PMOD Technologies Ltd

PMOD v4.2xx

Version 1.0
Date: 2020.10.19

1 CONFORMANCE STATEMENT OVERVIEW

This document is a DICOM Conformance statement for PMOD application version 4.2 build 1, and all later builds of PMOD 4.2 version. Whenever build is omitted or referred as xx the information pertains to all builds of PMOD 4.2 version. PMOD application includes implementation of DICOM services necessary to access images stored on media, to send images across the network to another system, and to query a remote system for a list of DICOM objects that may be then retrieved. DICOM Server module that must be started separately (either automatically during application start or manually from modules selection dialog) includes capability to receive images from other systems and to answer queries from remote systems. Both color and grayscale images are supported for display, however some viewing options and most processing options are limited to monochrome image data.

Supported storage related SOP Classes are listed in table 1-1.

Only hierarchical query and retrieval is supported. Relational Queries are not supported either as an SCU or SCP.

Table 1-1 provides an overview of the network services supported by PMOD v4.2xx.

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Computed Radiography Image Storage	YES [1]	YES
CT Image Storage	YES	YES
Enhanced CT Image Storage	YES	YES
Legacy Converted Enhanced CT Image Storage	YES	YES
Ultrasound Multi-frame Image Storage	YES [1]	YES
Ultrasound Multi-frame Image Storage (Retired)	YES [1]	YES
DX Image Storage for Presentation	YES [1]	YES
DX Image Storage for Processing	YES [1]	YES
Digital MG Image Storage for Presentation	YES [1]	YES
Digital MG Image Storage for Processing	YES [1]	YES
Digital Intra-oral X-Ray Image Storage for Presentation	YES [1]	YES
Digital Intra-oral X-Ray Image Storage for Processing	YES [1]	YES
MR Image Storage	YES	YES
Enhanced MR Image Storage	YES	YES
MR Spectroscopy Storage	YES [1]	YES
Enhanced MR Colored Image Storage	YES [1]	YES
Legacy Converted Enhanced MR Image Storage	YES [1]	YES
Ultrasound Image Storage (Retired)	YES [1]	YES

Ultrasound Image Storage	YES [1]	YES
Enhanced US Volume Storage	YES [1]	YES
Secondary Capture Image Storage	YES	YES
Multi-frame Single Bit Secondary Capture Image Storage	YES [1]	YES
Multi-frame Grayscale Byte Secondary Capture Image Storage	YES [1]	YES
Multi-frame Grayscale Word Secondary Capture Image Storage	YES [1]	YES
Multi-frame True Color Secondary Capture Image Storage	YES	YES
12-lead ECG Waveform Storage	YES [1]	YES
General ECG Waveform Storage	YES [1]	YES
Ambulatory ECG Waveform Storage	YES [1]	YES
Hemodynamic Waveform Storage	YES [1]	YES
Cardiac Electrophysiology Waveform Storage	YES [1]	YES
Basic Voice Audio Waveform Storage	YES [1]	YES
General Audio Waveform Storage	YES [1]	YES
Arterial Pulse Waveform Storage	YES [1]	YES
Respiratory Waveform Storage	YES [1]	YES
Grayscale Softcopy Presentation State Storage	YES [1]	YES
Color Softcopy Presentation State Storage	YES [1]	YES
Pseud-Color Softcopy Presentation State Storage	YES [1]	YES
Blending Softcopy Presentation State Storage	YES [1]	YES
XA/XRF Grayscale Softcopy Presentation State Storage	YES [1]	YES
Grayscale Planar MPR Volumetric Presentation State Storage	YES [1]	YES
Compositic Planar MPR Volumetric Presentation State Storage	YES [1]	YES
Advanced Blending Presentation State Storage	YES [1]	YES
Volume Rendering Volumetric Presentation State Storage	YES [1]	YES
Segmented Volume Rendering Volumetric Presentation State Storage	YES [1]	YES
Multiple Volume Rendering Volumetric Presentation State Storage	YES [1]	YES
X-Ray Angiographic Image Storage	YES [1]	YES
Enhanced XA Image Storage	YES [1]	YES
X-Ray Radiofluoroscopic Image Storage	YES [1]	YES
Enhanced XRF Image Storage	YES [1]	YES
X-Ray 3D Angiographic Image Storage	YES [1]	YES
X-Ray 3D Craniofacial Image Storage	YES [1]	YES
Breast Tomosynthesis Image Storage	YES [1]	YES
Breast Projection X-Ray Image Storage for Presentation	YES [1]	YES
Breast Projection X-Ray Image Storage for Processing	YES [1]	YES
Intravascular Optical Coherence Tomography Image Storage for Presentation	YES [1]	YES

Intravascular Optical Coherence Tomography Image Storage for Processing	YES [1]	YES
Nuclear Medicine Image Storage	YES	YES
Nuclear Medicine Image Storage (Retired)	YES [1]	YES
Parametric Map Storage	YES [1]	YES
RAW Data Storage	YES [1]	YES
Spatial Registration Storage	YES [1]	YES
Spatial Fiducials Storage	YES [1]	YES
Deformable Spatial Registration Storage	YES [1]	YES
Segmentation Storage	YES	YES
Surface Segmentation Storage	YES [1]	YES
Tractography Results Storage	YES [1]	YES
Real World Value Mapping Storage	YES [1]	YES
Surface Scan Mash Storage	YES [1]	YES
Surface Scan Point Cloud Storage	YES [1]	YES
VL Endoscopic Image Storage	YES [1]	YES
Video Endoscopic Image Storage	YES [1]	YES
VL Microscopic Image Storage	YES [1]	YES
Video Microscopic Image Storage	YES [1]	YES
VL Slide Coordinates Microscopic Image Storage	YES [1]	YES
VL Photographic Image Storage	YES [1]	YES
Video Photographic Image Storage	YES [1]	YES
Ophthalmic Photography 8 Bit Image Storage	YES [1]	YES
Ophthalmic Photography 16 Bit Image Storage	YES [1]	YES
Stereometric Relationship Storage	YES [1]	YES
Ophthalmic Tomography Image Storage	YES [1]	YES
Wide Field Ophthalmic Photography Stereographic Projection Image Storage	YES [1]	YES
Wide Field Ophthalmic 3D Coordinates Image Storage	YES [1]	YES
Ophthalmic Optical Coherence Tomography En Face Image Storage	YES [1]	YES
Ophthalmic Optical Coherence Tomography B-Scan Volume Analysis Storage	YES [1]	YES
VL Whole Slide Microscopy Image Storage	YES [1]	YES
Lensometry Measurements Storage	YES [1]	YES
Autorefraction Measurements Storage	YES [1]	YES
Kreatometry Measurements Storage	YES [1]	YES
Subjective Refraction Measurements Storage	YES [1]	YES
Visual Acuity Measurements Storage	YES [1]	YES
Spectacle Prescription Report Storage	YES [1]	YES
Ophthalmic Axial Measurements Storage	YES [1]	YES
Intraocular Lens Calculation Storage	YES [1]	YES
Macular Grid Thickness and Volume Report	YES [1]	YES
Ophthalmic Visual Field Static Perimetry Measurements Storage	YES [1]	YES
Ophthalmic Thickness Map Storage	YES [1]	YES
Corneal Topography Map Storage	YES [1]	YES
Basic Text SR Storage	YES [1]	YES
Enhanced SR Storage	YES [1]	YES
Comprehensive SR Storage	YES	YES

Comprehensive 3D SR Storage	YES	YES
Extensible SR Storage	YES [1]	YES
Procedure Log Storage	YES [1]	YES
Mammography CAD SR Storage	YES [1]	YES
Key Object Selection Storage	YES [1]	YES
Chest CAD SR Storage	YES [1]	YES
X-Ray Radiation Dose SR Storage	YES [1]	YES
Radiopharmaceutical Radiation Dose SR Storage	YES [1]	YES
Colon CAD SR Storage	YES [1]	YES
Implantation Plan SR Document Storage	YES [1]	YES
Acquisition Context SR Storage	YES [1]	YES
Simplified Adult Echo SR Storage	YES [1]	YES
Patient Radiation Dose SR Storage	YES [1]	YES
Content Assessment Results Storage	YES [1]	YES
Encapsulated PDF Storage	YES [1]	YES
Encapsulated CDA Storage	YES [1]	YES
Encapsulated STL Storage	YES [1]	YES
Positron Emission Tomography Image Storage	YES	YES
Enhanced PET Image Storage	YES	YES
Legacy Converted Enhanced PET Image Storage	YES	YES
Basic Structured Display Storage	YES [1]	YES
CT Performed Procedure Protocol Storage	YES [1]	YES
RT Image Storage	YES [1]	YES
RT Structure Set Storage	YES	YES
RT Dose Storage	YES [1]	YES
RT Plan Storage	YES [1]	YES
RT Ion Plan Storage	YES [1]	YES
RT Ion Beams Treatment Record Storage	YES [1]	YES
RT Brachy Treatment Record Storage	YES [1]	YES
RT Treatment Summary Record Storage	YES [1]	YES
PMOD Multi-frame Image Storage[2]	YES	YES
Siemens Tensor (1.3.12.2.1107.5.9.1) Storage[2]	NO	YES
Storage Commitment		
Storage Commitment Push Model SOP Class	NO	YES
Query/Retrieve		
Patient Root Query/Retrieve Information Model – FIND	YES – Hierarchical only	YES – Hierarchical only
Patient Root Query/Retrieve Information Model – MOVE	YES – Hierarchical only	YES – Hierarchical only
Study Root Query/Retrieve Information Model – FIND	YES – Hierarchical only	YES – Hierarchical only
Study Root Query/Retrieve Information Model – MOVE	YES – Hierarchical only	YES – Hierarchical only

[1] Object creation not supported. Service available only for objects created outside PMOD application.

[2] Private Information Object Definition.

Table 1-2 provides an overview of the Media Storage Application Profiles supported by PMOD v4.2xx.

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
General Purpose CD-R, DVD and BD		
General Purpose CD-R Interchange	NO	YES
General Purpose Interchange on DVD-RAM Media	NO	YES
General Purpose Interchange on BD Media	NO	YES

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3 INTORDUCTION

3.1 REVISION HISTORY

Document Version	Date of Issue	Author	Description
1.0	19.10.2020	PMOD Technologies	First release for PMOD version 4.2

3.2 AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader has a working understanding of DICOM.

3.3 REMARKS

The scope of this Conformance Statement is to facilitate network communication and image exchange between PMOD Technologies' PMOD application and other vendors' products . This document should be read and understood in conjunction with the DICOM standard [DICOM]. 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.
Integration of PMOD application with applications of other vendors is outside the scope of the DICOM standard. Product Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information.
Future changes to the DICOM standard may require alterations to be made to PMOD application. PMOD Technologies reserves the right to modify the PMOD application architecture as needed, in order to meet changing standards.

3.4 DEFINITIONS, TERMS AND ABBREVIATIONS

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

AE DICOM Application Entity
CD-R Compact Disk Recordable
FSC File-Set Creator
FSU File-Set Updater
FSR File-Set Reader
IOD (DICOM) Information Object Definition
ISO International Standard Organization
R Required Key Attribute
O Optional Key Attribute
PDU DICOM Protocol Data Unit
SCU DICOM Service Class User (DICOM client)
SCP DICOM Service Class Provider (DICOM server)
SOP DICOM Service-Object Pair
U Unique Key Attribute

3.5 REFERENCES

[DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.22, 2020b
[PBF] PMOD Base Functionality User's Guide PBAS.pdf available for download on the PMOD website: http://www.pmod.com.

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

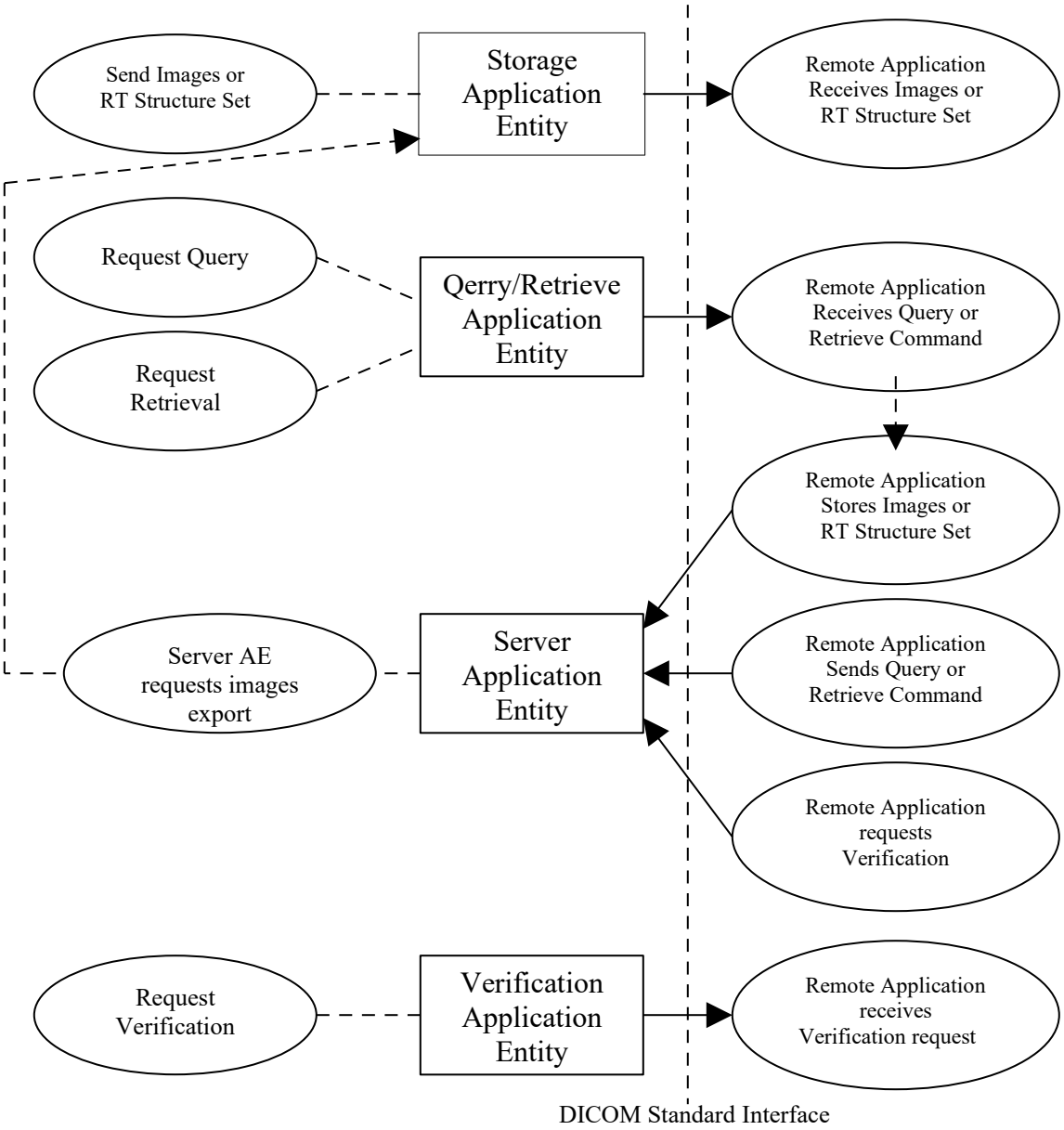

Figure 4.1-1
APPLICATION DATA FLOW DIAGRAM

The PMOD application is a pure Java application that includes: a user interface for viewing medical image data, access to remote storages through query/retrieve operations, ability to send images to remote systems, and media support. DICOM Server module provides a network listener that spawns additional threads as necessary to handle incoming connections for instances storage, query and retrieval.
Conceptually the network services may be modeled as the following separate AEs, though in fact all the client AEs share a single (configurable) PMOD installation AE Title:

- STORAGE AE, which sends images, RT Structure Set composite instances, and other composite objects instances created outside PMOD software.
- QUERY/RETRIEVE AE, which queries remote AEs for lists of patients, studies and series instances and retrieves selected patients, studies or series,
- VERIFICATION AE, which requests verification from remote AEs,
- SERVER AE, which receives all incoming connections including incoming images and other supported composite instances, verification requests, query/retrieval requests, and storage commitment requests.

SERVER AE daemon can be started as a JAVA command line utility or from PMOD module selection window. It is possible to configure and start several instances of server deamon. PMOD application may be also configured to automatically start the server daemon when the user logs into the PMOD application. Server daemon may either store received images to a local database or perform other configured operations on received instances. Information on how to start and configure server daemon can be found in the PMOD application User's Guide [PBF].

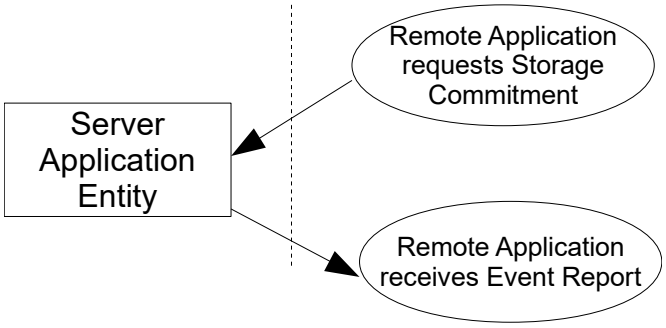

Figure 4.1-2
APPLICATION DATA FLOW DIAGRAM FOR STORAGE COMMITMENT

4.1.2 Functional Definitions of AE's

4.1.2.1 VERIFICATION AE

VERIFICATION AE is activated through the user interface when a user requests to test connection with selected remote AE. This option is always available in the interface together with selection of AE (from an application configured list).

4.1.2.2 STORAGE AE

STORAGE AE is activated through the user interface when a user selects one or more series from the current storage (local database, DICOMDIR or the local directory), the currently displayed image data or currently displayed region definition, and requests that they be sent to a remote AE (selected from an application configured list).

4.1.2.3 QUERY/RETRIEVE AE

QUERY/RETRIEVE AE is activated through the user interface when a user selects a remote AE to query (from an application configured list), then initiates a query. Depending on selected model Queries are performed recursively either from the patient through the study and series levels or from the study through the series level until all matching instances have been listed. Retrieve operation may be requested on listed instances. When retrieve is performed to local AE, SERVER AE receives retrieved images (provided the queried AE is properly configured).

4.1.2.4 SERVER AE

SERVER AE when started waits in the background for the incoming connections. It will accept

associations with:

- Presentation Contexts for SOP Class of the Verification Service Class and will respond successfully to echo requests from recognized AE.
- Presentation Contexts for SOP Classes of the Patient Root and Study Root Query/Retrieve Service Class and will respond with matched results for queries or send instances requested for retrieval on a separate connection,
- Presentation Contexts for recognized SOP Classes of the Storage Service Class, and will store the received instances to the configured local database where they may subsequently be listed and viewed through the user interface.
- Presentation Contexts for Storage Commitment Push Model SOP Class and will perform storage verification and will send Event Report message with requested statuses.

4.1.3 Sequencing of Real-World Activities

All SCP activities are performed asynchronously in the background and are not dependent on any sequencing.
All SCU activities except storage requests are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed. Storage requests may be performed in separate, independent threads.

4.2 AE SPECIFICATIONS

4.2.1 VERIFICATION AE

4.2.1.1 SOP Classes

VERIFICATION AE provides Standard Conformance to the following SOP Class(es):

Table 4.2-1
SOP CLASS FOR VERIFICATION AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4.2-2
DICOM APPLICATION CONTEXT

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

VERIFICATION AE initiates but never accepts associations.

Table 4.2-3
NUMBER OF ASSOCIATIONS AS AN ASSOCIATION INITIATOR FOR VERIFICATION AE

Maximum number of simultaneous associations	1

4.2.1.2.3 Asynchronous Nature

Asynchronous communication is not supported. VERIFICATION AE will only allow a single outstanding operation on an Association. Asynchronous operations window negotiation will not be performed.

4.2.1.2.4 Implementation Identifying Information

VERIFICATION AE will supply following implementation information:

Table 4.2-4
DICOM IMPLEMENTATION CLASS AND VERSION FOR PMOD v4.2

Implementation Class UID	2.16.840.1.114033.1
Implementation Version Name (see Note)	PMODDCM_1.1

Note: The ability to include implementation version name in the verification message is configurable and may be blocked.

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity - User Request for Verification

4.2.1.3.1.1 Description and Sequencing of Activities

VERIFICATION AE will attempt an association when user choose to test a connection with a remote, previously configured application node.

Only single verification action at a time is allowed and possible and sequencing do not apply.

4.2.1.3.1.2 Proposed Presentation Contexts

VERIFICATION AE will propose either single or multiple Presentation Context for Verification Abstract Syntax. This behavior is configurable through the node configuration option 'propose one Transfer Syntax per Presentation Context'.

When the option is turned off following Presentation Contexts are proposed:

Table 4.2-5
PROPOSED PRESENTATION CONTEXTS FOR VERIFICATION AE (single TS option off).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Otherwise the presentation contexts listed below are proposed:

Table 4.2-6
PROPOSED PRESENTATION CONTEXTS FOR VERIFICATION AE (single TS option on).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Verification	1.2.840.10008.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Verification	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

VERIFICATION AE do not perform any extended negotiation.

4.2.1.4 Association Acceptance Policy

VERIFICATION AE does not accept associations.

4.2.2 STORAGE AE

4.2.2.1 SOP Classes

STORAGE AE provides Standard Conformance to the following SOP Class(es):
Table 4.2-7
SOP CLASSES FOR STORAGE AE

SOP Class Name	SOP Class UID	SCU	SCP
Computed Radiography Image Storage [1]	1.2.840.10008.5.1.4.1.1.1	Yes	No
Digital X-Ray Image Storage - for Presentation [1]	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image Storage - for Processing [1]	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography X-Ray Image Storage - for Presentation [1]	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography X-Ray Image Storage - for Processing [1]	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Digital Intra-oral X-Ray Image Storage - for Presentation [1]	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image Storage - for Processing [1]	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	No
Legacy Converted Enhanced CT Image Storage [1]	1.2.840.10008.5.1.4.1.1.2.2		
Ultrasound Multi-frame Image Storage (retired) [1]	1.2.840.10008.5.1.4.1.1.3	Yes	No
Ultrasound Multi-frame Image Storage [1]	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 Storage [1]	1.2.840.10008.5.1.4.1.1.4.2	Yes	No
Enhanced MR Color Image Storage [1]	1.2.840.10008.5.1.4.1.1.4.3	Yes	No
Legacy Converted Enhanced MR Image Storage [1]	1.2.840.10008.5.1.4.1.1.4.4	Yes	No
Nuclear Medicine Image Storage (retired) [1]	1.2.840.10008.5.1.4.1.1.5	Yes	No
Ultrasound Image Storage (retired) [1]	1.2.840.10008.5.1.4.1.1.6	Yes	No
Ultrasound Image Storage [1]	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Enhanced US Volume Storage [1]	1.2.840.10008.5.1.4.1.1.6.2	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]	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage [1]	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image Storage [1]	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
12-lead ECG Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
General ECG Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No

SOP Class Name	SOP Class UID	SCU	SCP
Ambulatory ECG Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Hemodynamic Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Cardiac Electrophysiology Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
Basic Voice Audio Waveform Storage[1]	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
General Audio Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.4.2	Yes	No
Arterial Pulse Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.5.1	Yes	No
Respiratory Waveform Storage [1]	1.2.840.10008.5.1.4.1.1.9.6.1	Yes	No
Grayscale Softcopy Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Color Softcopy Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.2	Yes	No
Pseudo-Color Softcopy Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.3	Yes	No
Blending Softcopy Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.4	Yes	No
XA/XRF Grayscale Softcopy Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.5	Yes	No
Grayscale Planar MPR Volumetric Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.6	Yes	No
Compositing Planar MPR Volumetric Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.7	Yes	No
Advanced Blending Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.8	Yes	No
Volume Rendering Volumetric Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.9	Yes	No
Segmented Volume Rendering Volumetric Presentation State Storage[1]	1.2.840.10008.5.1.4.1.1.11.10	Yes	No
Multiple Volume Rendering Volumetric Presentation State Storage [1]	1.2.840.10008.5.1.4.1.1.11.11	Yes	No
X-Ray Angiographic Image Storage [1]	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
Enhanced XA Image Storage [1]	1.2.840.10008.5.1.4.1.1.12.1.1	Yes	No
X-Ray Radiofluoroscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
Enhanced XRF Image Storage [1]	1.2.840.10008.5.1.4.1.1.12.2.1	Yes	No
X-Ray 3D Angiographic Image Storage [1]	1.2.840.10008.5.1.4.1.1.13.1.1	Yes	No
X-Ray 3D Craniofacial Image Storage[1]	1.2.840.10008.5.1.4.1.1.13.1.2	Yes	No
Breast Tomosynthesis Image Storage[1]	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	No
Breast Projection X-Ray Image Storage - For Presentation [1]	1.2.840.10008.5.1.4.1.1.13.1.4	Yes	No
Breast Projection X-Ray Image Storage - For Processing [1]	1.2.840.10008.5.1.4.1.1.13.1.5	Yes	No
Intravascular Optical Coherence Tomography Image Storage - For Presentation [1]	1.2.840.10008.5.1.4.1.1.14.1	Yes	No
Intravascular Optical Coherence Tomography Image Storage - For Processing [1]	1.2.840.10008.5.1.4.1.1.14.2	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
Parametric Map Storage [1]	1.2.840.10008.5.1.4.1.1.30	Yes	No
RAW Data Storage [1]	1.2.840.10008.5.1.4.1.1.66	Yes	No
Spatial Registration Storage [1]	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Spatial Fiducials Storage [1]	1.2.840.10008.5.1.4.1.1.66.2	Yes	No

SOP Class Name	SOP Class UID	SCU	SCP
Deformable Spatial Registration Storage [1]	1.2.840.10008.5.1.4.1.1.66.3	Yes	No
Segmentation Storage [1]	1.2.840.10008.5.1.4.1.1.66.4	Yes	No
Surface Segmentation Storage [1]	1.2.840.10008.5.1.4.1.1.66.5	Yes	No
Tractography Results Storage [1]	1.2.840.10008.5.1.4.1.1.66.6	Yes	No
Real World Value Mapping Storage [1]	1.2.840.10008.5.1.4.1.1.67	Yes	No
Surface Scan Mesh Storage [1]	1.2.840.10008.5.1.4.1.1.68.1	Yes	No
Surface Scan Point Cloud Storage [1]	1.2.840.10008.5.1.4.1.1.68.2	Yes	No
VL Endoscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
Video Endoscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	No
VL Microscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No
Video Microscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	No
VL Slide-Coordinates Microscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No
VL Photographic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
Video Photographic Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	No
Ophthalmic Photography 8 Bit Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	No
Ophthalmic Photography 16 Bit Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	No
Stereometric Relationship Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	No
Ophthalmic Tomography Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	No
Wide Field Ophthalmic Photography Stereographic Projection Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.5	Yes	No
Wide Field Ophthalmic Photography 3D Coordinates Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.6	Yes	No
Ophthalmic Optical Coherence Tomography En Face Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.7	Yes	No
Ophthalmic Optical Coherence Tomography B-scan Volume Analysis Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.5.8	Yes	No
VL Whole Slide Microscopy Image Storage [1]	1.2.840.10008.5.1.4.1.1.77.1.6	Yes	No
Lensometry Measurements Storage [1]	1.2.840.10008.5.1.4.1.1.78.1	Yes	No
Autorefraction Measurements Storage[1]	1.2.840.10008.5.1.4.1.1.78.2	Yes	No
Keratometry Measurements Storage [1]	1.2.840.10008.5.1.4.1.1.78.3	Yes	No
Subjective Refraction Measurements Storage [1]	1.2.840.10008.5.1.4.1.1.78.4	Yes	No
Visual Acuity Measurements Storage [1]	1.2.840.10008.5.1.4.1.1.78.5	Yes	No
Spectacle Prescription Report Storage[1]	1.2.840.10008.5.1.4.1.1.78.6	Yes	No
Ophthalmic Axial Measurements Storage [1]	1.2.840.10008.5.1.4.1.1.78.7	Yes	No
Intraocular Lens Calculations Storage[1]	1.2.840.10008.5.1.4.1.1.78.8	Yes	No
Macular Grid Thickness and Volume Report [1]	1.2.840.10008.5.1.4.1.1.79.1	Yes	No
Ophthalmic Visual Field Static Perimetry Measurements Storage [1]	1.2.840.10008.5.1.4.1.1.80.1	Yes	No
Ophthalmic Thickness Map Storage [1]	1.2.840.10008.5.1.4.1.1.81.1	Yes	No
Corneal Topography Map Storage [1]	1.2.840.10008.5.1.4.1.1.82.1	Yes	No
Basic Text SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.11	Yes	No
Enhanced SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	Yes	No

SOP Class Name	SOP Class UID	SCU	SCP
Comprehensive 3D SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.34		
Extensible SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.35		
Procedure Log Storage [1]	1.2.840.10008.5.1.4.1.1.88.40	Yes	No
Mammography CAD SR [1]	1.2.840.10008.5.1.4.1.1.88.50	Yes	No
Key Object Selection Document [1]	1.2.840.10008.5.1.4.1.1.88.59	Yes	No
Chest CAD SR [1]	1.2.840.10008.5.1.4.1.1.88.65	Yes	No
X-Ray Radiation Dose SR [1]	1.2.840.10008.5.1.4.1.1.88.67	Yes	No
Radiopharmaceutical Radiation Dose SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.68		
Colon CAD SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.69		
Implantation Plan SR Document Storage [1]	1.2.840.10008.5.1.4.1.1.88.70		
Acquisition Context SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.71		
Simplified Adult Echo SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.72		
Patient Radiation Dose SR Storage [1]	1.2.840.10008.5.1.4.1.1.88.73		
Content Assessment Results Storage[1]	1.2.840.10008.5.1.4.1.1.90.1		
Encapsulated PDF [1]	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Encapsulated CDA Storage [1]	1.2.840.10008.5.1.4.1.1.104.2		
Encapsulated STL Storage [1]	1.2.840.10008.5.1.4.1.1.104.3		
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	No
Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.130	Yes	No
Legacy Converted Enhanced PET Image Storage [1]	1.2.840.10008.5.1.4.1.1.128.1		
Basic Structured Display Storage [1]	1.2.840.10008.5.1.4.1.1.131		
CT Performed Procedure Protocol Storage [1]	1.2.840.10008.5.1.4.1.1.200.2		
RT Image Storage [1]	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Dose [1]	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Plan [1]	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Beams Treatment Record [1]	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Brachy Treatment Record [1]	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Treatment Summary Record [1]	1.2.840.10008.5.1.4.1.1.481.7	Yes	No
RT Ion Plan [1]	1.2.840.10008.5.1.4.1.1.481.8	Yes	No
RT Ion Beams Treatment Record [1]	1.2.840.10008.5.1.4.1.1.481.9	Yes	No
RT Beams Delivery Instruction Storage [1]	1.2.840.10008.5.1.4.34.7		
RT Brachy Application Setup Delivery Instruction Storage [1]	1.2.840.10008.5.1.4.34.10		
PMOD Multi-frame Image Storage	2.16.840.1.114033.5.1.4.1.1.130	Yes	No
Siemens CSA non-image Storage [1]	1.3.12.2.1107.5.9.1	Yes	No

[1] Object creation is not supported. Functionality applies only to objects created outside PMOD application.

4.2.2.2 Association Policies

4.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed. See Table 4.2-2.

4.2.2.2.2 Number of Associations

STORAGE AE initiates but never accepts associations. It will create one association for each

series instance selected for send. Only one association at time is created. When more then one series is requested for sending they are sent sequentially. It is possible to create multiple independent sending threads from user interface, however within the thread sequential nature of sending holds.

Table 4.2-8
NUMBER OF ASSOCIATIONS AS AN ASSOCIATION INITIATOR FOR STORAGE AE

Maximum number of simultaneous associations	1 (See Note)

NOTE: Only one association per user requested sending action is created regardless of number of instances to send, however user may request multiple independent sending actions.

4.2.2.2.3 Asynchronous Nature

Asynchronous communication is not supported. STORAGE AE will only allow a single outstanding operation on an Association. Asynchronous operations window negotiation will not be performed.

4.2.2.2.4 Implementation Identifying Information

STORAGE AE will supply implementation information as in Table 4.2-4..

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity - User Request for Storage

STORAGE AE will attempt an association when the user choose to send a selected series from the local database, DICOMDIR, local directory, or the currently displayed image data, or currently displayed region definition, to the previously configured remote application entity.

4.2.2.3.1.1 Description and Sequencing of Activities

Each requested sending action is performed in an independent thread. Request for sending is performed at a series level. This application is capable of multiple C-STORE operations over single association and all image instances from selected series are send on a single association.
For each SOP instance selected to be transferred in a given action, a single attempt will be made to transmit it to the selected remote AE. If the send fails no retry will be performed, and an attempt will be made to send the next instance. If connection is broken sending action is considered failed. Instances that failed to be transferred are logged and the user is presented with the final status of the sending action.

4.2.2.3.1.2 Proposed Presentation Contexts

STORAGE AE will propose either single or multiple Presentation Context for supported Abstract Syntaxes. This behavior is configurable through PMOD DICOM advanced option 'propose one Transfer Syntax per Presentation Context'. Only Presentation Context for Abstract Syntaxes corresponding to instances actually selected for storage will be proposed. For memory loaded images new SOP instances are created of the SOP class selected by the user.

STORAGE AE will propose either single or multiple Presentation Context for each Abstract Syntax. This behavior is configurable through the node configuration option 'propose one Transfer Syntax per Presentation Context'. When the option is turned off following Presentation Contexts are proposed:

Table 4.2-9a
PROPOSED PRESENTATION CONTEXTS FOR MEMORY IMAGES (single TS option off).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		

Any creatable SOP form 4.2-7 and Note	Any creatable SOP form 4.2-7 and Note	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Note: Only Presentation Context for Abstract Syntaxes corresponding to instances actually selected for storage are proposed.

Table 4.2-9b
PROPOSED PRESENTATION CONTEXTS FOR STORAGE OF FILES (single TS option off).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
all SOPs from selected files	all SOPs from selected files	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		As in file	As in file		

Note: Proposed list consist of all pairs of Abstract Syntax and Transer Syntax as present in files selected for storage with Implicit VR Little Endian Transfer Syntax added if already not present.

When the option 'propose one Transfer Syntax per Presentation Context' is turned on the Presentation Contexts listed in the following tables are proposed:

Table 4.2-10a
PROPOSED PRESENTATION CONTEXTS FOR MEMORY IMAGES (single TS option on).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any creatable SOP form 4.2-7 and Note	Any creatable SOP form 4.2-7 and Note	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Any creatable SOP form 4.2-7 and Note	Any creatable SOP form 4.2-7 and Note	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Any creatable SOP form 4.2-7 and Note	Any creatable SOP form 4.2-7 and Note	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

Note: Only Presentation Context for Abstract Syntaxes corresponding to instances actually selected for storage are proposed.

Table 4.2-10b
PROPOSED PRESENTATION CONTEXTS FOR STORAGE OF FILES (single TS option on).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
all SOPs from selected files	all SOPs from selected files	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
all SOPs from selected files	all SOPs from selected files	As in file	As in file	SCU	None

Note: Proposed list consist of all pairs of Abstract Syntax and Transer Syntax as present in files selected for storage plus all Abstact Syntax present in the selected files paired with Implicit VR Little Endian Transfer Syntax unless it is original Transer Syntaxx of the selected file.

4.2.2.3.1.2.1 Extended Negotiation

STORAGE AE does not perform any extended negotiation.

4.2.2.3.1.3 SOP Specific Conformance to Storage SOP Classes

STORAGE AE provides standard conformance to the Storage Service Class.

STORAGE AE will behave as described in the Table below in response to the status returned in the C-STORE response command message. PMOD will try to send all instances for given job before closing the association. After association is closed user is presented with synthetic result for requested storage action.

Table 4.2-11
APPLICATION BEHAVIOR FOR RESPONSE STATUS FOR STORAGE AE

Service Status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources	A7xx	Failure logged, operations continue
Error	Data Set does not match SOP Class	A9xx	Failure logged, operations continue
	Cannot understand	Cxxx	Failure logged, operations continue
Warning	Coercion of Data Elements	B000	Warning logged, operations continue
	Data Set does not match SOP Class	B007	Warning logged, operations continue
	Elements Discarded	B006	Warning logged, operations continue
Success		0000	operations continue

4.2.2.4 Association Acceptance Policy

STORAGE AE does not accept associations.

4.2.3 QUERY/RETRIEVE AE

4.2.3.1 SOP Classes

QUERY/RETRIEVE AE provides Standard Conformance to the following SOP Classes:

Table 4.2-12
SOP CLASSES FOR QUERY/RETRIEVE AE

SOP Class Name	SOP Class UID	SCU	SCP
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	Yes	No
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

4.2.3.2 Association Policies

4.2.3.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed. See Table 4.2-2.

4.2.3.2.2 Number of Associations

QUERY/RETRIEVE AE initiates but never accepts associations.

Table 4.2-13
NUMBER OF ASSOCIATIONS AS AN ASSOCIATION INITIATOR FOR QUERY/RETRIEVE AE

Maximum number of simultaneous associations	2 (see note)

NOTE: Only one association is created to query user requested AE. When image retrieve is requested a second association may be created for retrieve handling depending on the state of the node configuration flag 'retrieve images on new connection'.

4.2.3.2.3 Asynchronous Nature

Asynchronous communication is not supported. QUERY/RETRIEVE AE will only allow a single outstanding operation on an Association.

4.2.3.2.4 Implementation Identifying Information

QUERY/RETRIEVE AE will supply implementation information as in Table 4.2-4..

4.2.3.3 Association Initiation Policy

QUERY/RETRIEVE AE attempts to initiate a new association when the user selects target AE in the query dialog. Until new remote AE is selected all queries will be performed on the same association.

4.2.3.3.1 Activity - User Request for Query Remote AE

4.2.3.3.1.1 Description and Sequencing of Activities

A single attempt will be made to query the remote AE. If the query fails, for whatever reason, no retry will be performed.

4.2.3.3.1.2 Proposed Presentation Contexts

QUERY/RETRIEVE AE will propose either single or multiple Presentation Context for supported Abstract Syntaxes. This behavior is configurable through the node configuration option 'propose one Transfer Syntax per Presentation Context'. Only Presentation Context for Abstract Syntaxes corresponding to instances actually selected for storage will be proposed. For memory loaded images new SOP instances are created of the SOP class selected by the user.

When the option is turned off following Presentation Contexts are proposed:

Table 4.2-14
PROPOSED PRESENTATION CONTEXTS FOR QUERY ASSOCIATION (single TS option off).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		

See Table 4.2-12	See Table 4.2-12	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Otherwise the presentation contexts listed below are proposed:
Table 4.2-15
PROPOSED PRESENTATION CONTEXTS FOR QUERY ASSOCIATION (single TS option on).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Table 4.2-12	See Table 4.2-12	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
See Table 4.2-12	See Table 4.2-12	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
See Table 4.2-12	See Table 4.2-12	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

4.2.3.3.1.2.1 Extended Negotiation

QUERY/RETRIEVE AE will perform extended negotiation on query associations for all proposed abstract syntaxes, but will not used relational queries.

4.2.3.3.1.3 SOP Specific Conformance

4.2.3.3.1.3.1 SOP Specific Conformance to C-FIND SOP Classes

QUERY/RETRIEVE AE provides standard conformance to the supported C-FIND SOP Classes. Only Patient Root and Study Root information models are supported. All queries are initiated at the highest level of the information model (the PATIENT level or the STUDY level). The SERIES level is the lowest level accessible for user.
No CANCEL requests are ever issued.
Unexpected attributes returned in a C-FIND response (those not requested) are not listed in the browser. Requested attributes not returned by the SCP are ignored. Non-matching responses returned by the SCP due to unsupported matching keys are not filtered locally by the QUERY/RETRIEVE AE and thus will still be presented in the browser. No attempt is made to filter out duplicate responses.
When user provides non ASCII characters for query pattern an UTF-8 encoding will be used and Specific Character Set element (0008,0005) will be set to ISO IR 192.

QUERY/RETRIEVE AE will behave as described in the Table below in response to the status returned in the C-FIND response command message.

Table 4.2-16
BEHAVIOR FOR RESPONSE STATUS FOR C-FIND SOP CLASES

Service Status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources	A700	Current query is terminated; remaining queries continue
Error	Data Set does not match SOP Class	A900	Current query is terminated; remaining queries continue
	Cannot understand	Cxxx	Current query is terminated; remaining queries continue

Service Status	Further Meaning	Status Codes	Behavior
Cancel	Matching terminated due to Cancel request	FE00	Current query is terminated; remaining queries continue
Success	Matching is complete	0000	Current query is terminated; remaining queries continue
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Data is used to populate result list for the browser
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Data is used to populate result list for the browser

4.2.3.3.2 Activity - User Request for Retrieve From Remote AE

4.2.3.3.2.1 Description and Sequencing of Activities

A single attempt will be made to retrieve instances from the selected remote AE. If the retrieval fails, for whatever reason, no retry will be performed. Instances retrieval is only available from query dialog and requires prior query execution. Retrieval requests are sent on the association created for queries.

4.2.3.3.2.2 Proposed Presentation Contexts

QUERY/RETRIEVE AE will propose either single or multiple Presentation Context for supported Abstract Syntaxes. This behavior is configurable through the node configuration option 'propose one Transfer Syntax per Presentation Context'. Only Presentation Context for Abstract Syntaxes corresponding to instances actually selected for storage will be proposed. For memory loaded images new SOP instances are created of the SOP class selected by the user.

When the option is turned off the following Presentation Contexts are proposed:

Table 4.2-17
PROPOSED PRESENTATION CONTEXTS FOR RETRIEVE ASSOCIATION (single TS option switched off).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
MOVE or GET classes from Table 4.2-12	See Table 4.2-12	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Otherwise the presentation contexts listed below are proposed:

Table 4.2-18
PROPOSED PRESENTATION CONTEXTS FOR RETRIEVE ASSOCIATION (single TS option switched on).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
MOVE or GET classes from Table 4.2-12	See Table 4.2-12	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
MOVE or GET classes from Table 4.2-12	See Table 4.2-12	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
MOVE or GET classes from Table 4.2-12	See Table 4.2-12	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

4.2.3.3.2.2.1 Extended Negotiation

QUERY/RETRIEVE AE do not perform any extended negotiation on retrieve association.

4.2.3.3.2.3 SOP Specific Conformance

QUERY/RETRIEVE AE provides standard conformance to the supported C-MOVE and C-GET SOP Classes. Only Patient Root and Study Root information models are supported. A retrieval will be performed at the SERIES level. No CANCEL requests are ever issued.
The retrieval is performed from the AE indicated in the query response. The instances are retrieved to the selected previously configured AE.

4.2.3.3.2.3.1 SOP Specific Conformance to C-MOVE SOP Classes

QUERY/RETRIEVE AE will behave as described in the Table 4.2-19 in response to the status returned in the C-MOVE response command message.

4.2.3.3.2.3.1.1 Sub-operation dependent behavior

QUERY/RETRIEVE AE do not monitor activities of either local or remote STORAGE-SCP AE that is receiving the retrieved instances. Once the C-MOVE has been initiated it runs to completion (or failure) as described in the C-MOVE response command message(s). There is no attempt by QUERY/RETRIEVE AE to confirm that instances have actually been successfully received or locally stored.
Whether or not completely or partially successful retrievals are made available in the local database to the user is purely dependent on the success or failure of the C-STORE sub operations, not on any explicit action by MOVE-SCU.
Whether or not the remote AE attempts to retry any failed C-STORE sub-operations is beyond the control of MOVE-SCU.
If the association on which the C-MOVE was issued is aborted for any reason, whether or not the CSTORE sub-operations continue is dependent on the remote AE. If the local STORAGE-SCP is running it will continue to accept associations and storage operations regardless.

Table 4.2-19
BEHAVIOR FOR RESPONSE STATUS FOR C-MOVE/C-GET SOP CLASSES

Service Status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources - Unable to calculate number of matches	A701	Retrieval is terminated, remaining series retrievals continue
	Out of Resources - Unable to perform sub-operations	A702	Retrieval is terminated, remaining series retrievals continue
	Move Destination unknown	A801	Retrieval is terminated, remaining series retrievals continue
Failed	Identifier does not match SOP Class	A900	Retrieval is terminated, remaining series retrievals continue
	Unable to process	Cxxx	Retrieval is terminated, remaining series retrievals continue
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Retrieval is terminated, remaining series retrievals continue
Warning	Sub-operations Complete - One or more Failures	B000	Retrieval is terminated, remaining series retrievals continue
Success	Sub-operations Complete – No Failures	0000	Retrieval is terminated, remaining series retrievals continue
Pending	Sub-operations are continuing	FF00	Retrieval continues

4.2.3.3.2.3.2 SOP Specific Conformance to C-GET SOP Classes

QUERY/RETRIEVE AE will behave as described in the Table 4.2-19 in response to the status returned in the C-GET response command message.

4.2.3.4 Association Acceptance Policy

QUERY/RETRIEVE AE does not accept associations.

4.2.4 SERVER AE

SERVER AE is a background running module that act as a provider of DICOM services. PMOD SERVER AE daemon waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, server expects it to be a DICOM application. Server will accept associations with Presentation Contexts for SOP Classes of the Verification, Storage, Storage Commitment, and Query Retrieve Service Class. By default the SERVER AE will accept all incoming associations even the ones that are destined for different AE. This functionality is however controlled by a DICOM SERVER configuration option 'accept incoming connetion from any AE'. When that option is turned off SERVER AE will accept only connections from IP addresses assigned to the AEs defined on the NODEs tab of the DICOM tab of the User Configuration dialog. Received composite instances will be written to the files in the format specified in PS 3.10. The files will be located in the subdirectories of configurable storage directory. For later access it is advised to configure server application for storage into optional database. PMOD will answer query/retrieve requests using information from configured storage.

4.2.4.1 SOP Classes

SERVER AE provides Standard Conformance to the following SOP Classes:

Table 4.2-20
SOP CLASSES SUPPORTED BY SERVER AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	No	Yes
Any SOP Class from Table 4.2-7	Any SOP Class from Table 4.2-7	No	Yes
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	No	Yes
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	No	Yes
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	No	Yes
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	No	Yes
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	No	Yes
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.2	No	Yes

4.2.4.2 Association Policies

4.2.4.2.1 General

SERVER AE accepts incoming associations. SERVER AE will use STORAGE AE for sending instances requested through MOVE operation of Query/Retrieve Service Class.

Table 4.2-21
MAXIMUM PDU SIZE RECEIVED AS A SCP FOR SERVER AE

Maximum PDU size received	131072 (configurable)

4.2.4.2.2 Number of Associations

Table 4.2-22
NUMBER OF ASSOCIATIONS AS A SCP FOR SERVER AE

Maximum number of simultaneous associations	10 (configurable)

4.2.4.2.3 Asynchronous Nature

Asynchronous communication is not supported. SERVER AE will only allow a single outstanding operation on an Association. Asynchronous operations window negotiation will not be performed.

4.2.4.2.4 Implementation Identifying Information

Table 4.2-23
DICOM IMPLEMENTATION CLASS AND VERSION FOR SERVER AE

Implementation Class UID	2.16.840.1.114033.1
Implementation Version Name	PMODDCM_1.1

4.2.4.3 Association Initiation Policy

PMOD will initiate a new association when it finishes processing of previously accepted Storage

Commitment request and requesting connection is closed, and in response to the accepted Retrieve – MOVE operation.

4.2.3.3.1 Activity - Return Commitment Result

When PMOD SERVER AE received a Storage Commitment request it tries to send the response back on the same association. When the association is not open anymore it will initiate an association to send the Storage Commitment response (N-EVENT-REPORT) to the SCU.

4.2.3.3.1.1 Proposed Presentation Context

SERVER AE will propose either single or multiple Presentation Context for Storage Commitment Push Model SOP Class Abstract Syntax. This behavior is configurable through the node configuration option 'propose one Transfer Syntax per Presentation Context'.

When the option is turned off following Presentation Contexts are proposed:

Table 4.2-24
PROPOSED PRESENTATION CONTEXTS FOR SC (single TS option off).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Otherwise the presentation contexts listed below are proposed:

Table 4.2-25
PROPOSED PRESENTATION CONTEXTS FOR SC (single TS option on).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
SC Push M SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
SC Push M SOP Class	1.2.840.10008.1.20.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
SC Push M SOP Class	1.2.840.10008.1.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

4.2.3.3.1.2 SOP Specific Conformance

Storage Media File-Set ID and UID Attributes are not be supported in the N-EVENT-REPORT created.

4.2.3.3.2 Activity – Send Requested Objects

When PMOD SERVER AE receives a retrieve-MOVE request it will initiate an association to send the requested objects to the destination AE.

4.2.3.3.1.1 Proposed Presentation Context

SERVER AE will propose either single or multiple Presentation Context for Storage Commitment Push Model SOP Class Abstract Syntax. This behavior is configurable through the node

configuration option 'propose one Transfer Syntax per Presentation Context'.

When the option is turned off following Presentation Contexts are proposed:

Table 4.2-26
PROPOSED PRESENTATION CONTEXTS FOR RETRIEVE C-MOVE (single TS option off).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
all SOPs from selected files	all SOPs from selected files	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		As in file	As in file		

Note: Proposed list consist of all pairs of Abstract Syntax and Transer Syntax as present in requested archived objects with Implicit VR Little Endian Transfer Syntax added if already not present.

When the option 'propose one Transfer Syntax per Presentation Context' is turned on the Presentation Contexts listed in the following tables are proposed:

Table 4.2-27
PROPOSED PRESENTATION CONTEXTS FOR RETRIEVE C-MOVE (single TS option on).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
all SOPs from selected files	all SOPs from selected files	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
all SOPs from selected files	all SOPs from selected files	As in file	As in file	SCU	None

Note: Proposed list consist of all pairs of Abstract Syntax and Transer Syntax as present in requested archived objects plus all Abstact Syntax present in the requested objects paired with Implicit VR Little Endian Transfer Syntax unless it is original Transer Syntaxx of the requested object.

4.2.4.4 Association Acceptance Policy

When SERVER AE accepts an association, it will:
- respond to echo requests,
- respond to storage requests,
- respond to storage commitment requests,
- respond to queries and retrieval requests.

If the DICOM SERVER configuration option 'accept incoming connections from any AE' is active all incoming connections will be processed. Otherwise only associations from IP addresses assigned to the AEs defined on the NODEs tab of User Configuration dialog will be accepted.

4.2.4.4.1 Activity – Receive Echo Request

4.2.4.4.1.1 Description and Sequencing of Activities

No sequencing applies.

4.2.4.4.1.2 Accepted Presentation Contexts

Table 4.2-28
ACCEPTABLE PRESENTATION CONTEXTS FOR SERVER AE AND RECEIVE ECHO REQUEST

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Verification	1.2.840.10008.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Verification	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Verification	1.2.840.10008.1.1	Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99	SCP	None
Verification	1.2.840.10008.1.1	JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression	1.2.840.10008.1.2.4.50	SCP	None
Verification	1.2.840.10008.1.1	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70	SCP	None
Verification	1.2.840.10008.1.1	RLE Lossless	1.2.840.10008.1.2.5	SCP	None

4.2.4.4.1.2.1 Extended Negotiation

No extended negotiation as a SCP is performed.

4.2.4.4.1.3 SOP Specific Conformance

4.2.4.4.1.3.1 SOP Specific Conformance to Verification SOP Class

SERVER AE provides standard conformance to the Verification Service Class.

4.2.4.4.1.3.2 Presentation Context Acceptance Criterion

SERVER AE will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

4.2.4.4.1.3.3 Transfer Syntax Selection Policies

SERVER AE does not prefer any Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will accept first supported Transfer Syntax. SERVER AE will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts.

4.2.4.4.2 Activity – Receive Storage Request

4.2.4.4.2.1 Description and Sequencing of Activities

As instances are received they are copied to the local file system. After connection is closed relevant records are inserted into the local database (if configured). If the received instance is a duplicate of a previously received instance new copy will be discarded.

4.2.4.4.2.2 Accepted Presentation Contexts

Table 4.2-29
ACCEPTABLE PRESENTATION CONTEXTS FOR SERVER AE AND RECEIVE STORAGE REQUEST

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
See Storage Classes in Table 4.2-20	See Storage Classes in Table 4.2-20	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Deflated DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70		
		RLE Lossless	1.2.840.10008.1.2.5		

4.2.4.4.2.2.1 Extended Negotiation

No extended negotiation is performed. SERVER AE is a Level 2 Storage SCP (Full – does not discard any data elements) and does not support digital signatures.

4.2.4.4.2.3 SOP Specific Conformance

4.2.4.4.2.3.1 SOP Specific Conformance to Storage SOP Classes

SERVER AE provides standard conformance to the Storage Service Class.

4.2.4.4.2.3.2 Presentation Context Acceptance Criterion

SERVER AE will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

4.2.4.4.2.3.3 Transfer Syntax Selection Policies

SERVER AE does not prefer any Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will accept first supported Transfer Syntax. SERVER AE will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts.

4.2.4.4.2.3.4 Response Status

SERVER AE will behave as described in the Table below when generating the C-STORE response command message.

Table 4.2-30
RESPONSE STATUS FOR SERVER AE AND RECEIVE STORAGE REQUEST

Service Status	Further Meaning	Status Codes	Reason
Refused	Out of Resources	A700	Sent when local resources do not allow to complete storage action.
Error	Data Set does not match SOP Class	A9xx	Never sent – data set is not checked prior to storage
	Cannot understand	Cxxx	Never sent
Warning	Coercion of Data Elements	B000	Sent when patient ID was modified to be coherent with previously stored patient information.
	Data Set does not match SOP Class	B007	Never sent - data set is not checked prior to storage
	Elements Discarded	B006	Never sent – all elements are always stored
Success	Success	0000	Sent when local storage successfully completed

4.2.4.4.3 Activity – Receive Storage Commitment Push Model Request

4.2.4.4.3.1 Description and Sequencing of Activities

Upon receive of Storage Commitment (N-ACTION) request Server AE validates its content. If verification of request fails a message with status Refused or Error as specified in table 4.2-32 will be send. If verification is successful a message with status Success will be send and database checking process will be started to look for the specified SOP instances. This process may finish when all requested images were confirmed to be stored, an unrecoverable error was encountered, or specified time has elapsed (default is 1 hour). The commitment response will be issued in a form of N-EVENT-REPORT. The optional Storage Media attributes are not supported. There is no fixed duration for images storage and they are kept until authorized person removes them from database.

4.2.4.4.3.2 Accepted Presentation Contexts

Table 4.2-31
ACCEPTABLE PRESENTATION CONTEXTS FOR SERVER AE AND RECEIVE STORAGE COMMITMENT PUSH MODEL REQUEST

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.4.4.3.2.1 Extended Negotiation

No extended negotiation is performed.

4.2.4.4.3.3 Proposed Presentation Contexts

QUERY/RETRIEVE AE will propose either single or multiple Presentation Context for supported Abstract Syntaxes. This behavior is configurable through the node configuration option 'propose one Transfer Syntax per Presentation Context'. Only Presentation Context for Abstract Syntaxes corresponding to instances actually selected for storage will be proposed. For memory loaded images new SOP instances are created of the SOP class selected by the user.

When the option is turned off following Presentation Contexts are proposed:

Table 4.2-14
PROPOSED PRESENTATION CONTEXTS FOR QUERY ASSOCIATION (single TS option off).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Otherwise the presentation contexts listed below are proposed:

Table 4.2-15
PROPOSED PRESENTATION CONTEXTS FOR QUERY ASSOCIATION (single TS option on).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
See Table 4.2-12	1.2.840.10008.1.20.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
See Table 4.2-12	1.2.840.10008.1.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

4.2.4.4.3.4 SOP Specific Conformance

4.2.4.4.3.4.1 SOP Specific Conformance to Storage Commitment Push Model SOP Class

SERVER AE provides standard conformance to the Storage Commitment Push Model Service Class.

4.2.4.4.3.4.2 Presentation Context Acceptance Criterion

SERVER AE will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

4.2.4.4.3.4.3 Transfer Syntax Selection Policies

SERVER AE does not prefer any Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will accept first supported Transfer Syntax. SERVER AE will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts.

4.2.4.4.3.4.4 Response Status

SERVER AE will behave as described in the Table below when generating the N-ACTION response for Storage Commitment N-ACTION request.

Table 4.2-32
RESPONSE STATUS FOR SERVER AE AND RECEIVE STORAGE COMMITMENT (N-ACTION) REQUEST

Service Status	Further Meaning	Status Codes	Reason
Refused	Not Authorized	0124	Sent when requesting AE is not recognized.

Service Status	Further Meaning	Status Codes	Reason
Error	No such SOP Class	0118	The SOP Class was not recognized.
	Processing failure	0110	Message delegated to Storage Commitment handler is not N-ACTION request or some unrecognized error occurred.
	No such SOP Instance	0112	The SOP Instance was not recognized
	No such action	0123	The action type specified was not supported
Success	Success	0000	Sent when request was validated and delegated for comparison with database storage.

4.2.4.4.3.4.5 Notifications

Upon completion of verification process for stored SOP instances the notification message in the form of N-EVENT-REPORT primitive with the results of storage commitment will be issued. The Media Storage is not supported thus optional Storage Media File-Set ID & UID attributes are not used in the notification message. The optional Retrieve AE Title (0008,0054) Attribute in the N-EVENT-REPORT is set to this SERVER AE title.

4.2.4.4.4 Activity – Receive Query/Retrieve Request

4.2.4.4.4.1 Description and Sequencing of Activities

No sequencing applies.

4.2.4.4.4.2 Accepted Presentation Contexts

Table 4.2-33
ACCEPTABLE PRESENTATION CONTEXTS FOR SERVER AE AND RECEIVE QUERY/RETRIEVE REQUEST

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Query/ Retrieve Classes in Table 4.2-20	See Query/ Retrieve Classes in Table 4.2-20	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.4.4.4.2.1 Extended Negotiation

No extended negotiation is performed.

4.2.4.4.4.3 SOP Specific Conformance

4.2.4.4.4.3.1 SOP Specific Conformance to Storage SOP Classes

SERVER AE provides standard conformance to the Query/Retrieve Service Class.

4.2.4.4.4.3.2 Presentation Context Acceptance Criterion

SERVER AE will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

4.2.4.4.4.3.3 Transfer Syntax Selection Policies

SERVER AE does not prefer any Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will accept first supported Transfer Syntax. SERVER AE will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts.

4.2.4.4.4.3.4 Response Status

Table 4.2-34
RESPONSE STATUS FOR SERVER AE AND RECEIVE QUERY/RETRIEVE REQUEST

Service Status	Further Meaning	Status Codes	Reason
Refused	Out of Resources	A7xx	Never sent
	Move Destination unknown	A801	Sent when unrecognized AE is specified as retrieve destination
Failed	Identifier does not match SOP class	A900	Never sent
	Unable to process	C000	Sent when no requested instances could be sent
Cancel	Sub-operations terminated due to cancel operation	FE00	Never sent
Pending	Matches are continuing and current match is supplied	FF00	Sent when match found and all optional keys were supported
	Matches are continuing but one or more optional keys were not supported	FF01	Sent when match found but some optional keys were not supported
Warning	Sub-operations complete – one or more failure	B000	Sent when not all requested instances were successfully sent.
Success	Sub-operations complete – no failures	0000	Sent when sending of requested insance completed successfully.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

The application is indifferent to the physical medium over which TCP/IP executes; which is dependent on the underlying operating system and hardware.

4.3.2 Additional Protocols

When host names rather than IP addresses are used in the User Configuration Dicom panel to specify presentation addresses for remote AEs, the application is dependent on the name resolution mechanism of the underlying operating system.

4.4 CONFIGURATION

All configuration is performed in User Configuration Dicom panel available from main Application bar.

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

PMOD application use the single AE Title for its all logically separable AEs. AE title and TCP/IP Port for incoming connection is configured via the User Configuration Dicom panel. Default AE Title is PMOD. Default server listening port number is 5004. Optionally server can be started on a secure TLS connection. Default secure port number is 2762. When two server instances are run both on secure and insecure connection they should use different AE titles.

Table 4.4-1
AE TITLE CONFIGURATION TABLE

Application Entity	Default AE Title	Default TCP/IP Port
ALL	PMOD	5004 (see Note)
TLS Server	PMODS	2762

Note: Versions previous to 3.0 were preconfigured with TCP/IP port set to 4030.

4.4.1.2 Remote AE Title/Presentation Address Mapping

All remote applications intended for receiving communication from PMOD application should be configured in the User Configuration DICOM panel. Remote application configuration includes its name visible in a selection interface, AE title, IP address or name from the hosts table, a remote port number and an indicator of a secure connection. When a node is defined as secure PMOD will communicate with a particular node only on a TLS connection.
The 'compressed' option allows PMOD to negotiate compressed transfer syntax with respective node.
The 'Accept incoming connections from any AE' check on the User Configuration / DICOM / DICOM SERVER tab allows to release restrictions on accepting remote connections only from configured nodes.

4.4.2 Parameters

Configuration parameters relevant to DICOM communication are available on User Configuration / DICOM / NODEs [C_STORE, Q/R], DICOM SERVER and ADVANCED panels. Their default value are listed in table below:

Table 4.4-2
CONFIGURATION PARAMETERS TABLE

Parameter name and description	Configurable (Yes/No)	Default Value
General Parameters		
Max PDU length This value is used for both Max PDU Receive Size and Max PDU Send Size. (larger PDUs will never be sent, even if the receiver supports a larger Max PDU Receive Size. If the receiver supports a smaller Max PDU Receive Size then the Max PDU Send Size will be reduced accordingly for the duration of the Association. Max PDU Receive Size information is exchanged during DICOM Association Negotiation in the Maximum Length Sub-Item of the A-ASSOCIATION-RQ and A-ASSOCIATE-AC)	Yes (Advanced Panel)	131072
ARTIM expiration time Waiting time for TCP/IP connection close after Abort Request or Release Response has been sent. If the client does not close the connection it will be disconnected.	Yes (Advanced Panel)	30 seconds
AE Specific Parameters (All)		
Size constraint in maximum object size	No	None Limited by available operating system resources
SOP Class support	No	All supported SOP Classes always proposed and accepted
Transfer Syntax support	No	All supported Transfer Syntaxes always proposed and accepted
Max association repetitions Number of association retries for transient refuse	Yes (Advanced Panel)	5
Repetition delay Time between association retries	Yes (Advanced Panel)	500 ms
NODEs AE Specific Parameters		
Do not send implementation version name When this option is on implementation version name is not included in the association messages directed to the node.	Yes (Nodes Panel)	No

Parameter name and description	Configurable (Yes/No)	Default Value
Propose one transfer syntax per presentation context If active each proposed presentation context consist of exactly one abstract syntax and transfer syntax, thus there are several presentation contexts for each abstract syntax. Otherwise all supported transfer syntaxes are proposed within a single presentation context, one for each abstract syntax	Yes (Nodes Panel)	Yes
Use basic query If active query request does not include optional keys.	Yes (Nodes Panel)	No
Retrieve images on new connection When sop retrieve operation is requested and option is active the retrieve request will be send on a new connection. Otherwise request will be send on the same connection as query requests.	Yes (Nodes Panel)	Yes
Use GET in Query Loader If active and C-GET operations are supported on an association they will be used in the Query loader.	Yes (Nodes Panel)	Yes
SERVER AE Specific Parameters		
Max server connections Number of simultaneous Associations by Service and/or SOP Class	Yes (Advanced Panel)	10
Idle expiration time Waiting time before idle connection with no data transmission is closed by the server.	Yes (Advanced Panel)	10 hours
Storage Commitment response max delay Time before server issues a final failed response when the requested data is not found in the PMOD database associated with the server.	Yes (Advanced Panel)	1 hour
Do not send implementation version name When this option is on implementation version name is not included in the association messages.	Yes (Dicom Server Panel)	Yes
Force default transfer syntax for all incoming connections When this option is on server will accept only presentation contexts that specify default transfer syntax (Implicit VR Little Endian) and when no such option is available for the given Abstract Syntax it will propose default transfer syntax in response.	Yes (Dicom Server Panel)	No

5 MEDIA INTERCHANGE

5.1 IMPLEMENTATION MODEL

5.1.1 Application Data Flow Diagram

For the purpose of media access whole PMOD application is treated as a single application entity (PMOD FSR AE). It provides capability to load PS3.10 compliant files, that includes DICOMDIR, images and RT structure region definitions, according to the user selection. The presence of the File Set in the selected directory will be automatically detected and DICOMDIR referenced images will be listed for selection at the series or acquisition level as selected by the user. When DICOMDIR is absent files are scanned for patient and series related information and results are displayed for selection. In the absence of PS3.10 compliant meta information header default transfer syntax is assumed (Implicit VR little endian). Files may be accessed from local file system or from PS3.12 compliant media according to the General Purpose CD-R, DVD and BD Interchange Profiles (PS3.11) listed in 5.2-1.

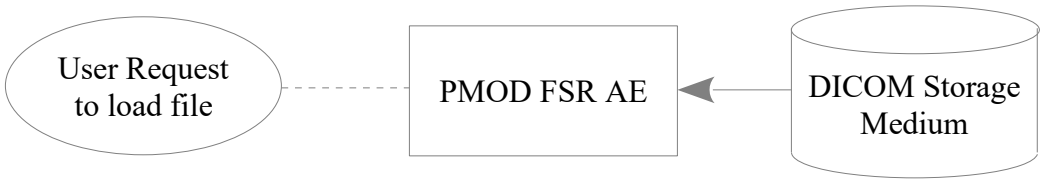

Figure 5.1-1
APPLICATION DATA FLOW DIAGRAM

5.1.2 File Meta Information

PMOD application do not create PS3.12 compliant media, however it is capable of storing PS3.10 compliant files to the local file system. The implementation information written to the File Meta Header in each file is:

Table 5.1-1
DICOM IMPLEMENTATION CLASS FOR MEDIA STORAGE

Implementation Class UID	2.16.840.1.114033.1

5.2 AE SPECIFICATIONS

5.2.1 PMOD FSR AE - Specification

PMOD FSR AE provides standard conformance as a FSR to the DICOM General Purpose CD-R, DVD and BD Interchange Profiles as specified in the following table:

Table 5.2-1
SUPPORTED APPLICATION PROFILES, REAL-WORLD ACTIVITIES AND ROLES

Application Profile	AP Identifier	Real-Word activity	Roles	SC option
General Purpose CD-R Interchange	STD-GEN-CD	Load/Import directory or file	FSR	Interchange
General Purpose Interchange on DVD-RAM Media	STD-GEN-DVD-RAM	Load/Import directory or file	FSR	Interchange

Application Profile	AP Identifier	Real-Word activity	Roles	SC option
General Purpose Interchange on BD Media	STD-GEN-BD	Load/Import directory or file	FSR	Interchange

Note: Actual support or physical media depends on the configuration of the hardware the PMOD application is run on.

Following classes are supported under STD-GEN Application Profile:

Table 5.2-2
STD-GEN SOP CLASSES AND TRANSFER SYNTAXES

Information Object Definition	SOP Class UID	Transfer Syntax and UID
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Storage Classes as in Table 4.2-7	SOP Class UID as in Table 4.2-7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1

5.2.1.1 Real-World Activities

5.2.1.1.1 Activity – Load directory or file

PMOD FSR AE is activated through the user interface when the user request images to be loaded for viewing or other processing including import to database.

5.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

None.

5.4 MEDIA CONFIGURATION

None.

6 SUPPORT OF CHARACTER SETS

PMOD application supports Unicode 3.2 character set using UTF-8 encoding (ISO_IR 192). That support excludes matching attributes for C-FIND requests received by SERVER AE.
PMOD will use UTF-8 encoding and will set Specific Character Set to ISO_IR 192 whenever non ASCII characters are provided by the user.
PMOD also recognizes all defined terms for character sets specified in DICOM PS 3.3 section C.12.1.1.2. And when encountered will attempt to convert them to Unicode representation. These functionality however depends on the Java Virtual Machine and underlying operating system configuration.
When unknown defined term for character set is encountered PMOD will ignore it and process data as if encoded with underlying operating system default character set.
When PMOD does not recognize the character set or it is not specified, the user may choose one of the character sets supported by the underlying operating system as default encoding (User Configuration DICOM Advanced panel option 'Use selected character set if not present in object').
The proper display of characters depends on the fonts installed in the underlying operating system.

7 SECURITY

7.1 SECURITY PROFILES

7.1.1 SECURE TRANSPORT CONNECTION

PMOD application supports BCP 195 TLS Secure Transport Connection Profile with features as specified in table 7-1. PMOD installation comes with X.509 certificate which is used for secure TLS connection however PMOD does not validate the other parties certificates. Following cipher suites are used for encryption of transferred data:

- TLS_DHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_RSA_WITH_AES_128_CBC_SHA

Table 7-1
SUPPORTED TLS FEATURES

Supported Feature	Mechanism
Data Integrity	SHA, SHA256, SHA384
Privacy	AES 128 CBC, AES 128 GCM, AES 256 GCM

7.2 ASSOCIATION LEVEL SECURITY

The only PMOD application entity accepting incoming connections is SERVER AE. The 'Accept incoming connections from any AE' check on Dicom / Dicom Server tab of the User Configuration dialog allows the user to switch on and off the security check at association level. When the option is enabled all incoming connections are accepted. Otherwise only connections from defined remote AEs are accepted (Dicom / Nodes tab of the User Configuration dialog).

8 ANNEXES

8.1 DATA DICTIONARY OF PRIVATE ATTRIBUTES

PMOD application reserves a block of private attributes in a group 55h for all created instances except enhanced objects. Private creator Id is PMOD_1. If present private group will always include frames durations vector. Additionally, created instances of NM Image Storage SOP class includes private elements for frames start times, positions, orientations and rescale slopes.
PGEN module reserves a block of private attributes in a group 7fe1h to store genes codes and labels. It uses a private creator Id PMOD_GENPET.
The table below includes all private elements created by PMOD application.

Table 8.1-1
DATA DICTIONARY OF PRIVATE ATTRIBUTES

Tag	Attribute Name	VR	VM
(0021,00xx)	Private Creator (PMOD_2)	LO	1
(0021,xx10)	Estimated noise (sigma) of b0 dw image (tensor images)	FD	1
(0021,xx20)	PICo LUT Watson distribution (tensor images)	OB	1-n
(0021,xx21)	PICo LUT Bingham distribution (tensor images)	OB	1-n
(0021,xx22)	PICo LUT Angular Central Gaussian distribution (tensor images)	OB	1-n
(0021,xx40)	Column names	LO	1-n
(0021,xx41)	Row names	LO	1-n
(0055,00xx)	Private Creator (PMOD_1)	LO	1
(0055,xx01)	Frame Start Times Vector	FD	1-n
(0055,xx02)	Frame Positions Vector	FD	3-3n
(0055,xx03)	Frame Orientations Vector	FD	6-6n
(0055,xx04)	Frame Durations (ms) Vector	FD	1-n
(0055,xx05)	Frame Rescale Slope Vector	FD	1-n
(7fe1,00xx)	Private Creator (PMOD_GENPET)	LO	1
(7fe1,xx01)	Slices Names	UT	1
(7fe1,xx02)	Gene Codes	UT	1
(7fe1,xx03)	Gene Labels	UT	1

8.2 LIST OF SAFE PRIVATE ELEMENTS

PMOD application supports keep safe private elements for the de-identification process. Following table lists private elements that will be kept during the de-identification process if the option is active. PMOD does not use Deidentification Action Sequence element (0008,0305) to determine which elements are safe.

Table 8.2-1
SAFE PRIVATE ELEMENTS

Tag	Private Creator	VR	VM
(7053,xx00)	Philips PET Private Group	DS	1
(7053,xx09)	Philips PET Private Group	DS	1

(00E1,xx21)	ELSCINT1	DS	1
(01E1,xx26)	ELSCINT1	CS	1
(01E1,xx50)	ELSCINT1	DS	1
(01F1,xx01)	ELSCINT1	CS	1
(01F1,xx07)	ELSCINT1	DS	1
(01F1,xx26)	ELSCINT1	DS	1
(01F1,xx27)	ELSCINT1	DS	1
(0019,xx23)	GEMS_ACQU_01	DS	1
(0019,xx24)	GEMS_ACQU_01	DS	1
(0019,xx27)	GEMS_ACQU_01	DS	1
(0019,xx9E)	GEMS_ACQU_01	LO	1
(0043,xx27)	GEMS_PARM_01	SH	1
(0045,xx01)	GEMS_HELIOS_01	SS	1
(0045,xx02)	GEMS_HELIOS_01	FL	1
(0903,xx10)	GEIIS PACS	US	1
(0903,xx11)	GEIIS PACS	US	1
(0903,xx12)	GEIIS PACS	US	1
(2001,xx03)	Philips Imaging DD 001	FL	1
(2001,xx04)	Philips Imaging DD 001	CS	1
(0019,xx0C)	SIEMENS MR HEADER	IS	1
(0019,xx0D)	SIEMENS MR HEADER	CS	1
(0019,xx0E)	SIEMENS MR HEADER	FD	3
(0019,xx27)	SIEMENS MR HEADER	FD	6
(0043,xx39)	GEMS_PARM_01	IS	4
(0043,xx6F)	GEMS_PARM_01	DS	3-4
(0025,xx07)	GEMS_SERS_01	SL	1
(2005,xx0D)	Philips MR Imaging DD 001	FL	1
(2005,xx0E)	Philips MR Imaging DD 001	FL	1
(0009,0036)	GEMS_PETD_01	LO	1
(0009,0038)	GEMS_PETD_01	FL	1
(0009,003A)	GEMS_PETD_01	FL	1
(0009,003C)	GEMS_PETD_01	FL	1
(0009,003E)	GEMS_PETD_01	SH	1
(0009,003F)	GEMS_PETD_01	FL	1
(0009,004A)	GEMS_PETD_01	FL	1
(0021,xx10)	PMOD_2	FD	1
(0021,xx20)	PMOD_2	OB	1-n
(0021,xx21)	PMOD_2	OB	1-n

(0021,xx22)	PMOD_2	OB	1-n
(0021,xx40)	PMOD_2	LO	1-n
(0021,xx41)	PMOD_2	LO	1-n
(0055,xx01)	PMOD_1	FD	1-n
(0055,xx02)	PMOD_1	FD	3-3n
(0055,xx03)	PMOD_1	FD	6-6n
(0055,xx04)	PMOD_1	FD	1-n
(0055,xx05)	PMOD_1	FD	1-n
(7fe1,xx01)	PMOD_GENPET	UT	1
(7fe1,xx02)	PMOD_GENPET	UT	1
(7fe1,xx03)	PMOD_GENPET	UT	1