PMOD Technologies Ltd

PMOD v3.6

Version 1.0
Date: 2014.11.20

1 CONFORMANCE STATEMENT OVERVIEW

This document is a DICOM Conformance statement for PMOD application version 3.6xx, where xx denotes the build number of PMOD 3.6 version. Whenever build is omitted or referred as xx the information pertains to all builds of PMOD 3.6 version. PMOD application includes implementation of DICOM services necessary to access images stored on media, to send memory loaded or stored 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 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 v3.6xx.

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
Ultrasound Multi-frame Image Storage	YES [1]	YES
Ultrasound Multi-frame Image Storage (Retired)	YES [1]	YES
MR Image Storage	YES	YES
Enhanced MR Image Storage	YES	YES
Ultrasound Image Storage	YES [1]	YES
Enhanced US Volume Storage	YES [1]	YES
Ultrasound Image Storage (Retired)	YES [1]	YES
Secondary Capture Image Storage	YES	YES
Multi-frame Grayscale Byte Secondary Capture Image Storage	YES [1]	YES
Multi-frame True Color Secondary Capture Image Storage	YES	YES
X-Ray Angiographic Image Storage	YES [1]	YES
X-Ray Radiofluoroscopic Image Storage	YES [1]	YES
Nuclear Medicine Image Storage	YES	YES
Nuclear Medicine Image Storage (Retired)	YES [1]	YES
Positron Emission Tomography Image Storage	YES	YES
Enhanced PET Image Storage	YES	YES
RT Image Storage	YES [1]	YES
RT Structure Set Storage	YES	YES
Basic Text SR Storage	YES [1]	YES
Enhanced SR Storage	YES [1]	YES
Comprehensive SR Storage	YES	YES

PMOD Multi-frame Image Storage[2]	YES	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] PMOD private Information Object Definition.

Table 1-2 provides an overview of the Media Storage Application Profiles supported by PMOD v3.6xx.

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disc – Recordable		
General Purpose CD-R	NO	YES
DVD		
General Purpose DVD-RAM	NO	YES

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3 INTORDUCTION

3.1 REVISION HISTORY

Document Version	Date of Issue	Author	Description
1.0	20.11.2014	PMOD Technologies	First release for PMOD version 3.6

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 3.1-3.20, 2014b
[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

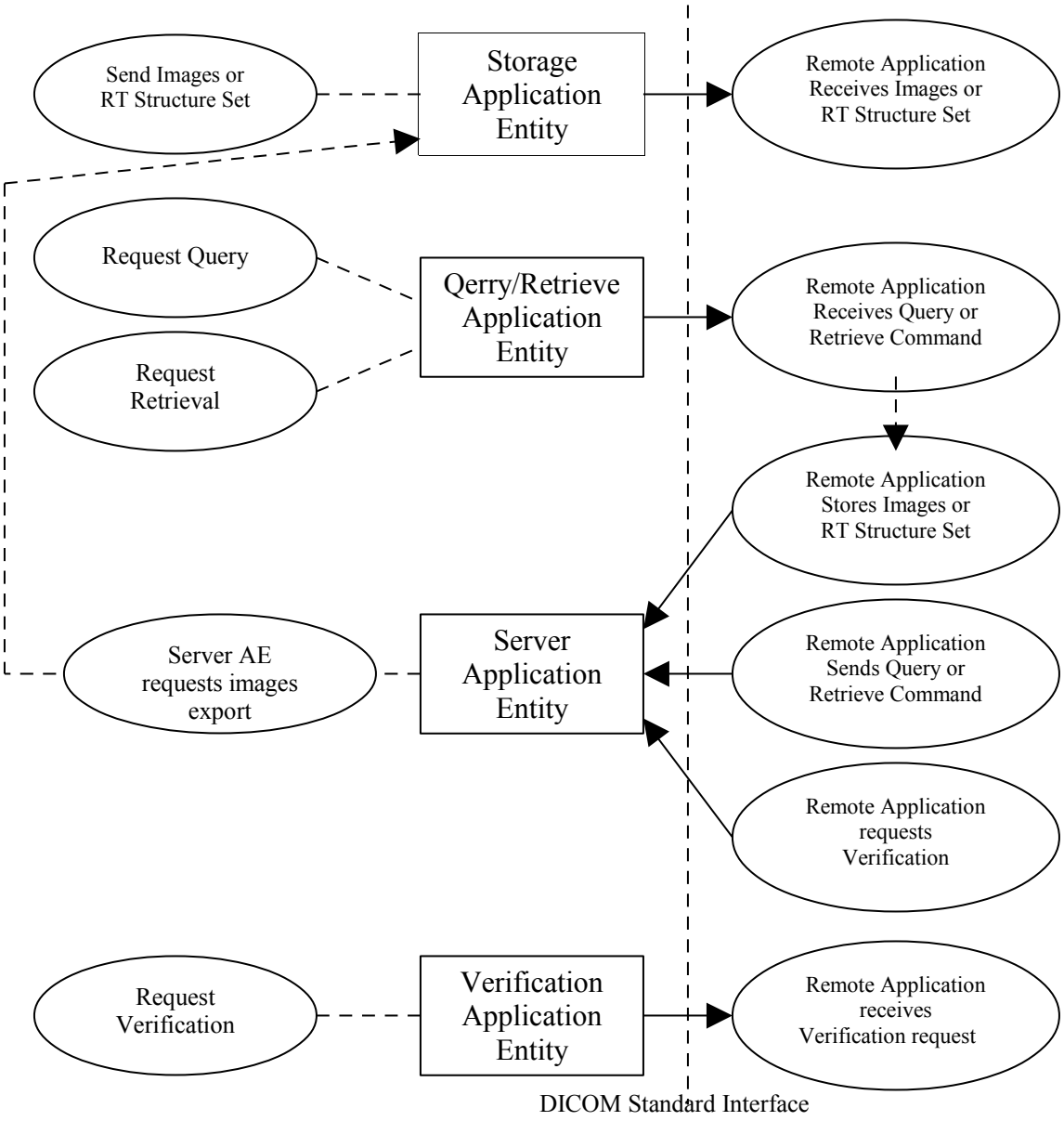

Figure 4.1-1
APPLICATION DATA FLOW DIAGRAM

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) AE Title:

- STORAGE AE, which sends images and RT Structure Set composite instances,
- 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 and query/retrieval 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].

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.

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 v3.6

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.

Only single verification action at a time is allowed 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
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	No
Ultrasound 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
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 Grayscale Byte Secondary Capture Image Storage [1]	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
X-Ray Angiographic Image Storage [1]	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image Storage [1]	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
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
RT Image Storage [1]	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	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
PMOD Multi-frame Image Storage	2.16.840.1.114033.5.1.4.1.1.130	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 4.2-9
PROPOSED PRESENTATION CONTEXTS FOR STORAGE AE (single TS option off).

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
See Table 4.2-7 and Note	See Table 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.

When the option is turned on the Presentation Contexts listed in the following table are proposed:

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

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Table 4.2-7 and Note	See Table 4.2-7 and Note	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
See Table 4.2-7 and Note	See Table 4.2-7 and Note	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
See Table 4.2-7 and Note	See Table 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.

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
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 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
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5	No	Yes
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Enhaned US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.130	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	No	Yes
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	No	Yes
PMOD Multi-frame Image Storage	2.16.840.1.114033.5.1.4.1.1.130	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

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 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 4.2-24
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 4.2-25
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 4.2-26
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 Query/Retrieve Request

4.2.4.4.3.1 Description and Sequencing of Activities

No sequencing applies.

4.2.4.4.3.2 Accepted Presentation Contexts

Table 4.2-27
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		

4.2.4.4.3.2.1 Extended Negotiation

No extended negotiation is performed.

4.2.4.4.3.3 SOP Specific Conformance

4.2.4.4.3.3.1 SOP Specific Conformance to Storage SOP Classes

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

4.2.4.4.3.3.2 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.

4.2.4.4.3.3.3 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.

4.2.4.4.3.3.4 Response Status

Table 4.2-28
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

Service Status	Further Meaning	Status Codes	Reason
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 was successfully sent.
Success	Sub-operations complete – no failures	0000	Sent when matching 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.

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

Parameter name and description	Configurable (Yes/No)	Default Value
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
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
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
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 one of the General Purpose Application Profiles of PS3.11 (CD-R or DVD-RAM).

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 Interchange Option of the Media Storage Service Class. Application profiles as specified in the following table are supported:

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

Supported Application Profiles	Real-Word activity	Roles	SC option
STD-GEN-CD	Load directory or file	FSR	Interchange
STD-GEN-DVD-RAM	Load directory or file	FSR	Interchange

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.

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

7.2 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
(0055,00xx)	Private Creator	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	LO	1
(7fe1,xx01)	Slices Names	UT	1
(7fe1,xx02)	Gene Codes	UT	1
(7fe1,xx03)	Gene Labels	UT	1