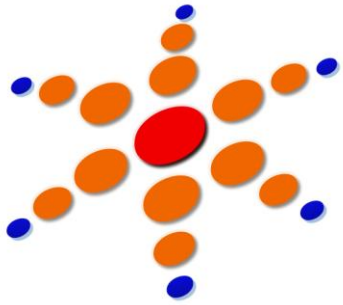

Vital Medical Data Storage Systems

A Safe Harbor For Medical Data Storage

Conformance Statement for CeloPACS

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Conformance Statement for CeloPACS

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Table of Contents

1 Introduction

The document is the DICOM 3.0 (DICOM) Conformance Statement for CeloPACS server. The server is a medical image and information distribution system designed for integration into a medical institution's existing healthcare network. It uses DICOM as the interface to the external world. This enables the server to communicate with any DICOM compliant products. The server accepts DICOM association requests for storage commitment, for image query and retrieve, and for sending images to an external server or for storage commitment. Images are transferred in the DICOM protocol based on TCP/IP as a transport layer.

1.1 DICOM Standard

This conformance statement describes the communication between the CeloPACS server and other DICOM compatible systems. This statement should be read and understood in conjunction with the DICOM standard.

The CeloPACS server will follow the evolution of the DICOM standard. Changes to DICOM standard may require changes to devices that have implemented DICOM.

1.2 Acronyms and Abbreviations

These abbreviations are used in this document:

- ACR American College of Radiology
- AE DICOM Application Entity
- DICOM Digital Imaging and Communications in Medicine
- DIMSE DICOM message service element
- FSC File-Set Creator
- FSR File-Set Reader
- IOD (DICOM) Information Object Definition
- LUT Lookup Table
- NEMA National Electrical Manufacturers Association
- SCU DICOM Service Class User (DICOM client)
- SCP DICOM Service Class Provider (DICOM server)
- SOP DICOM Service-Object Pair
- UID Unique Identifier
- VR Value Representation

1.3 Related Documents

- ACR-NEMA Digital Imaging and Communications in Medicine (DICOM) V3.0. 2004.

2 Implementation Model

The CeloPACS server is a Windows application that runs continuously as a Windows service. The server will start automatically on system start-up. The server is assigned an AE title, an IP address within the host network, and a non-conflicting communication port number (together abbreviated as presentation address).

The CeloPACS server verifies all incoming association requests. The server does not reject an incoming association request based on the calling AE title. The server queries its database to verify if the calling AE title of the incoming request exists in its database. If there is a match, the server verifies that the matching AE has access privileges to the database. The server then services the incoming association request. Otherwise, the server will reject this request.

The CeloPACS server accepts associations from remote AEs for the following activities:

- Verification
- Storing Information Objects in the Local AE database/media
- Querying information from the server database
- Retrieving Information Objects from the server
- Committing Storage of received SOPs
- Committing Storage of sent SOPs.

The server can initialize associations to remote AEs to request the following activities:

- Storing Information Objects on remote AEs
- Requesting Storage Commitment from remote AEs.

2.1 Application Data Flow Diagram

The following diagram shows the relationship between the CeloPACS server and the remote AEs.

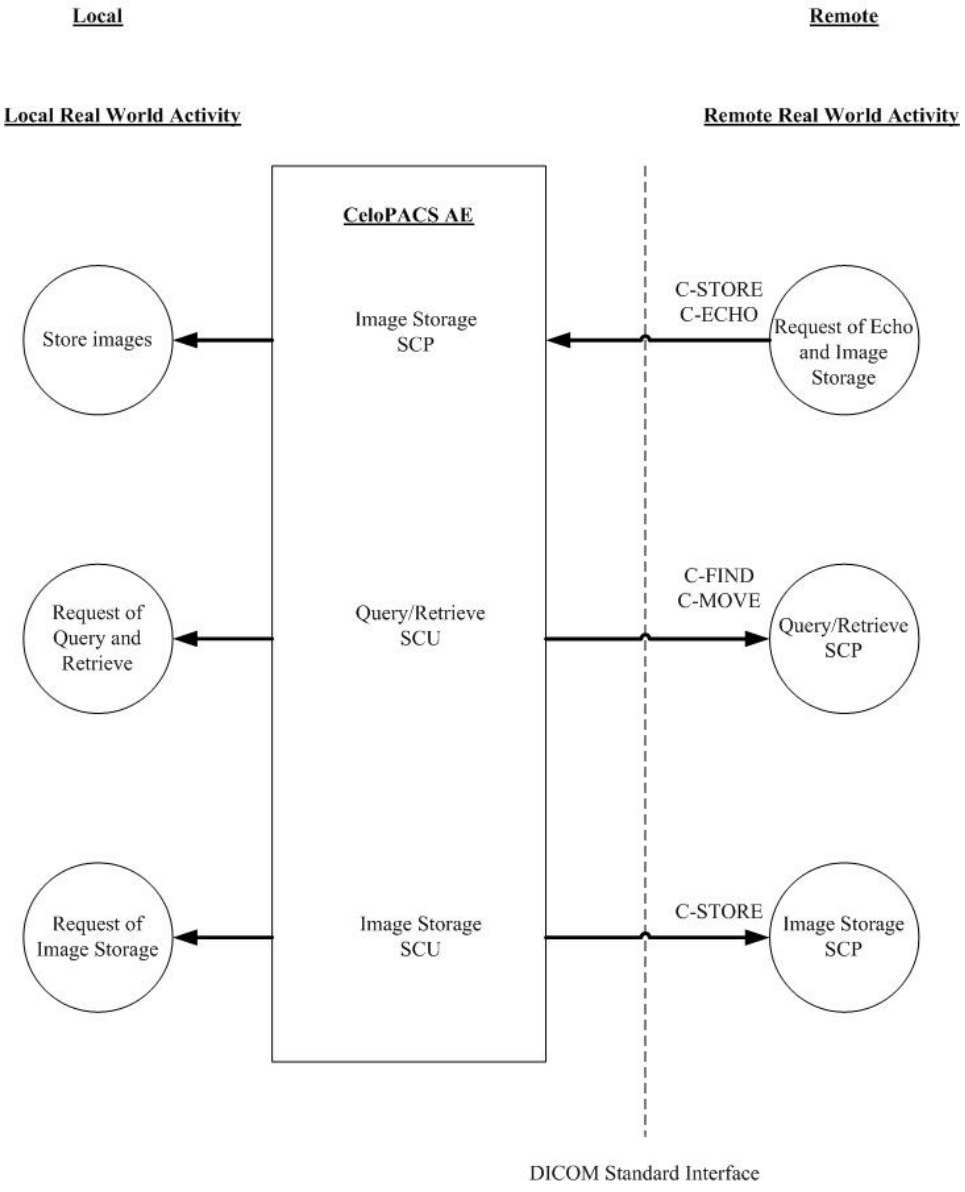

Fig 2.1: The Application Data Flow Model for CeloPACS Server

2.2 Functional Definition of Application Entities

2.2.1 Verification

The CeloPACS server supports the C-ECHO DIMSE-C service as SCU and SCP. The DICOM verification performs as follows:

- The remote AE initiates a DICOM association.
- The remote AE initiates a C-ECHO.

- The CeloPACS server responds with a C-ECHO-RSP.
- All transactions are logged.

The verification model is summarized in the following diagram.

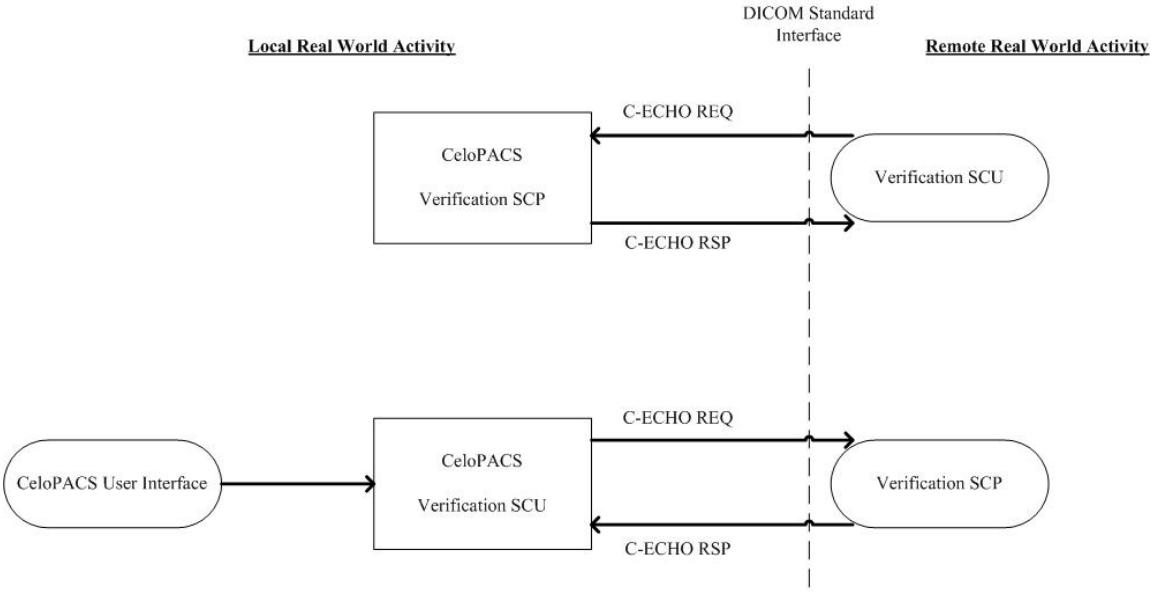

Fig 2.2: The Verification Model

2.2.2 Storage

The CeloPACS server implements DICOM Media Storage as an SCP. Storage operates as follows:

- The remote AE initiates a DICOM association.
- The CeloPACS server selects the appropriate transfer syntax from those proposed by the remote AE.
- The remote AE initiates a C-STORE to send the IOD.
- The CeloPACS server then responds with a C-STORE-RSP.
- The image is stored, and image header data is entered in the database at all four levels (patient, study, series, and image).
- All transactions are logged.

The Storage SCP data model is summarized in the following diagram.

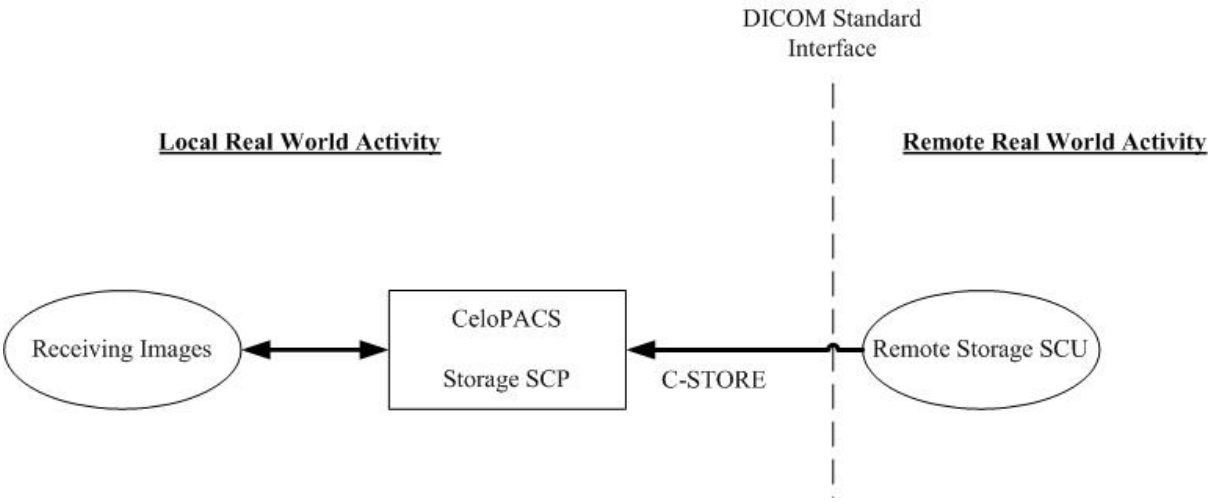

Fig.2.3: The Storage SCP model

2.2.3 Query and Retrieve

The CeloPACS server implements DICOM Query/Retrieve as an SCU. The Query/Retrieve SCU data model is summarized in the following diagram.

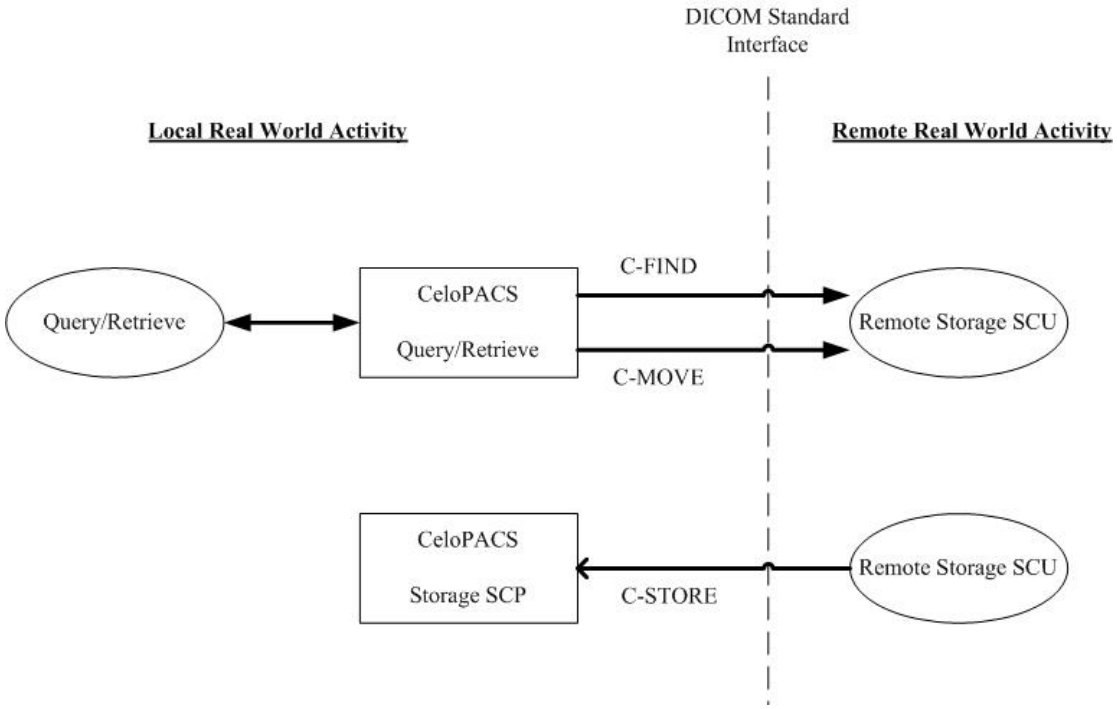

Fig 2.4: The Query and Retrieve Model

2.3 Sequencing of Real-World Activities

Refer to section 3.3 to section 3.5.

3 AE Specifications

The CeloPACS server runs as a Windows service and will start automatically as part of the operating system. Once started, the server will wait for another application to connect it to its DICOM storage service at the presentation address configured for its AE titles. Client applications also have the ability to initiate DICOM associations between the CeloPACS server and other remote DICOM devices for Storage and Query/Retrieve services.

3.1 Application Entity Specification

SOP Classes

CeloPACS provides Standard Conformance to the following DICOM SOP Classes:

SOP Class Name	SOP Class UID	Roles
Verification SOP Class	1.2.840.10008.1.1	SCU, SCP
Detached Study Management	1.2.840.10008.3.1.2.3.1	SCU
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	SCP
Modality Performed Procedure Step Retrieve	1.2.840.10008.3.1.2.3.4	SCP
Modality Performed Procedure Step Notification	1.2.840.10008.3.1.2.3.5	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	SCU
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	SCU
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCU, SCP
Digital X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	SCU, SCP
Digital X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	SCU, SCP
Digital Mammography X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	SCU, SCP
Digital Mammography X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	SCU, SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCU, SCP
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	SCU
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	SCU, SCP
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	SCU, SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCU, SCP
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	SCU
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	SCU
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5	SCU, SCP
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	SCU, SCP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	SCU, SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	SCU, SCP
Standalone Overlay Image Storage	1.2.840.10008.5.1.4.1.1.8	SCU, SCP
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	SCU, SCP
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	SCU, SCP
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	SCU, SCP
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	SCU, SCP
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	SCU, SCP
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	SCU
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	SCU
X-Ray Angiographic Bi-plane Image Storage (retired)	1.2.840.10008.5.1.4.1.1.12.3	SCU
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	SCU
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	SCU
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	SCU, SCP
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	SCU
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	SCU
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	SCU

Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	SCU, SCP
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	SCU
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	SCU
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	SCU
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	SCU
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	SCU
VL Whole Slide Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.6	SCU
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11	SCU, SCP
Enhanced Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.22	SCU, SCP
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	SCU
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67	SCU, SCP
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	SCU, SCP
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128	SCU
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	SCU
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	SCU
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	SCU
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	SCU
Patient Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	SCU, SCP
Patient Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	SCU, SCP
Patient Root Query/Retrieve Info Model - GET	1.2.840.10008.5.1.4.1.2.1.3	SCP
Study Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	SCU, SCP
Study Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	SCU, SCP
Patient/Study Only Query/Retrieve Info Model - GET	1.2.840.10008.5.1.4.1.2.3.3	SCP
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	SCP
Modality Worklist Info Model – FIND	1.2.840.10008.5.1.4.31	SCU, SCP

Table 3.1: SOP Classes Supported by CeloPACS Server as SCU

3.2 Association Establishment Policies

3.2.1 General

The DICOM standard Application Context Name for DICOM is:

Application Context Name	1.2.840.10008.3.1.1

Table 3.2: DICOM Application Context

3.2.2 Number of Associations

The number of simultaneous associations accepted by the CeloPACS server is limited by the kernel parameters of the underlying TCP/IP implementation and the resource utilization of the system. Therefore, there is no inherent limitation on the total number of simultaneous associations which CeloPACS can maintain.

3.2.3 Asynchronous Nature

CeloPACS server does not support asynchronous operations.

3.2.4 Implementation Identifying Information

CeloPACS uses the following implementation class UID:

Implementation Class UID	1.2.826.0.1.3680043.2.737
Implementation Version Name	configured at the time of installation

Table 3.3: DICOM Implementation Class and Version

3.3 Association Initiation Policies

The CeloPACS server initiates an association with a remote AE for the following activities:

- DICOM communication verification between the server and the remote AE.
- Sending images from the server to the remote AE.
- Retrieval of images from the remote AE to the server database.

3.3.1 Real-World Activity – Verification

The CeloPACS server provides standard conformance for the DICOM SOP Verification class.

3.3.1.1 Proposed Presentation Contexts – Verification

CeloPACS server proposes the Presentation Contexts as:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 3.4: Presentation Context for initiating Verification Requests

3.3.2 Real-World Activity – Query/Retrieve

The CeloPACS server transmits requests for Patient/Study Lists to remote AEs and to retrieve the requested images to the server storage device. It therefore performs the following tasks:

- Establishes DICOM Association with a remote AE with a C-FIND request
- Performs request for DICOM Query Objects to a remote AE
- Performs request for DICOM Retrieve Objects to a remote AE after getting the result of the search request
- Retrieves any matching patients and/or studies from a remote AE

3.3.2.1 Proposed Presentation Contexts – Query/Retrieve

The CeloPACS server accepts the following Presentation Contexts:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Patient Root Query/Retrieve 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	SCU	None
Patient Root	1.2.840.10008.5.1.4.1.2.1.2	DICOM	1.2.840.10008.1.2	SCU	None

Query/Retrieve Information Model - MOVE		Implicit VR Little Endian			
Study Root Query/Retrieve 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
Study Root Query/Retrieve 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

Table 3.5: Presentation Contexts for Initiating Query/Retrieve Requests

3.3.2.2 SOP Specific Conformance Statement - Query/Retrieve

The following matching methods are supported when initiating C-FIND requests.

Key Matching Methods	Description
SV	Single Value Matching
UM	Universal Matching
WC	Wild-Card Matching
DR	Date Range Matching

Table 3.6: Methods for C-FIND

There are four levels of search information that pertain to a C-FIND operation.

- Patient
- Study
- Series
- Image

The search keys supported for the above C-FIND search model are listed as follows:

Level	Description	Tag	Matching Method	Type
Patient	Patient Name	0010 0010	SV,UM,WC	R
	Patient ID	0010 0020	SV,UM,WC	U
	Patient´s Birth Date	0010 0030	SV,UM,DR	O
	Patient´s Birth Time	0010 0032		O
	Patient´s Sex	0010 0040		O
	Patient´s Age	0010 1010		O
	Patient´s Size	0010 1020		O
	Patient´s Weight	0010 1030		O
	Number of Patient Related Studies	0020 1200		O
	Number of Patient Related Series	0020 1202		O
	Number of Patient Related Instances	0020 1204		O
Study	Study Date	0008 0020	SV,UM,DR	R
	Study Time	0008 0030	SV,UM	R
	Accession Number	0008 0050	SV,UM,WC	R
	Referring Physician Name	0008 0090		O

	Study Description	0008 1030		O
	Study Instance UID	0020 000D	SV,UM	U
	Study ID	0020 0010	SV,UM,WC	R
	Number of Study Related Series	0020 1206		O
	Number of Study Related Instances	0020 1208		O
Series	Series Date	0008 0021	SV,UM,DR	O
	Series Time	0008 0031	SV,UM	O
	Modality	0008 0060	SV,UM,WC	R
	Body Part Examined	0018 0015		O
	Series Instance UID	0020 000E	SV,UM	U
	Series Number	0020 0011	SV,UM	R
	Number of Series Related Instances	0020 1209		O
Image	SOP Class UID	0008 0016	SV,UM	O
	SOP Instance UID	0008 0018	SV,UM	U
	Instance Number	0020 0013	SV,UM	R
	Overlay Number	0020 0022		O
	Curve Number	0020 0024		O
	LUT Number	0020 0026		O
	Samples Per Pixel	0028 0002		O
	Rows	0028 0010		O
	Columns	0028 0011		O
	Bits Allocated	0028 0100		O
	Bits Stored	0028 0101		O
	Pixel Representation	0028 0103		O

Table 3.7: The supported search keys for the Patient Root C-FIND SCP

3.3.3 Real-World Activity – Move

When a C-MOVE request from an external AE device is received, the CeloPACS server queries its data base. If a match is found, the server

- Initiates an association with the destination AE device specified in the C-MOVE request.
- Extracts the unique SOP classes from the image lists.
- Proposes a set of presentation contexts that includes one presentation context for each unique SOP class identified in the image list.

The association request may have a single presentation context or a number of multiple presentation contexts. Each presentation context contains the abstract syntax that identifies the image class as found in the image list.

3.3.3.1 Proposed Presentation Contexts – Move

The CeloPACS server Presentation Contexts are as follows:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	See Proposed Transfer Syntaxes	See Proposed Transfer Syntaxes	SCU	None

		below	below		
Digital X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Digital X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Digital Mammography X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Digital Mammography X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	See Proposed Transfer	See Proposed Transfer	SCU	None

		Syntaxes below	Syntaxes below		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
X-Ray Angiographic Bi-plane Image Storage (retired)	1.2.840.10008.5.1.4.1.1.12.3	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4	See Proposed	See Proposed	SCU	None

Storage		Transfer Syntaxes below	Transfer Syntaxes below		
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
VL Whole Slide Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.6	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Enhanced Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.22	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None

RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	See Proposed Transfer Syntaxes below	See Proposed Transfer Syntaxes below	SCU	None

Table 3.8: Presentation Contexts as C-STORE SCU

3.3.3.2 Proposed Transfer Syntaxes – Move Request

When sending images to a remote AE, the CeloPACS server will propose the same transfer syntax in which the stored SOP instance is encoded. If the encoding transfer syntax is Explicit VR Little-Endian transfer syntax (UID 1.2.840.10008.1.2.1), the server will propose the default Implicit VR Little-Endian transfer syntax (UID 1.2.840.10008.1.2).

When images are sent to applications that do not support the Explicit VR Little-Endian transfer syntax, the server will translate from the encoding Explicit VR Little-Endian transfer syntax to the Implicit VR Little-Endian transfer syntax.

If the images stored in CeloPACS server contain private elements whose encoding scheme is unknown to the CeloPACS server, those elements will be transmitted by the server in their current unaltered condition in Implicit VR Little Endian Transfer Syntax.

The CeloPACS server supports the following transfer syntaxes:

Transfer Syntax Name	**Transfer Syntax UID**
Implicit VR, Little Endian (DICOM Default)	1.2.840.10008.1.2
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Explicit VR, Big Endian	1.2.840.10008.1.2.2
Explicit VR, JPEG Lossless, Non-hierarchical, First-order prediction (Process 14)	1.2.840.10008.1.2.4.70
Explicit VR, JPEG Lossless (Process 14)	1.2.840.10008.1.2.4.57
Explicit VR, JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
Explicit VR, JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
JPEG-LS Lossless Compression	1.2.840.10008.1.2.4.80
JPEG-LS Near-Lossless Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Part-1 Lossless Only Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Part-1 Lossless Or Lossy Compression	1.2.840.10008.1.2.4.91
MPEG2 Image Compression	1.2.840.10008.1.2.4.100
RLE Lossless	1.2.840.10008.1.2.5

Table 3.9: Supported Transfer Syntaxes as C-STORE SCU

When sending images to a remote AE, CeloPACS server will propose the same transfer syntax in which the stored SOP instance is encoded. For example, the encoding transfer syntax is Explicit VR Little-Endian transfer syntax (UID 1.2.840.10008.1.2.1), CeloPACS server will also propose the default Implicit VR Little-Endian transfer syntax (UID 1.2.840.10008.1.2), so that when sending images to applications that do not support the Explicit VR Little-Endian transfer syntax (for example, eFilm), CeloPACS server will translate from the encoding Explicit VR Little-Endian to the Implicit VR Little-Endian transfer syntax.

3.3.3.3 SOP Specific Conformance Statement – Move Request

All C-STORE operations are in the context of a C-MOVE request from an external application. CeloPACS server sends one C-MOVE response message for each attempted C-STORE operation.

The server

- Does not attempt any extended negotiation.
- Does not delete any elements from the files it transfers.

Therefore the set of optional elements depends entirely on the contents of the files which were originally stored on the CeloPACS server.

In the event that CeloPACS server receives an unsuccessful C-STORE response, the server will continue sending the remaining images in the requested set.

3.3.4 Real-World Activity – User Forwarding

User can select multiple patients, studies or series to be sent to a remote AE title. The request is forwarded to the job queue and then processed. The CeloPACS server will attempt to initiate a new association in order to issue a C-STORE request to the remote AE title. The association will be terminated when the last image set is received by the remote AE.

3.3.4.1 Proposed Presentation Contexts – User Forwarding

Same as Section 3.3.3.1

3.3.4.2 Proposed Transfer Syntaxes – User Forwarding

Same as Section 3.3.3.2

3.3.4.3 SOP Specific Conformance Statement – User Forwarding

Same as Section 3.3.3.3

3.3.5 Real-World Activity – Automatic Routing

CeloPACS server incorporates an Automatic Routing table to support image data forwarding. The Automatic Routing table can be modified through the user interface for privileged users.

When an image is received by the server, the server queries the Automatic Routing table to check for the existence of an entry that matches the source AE title. If a match is found, the received image will be forwarded to the targeted AE. In the event multiple destination AEs exist, the received image will be forwarded to the multiple targeted AEs.

3.3.5.1 Proposed Presentation Contexts – Automatic Routing

Same as Section 3.3.3.1

3.3.5.2 Proposed Transfer Syntaxes – Automatic Routing

Same as Section 3.3.3.2

3.3.5.3 Proposed SOP Specific Conformance Statement – Automatic Routing

Same as Section 3.3.3.3

3.3.6 Real-World Activity – Modality Worklist Management

An association between the CeloPACS server and a remote AE must be established prior to any DICOM Modality Worklist operations. When the server receives unsolicited Study Scheduled N-EVENT-REPORT notifications, CeloPACS will send a Modality Worklist – FIND command to query all configured Modality Worklist SCP AEs for the corresponding study. Any matching result returned by the remote Modality Worklist SCP will be displayed on the user interface. Otherwise, a timeout error or any error response from the remote AE device will be displayed. The server polls any configured Modality Worklist SCP application entities to update the Worklist table on a regular basis.

3.3.6.1 Proposed Presentation Contexts – Modality Worklist Management

The proposed Presentation Context for CeloPACS Modality Worklist is as follows:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Info Model – FIND	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 3.10: Presentation Context For Initiating Modality Worklist - FIND Requests

3.3.6.2 SOP Specific Conformance Statement – Modality Worklist Management

When initiating Modality Worklist-FIND requests to remote SCP applications, the matching methods supported by CeloPACS server are as follows:

Key Matching Methods	**Description**
SV	Single Value Matching
UM	Universal Matching
WC	Wild-Card Matching
DR	Date Range Matching

Table 3.11: Key matching methods for initiating Modality Worklist-FIND Requests

The keys used by the CeloPACS server for the Modality Worklist-FIND requests to remote Modality Worklist SCP applications are as follows:

Module	**Description**	**Tag**	**Matching Method**	**Return Type**
Scheduled Procedure Step	Scheduled Procedure Step Sequence	0040,0100		1
	>Modality	0008,0060	UM,WC	1
	>Scheduled Station AE Title	0040,0001	UM,WC	1
	>Scheduled Procedure Step Start Date	0040,0002	SV,UM,DR	1

	>Scheduled Procedure Step Start Time	0040,0003	UM	1
Requested Procedure	Requested Procedure ID	0040,1001	UM,WC	1
	Requested Procedure Description	0032,1060		1C
	Study Instance UID	0020,000D		1
	Referenced Study Sequence	0008,1110		2
	>Referenced SOP Class UID	0008,1150		1C
	>Referenced SOP Instance UID	0008,1155		1C
Imaging Service Request	Accession Number	0008,0050	SV,UM,WC	2
	Referring Physician´s Name	0008,0090	UM	2
	Requesting Physician´s Name	0032,1032		2
Patient Identification	Patient´s Name	0010,0010	SV,UM,WC	1
	Patient ID	0010,1020	SV,UM,WC	1
Patient Demographic	Patient´s Birth Date	0010,1030	SV,UM,DR	2
	Patient´s Sex	0010,1040	SV,UM	2

Table 3.12: Keys used by CeloPACS server for Modality Worklist-FIND requests

3.3.7 Real-World Activity – Printing

User requests for DICOM Image Printing are initiated by user interaction with the CeloPACS interface.

3.3.7.1 Proposed Presentation Contexts – Printing

The CeloPACS server is capable of proposing the two Presentation Contexts shown in the following table:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Basic Grayscale Print Management Meta	1.2.840.1000.8.5.1.1.9	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta	1.2.840.1000.8.5.1.1.18	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 3.13: Proposed Presentation Contexts for Printing request

3.3.7.2 Proposed Transfer Syntaxes – Printing

Refer to Table 3.7.

3.3.7.3 SOP Specific Conformance Statement – Printing

The SOP classes, regulated by the Basic Grayscale/Color Management Meta class in the CeloPACS server, are shown as follows:

SOP Class Name	**SOP Class UID**
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Basic Color Image Box	1.2.840.10008.5.1.1.4.1
Printer	1.2.840.10008.5.1.1.16

Table 3.14: The SOP Class supported for Basic Grayscale/Color Management Meta Classes

The following optional SOP class is also supported by CeloPACS.

SOP Class Name	SOP Class UID
Basic Annotation Box	1.2.840.10008.5.1.1.15

Table 3.15: The optional SOP Class supported for Basic Grayscale/Color Management Meta Classes

3.3.7.3.1 Conformance for Basic File Session SOP Class

The CeloPACS server supports the following attributes for N-CREATE command of the Basic Film Session SOP class:

N-CREATE Attributes of the Basic Film Session SOP class		
Tag	**Description**	**Possible Values**
2000,0010	Number of Copies	1 - 99
2000,0020	Print Priority	LOW, MED, HIGH
2000,0030	Medium Type	BLUE FILM, CLEAR FILM, PAPER
2000,0040	Film Destination	MAGAZINE, PROCESSOR, BIN_i

Table 3.16: Supported N-CREATE Attributes for a Basic Film Session

3.3.7.3.2 Conformance for SOP Class Basic Film Box

The following attributes of the Basic Film Box SOP class are supported.

N-CREATE Attributes of the Basic Film Box SOP class		
Tag	**Description**	**Possible Values**
2010,0010	Image Display Format	STANDARD\C,R; R1,R2,R3; C1,C2,C3; SLIDE; SUPERSLIDE
2010,0030	Annotation Display Format ID	Printer specific annotation display format string
2010,0040	Film Orientation	LANDSCAPE, PORTRAIT
2010,0500	Referenced Film Session Sequence	
0008,1150	> Referenced SOP Class UID	
0008,1155	> Referenced SOP Instance UID	

Table 3.17: Supported attributes for N-CREATE of the Basic Film Box SOP class

3.3.7.3.3 Conformance for SOP Class Basis Grayscale Image Box

The following attributes for N-SET command of the Basic Grayscale Image Box SOP class are supported.

N-SET Attributes of the Basic Grayscale Image Box SOP class		
Tag	**Description**	**Possible Values**
2020,0010	Image Position	1, 2,...
2020,0110	Preformatted Grayscale Image Sequence	
0028,0002	>Samples Per Pixel	
0028,0004	>Photometric Interpretation	MONOCHROME1, MONOCHROME2
0028,0010	>Rows	>0
0028,0011	>Columns	>0
0028,0034	>Pixel Aspect Ratio	1
0028,0100	>Bits Allocated	8,16

0028,0101	>Bits Stored	8,12
0028,0102	>High Bit	7,11
0028,0103	>Pixel Representation	0
7FE0,0010	>Pixel Data	

Table 3.18: Supported attributes for N-SET of the Basic Grayscale Image Box SOP class

3.3.7.3.4 Conformance for SOP Class Printer

The following attributes for N-GET command of the Printer Box SOP class are supported.

N-GET Attributes of the Printer SOP class	
Tag	**Description**
0008,0070	Manufacturer
0008,1090	Manufacturer Model Name
0018,1000	Device Serial Number
0018,1020	Software Versions
0018,1200	Date Last Calibration
0018,1201	Last Calibration
2110,0010	Printer Status
2110,0020	Printer Status Info
2110,0030	Printer Name

Table 3.19: Supported attributes for N-GET of the Printer SOP class

3.3.7.3.5 Conformance for Basic Annotation Box SOP Class

The following attributes for N-GET command of the Basic Annotation Box SOP class are supported.

N-GET Attributes of the Printer SOP class	
Tag	**Description**
2030,0010	Annotation Position
2030,0020	Text String

Table 3.20: Supported attributes for N-GET of the Basic Annotation Box SOP class

3.3.8 Real-World Activity – Remote Synchronization

The CeloPACS server supports synchronization of its local database with the remote studies stored on the remote AE devices. User defines the synchronization schedules for the remote AE. If the remote AE supports DICOM Query/Retrieve functions as a SCP, the user can select whether

- To enable or disable remote-synchronization for this remote AE
- To synchronize
    - All remote studies or
    - Recent studies received within the last N days on the remote AE.

Users can add, delete, and modify synchronization schedules (up to 24 per remote AE) from the server web user interface, provided that the logged-in user has the required 'Modify' privilege enabled.

3.3.8.1 Proposed Presentation Contexts – Remote Synchronization
Same as Section 3.3.3.1

3.3.8.3 Proposed Transfer Syntaxes – Remote Synchronization
Same as Section 3.3.3.2

3.3.8.4 SOP Specific Conformance Statement – Remote Synchronization
Same as Section 3.3.3.3

3.3.9 Real-World Activity – Detached Study Management
The CeloPACS server accepts unsolicited N-EVENT-REPORT notifications sent from Detached Study Management SCP application entities. Then the server issues N-GET requests to the remote SCP to get more information for the corresponding study.

Upon the receipt of the Study Scheduled Event Notification sent from the Detached Study Management SCP, the CeloPACS server will initiate a Modality Worklist – FIND query request to a configured Modality Worklist SCP AE or AEs about the corresponding study information contained in the event report.

3.3.9.1 Associated Real-World Activity – Detached Study Management
When the CeloPACS server receives any Detached Study Management N-EVENT-REPORT notifications sent from a Detached Study Management SCP AE, it will first validate the association request by checking the remote AE title against the internal database for the accessing privilege. If there is a match, the association request will be accepted and the event notification will be processed. Otherwise, the association request will be rejected by CeloPACS and the event notification will not be processed.

3.3.9.2 Presentation Context Table – Detached Study Management
The CeloPACS server supports the following Presentation Context for Detached Study Management.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Detached Study Management	1.2.840.10008.3.1.2.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 3.21: Proposed Presentation Context of Detached Study Management

3.3.9.3 SOP Specific Conformance for SOP Class – Detached Study Management
The CeloPACS server provides standard conformance to the DICOM Detached Study Management Service Class. The following attributes in the N-EVENT-REPORT-RQ notification sent from a Detached Study Management SCP application entity are supported.

Event Type Name	Attribute Name	Tag
Study Created	Instance Creation Date	0008,0012

	Referenced Patient Sequence	0008,1120
	>Referenced SOP Class UID	0008,1150
	>Referenced SOP Instance UID	0008,1155
	Referenced Visit Sequence	0008,1125
	>Referenced SOP Class UID	0008,1150
	>Referenced SOP Instance UID	0008,1155
	Instance Creation Time	0008,0013
	Instance Creator UID	0008,0014
	Study Status ID	0032,000A
Study Scheduled	Specific Character Set	0008,0005
	Referenced Patient Sequence	0008,1120
	>Referenced SOP Class UID	0008,1150
	>Referenced SOP Instance UID	0008,1155
	Referenced Visit Sequence	0008,1125
	>Referenced SOP Class UID	0008,1150
	>Referenced SOP Instance UID	0008,1155
	Scheduled Study Start Date	0032,1000
	Scheduled Study Start Time	0032,1001
	Scheduled Study Location	0032,1020
	Scheduled Study Location Application Entity Title	0032,1021
	Requested Procedure Description	0032,1060
	Requested Procedure Code Sequence	0032,1064
	>Code Value	0008,0100
	>Coding Scheme Designator	0008,0102
	>Code Meaning	0008,0104
Patient Arrived	Study Arrival Date	0032,1040
	Study Arrival Time	0032,1041
Study Started	Study Date	0008,0020
	Study Time	0008,0030
Study Completed	Referenced Performed Procedure Step Sequence	0008,1111
	>Referenced SOP Class UID	0008,1150
	>Referenced SOP Instance UID	0008,1155
	Study Completed Date	0032,1050
	Study Completed Time	0032,1051
Study Verified	Referenced Performed Procedure Step Sequence	0008,1111
	>Referenced SOP Class UID	0008,1150
	>Referenced SOP Instance UID	0008,1155
	Study Verified Date	0032,0032
	Study Verified Time	0032,0033
Study Read	Study Read Date	0032,0034
	Study Read Time	0032,0035
Study Deleted		

Table 3.22: Detached Study Management N-Event-Report Notification Attributes

The CeloPACS server returns the following status code in the N-EVENT-REPORT-RSP sent back to the Detached Study Management SCP:

Service Status	**Further Meaning**	**Status Codes**	**Description**
Success	Success	0x0000	Operation performed properly

Table 3.23: Detached Study Management N-EVENT-REPORT-RSP Status Code

3.3.9.4 Presentation Context Acceptance Criterion – Detached Study Management

Associations between a remote AE and the CeloPACS server can take place if the remote AE is known to the server and this remote AE is given the access privilege by the server. The server accepts the SOP class that is listed in Table 3.21. The server defines no limit on the number of presentation contexts accepted. In the event that the server runs out of resources when trying to accept multiple presentation contexts, the server will reject the association request.

3.3.9.5 Transfer Syntax Selection Policies – Detached Study Management

The CeloPACS server only supports the Implicit VR Little Endian transfer syntax when accepting Detached Study Management N-EVENT-REPORT requests. Any proposed presentation context which includes the Implicit VR Little Endian transfer syntax will be accepted with the Implicit VR Little Endian transfer syntax. Any proposed presentation context that does not include the Implicit VR Little Endian transfer syntax will be rejected.

3.3.10 Real-World Activity – Storage Commit

The Real-World activity is an N-ACTION request from an external AE. If the external AE successfully establishes an association with CeloPACS server and makes a valid N-ACTION request that contains a list of references to one or more SOP instances known to the server, the server sends one N-ACTION response message with a status of success or failure. The CeloPACS server will request a DICOM Storage Commitment Report (via the N-ACTION-RQ command) for any DICOM SOP instance sent to this remote AE.

3.3.10.1 Proposed Presentation Context – Storage Commitment Push Model

The CeloPACS server accepts the following presentation context for Storage Commitment Requests.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 3.24: Presentation Context for Storage Commitment Push Model

3.3.10.2 SOP Specific Conformance Statement – Storage Commitment Push Model

The attributes for the Storage Commit Push Model supported by the CeloPACS server are listed as follows.

Action Type Name	**Action Type ID**	**Attribute Name**	**Tag**
Request Storage Commitment	1	Transaction UID	0008,1195
		Referenced SOP Sequence	0008,1199
		>Referenced SOP Class UID	0008,1150
		>Referenced SOP Instance UID	0008,1155

Table 3.25: Storage Commitment Request – Action Information

3.3.10.3 Storage Commitment Results

After receiving the Dicom Storage Commitment Report request sent from the CeloPACS server, the remote AE will respond by sending the Storage Commitment Report for the requested SOP instances in the form of a Dicom N-EVENT-REPORT message back to the server.

The N-EVENT-REPORT contains the Transaction UID value that is contained in the initiating N-ACTION-RQ request sent from CeloPACS server. The N-EVENT-REPORT is sent on a separate association from the initiating N-ACTION-RQ request.

Objects sent to the CeloPACS server are considered committed for storage after they are received. The server supports the action information listed in the following table for the Storage Commitment Service Class.

Action Type Name	Event Type ID	Attribute Name	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 – Failure 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

Table 3.26: Storage Commitment Request – Event Information

After receiving the Storage Commitment Report (N-EVENT-REPORT) from the remote AE, the CeloPACS server will display one of the following status indications for the containing DICOM study of the referenced SOP instances for which the reports have been received:

- Report Initiated – the CeloPACS server has initiated the Storage Commitment Report (N-ACTION-RQ) for the SOP instances of this study
- Partially Committed – Storage Commitment Report (N-EVENT-REPORT) has been received for the SOP instances of this study, but not all instances have been committed successfully by the remote AE
- Fully Committed – Storage Commitment Report (N-EVENT-REPORT) has been received for the SOP instances of this study, and all instances have been committed successfully by the remote AE

3.4 Association Acceptance Policy

Any remote DICOM AE can send images to the server. The CeloPACS server only accepts the association from remote AEs that have access privileges. When the server accepts an association, it will receive any images transmitted on that association and store the supported SOP Classes on disk.

3.4.1 Real-World Activity – Verification
The CeloPACS server provides standard conformance to the Verification SOP Class as an SOP.

3.4.1.1 Associated Real World Activity – Verification
The CeloPACS server performs the Verification Service Class by responding with C-ECHO.

3.4.1.2 Presentation Context Table – Verification
The CeloPACS server proposed the following Presentation Context for Verification.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Table 3.27: Presentation Context for DICOM SOP Verification class

3.4.1.3 SOP Specific Conformance for SOP Class – Verification
The CeloPACS server provides standard conformance to the Verification SOP Class as an SCP. This verification is accomplished on an established association using the C-ECHO service.

3.4.1.4 Presentation Context Acceptance Criterion – Verification
Associations between a remote AE and the CeloPACS server can take place if the remote AE is known to the server and this remote AE is given the access privilege by the server. The server accepts any number of query SOP classes that are listed in Table 3.1. The server defines no limit on the number of presentation contexts accepted. In the event that the server runs out of resources when trying to accept multiple presentation contexts, the server will reject the association request.

3.4.1.5 Transfer Syntax Selection Policies – Verification
The CeloPACS server only supports the Implicit VR Little Endian transfer syntax. Any proposed presentation context which includes the Implicit VR Little Endian transfer syntax will be accepted with the Implicit VR Little Endian transfer syntax. Any proposed presentation context that does not include the Implicit VR Little Endian transfer syntax will be rejected.

3.4.2 Real-World Activity – Storage
The CeloPACS server waits for association request from remote AEs. When a remote AE makes a DICOM association request, the server acts as a SCP for the storage service class and the server stores the image as a DICOM object in the local database. The server also acts as a SCP for the verification service class; namely, it responds to C-ECHO requests from other remote AEs.

3.4.2.1 Associated Real-World Activity – Storage
The CeloPACS server is setup as a SCP to receive image data. The remote AE sending the images is set up as C–STORE SCU. The C-STORE service is used by the server to store DICOM images. Image data

for successful association must conform to the DICOM Part 10 file format. Image data are stored on a local disk within the server. After an image is stored to disk, the server updates the database with patient, study, series, and image information. The database is used by the server for query/retrieve operations. It is also used by the web server to display patient, study, series, image information displays, stored images through a web browser, and maintain patient/study/series/ image tables for authorized users.

The server will issue a failure status

- If it is unable to store image on disk
- Image data does not conform to the IOD of the SOP class under which it was transmitted
- Unable to successfully update its database.

3.4.2.2 Presentation Context Table – Storage

The CeloPACS server provides standard conformance to the following DICOM SOP classes in the role specified:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Digital X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Digital X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Digital Mammography X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Digital Mammography X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	See Transfer Syntax	See Transfer Syntax	SCP	None

		Selection Policies Below	Selection Policies Below		
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	See Transfer Syntax	See Transfer Syntax	SCP	None

		Selection Policies Below	Selection Policies Below		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
X-Ray Angiographic Bi-plane Image Storage (retired)	1.2.840.10008.5.1.4.1.1.12.3	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3	See Transfer Syntax	See Transfer Syntax	SCP	None

Storage		Selection Policies Below	Selection Policies Below		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
VL Whole Slide Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.6	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Enhanced Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.22	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
Positron Emission Tomography (PET)	1.2.840.10008.5.1.4.1.1.128	See Transfer Syntax	See Transfer Syntax	SCP	None

Image Storage		Selection Policies Below	Selection Policies Below		
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	See Transfer Syntax Selection Policies Below	See Transfer Syntax Selection Policies Below	SCP	None

Table 3.28: Presentation Contexts for Storage request

3.4.2.3 SOP Specific Conformance for SOP Class – Storage

The Storage SOP Classes in the CeloPACS server offer Level 2 (Full) conformance. No image data are modified in the storage process. Any image data stored in the server can be queried or retrieved by users. The server can display stored image data on a web browser through the web server interface. A list of status codes in response to a C-STORE request is as follows:

Status Code	Status	Description
0000H	Success	Image successfully stored
A700H	Refused	Out of resources, unable to create local file
A701H	Refused	Out of resources, failed to access database
A702H	Refused	Out of resources, memory allocation error
A703H	Refused	Out of resources, conflict with existing patient ID
A900H	Error	Data set does not match SOP Class
C000H	Error	Cannot understand

Table 3.29: List of possible response for C-STORE-RSP Status

3.4.2.4 Presentation Context Acceptance Criterion – Storage

Associations between a remote AE and the CeloPACS server can take place if the remote AE is known to the server and this remote AE is given the access privilege by the server. The server accepts any number of query SOP classes that are listed in Table 3.28. The server defines no limit on the number of presentation contexts accepted. In the event that the server runs out of resources when trying to accept multiple presentation contexts, the server will reject the association request.

3.4.2.5 Transfer Syntax Selection Policies – Storage

The CeloPACS server supports the following transfer syntaxes.

Transfer Syntax Name	Transfer Syntax UID
Implicit VR, Little Endian (DICOM Default)	1.2.840.10008.1.2
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Explicit VR, Big Endian	1.2.840.10008.1.2.2
Explicit VR, JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
Explicit VR, JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
Explicit VR, JPEG Lossless (Process 14)	1.2.840.10008.1.2.4.57
Explicit VR, JPEG Lossless, Non-hierarchical, First-order prediction (Process 14)	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Compression	1.2.840.10008.1.2.4.80
JPEG-LS Near-Lossless Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Part-1 Lossless Only Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Part-1 Lossless Or Lossy Compression	1.2.840.10008.1.2.4.91
MPEG2 Image Compression	1.2.840.10008.1.2.4.100
RLE Lossless	1.2.840.10008.1.2.5

Table 3.30: Supported Transfer Syntaxes for C-STORE SCP

3.4.2.6 Structured Reporting Storage as an SCU and SCP

The CeloPACS server supports the SOP classes listed below.

SOP Class	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
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 X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
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 Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
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
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
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

X-Ray Angiographic Bi-plane Image Storage (retired)	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
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
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3

Table 3.31: SOP classes supported by CeloPACS server

3.4.3 Real-World Activity – Query/Retrieve

In SCP mode, the CeloPACS server accepts associations from remote AEs to perform query (C-FIND) and retrieve (C-MOVE) operations on images that have been previously stored in the local server database.

3.4.3.1 Associated Real-World Activity – Query/Retrieve

The C-FIND and C-MOVE requests are query and retrieval operations initiated by another application. An application other than the CeloPACS server queries the server for patient/study/series/image information that has been previously stored in the local database, and can request the server to forward images to another AE.

3.4.3.2 Presentation Context Table – Query/Retrieve

The presentation contexts supported by the CeloPACS server for query operations are listed below.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve 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	Relational queries
Patient Root Query/Retrieve 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	Relational queries
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational queries
Study Root Query/Retrieve 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	Relational queries
Study Root	1.2.840.10008.5.1.4.1.2.2.2	DICOM	1.2.840.10008.1.2	SCP	Relational

Query/Retrieve Information Model - MOVE		Implicit VR Little Endian			queries
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational queries
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	Relational queries
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	Relational queries
Patient/Study Only Information Model - GET	1.2.840.10008.5.1.4.1.2.3.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational queries

Table 3.32: Acceptable Presentation Contexts for Query/Retrieve Classes

3.4.3.3 SOP Specific Conformance Statement – Query/Retrieve

When processing C-FIND request from remote Query/Retrieve SCU applications, the CeloPACS server supports the following key- matching methods.

Key Matching Methods	Description
SV	Single Value Matching
UM	Universal Matching
WC	Wild-Card Matching
DR	Date Range Matching
TR	Time Range Matching
LU	List Of UID Matching

Table 3.33: Key Matching Methods for processing C-FIND requests

The CeloPACS server supports relational queries and hierarchical queries. The server supports Patient Root Information Model and Patient/Study Only Information Model. For both models, the keys supported by the server are listed in the following table.

Level	**Description**	**Tag**	**Matching Method**	**Type**
Patient	Patient Name	0010 0010	SV,UM,WC	R
	Patient ID	0010 0020	SV,UM,WC	U
	Patient´s Birth Date	0010 0030	SV,UM,DR	O
	Patient´s Birth Time	0010 0032	SV,UM,TR	O
	Patient´s Sex	0010 0040	SV,UM	O
	Patient´s Age	0010 1010		O
	Patient´s Size	0010 1020		O
	Patient´s Weight	0010 1030		O
	Number of Patient Related Studies	0020 1200		O

	Number of Patient Related Series	0020 1202		O
	Number of Patient Related Instances	0020 1204		O
Study	Study Date	0008 0020	SV,UM,DR	R
	Study Time	0008 0030	SV,UM,TR	R
	Accession Number	0008 0050	SV,UM,WC	R
	Modalities In Study	0008 0061	SV,UM,WC	O
	Referring Physician Name	0008 0090		O
	Study Description	0008 1030		O
	Study Instance UID	0020 000D	SV,UM,WC	U
	Study ID	0020 0010	SV,UM,WC	R
	Number of Study Related Series	0020 1206		O
	Number of Study Related Instances	0020 1208		O
Series	Series Date	0008 0021	SV,UM,DR	O
	Series Time	0008 0031	SV,UM,TR	O
	Modality	0008 0060	SV,UM,WC	R
	Body Part Examined	0018 0015		O
	Series Instance UID	0020 000E	SV,UM,WC	U
	Series Number	0020 0011	SV,UM	R
	Number of Series Related Instances	0020 1209		O
Image	Instance Creation Date	0008 0012		O
	Instance Creation Time	0008 0013		O
	SOP Class UID	0008 0016	SV,UM,WC	O
	SOP Instance UID	0008 0018	SV,UM,WC	U
	Instance Number	0020 0013	SV,UM	R
	Overlay Number	0020 0022		O
	Curve Number	0020 0024		O
	LUT Number	0020 0026		O
	Samples Per Pixel	0028 0002		O
	Rows	0028 0010		O
	Columns	0028 0011		O
	Bits Allocated	0028 0100		O
	Bits Stored	0028 0101		O
	Pixel Representation	0028 0103		O

Table 3.34: Keys supported for the Patient Root Information Model

The CeloPACS server also supports the Study Root Information Model. The model supports the following keys.

Level	**Description**	**Tag**	**Matching Method**	**Type**
Study	Study Date	0008 0020	SV,UM,DR	R
	Study Time	0008 0030	SV,UM,TR	R
	Accession Number	0008 0050	SV,UM,WC	R
	Modalities In Study	0008 0061	SV,UM,WC	O
	Patient Name	0010 0010	SV,UM,WC	R
	Patient ID	0010 0020	SV,UM,WC	R
	Study ID	0020 0010	SV,UM,WC	R
	Study Instance UID	0020 000D	SV,UM,WC	U
	Referring Physician Name	0008 0090		O
	Study Description	0008 1030		O
	Patient´s Birth Date	0010 0030	SV,UM,DR	O
	Patient´s Birth Time	0010 0032	SV,UM,TR	O

	Patient´s Sex	0010 0040	SV,UM	O
	Patient´s Age	0010 1010		O
	Patient´s Size	0010 1020		O
	Patient´s Weight	0010 1030		O
Series	Series Date	0008 0021	SV,UM,DR	O
	Series Time	0008 0031	SV,UM,TR	O
	Modality	0008 0060	SV,UM,WC	R
	Body Part Examined	0018 0015		O
	Series Number	0020 0011	SV,UM	R
	Series Instance UID	0020 000E	SV,UM,WC	U
Image	Instance Creation Date	0008 0012		O
	Instance Creation Time	0008 0013		O
	SOP Instance UID	0008 0018	SV,UM,WC	U
	SOP Class UID	0008 0016	SV,UM,WC	O
	Image Number	0020 0013	SV,UM	R
	Overlay Number	0020 0022		O
	Curve Number	0020 0024		O
	LUT Number	0020 0026		O
	Samples Per Pixel	0028 0002		O
	Rows	0028 0010		O
	Columns	0028 0011		O
	Bits Allocated	0028 0100		O
	Bits Stored	0028 0101		O
	Pixel Representation	0028 0103		O

Table 3.35: The supported keys for Study Root Information Model

The CeloPACS server returns the following C-FIND-RSP status codes.

Status Code	**Status**	**Description**
0000H	Success	Operation performed properly
A700H	Refused	Out of Resources
A900H	Error	Identifier does not match SOP Class
C000H	Error	Unable to Process
FE00H	Cancel	Sub-operations terminated due to Cancel Indication
FF00H	Pending	Sub-operations are continuing

Table 3.36: C-FIND-RSP status code

The CeloPACS server supports the following C-MOVE SOP classes

- Patient Root Query/Retrieve Info Model – MOVE
- Study Root Query/Retrieve Info Model – MOVE
- Patient/Study Only Query/Retrieve Info Model - MOVE

The return status codes for these classes are as follows.

Status Code	Status	Description
0000H	Success	Operation performed properly
A701H	Refused	Out of Resources – Unable to calculate number of matches
A702H	Refused	Out of Resources – Unable to perform sub-operations
A801H	Refused	Move destination unknown
A900H	Error	Identifier does not match SOP Class
B000H	Warning	Sub-operations Complete – One or more Failures
C000H	Error	Unable to Process
FE00H	Cancel	Sub-operations terminated due to Cancel Indication
FF00H	Pending	Sub-operations are continuing

Table 3.37: C-MOVE-RSP status code

3.4.3.3 Presentation Context Acceptance Criterion – Query/Retrieve

Associations between a remote AE and the CeloPACS server can take place if the remote AE is known to the server and this remote AE is given the access privilege by the server. The server accepts any number of query SOP classes that are listed in Table 3.1. The server defines no limit on the number of presentation contexts accepted. In the event that the server runs out of resources when trying to accept multiple presentation contexts, the server will reject the association request.

3.4.3.5 Transfer Syntax Selection Policies – Query/Retrieve

The CeloPACS server only supports the Implicit VR Little Endian transfer syntax. Any proposed presentation context which includes the Implicit VR Little Endian transfer syntax will be accepted with the Implicit VR Little Endian transfer syntax. Any proposed presentation context that does not include the Implicit VR Little Endian transfer syntax will be rejected.

3.4.4 Real-World Activity – Modality Worklist Management

The CeloPACS server accepts associations from applications that wish to perform Worklist Query (Worklist-FIND) operations on worklist items that have been previously received and stored in the local server database.

3.4.4.1 Proposed Presentation Contexts – Modality Worklist Management

The CeloPACS server supports the following Modality Worklist – FIND request.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Info Model – FIND	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Table 3.38: Presentation Context for servicing Modality Worklist – FIND request

3.4.4.2 SOP Specific Conformance Statement – Modality Worklist Management

The CeloPACS server supports the following key matching methods for Modality Worklist-FIND requests from remote Worklist SCU applications.

Key Matching Methods	Description
SV	Single Value Matching
UM	Universal Matching
WC	Wild-Card Matching
DR	Date Range Matching

Table 3.39: Supported Key Matching methods for Modality Worklist-FIND request

The CeloPACS server provides standard conformance to the Modality Worklist SOP Class as a SCP. Supported Matching and Return keys are listed in Table 3.35. The server only supports required matching keys and return keys of Types 1, 1C, and 2.

Module	Description	Tag	Matching Method	Return Type
Scheduled Procedure Step	Scheduled Procedure Step Sequence	0040 0100		1
	>Modality	0008,0060	UM,WC	1
	>Scheduled Station AE Title	0040 0001	UM,WC	1
	>Scheduled Procedure Step Start Date	0040 0002	SV,UM,DR	1
	>Scheduled Procedure Step Start Time	0040 0003	UM	1
Requested Procedure	Requested Procedure ID	0040 1001	UM,WC	1
	Requested Procedure Description	0032 1060		1C
	Study Instance UID	0020 000D		1
	Referenced Study Sequence	0008 1110		2
	>Referenced SOP Class UID	0008 1150		1C
	>Referenced SOP Instance UID	0008 1155		1C
Imaging Service Request	Accession Number	0008 0050	SV,UM,WC	2
	Referring Physician´s Name	0008 0090	UM	2
	Requesting Physician´s Name	0032 1032		2
Patient Identification	Patient´s Name	0010 0010	SV,UM,WC	1
	Patient ID	0010 1020	SV,UM,WC	1
Patient Demographic	Patient´s Birth Date	0010 1030	SV,UM,DR	2
	Patient´s Sex	0010 1040	SV,UM	2

Table 3.40: Supported matching and return keys for Modality Worklist – FIND request

3.4.4.3 Presentation Context Acceptance Criterion – Modality Worklist Management

Associations between a remote AE and the CeloPACS server can take place if the remote AE is known to the server and this remote AE is given the access privilege by the server. The server accepts the SOP class that is listed in Table 3.38. The server defines no limit on the number of presentation contexts accepted. In the event that the server runs out of resources when trying to accept multiple presentation contexts, the server will reject the association request.

3.4.4.4 Transfer Syntax Selection Policies – Modality Worklist Management

The CeloPACS server only supports the Implicit VR Little Endian transfer syntax. Any proposed presentation context which includes the Implicit VR Little Endian transfer syntax will be accepted with the Implicit VR Little Endian transfer syntax. Any proposed presentation context that does not include the Implicit VR Little Endian transfer syntax will be rejected.

3.4.5 Real-World Activity – Storage Commitment Push Model

The CeloPACS server accepts DICOM Storage Commitment association requests that are initiated by remote DICOM AEs.

3.4.5.1 Associated Real-World Activity – Storage Commitment Push Model

The CeloPACS server stores images that are sent to it from an SCU. The request for storage commitment is transmitted to the server with a list of references to one or more SOP instances. The server receives and responds to the DIMSE N-ACTION of the Request Storage Commitment for a set of referenced SOP instances.

The DIMSE-N Services applicable to the Storage Commitment Push Model SOP Class are:

- N-EVENT_REPORT
- N-ACTION

3.4.5.2 Proposed Presentation Context – Storage Commitment Push Model

The supported presentation context for the Storage Commitment Push Model is listed below.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Table 3.41: The Acceptable Presentation Context for Storage Commitment Push Model

3.4.5.3 SOP Specific Conformance Statement Storage Commitment Push Model

The CeloPACS server supports the following elements for this SOP class as an SCP.

Action Type Name	**Action Type ID**	**Attribute Name**	**Tag**
Request Storage Commitment	1	Transaction UID	0008,1195
		Referenced SOP Sequence	0008,1199
		>Referenced SOP Class UID	0008,1150
		>Referenced SOP Instance UID	0008,1155

Table 3.42: Storage Commitment Push Model Request (N-ACTION) Message

3.4.5.3.1 Storage Commitment Results

After the Storage Commitment Push Model request is received, the CeloPACS server will query its database to determine if the referenced SOP instance exists in its database tables. The server will then further check to see if the raw image files that correspond to the referenced SOP instance do exist and are valid in the local storage file system.

If the server determines that both the database records and raw image files exist and are valid for the referenced SOP instances, the server will issue an N-EVENT-REPORT to the SCU including references to the successfully stored SOP Instances contained in the N-ACTION request. Otherwise, the server will issue an N-EVENT-REPORT to the SCU including references to the failed SOP Instances contained in the N-ACTION request.

The N-EVENT-REPORT contains the Transaction UID value contained in the initiating N-ACTION request. The N-EVENT-REPORT is sent on a separate association from the N-ACTION request.

The following Event Report Information is supported by the server.

Action Type Name	Event Type ID	Attribute Name	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 – Failure 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

Table 3.43: Supported Storage Commitment Push Model Event Report messages

3.4.5.4 Presentation Context Acceptance Criterion – Storage Commitment Push Model

Associations between a remote AE and the CeloPACS server can take place if the remote AE is known to the server and this remote AE is given the access privilege by the server. The server accepts the SOP class that is listed in Table 3.41. The server defines no limit on the number of presentation contexts accepted. In the event that the server runs out of resources when trying to accept multiple presentation contexts, the server will reject the association request.

3.4.5.5 Transfer Syntax Selection Policies – Storage Commitment Push Model

The CeloPACS server only supports the Implicit VR Little Endian transfer syntax. Any proposed presentation context which includes the Implicit VR Little Endian transfer syntax will be accepted with the Implicit VR Little Endian transfer syntax. Any proposed presentation context that does not include the Implicit VR Little Endian transfer syntax will be rejected.

3.5 DICOM Media Storage Services

The CeloPACS server conforms to DICOM Media Storage Service File Format (PS 3.10) and the Media Storage Application Profiles (PS 3.11) for reading images on the CD/DVD drive, as well as for writing images to a local DICOM file format directory (DICOMDIR), which can be archived into CD-R/RW or DVD-R/RW/RAM/+R/+RW media later.

3.5.1 Media Storage Application Profiles

The CeloPACS server supports the following application profiles.

Description	Identifier
General Purpose CD-R Interchange	STD-GEN-CD
General Purpose Interchange on DVD-RAM Media	STD-GEN-DVD-RAM

Table 3.44: Supported DICOM Media Storage Application Profiles

3.5.2 Real-World Activities

The CeloPACS server supports the following storage SOP classes when

- Importing from DICOM Media Storage format compliant CD/DVD drives.
- Exporting patients/studies stored in the local server database to the local DICOM Media Storage formatted directories.

Storage SOP Class Name	Storage SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
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 X-ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
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 Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
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
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2
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
X-Ray Angiographic Bi-plane Image Storage (retired)	1.2.840.10008.5.1.4.1.1.12.3
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66

VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1
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
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4
VL Whole Slide Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.6
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11
Enhanced Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.22
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3

Table 3.45: Supported storage SOP classes for DICOM Part 10 format import and export

When importing or exporting images of the storage SOP classes listed in Table 3.45, the CeloPACS server supports the transfer syntaxes listed in Table 3.30 in Section 3.4.2.5.

When importing or exporting images of the storage SOP classes listed in Table 3.45, the CeloPACS server requires or uses the following mandatory Selection Keys/Attributes defined in DICOM PS 3.10 and PS 3.3:

Directory Record Type	**Selection Key Name**	**Tag**
Patient	Patient Name	0010,0010
	Patient ID	0010,0020
Study	Study UID	0020,000D
	Study ID	0020,0010
Series	Modality	0008,0060
	Series Number	0020,0011
Image	Referenced File ID	0004,1500
	Referenced SOP Class UID in File	0004,1510
	Referenced SOP Instance UID in File	0004,1511
	Referenced Transfer Syntax UID in File	0004,1512
	Image Number	0020,0013
SR Document	Instance Number	0020,0013
	Completion Flag	0040,A491
	Verification Flag	0040,A493
	Content Date	0008,0023
	Content Time	0008,0033
	Verification DateTime	0040,A030
	Concept Name Code Sequence	0040,A043

Table 3.46: Mandatory selection keys supported by the Import/Export functions

3.5.2.1 Real-World Activities – Reading images from CD/DVD drives

The CeloPACS server functions as a FSR when reading images stored in media drives.

There are two methods when reading patient study records stored.

1. When DICOM studies exist in DICOM storage formatted compatible directory (with or without DICOMDIR directory record):

    a. The metadata of the DICOM file will be imported into the local server database
    b. The raw image part of the DICOM file will not be copied.

    The server database records will be linked directly to the source directory.
2. When DICOM studies exist in CD/DVD media drive, the entire DICOM studies (both metadata and the raw image data) will be imported into the server repository.

3.5.2.2 Real-World Activities – Writing images to local directory

The CeloPACS server functions as a FSC when writing images to a local directory using DICOM Media Storage compliant directory formats.

There are two methods to export patient study records stored in the server repository:

1. User can export DICOM studies to a local directory using DICOM Media Storage formats through the user interface.
2. User can select export media types which can be either CD (650MB) or DVD (4.7GB).
    a. If the total size of the selected patients/studies exceeds the storage limit for the selected media type, multiple volumes will be created with the volume number automatically appended to the specified media label.

4 Communication Profiles

4.1 TCP/IP Stack

The CeloPACS server provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8 of the DICOM Standard (2004). The server inherits its TCP/IP stack from the computer system.

4.1.1 TCP/IP API

The CeloPACS server uses the TCP/IP stack from Microsoft Windows platforms. It uses a subroutine library that is based on Windows Socket API (Winsock 2.0).

4.1.2 Physical Media Support

The CeloPACS server places no restrictions on the physical network upon which the server resides. The server has been tested using TCP/IP over Ethernet (10/100/1000 Mbps) as well as wireless LAN (IEEE 802.11x variants).

5 Extension, Specialization and Privatizations

Not applicable.

6 Configuration

The CeloPACS server obtains configuration information from a database table that is stored in a relational database.

6.1 AE Title/Presentation Address Mapping

A database table maps AE Titles and Presentation Addresses as follows:

Field	Type	Null	Key	Default
title	varchar(16)	NO	Primary	N/A
hostname	varchar(64)	YES	N/A	NULL
ipaddr	varchar(64)	YES	N/A	NULL
port	int(11)	YES	N/A	NULL
allowaccess	tinyint(1)	YES	N/A	0
archivedir	varchar(255)	YES	N/A	NULL

Table 6.1: AE Title/Presentation Address Mapping Table

6.2 Security Features

The CeloPACS server uses the above table (Table 6.1) to control access. The table allows the server to determine which applications is allowed to access and where received images should be stored.

6.3 Configurable Parameters

The following parameters may be configured for CeloPACS server:

- Application Entity Title
- Logfile Directory
- TCP/IP Port Number
- Storage Format

6.4 Support of Extended Character Sets

CeloPACS server currently does not support any extended character sets.

7. Web Access to DICOM Persistent Objects (WADO)

WADO specifies a web-based service for accessing and presenting DICOM persistent objects (e.g. images, medical imaging reports). It provides a simple mechanism for accessing a DICOM persistent object from HTML pages or XML documents, through HTTP/HTTPs protocol, using DICOM UIDs (Unique Identifiers). Data may be retrieved either in a presentation-ready form as specified by the requester (e.g. JPEG or GIF) or in a native DICOM format. This standard relates only to DICOM persistent objects (not to other DICOM objects or to non-DICOM objects).

Access to the content of a WADO object is enabled by specifying a "link" pointing to a specific DICOM Persistent Object by means of its URL/URI and specifying its DICOM object Instance UID. The general syntax of the standard respects the URI recommendation IETF RFC2396. It can be expressed as:

<scheme>://<authority><path>?<query>

It is structured following BNF syntax. The first definition of this syntax is:

- URI-reference = [absoluteURI | relativeURI] ["#" fragment]
- absoluteURI = scheme ":" (hier_part | opaque_part)
- relativeURI = (net_path | abs_path | rel_path) ["?" query]
- hier_part = (net_path | abs_path) ["?" query]

This definition of the term query shall respectfully the BNF syntax exposed in the IETF RFC2396. Within a query component, the characters ";", "/", "?", ":", "@", "&", "=", "+", ",", and "$" are reserved. It is only a restriction of it for the unique purpose of retrieving DICOM Persistent Objects through Web Access to DICOM Persistent Objects.

Control names and values are escaped. Space characters are replaced by "+", and then reserved characters are escaped as described in IETF RFC2396. Non-alphanumeric characters are replaced by "%HH", a percent sign and two hexadecimal digits representing the ASCII code of the character. Line breaks are represented as "CR LF" pairs (i.e., "%0D%0A"). The control names/values are listed in the order they appear in the document. The name is separated from the value by "=" and name/value pairs are separated from each other by "&".

Syntax of the <query> component
The BNF syntax restriction of parameters for the Web Access to DICOM Persistent Objects service is the following:

- query = parameter ["&" parameter]
- parameter = name "=" value
- name = nchars
- value = nchars
- nchars = *nchar
- nchar = unreserved | escaped

where unreserved and escaped are defined in IETF RFC2396.

7.1 URL Parameters Required for All DICOM Persistent Objects

7.1.1 Request type - Type of request performed
The parameter name shall be requestType, and the value shall be "WADO".

7.1.2 Unique Identifier of the Series - Series Instance UID
The parameter name shall be seriesUID, and the value shall be encoded as a Unique Identifier (UID) string, as specified in PS 3.5, except that it shall not be padded to an even length with a NULL character.

7.1.3 Unique Identifier of the Object - SOP Instance UID
The parameter name shall be objectUID, and the value shall be encoded as a Unique Identifier (UID) string, as specified in PS 3.5, except that it shall not be padded to an even length with a NULL character.

7.2 URL Parameters Optional for All DICOM Persistent Objects

7.2.1 MIME Type Constraints
MIME type(s) desired by the Web Client for the response from the Server, as defined in the IETF RFC2616.

This parameter is OPTIONAL. If present, the parameter name shall be contentType, and its value can be one of the following:

- application/dicom
- image/jpeg

If the contentType parameter is not present in the request, the response shall contain an image/jpeg MIME type.

7.2.2 AE Title
In case of multi-instance configurations where multiple instances of CeloPACS Server are running on the same server, this parameter will be used to identify the particular instance of CeloPACS Server in order to access the correct database for the requesting Dicom objects.

This parameter is OPTIONAL. If present, the parameter name shall be aetitle.

7.3 Authentication Methods for Web Access to DICOM Persistent Objects (WADO)
A valid username/password pair is required before the web clients can access the CeloPACS Server database, and the System Administrator must have pre-created this username/password before they can be used to login to the CeloPACS Server database.

7.3.1 Authentication via HTTP Request Parameters
Authentication information can be supplied via the following URL parameters sent as part of the HTTP request:

- username
- password

7.3.2 HTTP Basic Authentication
If authentication information is not supplied via HTTP Request parameters above, CeloPACS Server will switch to HTTP Basic Authentication method instead, by presenting a dialog window prompting for username/password information. Web users can then manually enter such username/password information before they can be authenticated to access the CeloPACS Server database.