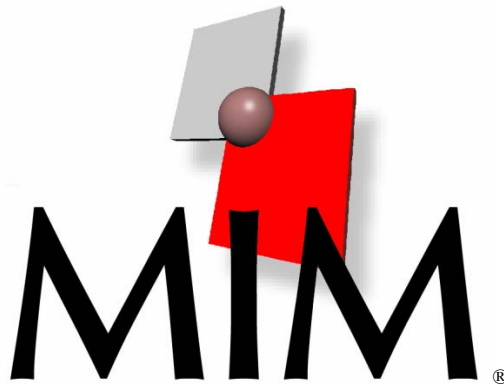


DICOM 3.0 Conformance Statement



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MIMviewer



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1 Revision History

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2 Copyright Statement

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3 Disclaimer

The MIMvista Corp. MIM and MIMviewer software is in compliance with the ACR-NEMA DICOM 3.0 standard; however, due to the inherent nature of DICOM, the user must perform acceptance testing to verify that the MIM DICOM software meets the requirements for your configuration. The acceptance testing must include all representative datasets (images) that you intend to transfer, all types of transfers desired for a type of dataset, and clinical evaluation of each representative dataset on the receiving end after each desired type of transfer.

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5 Introduction

The MIM and MIMviewer software applications are used for the registration, fusion and display of medical images from multi-modalities. The MIM application supports the import of CT, MR, PT, NM, Secondary Capture, and CR, and US images; and supports the export of CT, MR, PT, NM, CR, US and Secondary Capture images. MIM also supports import and export of RT Structure Sets and Registration objects. MIMviewer supports import of CT, MR, PT, NM, and Secondary Capture images. MIMviewer does not support export of any images or objects.

Import and export of CT, MR, PT and NM images is done through MIM. MIM is a Windows based application that uses the file system as storage for the DICOM image files. DICOM Server and Device configuration is done through the MIM or MIMviewer application. The MIMvista DICOM Store SCP can be installed / uninstalled and started/stopped as well as additional DICOM devices can be entered and configured in order to communicate with MIM.

MIM and MIMviewer also support DICOM Printing as an SCU, with support for both Grayscale and Color printing.

MIM and MIMviewer support DICOM Query/Retrieve as an SCU, and MIM as an SCP.

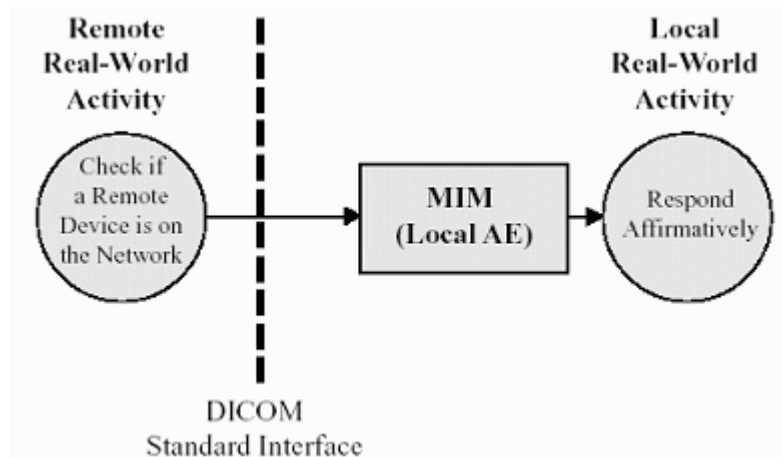
Because of the broadness and extensibility of the DICOM standard, each DICOM conforming system would normally support only a subset of DICOM 3.0. Each pair of DICOM peer devices, or Application Entities (AE), can only communicate over the intersection of commonly supported parts of DICOM. Fortunately, DICOM 3.0 standard requires some minimum conformance.

This conformance statement can help the user understand the level of connectivity between MIM/MIMviewer and other DICOM compatible devices

This conformance statement is written in accordance with Part 2 of DICOM, NEMA Standards Publication No. PS 3.2-2006.

6 Implementation Model

MIM DICOM Interface is implemented to support DICOM Application Entities (AE) as a SCP, which receive associations (Storage). MIM DICOM Interface originates SCU associations for Storage and for reading and generating DICOM 3.0 Part 10 File Formats.

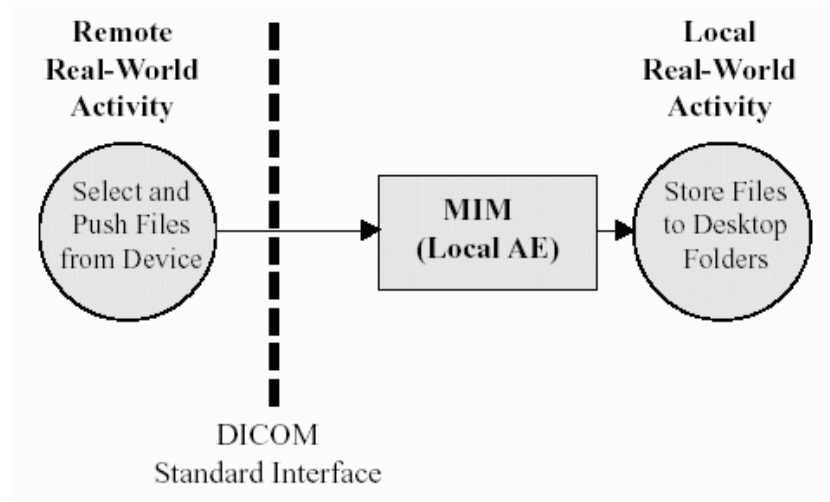


MIM is a Windows product utilizing DICOM services in order to communicate and import images from other DICOM compliant systems, thus allowing MIM to participate in a DICOM environment.

6.1 Application Data Flow Diagrams

This section consists of an Application Data Flow Diagram describing how the MIM DICOM Application Entity (AE) works with remote DICOM devices, a functional definition of the AE and its Real-World Activities, and a description of the Real-World sequence of events of the AE.

6.1.1 Application Flow Diagram - Store



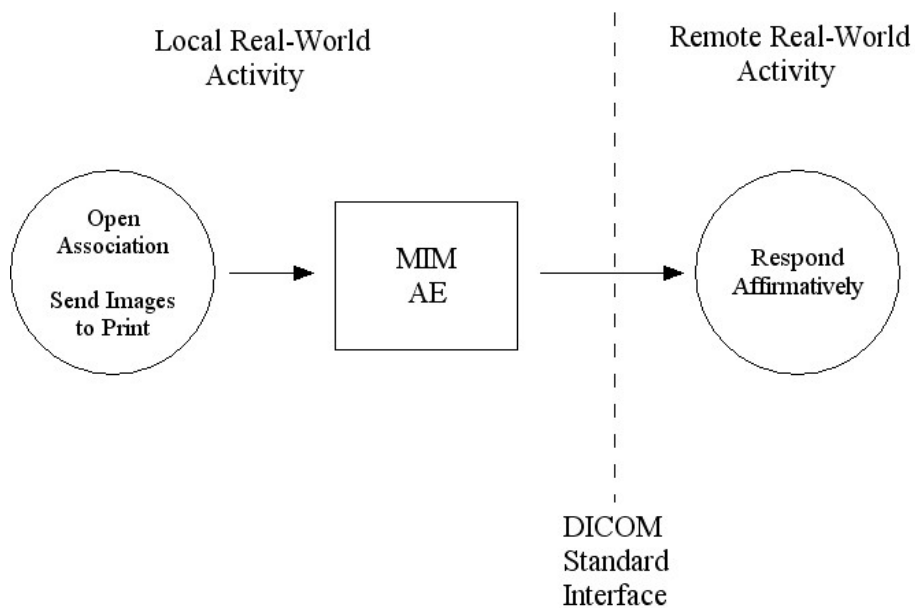
When a remote DICOM AE such as a medical scanner or Picture Archiving and Communications System (PACS) selects a number of files to send to MIM acting as the local DICOM AE, a DICOM association is initiated. The local AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, information as to the local AE's capabilities are communicated back to the remote AE, and the agreed upon transaction is started. The Real-World activity is that the files from the remote AE are stored to the local AE in a manner specified within MIM.

6.1.2 Application Flow Diagram – Store

If a remote DICOM AE wishes to verify that the MIM DICOM server is running at a site, it may initiate a verification request. MIM uses the same criteria for accepting or denying the association request. If accepted, MIM replies to the remote AE that it is capable of accepting associations.

When the user of the MIM software wishes to print images to a DICOM-enabled printer, a DICOM association is initiated. Provided the remote AE accepts the association, MIM will then send the images and send an N-ACTION action request. If everything works properly, the remote AE will respond affirmatively to the N-ACTION.

6.1.3 Application Flow Diagram – Print



6.2 Functional Definitions of AE's

MIM will act as a Service Class Provider (SCP) for both the Storage Service Class and the Verification Service Class. MIM receives images from remote DICOM AE's and stores them locally. All images transmitted using the C-STORE Service Class will be stored to a user-defined location in their entirety, with all private data elements remaining intact. Files are stored with the meta-header information defined within Part

10 of the DICOM 3.0 standard. Any verification requests received using the C-ECHO Service Class will be responded to.

6.3 Sequencing of Real-World Activities

The MIM DICOM Application Entity waits for association requests by listening on a specified TCP/IP port.

7 AE Specifications

The MIM application acts as a single Application Entity. The Application Entity name is configurable through the MIM application and a configuration file.

7.1 MIM Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

SOP Name	SOP Class UID
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Print Job SOP Class	1.2.840.10008.5.1.1.14
Printer SOP Class	1.2.840.10008.5.1.1.15
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2

And SOP Classes as an SCP:

SOP Name	SOP Class UID
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2

7.1.1 Association Acceptance Policies

7.1.1.1 General

This implementation will generally establish one association (connection) per SOP interaction, such as, Ping-Echo, Store (“put”), Find (query for patient, study or image directories) and Move (Retrieve). The association is closed at the completion of each interaction. The association will be aborted if the SOP class is not supported.

The Process Data Unit (PDU) describes the data segment with which two AE’s communicate. The maximum allowable size of the PDU to be transferred between the remote AE and MIM is negotiated at association establishment time.

The maximum PDU size accepted by MIM is: Maximum PDU Accepted 128 Kbytes

The maximum PDU size offered by MIM during the DICOM Association negotiation process is: Maximum PDU Offered 128 Kbytes

7.1.1.2 Number of Associations

MIM is able to accept only single associations with a single remote DICOM device.

7.1.1.3 Asynchronous Nature

Asynchronous mode of operation is not supported. All operations will be performed synchronously.

7.1.1.4 Implementation Identifying Information

MIM will present a single Implementation Class UID and Implementation Version:

Implementation UID:	1.2.826.0.1.3680043.2.419.1
Implementation Version:	MIM <major>.<minor>.<release>.<build>

7.1.2 Association Initiation by Real-World

7.1.2.1 Real-World Activity 1

7.1.2.1.1 Association Real-World Activity

When a DICOM association is detected, the association is first checked for validity and verification of the remote AE's ability to initiate an association with MIM. The sequences of activities are:

MIM checks the remote AE's association for the validity of the DICOM Application Context Name describing the version of the DICOM 3.0 standard, which the remote AE is utilizing. Currently only the Unique Identifier 1.2.840.10008.3.1.1.1 describing the Application Context Name is specified within the DICOM 3.0 standard. If not present or different from the above, the association will be rejected.

7.1.2.1.2 Proposed Presentation Contexts

Any of the Presentation Contexts shown in the following table are accepted by MIM and MIMviewer.

Transfer Syntax Table	
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
JPEG Baseline (Process 1)	1.2.840.10008.1.4.50
JPEG Extended (Process 2 & 4)	1.2.840.10008.1.4.51
JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.4.80
JPEG-LS Lossy (Near-Lossless) Image Compression	1.2.840.10008.1.4.81
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.4.90
JPEG 2000 Image Compression (Lossless or Lossy)	1.2.840.10008.1.4.91

Contexts Accepted for Viewing with Above Transfer Syntax as SCP

Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Ultrasound Image Storage (MIM Only)	1.2.840.10008.5.1.4.1.1.6.1
Computed Radiography Image Storage (MIM Only)	1.2.840.10008.5.1.4.1.1
RT Structure Set Storage (MIM Only)	1.2.840.10008.5.1.4.1.1.481.3
Spatial Registration Storage (MIM Only)	1.2.840.10008.5.1.4.1.1.66.1

Contexts Accepted for Sending with Implicit VR Transfer Syntax as SCU	
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1

7.1.2.1.2.1 Specific Conformance for C-ECHO

MIM provides standard conformance to the DICOM Verification Service Class.

7.1.2.1.2.2 Specific Conformance for C-STORE

MIM conforms to the SOP's of the Storage Service Class at Level 2 (full). No elements are dropped or coerced. When a successful C-STORE operation has completed, MIM will return a successful operation C-STORE Response. If a C-STORE operation cannot be completed successfully, the C-STORE Response will contain a status code defining the reason for the failure, as well as whether the failure was transient or permanent. The possible C-STORE Response status codes are given below:

0x0000: Successful Operation.

0xA700: Out of Resources. This may be due to insufficient disk space, too many current sessions, or lack of available memory. It is considered a transient error, meaning that the Remote DICOM AE should re-attempt the C-STORE event as some later time.

0xC000: Command Not Understood. This means that MIM was unable to parse the incoming DICOM file successfully.

7.1.2.1.2.3 Specific Conformance for C-FIND and C-STORE

The operator queries a Remote database by clicking on the file menu item Query DICOM Files... A new window appears (known as the Query DICOM Window) on the screen(s). The operator is able to select a remote location to query and the parameters to narrow the search criteria. Upon a successful query, the list of patient studies will be updated. Then, the operator can select one or several Patient/Study items to initiate either a transfer of all Patient/Study images or can initiate a new query for additional information regarding the series of each study. Upon a successful query, the list of Series will be updated. Then, the operator can select one or several Series Items to initiate either a transfer of all series images or can initiate a new query for additional information regarding the images of each series. Upon a successful query, the list of Images will be updated. Finally, the operator can select one or several Image Items to initiate a transfer of the selected images.

These operations will cause:

The DICOM SERVER AE to initiate a DICOM association.

The DICOM SERVER AE to emit a C-FIND request to get a list of patients regarding the criteria listed below, then to get the selected studies, series or images.

The DICOM SERVER AE to emit a C-MOVE request to specify a selected list of Patient Folders/Studies/Series/Images to be sent by the Remote Host to the MIM storage class provider.

Additionally, a remote operator may query the MIM C-FIND/C-MOVE SCP, specifying the search parameters, and then upon a successful query request the specified items be transferred to the AE specified in the C-MOVE request. Upon successful MOVE request, the MIM C-STORE SCP will transfer the items to the specified AE.

C-FIND Context Table as SCU/SCP	
Abstract Syntax	Transfer Syntax
FIND Patient Root Query Retrieve Information Model	1.2.840.10008.5.1.4.1.2.1.1
FIND Study Root Query Retrieve Information Model	1.2.840.10008.5.1.4.1.2.2.1
FIND Patient Study Only Query Retrieve Information Model	1.2.840.10008.5.1.4.1.2.3.1

C-MOVE Context Table as SCU/SCP	SOP Class UID
Abstract Syntax	Transfer Syntax
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1

7.1.2.1.3 Presentation Context Acceptance Criterion

The application entity will accept all presentation contexts which contain one of the supported SOP classes and one of the supported transfer syntaxes.

7.1.2.1.4 Transfer Syntax Selection Policies

The default Implicit Little Endian Transfer Syntax will always be supported for each SOP Class. While a Transfer Syntax may be negotiated for storing image information to some other non-standard format, the Transfer Syntax used to encode all non-image data will be Explicit Value Representation (VR) Little Endian, as per the DICOM standard.

8 Communication Profiles

MIM provides DICOM 3.0 TCP/IP Network Communication Support as defined in Part 8 of the Standard.

8.1 Supported Communication Stacks (Parts 8, 9)

MIM provides DICOM 3.0 TCP/IP Network Communication Support as defined in PS 3.8.

8.2 TCP/IP Stack

MIM inherits the TCP/IP stack from the Windows OS on which it is running.

8.2.1 Physical Media Support

MIM is indifferent to the physical medium over which TCP/IP executes.

9 Extensions/Specializations/Privatizations

Not Applicable.

10 Configuration

The configuration screen within MIM for DICOM Server Configuration and DICOM Location Configuration saves the DICOM configuration data in text configuration files under the MIM installation directory.

10.1.1 AE Title/Presentation Address Mapping

The configurable MIM DICOM server AE_TITLE is AE_MIM and the configurable port is defined as 4008. MIM DICOM server is open for anonymous connections.

10.1.2 Configurable Parameters

A timer called the Association Request / Reject / Release Timer (ARTIM) is used for making sure that DICOM Associations do not stay in an indeterminate state for longer than a user specified amount of time. This can happen when the physical connection is disrupted, or there has been a problem with a local or remote application. When the ARTIM timer expires, this indicates that an association is no longer valid and the association is automatically terminated. The maximum length of the data units used by two DICOM Application Entities to communicate, called the Maximum Process Data Unit (PDU) size, can also be specified. The default value is 16 Kbytes in size, and can range from 4 - 128 Kbytes. You should refer to the DICOM Conformance Statements of other devices with which MIM will be communicating to determine the optimum Maximum PDU Size.

11 Support of Extended Character Sets

Extended character sets are not directly supported.

12 Codes and Controlled Terminology

Not Applicable.

13 Security Profiles

Not Applicable.