GE Healthcare

Centricity* PACS-IW
DICOM Conformance Statement

Release 3.7.3.5, 3.7.3.6, 3.7.3.7

Direction: DOC0903053 rev. 1

CE
0459

EC REP

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CONFORMANCE STATEMENT OVERVIEW

GE Centricity® PACS-IW (formerly Dynamic Imaging IntegradWeb PACS) is a self-contained networked computer system used for archiving, manipulating and managing diagnostic medical images and complementary non-image objects such as Grayscale Softcopy Presentation States, Key Image Notes and Mammography CAD SR. It allows external systems to send objects to it for permanent storage, retrieve information about such objects, and retrieve the objects themselves. It also can query and retrieve studies from a remote system and transmit objects to such a system for storage. The system conforms to the DICOM standard to allow sharing of medical information with other digital imaging systems.

NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Verification		
Verification	No	Yes
Transfer		
Computed Radiography Image Storage	Yes	Yes
CT Image Storage	Yes	Yes
Enhanced CT Image Storage	Yes	Yes
Ultrasound Image Storage (Retired)	Yes	Yes
Ultrasound Multi-Frame Image Storage (Retired)	Yes	Yes
MR Image Storage	Yes	Yes
Enhanced MR Image Storage	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes
Positron Emission Tomography Image Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Ultrasound Image Storage	Yes	Yes
Ultrasound Multi-frame Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	Yes	Yes
Digital X-Ray Image Storage - For Presentation	Yes	Yes
Digital X-Ray Image Storage - For Processing	Yes	Yes
Digital Mammography Image Storage - For Presentation	Yes	Yes
Digital Mammography Image Storage - For Processing	Yes	Yes
Digital Intro-oral X-Ray Image Storage - For Presentation	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
VL Endoscopic Image Storage	Yes	Yes
VL Microscopic Image Storage	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	Yes	Yes
VL Photographic Image Storage	Yes	Yes
Mammography CAD SR Storage	Yes	Yes
Grayscale Softcopy Presentation State Storage	Yes	Yes
Key Object Selection Storage	Yes	Yes
Storage Commitment		
Storage Commitment Push Model	No	Yes
Query/Retrieve		
Patient Root Q/R – FIND	No	Yes
Patient Root Q/R – MOVE	No	Yes
Study Root Q/R – FIND	Yes	Yes
Study Root Q/R – MOVE	Yes	Yes
Print		
Basic Grayscale Print Management Meta SOP Class	Yes	No
Basic Color Print Management Meta SOP Class	Yes	No
Presentation LUT	Yes	No

NOTE: Relational Queries are not supported either as SCU or SCP.

MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC)	Read Files (FSR)
Compact Disk - Recordable		
General Purpose CD-R	Yes	Yes
DVD		
General Purpose DVD-RAM	Yes	Yes

Table of Contents

1 INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the Centricity PACS-IW compliance to the DICOM requirements for the implementation of Networking features.

Section 3 (Media Storage Conformance Statement), which specifies the Centricity PACS-IW compliance to the DICOM requirements for the implementation of Media Storage features.

Section 4 (Grayscale Softcopy Presentation State Information Object Implementation), which specifies the Centricity PACS-IW compliance to DICOM requirements for the implementation of a CT Image Information Object.

Section 5 (Key Object Selection Document Information Object Implementation), which specifies the Centricity PACS-IW compliance to DICOM requirements for the implementation of the Modality Worklist service.

Section 6 (Basic Directory Information Object Implementation), which specifies the Centricity PACS-IW compliance to DICOM requirements for the implementation of the Modality Worklist service.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

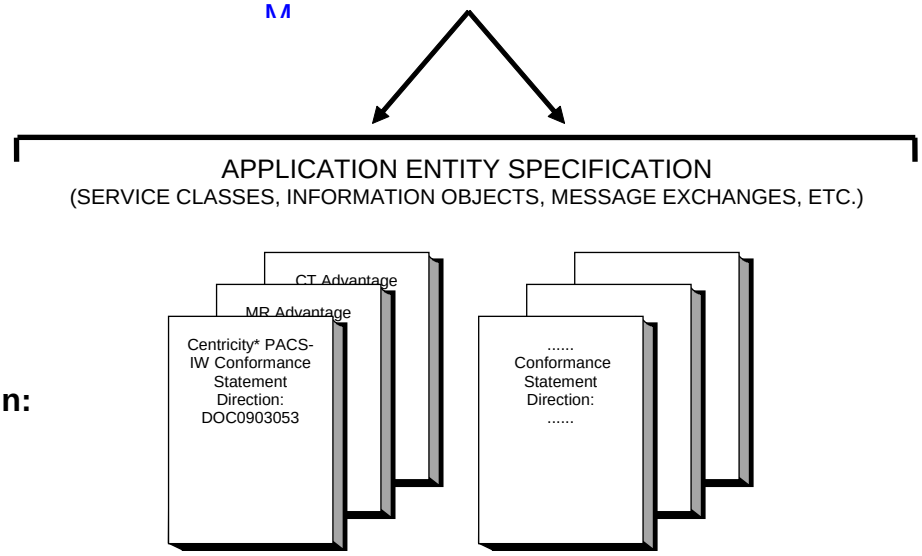
The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.

GEHC DICOM Conformance Statements

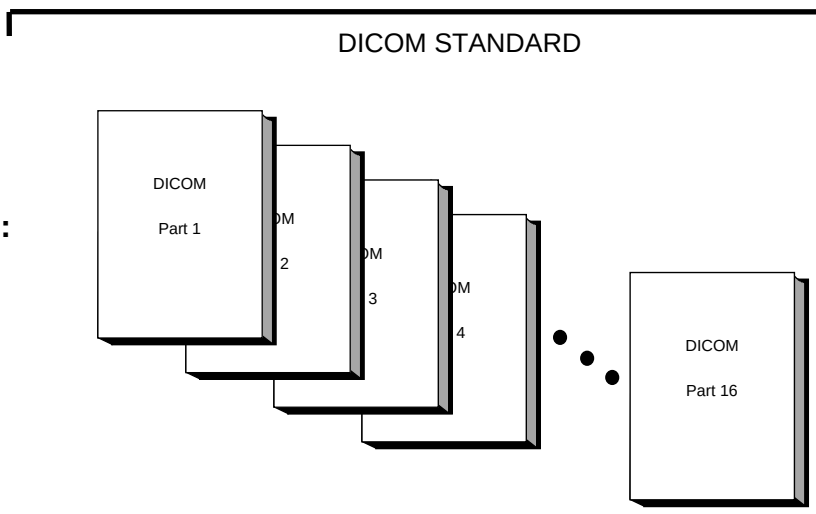
@

http://www.ge.com/DICOM

Product Implementation:



Standard Specification:



This document specifies the DICOM implementation. It is entitled:

Centricity* PACS-IW DICOM Conformance Statement

Release 3.7.3.5/3.7.3.6/3.7.3.7

Direction DOC0903053

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

The GEHC Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat

NEMA

1300 N. 17th Street, Suite 1752

Rosslyn, VA 22209

USA

Phone: +1.703.841.3200

1.3 AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

1.5 REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not**

sufficient to ensure that inter-operation will be successful. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the user's responsibility and should not be underestimated. The user is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the user should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements.** The user should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REMARKS

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/.

1.7 REMARKS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association – a network communication channel set up between Application Entities.

Attribute – a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 DEFINITIONS, TERMS AND ABBREVIATIONS

AE Application Entity

AET Application Entity Title

CAD Computer Aided Detection

CD-R Compact Disk Recordable

CR Computerized radiography

CSE Customer Service Engineer

CT Computerized Tomography

DHCP Dynamic Host Configuration Protocol

DICOM Digital Imaging and Communications in Medicine

DX Digital X-ray

FSC File-Set Creator

FSU File-Set Updater

FSR File-Set Reader

GSDF Grayscale Standard Display Function

GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System
HL7	Health Level 7 Standard
IE	Information Entity
IHE	Integrating the Healthcare Enterprise
IO	Intra-oral X-ray
IOD	Information Object Definition
ISO	International Standards Organization
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MG	Mammography (X-ray)
MR	Magnetic Resonance
NM	Nuclear Medicine
O	Optional (Key Attribute)
OP	Ophthalmic Photography
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
R	Required (Key Attribute)
RF	Radiofluoroscopy
RIS	Radiology Information System
RT	Radiotherapy
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
U	Unique (Key Attribute)
UL	Upper Layer

US Ultrasound
VM Value Multiplicity
VL Visible Light
VR Value Representation
XA X-ray Angiography

2 NETWORKING

2.1 IMPLEMENTATION MODEL

2.1.1 APPLICATION DATA FLOW

PACS-IW implements a number of Application Entities each of which supports one logical set of functions, typically a single DICOM Service Class. By default all of the defined Application Entities have different AE Titles, and are mapped to different network presentation addresses.

All application entities are implemented as Windows applications that either run continuously as services or are invoked by the PACS-IW business logic on as needed basis. Those that run continuously, start during system start-up and listen for associations. A new thread is created for processing of association requests and data exchange over accepted association.

Data flow of continuously running Application Entities is depicted on the Figure 2.1-1, and the Data flow for those that are invoked on the request from a user – on the Figure 2.1-2.

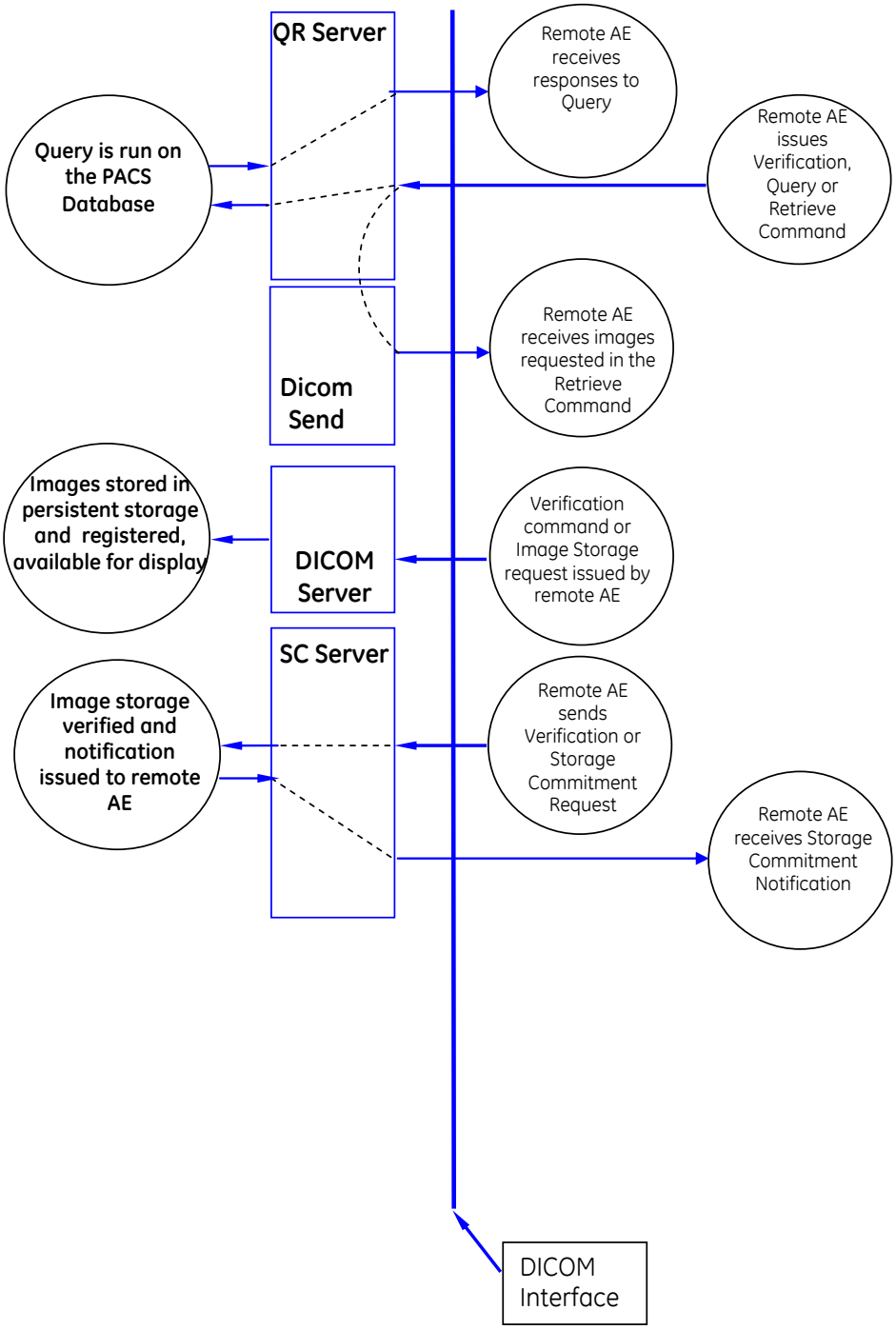


Figure 2.1.1-1 Application Data Flow for Server Applications.

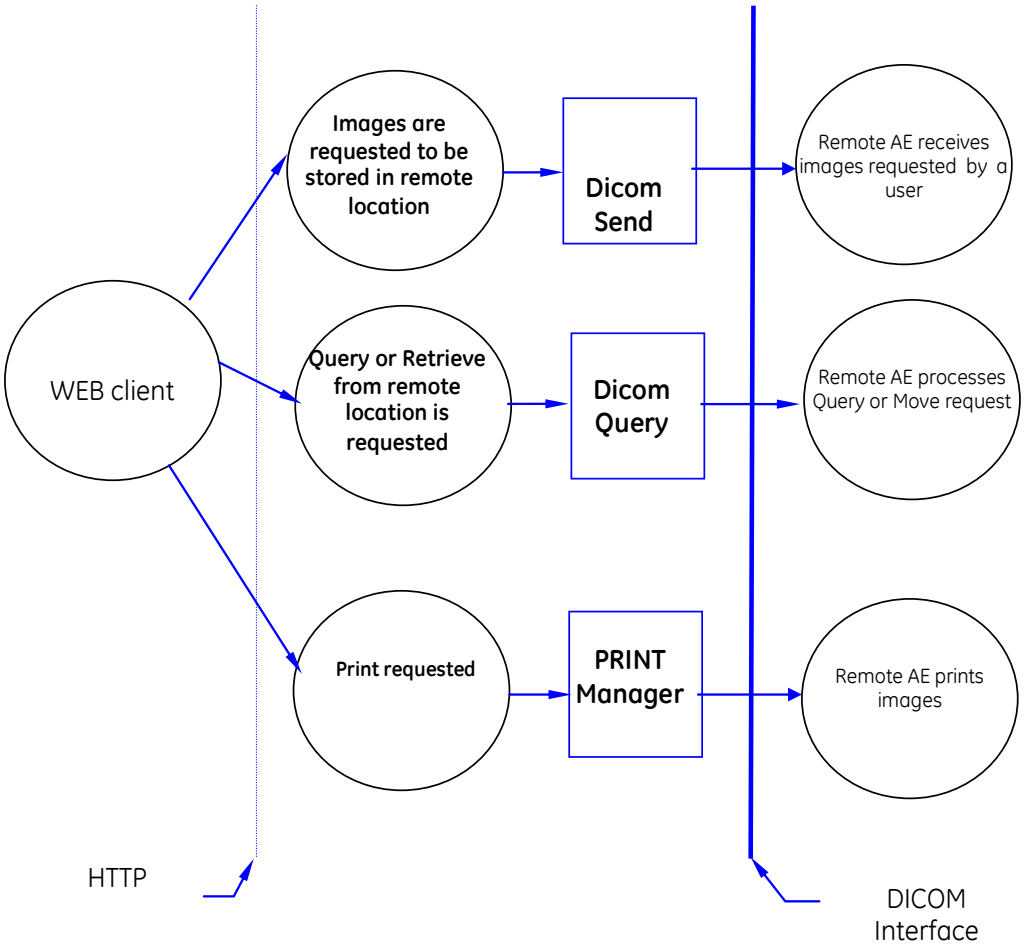


Figure 2.1.1-2 Application Data Flow for User-Requested Operations.

2.1.2 FUNCTIONAL DEFINITIONS OF AE'S

2.1.2.1 Functional Definition of DICOMSend Application Entity

The DICOMSend AE can be invoked by the QRServer AE or on user's request to trigger the transfer of specific objects to a remote destination AE (only full studies are being sent out at the user's request). The DICOMSend AE must be correctly configured with the host and port number of any external DICOM AE's that will be transfer destinations. The Presentation Contexts to use are determined from the headers of the DICOM files to be transferred.

2.1.2.2 Functional Definition of DICOMQuery Application Entity

The DICOMQuery AE can be invoked on user's request to trigger the query from remote DICOM server or request transfer of specific studies from a remote AE to PACS-IW or any third destination. The DICOMQuery AE must be correctly configured with the host and port number of any external DICOM AE's that will be used as query/retrieve request targets.

2.1.2.3 Functional Definition of QRServer Application Entity

The QRServer AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, QRServer AE expects it to be a DICOM application. QRServer AE will accept Associations with Presentation Contexts for SOP Classes of the DICOM Query-Retrieve Service Class, and Verification Service Class. It will handle query and retrieve requests on these Presentation Contexts and respond with data objects with values corresponding to the contents of the PACS-IW database. For retrieve requests the destination for the objects is determined from the Destination AE Title contained in the C-MOVE request. When a retrieval request is received, the QRServer AE invokes DICOMSend AE to send the specified objects to the C-MOVE Destination AE.

2.1.2.4 Functional Definition of DICOMServer Application Entity

The DICOMServer AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the DICOMServer AE expects it to be a DICOM application. The DICOMServer AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Storage Service Classes. Any objects received on such Presentation Contexts will be added to the PACS-IW database.

2.1.2.5 Functional Definition of SCServer Application Entity

The SCServer AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the SCServer AE expects it to be a DICOM application. The SCServer AE will accept Associations with Presentation Contexts for the Storage Commitment Push Model SOP Class and Verification Service Class. When a Storage Commitment Push Model N-ACTION Request is received, the SCServer AE will immediately check if the referenced Composite SOP Instances are in the PACS-IW database and return an N-EVENT-REPORT Notification on the newly established association if all references are already in the database. If one or more references are not found, the SCServer will wait configurable period of time for the arrival of the SOP Instances and returning the N-EVENT-REPORT Notification. Shall the remote AE terminate association before the notification is ready, the SCServer AE will attempt to open association with the remote AE to transmit notification. Shall this attempt fail, the notification will be lost.

SCServer AE does not 'cache' Storage Commitment Push Model Requests and wait for Composite SOP Instances to be received at a later time, thus the requests referencing unknown objects will result in the notification of storage commitment failure for those objects.

2.1.2.7 Functional Definition of PRINTManager Application Entity

The PRINTManager AE is be invoked by the user's request to trigger the transfer of specific images to a remote destination AE that is capable of printing images on paper or film. The PRINTManager AE must be correctly configured with the host and port number of any external DICOM AE's that are to be transfer destinations. The Presentation Contexts to use are Basic Grayscale Print Management

Meta SOP Class and Basic Color Print Management Meta SOP Class as well as Presentation LUT SOP Class.

2.1.3 SEQUENCING OF REAL-WORLD ACTIVITIES

The only sequencing constraint that exists across all the PACS-IW Application Entities is the fact that a Composite SOP Instance must be received by the DICOMServer AE before Query-Retrieve Requests related to this SOP Instance can be successfully handled. In the case of Storage Commitment Push request, if it is received before corresponding SOP Instance has been received by the DICOMServer AE, the system will wait for configured period of time BEFORE returning "Commitment Failed" notification to the Peer AE.

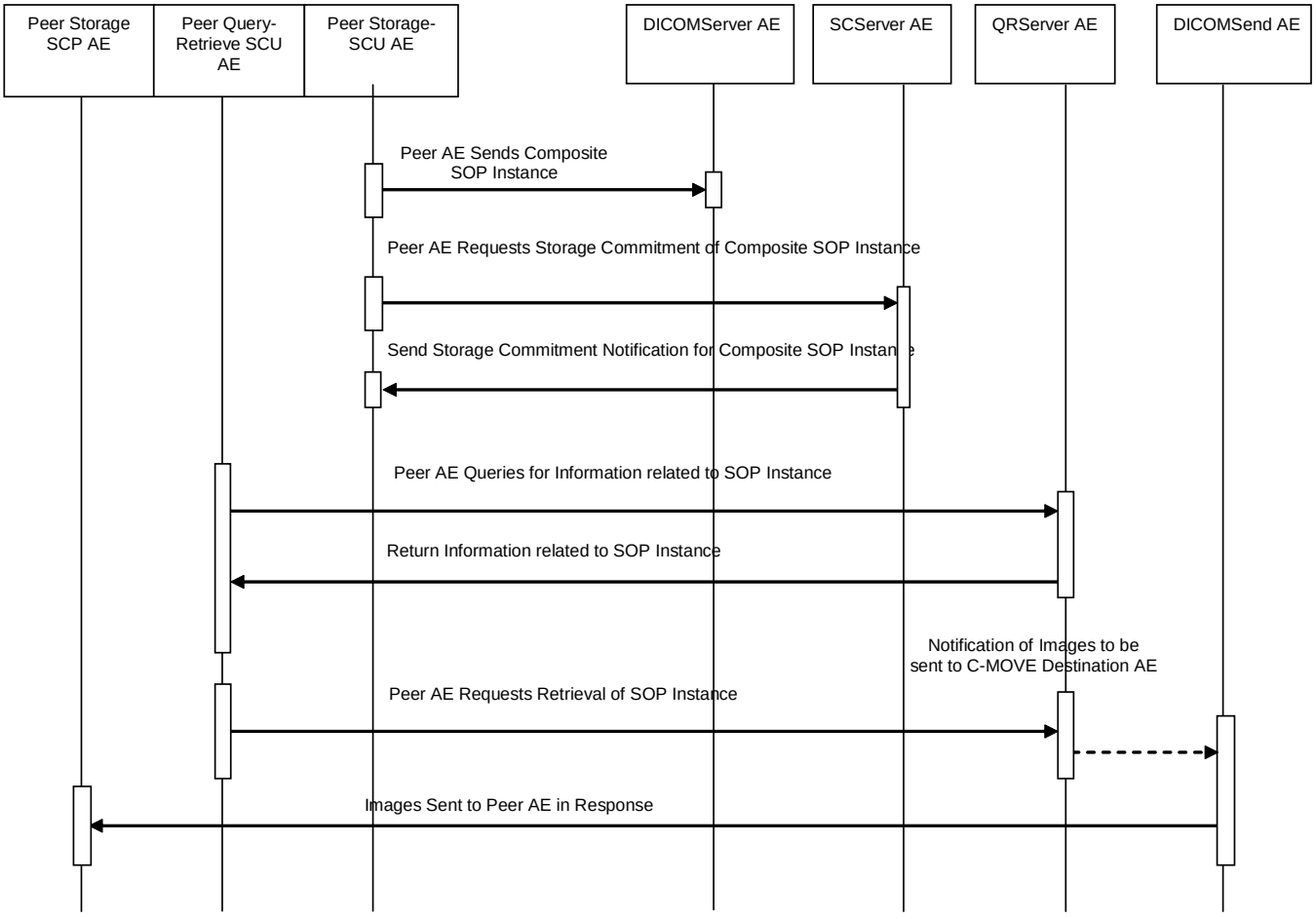


Figure 2.1.3-1. Sequencing Constraints

2.2 AE SPECIFICATIONS

2.2.1 DICOMSend APPLICATION ENTITY SPECIFICATION

2.2.1.1 SOP Classes

The DICOMSend AE provides Standard Conformance to the following DICOM SOP Classes.

TABLE 2.2.1-1. SOP Classes Supported by DICOMSend AE

SOP Class Name	SOP Class UID	SCU	SCP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	No
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	No
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	No
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	No
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20	Yes	No
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.	Yes	No
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No

SOP Class Name	SOP Class UID	SCU	SCP
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	Yes	No
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	Yes	No

2.2.1.2 Association Establishment Policy

2.2.1.2.1 General

The DICOMSend AE initiates Associations only when requested to do so by one of three events:

- the PACS-IW user selects to send a Study to remote AE;
- the QRServer AE requests to send a set of objects (not necessarily a full study) to remote AE;

The DICOM standard Application Context Name for DICOM is always proposed:

Table 2.2.1-2 DICOM Application Context for DICOMSend AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DICOMSend AE is

Maximum Length PDU	16384 (not configurable)

2.2.1.2.2 Number of Associations

The maximum number of simultaneous Associations is determined by a number of instances of DICOMSend application invoked by all requests from users and QRServer. This number is limited to one on each of the PACS-IW Application servers.

Table 2.2.1-3 Number of Associations as a SCU for DICOMSend AE

Maximum number of simultaneous Associations	1 per instance; number of instances is 1 per server

2.2.1.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.1.2.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

Table 2.2.1-5 DICOM Implementation Class and Version for DICOMSend AE

Implementation Class UID	1.2.840.113654.2.3.1995.2.11.2
Implementation Version Name	MIRCTN17MAR2000

2.2.1.3 Association Initiation Policy

2.2.1.3.1 Activity - Move Request by an External Peer AE or by PACS-IW User

2.2.1.3.1.1 Description and Sequencing of Activity

The DICOMSend AE will initiate a new Association when the QRServer AE invokes it to transmit images and other objects. The QRServer AE will make such invocation whenever it receives a valid C-MOVE Request. An Association Request is sent to the specified C-MOVE Destination AE and upon successful negotiation of the required Presentation Context the object transfer is started. In all cases an attempt will be made to transmit all the indicated objects in a single Association, but this may not always be possible. The Association will be released when all the objects have been sent. If an error occurs during transmission over an open Association then the object transfer is halted. The DICOMSend AE will not attempt to independently retry the object transfer. If there are any outstanding objects that have not been sent, transmission of them will not be attempted and association will be closed.

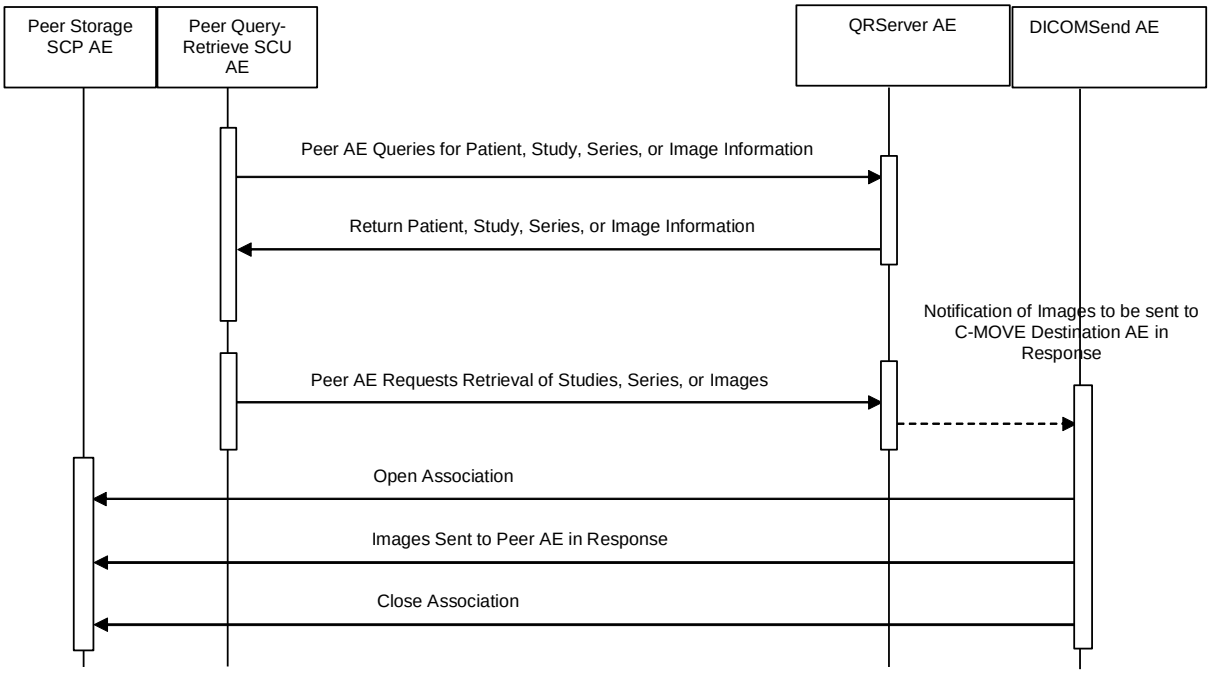


Figure 2.2.1-1 Sequencing of Activity - Send Objects Requested by an External Peer AE

The following sequencing constraints illustrated in Figure 2.2.1-1 apply to the DICOMSend AE:

1. Peer AE requests retrieval of Study, Series, or Objects from QRServer AE (C-MOVE-RQ).
2. QRServer AE invokes DICOMSend AE to send the Composite SOP Instances indicated in the C-MOVE-RQ to the C-MOVE Destination AE.
3. DICOMSend AE opens a new Association with the indicated C-MOVE Destination AE.
4. DICOMSend AE sends the indicated Composite SOP Instances.
5. DICOMSend AE closes the Association.

Similar activity takes place when a user of PACS-IW system requests a study to be moved to a different destination. When user indicates a study to be sent to a specific destination, the DICOMSend AE is invoked. An Association Request is sent to the specified Destination AE and upon successful negotiation of the required Presentation Context the object transfer is started. In all cases an attempt will be made to transmit all the SOP Instances belonging to specified study in a single Association, but this may not always be possible. The Association will be released when all the objects have been sent. If an error occurs during transmission over an open Association then the object transfer is halted. The DICOMSend AE will not attempt to independently retry the object transfer.

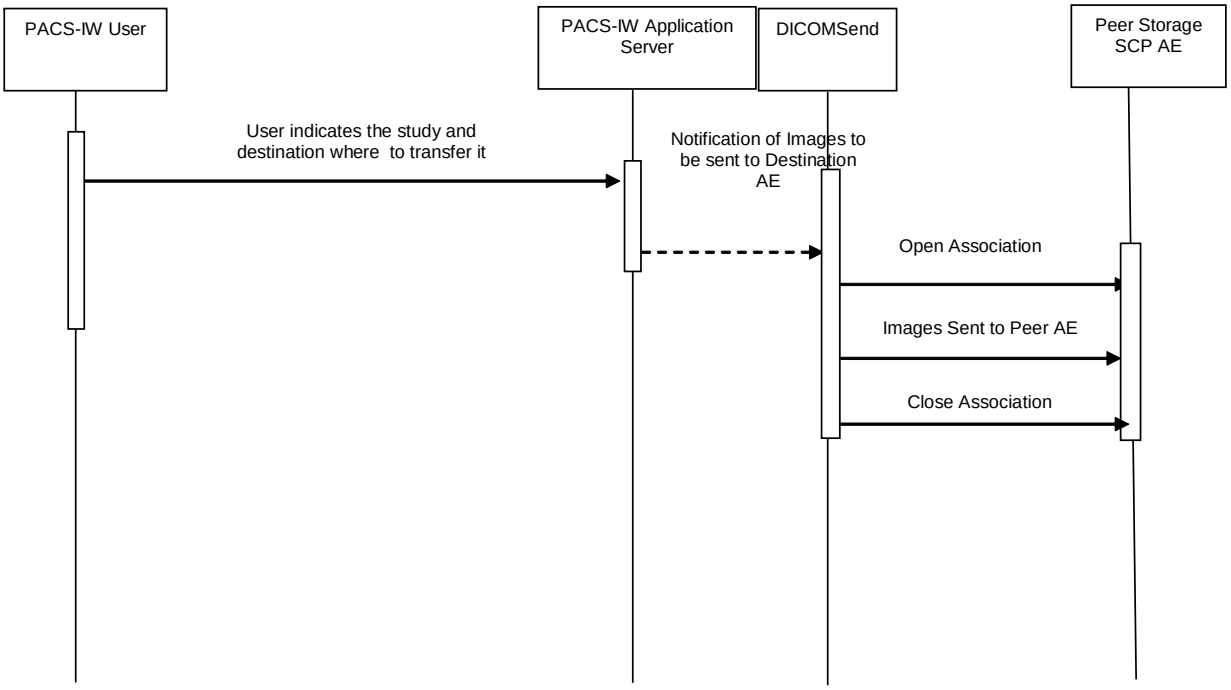


Figure 2.2.1-2 Sequencing of Activity - Send Objects Requested by a User

The following sequencing constraints illustrated in Figure 2.2.1-2 apply to the DICOMSend AE:

1. User indicates a study to be transferred.
2. PACS-IW application server invokes DICOMSend AE to send the Composite SOP Instances belonging to the study, to the Destination AE.

3. DICOMSend AE opens a new Association with the indicated Destination AE.
4. DICOMSend AE sends the indicated Composite SOP Instances.
5. DICOMSend AE closes the Association.

2.2.1.3.1.2 Proposed Presentation Contexts

DICOMSend AE will propose Presentation Contexts as shown in the following table:

Table 2.2.1-6 Proposed Presentation Contexts by the DICOMSend AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name**	**UID**		
Computer Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
US Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
US Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
US Multi-frame Storage	1.2.840.10008.5.1.4.1.1.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
X-Ray Radiofluoroscopic	1.2.840.10008.5.1.4.1.1.12.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext.**
Image Storage					
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.1.3.1.3 SOP Specific Conformance for All Storage SOP Classes

Composite DICOM SOP Instances are maintained in the internal PACS-IW format. The entire set of tags received with the object will be saved; this includes all Private and SOP Extended Elements. When a SOP Instance is selected for transfer, its content will be exported as it was originally received except for a few possible exceptions. Some of the Patient demographic and Study information Elements whose values have been altered due to changes administered on PACS-IW system can be altered when the SOP Instance is exported.

The Patient demographic and Study information can be entered or altered by several means: manually, or from HL7 messaging. The replacement behavior depends on which specific DICOM and HL7 services are supported.

In addition, the Study Instance UID and Series Instance UID may be changed if the particular SOP instance have been moved from one Study/Series to another through the merge and split operations.

The following is the list of attributes that may be updated:

Table 2.2.1-7 Attributes that may be coerced by DICOMSend AE

Attribute	Tag
Patient ID	(0010,0020)
Patient Name	(0010,0010)
Patient's Birthdate	(0010,0030)
Patient Sex	(0010,0040)
Patient Size	(0010,1020()
Patient Weight	(0010,1030)
Patient Comments	(0010,4000)
Institution Name	(0008,0080)
Study Instance UID	(0020,000D)
Study ID	(0020,0010)
Accession Number	(0008,0050)
Study Description	(0008,1030)
Additional Patient History	(0010,21B0)

Study Date	(0008,0020)
Study Time	(0008,0030)
Referring Physician's Name	(0008,0090)
Series Number	(0020,0011)
Series Instance UID	(0020,000E)
Series Description	(0008,103E)
Modality	(0008,0060)
Laterality	(0020,0060)
Body Part Examined	(0018,0015)
Patient Position	(0018,5100)
Frame of Reference UID	(0020,0052)
Series Date	(0008,0021)
Series Time	(0008,0031)
Field of View Dimension(s)	(0018,1149)
Contrast/Bolus Agent	(0018,0010)
Instance Number	(0020,0013)

The PACS-IW system creates log files that can be used to monitor status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these log files. In addition, error messages may be output as alerts to the User Interface in certain cases.

The DICOMSend AE will exhibit the following behavior according to the Status Code value returned in a C-STORE Response from a destination C-STORE SCP:

Table 2.2.1-8 DICOMSend AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the exported SOP Instance. If

Service Status	Further Meaning	Error Code	Behavior
			the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating successful export. The QRServer AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. No message is posted to the User Interface.
Refused	Out of Resources	A700 – A7FF	This is treated as a permanent Failure. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating an export failure and the Association is released. The QRServer AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the log file. No message is posted to the User Interface.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a permanent Failure. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating an export failure and the Association is released. The QRServer AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the log file. No message is posted to the User Interface.
Error	Cannot Understand	C000 - CFFF	This is treated as a permanent Failure If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating an export failure and the Association is released. The QRServer AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the log file. No message is posted to the User Interface.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating successful export. The QRServer AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the log file. No message is posted to the User Interface.
Warning	Data Set does not match SOP Class	B007	Image transmission is considered successful. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating successful export. The QRServer AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the log file. No message is posted to the User Interface.
Warning	Elements Discarded	B006	Image transmission is considered successful. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating successful export. The QRServer AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response.

Service Status	Further Meaning	Error Code	Behavior
			Warning indication message is output to the log file. No message is posted to the User Interface.
Warning	Attribute List Error	0107	Image transmission is considered successful. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating successful export. The QRServer AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the log file. No message is posted to the User Interface.
Warning	Attribute Value Out of Range	0116	Image transmission is considered successful. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating successful export. The QRServer AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the log file. No message is posted to the User Interface.
*	*	Any other status code.	This is treated as a permanent Failure. If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating an export failure and the Association is released. The QRServer AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the log file. No message is posted to the User Interface.

All Status Codes indicating an error or refusal are treated as a permanent failure. The DICOMSend AE never automatically resends images when an error Status Code is returned in a C-STORE Response. For specific behavior regarding Status Code values returned in C-MOVE Responses, refer to the Services Supported as an SCP by the QR Server AE.

Table 2.2.1-9 DICOMSend AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT and if the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE y indicating an export failure. The QRServer AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the log file. No message is posted to the User Interface.
Association A-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	If the C-STORE occurred as a move sub-operation, a message is sent to the QRServer AE indicating an export failure. The QRServer AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the log file. No message is posted to the User Interface.

2.2.1.3.1.4 SOP Specific DICOM Conformance Statement for the Grayscale Softcopy Presentation State Storage SOP Class

Centricity PACS-IW creates Grayscale Presentation State SOP Instances when user selects to export the internal presentation state of the study or internal print pages (sets of key images). One or more objects are created to represent content of the internal presentation state. If more than one GSPS object is created, all of them are created with the same values of Presentation Label, Description, Author, Creation Date and Time.

The Presentation Label and Description are entered by the user at the time of the export of the presentation state. If GSPS objects are created as part of the export the key image set, the Label and description are set automatically.

See Section 2.2.1.3.1.3 "SOP Specific DICOM Conformance Statement for All Storage SOP Classes" for details on general Storage Service SCU processing also applicable to the Grayscale Softcopy Presentation State Storage SOP Class.

The product supports calibration of the monitors used for user creation of presentation states to the Grayscale Display Function Standard of DICOM. The monitors shall be calibrated according to their manufacturers' recommendations and instructions.

The Centricity PACS-IW supports creation of Grayscale Softcopy Presentation State Storage SOP Instances for the following Image Storage SOP Classes:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
Nuclear Medicine Image Storage*	1.2.840.10008.5.1.4.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Secondary Capture Image Storage*	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage*	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage*	1.2.840.10008.5.1.4.1.1.3.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1

SOP Class Name	SOP Class UID
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1

*For images of these SOP Classes, the GSPS is only created if an image has Photometric interpretation of MONOCHROME1 or MONOCHROME2.

The PACS-IW supports including the following presentation transforms in Grayscale Softcopy Presentation State SOP Instances:

Transform	Source of Transform Data
Modality LUT	Modality LUT is copied to the GSPS object from a displayed image
Mask (Subtraction)	Not Supported
VOI LUT	VOI LUT recorded in the GSPS object reflects VOI LUT applied to the displayed image
Presentation LUT	Set to "IDENTITY" if Photometric Interpretation of displayed image is MONOCHROME2 and to "INVERSE" if it is MONOCHROME1
Shutter	Not Supported
Image Annotation	Image Annotation recorded in the GSPS reflects graphic annotations created by the user on the displayed image
Spatial Transformation	Spatial Transformation reflects the spatial transformation applied to the displayed image
Display Area Annotation	Not Supported

2.2.1.3.1.5 SOP Specific DICOM Conformance Statement for the Key Object Selection Document SOP Class

The PACS-IW creates the Key Object Selection Document SOP instance when a user selects to export the internal set of key images (print pages). The images that are referenced by the KOS object are selected by placing them into the placeholders of the Print Page template. In addition, the set of GSPS objects are created to reflect presentation state of each of the image.

Note that the print page template information (such layout of images on a page, header and footer information) as well as annotations placed on the page (and not on a particular image) are not recorded in the KOS object

See Section <section number> "SOP Specific DICOM Conformance Statement for All Storage SOP Classes" for details on general Storage Service SCU processing also applicable to Key Object Selection Document SOP Class.

The PACS-IW supports creation and transmission of Key Object Selection Document SOP Instances referencing Instances of the following Storage SOP Classes:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
Grayscale Softcopy Presentation State Image Storage	1.2.840.10008.5.1.4.1.1.11.1

2.2.1.4 Association Acceptance Policy

DICOMSend AE does not accept associations.

2.2.2 DICOMQuery APPLICATION ENTITY SPECIFICATION

2.2.2.1 SOP Classes

The DICOMQuery AE provides Standard Conformance to the following DICOM SOP Classes.

Table 2.2.2-1. SOP Classes Supported by DICOMQuery AE

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

2.2.2.2 Association Establishment Policy

2.2.2.2.1 General

The DICOMQuery AE initiates Associations only when the PACS-IW user selects to query remote AE for the studies.

The DICOM standard Application Context Name for DICOM is always proposed:

Table 2.2.2-2 DICOM Application Context for DICOMQuery AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DICOMQuery AE is:

Maximum Length PDU	16384 (not configurable)

2.2.2.2.2 Number of Associations

The maximum number of simultaneous Associations is determined by a number of instances of DICOMQuery application invoked by all requests from users. This number is limited only by available system resources.

Table 2.2.2-3 Number of Associations as a SCU for DICOMQuery AE

Maximum number of simultaneous Associations	1 per instance; number of instances unlimited

2.2.2.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.2.2.4 Implementation Identifying Information

Table 2.2.2-5 DICOM Implementation Class and Version for DICOMQuery AE

Implementation Class UID	1.2.840.113654.2.3.1995.2.11.2
Implementation Version Name	MIRCTN17MAR2000

2.2.2.3 Association Initiation Policy

2.2.2.3.1 Activity – Query Request by PACS-IW User

2.2.2.3.1.1 Description and Sequencing of Activity

The DICOMQuery AE will initiate a new Association when the PACS-IW user requests to query DICOM server from the search screen. An Association Request is sent to the specified Destination AE and upon successful negotiation of the required Presentation Context the Query is sent. The Association will be released when the C_FIND response with the status other than PENDING is received. Received information is displayed to the user.

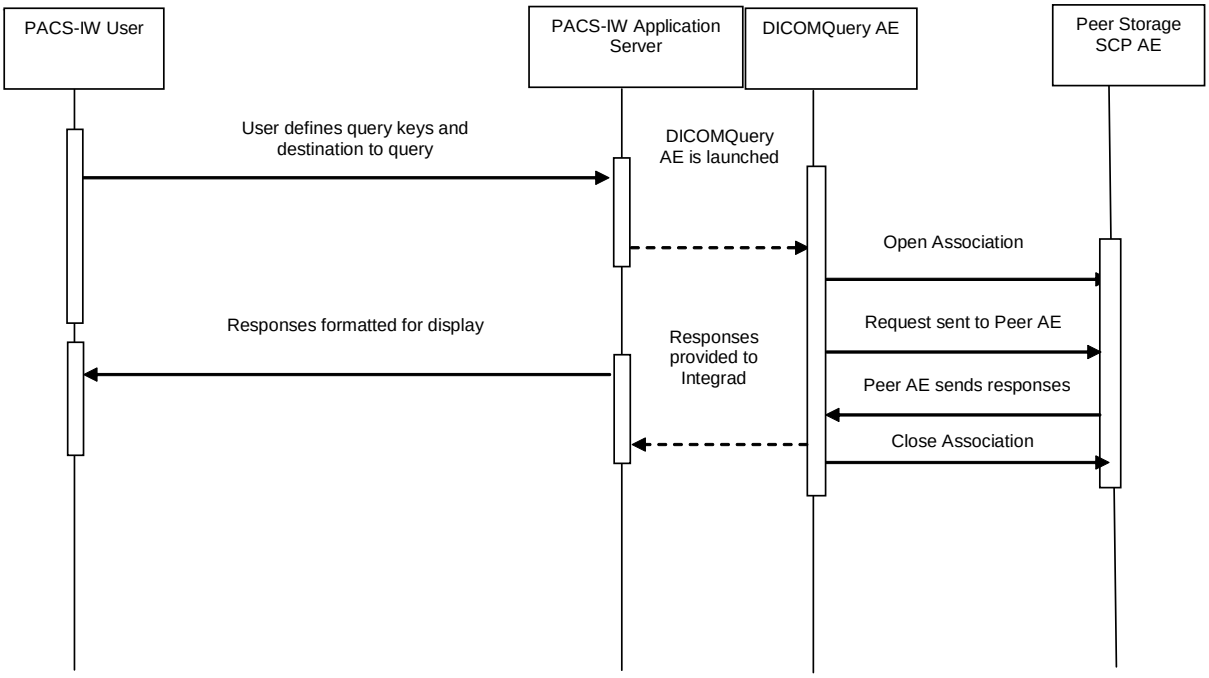


Figure 2.2.2-1 Sequencing of Activity - Send Query Requested by a User

The following sequencing constraints illustrated in Figure 2.2.2-1 apply to the DICOMQuery AE:

1. User indicates query keys and destination to query.
2. PACS-IW application server invokes DICOMQuery AE to send the C-FIND request to the Peer AE.
3. DICOMQuery AE opens a new Association with the indicated Destination AE.
4. DICOMQuery AE sends the indicated queries and receives one or more responses.
5. DICOMQuery AE closes the Association.

2.2.2.3.1.2 Proposed Presentation Contexts

DICOMQuery AE will propose Presentation Contexts as shown in the following table:

Table 2.2.2-6 Proposed Presentation Contexts by the DICOMQuery AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.2.3.1.3 SOP Specific Conformance for Study Root Q/R Information Model - FIND SOP Class

The DICOMQuery AE is used to query remote AE to determine whether or not it has studies corresponding to the matching criteria defined by the user. Thus, DICOMQuery AE only performs queries on the STUDY level

The following table shows the matching and return keys that are used in forming the query and it should be read as follows:

- Attribute Name – Attributes supported for returned C-FIND Responses.
- Tag – Appropriate DICOM tag for this attribute.
- VR – Appropriate DICOM VR for this attribute.
- Types of Matching – The types of Matching that may be requested by the C-FIND SCU:
  - "S" indicates the identifier attribute can specify Single Value Matching,
  - “R” indicates Range Matching,
  - “*”denotes wildcard matching,
  - “U” indicates universal matching,
  - “L” indicates that UID lists are supported for matching,

Table 2.2.2-7 Study Root C-FIND SCU Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
Study Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,U
Patient's Birth Date	0010,0030	DA	U
Patient's Birth Time	0010,0032	TM	U
Patient's Sex	0010,0040	CS	U

Level Name Attribute Name	Tag	VR	Types of Matching
Patient's Age	0010,1010	AS	U
Patient's Size	0010,1020	DS	U
Patient's Weight	0010,1030	DS	U
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	U
Study Instance UID	0020,000D	UI	U
Modalities In Study	0008,0061	CS	S
Referring Physician's Name	0008,0090	PN	U
Study Description	0008,1030	LO	U
Number of Study Related Series	0020,1206	IS	U
Number of Study Related Instances	0020,1208	IS	U

DICOMQuery AE will include the Specific Character Set (0008,0005) attribute into the Query request IF the system is installed with support of the non-English language. The value of the attribute will be defined by the configured language as described in the section 2.6.

DICOMQuery AE does not request any type of extended negotiation. In particular, it does not request from the SCP to perform fuzzy matching.

The PACS-IW system creates log files that can be used to monitor status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these log files. In addition, error messages may be output as alerts to the User Interface in certain cases.

DICOMQuery AE will never issue C-FIND-CANCEL command.

The DICOMQuery AE will exhibit the following behavior according to the Status Code value returned in a C-FIND Response from a destination SCP:

Table 2.2.2-8 DICOMQuery AE C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	All available matching records have been returned. All records are output to user interface.
Refused	Out of Resources	A700 – A7FF	This is treated as a permanent Failure. Error indication message is output to the log file. All records received so far are output to the User Interface.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a permanent Failure. Error indication message is output to the log file. All records received so far are output to the User Interface.
Error	Unable to process	C000 - CFFF	This is treated as a permanent Failure. Error indication message is output to the log file.

Service Status	Further Meaning	Error Code	Behavior
			All records received so far are output to the User Interface.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. Warning indication message is output to the log file. No message is posted to the User Interface.
Pending	Matches are continuing – Current Match is supplied.	FF00	Operation is in progress. Received information is stored for subsequent display to the user.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier.	FF01	Operation is in progress. Received information is stored for subsequent display to the user.
*	*	Any other status code.	This is treated as a permanent Failure. Error indication message is output to the log file. All records received so far are output to the User Interface.

Any return code not listed above is treated as indication of permanent failure, with the error message outputted into the log file. All records received before the error are output to the user interface.

The behavior of DICOMQuery AE in the case of communication failure is summarized in the following table:

Table 2.2.-9 DICOMQuery AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. Error indication message is output to the log file. No message is posted to the User Interface.
Association A-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error indication message is output to the log file. No message is posted to the User Interface.

2.2.2.3.2 Activity – Retrieve Request by PACS-IW User

2.2.2.3.2.1 Description and Sequencing of Activity

The DICOMQuery AE will initiate a new Association when the PACS-IW user requests to retrieve a selected study from remote DICOM storage. An Association Request is sent to the specified Destination AE and upon successful negotiation of the required Presentation Context the Retrieve request is sent. The Association will be released when the C-MOVE response with the status other than PENDING is received. User may request the study to be retrieved to the PACS-IW to any other destination. If PACS-IW is the Retrieve target, the study arrived to the system will be available for display.

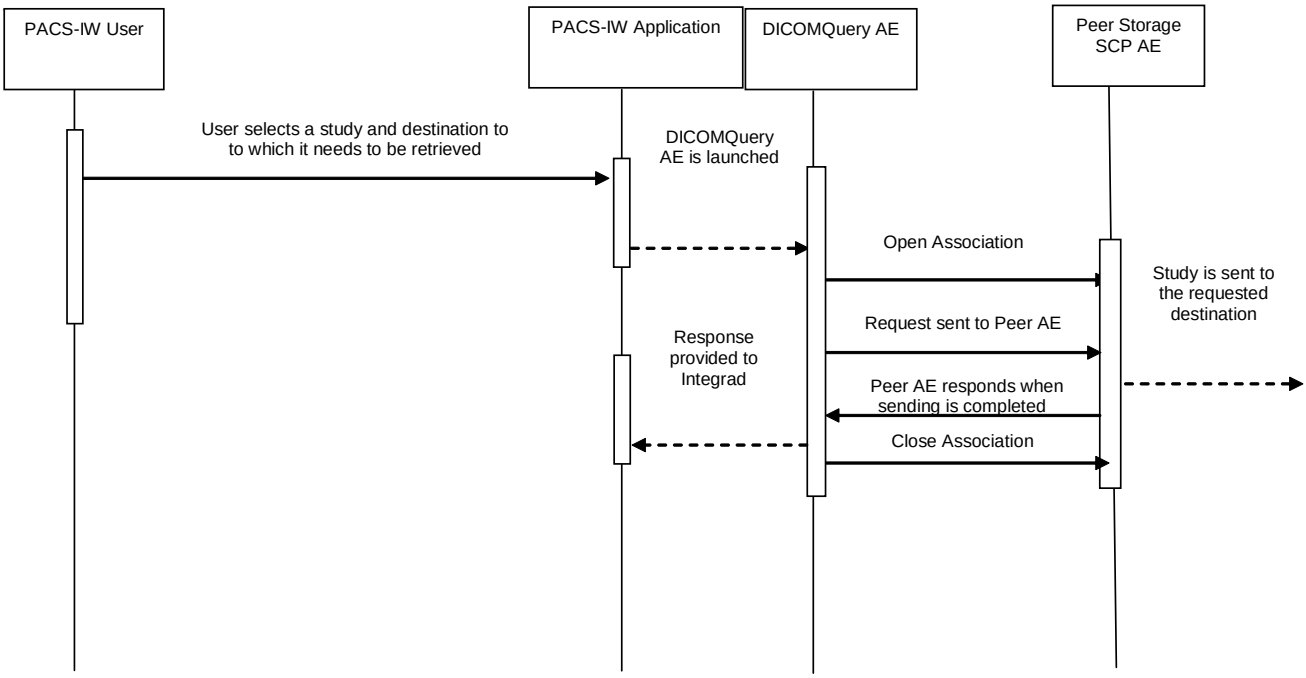


Figure 2.2.2-2 Sequencing of Activity – Retrieve Study Requested by a User

The following sequencing constraints illustrated in Figure 2.2.2-2 apply to the DICOMQuery AE:

1. User indicates query keys and destination to query.
2. PACS-IW application server invokes DICOMQuery AE to send the C-MOVE request to the Peer AE.
3. DICOMQuery AE opens a new Association with the indicated PEER AE.
4. DICOMQuery AE sends the Retrieve request and awaits the response indicating that transfer is completed.
5. DICOMQuery AE closes the Association.

2.2.2.3.2.2 Proposed Presentation Contexts

DICOMQuery AE will propose Presentation Contexts as shown in the following table:

Table 2.2.2-10 Proposed Presentation Contexts by the DICOMQuery AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.2.3.2.3 SOP Specific Conformance for Study Root Q/R Information Model - MOVE SOP Class

The DICOMQuery provides standard conformance to the supported C-MOVE SOP Class and is used to request a remote AE to transfer a specific study to another destination. Thus, DICOMQuery AE only performs C-MOVE request at the STUDY level and supports only one information model, Study Root.

If the retrieve fails, for whatever reason, no retry will be performed.

The target AE from which retrieve is to be performed is determined by the user at the request time. The SOP instances constituting a study are retrieved to the AE whose AE Title has been specified by the user at the request time. This can be current AETitle of the PACS-IW's DICOMServer AE or any other AE Title which is typed in by the user. This implies that the remote C-MOVE SCP must be preconfigured to determine the presentation address corresponding to the specified Move Destination AE Title.

The following table shows the matching keys that are used in forming the request and it should be read as follows:

- Attribute Name – Attributes supported as a matching key.
- Tag – Appropriate DICOM tag for this attribute.
- VR – Appropriate DICOM VR for this attribute.
- Types of Matching – The types of Matching used by the C-MOVE SCU:
    - "S" indicates the identifier attribute can specify Single Value Matching,

Table 2.2.2-11 Study Root C-MOVE SCU Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
Study Level Study Instance UID	0020,000D	UI	S

The PACS-IW system creates log files that can be used to monitor status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these log files. In addition, error messages may be output as alerts to the User Interface in certain cases.

DICOMQuery AE will never issue C-MOVE-CANCEL command.

The DICOMQuery AE will exhibit the following behavior according to the Status Code value returned in a C-FIND Response from a destination SCP:

Table 2.2.2-12 DICOMQuery AE C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations complete – No Failures	0000	All Instances are successfully retrieved. No message is posted to the User Interface.
Refused	Out of Resources	A700 – A7FF	This is treated as a permanent Failure. Error indication message is output to the log file. No message is posted to the User Interface.
Refused	Move Destination Unknown	A801	This is treated as a permanent Failure. Error indication message is output to the log file. No message is posted to the User Interface.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a permanent Failure. Error indication message is output to the log file. No message is posted to the User Interface.
Error	Unable to process	C000 - CFFF	This is treated as a permanent Failure. Error indication message is output to the log file. No message is posted to the User Interface.
Warning	Sub-operations complete – One or more Failures	B000	Image transmission is considered successful. Warning indication message is output to the log file. No message is posted to the User Interface.
Pending	Sub-operations are continuing	FF00	Operation is in progress. The response is ignored.
*	*	Any other status code.	This is treated as a permanent Failure. Error indication message is output to the log file. No message is posted to the User Interface.

The behavior of DICOMQuery AE in the case of communication failure is summarized in the following table:

Table 2.2.2-13 DICOMQuery AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. Error indication message is output to the log file. No message is posted to the User Interface.
Association A-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error indication message is output to the log file. No message is posted to the User Interface.

2.2.2.4 Association Acceptance Policy

DICOMQuery AE does not accept associations.

2.2.3 QRSERVER APPLICATION ENTITY SPECIFICATION

2.2.3.1 SOP Classes

The QRServer AE provides Standard Conformance to the following DICOM SOP Classes:

Table 2.2.3-1 SOP Classes for QRServer AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	No	Yes
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	No	Yes
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	No	Yes
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	No	Yes

2.2.3.2 Association Establishment Policies

2.2.3.2.1 General

The QRServer AE will never initiate Associations; it only accepts Association Requests from external DICOM AEs. The QRServer AE will accept Associations for Verification, C-FIND, and C-MOVE requests. In the case of a C-MOVE request, the QRServer AE will invoke the DICOMSend AE to initiate an Association with the Destination DICOM AE to send objects as specified by the originator of the C-MOVE Request.

The DICOM standard Application Context Name for DICOM is always accepted:

Table 2.2.3-2 DICOM Application Context for QRServer AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the QRServer AE is:

Maximum Length PDU	0 (unlimited, not configurable)

2.2.3.2.2 Number of Associations

The QRServer AE supports multiple simultaneous Associations. Each time the QRServer AE receives an Association request, a separate thread will be spawned to process the Verification, Query, or Retrieval request. The maximum number of threads, and thus the maximum number of simultaneous Associations that can be processed, is set by configuration. The default maximum is 5.

Table 2.2.3-3 Number of Simultaneous Associations as a SCP for QRServer AE

Maximum number of simultaneous Associations	5 (Configurable)

2.2.3.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.3.2.4 Implementation Identifying Information

The implementation information for the Application Entity is:

Table 2.2.3-5 DICOM Implementation Class and Version for QRServer AE

Implementation Class UID	1.2.840.114356.0.4
Implementation Version Name	Not provided

Note that the QRServer's implementation does not provide Implementation Version Name during association negotiation.

2.2.3.3 Association Initiation Policy

The QRServer AE does not initiate Associations.

2.2.3.4 Association Acceptance Policy

2.2.3.4.1 Activity – Handling Query and Retrieval Requests

2.2.3.4.1.1 Description and Sequencing of Activity

The QRServer AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected.

If QRServer AE receives a query (C-FIND) request then the response(s) will be sent over the same Association used to send the C-FIND-Request.

If QRServer AE receives a retrieval (C-MOVE) request then the responses will be sent over the same Association used to send the C-MOVE-Request. The QRServer AE will invoke the DICOMSend AE to send the requested SOP Instances to the C-MOVE Destination. The DICOMSend AE notifies the QRServer AE of the success or failure of an attempt to send all requested Composite SOP Instance to the peer C-MOVE Destination AE. The QRServer AE will not send a C-MOVE Response indicating the intermediate status of transmission. Once the DICOMSend AE has finished attempting to transfer all the requested SOP Instances, the QRServer AE sends a final C-MOVE Response indicating the overall status of the attempted retrieval.

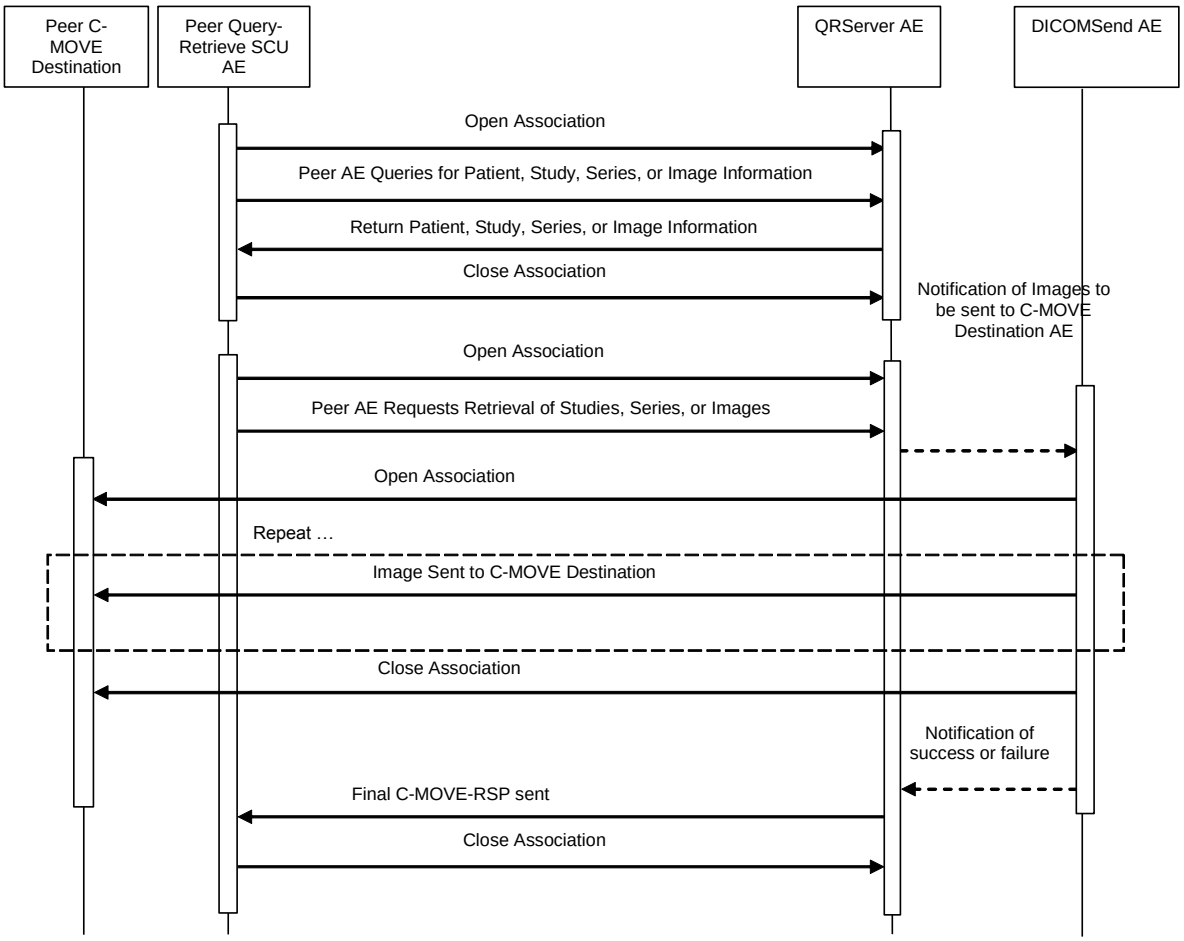


Figure 2.2.3-1 Sequencing of Activity – Handling Query and Retrieval Requests

The following sequencing constraints illustrated in Figure 2.2.3-1 apply to the QRServer AE for handling queries (C-FIND-Requests):

1. Peer AE opens an Association with the QRServer AE.
2. Peer AE sends a C-FIND-RQ Message.
3. QRServer AE returns a C-FIND-RSP Message to the peer AE with matching information. A C-FIND-RSP is sent for each entity matching the identifier specified in the C-FIND-RQ. A final C-FIND-RSP is sent indicating that the matching is complete.
4. Peer AE closes the Association. Note that the peer AE does not have to close the Association immediately. Further C-FIND or C-MOVE Requests can be sent over the Association before it is closed.

The following sequencing constraints illustrated in 2.2.3-1 apply to the QRServer AE for handling retrievals (C-MOVE-Requests):

1. Peer AE opens an Association with the QRSERVER AE.
2. Peer AE sends a C-MOVE-RQ Message

3. QRServer AE invokes the DICOMSend AE to send the Composite SOP Instances to the peer C-MOVE Destination AE as indicated in the C-MOVE-RQ.
4. After attempting to send a SOP Instance, the DICOMSend AE indicates to the QRServer AE whether the transfer succeeded or failed.
5. Once the DICOMSend AE has completed all attempts to transfer the SOP Instances to the C-MOVE Destination AE, the QRServer AE sends a final C-MOVE-RSP indicating the overall success or failure of the retrieval.
6. Peer AE closes the Association. Note that the peer AE does not have to close the Association immediately. Further C-FIND or C-MOVE Requests can be sent over the Association before it is closed.

The QRServer AE may reject Association attempts as shown in the table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

1 – DICOM UL service-user

2 – DICOM UL service-provider (ASCE related function)

3 – DICOM UL service-provider (Presentation related function)

Table 2.2.3-6 Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
2 – rejected-transient	3	2 – local-limit-exceeded	The (configurable) maximum number of simultaneous Associations has been reached. An Association request with the same parameters may succeed at a later time.
1 – rejected-permanent	1	2 – application-context-name-not-supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will not succeed at a later time.
1 – rejected-permanent	1	7 – called-AE-title-not-recognized	The Association request contained an unrecognized Called AE Title. An Association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the Association initiator is incorrectly configured and attempts to address the Association acceptor using the wrong AE Title.
1 – rejected-permanent	2	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time.

Note: QRServer AE does not check the Calling AE Title of the Association requestor.

2.2.3.4.1.2 Accepted Presentation Contexts

QRServer AE will accept Presentation Contexts as shown in the following table:

Table 2.2.3-7 Accepted Presentation Contexts by the QRServer AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.2.3.4.1.3 SOP Specific Conformance for Verification SOP Class

The QRServer AE provides standard conformance to the Verification SOP Class as an SCP.

2.2.3.4.1.4 SOP Specific Conformance for Query SOP Classes

The QRServer AE supports hierarchical queries and not relational queries. If so configured, the QRServer will return the attribute Instance Availability (0008,0056) with value of "ONLINE" in each response identifier. Otherwise, only those attributes requested in the query identifier are returned. Query responses always return values from the PACS-IW database. Exported SOP Instances are always updated with the latest values in the database prior to export. Thus, a change in Patient demographic information will be contained in both the C-FIND Responses and any Composite SOP Instances exported to a C-MOVE Destination AE.

Query Extended Negotiation is not supported. Fuzzy matching is not supported. Matching of PatientName is case-insensitive.

2.2.3.4.1.4.1 Patient Root Information Model

All required search keys on each of the four levels (Patient, Study, Series, and Object) are supported (see table 2.2.3-8 for the list of all supported elements).

2.2.3.4.1.4.2 Study Root Information Model

All the required search keys on each of the three levels (Study, Series, and Object) are supported (see table 2.2.3-9 for the list of all supported elements).

The tables 2.2.3-8 and 2.2.3-9 should be read as follows:

- Attribute Name – Attributes supported for returned C-FIND Responses.

- Tag – Appropriate DICOM tag for this attribute.
- VR – Appropriate DICOM VR for this attribute.
- Types of Matching – The types of Matching supported by the C-FIND SCP:
    - "S" indicates the identifier attribute can specify Single Value Matching,
    - “R” indicates Range Matching,
    - “*”denotes wildcard matching,
    - “U” indicates universal matching,
    - “L” indicates that UID lists are supported for matching,

Table 2.2.3-8 Patient Root C-FIND SCP Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
Patient Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,U
Patient's Birth Date	0010,0030	DA	S,U
Patient's Birth Time	0010,0032	TM	U
Patient's Sex	0010,0040	CS	U
Patient’s Age	0010,1010	AS	U
Patient’s Size	0010,1020	DS	U
Patient’s Weight	0010,1030	DS	U
Study Level			
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U
Modalities In Study	0008,0061	CS	S,U
Referring Physician's Name	0008,0090	PN	S,U
Study Description	0008,1030	LO	S,U
Number of Study Related Series	0020,1206	IS	U
Number of Study Related Instances	0020,1208	IS	U
Series Level			
Modality	0008,0060	CS	S,U
Series Number	0020,0011	IS	S,*,U
Series Instance UID	0020,000E	UI	S,U
Series Description	0008,103E	LO	U
Body Part Examined	0018,0015	CS	U
Number of Series Related Instances	0020,1209	IS	U
Image Level			

Level Name Attribute Name	Tag	VR	Types of Matching
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U
SOP Class UID	0008,0016	UI	U
Samples Per Pixel	0028,0002	US	U
Rows	0028,0010	US	U
Columns	0028,0011	US	U
Bits Allocated	0028,0100	US	U
Bits Stored	0028,0101	US	U
Pixel Representation	0028,0103	US	U
Content Date	0008,0023	DA	U
Content Time	0008,0033	TM	U
Observation DateTime	0040,A032	DT	U

Table 2.2.3-9 Study Root C-FIND SCP Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
Study Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,U
Patient's Birth Date	0010,0030	DA	U
Patient's Birth Time	0010,0032	TM	U
Patient's Sex	0010,0040	CS	U
Patient’s Age	0010,1010	AS	U
Patient’s Size	0010,1020	DS	U
Patient’s Weight	0010,1030	DS	U
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U
Modalities In Study	0008,0061	CS	S
Referring Physician's Name	0008,0090	PN	U
Study Description	0008,1030	LO	U
Number of Study Related Series	0020,1206	IS	U
Number of Study Related Instances	0020,1208	IS	U
Series Level			
Modality	0008,0060	CS	S,U
Series Number	0020,0011	IS	S,*,U
Series Instance UID	0020,000E	UI	S,U
Series Description	0008,103E	LO	U
Body Part Examined	0018,0015	CS	U

Level Name Attribute Name	Tag	VR	Types of Matching
Number of Series Related Instances	0020,1209	IS	U
Image Level			
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U
SOP Class UID	0008,0016	UI	U
Samples Per Pixel	0028,0002	US	U
Rows	0028,0010	US	U
Columns	0028,0011	US	U
Bits Allocated	0028,0100	US	U
Bits Stored	0028,0101	US	U
Pixel Representation	0028,0103	US	U
Content Date	0008,0023	DA	U
Content Time	0008,0033	TM	U
Observation DateTime	0040,A032	DT	U

Table 2.2.3-10 QRServer AE C-FIND Response Status Return Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied.
Refused	Out of Resources	A700	System reached the limit in disk space or memory usage. Error message is output to as an alert to the User Interface, and to the Service Log.
Failed	Identifier does not match SOP Class	A900	The C-FIND query identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class. Error message is output to the Service Log.
	Unable to process	C001	The C-FIND query identifier is valid for the specified SOP Class but cannot be used to query the database. For example, this can occur if a Patient Level query is issued but the identifier has only empty values for both the Patient ID and the Patient Name. Error message is output to the Service Log.
Cancel	Matching terminated due to Cancel Request	FE00	The C-FIND SCU sent a Cancel Request. This has been acknowledged and the search for matches has been halted.
Pending	Matches are continuing and current match is supplied.	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. This status code is returned if all Optional keys in the query identifier are actually supported.

2.2.3.4.1.5 SOP Specific Conformance for Retrieval SOP Classes

The QRServer AE will convey to the DICOMSend AE that an Association with a DICOM Application Entity named by the external C-MOVE SCU (through a MOVE Destination AE Title) should be established. It will also convey to the DICOMSend AE to perform C-STORE operations on specific images requested by the external C-MOVE SCU. One or more of the Image Storage Presentation Contexts listed in table 2.2.1-6 will be negotiated.

Only one C-MOVE Response will be returned. If the C-MOVE Request itself cannot be processed, failure response will be sent immediately. Otherwise, the QRServer AE will return a response after the DICOMSend AE completes its attempts to send all requested images. This response reports the number of remaining SOP Instances to transfer (which always be 0), and the number transferred having a successful, failed, or warning status.

Table 2.2.3-11 QRServer AE C-MOVE Response Status Return Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations complete – No Failures	0000	All the Composite SOP Instances have been successfully sent to the C-MOVE Destination AE.
Warning	Sub-operations complete – One or more Failures	B000	Some but not all the Composite SOP Instances have been successfully sent to the C-MOVE Destination AE. Returned if the count of failed sub-operations is greater than 0. Warning message is output to the log file.
Refused	Out of Resources – Unable to calculate number of matches	A701	Number of matches cannot be determined due to system failure. Returned if the server's database is not functioning so the search for matches to the C-MOVE Request cannot be found. Error message is output to the log file.
	Out of Resources – Unable to perform sub-operations	A702	C-STORE sub-operations cannot be performed due to failure to access Composite SOP Instances in archive, or failure of a C-STORE Request. For example, this Status will be returned if the required SOP Instances are missing from expected location, or if the C-STORE SCP rejects association. Error message is output to the log file.
	Move destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to Query-Retrieve SCP AE. Error message is output to the log file.
Failed	Identifier does not match SOP Class	A900	The C-MOVE identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class or retrieval level. Error message is output to the log file.
Cancel	Matching terminated due to Cancel Request	FE00	The C-MOVE SCU sent a Cancel Request. This has been acknowledged and the export of Composite SOP Instances to the C-MOVE Destination AE has been halted.

Pending	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Table 2.2.3-12 QRServer AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). I.e. The QRServer AE is waiting for the next message PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the log file. If the DICOMSend AE is still exporting Composite SOP Instances as a result of an earlier C-MOVE Request received on this Association, it will continue attempting to complete the entire C-MOVE Request.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the log file. If the DICOMSend AE is still exporting Composite SOP Instances as a result of an earlier C-MOVE Request received on this Association, it will continue attempting to complete the entire C-MOVE Request.

2.2.4 DICOMSERVER APPLICATION ENTITY SPECIFICATION

2.2.4.1 SOP Classes

The DICOMServer applications provide Standard Conformance to the following DICOM SOP Classes.

TABLE 2.2.4-1. SOP Classes Supported by DICOMServer AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	No	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.2	No	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.2.1	No	Yes
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.6	No	Yes
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.3	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.4.1	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.	No	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	No	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	No	Yes

2.2.4.2 Association Establishment Policy

2.2.4.2.1 General

The DICOMServer AE will never initiate Associations; it only accepts Association Requests from external DICOM AEs. The DICOMServer AE will accept Associations for Verification and C-STORE requests.

The DICOM standard Application Context Name for DICOM is always accepted:

Table 2.2.4-2 DICOM Application Context for DICOMServer AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DICOMServer AE is:

Maximum Length PDU	16384 (not configurable)

2.2.4.2.2 Number of Associations

The DICOMServer AE supports multiple simultaneous Associations. Each time the DICOMServer AE receives an Association request, a separate thread will be spawned to process the Verification, or

Storage request. The maximum number of threads, and thus the maximum number of simultaneous Associations that can be processed, is limited only by the system resources.

Table 2.2.4-3 Number of Simultaneous Associations as a SCP for DICOMServer AE

Maximum number of simultaneous Associations	Unlimited

2.2.4.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.4.2.4 Implementation Identifying Information

Table 2.2.4-5 DICOM Implementation Class and Version for DICOMServer AE

Implementation Class UID	1.2.840.113654.2.3.1995.2.11.2
Implementation Version Name	MIRCTN17MAR2000

2.2.4.3 Association Initiation Policy

DICOMServer does not initiate Associations.

2.2.4.4 Association Acceptance Policy

2.2.4.4.1 Activity – Receive Objects

2.2.4.4.1.1 Description and Sequencing of Activity

The DICOMServer accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected.

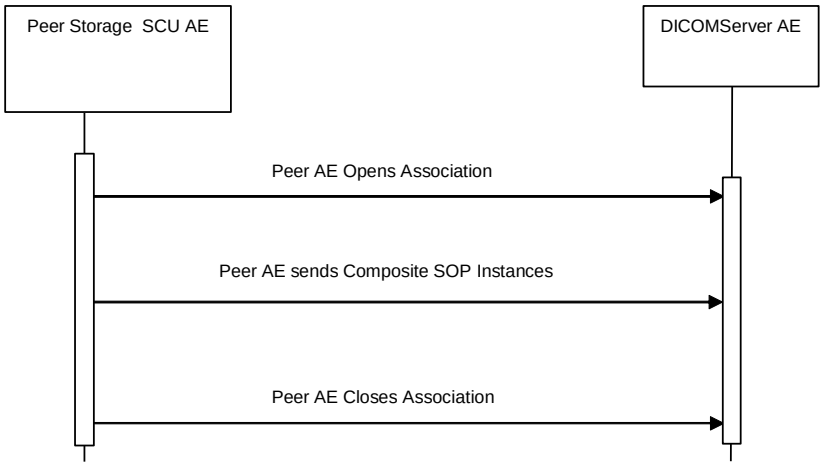


Figure 2.2.4-1 Sequencing of Activity – Receive Objects

The following sequencing constraints illustrated in Figure 2.2.4-1 apply to the DICOMServer AE for handling Storage Requests over the original Association:

1. Peer AE opens an Association with the DICOMServer AE.
2. Peer AE sends one or more Composite SOP Instances.
3. Peer AE closes the Association.

The DICOMServer AE may reject Association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

1 – DICOM UL service-user

2 – DICOM UL service-provider (ASCE related function)

3 – DICOM UL service-provider (Presentation related function)

Table 2.2.4-6 Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
1 – rejected-permanent	1	2 – application-context-name-not-supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will not succeed at a later time.
1 – rejected-permanent	1	7 – called-AE-title-not-recognized	The Association request contained an unrecognized Called AE Title. An Association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the Association initiator is incorrectly configured and attempts to address the Association acceptor using the wrong AE Title.
1 – rejected-permanent	2	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time.

Note: DICOMServer AE does not check the Calling AE Title of the Association requestor.

2.2.4.4.1.2 Accepted Presentation Contexts

The DICOMServer AE supports only the Implicit VR Little Endian Transfer Syntax for all Associations.

Any of the Presentation Contexts shown in the following table are acceptable to the DICOMServer AE for receiving objects.

Table 2.2.4-7 Accepted Presentation Contexts by DICOMServer AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Computer Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext.**
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
US Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
US Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
US Multi-frame Storage	1.2.840.10008.5.1.4.1.1.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Digital X-Ray Image Storage	1.2.840.10008.5.1.4.1.1.1.1	DICOM Implicit VR	1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext.**
- For Presentation		Little Endian			
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.3.	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Grayscale Softcopy	1.2.840.10008.5.1.4.1.1.11.1	DICOM Implicit VR	1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext.**
Presentation State Storage		Little Endian			
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.2.4.4.1.3 SOP Specific Conformance for Verification SOP Class

The DICOMServer AE provides standard conformance to the Verification SOP Class as an SCP.

2.2.4.4.1.4 SOP Specific Conformance for All Storage SOP Classes

The activity associated with the C-STORE operation is the storage of the object on the disk of the system upon which the DICOMServer is running. Objects are stored by writing the data set of the C-STORE command directly to disk with no further header or interpretation.

The DICOMServer AE is Level 2 (Full) conformant as a Storage SCP. In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files. In addition to saving all Elements in files, a subset of the Elements are stored in the PACS-IW database to support query and retrieval requests and also allow updating of Patient, Study, and Series information by user input, or demographic and Study related messages.

DICOMServer AE does not coerce any attributes. The coercion of attributes may be done by DICOMSend AE (see Section 2.2.1.3.1.2 for further details).

DICOMServer AE provides Level 1 support of Digital Signatures.

The DICOMServer AE does not have any dependencies on the number of Associations used to send objects to it. Objects belonging to more than one Study or Series can be sent over a single or multiple Associations. Objects belonging to a single Study or Series can also be sent over different Associations. There is no limit on either the number of SOP Instances or the maximum amount of total SOP Instance data that can be transferred over a single Association.

If a triplet of Study Instance UID, Series Instance UID and SOP Instance UID of the received SOP Instance matches with an existing triplet of UIDs of an object stored in the system, SOP Instance UID, the newly received object will be ignored. The new SOP Instance will be held in temporary area of duplicate objects for possible analysis.

For the purposes of object display the system supports the following photometric interpretations: MONOCHROME1, MONOCHROME2, RGB.

It is expected that optimal Window Center and Width values are specified in the DICOM Object Objects if they have greater than 8 bits of object data stored per sample. If optimal Window Center and Width values are not provided, then the PACS-IW is capable of estimating values using histogram analysis.

The DICOMServer will issue a failure status if it is unable to store the object on disk, if the object does not conform to the IOD of the SOP class under which it was transmitted, or if the object server is not able to successfully update its object database:

Table 2.2.4-8 DICOMServer AE C-STORE Response Status Return Reasons

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the system database.
Refused	Out of Resources	A710	Indicates that there was not enough memory to process the image. Error message is output to the log file. The SOP Instance will not be saved.
Refused	Out of Resources	A711 - A717	Indicates that there was not enough disk space available to store the image. Error message is output to the log file. The SOP Instance will not be saved.
Error	Data Set does not match SOP Class	A900	Indicates that the Data Set does not encode a valid instance of the SOP Class specified. This status is returned if the DICOM Object stream can be successfully parsed but does not contain values for one or more mandatory Elements of the SOP Class. The DICOMServer AE does not perform a comprehensive check, as it only checks a subset of required Elements. In addition, if the SOP Class is for a type of image but the SOP Instance does not contain values necessary for its display then this status is returned. Error message is output to the log file. The SOP Instance will not be saved.
	Cannot understand	C010	Indicates that the DICOMServer AE cannot parse the Data Set into Elements, in particular, if an object does not contain pixel data Error message is output to the log file. The SOP Instance will not be saved.
		C011	Indicates that the DICOMServer AE cannot parse the Data Set into Elements, in particular, if pixel data size does not match expected length. Error message is output to the log file. The SOP Instance will not be saved.
		C012	Indicates that the DICOMServer AE cannot parse the Data Set into Elements, in particular, if it cannot read pixel data Error message is output to the log file. The SOP Instance will not be saved.

The behavior of DICOMServer AE during communication failure is summarized in the following table:

Table 2.2.4-9 DICOMServer AE Storage Service Communication Failure Reasons

Exception	Reason
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If a C-STORE Data

I.e. The DICOMServer AE is waiting for the next C-STORE Data Set PDU but the timer expires.	Set has not been fully received then the data already received is discarded. If some Composite SOP Instances have already been successfully received over the Association then they are maintained in the database.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received then they are maintained in the database. They are not automatically discarded because of a later failure.

2.2.4.4.1.5 SOP Specific DICOM Conformance Statement for the Grayscale Softcopy Presentation State Storage SOP Class

See Section 2.2.4.4.1.4 "SOP Specific DICOM Conformance Statement for All Storage SOP Classes" for details on general Storage Service SCP processing also applicable to the Grayscale Softcopy Presentation State Storage SOP Class.

The product supports calibration of the monitors used for display of images to the Grayscale Display Function Standard of DICOM. Monitors have to be calibrated according to their manufacturers's recommendations.

The PACS-IW supports use of Grayscale Softcopy Presentation State Storage SOP Instances for the display presentation of the following Image Storage SOP Classes:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
Nuclear Medicine Image Storage*	1.2.840.10008.5.1.4.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Secondary Capture Image Storage*	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage*	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage*	1.2.840.10008.5.1.4.1.1.3.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.

SOP Class Name	SOP Class UID
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1

*For images of these SOP Classes, the GSPS is only applied if an image has Photometric interpretation of MONOCHROME1 or MONOCHROME2.

The PACS-IW supports including the following presentation transforms in Grayscale Softcopy Presentation State SOP Instances:

Transform	Source of Transform Data
Modality LUT	Modality LUT specified in GSPS is applied to the referenced image when it is displayed
Mask (Subtraction)	Not Supported
VOI LUT	VOI LUT specified in GSPS is applied to the referenced image when it is displayed
Presentation LUT	Only "IDENTITY" and "INVERSE" Presentation LUTs are supported. Non-Linear Presentation LUT is not supported
Shutter	Shutter specified in GSPS is applied to the referenced image when it is displayed
Image Annotation	Image Annotation specified in GSPS is applied to the referenced image when it is displayed
Spatial Transformation	Spatial Transformation specified in GSPS is applied to the referenced image when it is displayed
Display Area Annotation	Not Supported

When displaying an image, the most recently saved Grayscale Softcopy Presentation State containing references to the image will be automatically applied, and the GSPS Presentation Label and Presentation Description will be displayed. The user has the option to select another Presentation State that also references the image.

2.2.4.4.1.6 SOP Specific DICOM Conformance Statement for the Key Object Selection Document SOP Class

See Section 2.2.4.4.1.4 "SOP Specific DICOM Conformance Statement for All Storage SOP Classes" for details on general Storage Service SCP processing also applicable to the Key Object Selection Document Storage SOP Class.

The Key Object Selection Document is rendered in the form of PACS-IW Print Page (Key Image Set, where images are displayed in the placeholders of the default Print Page Template.

The <Name of the AE> supports rendering of instances of the following Storage SOP Classes referenced in Key Object Selection Document , provided the referenced instances are locally stored on this product. If the referenced instances are not locally stored, the application will display an error message in the corresponding placeholder.

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
Grayscale Softcopy Presentation State Image Storage	1.2.840.10008.5.1.4.1.1.11.1

2.2.5 SCSERVER APPLICATION ENTITY SPECIFICATION

2.2.5.1 SOP Classes

The SCServer AE provides Standard Conformance to the following DICOM SOP Classes:

Table 2.2.5-1 SOP Classes for SCServer AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	No	Yes
Storage Commitment Push Model	1.2.840.10008.1.20.1	No	Yes

2.2.5.2 Association Establishment Policies

2.2.5.2.1 General

The SCServer AE can both accept and propose Association Requests. The SCServer AE will accept Association Requests for the Storage Commitment Push Model Services. It will propose Associations for the Storage Commitment Push Model Service.

The DICOM standard Application Context Name for DICOM 3.0 is always accepted:

Table 2.2.5-2 DICOM Application Context for SCServer AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the SCServer AE is:

Maximum Length PDU	16384 (not configurable)

2.2.5.2.2 Number of Associations

The SCServer AE can support multiple simultaneous Associations requested by peer AEs. Each time the SCServer AE receives an Association, a separate thread will be spawned to process the Storage Commitment Push Model Service requests. The maximum number of threads, and thus the maximum number of simultaneous Associations that can be processed, depends only on the system resources.

The SCServer AE initiates one Association at a time for sending Storage Commitment Push Model N-EVENT-REPORTs to peer AEs. If communication does not successfully complete, SCServer attempts to repeatedly send the unsuccessful notification after configurable delay, for configurable number of times.

Table 2.2.5-3 Number of Simultaneous Associations as an SCP for QRServer AE

Maximum number of simultaneous Associations proposed by peer AE	Unlimited
Maximum number of simultaneous Associations proposed by SCServer AE	1

2.2.5.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.5.2.4 Implementation Identifying Information

The implementation information for the Application Entity is:

Table 2.2.5-5 DICOM Implementation Class and Version for SCServer AE

Implementation Class UID	1.2.840.114356.0.4
Implementation Version Name	Not provided

Note that the SCServer's implementation does not provide Implementation Version Name during association negotiation.

2.2.5.3 Association Initiation Policy

2.2.5.3.1 Activity – Send Storage Commitment Notification over new Association

2.2.5.3.1.1 Description and Sequencing of Activity

The SCServer AE will always initiate a new Association. A new Association will always be requested by the SCServer AE even if the peer AE requests another Association after the original has been closed, and which is available at the time the notification is sent For example, a peer AE opens an Association and sends some Storage requests and a Storage Commitment Push Model request. Before the SCServer AE can send the Storage Commitment Push Model N-EVEN-REPORT the Association is closed. The peer AE then opens another Association and sends another Storage Commitment request. In such a case the SCServer AE will always initiate a new Association to send the N-EVENT-REPORT for the first request even though it could send the N-EVENT-REPORT over the new Association opened by the peer AE.

An Association Request is sent to the peer AE that sent the Storage Commitment Push Model request and upon successful negotiation of the required Presentation Context the outstanding N-EVENT-REPORT is sent. Association is subsequently closed. If there are multiple outstanding N-EVENT-REPORTs, each one will be sent over a separate association. If any type of error occurs during transmission (either a communication failure or indicated by a Status Code returned by the peer AE) over an open Association then the transfer of N-EVENT-REPORT will be queued up for retries at configurable intervals, for configurable number of tries.

The sequencing of events while sending a Storage Commitment Push Model Notifications (N-EVENT-REPORT), is illustrated in Figure 2.2.5-1.

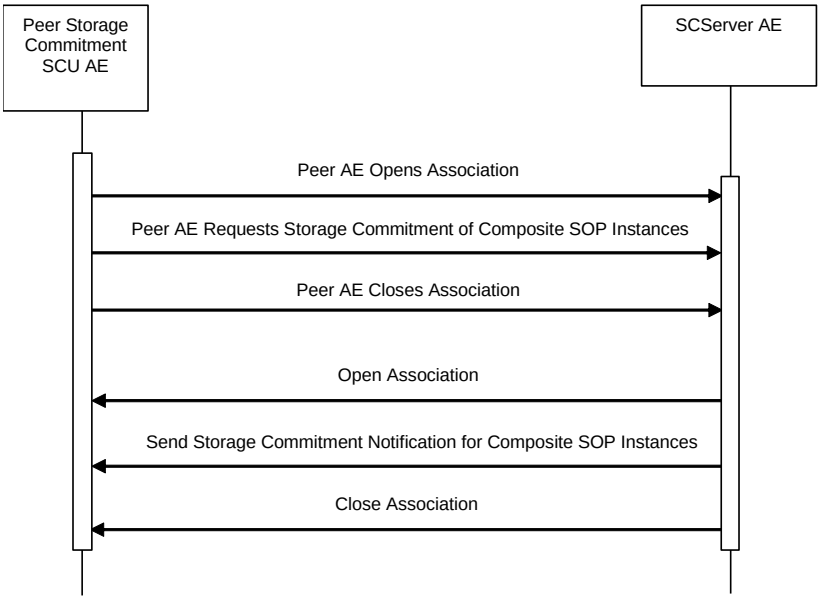


Figure 2.2.5-1 Sequencing of Activity –
Send Storage Commitment Notification Over New Association

The following sequencing constraints illustrated in 2.2.5-1 apply to the SCServer AE for handling Storage Commitment Push Model Requests using a new Association:

1. Peer AE opens an Association with the SCServer AE.
2. Peer AE requests Storage Commitment of Composite SOP Instance(s) (peer sends N-ACTION-RQ and SCServer AE responds with N-ACTION-RSP to indicate that it received the request).
3. Peer AE closes the Association before the SCServer AE can successfully send the Storage Commitment Push Model Notification (N-EVENT-REPORT-RQ).
4. SCServer AE opens an Association with the peer AE.
5. SCServer AE sends Storage Commitment Push Model Notification (N-EVENT-REPORT). More than one can be sent over a single Association if multiple Notifications are outstanding.
6. SCServer AE closes the Association with the peer AE.

2.2.5.3.1.2 Proposed Presentation Contexts

SCServer AE will propose Presentation Contexts as shown in the following table:

Table 2.2.5-6 Proposed Presentation Contexts by the SCServer AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name**	**UID**		
Storage Commitment	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Push Model					

2.2.5.3.1.3 SOP Specific Conformance for Storage Commitment Push Model SOP Class

The associated Activity with the Storage Commitment Push Model service is the communication by the SCServer AE to peer AEs that it has committed to permanently store Composite SOP Instances that have been sent to it. It thus allows peer AEs to determine whether PACS-IW has taken responsibility for the archiving of specific SOP Instances so that they can be removed from the peer AE system. SCServer would also communicate failure to commit SOP Instances if they have not arrived to PACS-IW within configured period of time after Storage Commitment request has been received by SCServer AE.

The SCServer AE will initiate a new Association to a peer AE that sent a Storage Commitment Push Model request, for the N-EVENT-REPORT communication. The SCServer will propose the SCP role (via SCP/SCU Role Selection Negotiation) within a Presentation Context for the Storage Commitment Push Model SOP Class. If the destination does not accept that Role Negotiation, the AE will not be able to send Storage Commitment Results using N-Event-Report Requests.

The SCServer AE will include the following attributes into the N-EVENT-REPORT Data Set:

Event Type Name	Event Type ID	Attribute	Tag
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)
		Referenced SOP Sequence	(0008,1199)
		>Referenced SOP Class UID	(0008,1150)
		>Referenced SOP Instance UID	(0008,1155)
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)
		Referenced SOP Sequence	(0008,1199)
		>Referenced SOP Class UID	(0008,1150)
		>Referenced SOP Instance UID	(0008,1155)
		Failed SOP Sequence	(0008,1198)
		>Referenced SOP Class UID	(0008,1150)
		>Referenced SOP Instance UID	(0008,1155)
		>Failure Reason	(0008,1197)

The SCServer AE will exhibit the following Behavior according to the Status Code value returned in an N-EVENT-REPORT Response from a destination Storage Commitment Push Model SCU:

Table 2.2.5-7 SCServer AE N-EVENT-REPORT Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCU has successfully received the Storage Commitment Push Model N-EVENT-REPORT Request.
Warning	Attribute List Error	0107	Transmission of Storage Commitment Push Model N-EVENT-REPORT Request is considered successful. Warning indication message is output to the log file. No message is posted to the User Interface.
*	*	Any other status code.	This is treated as a permanent Failure. Error indication message is output to the log file. No message is posted to the User Interface.

All Status Codes indicating an error or refusal are treated as a permanent failure. The SCServer AE will not attempt to re-send failed Notifications. If the connection cannot be made, it will attempt to re-send Notification at a later time.

Table 2.2.5-8 SCServer AE Storage Commitment Push Model Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM A-ABORT. Any previously received Storage Commitment Push Model N-ACTION Requests will still be fully processed. Error indication message is output to the Service Logs. No message is posted to the User Interface.
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	The TCP/IP socket is closed. Any previously received Storage Commitment Push Model N-ACTION Requests will still be fully processed. Error indication message is output to the Service Logs. No message is posted to the User Interface.

2.2.5.4 Association Acceptance Policy

2.2.5.4.1 Activity – Receive Storage Commitment Requests

The SCServer AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected.

The default behavior of the SCServer AE is to always attempt to send a Storage Commitment Push Model Notification (N-EVENT-REPORT) over the new Association opened by the peer AE to send the request (N-ACTION). See section 2.2.5.3.1.1 for details.

The SCServer AE may reject Association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

1 – DICOM UL service-user

2 – DICOM UL service-provider (ASCE related function)

3 – DICOM UL service-provider (Presentation related function)

Table 2.2.5-9 Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
1 – rejected-permanent	1	2 – application-context-name-not-supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will not succeed at a later time.
1 – rejected-permanent	1	7 – called-AE-title-not-recognized	The Association request contained an unrecognized Called AE Title. An Association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the Association initiator is incorrectly configured and attempts to address the Association acceptor using the wrong AE Title.
1 – rejected-permanent	2	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time.

Note: SCServer AE does not check the Calling AE Title of the Association requestor.

2.2.5.4.1.1 Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are acceptable to the SCServer AE for receiving objects.

Table 2.2.5-10 Accepted Presentation Contexts by SCServer AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.2.5.4.1.2 SOP Specific Conformance for Verification SOP Class

The SCServer AE provides standard conformance to the Verification SOP Class as an SCP.

2.2.5.4.1.3 SOP Specific Conformance for Storage Commitment SOP Class

The associated Activity with the Storage Commitment Push Model service is the communication by the SCServer AE to peer AEs that it has committed to permanently store Composite SOP Instances that have been sent to it. It thus allows peer AEs to determine whether the PACS-IW has taken responsibility for the archiving of specific SOP Instances so that they can be removed from the peer AE system.

The SCServer AE takes the list of Composite SOP Instance UIDs specified in a Storage Commitment Push Model N-ACTION Request and checks if they are present in the PACS-IW Online Storage. As long as the Composite SOP Instance UIDs are present in the database, the SCServer AE will consider those Composite SOP Instance UIDs to be successfully archived. The SCServer AE does not require the Composite SOP Instances to actually be successfully written to archive media in order to commit to responsibility for maintaining these SOP Instances.

Once the SCServer AE has checked for the existence of the specified Composite SOP Instances, it will then attempt to send the Notification request (N-EVENT-REPORT-RQ). The SCServer AE will request a new Association with the peer AE that made the original N-ACTION Request. The SCServer AE can also be configured to open a new Association to a different AE associated with the one that made the original request.

The SCServer will save Storage Commitment Push Model N-ACTION Requests that specify Composite SOP Instances that have not yet been transferred to the PACS-IW for configurable period of time. If a peer AE sends a Storage Commitment Push Model N-ACTION Request before the specified Composite SOP Instances are transmitted, it will save the request, and for each incoming object will check whether it has been listed in the saved request. If objects have not been sent within configurable period of time, the SCServer AE will send the failure Notification listing SOP Instances which have never been received.

The SCServer AE does not support the optional Storage Media File-Set ID & UID attributes in the N-ACTION.

PACS-IW never automatically deletes Composite SOP Instances from the archive though it may migrate them between different physical locations. The absolute persistence of SOP Instances and the maximum archiving capacity for such SOP Instances is dependent on the actual specifications of the purchased system. It is necessary to check the actual system specifications to determine these characteristics.

The SCServer AE will support Storage Commitment Push Model requests for SOP Instances of any of the Storage SOP Classes that are also supported by the DICOMStore AE:

Table 2.2.5-9 Supported Referenced SOP Classes in Storage Commitment Push Model N-ACTION Requests

Supported Referenced SOP Classes
Computed Radiography Image Storage
CT Image Storage
Enhanced CT Image Storage
Ultrasound Image Storage (Retired)
Ultrasound Multi-Frame Image Storage (Retired)
MR Image Storage

Enhanced MR Image Storage
Nuclear Medicine Image Storage
Positron Emission Tomography Image Storage
Secondary Capture Image Storage
Ultrasound Image Storage
Ultrasound Multi-frame Image Storage
X-Ray Angiographic Image Storage
X-Ray Radiofluoroscopic Image Storage
Digital X-Ray Image Storage - For Presentation
Digital X-Ray Image Storage - For Processing
Digital Mammography Image Storage - For Presentation
Digital Mammography Image Storage - For Processing
Digital Intro-oral X-Ray Image Storage - For Presentation
Digital Intra-oral X-Ray Image Storage - For Processing
VL Endoscopic Image Storage
VL Microscopic Image Storage
VL Slide-Coordinates Microscopic Image Storage
VL Photographic Image Storage
Mammography CAD SR Storage
Grayscale Softcopy Presentation State Storage
Key Object Selection Storage

The SCServer AE will return the following Status Code values in N-ACTION Responses:

Table 2.2.5-10 SCServer AE Storage Commitment Push Model N-ACTION Response Status Return Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully received the Storage Commitment Push Model N-ACTION Request and can process the commitment request for the indicated SOP Instances.
Error	Processing Failure	0110	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be parsed or fully processed due to a database or system failure.
Error	Missing Attribute	0120	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be processed because a required attribute is missing from the N-ACTION Request Data Set.
Error	Missing Attribute Value	0121	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be processed because a Type 1 attribute in the N-ACTION Request Data Set does not specify a value.

2.2.6 PRINTMANAGER APPLICATION ENTITY SPECIFICATION

2.2.6.1 SOP Classes

PRINTManager provides Standard Conformance to the following SOP Classes:

Table 2.2.6-1 SOP Classes for PRINTManager AE

SOP Class Name	SOP Class UID	SCU	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No
Presentation LUT	1.2.840.10008.5.1.1.23	Yes	No

2.2.6.2 Association Policies

2.2.6.2.1 General

The PRINTManager AE initiates Associations only when requested to do so by the PACS-IW user that selects to print an image he is currently viewing. The PACS-IW user interface provides a graphical user interface to control the application. One option provided by the interface presents a list of print servers configured in the system. When user composes the 'films' to be printed and sends print request to the server, the Print Manager will attempt to initiate an association with the selected print server.

The DICOM standard application context name for DICOM is always proposed:

Table 2.2.6-2 DICOM Application Context for PRINTManager AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the PRINTManager AE is:

Maximum Length PDU	16384 (not configurable)

2.2.6.2.2 Number of Associations

PRINTManager initiates one Association for each of the requests it receives. The Print Manager will initiate no other associations while the current association is active. Multiple copies of the Print Manager cannot be invoked on the same system.

Table 2.2.6-3 Number of Associations Initiated for PRINTManager AE

Maximum number of simultaneous Associations	1 (Not configurable)

2.2.6.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.6.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 2.2.6-5 DICOM Implementation Class and Version for PRINTManager AE

Implementation Class UID	1.2.840.113654.2.3.1995.2.11.2
Implementation Version Name	MIRCTN17MAR2000

2.2.6.3 Association Initiation Policy

2.2.6.3.1 Activity – Print Images

2.2.6.3.1.1 Description and Sequencing of Activities

A user composes images onto film sheets and requests them to be sent to a specific printer. The user can select the desired film format and number of copies. Each print-job is forwarded to the job queue and processed individually.

The PRINTManager AE is invoked by the job control interface that is responsible for processing network tasks. The job consists of data describing the images and graphics to be printed as well as the requested layout and other parameters. The film sheet is internally processed, converted to a STANDARD/1,1 page and then the page image is sent. If no association to the printer can be established, the print-job is switched to a failed state and the user informed.

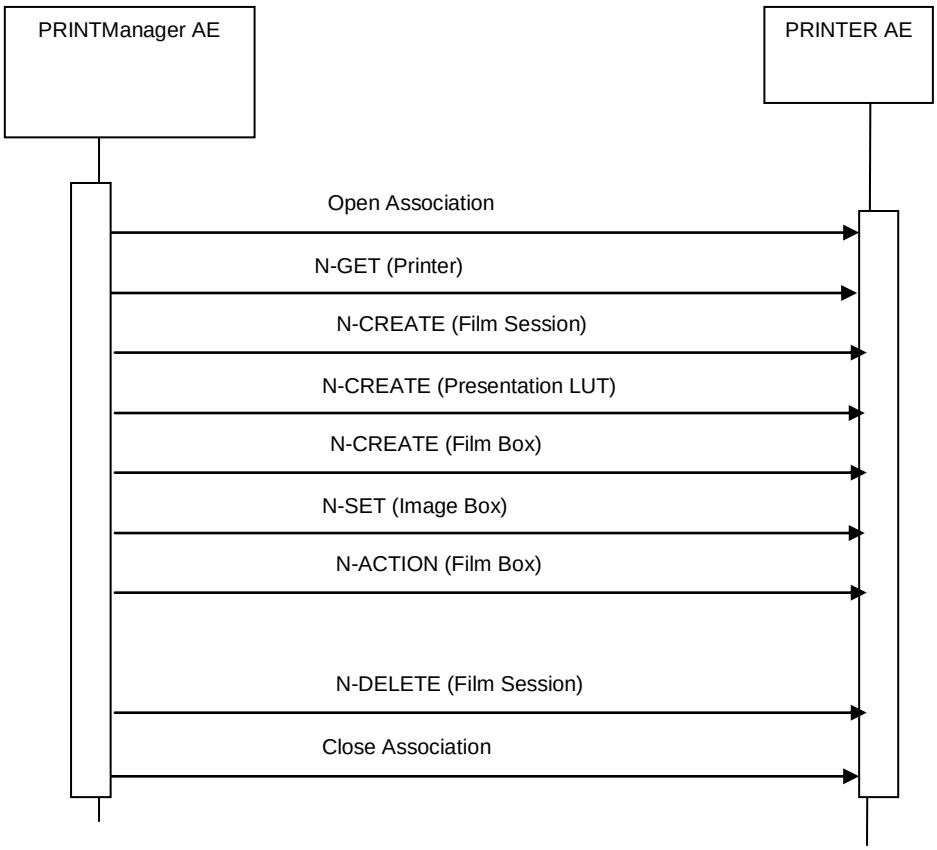


Figure 2.2.6-1 Sequencing of Activity – Print Images

A typical sequence of DIMSE messages sent over an association between PRINTManager AE and a Printer is illustrated in Figure 2.2.6-1:

1. PRINTManager AE opens an association with the Printer
2. N-GET on the Printer SOP Class is used to obtain current printer status information. If the Printer reports a status of FAILURE, the print-job is switched to a failed state and the user informed.
3. N-CREATE on the Film Session SOP Class creates a Film Session.
4. N-CREATE on the Presentation LUT SOP Class creates a Presentation LUT (if supported by the printer).
5. N-CREATE on the Film Box SOP Class creates a Film Box linked to the Film Session. A single Image Box will be created as the result of this operation (PRINTManager AE only uses the format STANDARD\1,1)
6. N-SET on the Image Box SOP Class transfers the contents of the film sheet to the printer. If the printer does not support the Presentation LUT SOP Class, the image data will be passed through a printer-specific correction LUT before being sent.
7. N-ACTION on the Film Box SOP Class instructs the printer to print the Film Box
8. The printer prints the requested number of film sheets

9. N-DELETE on the Film Session SOP Class deletes the complete Film Session SOP Instance hierarchy.

10. PRINTManager AE closes the association with the Printer

Status of the print-job is reported through the job control interface. Only one job will be active at a time. If any Response from the remote Application contains a status other than Success or Warning, the Association is aborted and the related Job is switched to a failed state. It can be restarted any time by user interaction or, if configured, by automated retry.

2.2.6.3.1.2 Proposed Presentation Contexts

PRINTManager is capable of proposing the Presentation Contexts shown in the Table below:

Table 2.2.6-6 Proposed Presentation Contexts for Activity Film Images

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Presentation LUT	1.2.840.10008.5.1.1.23	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.6.3.1.3 Common SOP Specific Conformance for all Print SOP Classes

The general behavior of PRINTManager AE during communication failure is summarized in the Table below. This behavior is common for all SOP Classes supported by PRINTManager AE.

Table 2.2.6-7 PRINTManager Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the print-job is marked as failed. The reason is logged and the job failure is reported to the user via the job control application.
Association aborted by the SCP or network layers	The print-job is marked as failed. The reason is logged and the job failure is reported to the user via the job control application.

2.2.6.3.1.4 SOP Specific Conformance for the Film Session SOP Class

PRINTManager AE supports the following DIMSE operations for the Film Session SOP Class:

1. N-CREATE

2. N-DELETE

Details of the supported attributes and status handling behavior are described in the following subsections.

2.2.6.3.1.4.1 Film Session SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 2.2.6-8 Film Session SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Copies	(2000,0010)	IS	1 .. 10	ALWAYS	User
Print Priority	(2000,0020)	CS	HIGH, MED, LOW	ALWAYS	User
Medium Type	(2000,0030)	CS	BLUE FILM, CLEAR FILM or PAPER	ALWAYS	User
Film Destination	(2000,0040)	CS	MAGAZINE or PROCESSOR	ALWAYS	User
Film Session Label	(2000,0050)	LO	Free text	ALWAYS	User

The behavior of PRINTManager AE when encountering status codes in an N-CREATE response is summarized in the Table below:

Table 2.2.6-9 Film Session SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	Attribute Value Out of Range	0116H	The N-CREATE operation is considered successful but the status meaning is logged
Warning	Attribute List Error	0107H	The N-CREATE operation is considered successful but the status meaning is logged
*	*	Any other status code.	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

2.2.6.3.1.4.2 Film Session SOP Class Operations (N-DELETE)

The behavior of PRINTManager AE when encountering status codes in an N-DELETE response is summarized in the Table below:

Table 2.2.6-10 Printer SOP Class N-DELETE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other status code.	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

2.2.6.3.1.5 SOP Specific Conformance for the Presentation LUT SOP Class

PRINTManager AE supports the N-CREATE DIMSE operation for the Presentation LUT SOP Class.

Details of the supported attributes and status handling behavior are described in the following subsections.

2.2.6.3.1.5.1 Presentation LUT SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 2.2.6-11 Presentation LUT SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Presentation LUT Shape	(2050,0020)	CS	IDENTITY	ALWAYS	Auto

The behavior of PRINTManager AE when encountering status codes in an N-CREATE response is summarized in the Table below:

Table 2.2.6-12 Presentation LUT SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	Requested Min Density or Max Density outside of printer's operating range	B605H	The N-CREATE operation is considered successful but the status meaning is logged.
*	*	Any other status code.	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

2.2.6.3.1.6 SOP Specific Conformance for the Film Box SOP Class

PRINTManager AE supports the following DIMSE operations for the Presentation LUT SOP Class:

1. N-CREATE
2. N-ACTION

Details of the supported attributes and status handling behavior are described in the following subsections.

2.2.6.3.1.6.1 Film Box SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 2.2.6-13 Film Box SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	(2010,0010)	CS	STANDARD\1,1	ALWAYS	Auto
Referenced Film Session Sequence	(2010,0500)	SQ		ALWAYS	Auto
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	Auto
>Referenced SOP Instance UID	(0008,1155)	UI	From created Film Session SOP Instance	ALWAYS	Auto
Referenced Image Box Sequence	(2010,0510)	SQ	Not included into the N-CREATE Request. The values returned by the printer in the N-CREATE Response are used to populate the attributes of the corresponding Basic Image Box N-SET Request	Not Included in Request	N/A
>Referenced SOP Class UID	(0008,1150)	UI	Used to populate SOP Class UID of the Basic Grayscale or Color Image Box N-Set Request	Not Included in Request	N/A
>Referenced SOP Instance UID	(0008,1155)	UI	Used to populate SOP Class UID of the Basic Grayscale or Color Image Box N-Set Request	Not Included in Request	N/A
Film Orientation	(2010,0040)	CS	PORTRAIT or LANDSCAPE	ALWAYS	User
Film Size ID	(2010,0050)	CS	14INX17IN, 14INX14IN, 11INX14IN, 11INX11IN, 85INX11IN, 8INX10IN	ALWAYS	User
Magnification Type	(2010,0060)	CS	REPLICATE, BILINEAR, CUBIC or NONE	ALWAYS	User
Border Density	(2010,0100)	CS	BLACK or WHITE	ALWAYS	User
Max Density	(2010,0130)	US	0 .. 310	ALWAYS	Auto
Min Density	(2010,0120)	US	0 .. 50	ALWAYS	Auto
Empty Image Density	(2010,0110)	US	0	ALWAYS	Auto
Referenced Presentation LUT Sequence	(2050,0500)	SQ	Only sent if Presentation LUT SOP Class has been negotiated.	ANAP	Auto
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.23	ALWAYS	Auto

>Referenced SOP Instance UID	(0008,1155)	UI	From created Presentation LUT SOP Instance	ALWAYS	Auto

The behavior of PRINTManager AE when encountering status codes in an N-CREATE response is summarized in the Table below:

Table 2.2.6-14 Film Box SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	Requested Min Density or Max Density outside of printer's operating range	B605H	The N-CREATE operation is considered successful but the status meaning is logged.
*	*	Any other status code.	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

2.2.6.3.1.6.2 Film Box SOP Class Operations (N-ACTION)

An N-ACTION Request is issued to instruct the Print SCP to print the contents of the Film Box. The Action Reply argument in an N-ACTION response is not evaluated.

The behavior of PRINTManager AE when encountering status codes in an N-ACTION response is summarized in the Table below:

Table 2.2.6-15 Film Box SOP Class N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. The film has been accepted for printing.
Warning	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	B603H	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Warning	Image size is larger than Image Box size. The image has been demagnified.	B604H	The N-ACTION operation is considered successful but the status meaning is logged.
Warning	Image size is larger than Image Box size. The image has been cropped to fit.	B609H	The N-ACTION operation is considered successful but the status meaning is logged.
Warning	Image size or Combined Print Image Size is larger than Image Box size. The image or	B60AH	The N-ACTION operation is considered successful but the status meaning is

Service Status	Further Meaning	Error Code	Behavior
	combined Print Image has been decimated to fit.		logged.
Failure	Unable to create Print Job SOP Instance; print queue is full.	C602	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Image size is larger than Image Box size.	C603	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Combined Print Image Size is larger than Image Box size.	C613	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
*	*	Any other status code.	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

2.2.6.3.1.7 SOP Specific Conformance for the Image Box SOP Class

PRINTManager AE supports the N-SET DIMSE operation for the Image Box SOP Class:

Details of the supported attributes and status handling behavior are described in the following subsections.

2.2.6.3.1.7.1 Image Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET Request are listed in the Table below:

Table 2.2.6-16 Grayscale Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)	US	1	ALWAYS	Auto
Polarity	(2020,0020)	CS	NORMAL, REVERSE	ALWAYS	User
Basic Grayscale Image Sequence	(2020,0110)	SQ		ALWAYS	Auto
>Samples Per Pixel	(0028,0002)	US	1	ALWAYS	Auto
>Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	Auto
>Rows	(0028,0010)	US	Depends on film size	ALWAYS	Auto
>Columns	(0028,0011)	US	Depends on film size	ALWAYS	Auto

Attribute Name	Tag	VR	Value	Presence of Value	Source
>Pixel Aspect Ratio	(0028,0034)	IS	1\1	ALWAYS	Auto
>Bits Allocated	(0028,0100)	US	8	ALWAYS	Auto
>Bits Stored	(0028,0101)	US	8	ALWAYS	Auto
>High Bit	(0028,0102)	US	7	ALWAYS	Auto
>Pixel Representation	(0028,0103)	US	0	ALWAYS	Auto
>Pixel Data	(7FE0,0010)	OB	Pixels of rendered film sheet	ALWAYS	Auto

Table 2.2.6-17 Color Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)	US	1	ALWAYS	Auto
Polarity	(2020,0020)	CS	NORMAL, REVERSE	ALWAYS	User
Basic Color Image Sequence	(2020,0111)	SQ		ALWAYS	Auto
>Samples Per Pixel	(0028,0002)	US	3	ALWAYS	Auto
>Photometric Interpretation	(0028,0004)	CS	RGB	ALWAYS	Auto
>Rows	(0028,0010)	US	Depends on film size	ALWAYS	Auto
>Columns	(0028,0011)	US	Depends on film size	ALWAYS	Auto
>Pixel Aspect Ratio	(0028,0034)	IS	1\1	ALWAYS	Auto
>Bits Allocated	(0028,0100)	US	8	ALWAYS	Auto
>Bits Stored	(0028,0101)	US	8	ALWAYS	Auto
>High Bit	(0028,0102)	US	7	ALWAYS	Auto
>Pixel Representation	(0028,0103)	US	0	ALWAYS	Auto
>Pixel Data	(7FE0,0010)	OB	Pixels of rendered film sheet	ALWAYS	Auto

The behavior of PRINTManager AE when encountering status codes in an N-SET response is summarized in the Table below:

Table 2.2.6-18 Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Image successfully stored in Image Box.
Warning	Image size is larger than Image Box size. The image has been demagnified.	B604H	The N-SET operation is considered successful but the status meaning is logged.
Warning	Requested Min Density or Max Density outside of printer's operating range.	B605H	The N-SET operation is considered successful but the status meaning is logged.
Warning	Image size is larger than Image Box size. The image has been cropped to fit.	B609H	The N-SET operation is considered successful but the status meaning is logged.
Warning	Image size or Combined Print Image Size is larger than Image Box size. The image or combined Print Image has been decimated to fit.	B60AH	The N-SET operation is considered successful but the status meaning is logged.
Failure	Image size is larger than Image Box size.	C603	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Insufficient memory in printer to store the image.	C605	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Combined Print Image Size is larger than Image Box size.	C613	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
*	*	Any other status code.	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

2.2.6.4 Association Acceptance Policy

The PRINTManager Application Entity does not accept Associations.

2.3 NETWORK INTERFACES

2.3.1 PHYSICAL NETWORK INTERFACE

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the Windows Server 2003 Operating System. Only IPv4 is supported. IPv6 is not supported.

The PACS-IW DICOM applications are indifferent to the physical medium over which TCP/IP executes.

2.3.2 ADDITIONAL PROTOCOLS

DHCP support is not provided, all PACS-IW servers shall be assigned static IP addresses.

If DNS support exists on the local network, then DNS is used for address resolution. If DNS is not supported then the hostnames and addresses are configured in the local hosts file.

2.4 EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

2.4.1 STANDARD EXTENDED / SPECIALIZED / PRIVATE SOP CLASSES

2.4.1.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to Grayscale Softcopy Presentation State and Key Object Selection Storage SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements into the generated objects. See sections 4 and 5, respectively, for the list of supported attributes.

2.5 CONFIGURATION

2.5.1 AE TITLE/PRESENTATION ADDRESS MAPPING

The AE Title and port of PACS-IW DICOM applications are configurable by the Field Engineer. The IP Address is picked by the site and may be changed by a Field Engineer. No support for LDAP is provided.

2.5.1.1 Local AE Titles

Table 2.5.1-1 AE Title configuration table

Application Entity	Default AE Title	Default TCP/IP Port
DICOMSend	Must be configured	N/A
DICOMServer	Must be configured	104
QRServer	Must be configured	2104
SCServer	Must be configured	1104
PRINTManager	Must be configured	N/A

2.5.1.2 Remote AE Title/Presentation Address Mapping

The AE Titles, host names, port numbers and supported Presentation Contexts of remote applications are configured in the configuration files.

2.5.2 PARAMETERS

See PACS-IW documentation for further discussion of Parameters.

2.6 SUPPORT OF EXTENDED CHARACTER SETS

The Centricity PACS-IW is configurable with a single single-byte or multi-byte extended character set, depending on the language selected during installation of the system. The following extended Character Sets are supported:

Encoding	DICOM Term in Specific Character Set (0008,0005)	Supported Languages
ASCII	Attribute is not present	English
Latin-1	ISO IR-100	English, Faeroese, Finnish, French, German, Italian, Portuguese, Spanish,
Latin-2	ISO IR-101	English, Polish, Hungarian.
Latin/Cyrillic	ISO IR-144	English, Russian
Latin/Hebrew	ISO IR-138	English, Hebrew
JIS X 0201	ISO IR-13	English, Japanese (in Katakana alphabet). Limited use as Japanese encoding does not support hieroglyphic alphabet
JIS X 0208	\ISO 2022 IR-87	English, Japanese Kanji (hieroglyphic) – uses escape sequences to switch between ASCII (single byte) and Japanese (two-byte per character)
KS X 1001	\ISO 2022 IR-149	English, Korean – uses escape sequences to switch between ASCII (single byte) and Korean (two-byte per character)
GB18030	GB18030	English, Simplified Chinese

As a Storage SCP or Media Storage FSR, the product will accept SOP Instances with any value of Specific Character Set (0008,0005). As a Query SCU, it will similarly accept response items with any

value of Specific Character Set. However, it will display in the user interface only characters specified as within ISO_IR 6 (ASCII) or the configured extended character set.

The product user interface will allow the user to enter characters from the console keyboard that are within ASCII or the configured extended character set. If any such extended characters are included in SOP Instances or in query identifier matching fields, the product will appropriately specify the extended character set in Specific Character Set (0008,0005).

2.7 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.

2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.

3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

2.8 GRAYSCALE IMAGE CONSISTENCY

The product requires that any monitor used for display of grayscale images has been calibrated to the DICOM Grayscale Display Function in accordance with the requirements of DICOM Standard PS 3.14.

Calibration of monitors shall be performed with the tools and in accordance to the instructions of the monitor vendor.

3 MEDIA INTERCHANGE

3.1 IMPLEMENTATION MODEL

This section of the DICOM conformance statement specifies the Centricity* PACS-IW compliance to DICOM requirements for Media Interchange. It details the DICOM Media Storage Application Profiles and roles that are supported by this product.

3.1.1 APPLICATION DATA FLOW

PACS-IW implements a number of Application Entities each of which supports one logical set of functions, typically a single DICOM Service Class.

All application entities are implemented to be invoked by the PACS-IW business logic on as needed basis.

Data flow of Application Entities is depicted on the Figure 3.1-1.

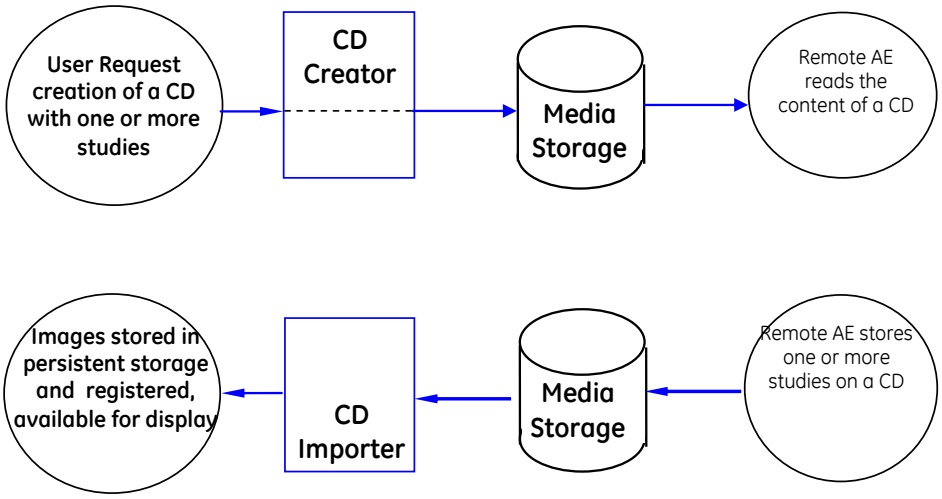


Figure 3.1.1-1 Application Data Flow .

3.1.2 FUNCTIONAL DEFINITIONS OF AE'S

3.1.2.1 Functional Definition of CDCreator Application Entity

The CD Creator AE can be invoked directly by user for saving studies currently being viewed, or by the system after a user requested creation of a CD using CD-Film station. The Presentation Contexts to use are determined from the headers of the DICOM files to be stored.

3.1.2.2 Functional Definition of CDImporter Application Entity

The CDImporter AE can be invoked on user's request to import the content of the DICOM media to the PACS-IW. When invoked, the CDImporter AE reads the content of DICOMDIR file of the specified media to allow a user to indicate which studies are to be imported. After user selection, the CDImporter reads all supported DICOM objects belonging to the selected studies and imports them to PACS-IW.

3.1.3 SEQUENCING OF REAL-WORLD ACTIVITIES

Not Applicable

3.1.4 FILE META INFORMATION OPTIONS

File Meta-Information Version	1
CDCreator Implementation UID	1.2.276.0.7230010.3.0.3.5.3

3.2 AE SPECIFICATIONS

3.2.1 CDCreator APPLICATION ENTITY SPECIFICATION

The CDCreator AE provides Standard Conformance to DICOM Interchange Option of the Media Storage Service Class. The supported Application Profiles and roles are listed below.

TABLE 3.2.1-1. Application profiles supported by CDCreator AE

Supported Application Profile	Real World Activity	Role	Option
STD-GEN-CD	Create CD Request Creation of CD	FSC	Interchange
STD-GEN-DVD-RAM	Create DVD Request Creation of DVD	FSC	Interchange

3.2.1.1 File Meta Information for CDCreator Application Entity

The following are the values set in the File Meta Information for this AE.

File Meta-Information Version	1
CDCreator Implementation UID	1.2.276.0.7230010.3.0.3.5.3

3.2.1.2 Real World Activities for CDCreator Application Entity

3.2.1.2.1 Real World Activity – Create CD or DVD

While viewing the study or studies, user selects an option Save Study on CD which invokes the CDCreator Module. User indicates one or more studies that need to be saved onto a CD, selects the appropriate drive and media and initiates creation of the CD/DVD.

The CDCreator Module retrieves DICOM objects contained in the study or studies, from the server, generates DICOMDIR file and saves complete File-Set onto Media.

Upon completion of the burning process, the media is ejected from the drive and user is informed to label the created media.

The remote application entity that implements the FSR role can read the content of the dataset for the purpose of its visualization or importing into the remote system.

3.2.1.2.1.1 Media Storage Application Profile for the RWA Create CD or DVD

For the list of Application Profiles that invoke this AE for the Real-World Activity Create CD or DVD, see the Table 3.2.1-1 describing the Application Profiles and Real-World Activities.

3.2.1.2.2 Real World Activity – Request creation of CD or DVD

While viewing the list of studies, user selects an option to burn selected list of studies to a CD or DVD using the remote CD-Film station. Upon saving request, the CD creation job is scheduled

CD-Film station receives indication of a scheduled CD creation job and invokes CDCreator module.

The CDCreator Module retrieves DICOM objects contained in the study or studies, from the server, generates DICOMDIR file and saves complete File-Set onto Media.

Upon completion of the burning process, the media is printed with preconfigured labeling information and is ejected from the drive into the receiving bin.

The remote application entity that implements the FSR role can read the content of the dataset for the purpose of its visualization or importing into the remote system.

3.2.1.2.2.1 Media Storage Application Profile for the RWA Request Creation of CD or DVD

For the list of Application Profiles that invoke this AE for the Real-World Activity Create CD or DVD, see the Table 3.2.1-1 describing the Application Profiles and Real-World Activities.

3.2.1.2.2 Options for STD-GEN-CD and STD-GEN-DVD-RAM Application Profile

Following are the optional SOP Classes supported by this AE. All SOP Instances use the Explicit VR Little Endian Uncompressed Transfer Syntax, UID 1.2.840.10008.1.2.1.

TABLE 3.2.1-2. SOP Classes Supported by CDCreator AE

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59

Common DICOMDIR Directory Records created by this AE will include key attributes as described in Section 6.

3.2.2 CDImporter APPLICATION ENTITY SPECIFICATION

The CDImporter AE provides Standard Conformance to DICOM Interchange Option of the Media Storage Service Class. The supported Application Profiles and roles are listed below.

TABLE 3.2.2-1. Application profiles supported by CDImporter AE

Supported Application Profile	Real World Activity	Role	Option
STD-GEN-CD	Import CD	FSR	Interchange
STD-GEN-DVD-RAM	Import DVD	FSR	Interchange

3.2.2.1 File Meta Information for CDImporter Application Entity

This AE does not generate File Meta Information.

3.2.2.2 Real World Activities for CDImporter Application Entity

3.2.2.2.1 Real World Activity – Import CD or DVD

While viewing the list of studies, user selects an option to Import a CD which invokes the CDImporter Utility. User indicates the drive in which the interchange media is located.

The CDImporter Utility reads the DICOMDIR file from the media and presents the user with the list of studies located on the media and an option to select and import them.

When user selects one or more studies and confirms the import operation, all objects supported by the CDImporter AE and belonging to selected studies are imported into PACS-IW.

3.2.2.2.1.1 Media Storage Application Profile for the RWA Request Creation of CD or DVD

For the list of Application Profiles that invoke this AE for the Real-World Activity Create CD or DVD, see the Table 3.2.1-1 describing the Application Profiles and Real-World Activities.

3.2.2.2.1.2 Options for STD-GEN-CD and STD-GEN-DVD-RAM Application Profile

Following are the optional SOP Classes supported by this AE. All SOP Instances use the Explicit VR Little Endian Uncompressed Transfer Syntax, UID 1.2.840.10008.1.2.1.

TABLE 3.2.2-2. SOP Classes Supported by CDCreator AE

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intro-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3.
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1

SOP Class Name	SOP Class UID
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59

Common DICOMDIR Directory Records read by this AE will include key attributes as described in Section 6.

3.3 *AUGMENTED AND PRIVATE PROFILES*

No augmented/private profile is implemented.

3.4 EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

3.4.1 STANDARD EXTENDED / SPECIALIZED / PRIVATE SOP CLASSES

3.4.1.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to Grayscale Softcopy Presentation State and Key Object Selection Storage SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements into the generated objects. See sections 4 and 5, respectively, for the list of supported attributes.

3.5 CONFIGURATION

The product does not provide any configuration options for Meta File Information.

3.6 SUPPORT OF EXTENDED CHARACTER SETS

The Centricity PACS-IW provides support for Extended Character Sets as specified in the section 2.6.

4 GRAYSCALE SOFCOPY PRESENTATION STATE INFORMATION OBJECT IMPLEMENTATION

This section specifies the use of the DICOM Grayscale Softcopy Presentation State (GSPS) IOD to represent the information included in GSPSs produced and received by this implementation. Corresponding attributes are conveyed using the module construct.

4.1 Centricity PACS-IW MAPPING OF DICOM ENTITIES

The Centricity PACS-IW maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 4.1-1 1

MAPPING OF DICOM ENTITIES TO PACS-IW ENTITIES

DICOM IE	PACS-IW Entity
Patient	Patient
Study	Study
Series	Series
Presentation State	Presentation State

4.2 IOD Module Table

The Grayscale Softcopy Presentation State Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 4.5.

TABLE 4.2-1

GSPS IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.3.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	4.3.2.1
	Patient Study	Not Used	
	Clinical Trial Study	Not Used	
Series	General Series	Used	4.3.3.1
	Clinical Trial Series	Not Used	
	Presentation Series	Used	4.3.3.2

Equipment	General Equipment	Used	4.3.4.1
Presentation State	Presentation State Identification	Used	4.3.5.1
	Presentation State Relationship	Used	4.3.5.2
	Presentation State Shutter	Used	4.3.5.3
	Presentation State Mask	Used	4.3.5.4
	Mask	Not Used	
	Display Shutter	Not Used	
	Bitmap Display Shutter	Not Used	
	Overlay Plane	Not used	
	Overlay Activation	Not used	
	Displayed Area	Used	4.3.5.5
	Graphic Annotation	Used when measurements or graphic/text labels are present	4.3.5.6
	Spatial Transformation	Used when Image is zoomed/rotated	4.3.5.7
	Graphic Layer	Used	4.3.5.8
	Modality LUT	Used if referenced image includes Modality LUT	4.3.5.9
	Softcopy VOI LUT	Used	4.3.5.10
	Softcopy Presentation LUT	Used	4.3.5.11
	SOP Common	Used	4.3.5.12

4.3 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the GSPS Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance.

It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

4.3.1 PATIENT ENTITY MODULES

4.3.1.1 Patient Module

TABLE 4.3.1-1

PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Taken from the images of the study
Patient ID	(0010,0020)	2	Taken from images of the study
Issuer of Patient ID	(0010,0021)	3	Not Used
Patient's Birth Date	(0010,0030)	2	Taken from images of the study
Patient's Sex	(0010,0040)	2	Taken from images of the study
Referenced Patient Sequence	(0008,1120)	3	Not Used
Patient's Birth Time	(0010,0032)	3	Not Used
Other Patient IDs	(0010,1000)	3	Not Used
Other Patient IDs Sequence	(0010,1002)	3	Not Used
Other Patient Names	(0010,1001)	3	Not Used
Ethnic Group	(0010,2160)	3	Not Used
Patient Comments	(0010,4000)	3	Not Used

4.3.2 STUDY ENTITY MODULES

4.3.2.1 General Study Module

TABLE 4.3.2-1

GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Taken from images of

			the study
Study Date	(0008,0020)	2	Taken from Images of the study
Study Time	(0008,0030)	2	Taken from Images of the study
Referring Physician's Name	(0008,0090)	2	Always empty
Referring Physician Identification Sequence	(0008,0096)	3	Not Used
Study ID	(0020,0010)	2	Taken from Images of the Study
Accession Number	(0008,0050)	2	Taken from Images of the Study
Study Description	(0008,1030)	3	Taken from Images of the Study

4.3.3 SERIES ENTITY MODULES

4.3.3.1 General Series Module

TABLE 4.3.3-1

GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Value = PR
Series Instance UID	(0020,000E)	1	New value is assigned for the set of GSPS objects created at the same time
Series Number	(0020,0011)	2	Always 1
Laterality	(0020,0060)	2C	Not Used
Series Date	(0008,0021)	3	Date of series creation
Series Time	(0008,0031)	3	Time of series creation

4.3.3.2 Presentation Series Module

TABLE 4.3.3-2

PRESENTATION SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	1	Value = PR

4.3.4 EQUIPMENT ENTITY MODULES

4.3.4.1 General Equipment Module

TABLE 4.3.4-1

GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Value = GE Healthcare IT Radiology
Institution Name	(0008,0080)	3	Not Used
Institution Address	(0008,0081)	3	Not Used
Station Name	(0008,1010)	3	Value = name of workstation computer
Institutional Department Name	(0008,1040)	3	Not Used
Manufacturer's Model Name	(0008,1090)	3	Not Used
Device Serial Number	(0018,1000)	3	Not Used
Software Versions	(0018,1020)	3	Not Used
Gantry ID	(0018,1008)	3	Not Used
Spatial Resolution	(0018,1050)	3	Not Used
Date of Last Calibration	(0018,1200)	3	Not Used
Time of Last Calibration	(0018,1201)	3	Not Used
Pixel Padding Value	(0028,0120)	1C	Not Used

4.3.5 PRESENTATION STATE ENTITY MODULES

4.3.5.1 Presentation State Identification Module

TABLE 4.3.5-1

PRESENTATION STATE IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Presentation Creation Date	(0070,0082)	1	Date of instance creation
Presentation Creation Time	(0070,0083)	1	Time of instance creation
Instance Number	(0020,0013)	1	Always 1
Content Label	(0070,0080)	1	Entered by user or generated automatically
Content Description	(0070,0081)	2	Generated automatically
Content Creator's Name	(0070,0084)	2	Name of the user who created Presentation State
Content Creator's Identification Code Sequence	(0070,0086)	3	Not Used

4.3.5.2 Presentation State Relationship Module

TABLE 4.3.5-2

PRESENTATION STATE RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Referenced Series Sequence	(0008,1115)	1	
>Series Instance UID	(0020,000E)	1	
>Referenced Image Sequence	(0008,1140)	1	
>>Referenced SOP Class UID	(0008,1150)	1	
>>Referenced SOP Instance UID	(0008,1155)	1	
>>Referenced Frame Number	(0008,1160)	1C	Used if Presentation State related to the frame of multi-frame image
>>Referenced Segment Number	(0062,000B)	1C	Not Used

4.3.5.3 Presentation State Shutter Module

TABLE 4.3.5-3

PRESENTATION STATE SHUTTER MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Shutter Presentation Value	(0018,1622)	1C	Not Used
Shutter Presentation Color CIELab Value	(0018,1624)	1C	Not Used

4.3.5.4 Presentation State Mask Module

TABLE 4.3.5-4

PRESENTATION STATE MASK MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Mask Subtraction Sequence	(0028,6100)	1C	Not Used
>Mask Operation	(0028,6101)	1	
>Contrast Frame Averaging	(0028,6112)	1C	Not Used
Recommended Viewing Mode	(0028,1090)	1C	Not Used

4.3.5.5 Displayed Area Module

TABLE 4.3.5-5

DISPLAYED AREA MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Displayed Area Selection Sequence	(0070,005A)	1	
>Referenced Image Sequence	(0008,1140)	1C	Used
>>Referenced SOP Class UID	(0008,1150)	1	
>>Referenced SOP Instance UID	(0008,1155)	1	

>>Referenced Frame Number	(0008,1160)	1C	Used if applied to subset of frames of multi-frame image
>>Referenced Segment Number	(0062,000B)	1C	Not Used
>Displayed Area Top Left Hand Corner	(0070,0052)	1	
>Displayed Area Bottom Right Hand Corner	(0070,0053)	1	
>Presentation Size Mode	(0070,0100)	1	Enumerated Values used: SCALE TO FIT TRUE SIZE MAGNIFY
>Presentation Pixel Spacing	(0070,0101)	1C	Not Used
>Presentation Pixel Aspect Ratio	(0070,0102)	1C	Not Used
>Presentation Pixel Magnification Ratio	(0070,0103)	1C	Used if Presentation Size Mode is MAGNIFY

4.3.5.6 Graphic Annotation Module

TABLE 4.3.5-6

GRAPHIC ANNOTATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Graphic Annotation Sequence	(0070,0001)	1	
>Referenced Image Sequence	(0008,1140)	1C	Used
>>Referenced SOP Class UID	(0008,1150)	1	
>>Referenced SOP Instance UID	(0008,1155)	1	
>>Referenced Frame Number	(0008,1160)	1C	Used if annotation is applied to subset of frames of multi-frame

			image
>>Referenced Segment Number	(0062,000B)	1C	Not Used
>Graphic Layer	(0070,0002)	1	
>Text Object Sequence	(0070,0008)	1C	
>>Bounding Box Annotation Units	(0070,0003)	1C	Enumerated Values used: PIXEL
>>Anchor Point Annotation Units	(0070,0004)	1C	Enumerated Values used: PIXEL
>>Unformatted Text Value	(0070,0006)	1	
>>Bounding Box Top Left Hand Corner	(0070,0010)	1C	Used
>>Bounding Box Bottom Right Hand Corner	(0070,0011)	1C	Used
>>Bounding Box Text Horizontal Justification	(0070,0012)	1C	Enumerated Values used: CENTER
>>Anchor Point	(0070,0014)	1C	Used
>>Anchor Point Visibility	(0070,0015)	1C	Not Used
>Graphic Object Sequence	(0070,0009)	1C	Used
>>Graphic Annotation Units	(0070,0005)	1	Enumerated Values used: PIXEL
>>Graphic Dimensions	(0070,0020)	1	
>>Number of Graphic Points	(0070,0021)	1	
>> Graphic Data	(0070,0022)	1	
>>Graphic Type	(0070,0023)	1	Enumerated Values used: POINT

			POLYLINE CIRCLE ELLIPSE
>>Graphic Filled	(0070,0024)	1C	Enumerated Values used: N = no

4.3.5.7 Spatial Transformation Module

TABLE 4.3.5-7

SPATIAL TRANSFORMATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Image Rotation	(0070,0042)	1	Enumerated Values used: 0 90 180 270
Image Horizontal Flip	(0070,0041)	1	Enumerated Values used: Y = yes N = no

4.3.5.8 Graphic Layer Module

TABLE 4.3.5-8

GRAPHIC LAYER MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Graphic Layer Sequence	(0070,0060)	1	
>Graphic Layer	(0070,0002)	1	
>Graphic Layer Order	(0070,0062)	1	
>Graphic Layer Recommended Display Grayscale Value	(0070,0066)	3	Not Used

>Graphic Layer Recommended Display RGB Value	(0070,0067)	3	Not Used
>Graphic Layer Recommended Display CIELab Value	(0070,0401)	3	Not Used
>Graphic Layer Description	(0070,0068)	3	Not Used

4.3.5.9 Modality LUT Module

TABLE 4.3.5-9

MODALITY LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality LUT Sequence	(0028,3000)	1C	Copied from the referenced image, if present
>LUT Descriptor	(0028,3002)	1	
>LUT Explanation	(0028,3003)	3	
>Modality LUT Type	(0028,3004)	1C	
>LUT Data	(0028,3006)	1	
Rescale Slope	(0028,1052)	1C	Copied from the referenced image, if present
Rescale Intercept	(0028,1053)	1C	Copied from the referenced image, if present
Rescale Type	(0028,1054)	1C	Not Used

4.3.5.10Softcopy VOI LUT Module

TABLE 4.3.5-10

SOFTCOPY VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Softcopy VOI LUT Sequence	(0028,3110)	1	
>Referenced Image Sequence	(0008,1140)	1C	Used

>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>>Referenced Frame Number	(0008,1160)	1C	Used if referencing a frame in multi-frame image
>VOI LUT Sequence	(0028,3010)	1C	Used if applied to the referenced image
>>LUT Descriptor	(0028,3002)	1	
>>LUT Explanation	(0028,3003)	3	
>>LUT Data	(0028,3006)	1	
>Window Center	(0028,1050)	1C	A single Value is provided
>Window Width	(0028,1051)	1C	A single Value is provided
>Window Center & Width Explanation	(0028,1055)	3	Not Used
>VOI LUT Function	(0028,1056)	3	Not Used

4.3.5.11Softcopy VOI LUT Module

TABLE 4.3.5-11

SOFTCOPY PRESENTATION LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Presentation LUT Sequence	(2050,0010)	1C	Not Used
>LUT Descriptor	(0028,3002)	1	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1	
Presentation LUT Shape	(2050,0020)	1C	Enumerated Values used: IDENTITY INVERSE

4.3.5.12SOP Common Module

TABLE 4.3.5-12

SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	
SOP Instance UID	(0008,0018)	1	Generated using the internal computer clock
Specific Character Set	(0008,0005)	1C	Set according to the system configuration. Defined terms shown in Table 2.6-1
Instance Creation Date	(0008,0012)	3	Used
Instance Creation Time	(0008,0013)	3	Used
Instance Creator UID	(0008,0014)	3	Not Used

4.4 PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended GSPS SOP Instances as Type 3 data elements.

4.4.1 Private Group GEIIS_IW

Private Group GEIIS_IW is modeled as part of the Presentation State Information Entity.

TABLE 4.4.1-1

PRIVATE GROUP GEIIS_IW

Attribute Name	Tag	VR	VM	Use
Private Creator Identification	(0075,00xx)	LO	1	GEIIS_IW
COUNT_IN_SET	(0075,xx02)	US	1	
GSPS_DISPLAY_ONLY	(0075,xx05)	CS	1	
PRIMITIVE_ID	(0075,xx10)	US	1	
STUDY_PART_INFO	(0075,xx15)	LO	1	
STUDY_LAYOUT_DATA	(0075,xx16)	LO	1	
LAYOUT_SEQUENCE	(0075,xx17)	SQ		
>GROUP_ID	(0075,xx18)	US	1	
>LAY_PAGE_FORMAT	(0075,xx19)	CS	1	

>LAY_ACTIVE_PAGE	(0075,xx1A)	US	1	
DEPENDENT_PS_SEQUENCE	(0075,xx20)	SQ		
>DEPENDENT_PS_STUDY_NCD	(0075,xx21)	UL	1	
>DEPENDENT_PS_OBJECT_ID	(0075,xx22)	US	1	
>DEPENDENT_PS_STUDY_CBP	(0075,xx23)	CS	1	
>DEPENDENT_PS_GSPS_LABEL	(0075,xx24)	CS	1	
FONT_NAME	(0075,xx60)	CS	1	
FONT_STYLE	(0075,xx61)	US	1	
FONT_SIZE	(0075,xx62)	US	1	
FONT_COLOR	(0075,xx63)	UL	1	
GFT_SEQUENCE	(0075,xx69)	SQ		
GFT_TYPESTYLEMODE	(0075,xx70)	CS	N	
GFT_GRAFFITY_ID	(0075,xx71)	SS	1	
GFT_SPINE_LABEL	(0075,xx72)	SS	1	
GFT_INTER_VERTEBRAL_SPACE	(0075,xx73)	CS	1	
GFT_SHOW_SPINE_LETTER	(0075,xx74)	CS	1	
GFT_IS_SUV_ROI	(0075,xx75)	CS	1	
GFT_VOI_TYPE	(0075,xx76)	US	1	
GFT_CALC_TYPE	(0075,xx77)	US	1	
GFT_VOI_SLICE_INDEXES	(0075,xx78)	US	N	
GFT_IS_PRIMARY_SLICE	(0075,xx79)	US	N	
GFT_DIAMETER	(0075,xx7A)	US	N	
GFT_SLICES_NUM	(0075,xx7B)	US	N	
GFT_WHOLE_SEQUENCE	(0075,xx7C)	US	N	
GFT_UNITS_TYPE	(0075,xx7D)	US	1	
GFT_POINTS	(0075,xx7E)	FL	N	
GFT_QPOINTS	(0075,xx7F)	FL	N	
GFT_SPLINE	(0075,xx80)	FL	N	
GFT_TEXT_LOCATION	(0075,xx81)	FL	2	
GFT_AUX_TEXT_LOCATION_1	(0075,xx82)	FL	2	
GFT_AUX_TEXT_LOCATION_2	(0075,xx83)	FL	2	

GFT_COLOR	(0075,xx84)	UL	1	
GFT_COLOR_BW	(0075,xx85)	UL	1	
GFT_TEXT	(0075,xx86)	LO	1	
GFT_AUX_TEXT_1	(0075,xx87)	LO	1	
GFT_AUX_TEXT_2	(0075,xx88)	LO	1	
GFT_FROM_ANCHOR	(0075,xx89)	SL	1	
GFT_TO_ANCHOR	(0075,xx8A)	SL	1	
GFT_SEED_SLICE	(0075,xx8B)	UL	1	
GFT_SEED_POS	(0075,xx8C)	UL	2	
GFT_THRESHOLD	(0075,xx8D)	US	1	
GFT_VALUES_RANGE	(0075,xx8E)	UL	2	
GFT_NEEDS_RECALC	(0075,xx8F)	CS	1	
GFT_FONT_ALIGN	(0075,xx90)	CS	1	
GFT_FIT_TEXT	(0075,xx91)	LO	1	
COPY_INDEX	(0075,xx92)	US	1	
GFT_GSPS_RECALC	(0075,xx93)	CS	1	
PS_OVERLAY_STATE	(0075,xx1B)	CS	1	
GFT_OID_SEQID	(0075,xxC0)	UI	1	
GFT_OID_IMAGEID	(0075,xxC1)	UI	1	
GFT_OID_COPY_INDEX	(0075,xxC2)	SS	1	

4.4.2 Private Group GEIIS_IW

Private Group GEIIS_IW is modeled as part of the Presentation State Information Entity.

TABLE 4.4.2-1

PRIVATE GROUP GEIIS_IW

Attribute Name	Tag	VR	VM	Use
Private Creator Identification	(0075,00xx)	LO	1	GEIIS_RA1000
Private GSPS Type	(0071,xx10)	CS	1	2 possible values: DISPLAYLIST and NONDISPLAYLIST

Private Font Name	(0071,xx20)	ST	1	Font used for Text Annotation
Private Font Style	(0071,xx21)	US	1	Style code of the font used for Text Annotation
Private Font Size	(0071,xx22)	US	1	Point Size of the font used for Text Annotation
Annotation State View	(0071,xx23)	US	1	Index for an annotation that corresponds to the order it should appear in the statistics view display of the workstation

5 KEY OBJECT SELECTION DOCUMENT INFORMATION OBJECT IMPLEMENTATION

This section specifies the use of the DICOM Key Object Selection Document (KIN) IOD to represent the information included in KINs produced and received by this implementation. Corresponding attributes are conveyed using the module construct.

5.1 Centricity PACS-IW MAPPING OF DICOM ENTITIES

The Centricity PACS-IW maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 5.1-1 1

MAPPING OF DICOM ENTITIES TO PACS-IW ENTITIES

DICOM IE	PACS-IW Entity
Patient	Patient
Study	Study
Series	Series
Presentation State	Presentation State

5.2 IOD Module Table

The Grayscale Softcopy Presentation State Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 4.5.

TABLE 4.2-1

GSPS IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.3.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	4.3.2.1
	Patient Study	Not Used	
	Clinical Trial Study	Not Used	
Series	Key Object Document Series	Used	4.3.3.1
	Clinical Trial Series	Not Used	5.3.1.1

Equipment	General Equipment	Used	4.3.4.1
Document	Key Object Document	Used	5.3.2.1
	SR Document Content	Used	5.3.2.2
	SOP Common	Used	4.3.5.12

5.3 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the Key Object Selection Document Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

5.3.1 SERIES ENTITY MODULES

5.3.1.1 Key Object Document Series Module

TABLE 5.3.1-1

KEY OBJECT DOCUMENT SERIES MODULEATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	1	Value = KO
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	1	
Series Date	(0008,0021)	3	Used
Series Time	(0008,0031)	3	Used
Series Description	(0008,103E)	3	Used
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Not Used

5.3.2.1 DOCUMENT ENTITY MODULES

5.3.2.1 Key Object Document Module

TABLE 5.3.2-1

KEY OBJECT DOCUMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Instance Number	(0020,0013)	1	
Content Date	(0008,0023)	1	
Content Time	(0008,0033)	1	
Referenced Request Sequence	(0040,A370)	1C	
>Study Instance UID	(0020,000D)	1	
>Referenced Study Sequence	(0008,1110)	2	
>>Include 'SOP Instance Reference Macro'			
>Accession Number	(0008,0050)	2	
>Placer Order Number/Imaging Service Request	(0040,2016)	2	
>Filler Order Number/Imaging Service Request	(0040,2017)	2	
>Requested Procedure ID	(0040,1001)	2	
>Requested Procedure Description	(0032,1060)	2	
>Requested Procedure Code Sequence	(0032,1064)	2	
>>Include 'Code Sequence Macro'			
Current Requested Procedure Evidence Sequence	(0040,A375)	1	
>Include 'Hierarchical SOP Instance Reference Macro'			
Identical Documents Sequence	(0040,A525)	1C	Not used
>Include 'Hierarchical SOP Instance			

Reference Macro'			

5.3.2.2 SR Document Content Module

TABLE 5.3.2-2

SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Observation DateTime	(0040,A032)	1C	
Content Template Sequence	(0040,A504)	1C	
>Mapping Resource	(0008,0105)	1	
>Template Identifier	(0040,DB00)	1	
Value Type	(0040,A040)	1	
Continuity of Content	(0040,A050)	1C	
Concept Name Code Sequence	(0040,A043)	1C	
>Include 'Code Sequence Macro'			
Insert Concept Value attribute(s)			
Content Sequence	(0040,A730)	1C	
> Relationship Type	(0040,A010)	1	
> Referenced Content Item Identifier	(0040,DB73)	1C	Not used
> Insert SR DocumentContent Module Recursive inclusion to create document content tree.			

See section 5.3.2.3 for the list of supported templates

5.3.2.3 SR Document Content Descriptions

5.3.2.3.1 Content Template

The product supports the following root Templates for SR SOP Instances created, processed, or displayed by the product.

TABLE 5.3.2-3

SR ROOT TEMPLATES

SOP Class	Template ID	Template Name	Use
Key Object Selection	2010	Key Object Selection	Create/Display

Document			

5.4 PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended GSPS SOP Instances as Type 3 data elements.

5.4.1 Private Group GEIIS_IW

Private Group GEIIS_IW is modeled as part of the SR Document Information Entity.

TABLE 4.4.1-1

PRIVATE GROUP GEIIS_IW

Attribute Name	Tag	VR	VM	Use
Private Creator Identification	(0075,00xx)	LO	1	GEIIS_IW
GFT_OID_PP_PP	(0075,xxA0)	US	1	
GFT_OID_PP_CELL_ID	(0075,xxA1)	US	1	
GFT_OID_PETCT_PETCT	(0075,xxA5)	US	1	
GFT_OID_PETCT_PLACEHOLER	(0075,xxA6)	US	1	
GFT_OID_PETCT_ROWVECTOR	(0075,xxA7)	UL	2	
GFT_OID_PETCT_COLVECTOR	(0075,xxA8)	UL	2	
GFT_OID_PETCT_ORIGIN	(0075,xxA9)	UL	2	
GFT_OID_PETCT_SLICETHICKNESS	(0075,xxAA)	US	1	
GFT_OID_PETCT_SCALEX	(0075,xxAB)	FL	1	
GFT_OID_PETCT_SCALEY	(0075,xxAC)	FL	1	
GFT_OID_PETCT_SLICESIZE	(0075,xxAD)	UL	1	
GFT_OID_PETCT_SEQID_1	(0075,xxAE)	US	1	
GFT_OID_PETCT_SEQID_2	(0075,xxAF)	US	1	
PP_GFT_SEQUENCE	(0075,xxC5)	SQ	1	
>PP_START_END_CELL	(0075,xxC7)	US	2	
>PP_CATEGORY	(0075,xxC8)	CS	1	
>PP_PAGE_COUNT	(0075,xxC9)	US	1	
>PP_CURRENT_PAGE	(0075,xxCA)	US	1	
>PP_PAGE_BREAKS	(0075,xxCC)	CS	1	

>PP_FILM_BREAKS	(0075,xxCD)	CS	N	
>PP_SCOUT_CELLS	(0075,xxCE)	US	2	
>PP_LAYOUT	(0075,xxCF)	OB	1	
>PP_CELL_SEQUENCE	(0075,xxB0)	SQ	N	
>>PP_CELL_SHARPEN	(0075,xxB1)	CS	1	
>>PP_CELL_CRV	(0075,xxB3)	CS	1	
>>PP_CELL_OVERLAY_LOCK	(0075,xxB4)	CS	1	
>>PALETTE	(0075,xxB5)	US	1	
>>PALETTE_SEQ	(0075,xxB6)	US	1	
>> 3DA_SEQUENCE	(0075,xxDE)	SQ	N	
>>>3DA_MEAS_SEQUENCE	(0075,xxDF)	SQ	N	
>>>>3DA_ID	(0075,xxE0)	US	1	
>>>>3DA_COLOR	(0075,xxE1)	UL	1	
>>>>3DA_LABEL	(0075,xxE2)	LO	1	
>>>>3DA_LABEL_OFFSET	(0075,xxE3)	SL	1	
>>>>3DA_LOCATION	(0075,xxE4)	US	2	
>>>>3DA_IS_ACTIVE	(0075,xxE5)	CS	1	
>>>>3DA_MEAS_ENABLED	(0075,xxE6)	CS	1	
>>>>3DA_MEAS_DIAMETER IW_MAKETAG(0x)	(0075,xxE7)	US	1	
>>>>3DA_MEAS_SHOW	(0075,xxE8)	CS	1	
>>>>3DA_ANCHOR_FROM	(0075,xxE9)	UL	2	
>>>>3DA_ANCHOR_TO	(0075,xxEA)	UL	2	

6 BASIC DIRECTORY INFORMATION OBJECT IMPLEMENTATION

6.1 IOD MODULE TABLE

Table 6.1-1 identifies the defined modules within the entities which comprise the Basic Directory IOD. Modules are identified by Module Name.

See DICOM Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 6.1-1

BASIC DIRECTORY IOD MODULES

Entity Name	Module Name	Reference
File Set Identification	File Set Identification	6.2.1
Directory Information	Directory Information	6.2.2

FSC of this implementation creates Directory Information Module, and FSR supports it.

6.2 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Basic Directory Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

6.2.1 FILE SET IDENTIFICATION MODULE

TABLE 6.2-1

FILE-SET IDENTIFICATION MODULE

Attribute Name	Tag	Type	Attribute Description
File-set ID	(0004,1130)	2	Always empty
File-set Descriptor File ID	(0004,1141)	3	Not Used
Specific Character Set of File-set Descriptor File	(0004,1142)	1C	Not Used

6.2.2 DIRECTORY INFORMATION MODULE

TABLE 6.2-2

DIRECTORY INFORMATION MODULE

Attribute Name	Tag	Type	Attribute Description
Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	
Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	
File-set Consistency Flag	(0004,1212)	1	Always set to 0000H by FSC, not supported by FSR
Directory Record Sequence	(0004,1220)	2	FSC creates items in this sequence (Directory Records).
>Offset of the Next Directory Record	(0004,1400)	1C	
>Record In-use Flag	(0004,1410)	1C	Always set to FFFFH by FSC, not supported by FSR
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	
>Directory Record Type	(0004,1430)	1C	The following Enumerated Values are created by an FSC or and are supported by an FSR: PATIENT STUDY SERIES IMAGE PRESENTATION SR DOCUMENT KEY OBJECT DOC
>Private Record UID	(0004,1432)	1C	Not Used
>Referenced File ID	(0004,1500)	1C	Path to the file containing the object,

			only on the instance level (IMAGE, PRESENTATION, SR DOCUMENT, KEY OBJECT DOC
>Referenced SOP Class UID in File	(0004,1510)	1C	
>Referenced SOP Instance UID in File	(0004,1511)	1C	
>Referenced Transfer Syntax UID in File	(0004,1512)	1C	
> Referenced Related General SOP Class UID in File	(0004,151A)	1C	Not Used
>Record Selection Keys			See 6.2.3.

6.2.3 DEFINITION OF SPECIFIC DIRECTORY RECORDS

6.2.3.1 Patient Directory Record Definition

TABLE 6.2.3-1

PATIENT KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Patient's Name	(0010,0010)	2	Filled by an FSU based on the information from Study, FSR uses the value from this attribute to list the patients.
Patient ID	(0010,0020)	1	Filled by an FSU based on the information from Study, FSR uses the value from this attribute to list the patients.

Patient's Birth Date	(0010,0030)	3	
Patient's Sex	(0010,0040)	3	

6.2.3.2 Study Directory Record Definition

TABLE 6.2.3-2

STUDY KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Study Date	(0008,0020)	1	Filled by an FSU based on the information from Study, FSR uses the value from this attribute to list the Studies.
Study Time	(0008,0030)	1	Filled by an FSU based on the information from Study, FSR uses the value from this attribute to list the Studies.
Study Description	(0008,1030)	2	Filled by an FSU based on the information from Study, FSR uses the value from this attribute to list the Studies.
Study Instance UID	(0020,000D)	1C	Used since no file is referenced by STUDY record
Study ID	(0020,0010)	1	Filled by an FSU based on the information from Study, FSR uses the value from this attribute to list the Studies.
Accession Number	(0008,0050)	2	Filled by an FSU based on the information

			from Study, FSR uses the value from this attribute to list the Studies.

6.2.3.3 Series Directory Record Definition

TABLE 6.2.3-3

SERIES KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Modality	(0008,0060)	1	Filled by an FSU based on the information from Study, not used by FSR
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	1	Filled by an FSU based on the information from Study, not used by FSR
Icon Image Sequence	(0088,0200)	3	Not used

6.2.3.4 Image Directory Record Definition

TABLE 6.2.3-4

IMAGE KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Instance Number	(0020,0013)	1	Filled by an FSU based on the information from Study, not used by FSR

Icon Image Sequence	(0088,0200)	3	Not Used

6.2.3.5 Presentation State Directory Record Definition

TABLE 6.2.3-5

PRESENTATION KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Presentation Creation Date	(0070,0082)	1	Filled by an FSU based on the information from Study, not used by FSR
Presentation Creation Time	(0070,0083)	1	
Instance Number	(0020,0013)	1	
Content Label	(0070,0080)	1	
Content Description	(0070,0081)	2	
Content Creator's Name	(0070,0084)	2	
Content Creator's Identification Code Sequence	(0070,0086)	3	
> Include 'Person Identification Macro'			
Referenced Series Sequence	(0008,1115)	1C	
>Series Instance UID	(0020,000E)	1	
>Referenced Image Sequence	(0008,1140)	1	
>>Include 'SOP Instance Reference Macro'			
Blending Sequence	(0070,0402)	1C	
>Study Instance UID	(0020,000D)	1	

>Referenced Series Sequence	(0008,1115)	1	
>>Series Instance UID	(0020,000E)	1	
>>Referenced Image Sequence	(0008,1140)	1	
>>>Include 'SOP Instance Reference Macro'			
Any other Attribute of the Presentation IE Modules		3	List and describe these in detail.

6.2.3.6 SR Document Directory Record Definition

TABLE 6.2.3-6

SR DOCUMENT KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Instance Number	(0020,0013)	1	Filled by an FSU based on the information from Study, not used by FSR
Completion Flag	(0040,A491)	1	Filled by an FSU based on the information from Study, not used by FSR
Verification Flag	(0040,A493)	1	Filled by an FSU based on the information from Study, not used by FSR
Content Date	(0008,0023)	1	Filled by an FSU based on the information from Study, not used by FSR
Content Time	(0008,0033)	1	Filled by an FSU based on the information from Study, not used

			by FSR
Verification DateTime	(0040,A030)	1C	Not used
Concept Name Code Sequence	(0040,A043)	1	Filled by an FSU based on the information from Study, not used by FSR
>Include 'Code Sequence Macro'			
Content Sequence	(0040,A730)	1C	Not Used
>Relationship Type	(0040,A010)	1	
>Include 'Document Content Macro'			
Any other Attribute of the Document IE Modules		3	List and describe these in detail.

6.2.3.7 Key Object Document Directory Record Definition

TABLE 6.2.3-7

KEY OBJECT DOCUMENT KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Depending on the system configuration, one of the defined terms listed in section 2.6 is used
Instance Number	(0020,0013)	1	Filled by an FSU based on the information from Study, not used by FSR
Content Date	(0008,0023)	1	Filled by an FSU based on the information from Study, not used by FSR
Content Time	(0008,0033)	1	Filled by an FSU based on the information from Study, not used by FSR
Concept Name Code	(0040,A043)	1	Filled by an FSU based on the information

Sequence			from Study, not used by FSR
>Include 'Code Sequence Macro'			
Content Sequence	(0040,A730)	1C	Not used
>Relationship Type	(0040,A010)	1	
>Include 'Document Content Macro'			
Any other Attribute of the Document IE Modules		3	List and describe these in detail.