient-care-episode
- Patient-care-protocol

The "Actor-config" trigger event is an extension of the ATNA triggers to provide continued support for Basic Security.

4020 **Table 5.1-1: Audit Record Trigger Events**

Trigger Event	Description	IHE Audit Message Audit EventID (EventCodeType(s))	Provisional Audit Message – Deprecated
Actor-config	Generated for any configuration change related to the actor. Applies to all actors.	Application Activity (Software Configuration)	ActorConfig
Actor-start-stop	Startup and shutdown of any actor. Applies to all actors. Is distinct from hardware powerup and shutdown.	Application Activity (Application Start, Application Stop)	ActorStartStop
Audit-Log-Used	The audit trail repository has been accessed or modified by something other than the arrival of audit trail messages.	Audit Log Used	AuditLogUsed
Begin-storing-instances	Begin storing SOP Instances for a study. This may be a mix of instances. Involved actors: Acquisition Modality, Evidence Creator.	Begin Transferring DICOM Instances	BeginStoringInstances
Images Availability Query	Image availability query is received.	Query	DICOMQuery
Instances-deleted	SOP Instances are deleted from a specific study.	DICOM Study Deleted	DICOMInstancesDeleted
Instances-Stored	Instances for a particular study have been stored on this system.	DICOM Instances Transferred	InstancesStored
Mobile-machine-event	Mobile machine joins or leaves secure domain.	Network Entry (Attach, Detach)	NetworkEntry
Node-Authentication-failure	A secure node authentication failure has occurred during TLS negotiation, e.g. invalid certificate.	Security Alert (Node Authentication)	SecurityAlert
Order-record-event	Order record created, accessed, modified or deleted. Involved actors: Order Placer, Order Filler.	Order Record	OrderRecord
Patient-record-event	Patient record created, modified, or accessed. Involved actors: ADT Patient Registration.	Patient Record	PatientRecord
PHI-export	Any export of PHI on media, either removable physical media such as CD-ROM or electronic transfer of files such as email. Any printing activity, paper or film, local or remote, that prints PHI. Applies to all actors.	Export	Export
PHI-import	Any import of PHI on media, either removable physical media such as CD-ROM or electronic transfers of files such as email. Applies to all actors.	Import	Import
Procedure-record-event	Procedure record created, modified, accessed or deleted. Involved actors: Department System Scheduled/Order Filler.	Procedure Record	ProcedureRecord

Trigger Event	Description	IHE Audit Message Audit EventID (EventCodeType(s))	Provisional Audit Message – Deprecated
Query Information	A query has been received, either as part of an IHE transaction, or as part other products functions. For example: 1. Modality Worklist Query	Query	DICOMQuery
Security Administration	Administrative actions create, modify, delete, query, and display the following: (from ITI ATNA ITI TF-2a: Table 3.20.6-1 – not all numbered items included here.) 10. User authentication, authentication failure, authentication revocation, or signoff. Security administration events should always be audited.	User Authentication (Login, Logout)	UserAuthenticated
Study-Object-Event	Study is created, modified, or accessed. This reports on addition of new instances to existing studies as well as creation of new studies.	DICOM Instances Accessed	DICOMInstancesUsed
Study-used	SOP Instances from a specific study are created, modified or accessed. One event covers all instances used for the particular study.	DICOM Instances Accessed	DICOMInstancesUsed

Table 5.1-2 lists all the Radiology transactions which cause the corresponding Trigger Events found in Table 5.1-1. The last column specifies whether the sender or receiver side of the transaction is required to audit this transaction.

Note: There are a number of trigger events in Table 5.1-1 that are not related to an IHE transaction in table 5.1-2. Trigger events like "Actor-config" or "Actor-start-stop" are application activities. The audit of these events is required when these types of triggers occur within your application.

Note: No status notifications are audited (PPS messages, Status Updates), since both the sender and receiver have an established trust relationship and they contain minimal amount of PHI.

Note: The Acquisition Modality and the Evidence Creator shall be able to report the Instances-deleted event when they delete instances after Storage Commitment.

Note: The receiver node of the query request, not the initiator of the request, shall be able to report any of the Query transactions. The audit message records the query request not the query results.

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
Placer Order Management [RAD-2]	Order-record-event	Order Placer DSS/OF - when PHI is presented
Filler Order Management [RAD-3]	Order-record-event	DSS/OF
Procedure Scheduled [RAD-4]	Procedure-record-event	DSS/OF

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Query Modality Worklist [RAD-5]	Query Information	DSS/OF
Modality Procedure Step In Progress [RAD-6]	None	
Modality Procedure Step Completed [RAD-7]	None	
Modality Images Stored [RAD-8]	Begin-storing-instances	Acquisition Modality
	Instances-Stored	Image Manager/Image Archive
Modality Presentation State Stored [RAD-9]	Begin-storing-instances	Acquisition Modality
	Instances-Stored	Image Manager/Image Archive
Storage Commitment [RAD-10]	None	
Images Availability Query [RAD-11]	Images Availability Query	Image Manager/Image Archive
Patient Update [RAD-12]	Patient-record-event	ADT Order Placer, DSS/OF - when PHI is presented
Procedure Update [RAD-13]	Procedure-record-event	DSS/OF
Query Images [RAD-14]	Query Information	Image Manager/Image Archive
Query Presentation States [RAD-15]	Query Information	Image Manager/Image Archive
Retrieve Images [RAD-16]	Instances-Stored	Image Manager/Image Archive, Imaging Document Source
	Study-used	Image Display, Imaging Document Consumer
Retrieve Presentation States [RAD-17]	Instances-Stored	Image Manager/Image Archive
	Study-used	Image Display
Creator Images Stored [RAD-18]	Begin-storing-instances	Evidence Creator
	Instances-Stored	Image Manager/Image Archive
Creator Presentation State Stored [RAD-19]	Begin-storing-instances	Evidence Creator
	Instances-Stored	Image Manager/Image Archive
Creator Procedure Step In Progress [RAD-20]	None	
Creator Procedure Step Completed [RAD-21]	None	
Print Request with Presentation LUT [RAD-23]	PHI-export	Print Composer
Report Submission [RAD-24]	Begin-storing-instances	Report Creator
	Instances-Stored	Report Manager
Report Issuing [RAD-25]	Begin-storing-instances	Report Manager
	Instances-Stored	Report Repository
Query Reports [RAD-26]	Query Information	Report Repository/External Report Repository
Retrieve Reports [RAD-27]	Instances-Stored	Report Repository/External Report Repository
	Study-used	Report Reader
Structured Report Export [RAD-28]	Instances-Stored	Report Manager

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Key Image Note Stored [RAD-29]	Begin-storing-instances	Evidence Creator, Acquisition Modality
	Instances-Stored	Image Manager/Image Archive
Query Key Image Notes [RAD-30]	Query Information	Image Manager/Image Archive
Retrieve Key Image Notes [RAD-31]	Instances-Stored	Image Manager/Image Archive
	Study-used	Image Display
Authenticate Node [ITI-19]	Node-Authentication-failure	Any secure node
Maintain Time [ITI-1]	None	
Record Audit Event [ITI-20]	None	
Charge Posted [RAD-35]	PHI-export	DSS/OF
Account Management [RAD-36]	PHI-export	ADT
Query Post-Processing Worklist [RAD-37]	Query Information	Post-Processing Manager
Workitem Claimed [RAD-38]	None	
Workitem PPS In-Progress [RAD-39]	None	
Workitem PPS Completed [RAD-40]	None	
Workitem Completed [RAD-41]	None	
Performed Work Status Update [RAD-42]	None	
Evidence Document Stored [RAD-43]	Begin-storing-instances	Acquisition Modality / Evidence Creator
	Instances-Stored	Image Manager/Image Archive
Query Evidence Documents [RAD-44]	Query Information	Image Manager/Image Archive
Retrieve Evidence Documents [RAD-45]	Instances-Stored	Image Manager/Image Archive
	Study-used	Image Display
Query Reporting Worklist [RAD-46]	Query Information	Report Manager
Distribute Imaging Information on Media [RAD-47]	PHI-export	Portable Media Creator
	PHI-import	Portable Media Importer
	Study-used	Image Display, Report Reader, Print Composer
Appointment Notification [RAD-48]	None	
Instance Availability Notification [RAD-49]	None	
Store Instances [RAD-50]	Begin-storing-instances	Export Selector
	Instances-Stored	Export Manager
Store Export Selection [RAD-51]	Begin-storing-instances	Export Selector
	Instances-Stored	Export Manager
Store Additional Teaching File	Begin-storing-instances	Export Selector

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Information [RAD-52]	Instances-Stored	Export Manager
Export Instances [RAD-53]	Begin-storing-instances	Export Manager – when PHI is exported
	Instances-Stored	Receiver – when PHI is exported
WADO Retrieve [RAD-55]	Instances-Stored	Imaging Document Source
	Study-used	Imaging Document Consumer
Import Procedure Step In Progress [RAD-59]	None	
Import Procedure Step Completed [RAD-60]	None	
Imported Objects Stored [RAD-61]	Begin-storing-instances	Sender Importer shall audit
	Instances-Stored	Receiver (IM/IA) shall audit
Store Dose Information [RAD-62]	Begin-storing-instances	Acquisition Modality
	Instances-Stored	Image Manager/Image Archive, Dose Information Reporter, Dose Information Consumer
Submit Dose Information [RAD-63]	Begin-storing-instances	Dose Information Reporter – when PHI is exported
	Instances-Stored	Dose Registry – when PHI is exported
Query Dose Information [RAD-64]	Query Information	Image Manager/Image Archive
Retrieve Dose Information [RAD-65]	Instances-Stored	Image Manager/Image Archive
	Study-used	Dose Information Reporter, Dose Information Consumer
Patient Demographics Query [ITI-21]	Query Information	Patient Demographics Supplier shall audit
Provide and Register Imaging Document Set – MTOM/XOP [RAD-68]	PHI-export	Imaging Document Source
Retrieve Imaging Document Set [RAD-69]	Instances-Stored	Imaging Document Source
	Study-used	Imaging Document Consumer

Appendix A: Deprecated

Appendix B: Deprecated

Appendix C: Attribute Consistency between General Purpose Worklist, SPS, PPS and Resulting Composite IODs in Post-Processing Workflow

This appendix provides requirements for the use of attributes in the objects generated by the different participants of the Post-Processing Workflow. In particular, it specifies which attributes provided by the Post-Processing Manager shall be used unaltered to populate the attributes in the GP-PPS objects, objects that may be produced as a result of postprocessing operations, and also the N-ACTION command that is used to claim and complete workitems.

C.1: Integration-critical Attributes

The table below shall be interpreted as follows:

- An Attribute shown in the first column shall be requested by a GPWL SCU (for example, image processing workstation or CAD device) as a return key in its C-FIND Requests. The Post-Processing Manager shall return attribute Values in the C-FIND response.
- The return Attribute Values shall be used by the performing station in filling the Attribute shown on the corresponding line of table C.1-1 both for Composite Instances (second column) and GP-PPS Instances.
- The Post-Processing Manager shall be capable of handling the Attributes shown in the corresponding line of the third column as defined by the SCP Type and the additional notes.

Table C.1-1: Comparison of Corresponding Attributes of General Purpose Worklist, SPS, PPS, Images, GSPS and other IODs

General Purpose Worklist	General Purpose SPS N-ACTION	General Purpose PPS	Images and GSPS IOD	SR Based Evidence Documents	KIN
--	--	Referenced General Purpose Scheduled Procedure Step Sequence [1C]	--	--	--
SOP Class UID [1]	SOP Class UID [1]	>SOP Class UID [1]	--	--	--
SOP Instance UID [1]	SOP Instance UID [1]	>SOP Instance UID [1]	--	-	--
--	Transaction UID [1]	> Referenced General Purpose Scheduled Procedure Step Transaction UID [1]	--		
General Purpose Scheduled Procedure Step Status [1]	General Purpose Scheduled Procedure Step Status[1]	--	--	--	--

General Purpose Worklist	General Purpose SPS N-ACTION	General Purpose PPS	Images and GSPS IOD	SR Based Evidence Documents	KIN
Input Information Sequence [2]	--	--	--	Current Requested Procedure Evidence Sequence [1C]	--
Relevant Information Sequence [2]	--	--	--	Pertinent Other Evidence Sequence [1C]	--
Referenced Study Component Sequence [2]					
Resulting General Purpose Performed Procedure Step Sequence [2]			Referenced Study Component Sequence [3]	Referenced Study Component Sequence [2]	Referenced Study Component Sequence [2]
>Referenced SOP Class UID [1]	--	SOP Class UID [1]	>SOP Class UID [1]	>SOP Class UID [1]	>SOP Class UID [1]
>Referenced SOP Instance UID [1]	--	SOP Instance UID [1]	>SOP Instance UID [1]	>SOP Instance UID [1]	>SOP Instance UID [1]
Actual Human Performers Sequence [2]	Actual Human Performers Sequence [3]	Actual Human Performers Sequence [2]	--	--	--
Study Instance UID [1]	--	--	Study Instance UID [1]	Study Instance UID [1]	Study Instance UID [1]
--	--	--	Request Attributes Sequence [3]	--	--
Scheduled Procedure Step ID [1]			>Scheduled Procedure Step ID [1C]		
Referenced Request Sequence [1]		Referenced Request Sequence [2]		Referenced Request Sequence[1C]	Referenced Request Sequence [1C]
>Study Instance UID [1]		>Study Instance UID [1]		>Study Instance UID [1]	>Study Instance UID [1]
>Requested Procedure ID [1]		>Requested Procedure ID [2]	>Requested Procedure ID [1C]	>Requested Procedure ID [2]	>Requested Procedure ID [2]
>Requested Procedure Description [1C]		>Requested Procedure Description [2]		>Requested Procedure Description [2]	>Requested Procedure Description [2]
>Requested Procedure Code Sequence [1C]		>Requested Procedure Code Sequence [2]		>Requested Procedure Code Sequence [2]	>Requested Procedure Code Sequence [2]
>Referenced Study Sequence [2]		>Referenced Study Sequence [2]	Referenced Study Sequence [3]	>Referenced Study Sequence [2]	>Referenced Study Sequence [2]
>Accession		>Accession	Accession	>Accession	>Accession

General Purpose Worklist	General Purpose SPS N-ACTION	General Purpose PPS	Images and GSPS IOD	SR Based Evidence Documents	KIN
Number [2]		Number [2]	Number [2]	Number [2]	Number [2]
>Placer Order Number/Imaging Service Request [3]		>Placer Order Number/Imaging Service Request [3]		>Placer Order Number/Imaging Service Request [2]	>Placer Order Number/Imaging Service Request [2]
>Filler Order Number/Imaging Service Request [3]		>Filler Order Number/Imaging Service Request [3]		>Filler Order Number/Imaging Service Request [2]	>Filler Order Number/Imaging Service Request [2]
>Requesting Physician [2]		>Requesting Physician [2]		>Requesting Physician [2]	>Requesting Physician [2]
		Performed Procedure Step ID [1]	Performed Procedure Step ID [3]		
		Performed Procedure Step Start Date [1]	Performed Procedure Step Start Date [3]		
		Performed Procedure Step Start Time [1]	Performed Procedure Step Start Time [3]		
		Performed Procedure Step Description [1]	Performed Procedure Step Description [3]		

4065

Appendix D: Attribute Consistency between General Purpose Worklist, SPS, PPS and Resulting Composite IODs In Reporting Workflow

This appendix provides requirements for the use of attributes in the diagnostic reports generated by the Report Creator as a participant of Reporting Workflow. These reports are encoded as DICOM SR objects. In particular, it specifies which attributes provided by the Report Manager shall be used unaltered to populate the attributes in the GP-PPS objects, resulting DICOM SR objects, and also the N-ACTION command that is used to claim and complete workitems.

D.1: Integration-critical Attributes

The table below shall be interpreted as follows:

- An Attribute shown in the first column shall be requested by a GPWL SCU (Report Creator) as a return key in its C-FIND Requests. The Report Manager shall return attribute Values in the C-FIND response.
- The return Attribute Values shall be used by the Report Creator in filling the Attribute shown on the corresponding line of table D.1-1 both for Composite Instances (fourth column) and GP-PPS Instances.
- The Report Manager shall be capable of handling the Attributes shown in the corresponding line of the third column as defined by the SCP Type and the additional notes.

Table D.1-1: Comparison of Corresponding Attributes of General Purpose Worklist, SPS, PPS, Images, GSPS and other IODs

General Purpose Worklist	General Purpose SPS N-ACTION	General Purpose PPS	SR Based Report Documents
--	--	Referenced General Purpose Scheduled Procedure Step Sequence [1C]	--
SOP Class UID [1]	SOP Class UID [1]	>SOP Class UID [1]	--
SOP Instance UID [1]	SOP Instance UID [1]	>SOP Instance UID [1]	-
--	Transaction UID [1]	> Referenced General Purpose Scheduled Procedure Step Transaction UID [1]	
General Purpose Scheduled Procedure Step Status [1]	General Purpose Scheduled Procedure Step Status[1]	--	--
Input Information Sequence [2]	--	--	Current Requested Procedure Evidence Sequence [1C]
Relevant Information	--	--	Pertinent Other

General Purpose Worklist	General Purpose SPS N-ACTION	General Purpose PPS	SR Based Report Documents
Sequence [2]			Evidence Sequence [1C]
Referenced Study Component Sequence [2]			
Resulting General Purpose Performed Procedure Step Sequence [2]			Referenced Study Component Sequence [2]
>Referenced SOP Class UID [1]	--	SOP Class UID [1]	>SOP Class UID [1]
>Referenced SOP Instance UID [1]	--	SOP Instance UID [1]	>SOP Instance UID [1]
--	Actual Human Performers Sequence [3]	Actual Human Performers Sequence [2]	Actual Human Performers Sequence [2]
Study Instance UID [1]	--	--	Study Instance UID [1]
--	--	--	--
Scheduled Procedure Step ID [1]			
Referenced Request Sequence [1]		Referenced Request Sequence [2]	Referenced Request Sequence[1C]
>Study Instance UID [1]		>Study Instance UID [1]	>Study Instance UID [1]
>Requested Procedure ID [1]		>Requested Procedure ID [2]	>Requested Procedure ID [2]
>Requested Procedure Description [1C]		>Requested Procedure Description [2]	>Requested Procedure Description [2]
>Requested Procedure Code Sequence [1C]		>Requested Procedure Code Sequence [2]	>Requested Procedure Code Sequence [2]
>Referenced Study Sequence [2]		>Referenced Study Sequence [2]	>Referenced Study Sequence [2]
>Accession Number [2]		>Accession Number [2]	>Accession Number [2]
>Placer Order Number/Imaging Service Request [3]		>Placer Order Number/Imaging Service Request [3]	>Placer Order Number/Imaging Service Request [2]
>Filler Order Number/Imaging Service Request [3]		>Filler Order Number/Imaging Service Request [3]	>Filler Order Number/Imaging Service Request [2]
>Requesting Physician [2]		>Requesting Physician [2]	>Requesting Physician [2]
		Performed Procedure Step ID [1]	
		Performed Procedure Step Start Date [1]	
		Performed Procedure Step Start Time [1]	

General Purpose Worklist	General Purpose SPS N-ACTION	General Purpose PPS	SR Based Report Documents
		Performed Procedure Step Description [1]	

Appendix E: DICOM Media Interchange – Critical DICOM Compatibility Tips

This appendix presents a number of compatibility issues that result from not following the DICOM Media Interchange standard (PS 3.10, PS 3.11 and PS 3.12). This appendix is simply intended to be a reminder for the most common DICOM issues that have resulted in the past in incompatibilities between file set creators and readers.

This list shall not be interpreted, as being the only DICOM requirements that implementers should pay attention to. DICOM has proven to be a very effective and thorough specification that implementers of this IHE profile shall be familiar with.

1. The CD Media shall be formatted according to ISO 9660 Level 1. Extensions such as Joliet or Rock Ridge are not forbidden by DICOM and hence are permitted by the PDI profile. A UDF file system is not allowed unless an ISO 9660 Level 1 Filesystem is also present. Such extensions may be necessary to encode non-DICOM content on the media, such as long filenames for viewing software. Such extensions may result in ISO 9660 Level 1 uppercase filenames being presented to application software as lowercase or mixed case depending on the operating system's mount behavior; accordingly, all Portable Media Displays and Portable Media Importers shall be case insensitive in this respect.
2. The *DICOMDIR* file shall be at the root directory of the Interchange Media
3. All DICOM file names shall contain only uppercase letters, numeric digits and the underscore character, and the file name size without extensions shall not exceed 8 characters.
4. All Directory names in DICOM paths shall contain only uppercase characters, numeric digits and the underscore character. Directory names shall not contain extensions.
5. Non-DICOM files may have extensions with more than 3 characters.
6. DICOM files shall have no extension.
7. DICOM files shall have an ISO 9660 version of 1, which may be displayed by some operating systems as a ".;1" at the end. However, the ".;1" should not be included in the name of the file itself.
8. The version number of the file name shall not be included in the reference data element in the DICOMDIR.
9. Only 8 levels of Directories are allowed, including the root directory (i.e. there may be up to 7 levels of sub-directories below the root).
10. Objects in DICOM files shall be stored in Explicit VR Little Endian (not Implicit)
11. DICOM File Meta-Information shall be in Explicit VR Little Endian (not Implicit)
12. File Meta Information Version (0002,0001) shall contain a two byte OB value consisting of a 0x00 byte, followed by 0x01 byte, and not the value 0x0001 encoded as a little endian 16 bit short value, which would be the other way around.

13. The file meta information shall include the Media Storage SOP Class UID (0002,0002) data element, and its value shall be equal to the SOP Class UID data element in the data set.
14. The file meta information shall include the Media Storage SOP Instance UID (0002,0003) data element, and its value shall be equal to the SOP Instance UID data element in the data set.
15. No private elements shall be included in the file meta information.
16. The file meta information header shall contain an attribute (0002,0000) Group Length with a correct value as specified in DICOM PS 3.10.
17. The physical format of the DICOM CD-R discs shall comply with the application definitions within ISO/IEC 10149 Part II as specified in PS3.12. This allows discs to be written with:
    - Mode 1 sectors or
    - Mode 2, Form 1 sectors with CD-ROM-XA File Number = 0, Channel Number = 0 and Coding Information Byte = 0.

Appendix F: Example Created Media Instance Content

Example F-1. Media containing a DICOM CT imaging study, a DICOM Presentation States and a DICOM Structured Report. The creator supports the Web Content Option and includes web-viewable data derived from DICOM data on the media. Also a DICOM Viewer is included on the media.

Content element(s)	Description
Identification Marking	Marker with content per 4.47.4.1.2.2: patient name creation date name of the institution that created the media
/README.TXT	File with content per 4.47.4.1.2.2
/INDEX.HTM	File with content per 4.47.4.1.2.2: media type: "DICOM PLUS WEB" links to XHTML report and to another page (THUMBS.HTM) with thumbnails that link the full resolution JPEG images link to a launch point for the DICOM viewer in the VIEWERS directory link to the list of importable data
/DICOMDIR	DICOM Directory file referencing all DICOM instances: all DICOM images the PS object the SR object
/ DICOM/ /DICOM /12296 /DICOM /12297 . . . /DICOM /NNNNN /DICOM /98732 /DICOM /12312 /IHE_PDI /REPORT.HTM /IHE_PDI /THUMBS.HTM /IHE_PDI /T_12296.JPG /IHE_PDI /T_12297.JPG /IHE_PDI /I_12296.JPG /IHE_PDI /I_12297.JPG	Directory with content per 4.47.4.1.2.2: Image object 1 Image object 2 . . . Image object N DICOM Presentation State object Basic Text DICOM Structured Report object XHTML report navigation page derived from DICOM data that displays T_12296.JPG and T_12297.JPG thumbnail of Image object 1 thumbnail of Image object 2 full resolution JPEG image for view within browser full resolution JPEG image for view within browser

Content element(s)	Description
/VIEWERS/ /VIEWERS/VIEWER.EXE	Optional directory: executable viewer

Example F-2. Media containing a DICOM US imaging study and a DICOM SR diagnostic report. The creator does not support the Web Content Option but chose to optionally include the README.TXT file. No web-viewable data derived from DICOM data is included on the media.

Content element(s)	Description
Identification Marking	**Marker with content per 4.47.4.1.2.2:** **patient name** **creation date** name of the institution that created the media **media type: "DICOM ONLY"**
/README.TXT	**File with content per 4.47.4.1.2.2**
/DICOMDIR	DICOM Directory file referencing all DICOM instances: all DICOM images the SR object
/DICOM/ **/DICOM**/78567856 **/DICOM**/78567857 . . . **/DICOM**/NNNNNNN **/DICOM**/12343412	**Directory with content per 4.47.4.1.2.2:** **Image object 1** **Image object 2** **.** . . **Image object N** **Basic Text DICOM Structured Report object**

Appendix G: Configuration for Accessing DICOM, WADO and Web Services Retrieve Services

G.1: Mapping DICOM AE Title to DICOM AE Network Address

When an Imaging Document Consumer wants to retrieve DICOM instances that are referenced within a shared manifest Document using DICOM C-Move/C-Store, the following configuration is necessary.

The Key Object Selection Document Instance includes an AE Title but does not include any IP address or any port number. As AE Title alone is not sufficient to retrieve DICOM objects, the Imaging Document Consumer needs to get the IP address and the port number of the Imaging Document Source from its local configuration file.

Similarly, the Imaging Document Source needs to know the AE Title, the IP address and the port number of the Imaging Document Consumer in order to store the DICOM objects. The Imaging Document Source needs to get the IP address, the AE Title, the port number of the Imaging Document Consumer from its local configuration file.

In this profile, it is assumed that mapping of AE Titles of Imaging Document Source and Imaging Document Source to their network presentation addresses (IP and port) is supported by exchanging configuration files of the related actors, under the guidance of affinity domain policies and processes. The method of configuration file exchange is out of the scope of this profile. In the future, DICOM Supplement 67 (Configuration Management) and its proper extension in cross-enterprise use can be employed to automate this mapping. This may be a future Integration Profile candidate of IHE IT Infrastructure domain.

As IP addresses and port numbers need to be resolved from AE titles, a special attention is required to ensure that AE titles of actors that are involved in this profile are uniquely allocated in an affinity domain.

G.2: Mapping DICOM AE Title to WADO Service Network Address

In order for an Imaging Document Consumer to retrieve DICOM instances referenced within a shared Manifest Document using WADO Access transaction (RAD-55), it needs to build a WADO HTTP Request-URI for the SOP instance. Though SOP instance identification information is fully specified in the Manifest, the Imaging Document Consumer needs an auxiliary method to map the Retrieve AE Title specified for a referenced SOP Instance in the Manifest to the server network address, which supports the WADO retrieve service.

The Imaging Document Consumer needs to maintain a mapping configuration of the server network addresses of all Imaging Document Source in the Affinity Domain, and their Retrieve AE Titles. Using this mapping, the Retrieve AE Title of a referenced SOP instance in the Manifest can be translated to WADO service server address, which is then used to build the

WADO HTTP Request-URI together with SOP instance identification information, and optionally other standard WADO HTTP parameters.

To achieve an unambiguous, automated mapping of Retrieve AE Title and WADO access service server network address, some policy needs to be in place to ensure unique Retrieve AE Titles of Imaging Document Source in the entire Affinity Domain.

G.3: Mapping DICOM AE Title to Web Services Address

To use the Retrieve Imaging Document Set transaction (RAD-69) to retrieve DICOM instances referenced within a manifest document, an Imaging Document Consumer must pass a repositoryUniqueId attribute in the Retrieve Imaging Document Set Request.

The Imaging Document Consumer needs to maintain a list that associates the web service addresses of all Imaging Document Sources in the XDS Affinity Domain and their Retrieve AE Titles and/or Retrieve Location UIDs. Using this mapping, the Retrieve AE Title of a referenced SOP instance in the manifest can be translated to a repositoryUniqueId, which is then passed in the Retrieve Imaging Document Set Request together with a documentUniqueId (SOP instance identification information). Alternatively, a Retrieve Location UID can be used directly as the repositoryUniqueId in the Retrieve Imaging Document Set Request.

To achieve an unambiguous, automated mapping from Retrieve AE Title to a web service address, some policy needs to be in place to ensure unique Retrieve AE Titles of Imaging Document Sources within the entire XDS Affinity Domain.

Appendix H: Example Template for Teaching File Structured Report Manifests

Included here is a DICOM 2011 PS 3.16 style template containing:

- section headings (container concept names) for plain text blocks to mirror the MIRC concepts of history, findings, discussion, plus coded alternatives where likely (e.g. history and findings)
- section headings (container concept names) and code concept names for differential diagnosis, diagnosis, pathology, anatomy and organ system, etc.
- context groups for coded values for differential diagnosis, diagnosis, pathology, anatomy and organ system (likely from SNOMED +/- ICD9CM, +/- ACR Index)
- diagnosis confirmation flag

The idea is to provide for the partial or complete authoring of teaching files on the Image Display. The concepts are derived from those in the RSNA MIRC Document Schema Version 16.

Note that this template will not replicate the function of the Key Object Selection document in its role as a manifest; hence neither a listing of the referenced instances to be included, nor the person observer context for the receiver of the manifest to route it to the correct user will be required.

Table H-1: Example Additional Teaching File Information Template

	NL	Rel with parent	Value Type	Concept Name	VM	Req Type	Cond	Value Set Constraint
1			CONTAINER	EV (TCE006, IHERADTF, "Additional Teaching File Information")	1	M		Root node
2	>	CONTAINS	TEXT	EV (TCE101, IHERADTF, "Author")	1	M		
3	>>	HAS PROPERTIES	TEXT	EV (TCE102, IHERADTF, "Affiliation")	1	U		
4	>>	HAS PROPERTIES	TEXT	EV (TCE103, IHERADTF, "Contact")	1	U		
5	>	CONTAINS	TEXT	EV (TCE104, IHERADTF, "Abstract")	1	M		
6	>	CONTAINS	TEXT	EV (TCE105, IHERADTF, "Keywords")	1-n	MC	XOR row 7	
7	>	CONTAINS	CODE	EV (TCE105, IHERADTF, "Keywords")	1-n	MC	XOR row 6	ACR or MESH or ICD9CM Diagnosis Codes
8	>	CONTAINS	TEXT	EV (121060, DCM, "History")	1-n	U		
9	>	CONTAINS	CODE	EV (121060, DCM, "History")	1-n	U		
10	>	CONTAINS	TEXT	EV (121071, DCM, "Finding")	1-n	U		
11	>	CONTAINS	CODE	EV (121071, DCM, "Finding")	1-n	U		
12	>	CONTAINS	TEXT	EV (TCE106, IHERADTF, "Discussion")	1-n	U		
13	>	CONTAINS	TEXT	(111023, DCM, "Differential Diagnosis/ Impression")	1-n	U		
14	>	CONTAINS	CODE	(111023, DCM, "Differential Diagnosis/ Impression")	1-n	U		
15	>	CONTAINS	TEXT	EV (TCE107, IHERADTF, "Diagnosis")	1-n	U		
16	>	CONTAINS	CODE	EV (TCE107, IHERADTF,	1-n	U		

	NL	Rel with parent	Value Type	Concept Name	VM	Req Type	Cond	Value Set Constraint
				"Diagnosis")				
17	>	CONTAINS	TEXT	(112005, DCM, "Radiographic anatomy")	1-n	U		
18	>	CONTAINS	CODE	(112005, DCM, "Radiographic anatomy")	1-n	U		
19	>	CONTAINS	TEXT	(111042, DCM, "Pathology")	1-n	U		
20	>	CONTAINS	CODE	(111042, DCM, "Pathology")	1-n	U		
21	>	CONTAINS	TEXT	EV (TCE108, IHERADTF, "Organ system")	1-n	U		
22	>	CONTAINS	CODE	EV (TCE108, IHERADTF, "Organ system")	1-n	U		
23	>	CONTAINS	CODE	(121139, DCM, "Modality")	1-n	U		DCID (29) Acquisition Modality
24	>	CONTAINS	CODE	EV (TCE109, IHERADTF, "Category")	1	M		BCID Table Q-2 categories of teaching files
25	>	CONTAINS	CODE	EV (TCE110, IHERADTF, "Level")	1	U		BCID Table Q-3 levels of teaching files
27	>	CONTAINS	CODE	EV (TCE111, IHERADTF, "Diagnoses confirmed")	1	U		DCID (230) Yes-No

Table H-2: Categories of Teaching Files (American Board of Radiology categories)

Coding Scheme Designator	Code Value	Code Meaning
IHERADTF	TCE301	Musculoskeletal
IHERADTF	TCE302	Pulmonary
IHERADTF	TCE303	Cardiovascular
IHERADTF	TCE304	Gastrointestinal
IHERADTF	TCE305	Genitourinary
IHERADTF	TCE306	Neuro
IHERADTF	TCE307	Vascular and Interventional
IHERADTF	TCE308	Nuclear
IHERADTF	TCE309	Ultrasound
IHERADTF	TCE310	Pediatric
IHERADTF	TCE311	Breast

Table H-3: Levels of Teaching Files

Coding Scheme Designator	Code Value	Code Meaning
IHERADTF	TCE201	Primary
IHERADTF	TCE202	Intermediate
IHERADTF	TCE203	Advanced

Appendix I: De-identification, Re-identification, Pseudonymization, Persistence of Identification and Clinical Trial Attributes (Informative)

I.1: De-identification

Complete de-identification of a DICOM instance to remove all PHI contained within attributes without a priori knowledge of how the instance was created requires removal of the values all attributes containing text as well as all private attributes. This is often impractical, since useful information required for subsequent applications may be contained in some of the text values.

For example, Study Description and Series Description typically contain useful information that it is often undesirable to remove. De-identification of a report would not typically remove the text values that are the payload of the report. In some cases it may be useful to provide a mechanism for replacement of Study Description and Series Description that are more meaningful or more correct for a particular teaching file or clinical trial application, e.g. to state that a series is "T1 axial post-contrast" or similar, when this information is otherwise absent.

Dates and times may or may not be appropriate to remove. For example, it may be desirable to remove any evidence of a particular visit date (e.g. Study Date), though the times may need to be preserved in order to maintain the temporal relationship between images. In other scenarios, dates may need to be preserved exactly, in order to correlate with real-world events, such as therapy.

Ages and dates of birth are particularly problematic, since they are also a form of PHI, but may be required for the statistical purpose of a clinical trial or the meaningful interpretation of a teaching file case where age affects diagnostic possibilities. A typical technique is to remap ages into exemplars of an age range, or to make dates the first of the same month, etc. The validity of such techniques requires review by an expert.

In addition, site policy and local regulations may impose specific requirements on removal of PHI for specific purposes, and these requirements may differ. It is not possible or desirable to standardize for every use case which attributes must be removed.

One can go to extraordinary lengths to attempt to ensure de-identification by such means as adding noise to pixel data to confound binary or hash matching, removal of facial features and other such mechanisms. This is rarely, if ever, required in practice and is beyond the scope of IHE to define.

I.2: Consistency of Identifiers on Repeated Export

Whilst it is entirely possible to devise reversible and irreversible algorithms to consistently map identifiers into new values, even if those algorithms are based on cryptographic one-way hash functions, anyone with access to a list of all possible inputs (e.g., all patient names and IDs in the institution) could identify the subject by a relatively short exhaustive search. Thus while such

mechanisms may be effective for de-identification for distribution outside an institution, they may not be not sufficient within an institution.

An alternative means to provide deterministic mapping would be to maintain a persistent record of the mapping (such as a database), and to consult that record on the next occasion. Such a record would need to be well protected.

For the same reason, if auditing export actions, care should be taken not to include both the original and replacement identities in the audit trail.

Reversible mapping might be desirable in some scenarios in which authorized individuals were permitted to recover the original identity. Means of achieving this are not defined by IHE, though either a persistent record of mapping as described, or embedded encrypted original attributes as described in DICOM 2011 PS 3.15 Basic Application Level Confidentiality Profile, could be used.

An irreversible, but repeatable, mapping may also be useful for later updates of teaching files, as additional information becomes available. For example, follow-up studies and reports or pathology information could automatically be re-mapped to the same teaching file identifiers and hence automatically become part of the same teaching file, since the same "pseudonymous" identifiers would be used.

I.3: Addition of Clinical Trial Attributes

DICOM defines additional optional attributes that may be added to any composite SOP instance for the purpose of clinical trials. These are defined in the Clinical Trial Subject, Clinical Trial Study and Clinical Trial Series Modules in PS 3.3.

These attributes provide:

- Subject identification information that may be used to augment the patient identification, e.g. the combination of Clinical Trial Protocol ID, Clinical Trial Site ID and Clinical Trial Subject ID
- Other trial-specific identifiers useful for the trial workflow, not specifically related to identification of the subject, e.g., Clinical Trial Timepoint ID

To the extent that this information is known at the time of the Export Instances transaction, it is desirable to populate these fields.

Since many downstream systems will not be aware of these attributes, however, it is common practice to also replace the normal DICOM patient and other identification fields with values corresponding to the clinical trial identifiers. For example, not only might one insert Clinical Trial Protocol ID, Clinical Trial Site ID and Clinical Trial Subject ID, but also replace Patient ID with Clinical Trial Subject ID, Patient Name with a concatenation of Clinical Trial Protocol ID, Clinical Trial Site ID and Clinical Trial Subject ID, and Institution Name with Clinical Trial Site ID, etc.

The Remap Identifiers Option provides a mechanism to automatically populate these values.

GLOSSARY

Please see RAD TF-1: Appendix E - Glossary

