0. COVER PAGE

CoActiv, LLC

CoActiv Medical Business Solutions

EXAM-PACS® Conformance Statement

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1. CONFORMANCE STATEMENT OVERVIEW

The EXAM-Server is a self-contained networked computer system used for archiving diagnostic medical images. It allows external systems to send images to it for permanent storage, retrieve information about such images, and retrieve the images themselves. The system conforms to the DICOM standard to allow the sharing of medical information with other digital imaging systems.

Table F.1-1
NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
All DICOM Persistent Object Storage classes	Yes	Yes
Storage Commitment		
Storage Commitment Push Model	Yes	Yes
Query/Retrieve		
Patient Root Q/R - FIND	No	Yes
Patient Root Q/R - MOVE	No	Yes
Patient Root Q/R - GET	No	Yes
Study Root Q/R - FIND	No	Yes
Study Root Q/R - MOVE	No	Yes
Study Root Q/R - MOVE	No	Yes
Workflow Management		
Modality Worklist - FIND	No	Yes

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3. INTRODUCTION

3.1. REVISION HISTORY

Date	Author	Notes
July 2004	David Harvey	First version
Nov 2008	DCS Team	Revision 2.0 Final Adding Q/R SCP, MWL SCP, Storage Commitment SCP & Printing SCU functions.

3.2. AUDIENCE

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.3. REMARKS

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between the EXAM-Server and other DICOM systems. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [DICOM]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

— The comparison of different Conformance Statements is the first step towards assessing interconnectivity between EXAM-Server and other DICOM conformant equipment.

— Test procedures should be defined to validate the desired level of connectivity.

3.4. DEFITIONS, TERMS AND ABBREVIATIONS

AE	Application Entity
CR	Computerized radiography
CT	Computerized Tomography
DICOM	Digital Imaging and Communications in Medicine
IE	Information Entity
IOD	Information Object Definition
ISO	International Standards Organization
MR	Magnetic Resonance
PDU	Protocol Data Unit
SC	Secondary Capture
SCP	Service Class Provider

SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
US	Ultrasound
VM	Value Multiplicity
VR	Value Representation

4. NETWORKING

4.1. IMPLEMENTATION MODEL

4.1.1 Application Data Flow
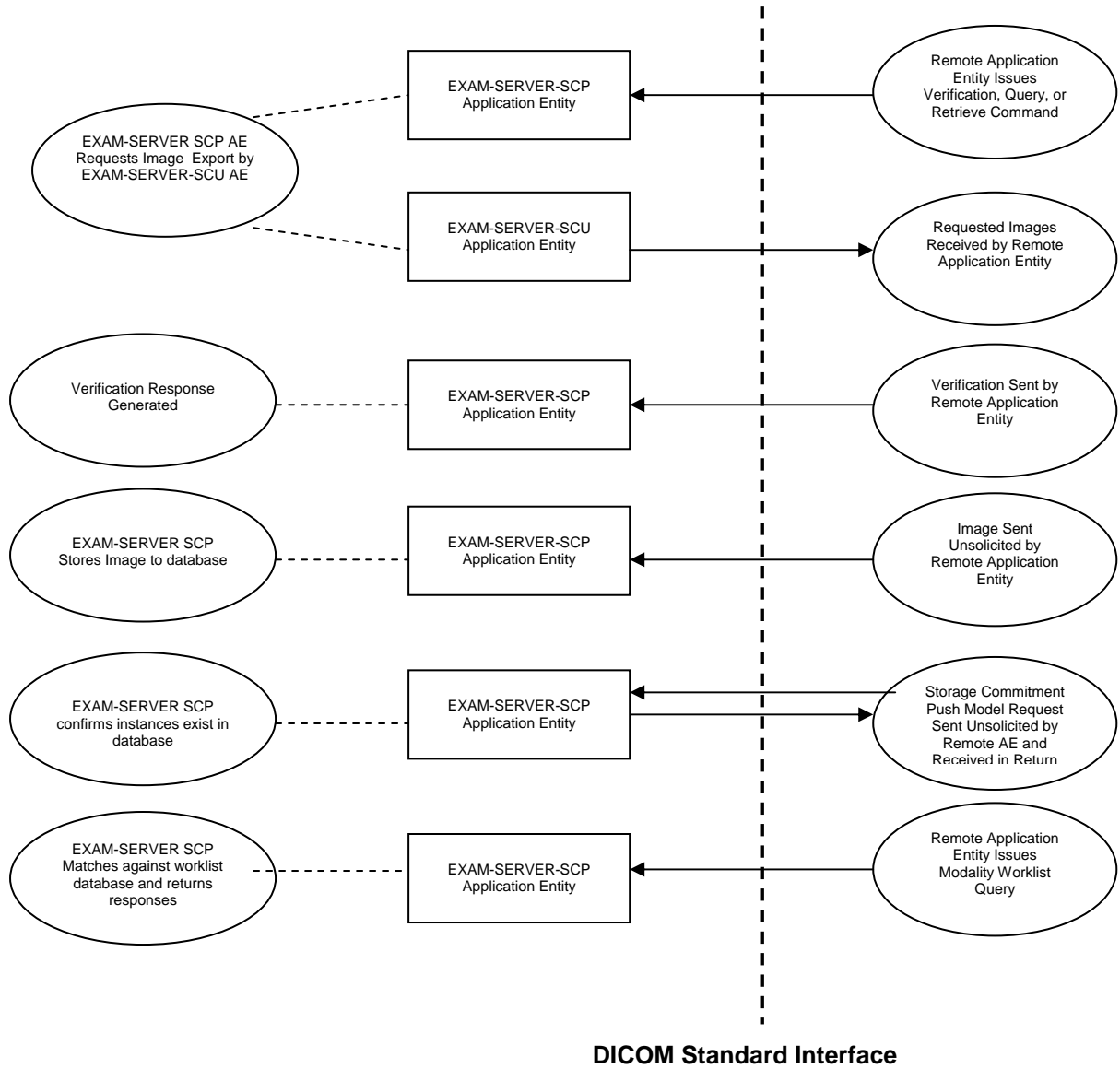
Figure 4.1-1
EXAM-SERVER DICOM DATA FLOW DIAGRAM

The Application Entities detailed in the Application Data Flow Diagram are all part of the same Windows Service.

— The EXAM-Server-SCU AE can send Composite SOP Instances. It handles requests from the EXAM-Server-SCP AE to transmit Images to a specific DICOM destination in response to C-MOVE requests. The EXAM-Server-SCU AE functions as a C-STORE SCU.

— The EXAM-Server-SCP AE can handle incoming query and retrieve requests. It can handle external queries for Patient, Study, Series, and Image data, and also handle Image retrieval requests. The EXAM-Server-SCP AE handles C-MOVE requests by issuing a command to the EXAM-Server-SCU AE to send the requested Images to the destination specified by the Remote AE. The EXAM-Server-SCP AE functions as an SCP for C-FIND and C-MOVE & C-GET requests.

— The EXAM-Server-SCP AE can receive incoming DICOM images and add them to the EXAM-Server database. It can respond to external Storage and Verification Requests as a Service Class Provider (SCP) for C-STORE and C-ECHO requests. The Exam-Server-SCP AE can also handle Storage Commitment Push Model Requests. It can thus be used to query whether the EXAM-Server will confirm ownership and responsibility for specific Composite SOP Instances. The EXAM-Server-SCP AE currently supports all types of Composite SOP Instances.

— The EXAM-Server-SCP AE can receive incoming Modality Worklist Queries, and match them against the database of scheduled studies, returning the results to the Remote AE.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of EXAM-Server-SCU Application Entity

The EXAM-Server-SCU AE can be invoked by the EXAM-Server-SCP AE to trigger the transfer of specific images to a remote destination AE. The EXAM-Server-SCU AE must be correctly configured with the host and port number of any external DICOM AE's that are to be C-MOVE retrieval destinations. The Presentation Contexts to use are determined from the SOP Classes of the DICOM files to be transferred.

4.1.2.2 Functional Definition of EXAM-Server-SCP Application Entity

The EXAM-Server-SCP AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, EXAM-Server-SCP AE expects it to be a DICOM application. EXAM-Server-SCP AE will accept Associations with Presentation Contexts for SOP Classes of the DICOM Query-Retrieve, Storage, Modality Worklist and Verification Service Classes. It will handle query and retrieve requests on these Presentation Contexts and respond with data objects with values corresponding to the contents of the EXAM-Server database. For C-MOVE requests the destination for the image objects is determined from the Destination AE Title contained in the C-MOVE request. When a C-MOVE request is received, the EXAM-Server-SCP AE issues a command to the EXAM-Server-SCU AE to send the specified images to the C-MOVE Destination AE.

4.1.2.3 Functional Definition of STORAGE-SCP Application Entity

The EXAM-Server-SCP AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the EXAM-Server-SCP AE expects it to be a DICOM application. The EXAM-Server-SCP AE will accept Associations with Presentation Contexts for SOP Classes of the Verification, Storage, and Storage Commitment Service Classes. Any images received on such Presentation Contexts will be added to the EXAM-Server database. If a Storage Commitment Push Model N-ACTION Request is received then the EXAM-Server-SCP AE will immediately check if the referenced Composite SOP Instances are in the EXAM-Server database and return an N-EVENT-REPORT Notification. It will never 'cache' Storage Commitment Push Model Requests and wait for Composite SOP Instances to be received at a later time.

4.1.3 Sequencing of Real-World Activities

The only sequencing constraint that exists across all the EXAM-Server Application Entities is the fact that a Composite SOP Instance must be received by the EXAM-Server-SCP AE before Storage Commitment Push Model or Query-Retrieve Requests related to this SOP Instance can be successfully handled:
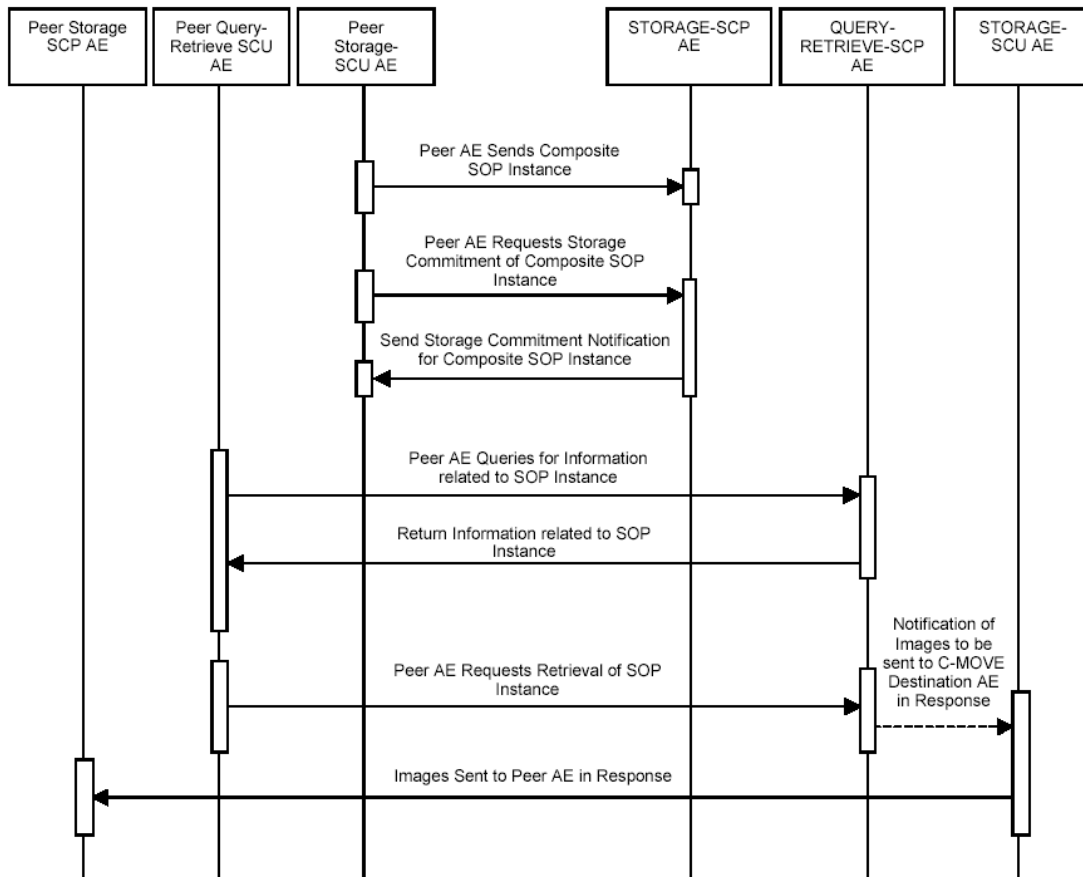

Figure 4.1-2 SEQUENCING CONSTRAINTS

Note that the only constraint is for the Composite SOP Instance to be received prior to the other events. For example, it is not necessary for the Storage Commitment Push Model Request to be received prior to receiving Query or Retrieval Requests related to the SOP Instance.

4.2. AE SPECIFICATIONS

4.2.1 EXAM-Server-SCU Application Entity Specification

4.2.1.1 SOP Classes

The EXAM-Server-SCU AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 4.2-1
SOP CLASSES FOR EXAM-SERVER-SCU AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	No
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	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 Intra-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
CT Image Storage	1.2.840.10008.5.1.4.1.1.6	Yes	No
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1		
US Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.2	Yes	No
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
US Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No
US Multi-frame Storage	1.2.840.10008.5.1.4.1.1.3.1	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
MR Spectroscopy	1.2.840.10008.5.1.4.1.1.4.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Stand-alone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	Yes	No
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Yes	No
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No

Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Stand-alone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	Yes	No
Stand-alone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	Yes	No
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	No
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	No
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	No

By altering the configuration it is possible to support additional or fewer SOP Classes.

4.2.1.2 Association Establishment Policies

4.2.1.2.1 General

The EXAM-Server-SCU AE can only form Associations when requested to do so by the EXAM-Server-SCP AE. The EXAM-Server-SCU AE can only request the opening of an Association. It cannot accept requests to open Associations from external Application Entities.

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

Table 4.2-2
DICOM APPLICATION CONTEXT FOR EXAM-SERVER-SCU AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The maximum number of simultaneous Associations both in total and to an individual Remote AE is unlimited.

4.2.1.2.3 Asynchronous Nature

The EXAM-Server-SCU AE does not support asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 4.2-3
ASYNCHRONOUS NATURE AS A SCU FOR EXAM-SERVER-SCU AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

4.2.1.2.4 Implementation Identifying Information

Table 4.2-4
DICOM IMPLEMENTATION CLASS AND VERSION FOR EXAM-SERVER-SCU AE

Implementation Class UID	1.2.826.0.1.3680043.2.859.1.1.xy
Implementation Version Name	COACTIV-EP-227

Note that the EXAM-Server-SCU AE and EXAM-Server-SCP AE use the same Implementation Class UID. All EXAM-Server AE's use the same Implementation Version Name. This Version Name is updated with each new release of the product software, as the different AE versions are never released independently. X and y will increment with new versions.

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Send Images Requested by an External Peer AE

4.2.1.3.1.1 Description and Sequencing of Activity

The EXAM-Server-SCU AE will initiate a new Association when the EXAM-Server-SCP AE invokes the EXAM-Server-SCU AE to transmit images. The EXAM-Server-SCP AE will issue such a command 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 image transfer is started. In all cases an attempt will be made to transmit all the indicated images in a single Association, but this may not always be possible. The Association will be released when all the images have been sent. If an error occurs during transmission over an open Association then the image transfer is halted. The EXAM-Server-SCU AE will not attempt to independently retry the image export.

Note that the EXAM-Server-SCU AE does not support the unsolicited sending of SOP Instances using the DICOM Storage Service Class. It will only send SOP Instances in response to a C-MOVE Request from a peer AE.
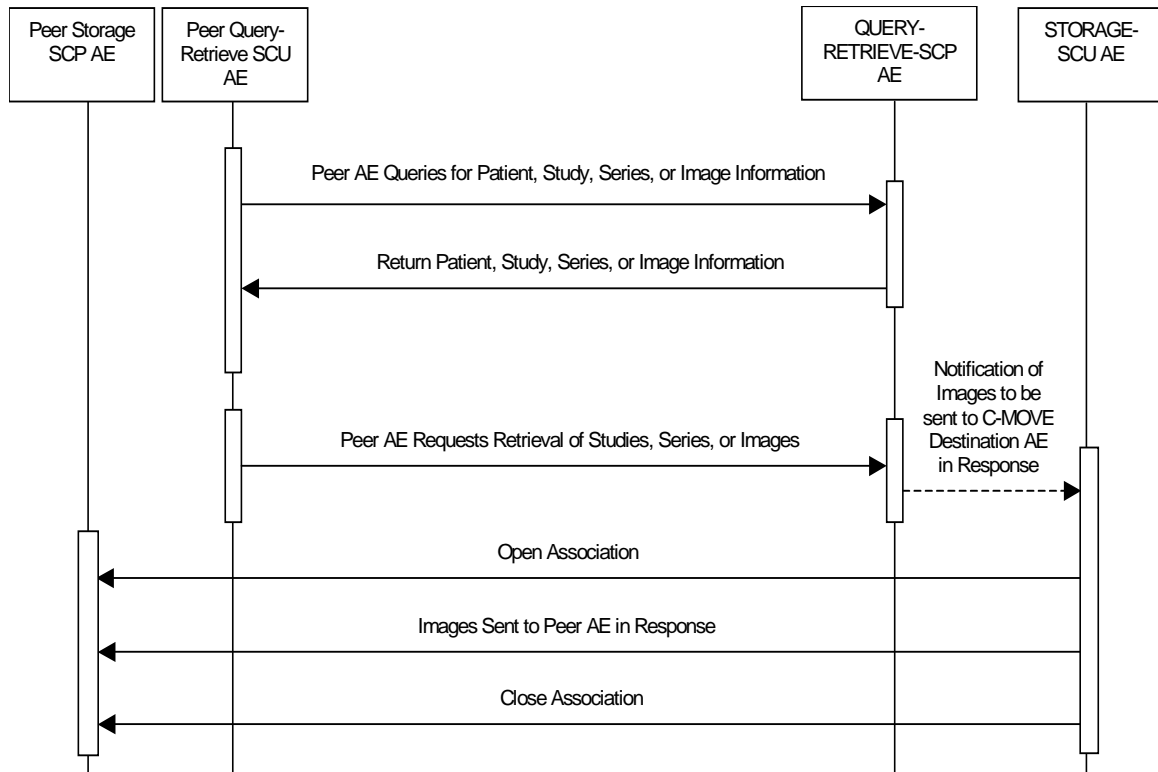
Table 4.2-5
SEQUENCING OF ACTIVITY - SEND IMAGES REQUESTED BY AN EXTERNAL PEER AE

The following sequencing constraints illustrated in 4.2-1 apply to the EXAM-Server-SCU AE:

1. Peer AE requests retrieval of Study, Series, or Images from EXAM-Server-SCP AE (C-MOVE-RQ).

2. EXAM-Server-SCP AE signals EXAM-Server-SCU AE to send the image Composite SOP Instances indicated in the C-MOVE-RQ to the C-MOVE Destination AE.

3. EXAM-Server-SCU AE opens a new Association with the indicated C-MOVE Destination AE.

4. EXAM-Server-SCU AE sends the indicated Composite SOP Instances, and after each one, the Exam-Server-SCP AE sends a pending C-MOVE-RSP to update progress,

5. EXAM-Server-SCU AE closes the Association.

6. EXAM-Server-SCP sends a final C-MOVE RSP to indicate completion

7. The Verification Service is only supported as a utility function for Service staff. It is used only as a diagnostic tool.

4.2.1.3.1.2   Proposed Presentation Contexts

EXAM-Server-SCU AE will propose Presentation Contexts as shown in the following table:

Table 4.2-6
PROPOSED PRESENTATION CONTEXTS BY THE EXAM-SERVER-SCU 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	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 Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
US Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Explicit JPEG baseline lossy compression	1.2.840.10008.1.2.4.50	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 Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit JPEG baseline lossy compression	1.2.840.10008.1.2.4.50	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
US Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
US Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	DICOM Explicit JPEG baseline lossy compression	1.2.840.10008.1.2.4.50	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
US Multi-frame Storage	1.2.840.10008.5.1.4.1.1.3.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
US Multi-frame Storage	1.2.840.10008.5.1.4.1.1.3.1	DICOM Explicit JPEG baseline lossy compression	1.2.840.10008.1.2.4.50	SCU	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	SCU	None
Computer Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	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
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax			
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
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	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
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit JPEG baseline lossy compression	1.2.840.10008.1.2.4.50	SCU	None

Note: The SOP Classes and Transfer Syntaxes that the EXAM-Server-SCU AE proposes, as listed above, represent the default behavior. The EXAM-Server-SCU AE can be configured to propose a subset of these contexts or additional Presentation Contexts.

4.2.1.3.1.3 SOP Specific Conformance for SOP Class(es)

4.2.1.3.1.3.1 SOP Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

4.2.1.3.1.3.2 SOP Specific Conformance for Image SOP Classes

Composite DICOM SOP Instances are maintained as DICOM Part 10 compliant files in the EXAM-Server database. The entire set of attributes received with the image will be saved in EXAM-Server; this includes all Private and SOP Extended Elements. When a SOP Instance is selected for export from EXAM-Server, 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 can have been altered due to changes administered on EXAM-Server or changes to the state of the image data due to compression can be altered when the SOP Instance is exported.

The Patient demographic and Study information can be entered or altered by several means. Values can be altered without changing the SOP Instance UID unless otherwise noted. Refer to the Annex for the specific details of which Elements can have their values altered at time of export.

The EXAM-Server creates files called Service Logs that can be used to monitor their status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these Service Logs.

The EXAM-Server-SCU 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 4.2-7
EXAM-SERVER-SCU 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. A message is sent to the EXAM-Server-SCP AE indicating successful export. The EXAM-Server-SCP AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Success indication message is output to the Service Logs.
Refused	Out of Resources	A700 – A7FF	This is treated as a permanent Failure. A message is sent to the EXAM-Server-SCP AE indicating an export failure and the Association is released. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a permanent Failure. A message is sent to the EXAM-Server-SCP AE indicating an export failure and the Association is released. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.
Error	Cannot Understand	C000 - CFFF	This is treated as a permanent Failure. A message is sent to the EXAM-Server-SCP AE indicating an export failure and the Association is released. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. A message is sent to the EXAM-Server-SCP AE indicating successful export. The EXAM-Server-SCP AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the Service Logs.
Warning	Data Set does not match SOP Class	B007	Image transmission is considered successful. A message is sent to the EXAM-Server-SCP AE indicating successful export. The EXAM-Server-SCP AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the Service Logs.
Warning	Elements Discarded	B006	Image transmission is considered successful. A message is sent to the EXAM-Server-SCP AE indicating successful export. The EXAM-Server-SCP AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the Service Logs.
Warning	Attribute List Error	0107	Image transmission is considered successful. A message is sent to the EXAM-Server-SCP AE indicating successful export. The EXAM-Server-SCP AE will send the appropriate PENDING or SUCCESS Status in the C-MOVE Response. Warning indication message is output to the Service Logs.
Warning	Attribute Value Out of Range	0116	Image transmission is considered successful. A message is sent to the EXAM-Server-SCP AE indicating successful export. The EXAM-Server-SCP AE will send the appropriate PENDING or SUCCESS Status in the C-

			MOVE Response. Warning indication message is output to the Service Logs.
*	*	Any other status code.	This is treated as a permanent Failure. A message is sent to the EXAM-Server-SCP AE indicating an export failure and the Association is released. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.

All Status Codes indicating an error or refusal are treated as a permanent failure. The EXAM-Server-SCU 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 EXAM-Server-SCP AE.

Table 4.2-8
EXAM-SERVER-SCU AE COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT and a message is sent to the EXAM-Server-SCP AE indicating an export failure. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT and a message is sent to the EXAM-Server-SCP AE indicating an export failure. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.
Association A-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	A message is sent to the EXAM-Server-SCP AE indicating an export failure. The EXAM-Server-SCP AE will send an appropriate Status in the C-MOVE Response. Error indication message is output to the Service Logs.

4.2.1.4 Association Acceptance Policy

The EXAM-Server-SCU AE does not accept Associations.

4.2.2 EXAM-Server-SCP Application Entity Specification

4.2.2.1 SOP Classes

The EXAM-Server-SCP AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 4.2-9
SOP CLASSES FOR EXAM-SERVER-SCP AE

SOP Class Name	SOP Class UID	SCU	SCP
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
Patient Root Q/R Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	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
Study Root Q/R Information Model - GET	1.2.840.10008.5.1.4.1.2.3.3	No	Yes

Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	No	Yes

4.2.2.2 Association Policies

4.2.2.2.1   General

The EXAM-Server-SCP AE will never initiate Associations; it only accepts Association Requests from external DICOM AEs. The EXAM-Server-SCP AE will accept Associations for Verification, C-FIND (Image query and modality worklist), C-GET and C-MOVE requests. In the case of a C-MOVE request, the EXAM-Server-SCP AE will issue a command to the EXAM-Server-SCU AE to initiate an Association with the Destination DICOM AE to send images as specified by the originator of the C-MOVE Request.

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

Table 4.2-10
DICOM APPLICATION CONTEXT FOR EXAM-SERVER-SCP AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2   Number of Associations

The EXAM-Server-SCP AE can support multiple simultaneous Associations. There is no maximum number of simultaneous associations.

Table 4.2-11
NUMBER OF SIMULTANEOUS ASSOCIATIONS AS A SCP FOR EXAM-SERVER-SCP AE

Maximum number of simultaneous Associations	unlimited

4.2.2.2.3   Asynchronous Nature

The EXAM-Server-SCP AE does not support asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 4.2-12
ASYNCHRONOUS NATURE AS A SCP FOR EXAM-SERVER-SCP AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

4.2.2.2.4   Implementation Identifying Information

The implementation information for the Application Entity is:

Table 4.2-13
DICOM IMPLEMENTATION CLASS AND VERSION FOR EXAM-SERVER-SCP AE

Implementation Class UID	1.2.826.0.1.3680043.2.859.1.1.xy
Implementation Version Name	COACTIV-EP-227

Note that the EXAM-Server-SCU AE, and EXAM-Server-SCP AE use the same Implementation Class UID. All EXAM-Server AE's use the same Implementation Version Name. This Version Name is updated with each new release of the product software, as the different AE versions are never released independently, and such versions will be reflected in the x and y values above..

4.2.2.3 Association Initiation Policy

The EXAM-Server-SCP AE does not initiate Associations.

4.2.2.4 Association Acceptance Policy

4.2.2.4.1 Activity – Handling Query and Retrieval Requests

4.2.2.4.1.1 Description and Sequencing of Activity

The EXAM-Server-SCP 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. It can be configured to only accept Associations with certain hosts (using TCP/IP address) and/or Application Entity Titles.

If EXAM-Server-SCP 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 EXAM-Server-SCP AE receives a query (C-GET) request then the response(s) including the requested instances will be sent over the same Association used to send the C-GET-Request.

If EXAM-Server-SCP AE receives a C-MOVE request then the responses will be sent over the same Association used to send the C-MOVE-Request. The EXAM-Server-SCP AE will notify the EXAM-Server-SCU to send the requested SOP Instances to the C-MOVE Destination. The EXAM-Server-SCU AE notifies the EXAM-Server-SCP AE of the success or failure of each attempt to send a Composite SOP Instance to the peer C-MOVE Destination AE. The EXAM-Server-SCP AE then sends a C-MOVE Response indicating this status after each attempt. Once the EXAM-Server-SCU AE has finished attempting to transfer all the requested SOP Instances, the EXAM-Server-SCP AE sends a final C-MOVE Response indicating the overall status of the attempted retrieval.
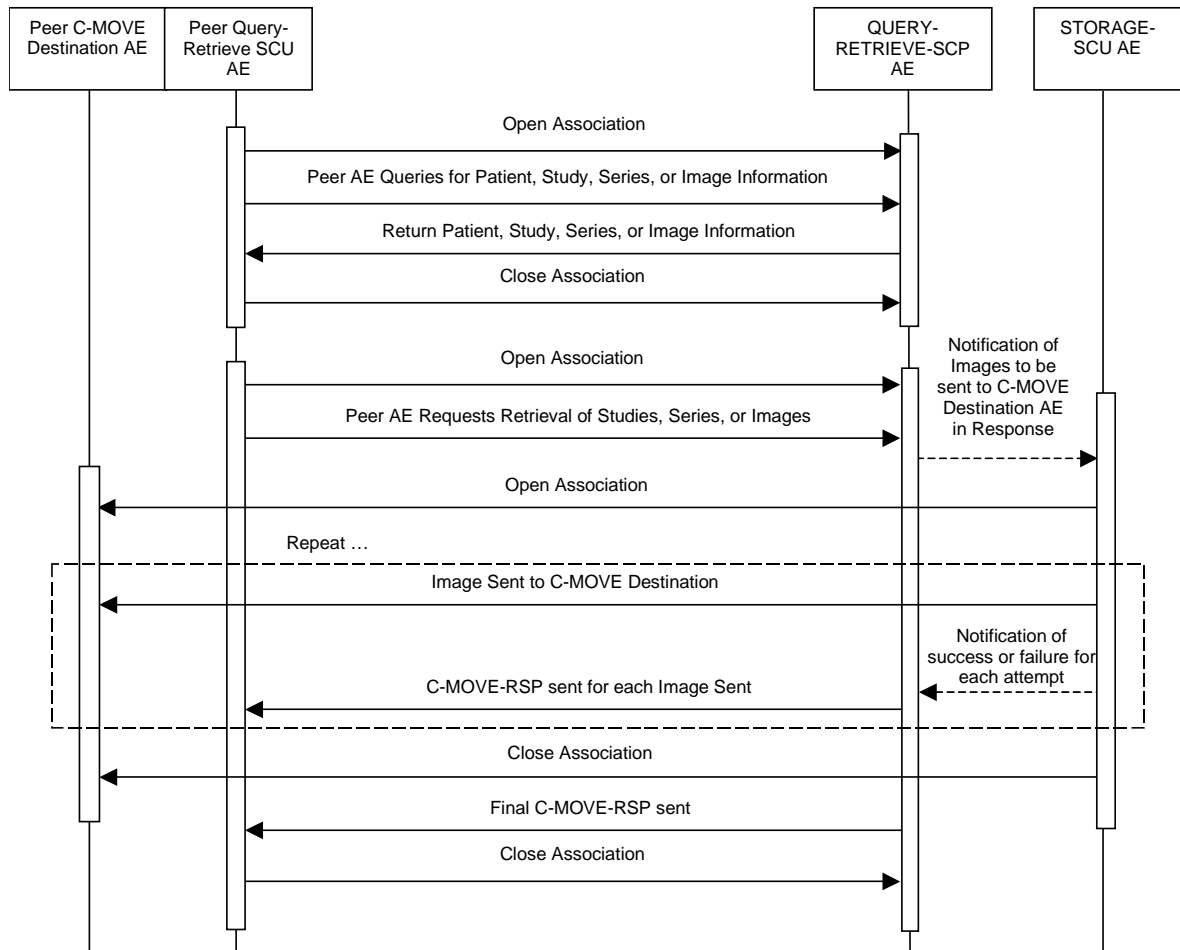
```
 Peer C-MOVE      Peer Query-                              QUERY-            STORAGE-
 Destination AE   Retrieve SCU                          RETRIEVE-SCP        SCU AE
                      AE                                      AE

                              Open Association

                   Peer AE Queries for Patient, Study, Series, or Image Information

                   Return Patient, Study, Series, or Image Information

                              Close Association


                              Open Association                          Notification of
                                                                        Images to be
                   Peer AE Requests Retrieval of Studies, Series, or Images     sent to C-MOVE
                                                                        Destination AE
                                                                          in Response
                              Open Association

                   Repeat …

                    Image Sent to C-MOVE Destination
                                                                        Notification of
                                                                       success or failure for
                   C-MOVE-RSP sent for each Image Sent                   each attempt

                              Close Association

                   Final C-MOVE-RSP sent

                              Close Association
```

Figure 4.2-1
Sequencing of Activity – Handling Query and Retrieval Requests

The following sequencing constraints apply to the EXAM-Server-SCP AE for handling queries (C-FIND-Requests):

1. Peer AE opens an Association with the EXAM-Server-SCP AE.

2. Peer AE sends a C-FIND-RQ Message

3. EXAM-Server-SCP 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, C-GET or C-MOVE Requests can be sent over the Association before it is closed.

The following sequencing constraints apply to the EXAM-Server-SCP AE for handling C-GET Requests:

1. Peer AE opens an Association with the EXAM-Server-SCP AE.

2. Peer AE sends a C- GET -RQ Message

3. EXAM-Server-SCP AE uses the C-STORE service to send images over the same association on which the C-GET was received.

4. Following each C-STORE, EXAM-Server-SCP AE returns a C- GET -RSP Pending Message to the peer AE

5. Following the final image, a final C-FIND-RSP is sent indicating that the retrieval is complete.

6. Peer AE closes the Association. Note that the peer AE does not have to close the Association immediately. Further C-FIND, C-GET or C-MOVE Requests can be sent over the Association before it is closed.

The following sequencing constraints apply to the EXAM-Server-SCP AE for handling C-MOVE-Requests:

1. Peer AE opens an Association with the EXAM-Server-SCP AE.

2. Peer AE sends a C-MOVE-RQ Message

3. EXAM-Server-SCP AE notifies the EXAM-Server-SCU 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 EXAM-Server-SCU AE indicates to the EXAM-Server-SCP AE whether the transfer succeeded or failed. The EXAM-Server-SCP AE then returns a C-MOVE-RSP indicating this success or failure.

5. Once the EXAM-Server-SCU AE has completed all attempts to transfer the SOP Instances to the C-MOVE Destination AE, or the first failure occurred, the EXAM-Server-SCP 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, C-GET or C-MOVE Requests can be sent over the Association before it is closed.

4.2.2.4.1.2 Accepted Presentation Contexts

EXAM-Server-SCP AE will accept Presentation Contexts as shown in the following table:

Table 4.2-14
ACCEPTED PRESENTATION CONTEXTS BY THE EXAM-SERVER-SCP AE FOR HANDLING QUERY AND RETRIEVAL REQUESTS

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	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit	1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**			
Q/R Information Model - FIND		VR Little Endian			
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
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Study Only Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

4.2.2.4.1.3 SOP Specific Conformance

4.2.2.4.1.3.1 SOP Specific Conformance for Query SOP Classes

The EXAM-Server-SCP AE supports hierarchical queries and not relational queries. There are no attributes always returned by default. Only those attributes requested in the query identifier are returned. Query responses always return values from the EXAM-Server 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.

Patient Root Information Model

All required search keys on each of the four levels (Patient, Study, Series, and Image) are supported. However, the Patient's Name (0010,0010) key must have at least a partial value if the Patient ID (0010,0020) key is not present in a Patient Level query.

Study Root Information Model

All the required search keys on each of the three levels (Study, Series, and Image) are supported. If no partial values are specified for Study attributes then either the Patient ID (0010,0020) key or the Patient's Name (0010,0010) must have at least a partial value specified.

Patient/Study Only Information Model

All the required search keys on the Patient and Study levels are supported. The Patient ID (0010,0020) key must be at least partially stated if the Patient's Name (0010,0010) is not present in a Patient Level query.

Table 4.2-15
PATIENT ROOT C-FIND SCP SUPPORTED ELEMENTS

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common Specific Character Set	0008,0005	CS	NONE

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 Sex	0010,0040	CS	S,U
Other Patient IDs	0010,1000	LO	NONE
Other Patient Names	0010,1001	PN	NONE
Study Level			
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	R,U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U,L
Referring Physician's Name	0008,0090	PN	S,*,U
Study Description	0008,1030	LO	S,*,U
Series Level			
Modality	0008,0060	CS	S,U
Series Number	0020,0011	IS	S,*,U
Series Instance UID	0020,000E	UI	S,U,L
Operator's Name	0008,1070	PN	NONE
Image Level			
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U,L

Table 4.2-16
STUDY ROOT C-FIND SCP SUPPORTED ELEMENTS

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
Study 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 Sex	0010,0040	CS	S,U
Other Patient IDs	0010,1000	LO	NONE
Other Patient Names	0010,1001	PN	NONE
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	R,U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U,L
Referring Physician's Name	0008,0090	PN	S,*,U
Study Description	0008,1030	LO	S,*,U
Series Level			
Modality	0008,0060	CS	S,U
Series Number	0020,0011	IS	S,*,U
Series Instance UID	0020,000E	UI	S,U,L

Operator's Name	0008,1070	PN	NONE
Image Level			
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U,L

Table 4.2-17
PATIENT-STUDY ONLY C-FIND SCP SUPPORTED ELEMENTS

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
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 Sex	0010,0040	CS	S,U
Other Patient IDs	0010,1000	LO	NONE
Other Patient Names	0010,1001	PN	NONE
Study Level			
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	R,U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U,L
Referring Physician's Name	0008,0090	PN	S,*,U
Study Description	0008,1030	LO	S,*,U

The tables 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. A "S" indicates the identifier attribute can specify Single Value Matching, a "R" will indicate Range Matching, a "*" will denote wildcard matching, an 'U' will indicate universal matching, and 'L' will indicate that UID lists are supported for matching. "NONE" indicates that no matching is supported, but that values for this Element in the database can be returned.

Table 4.2-18
EXAM-SERVER-SCP 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.
	Matches are continuing but one or more Optional Keys were not supported.	FF01	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 there are Optional keys in the query identifier that are not supported.

4.2.2.4.1.3.2 SOP Specific Conformance for Retrieval SOP Classes

For C-MOVE, the EXAM-Server-SCP AE will convey to the EXAM-Server-SCU 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 EXAM-Server-SCU 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 F.4.2-6 will be negotiated. For C-GET, the EXAM-Server-SCP AE sends the images itself.

The EXAM-Server-SCP AE can support lists of UIDs in the C-GET/C-MOVE Request at the Study, Series, and Image Levels. The list of UIDs must be at the Level of the C-MOVE Request however. For example, if the C-GET/C-MOVE Request is for Series Level retrieval but the identifier contains a list of Study UIDs then the C-GET/C-MOVE Request will be rejected, and the A900 Failed Status Code will be returned in the C-GET/C-MOVE Response.

The EXAM-Server-SCP AE will return a response to the C-GET/C-MOVE SCU after the EXAM-Server-SCU AE or itself 9accoridng to the request type, has attempted to send each image. This response reports the number of remaining SOP Instances to transfer, and the number transferred having a successful, failed, or warning status.

Table 4.2-19
EXAM-SERVER-SCP AE C-GET AND 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.

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 as an alert on the User Interface, and to the Service Log.
	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 determined to be off-line (i.e. the MO media has been removed from the archive jukebox). Error message is output as an alert on the User Interface, and to the Service Log.
	Move destination unknown	A801	The Destination Application Entity named in the CGET/ C-MOVE Request is unknown to Query-Retrieve SCP AE. Error message is output to the Service Log.
Failed	Identifier does not match SOP Class	A900	The CGET/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 Service Log.
Warning	Sub-operations complete – One or more Failures	B000	One or more images failed to be sent
Cancel	Matching terminated due to Cancel Request	FE00	The CGET/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 CGET/C-MOVE Destination AE.

Table 4.2-20
EXAM-SERVER-SCP AE COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The EXAM-Server-SCP AE is waiting for the next C-FIND or C-MOVE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If the EXAM-Server-SCU 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.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). I.e. The EXAM-Server-SCP 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 Service Log. If the EXAM-Server-SCU 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 Service Log. If the EXAM-Server-SCU 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.

4.2.2.4.2 Activity - Configured AE Requests MWL Query

4.2.2.4.2.1 Description and Sequencing of Activities

When Modality Worklist SCUs query EXAM-PACS the queries run against the Scheduled Procedure Step Worklist (referred to hereafter as the 'SPS Worklist' or 'Worklist') in the EXAM-PACS database. There is a configurable mapping between the Universal Service ID contained in the HL7 Order messages (See Table in section C.8.3-1) and one or more Requested Procedures within the EXAM-PACS database. A Requested Procedure may, in turn, map to 1 or more Scheduled Procedure Steps though the relation is usually 1-to-1. This mapping is also site-configurable. The relation between Accession Number (0008,0050) and Requested Procedure ID (0040,1001) is 1-to-1 within EXAM-PACS and these attributes have the same value in all MWL responses. Scheduled Procedure Step entries are added and removed from the Worklist as follows:

— Add Scheduled Procedure Step Entries Normal Pathway - As orders are received from the HIS via HL7 or entered using EXAM-PACS' Ordering and Scheduling application, additions are made to the SPS Worklist in the EXAM-PACS database per the mapping specified above.

— Add Scheduled Procedure Step Entries Exception Pathway – Users can interactively create additional Scheduled Procedure Step entries for a given Requested Procedure using the Procedure Update application. It may be necessary to create additional entries under certain conditions such as when it is discovered that a procedure must be redone after having previously been marked as completed. This does not apply to canceled procedures

— Remove Scheduled Procedure Step Entries Normal Pathway – An SPS entry is removed from the SPS Worklist under the following circumstances:

    — As mentioned previously, EXAM-PACS supports common RIS function to set the state of the procedure as it progresses from being ordered to being resulted and signed. Setting the procedure state may be initiated interactively via the Procedure Update application or as a result of various events. An entry in the SPS Worklist is removed when the Requested Procedure that is the parent of the SPS is set to a configured status. This configuration is system-wide applying equally to all procedures.

— Remove Entries Exception Pathway – When a procedure is canceled all SPS entries related to that procedure are removed from the Worklist.

Remove Entries Maintenance Pathway – SPS entries that are still in the Worklist a configurable time after their scheduled start date/time will be removed by a day-end maintenance job.

Table 4.2-21
SCHEDULED PROCEDURE STEP ENTRY ACTIONS TABLE

Events	Scheduled Procedure Step Entry Actions
Order received from HIS or entered using EXAM-PACS application	Add one or more Entries to Worklist
User adds SPS entry interactively	Add Entry to Worklist
Current time exceeds SPS scheduled time by a Worklist configured time interval	Remove Entry from Worklist
Parent procedure canceled	Remove one or more Entries from Worklist

Events	Scheduled Procedure Step Entry Actions
Parent procedure set to a state that causes removal of child SPS entries from Worklist	Remove one or more Entries from Worklist

Table 4.2-22
SEQUENCING DIAGRAM FOR ACTIVITY: CONFIGURED AE REQUESTS MWL QUERY

The figure above is a possible sequence of messages between a Modality Worklist SCU and EXAM-PACS.

1. The Modality opens an Association with EXAM-PACS for the purpose of querying for a Modality Worklist

2. The Modality sends an MWL C-FIND query to EXAM-PACS

3. EXAM-PACS queries its database using the attributes from the C-FIND Request and returns 0 to N C-FIND responses depending on matches returned from the database. EXAM-PACS checks for a C-FIND Cancel Request after a configured number of responses are sent. If a Cancel is received then no further Pending responses are sent.

4. EXAM-PACS sends the final C-FIND response

5. The Modality closes the Association

4.2.2.4.2.2 Accepted Presentation Contexts

EXAM-Server-SCP AE will accept Presentation Contexts for Modality Worklist Queries as

Table 4.2-23
ACCEPTED PRESENTATION CONTEXTS BY THE EXAM-SERVER-SCP AE FOR HANDLING MODALITY WORKLIST REQUESTS

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian DICOM Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

4.2.2.4.2.2.1 Presentation Context Acceptance Criterion

Depending on configuration, EXAM-PACS may or may not accept multiple Presentation Contexts containing the same Abstract Syntax.

4.2.2.4.2.2.2 Transfer Syntax Selection Policy

Transfer Syntaxes in addition to the default Implicit VR Little Endian may be configured for a given Abstract Syntax. EXAM-PACS's preferred Transfer Syntax is Explicit VR Little Endian and this will be selected if offered.

4.2.2.4.2.2.3 Association Rejection

The EXAM-Server-SCP 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:

a. 1 – DICOM UL service-user
b. 2 – DICOM UL service-provider (ASCE related function)
c. 3 – DICOM UL service-provider (Presentation related function)

Table 4.2-24
ASSOCIATION REJECTION REASONS

Result	Source	Reason/Diag	Explanation
2 – rejected-transient	c	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.
2 – rejected-transient	c	1 – temporary-congestion	No Associations can be accepted at this time due to the real-time requirements of higher priority activities (e.g. during image acquisition no Associations will be accepted) or because insufficient resources are available (e.g. memory, processes, threads). An Association request with the same parameters may succeed at a later time.
1 – rejected-permanent	a	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	a	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	a	3 – calling-AE-title-not-recognized	The Association request contained an unrecognized Calling 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 acceptor has not been configured to recognize the AE Title of the Association initiator.
1 – rejected-permanent	b	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.

4.2.2.4.2.3 SOP Specific Conformance for Modality Worklist SOP Class

EXAM-PACS does not support matching on any optional matching key attributes.

EXAM-PACS supports case-insensitive matching on the following Person Name Value Representation elements:

    Patient Name (0010, 0010)

EXAM-PACS supports optional return key attributes as described in the table below.

Table 4.2-25
MODALITY WORKLIST OPTIONAL RETURN KEYS SUPPORTED

Description/Module	Tag	Remark
Scheduled Procedure Step		
>Scheduled Protocol Code Sequence	(0040, 0008)	
>>Code Meaning	(0008, 0104)	
>Comments on the Scheduled Procedure Step	(0040, 0400)	This attribute, if valued, will contain details of the protocol to be used in carrying out this step. The attribute could contain a full description of the protocol or simply indicate modifications to the protocol designated by the Scheduled Protocol Code Sequence
>Requested Contrast Agent	(0032,1070)	
Requested Procedure		
Reason for the Requested Procedure	(0040, 1002)	
Requested Procedure Comments	(0040, 1400)	
Imaging Service Request		
Reason for the Imaging Service Request	(0040,2001)	
Imaging Service Request Comments	(0040,2400)	
Requesting Service	(0032,1033)	
Issuing Date of Imaging Service Request	(0040,2004)	
Issuing Time of Imaging Service Request	(0040,2005)	
Placer Order Number / Imaging Service Request	(0040,2016)	
Filler Order Number / Imaging Service Request	(0040,2017)	
Order entered by	(0040,2008)	
Order Enterer's Location	(0040,2009)	
Visit Status		
Patient's Institution Residence	(0038,0400)	
Visit Admission		
Referring Physician's	(0008,0090)	
Referring Physician's Address	(0008,0092)	
Referring Physician's Phone Numbers	(0008,0094)	
Admitting Diagnosis Description	(0008,1080)	
Admitting Date	(0038,0020)	

Admitting Time	(0038,0021)	
Patient Identification		
Issuer of Patient ID	(0010,0021)	
Patient Demographic		
Occupation	(0010,2180)	
Patient's Address	(0010,1040)	
Country of Residence	(0010,2150)	
Patient's Telephone Numbers	(0010,2154)	
Ethnic Group	(0010,2160)	
Patient's Religious Preference	(0010,21F0)	
Patient Comments	(0010,4000)	
Patient Medical		
Smoking Status	(0010,21A0)	
Last Menstrual Date	(0010,21D0)	

EXAM-PACS returns C-FIND response statuses as specified below.

Table 4.2-26
MWL C-FIND RESPONSE STATUS REASONS

Service Status	Further Meaning	Error Code	Reasons
Success	Matching is complete	0000	The response status code and meaning are logged in the job log file.
Failure	Out of resources	A700	If the number of matches exceeds a configurable maximum this error code is returned. An error comment describing the error is also returned. The response status code and meaning are logged in the job log file.
	Identifier does not match SOP class	A900	This status is returned if the C-FIND request specifies query or Return keys that are not specified as part of the Modality Worklist Information Model – FIND SOP Class. The response status code and meaning are logged in the job log file.
	Unable to process	C001	This status is returned due to internal errors within EXAM-PACS such as a processing failure response on a query of the EXAM-PACS database. The response status code and meaning are logged in the job log file.
Canceled	Matching terminated due to cancel request	FE00	This status is returned if a Cancel Request is received from the SCU during the processing of a Modality Worklist request. The response status code and meaning are logged in the job log file.
Pending	Matching is continuing	FF00	The status is returned with each matching response. A message is logged for each pending response.

Matching is continuing – Current match is supplied and any optional keys were supported in the same matter as required keys	FF01	The status is returned with each matching response if one or more optional matching or return keys are not supported for existence. A message is logged for each pending response.

4.2.2.4.3 Activity - Configured AE Requests Verification

See section 4.2.1.4.2.3 (same AE responding)

4.3. NETWORK INTERFACES

4.3.1 Physical Network Interface

The EXAM-Server supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

Table 4.3-1
SUPPORTED PHYSICAL NETWORK INTERFACES

Ethernet 100baseT
Ethernet 10baseT

4.3.2 Additional Protocols

EXAM-Server conforms to the System Management Profiles listed in Table 4.3-2. All requested transactions for the listed profiles and actors are supported. It does not support any optional transactions.

Table 4.3-2
SUPPORTED SYSTEM MANAGEMENT PROFILES

Profile Name	Actor	Protocols Used	Optional Transactions	Security Support
Network Address Management	DHCP Client	DHCP	N/A	
	DNS Client	DNS	N/A	

4.3.2.1 DHCP

DHCP is not used.

4.3.2.2 DNS

DNS can be used for address resolution.

4.4. CONFIGURATION

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

The mapping from AE Title to TCP/IP addresses and ports is configurable and set at the time of installation by Installation Personnel.

Table 4.4-1
DEFAULT APPLICATION ENTITY CHARACTERISTICS

Application Entity	Role	Default AE Title	Default TCP/IP Port
EXAM-Server-SCU	SCU	EXAM-PACS	None
EXAM-Server-SCP	SCP	EXAM-PACS	104

The EXAM-Server-SCU and EXAM-Server-SCP Application Entities can be configured to have the same or different AE Titles.

4.4.1.2 Remote AE Title/Presentation Address Mapping

The mapping of external AE Titles to TCP/IP addresses and ports is configurable and set at the time of installation by Installation Personnel. This mapping is necessary for resolving the IP address and port of C-MOVE Destination Application Entities and must be correctly configured for the EXAM-Server-SCP AE to correctly function as a C-MOVE SCP.

4.4.2 Parameters

Table 4.4-2
CONFIGURATION PARAMETERS

Parameter	Configurable	Default Value
General Parameters		
Maximum PDU Size	Yes	16 kbytes
Time-out waiting for A-ASSOCIATE RQ PDU on open TCP/IP connection. (ARTIM timeout)	Yes	60 s
Time-out waiting for acceptance or rejection response to an Association Open Request. (Application Level timeout)	Yes	60s
Time-out waiting for acceptance of a TCP/IP message over the network. (Low-level timeout)	Yes	60 s
Time-out for waiting for data between TCP/IP packets. (Low-level timeout)	Yes	As configured by Windows
EXAM-Server-SCU AE Parameters		
EXAM-Server-SCU AE time-out waiting for a Response to a C-STORE-RQ. (DIMSE timeout)	Yes	60 s
EXAM-Server-SCU AE number of times a failed send job to a C-MOVE Destination is automatically retried.	No	0
EXAM-Server-SCP AE Parameters		
Maximum PDU Size	Yes	16 kbytes
Permanent archival of SOP Instances sent by a peer AE to the EXAM-Server-SCP AE in response to a retrieval request from EXAM-Server AE.	Yes	FALSE (Such received SOP Instances are not archived.)
Permanent archival of SOP Instances sent unsolicited by a peer AE to the EXAM-Server-SCP AE. I.e. Not in response to a retrieval request from EXAM-Server AE.	Yes	TRUE (Such received SOP Instances are archived.)
Always open a new Association to send a Storage Commitment Push Model Notification request (N-EVENT-REPORT-RQ).	Yes	FALSE (Default is to try and send Notifications over original Association opened by peer AE).
Maximum number of times to attempt sending a Storage Commitment Push Model N-EVENT-REPORT Request when an error status is returned or communication failure occurs.	Yes	5

Time to wait between attempts to send a Storage Commitment Push Model N-EVENT-REPORT Request when an error status is returned or communication failure occurs.	Yes	5 minutes
Modality Worklist Parameters		
Maximum Number of Matches for an MWL Request	Yes	100
Time period after Scheduled Date/Time to leave SPS entries in the SPS Worklist	Yes	2880 min
State of Parent Procedure that causes deletion of child SPS Entries	Yes	PROCEDURE STARTED
Supported Transfer Syntaxes	Yes	Explicit VR Little Endian Implicit VR Little Endian

5. MEDIA INTERCHANGE

EXAM-PACS does not support Media Storage

6. SUPPORT OF CHARACTER SETS

EXAM-PACS supports the following character sets in addition to the default: — ISO_IR 100

7. SECURITY

EXAM-PACS does not support any specific security measures

8. ANNEXES

8.1. IOD CONTENTS

8.1.1 Created SOP Instances

EXAM-PACS does not create SOP instances

8.1.2 Usage of Attributes from received IOD's

EXAM-PACS indexes the fields defined elsewhere as being available for querying.

8.1.3 Attribute Mapping

The mapping between attributes received via HL7 from the HIS and those supplied in Modality Worklist is configurable. The default mapping is contained in the table below. Empty cells indicate that there is no mapping for the specific attribute

Table 8.1-1
HL7/MODALITY WORKLIST ATTRIBUTE MAPPING

DICOM Attribute	DICOM Tag	HL7 Attribute Name	HL7 Segment	Notes
Scheduled Procedure Step				
Scheduled Procedure Step Sequence	(0040,0100)			
> Scheduled Station AET	(0040,0002)			EXAM-PACS generated
> Scheduled Procedure Step Start Date	(0040,0003)	Quantity/Timing	ORM OBR:27	EXAM-PACS generated
> Scheduled Procedure Step Start Time	(0040,0006)	Quantity/Timing	ORM OBR:27	EXAM-PACS generated
> Modality	(0008,0060)			EXAM-PACS generated
> Scheduled Performing Physician's Name	(0040,0006)	Technician	ORM OBR:34	
> Scheduled Procedure Step Description	(0040,0007)			EXAM-PACS generated
>Scheduled Station Name	(0040,0010)			EXAM-PACS generated
>Scheduled Procedure Step Location	(0040,0011)			EXAM-PACS generated
>Scheduled Protocol Code Sequence	(0040, 0008)			
>>Code Value	(0008, 0100)			EXAM-PACS generated
>>Coding Scheme Designator	(0008, 0102)			EXAM-PACS generated
>>Code Meaning	(0008, 0104)			EXAM-PACS generated

> Pre-Medication	(0040,0012)			EXAM-PACS generated
> Scheduled Procedure Step ID	(0040,0009)			EXAM-PACS generated
> Requested Contrast Agent	(0032,1070)			EXAM-PACS generated
>Scheduled Procedure Step Status	(0040,0020)			EXAM-PACS generated
>Comments on the Scheduled Procedure Step	(0040, 0400)			EXAM-PACS generated
Requested Procedure				
Requested Procedure ID	(0040,1001)			EXAM-PACS generated
Requested Procedure Description	(0032,1060)			EXAM-PACS generated
Requested Procedure Code Sequence	(0032,1064)			
>Code Value	(0008, 0100)	Universal Service Id	ORM OBR:4	The value in the HL7 attribute is mapped to one or more procedure codes in the EXAM-PACS database. The mapping is configurable
>Coding Scheme Designator	(0008, 0102)	Universal Service Id	ORM OBR:4	Maps to a site-defined Coding Scheme, the CPT Coding Scheme or the EXAM-PACS internal Coding Scheme
>Code Meaning	(0008, 0104)			EXAM-PACS generated
Study Instance UID	(0020,000D)			EXAM-PACS generated
Referenced Study Sequence	(0008,1110)			
>Referenced SOP Class UID	(0008,1150)			EXAM-PACS generated
>Referenced SOP Instance UID	(0008,1155)			EXAM-PACS generated
Requested Procedure Priority	(0040,1003)		ORM OBR:27	
Patient Transport Arrangements	(0040,1004)		ORM OBR:30	
Reason for the Requested Procedure	(0040, 1002)			EXAM-PACS generated
Imaging Service Request				
Accession Number	(0008,0050)			EXAM-PACS

				generated
Requesting Physician	(0032,1032)		ORM OBR:16	
Referring Physician's Name	(0008,0090)		ORM PV1:8	
Reason for the Imaging Service Request	(0040,2001)	Reason for Study	ORM OBR:31	
Order Entered By	(0040,2008)	Entered By	ORM ORC:10	
Order Enterer's Location	(0040,2009)	Entering Organization	ORM ORC:17	
Visit Identification				
Admission ID	(0038,0010)		ADT PID:3	
Admitting Diagnosis Description	(0008,1080)		ADT DG1:4	
Admitting Diagnoses Code Sequence	(0008,1084)			
>Code Value	(0008, 0100)		ADT DG1:3	
>Coding Scheme Designator	(0008, 0102)		ADT DG1:2	
>Code Meaning	(0008, 0104)			
Patient Identification				
Patient's Name	(0010,0010)		ADT PID:5	
Patient ID	(0010,0020)		ADT PID:3	
Patient Demographics				
Patients Birth Date	(0010,0030)		ADT PID:7	
Patient's Sex	(0010,0040)		ADT PID:8	
Patient's Weight	(0010,1030)		ADT OBX:5	
Ethnic Group	(0010,2160)		ADT PID:10	
Patient Comment	(0010,4000)		ORM NTE:3	
Patient Medical				
Patient State	(0038,0500)	Danger Code	ORM OBR:12	
Pregnancy Status	(0010,21C0)	Filler Field 1	ORM OBR:20	
Medical Alerts	(0010,2000)	Relevant Clinical Information	ORM OBR:13	
Contrast Allergies	(0010,2110)		ADT	

			AL1:3	
Last Menstrual Date	(0010,21D0)	Filler Field 1	ORM OBR:20	

8.1.4 Coerced/Modified Fields

EXAM-PACS does not use coerce any fields.

8.2.   DATA DICTIONARY OF PRIVATE ATTRIBUTES

EXAM-PACS does not use any private attributes.

8.3.   CODED TERMINOLOGY AND TEMPLATES

EXAM-PACS's usage of Coding Schemes is specified in the table below. This table lists the Coding Schemes used by EXAM-PACS for attributes it originates. Usage of Controlled Terminology by Applications sending IODs to EXAM-PACS is discussed in the relevant SOP Specific Conformance sections above. The Procedure and Protocol Codes in the EXAM-PACS database can be exported to files and transferred across the network using the Configuration Utility. This allows Modalities to access and incorporate these codes if so desired.

Table 8.3-1
EXAM-PACS CONTROLLED TERMINOLOGY USAGE

SOP Class/Service	Attribute Name	Tag	Baseline Context Id	Coding Scheme	Remarks
Scheduled Procedure Step Module					
MWL/ C-FIND	>Scheduled Protocol Code Sequence	(0040,0008)	None	CPT-4, EXAM-PACS Procedure, site-supplied procedure codes or site-supplied protocol codes	At the option of the site, EXAM-PACS may be configured to associate CPT-4, EXAM-PACS Internal codes or site-supplied procedure codes with the various procedures represented in their Item master file. The configured procedure code will be passed in this attribute unless the site has supplied and configured protocol codes to be associated with the respective procedures in addition to procedure codes. In this case the configured protocol code will be passed
Requested Procedure Module					
	Requested Procedure Code Sequence	(0032,1064)	None	CPT-4, EXAM-PACS Procedure, site-supplied procedure	See remarks for Scheduled Protocol Code Sequence (0040, 0008). The difference is that a procedure code is always passed in this attribute rather than a protocol

				codes	code

8.4. GREYSCALE IMAGE CONSISTENCY

EXAM-PACS does not support the Grayscale Standard Display Function

8.5. STANDARD EXTENDED/SPECIALIZED/PRIVATE SOP CLASSES

EXAM-PACS does not claim conformance to any Extended, Specialized or Private SOP Classes.

8.6. PRIVATE TRANSFER SYNTAXES

EXAM-PACS does not employ any Private Transfer Syntaxes.