



DICOM 3.0 Conformance Statement



for MR Scanners
and Independent Medical Imaging Workstations

Marconi Medical Systems, Inc. 2000

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MR Global Business Center
595 Miner Road
Highland Heights, Ohio 44143

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ABSTRACT:

This document describes the conformance of the following MR Scanners and

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A Introduction

The purpose of this conformance statement is to provide detailed technical information pertaining to DICOM 3.0 compliance for the following Marconi MR product lines:

<u>MR Scanners</u>		<u>Independent Medical Imaging Workstations</u>	
Eclipse	Edge with Accelerator	ViStar	ViStar XL
Polaris	Vista with Accelerator	TwinStar	ViStar L
Apollo	EXP Upgrades Montage	ViStar R	

All of the systems identified in the above table utilize the same DICOM software implementation. In this document, MR Scanner, refers to any of the MR Scanners identified in the table above and, MR Workstation, refers to any of the Independent Medical Imaging Workstations identified in the table above.

This conformance statement does not apply to other MR products or medical imaging devices manufactured by Marconi Medical Systems, Inc.

This conformance statement applies to the MR VIA 2.0E.001 software release. The VIA 2.0E.001 software release is a layered product, refer to section A.1, "Implementation Model", to determine whether a feature is enabled by a Marconi MR license or included with the base system.

For those who are not interested in the technical details, the following summary is provided:

Each feature describes half of the interoperability scenario supported by the MR system. These features also require sufficient network bandwidth and the complimentary DICOM 3.0 compliant device to complete the scenario.

- **DICOM Storage Service Class as a User**
This facility sends images from the MR Scanner or MR Workstation to a DICOM archive or workstation over an ethernet network. (DICOM export)

➤ DICOM Storage Service Class as a Provider

This facility permits the MR Scanner or MR Workstation to receive images from a DICOM scanner, archive, or workstation. (DICOM Import)

➤ DICOM Query/Retrieve Service Class as a User

This facility permits the MR Scanner or MR Workstation to browse other DICOM databases on the network and to copy operator selected images from the DICOM database to the local system for review and image processing.

➤ DICOM Query/Retrieve Service Class as a Provider

This facility permits the another workstation to browse the Marconi MR local database from the network and permits that workstation to copy the images to that workstation.

➤ DICOM Print Service Class as a User

This facility permits images to be sent over a network to any valid DICOM printer.

➤ DICOM Modality Worklist Management Service Class as a User

This facility is restricted to MR Scanners, it provides the ability to access a DICOM conformant HIS/RIS and permits the MR scanner the ability to download the patient name, demographics, accession number for the study.

➤ DICOM Modality Perform Procedure Step Service Class as a User

This facility is restricted to MR Scanners, it provides the ability to access a DICOM conformant HIS/RIS to schedule procedures on the MR scanner. The MR scanner relays details on procedures performed back to the scheduling device.

➤ DICOM Media Storage as a File Set Creator

This facility permits images and a directory structure to be stored on a CD. The CD can be used for archiving images and for situations where another workstation cannot access the Marconi MR image data from a network.

➤ DICOM Media Storage as a File Set Reader

This facility permits the DICOM directory structure stored with the images to be read when a CD is installed in the system. The operator can then access the images by selecting the the series. Support for reading uncompressed data from a DICOM Magneto-Optical is also provide on systems with a Linux operating system.

Note: Interpretation of a conformance statement should not be used as a substitute for rigorous clinical validation of the information being transferred between heterogeneous pieces of equipment.

A.1 Implementation Model

This implementation provides for simple transfer of images via the DICOM Storage Service Class as a Service Class User (SCU) and a Service Class Provider (SCP), access to a Hospital Information System (HIS) or Radiology Information System (RIS) from an MR Scanner via the DICOM Modality Worklist as a Service Class User (SCU) and Performed Procedure Step as a Service Class User (SCU), simple management of images using the DICOM Query/Retrieve Service Class as a Service Class User (SCU) and a Service Class Provider (SCP), DICOM Basic Grayscale Print Management Meta SOP Class as a Service Class User (SCU), DICOM Media Storage as a File Set Creator (FSC) and as a File Set Reader (FSR), and DICOM Verification as a Service Class User (SCU) and a Service Class Provider (SCP). As indicated earlier, a Marconi MR license may be required to enable a feature, included with each implementation model description is the required license.

DICOM Storage Service Class as a Service Class User (SCU)

Marconi MR License	none, included with the base system
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Transfer of images to a remote SCP is initiated by an operator enabling the EXPORT application from the UTILITY menu, and then selecting the destination and sets of Patients, Studies, or Series to be queued for transfer. Automatic export may also be configured by the operator on an MR Workstation or MR Scanner. The export_engine Application Entity (AE) is informed of newly reconstructed series and any series created through the VIEW application as they are completed. The export_engine Application Entity (AE) transfers one series of images per association established with a selected Storage SCP.

DICOM Storage Service Class as a Service Class Provider (SCP)

Marconi MR License	DIIMP
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The import_server task supports the role of Storage SCP, and accepts images from DICOM 3.0 compliant remote SCUs. This task runs as a background process and requires no local operator actions to accept images.

Access to HIS/RIS via the DICOM Modality Worklist as a Service Class User (SCU)

Marconi MR License	DIMODWL
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An operator, on an MR Scanner, initiates queries to a DICOM Modality Worklist Service Class Provider by updating/refreshing an HIS/RIS directory listing. The direc_server task is responsible for sending out the appropriate query information to the Modality Worklist Service Class Provider (SCP).

Access to HIS/RIS via the DICOM Performed Procedure Step as a Service Class User (SCU)

Marconi MR License	DIPPS
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An operator, on an MR Scanner, configures Performed Procedure Step export by enabling the EXPORT application from the UTILITY menu, selecting PROCEDURE STEP, and selecting the destination. Completed Performed Procedure Steps are queued for export by the operator indicating step completion from SCAN SETUP. The pps_export_engine Application Entry (AE) transfers the completed steps to the HIS/RIS system.

DICOM Query/Retrieve Service Class as a Service Class Provider (SCP)

Marconi MR License	DIQUERY
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The import_server task supports the role of Query/Retrieve SCP, and processes C-FINessC-eustssf ro98(m)-4.2((essl/)0.6(C)5O/)0.6M-o98((pl)8(i)5ae)8.9(te r)5.8(e)8.9mo te as abackgaaccess andrles nodlConts to ccptEusts(.)T/T6 1 Tf 0.62 -2.2977 TD0.003 Tc-0.0008 Tw(D)5.2()30.8CD Query2iev Service C (T)-6.2(Le95.2(l)108((T)-6.2(Y)12(Se95.2nu,s)10(hene95.2, sel)5.2ea)-0.8(c)16(t05.8(i)5.2na) tsddeni4314(s od)810(f)05.3(im)149(agd)810(s tod)810 e(e)-.9tme. Th(e i14314mo)-517(p

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The print implementation provides for simple transfer of images using the DICOM Basic Grayscale Print Management Meta SOP Class as a Service Class User (SCU). Transfers to a remote printer are initiated by an operator selecting the PRINT button from a filming keypad, or from the FILM application.

DICOM Media Storage as a File Set Creator (FSC)

Marconi MR License	CDWRITE
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The import_server task supports the role of File Set Creator, and accepts images from DICOM 3.0 compliant SCUs. This task runs as a background process and requires no local operator actions to accept images. The images are buffered on the local disk until the operator initiates the transfer of the buffered data to a CD, at which time the dcmgpdirc utility is invoked to create the required DICOM media directory structure, DICOMDIR.

DICOM Media Storage as a File Set Reader (FSR)

Marconi MR License	DIMEDIAR
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The read_dicomdir task supports the role of File Set Reader. The read_dicomdir task reads the DICOM directory structure, DICOMDIR, and fills in a database, created locally, with sufficient information such that the operator can access the image data directly from any of the utilities. The read_dicomdir task is notified when removable media is automatically mounted, so no operator intervention is required to access the DICOM directory structure. The implementation allows for reading of CD's. The implementation also allows for reading uncompressed data from a DICOM Magneto-Optical on systems with a Linux operating system.

DICOM Verification as a Service Class Provider (SCP)

Marconi MR License	DIQUERY or DIIMP
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For diagnostic purposes, the import_server task also supports the DICOM Verification Service Class as an SCP.

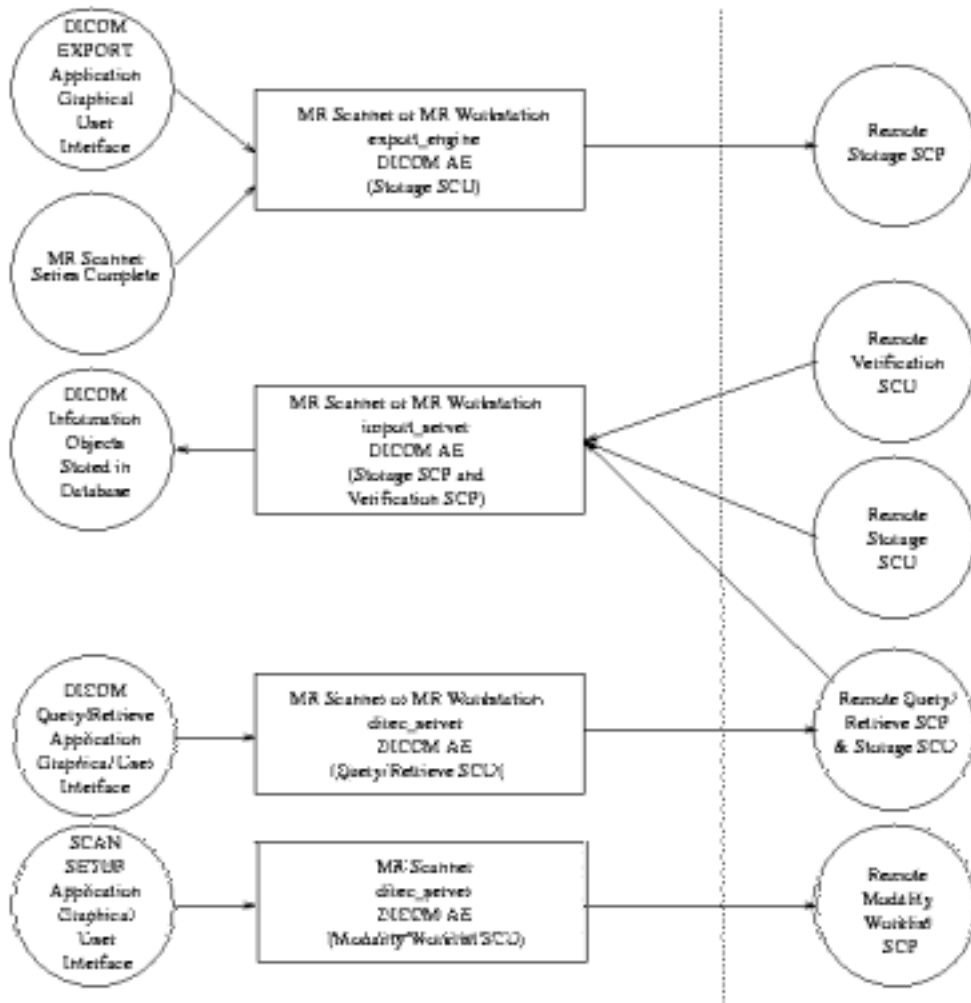
DICOM Verification as a Service Class Provider (SCU)

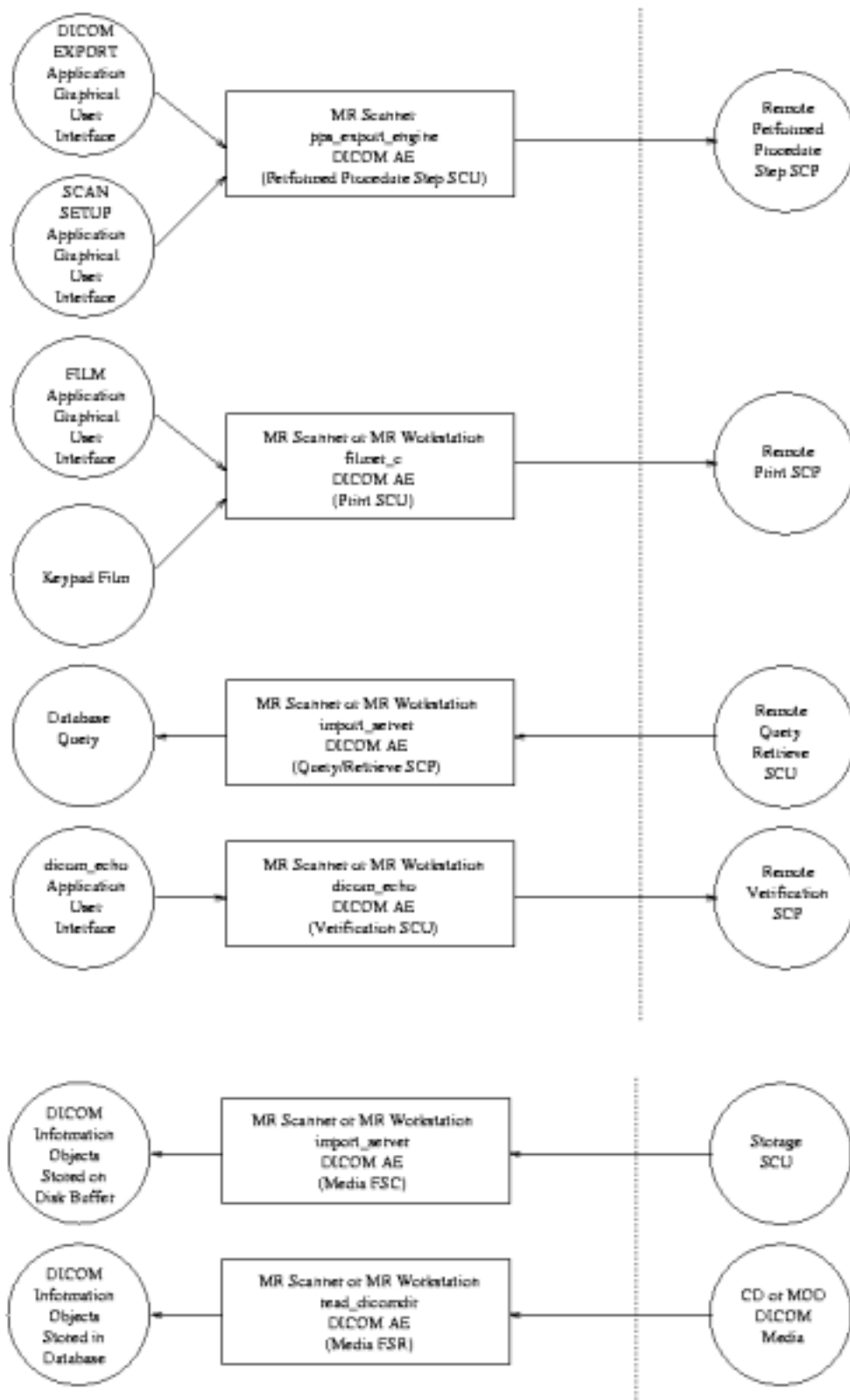
Marconi MR License	none, included with the base system
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For diagnostic purposes, the distributed software includes a stand-alone utility dicom_echo task that supports DICOM Verification Service Class as an SCU.

For complete user interface details, consult the MR Scanner or MR Workstation User's Guide.

A.1.1 Application Data Flow Diagram





A.1.2 Functional Definitions of AE's

The following describes the export_engine, import_server, query_server, direc_server, pps_export_engine, filmer_c, read_dicomdir, and dicom_echo Application Entities:

export_engine AE

The export_engine AE begins execution when at least one series of images is queued for sending via DICOM. The export_engine establishes an association with the remote Storage SCP, sends all images in the series, then terminates the association. If the export_engine detects an error while sending an image, it will

scan setup application for display. In the event that an error occurred, the user will be notified.

pps_export_engine AE

The pps_export_engine begins execution when a Performed Procedure Step action is queued for sending to the HIS/RIS system. The pps_export_engine will send a N_CREATE message for Performed Procedure Step status "In Progress" and a N_SET for a "Complete" or "Discontinued" status. If the pps_export_engine detects an error while sending, it will notify the operator and request operator intervention. If no errors are detected, the pps_export_engine continues to run until the pps export queue is emptied.

filmer_c AE

The filmer_c AE runs as a server process that accepts requests initiated by Keypad Film and the Film application. Each time the operator presses the PRINT button, filmer_c establishes an association with the remote Print SCP, sends a film, and then terminates the association. The process is repeated as necessary to film all of the images. If the filmer_c detects an error while sending a film, the filmer_c AE will notify the operator and request operator intervention.

read_dicomdir AE

The read_dicomdir AE (forks) a separate process for each CD or Magneto-Optical installed on the system. The process examines the mounted file system for the file DICOMDIR in the root directory. If a DICOMDIR file is located, a database is created with entries from the DICOMDIR. The ability to read media is limited to supported image SOP classes and the ability of the operating system to mount the media. DICOM Magneto-Optical File Set Read is limited to uncompressed data and is not supported on Unix systems.

dicom_echo AE

The dicom_echo AE is a diagnostic tool that must be manually invoked. Each time the operator invokes dicom_echo, an association with the specified Verification SCP is established, diagnostic messages are displayed and the association is terminated.

A.2 AE Specifications

A.2.1 Application Entities - Specification

The filmer_c Application Entity provides Standard Conformance to the following DICOM 3.0 Meta SOP Classes.

Table A.2.1-1 Supported Meta SOP Classes

Meta SOP Class Name	Meta SOP Class UID	Role
Basic Grayscale Print Management	1.2.840.10008.5.1.1.9	SCU

Support for this Meta SOP Class as SCU also implies support for the SOP Classes listed in table A.2.1-2. However, the SCU never presents individual Presentation Contexts for these SOP Classes.

Table A.2.1-2 Supported SOP Classes

SOP Class Name	SOP Class UID	Role
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	SCU
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	SCU
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	SCU
Printer SOP Class	1.2.840.10008.5.1.1.16	SCU

The import_server AE working in conjunction with the utility dcmgpdirc provide standard conformance as a FSC, the read_dicomdir AE provides standard conformance as a FSR, to the DICOM Interchange Option of the Media Storage Service Class with the following DICOM 3.0 application profiles:

Table A.2.1-3 Supported Application Profile

Supported Media Application Profile	Role
STD-GEN-CD	FSC

Table A.2.1-4 Supported Media Storage SOP Classes

SOP Class Name	SOP Class UID	Role
Media Storage Directory Storage	1.2.840.10008.1.3.10	FSC and FSR
CR Image	1.2.840.10008.5.1.4.1.1.1	FSC and FSR
CT Image	1.2.840.10008.5.1.4.1.1.2	FSC and FSR
MR Image	1.2.840.10008.5.1.4.1.1.4	FSC and FSR
NM Image	1.2.840.10008.5.1.4.1.1.20	FSC and FSR
US Image	1.2.840.10008.5.1.4.1.1.6	FSC and FSR
SC Image	1.2.840.10008.5.1.4.1.1.7	FSC and FSR

The export_engine, pps_export_engine, import_server, and direc_server Application Entities provide standard or standard extended conformance with the following DICOM 3.0 Service Object Pair (SOP) Classes:

Table A.2.1-5 Supported SOP Classes

SOP Class Name	SOP Class UID	Role
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	SCU and SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCU and SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCU and SCP
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	SCU and SCP
US Image Storage	1.2.840.10008.5.1.4.1.1.6	SCU and SCP
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	SCU and SCP
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	SCU and SCP
XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	SCU and SCP
Verification	1.2.840.10008.1.1	SCU and SCP
Modality Worklist Information Model, Find	1.2.840.10008.5.1.4.31	SCU
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	SCU
Patient Root Query/Retrieve Information Model, Find	1.2.840.10008.5.1.4.1.2.1.1	SCU and SCP
Patient Root Query/Retrieve Information Model, Move	1.2.840.10008.5.1.4.1.2.1.2	SCU and SCP
Study Root Query/Retrieve Information Model, Find	1.2.840.10008.5.1.4.1.2.2.1	SCU and SCP
Study Root Query/Retrieve Information Model, Move	1.2.840.10008.5.1.4.1.2.2.2	SCU and SCP
Patient/Study Only Query/Retrieve Information Model, Find	1.2.840.10008.5.1.4.1.2.3.1	SCU and SCP
Patient/Study Only Query/Retrieve Information Model, Move	1.2.840.10008.5.1.4.1.2.3.2	SCU and SCP

NOTE: The actual level of conformance may depend on the conformance of DICOM information objects originally received into a remote database.

Interpretation of a conformance statement should not be used as a substitute for rigorous clinical validation of the information being transferred between heterogeneous pieces of equipment.

A.2.1.1 Association Establishment Policies

A.2.1.1.1 General

The DICOM Application Context proposed is always: 1.2.840.10008.3.1.1.1

SOP class extended negotiation is not supported.

The maximum PDU size allowed is 16 Kbytes for the export_engine, pps_export_engine, import_server, direc_server, and dicom_echo.

The filmer_c server will attempt to establish an association each time the PRINT button is pressed on a filming keypad or in the FILM application (i.e. for each separate film page). The association is maintained until all images for one film page have been processed.

The maximum PDU size allowed is 4096 bytes for Print Management.

A.2.1.1.2 Number of Associations

For C-STORE operations, the export_engine establishes a new association for each series of images transferred, and terminates the association after each series transfer is completed.

When processing C-MOVE operations, the export_engine establishes a new association for each image transferred, and terminates the association after each image transfer is completed.

The direc_server establishes a new association each time the operator updates/refreshes an HIS directory listing. This association is maintained until all requested patient scheduling information has been received, or an error condition is detected.

The pps_export_engine establishes a new association for each N-CREATE and N-SET operation performed.

The filmer_c server will attempt one association per film.

The dicom_echo utility will attempt one association each time it is invoked.

A.2.1.1.3 Asynchronous Nature

There is no asynchronous activity in this implementation.

A.2.1.1.4 Implementation Identifying Information

The Implementation UID supplied for DICOM 3.0 associations is:
2.16.840.1.113662.4.2.1.

A.2.1.2 Association Initiation By Real World Activity

The following real world activities initiate associations:

- The export_engine AE initiates an association for each series queued for transfer.
- The pps_export_engine AE initiates an association for each "START STEP" and "END STEP" message relayed from the scan setup application.
- Selecting a new remote SCP (a new destination for DICOM EXPORT or a new source for the Modality Worklist SCU) initiates a temporary association to determine the roles and services supported by the remote SCP.
- The direc_server AE initiates an association each time the operator updates/refreshes an HIS directory listing.
- The filmer_c AE server initiates an association once each time film is printed.
- The dicom_echo AE utility initiates an association once each time it is invoked.

A.2.1.2.1 Real World Activity 1. Sending a Series of Images

A.2.1.2.1.1 Associated Real World Activity

To export DICOM information an operator:

Enables "MANUAL" DICOM EXPORT; selects a valid "Destination" AE for DICOM

EXPORT; selects interactively from the available databases sets of Patients, Studies, or Series for DICOM EXPORT.

Enables "AUTO" DICOM EXPORT; selects a valid "Destination: AE for DICOM EXPORT; which will cause newly reconstructed series and any series created through the VIEW application to be queued for DICOM EXPORT.

Issues a "Continue" command when a series is unable to transfer completely possibly because of an error situation. The export_engine will retry sending any given image a maximum of three times before notifying the operator that a problem exists (a warning message is posted in the system's DICOM log file).

For complete user interface details, consult the User's Guide.

A.2.1.2.1.2 Proposed Presentation Contexts

Table A.2.1.2.1.2-1 Proposed Presentation Contexts, Sending a Series of Images

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext.Neg
Name	UID	Name List	UID List		
CR Image	1.2.840.10008.5.1.4.1.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
CT Image	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
MR Image	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
NM Image	1.2.840.10008.5.1.4.1.1.20	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
US Image	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
SC Image	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

A.2.1.2.1.3 SOP Specific Conformance to Storage SOP Classes

If the export_engine AE detects any errors, a message suggesting to the operator an alternative course of action is always displayed. An operator may elect to: continue (retry), skip the series (delete it from the export queue), or cancel all remaining series in the queue. If the export_engine AE is unable to open an association with a selected destination AE, an appropriate message is displayed on the screen. There are no special messages displayed when a successful response to the C-STORE operation is received.

When the export_engine sends any image that was originally received via DICOM into a remote database, the original information object received is re-sent.

When exporting Marconi MR Scanner or MR Workstation images the following optional elements (Type 3) may be included.

Table A.2.1.2.1.3-1 Optional Elements for MR Scanner or MR Workstation Images

Tag	Name	Conditions for inclusion
0008,0021	Series Date	Always
0008,0031	Series Time	Always
0008,0080	Institution Name	Always
0008,0090	Referring Physician's Name	When entered by the operator
0008,1010	Station Name	Always
0008,1030	Study Description	When entered by the operator
0008,1060	Name of Physician(s) Reading Study	When entered by the operator
0008,1070	Operator's Name	When entered by the operator
0008,1090	Manufacturer's Model Name	Always
0008,1140	Referenced Image Sequence	Sent for images which have a corresponding localizer, scout, or pilot
0010,1010	Patient's Age	When entered by the operator
0010,1030	Patient's Weight	When entered by the operator
0010,4000	Patient Comments	When entered by the operator
0018,0083	Number of Averages	Always
0018,0084	Imaging Frequency	When entered by the operator
0018,0094	Percent Phase Field of View	Always
0018,1000	Device Serial Number	Always
0018,1020	Software Version(s)	Always
0018,1030	Protocol Name	Always
0018,1250	Receiving Coil	Always
0018,1310	Acquisition Matrix	Always
0018,1314	Flip Angle	Always
0020,0012	Acquisition Number	When entered by the operator
0020,0100	Temporal Position Identifier	Temporally related images
0020,0105	Number of Temporal Positions	Temporally related images
0020,0110	Temporal Resolution	Temporally related images
0020,1002	Images in Acquisition	Always
0028,1050	Window Center	Always
0028,1051	Window Width	Always

Table A.2.1.2.1.3-2 Localizer, Scout, Pilot Grids for MR Scanner Images The tags identified below permit a system to generate cross-reference lines between a spatially related slice and a series. All of the information in the table is type 1, mandatory, with the exception of slice thickness, which Marconi MR supplies, but which is defaulted to zero in our system when images are received from a vendor who does not supply the value.

Tag	Type	Name
0018,0050	2	Slice Thickness
0020,0037	1	Image Orientation (Patient)
0020,0032	1	Image Position (Patient)
0020,0052	1	Frame of Reference UID
0028,0010	1	Rows
0028,0011	1	Columns
0028,0030	1	Pixel Spacing

Additionally Marconi MR supplies the following information to uniquely identify the pilot slice.

Tag	Type	Name
0008,1140	3	Referenced Image Sequence

The above elements provides the remote SCP with the required information to not only generate a pilot grid but the option of generating mini-pilots whereby each slice position can be independently drawn on the pilot image rather than always displaying a static overlay plane. The optional overlay plane module is therefore not supplied with Marconi MR Scanner images.

If the remote SCP cannot generate a pilot grid or mini-pilots based on the information above, the operator has the ability to store secondary capture images as they appear on the MR Scanners and MR Workstations with any grids/annotation included in the pixel data.

Table A.2.1.2.1.3-3 Private Elements for MR Scanner or MR Workstation Images
When exporting Marconi MR Scanner or MR Workstation images the following private elements may be included.

Tag	Name	Value Representation
7101,0010	Private MR Creator Data element	LO
7101,1000	MR Processing Field 1	OB
7101,1001	MR Processing Field 1 Length	SL
7101,1002	MR Processing Field 2	OB
7101,1003	MR Processing Field 2 Length	SL
7101,1004	Scan Duration	SH
7101,1005	MR Processing Field 3	SH
7101,1006	MR Processing Field 4	SH

A.2.1.2.2 Real World Activity 2. Selecting a New Remote SCP

A.2.1.2.2.1 Associated Real World Activity

Selecting a new remote SCP (a new source for Query/Retrieve) initiates a temporary association to determine the roles and services supported by the remote SCP.

A.2.1.2.2.2 Proposed Presentation Contexts

These are the same as for Real World Activity 5.

A.2.1.2.2.3 SOP Specific Conformance to Storage SOP Classes

Not Applicable.

A.2.1.2.3 Real World Activity 3. Query Patient Schedules

A.2.1.2.3.1 Associated Real World Activity

The Associated Real World Activity of the direc_server is to request patient scheduling information from a remote DICOM server. This occurs when the operator updates/refreshes an HIS directory listing.

A.2.1.2.3.2 Proposed Presentation Contexts

Table A.2.1.2.3.2-1 Proposed Presentation Contexts, Query Patient Schedules

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Ext.	
Name	UID	Name List	UID List	Role	Neg.
Modality Worklist Information Model, Find	1.2.840.10008.5.1.4.31	DICOM Ic.36 0.6Tc0.01 Little Endian Transfer Syntax	1.2.840.10008.1.2 0.emVR	SCU	None

A.2.1.2.3.3 SOP Specific Conformance to Find SOP Classes

If the direc_server AE detects any errors, a message suggesting to the operator an alternative course of action is always displayed. If the direc_server AE is unable to open an association with a selected destination AE, an appropriate message is displayed on the screen.

When querying from the Marconi MR Scanner, the fields included in Table A.2.1.2.3.3-2 are part of the C-FIND identifier set. The operator has the ability to specify several of the query matching key values, default key values are identified in Table A.2.1.2.3.3-1

Table A.2.1.2.3.3-1 Query Matching Key Values

Tag	Name	Operator	Default
		Accessible	Key Value
0008, 0050	Accession Number	*	NULL
0008, 0060	Modality	*	"MR"
0010, 0010	Patient's Name	*	"*"
0010, 0020	Patient ID	*	NULL
0040, 0001	Scheduled Station AE Title		NULL
0040, 0002	Scheduled Procedure Step Start Date	*	NULL
0040, 1001	Requested Procedure ID		NULL

Table A.2.1.2.3.3-2 C-FIND Identifier Set for MR Scanner

Tag	Name	Usage
0008,0050	Accession Number	Return Key
0008,0060	Modality	Matching Key
0008,0090	Referring Physician's Name	Return Key
0010,0010	Patient's Name	Matching Key
0010,0020	Patient ID	Matching Key
0010,0030	Patient's Birth Date	Return Key
0010,0040	Patient's Sex	Return Key
0010,1030	Patient's Weight	Return Key
0020,000D	Study Instance UID	Return Key
0040,0001	Scheduled Station AE Title	Return Key
0040,0002	Scheduled Procedure Step Start Date	Return Key
0040,0006	Scheduled Performing Physician's Name	Return Key
0040,0007	Scheduled Procedure Step Description	Return Key
0040,0008	Scheduled Action Item Code Sequence	Return Key
0040,0100	Scheduled Procedure Step Sequence	Return Key

A.2.1.2.4 Real World Activity 4. Sending Film Images

A.2.1.2.4.1 Associated Real World Activity

The filmer_c AE server attempts to initiate an association once each time a film is printed. There are two Real World Activities that can cause association establishment: Clicking on the PRINT button on a filming keypad, or clicking on the PRINT button from the FILM application.

A.2.1.2.4.2 Proposed Presentation Contexts, Sending Film Images

Table A.2.1.2.4.2-1 Proposed Presentation Contexts, Sending Image File

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext.Neg.
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

A.2.1.2.4.3 SOP Specific Conformance to Print SOP Classes

If the DICOM print software is unable to open an association with the selected destination AE, a message is displayed on the CAMERA SUMMARY screen.

There are no special messages displayed when a successful response to the print operation is received.

The filmer_c AE software does not attempt any extended negotiation.

Images are printed using the Basic Grayscale Print Management Meta SOP Class. The following optional elements may be included:

Table A.2.1.2.4.3-1 Optional Elements for N-CREATE request for Basic Film Session SOP Class

Tag	Name	Conditions for inclusion
2000,0010	Number of Copies	Always

Table A.2.1.2.4.3-2 Optional Elements for N-CREATE request for Basic Film Box SOP Class

Tag	Name	Conditions for inclusion
2010,0100	Border Density	Always

Table A.2.1.2.4.3-3 Optional Elements for N-SET request for Basic Grayscale Image Box SOP Class

Tag	Name	Conditions for inclusion
2020,0020	Polarity	Always

A.2.1.2.5 Real World Activity 5. Requesting Directory Information

A.2.1.2.5.1 Associated Real World Activity

The Associated Real World Activity of the `direc_server` is to request directory information from a remote DICOM server. This occurs when the operator selects the ARCHIVE application from the UTILITY menu, and selects the source SCP to Query for directory information.

A.2.1.2.5.2 Proposed Presentation Contexts

Table A.2.1.2.5.2-1 Proposed Presentation Contexts, Query

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient/Study Root Find	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Patient Root Find	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Study Root Find	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

A.2.1.2.5.3 SOP Specific Conformance to Find SOP Classes

This implementation does not make use of any optional keys. It also does not generate Relational queries or support any extended negotiations.

A.2.1.2.6 Real World Activity 6. Requesting Series of Images

A.2.1.2.6.1 Associated Real World Activity

The Associated Real World Activity is a request for the remote AE to transfer series of images to the MR Scanner or MR Workstation. This occurs when the operator selects from the displayed directory, the set of series of images to be sent to the import_server. A successful Query of the remote DICOM server must have taken place prior to the transfer request.

A.2.1.2.6.2 Proposed Presentation Contexts

Table A.2.1.2.6.2-1 Proposed Presentation Contexts, Move

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient/Study Root Move	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Patient Root Move	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Study Root Move	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

A.2.1.2.6.3 SOP Specific Conformance to Move SOP Classes

This implementation provides standard conformance as an SCU for C-MOVE.

A.2.1.2.7 Real World Activity 7. Verification

A.2.1.2.7.1 Associated Real World Activity

Manually invoking the dicom_echo application initiates a temporary association to determine if verification is supported by the SCP.

A.2.1.2.7.2 Proposed Presentation Contexts

Table A.2.1.2.7.2-1 Proposed Presentation Contexts, Verification

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

A.2.1.2.7.3 SOP Specific Conformance to Verification SOP Classes

This implementation provides standard conformance as an SCU for verification.

A.2.1.2.8 Real World Activity 8. Sending Performed Procedure Step

A.2.1.2.8.1 Associated Real World Activity

To export Performed Procedure Step information the operator:

Enables "PPS" EXPORT; selects a valid "Destination" AE for PPS EXPORT; which will cause newly started and completed Performed Procedure Steps to be queued for DICOM export.

Issues a "Continue" command when a Performed Procedure Step is unable to be transferred because of an error situation.

A.2.1.2.8.2 Proposed Presentation Contexts

Table A.2.1.2.8.2-1 Proposed Presentation Contexts, Performed Procedure Step

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Performed Procedure Step	1.2.840.10008.3.1.2.3.3	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

A.2.1.2.8.3 SOP Specific Conformance to Performed Procedure Step SOP Class

This implementation provides standard conformance as an SCU for Performed Procedure Step.

A.2.1.2.9 Real World Activity 9. Generating a CD of images.

A.2.1.2.9.1 Associated Real World Activity

The operator transfers images in a manner consistent with the activities in A.2.1.2.1.1, Sending a Series of Images, to the "Destination" AE for the File Set Creator. The operator has the ability to monitor disk space utilization for a CD using the utility CD WRITE. The operator then selects the option to "Generate a DICOM CD". This executes the utility dcmgpdirc, creating the required DICOM directory structure, DICOMDIR. The resultant information is then written to a CD.

A.2.1.2.9.2 Media Storage Service Class Profile.

Table A.2.1.2.9.2-1 Supported Application Profile

Supported Media Application Profile	Role
STD-GEN-CD	FSC

Table A.2.1.2.9.2-2 Supported Media Storage SOP Classes

Media Storage SOP Classes			
Abstract Syntax		Transfer Syntax	
Name	UID	Name List	UID List
Media Storage Directory Storage	1.2.840.10008.1.3.10	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
CR Image	1.2.840.10008.5.1.4.1.1.1	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
CT Image	1.2.840.10008.5.1.4.1.1.2	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
MR Image	1.2.840.10008.5.1.4.1.1.4	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
NM Image	1.2.840.10008.5.1.4.1.1.20	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
US Image	1.2.840.10008.5.1.4.1.1.6	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
SC Image	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1

A.2.1.2.9.3 SOP Specific Conformance for Media Storage Service Class

This implementation provides standard conformance as an FSC for Media Storage.

A.2.1.2.10 Real World Activity 10. Reading a DICOM CD or Magneto-Optical

A.2.1.2.10.1 Associated Real World Activity

After the operator inserts the DICOM Media, the system polls the Magneto-Optical and CD drives to determine if new media has been inserted. The system automatically mounts the media and the task read_dicomdir is informed. The read_dicomdir task, examines the media to determine if a DICOMDIR file is present in the root directory. If the above conditions are met, a standard image database is created and information from the DICOMDIR is written to the database. The operator will see a new database location appear automatically with a directory of series that can be accessed directly from the media.

A.2.1.2.10.2 Media Storage Service Class Profile.

Table A.2.1.2.10.2-1 Supported Application Profile

Supported Media Application Profile	Role
STD-GEN-CD	FSR

Table A.2.1.2.10.2-2 Supported Media Storage SOP Classes

Media Storage SOP Classes			
Abstract Syntax		Transfer Syntax	
Name	UID	Name List	UID List
Media Storage Directory Storage	1.2.840.10008.1.3.10	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
CR Image	1.2.840.10008.5.1.4.1.1.1	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
CT Image	1.2.840.10008.5.1.4.1.1.2	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
MR Image	1.2.840.10008.5.1.4.1.1.4	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
NM Image	1.2.840.10008.5.1.4.1.1.20	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
US Image	1.2.840.10008.5.1.4.1.1.6	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1
SC Image	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1

A.2.1.2.10.3 SOP Specific Conformance for Media Storage Service Class

This implementation provides standard conformance as an FSR for Media Storage.

A.2.1.3 Association Acceptance Policy

The export_engine, pps_export_engine, direc_server, filmer_c, read_dicomdir, and dicom_echo application entities never accept associations.

The import_server task accepts associations as a Storage SCP, a Query/Retrieve SCP, Media FSC, and as a Verification SCP.

Images accepted by the import_server acting as a Storage SCP, are entered into the database. The MR Scanners and MR Workstations attempt, whenever possible, to store DICOM information in a form that may be re-exported exactly as received.

The import_server may be configured to accept associations on various ports (as long as there is no conflict with a port used by other tasks); port 104 is typically used by default. Usually a single Application Title is configured for use by all SCUs that will be sending images to the MR Scanner or MR Workstation. The DICOM import_server must be configured by a Marconi Medical Systems Field Service Engineer (FSE).

The import_server software has no limitation on the number of simultaneous connections it will support except those imposed by the kernel parameters of the underlying TCP/IP implementation and by the memory resources available on the MR Scanner or MR Workstation.

A new copy of the import_server task is executed (via Unix fork) for each new association established.

A.2.1.3.1 Associated Real-World Activity

The Real-World Activity associated with the C-FIND and C-MOVE operation in the import_server is the return of requested DICOM elements and the export of requested images from the database.

A.2.1.3.2 Presentation Context Table

Table A.2.1.3.2-1 Acceptable Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
CR Image	1.2.840.10008.5.1.4.1.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
CT Image	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
MR Image	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
NM Image	1.2.840.10008.5.1.4.1.1.20	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
US Image	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
SC Image	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
Patient Root Query/Retri eve Information Model FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
Patient Root Query/Retri eve Information Model MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None

Study Root Query/Retrieve Information Model FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
Study Root Query/Retrieve Information Model MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
Patient/Study Only Query/Retrieve Information Model FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
Patient/Study Only Query/Retrieve Information Model MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None

A.2.1.3.3 SOP Specific Conformance

A.2.1.3.3.1 SOP Specific Conformance to Verification SOP Class

The import_server AE provides standard conformance to the DICOM Verification Service Class.

A.2.1.3.3.2 SOP Specific Conformance to Storage SOP Classes

MR Scanner and MR Workstations conform to the Storage SCP at Level 2 (Full).

The import_server does not attempt to verify that DICOM images sent to the workstation are fully compliant with DICOM. If the sending system sends the required Type 1 fields, the import_server will accept the object.

A successful C-STORE operation implies that the image was successfully entered into the workstation database.

Images will be stored in the workstation database until they are deleted by the operator.

If the C-STORE operation is unsuccessful, the import_server will return one of the following status codes:

Table A.2.1.3.3.2-1 C-STORE error codes

Status code	Meaning
A700 (Out of Resources)	Indicates that there is not enough room to store or process the image. Recovery is left to the user.
A800 (SOP Class not supported)	Indicates that the SOP Class of the image in the C-STORE operation did not match the Abstract Syntax negotiated for the Presentation Context. This indicates a problem with the SCU of the Service Class.
C204 (System Error)	A system error has occurred while storing or processing the incoming image. Recovery is left to the user.
CF01 (Protocol Error)	A system level protocol error occurred while processing the incoming message

A.2.1.3.3.3 SOP Specific Conformance to Query/Retrieve SOP Class

The import_server AE provides standard conformance to the DICOM Query/Retrieve Service Class. All required elements are supported.

The following errors/status may be returned from a Query/Retrieve operation:

Table A.2.1.3.3.3-1 C-FIND response codes

Status code	Meaning
A700 Refused	Out of Resources.
A900 Failed	Identifier does not match SOP Class.
Cxxx	Unable to process.
FE00 Cancel	Matching terminated due to Cancel request.
FF00 Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.
FF01 Pending	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier.

Table A.2.1.3.3.3-2 C-MOVE response codes

Status code	Meaning
A702 Refused	Out of Resources - Unable to perform sub-operations.
A801 Refused	Move Destination unknown.
A900 Failed	Identifier does not match SOP Class.
Cxxx Failed	Unable to process.
FE00 Cancel	Sub-operations terminated due to Cancel request.
B000 Warning	Sub-operations complete - One or more failures.
FF00 Pending	Sub-operations are continuing.

A.2.1.3.4 Presentation Context Acceptance Criterion

The import_server always accepts a Presentation Context for the Verification SOP Class with the DICOM Default Transfer Syntax. It will also accept any of the presentation contexts listed in the table in section A.2.1.3.2.

A.2.1.3.5 Transfer Syntax Selection Policies

The import_server will only receive images using the Implicit VR, Little Endian, transfer syntax.

A.3 Communication Profiles

A.3.1 Supported Communications Stacks (Parts 8,9)

The export_engine, pps_export_engine, import_server, direc_server, filmer_c, and dicom_echo application entities provide DICOM 3.0 TCP/IP Network Communications Support as defined in Part 8 of the DICOM Standard.

A.3.2 OSI Stack

No OSI stack communications are provided with this implementation.

A.3.3 TCP/IP Stack

The TCP/IP protocol stack is supported.

A.3.3.1 Physical media supported

The physical media supported depend on the system configuration:

Configuration	Media Supported
Tower Based System: ➤ MR Scanner or ➤ MR Workstation	Thinnet
Desk Top System: ➤ MR Workstation	Thinnet or Twisted pair Ethernet

Adapters from Thinnet to either Twisted pair Ethernet or Thicknet Ethernet can be provided.

A.3.4 Point to Point Stack

No point-to-point stack communications are provided with this implementation.

A.4 Extensions/Specializations/Privatizations

Private elements for MR Scanner or MR Workstation images are identified in table A.2.1.2.1.3-3. With the exception of these private elements and Type 3 DICOM extensions, no other specializations, or privatizations are used in this implementation.

A.5 Configuration

DICOM applications, and other networking applications must be configured by a Marconi Medical Systems Field Service Engineer.

A.6 Support of Extended Character Sets

Extended Character Sets are not used or supported in this implementation.
