

# **DigitizingStation**

## **DICOM V3.0 Conformance Statement**

**Copyright© 2004 by image diagnost GmbH**

© Image Diagnost International GmbH

Reproduction of this document without prior written approval is prohibited.  
Image diagnost reserves the right to revise this manual

DICOM MergeCOM3 Advanced Integrator's Tool Kit  
by Merge Technologies, Inc.

Image Diagnost International GmbH  
Balanstraße 57  
81541 München, Germany



## Document Versions

<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Changes</b>
1.00	04-Nov-03	Peter Heinlein	First Draft
1.10	10-Sept-04	Peter Heinlein	Minor corrections

# Table of Contents

<b>0</b>	<b>INTRODUCTION .....</b>	<b>6</b>
<b>0</b>	<b>IMPLEMENTATION MODEL .....</b>	<b>7</b>
0.1	APPLICATION DATA FLOW DIAGRAM .....	7
0.2	FUNCTIONAL DEFINITION OF APPLICATION ENTITIES (AE).....	8
0.3	SEQUENCING OF REAL-WORLD ACTIVITIES .....	8
<b>1</b>	<b>AE SPECIFICATIONS.....</b>	<b>9</b>
1.1	WORKLIST AE.....	9
1.1.1	Association establishment policies .....	9
1.1.1.1	General .....	9
1.1.1.2	Number of associations .....	9
1.1.1.3	Asynchronous nature .....	9
1.1.1.4	Implementation identifying information .....	9
1.1.2	Association initiation by real-world activity.....	9
1.1.2.1	Real-world activity: "Retrieve Scheduled Patient information".....	9
1.1.2.1.1	Associated real-world activity for "Retrieve Scheduled Patient information".....	9
1.1.2.1.2	Proposed presentation contexts for "Retrieve Scheduled Patient information".....	9
1.1.3	Association Acceptance Policy .....	10
1.2	NETWORK AE .....	11
1.2.1	Association establishment policies .....	11
1.2.1.1	General .....	11
1.2.1.2	Number of associations .....	11
1.2.1.3	Asynchronous nature .....	11
1.2.1.4	Implementation identifying information .....	11
1.2.2	Association initiation by real-world activity.....	11
1.2.2.1	Real-world activity: "Send Images".....	11
1.2.2.1.1	Associated real-world activity for "Send Images".....	11
1.2.2.1.2	Proposed presentation contexts for "Send Images".....	11
1.2.3	Association Acceptance Policy .....	12
1.3	MEDIA INTERCHANGE AE .....	12
1.3.1	Introduction .....	12
1.3.2	Implementation Model .....	12
1.3.2.1	Application Data Flow Diagram .....	12
1.3.3	Functional definition of the Media Interchange AE .....	12
1.3.4	File Meta Information For Implementation Class And Version.....	13
1.3.5	AE SPECIFICATION .....	13
1.3.5.1	Media Interchange AE Specification.....	13
1.3.5.2	File Meta Information for the Application Entity .....	13
1.3.5.3	Real world activities for the Media Interchange AE .....	13
1.3.5.3.1	Display Directory .....	13
1.3.5.3.2	Real world activity "CD-R burning" .....	13
1.3.5.3.3	Real world activity "CD-R/CDROM reading".....	14
1.3.6	Augmented And Private Application Profiles .....	15
1.3.7	Extensions, Specializations And Privatizations Of SOP Classes And Transfer Syntaxes .....	15
<b>2</b>	<b>COMMUNICATION PROFILES .....</b>	<b>16</b>
2.1	SUPPORTED COMMUNICATION STACKS .....	16
2.2	TCP/IP STACK.....	16
2.2.1	Physical Media Support .....	16
<b>3</b>	<b>EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS .....</b>	<b>16</b>

3.1	STANDARD EXTENDED/SPECIALIZED/PRIVATE SOPs .....	16
3.2	PRIVATE TRANSFER SYNTAXES .....	16
<b>4</b>	<b>CONFIGURATION .....</b>	<b>16</b>
4.1	AE TITLE/PRESENTATION ADDRESS MAPPING.....	16
4.2	CONFIGURABLE PARAMETERS.....	16
<b>5</b>	<b>SUPPORT OF EXTENDED CHARACTER SETS.....</b>	<b>17</b>

## 0 Introduction

This is a conformance statement for the “DigitizingStation” for Film-screen Mammography. Digitizing Station is a dedicated system to create Secondary Capture DICOM documents from film-screen mammographs. MERGECOM-3™ Advanced Integrator’s Tool Kit is used to implement and provide DICOM services.

### 0.1 Definition, Acronyms, Abbreviations

This document uses the following abbreviations.

AE	Application Entity
CAD	Computer Aided Detection
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
IOD	Information Object Definition
LUT	Look-up Table
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
SR	Structured Report
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
VR	Value Representation

# 1 Implementation model

## 1.1 Application data flow diagram

The application data flow models for the DigitizingStation are shown in the following Illustration:

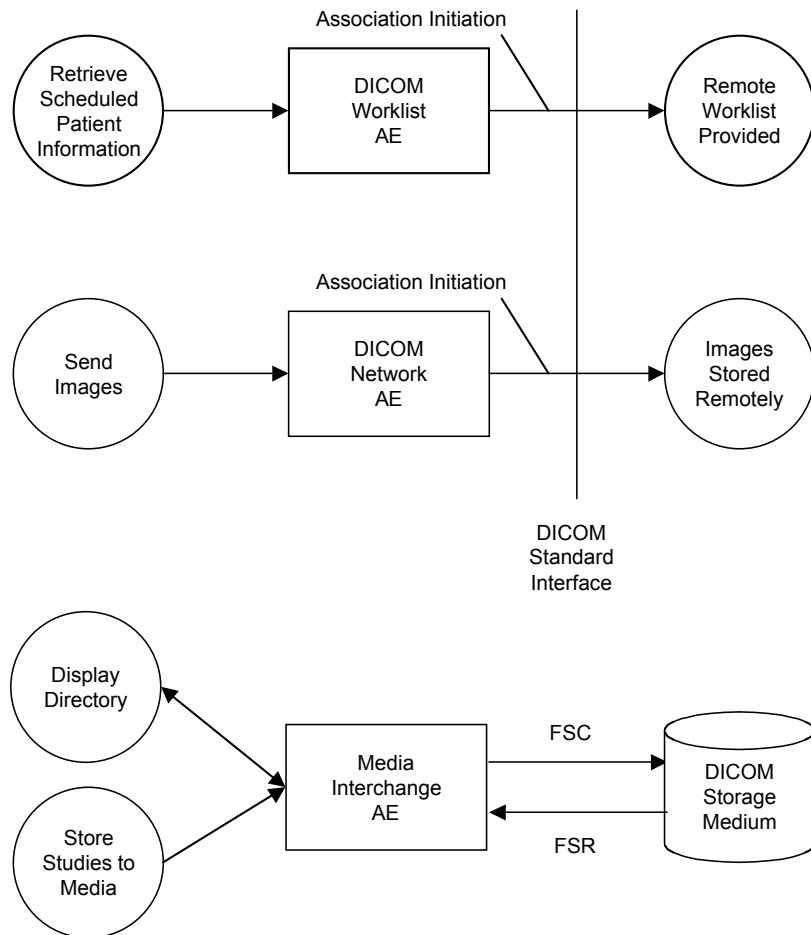


Figure 1.1-1 – Application data flow diagram

The DigitizingStation application is composed of the following Application Entities (AE): The DICOM Worklist Application Entity, the DICOM Network AE, and the DICOM Media Interchange AE.

The DICOM Worklist Application Entity provides DICOM protocol communication with remote DICOM Modality Worklist Servers. The DICOM Worklist AE is activated when the user opens the worklist tab of the DigitizingStation.

The DICOM Worklist AE provides the following Real World Activities:

- Retrieve scheduled patient information from a remote Worklist Server (DICOM General Purpose Worklist SCU).

The **DICOM Network** Application Entity provides DICOM protocol communication for image documents.

The DICOM Network AE provides the following Real World Activities:

- Send images and reports to remote DICOM Storage stations (DICOM Store SCU).

The **DICOM Media Interchange** Application Entity is activated when the user requests to browse a DICOM Media.

The DICOM Media Interchange AE provides the following Real World Activities:

- Store studies to a DICOM Storage Medium.

Possible Media are local disk, CD or DVD.

## 1.2 Functional definition of Application Entities (AE)

### **Worklist AE:**

When the user clicks on the “Worklist” tab in the patient selection window, he can search in the scheduled procedure steps inserted in a remote RIS (supporting Modality Worklist SCP using different filters (e.g. scheduled station, scheduled date)). Then the scheduled procedure steps are shown in a list control contained in the dialog box. The user can select one item and start to review the corresponding patient.

### **Network AE:**

The DICOM Network AE initiates the following operations:

- Initiate a DICOM association to send DICOM SOP Classes (secondary capture images) to a remote DICOM AE.

### **Media Interchange AE:**

The DICOM **Media Interchange AE** initiates the following operations:

- When the user select a DICOM CD as a destination, and sends images to this destination, then the Media Interchange AE appends the images to the selected DICOM CD media.

## 1.3 Sequencing of real-world activities

Not applicable.



## 2 AE specifications

### 2.1 Worklist AE

The Worklist AE, in conjunction with MergeCOM-3, provides Standard Conformance to the following DICOM V3.0 Service Object Pair (SOP) Class as a Modality Worklist Service Class User:

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

#### 2.1.1 Association establishment policies

##### 2.1.1.1 General

The WORKLIST AE will initiate an association as a Modality Worklist Service Class User requesting Application Entity Title and patient data.

The PDU size is 28672 bytes.

##### 2.1.1.2 Number of associations

The WORKLIST AE allows a single association for association initiation.

##### 2.1.1.3 Asynchronous nature

The WORKLIST AE does not support asynchronous communication (multiple outstanding transactions over a single association).

##### 2.1.1.4 Implementation identifying information

The Implementation Class Unique Identifier (UID) for the WORKLIST AE is:

Implementation UID	1.2.276.0.69.25.1.1
--------------------	---------------------

#### 2.1.2 Association initiation by real-world activity

There is only one real world activity which initiates association for the WORKLIST AE:

1. Retrieve Scheduled Patient information

##### 2.1.2.1 Real-world activity: "Retrieve Scheduled Patient information"

###### 2.1.2.1.1 Associated real-world activity for "Retrieve Scheduled Patient information"

When the user clicks on the "Worklist" tab from the DigitizingStation and then on the "Refresh" button, the Worklist AE initiates an association for the appropriate Modality Worklist Service Class that corresponds to the set of data requested to be transferred. Then the Worklist AE performs a C-FIND and it is closed when all the response items are received from the remote SCP.

###### 2.1.2.1.2 Proposed presentation contexts for "Retrieve Scheduled Patient information"

The presentation contexts that are proposed by WORKLIST AE for the FIND operation are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Find	1.2.840.10008.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

#### 2.1.2.1.2.1 SOP Specific Conformance Statement for Modality Worklist Find

WORKLIST AE provides standard conformance as an SCU to the Modality Worklist Service Class and uses the following elements for this SOP class.:

Description / Name	Tag	Matching Key Type	Return Key Type
<b>SOP Common</b>			
Specific Character Set	(0008,0005)	O	1C
<b>Scheduled Procedure Step</b>			
Scheduled Procedure Step Sequence	(0040,0100)	R	1
>Scheduled Station AE Title	(0040,0001)	R	1
>Scheduled Procedure Step Start Date	(0040,0002)	R	1
>Scheduled Procedure Step Start Time	(0040,0002)	R	1
>Modality	(0008,0060)	R	1
>Scheduled Performing Physician's Name	(0040,0006)	R	2
>Scheduled Procedure Step Description	(0040,0007)	O	1C
>Scheduled Station Name	(0040,0010)	O	2
>Scheduled Procedure Step ID	(0040,0009)	O	1
<b>Requested Procedure</b>			
Requested Procedure ID	(0040,1001)	O	1
Requested Procedure Description	(0032,1060)	O	1C
Study Instance UID	(0020,000D)	O	1
<b>Imaging Service Request</b>			
Accession Number	(0008,0050)	O	2
Referring Physician's Name	(0008,0090)	O	2
<b>Patient Identification</b>			
Patient's Name	(0010,0010)	R	1
Patient ID	(0010,0020)	R	1
<b>Patient Demographic</b>			
Patient's Birth Date	(0010,0030)	O	2
Patient's Sex	(0010,0040)	O	2

### 2.1.3 Association Acceptance Policy

WORKLIST AE does not respond to attempts by a remote AE to open an association.

## 2.2 NETWORK AE

The Network AE, in conjunction with MergeCOM-3, provides Standard Conformance to the following DICOM V3.0 Service Object Pair (SOP) Classes as a Service Class User (SCU):

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Verification SOP Class	1.2.840.10008.1.1

### 2.2.1 Association establishment policies

#### 2.2.1.1 General

The Network AE will initiate an association as an SCU of Storage Services when

- a local operator requests to send images or structured reports over the network to a remote Storage Service Class provider.

The PDU size is 28672 bytes.

#### 2.2.1.2 Number of associations

The Network AE opens one Store association for each image to be sent to the storage station.

#### 2.2.1.3 Asynchronous nature

The Network AE does not support asynchronous communication (multiple outstanding transactions over a single association).

#### 2.2.1.4 Implementation identifying information

The Implementation Class Unique Identifier (UID) for the NETWORK AE is:

Implementation UID	1.2.276.0.69.25.1.1
--------------------	---------------------

### 2.2.2 Association initiation by real-world activity

#### 2.2.2.1 Real-world activity: "Send Images"

##### 2.2.2.1.1 Associated real-world activity for "Send Images"

When the user has composed some studies/series/images, he clicks on the "Send" button of the DigitizingStation. The NETWORK AE initiates an association for each image contained in the selected study/series/image list. Every association is closed when the image has been sent (successfully or not) to the remote SCP. The NETWORK AE supports JPEG 2000 compression. Compression can be configured in the DigitizingStation and is invoked automatically.

##### 2.2.2.1.2 Proposed presentation contexts for "Send Images"

The presentation contexts that are proposed by NETWORK AE for the "Manual Storing" real world activity are:

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		

#### 2.2.2.1.2.1 SOP Specific Conformance Statement for Secondary Capture Image Storage SOP Class

The NETWORK AE will react in the following ways to the different C-STORE response status:

- Refused: the SCU will show the FAILED status for the image to be sent.
- Error: the SCU will show the FAILED status for the image to be sent.
- Warning: the SCU will show the SUCCESS status for the image to be sent.
- Success: the SCU will show the SUCCESS status for the image to be sent.

NETWORK AE will not attempt any extended negotiation.

### 2.2.3 Association Acceptance Policy

NETWORK AE does not respond to attempts by a remote AE to open an association.

## 2.3 MEDIA INTERCHANGE AE

### 2.3.1 Introduction

The Media Interchange AE, in conjunction with MergeCOM-3, provides Standard Conformance to DICOM V3.0 Media Interchange. Service Object Pair (SOP) Class as File-Set Creator (FSC) and File-Set Reader (FSR).

DigitizingStation provides capabilities to DICOM interchange on CD-Rs (Compact Disc-Recordable), and on CDROMs (Compact Disc Read Only Memory). The DigitizingStation creates and stores Secondary capture (SC) images.

### 2.3.2 Implementation Model

#### 2.3.2.1 Application Data Flow Diagram

Please confer to Figure 1.1.1.

### 2.3.3 Functional definition of the Media Interchange AE

The Media Interchange AE supports the following features:

- access to patient demographics and pixel data in the local database.
- generate a DICOM File Set (FSC) on the local disk to be burned on a CD-R.
- read a DICOM File Set (FSR) on a CD-R/CDROM or from local disk for showing the media directory.
- read a DICOM File Set (FSR) on a CD-R/CDROM or from local disk for importing the selected studies.

### 2.3.4 File Meta Information For Implementation Class And Version

File Meta Information Version	1
Implementation UID	1.2.276.0.69.25.1.1

### 2.3.5 AE SPECIFICATION

#### 2.3.5.1 Media Interchange AE Specification

The DICOM CDR/CDROM SERVER Application Entity provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The application Profiles and roles are listed below.

Application Profiles Supported	Real World Activity	Role	SC Option
STD-AP	CD-R burning	FSC	Interchange
	CD-R/CDROM reading	FSR	Interchange

#### 2.3.5.2 File Meta Information for the Application Entity

File Meta Information Version	1
-------------------------------	---

#### 2.3.5.3 Real world activities for the Media Interchange AE

##### 2.3.5.3.1 Display Directory

##### 2.3.5.3.2 Real world activity "CD-R burning"

In this fashion the Media Interchange AE acts as File-Set Creator (FSC) using the Interchange Option. After selecting at least one study the user can create a new DICOM file set by first clicking the DICOM CD button afterwards the Burn CD button. The Directory Information Module is always created and the Basic Directory IOD Definition Model is made from standard tags either of type 1 or 2 and from the Study Instance UID tag which is of type 1C.

##### 2.3.5.3.2.1 Media Storage Application Profile

Please see the 2.3.2.1 Section.

### 2.3.5.3.2.2 Options

Following are the SOP Classes supported by the “CD-burning” activity:

<b>Presentation Context Table</b>				
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>
<b>UID</b>	<b>Name</b>	<b>Name List</b>	<b>UID List</b>	
1.2.840.10008.1.3.10	Media Storage Directory Storage	Explicit VR Little Endian	1.2.840.10008.1.2.1	FSC
1.2.840.10008.5.1.4.1.1 .1.2	Digital Mammography Image Storage - For Processing			
1.2.840.10008.5.1.4.1.1 .1.2.1	Digital Mammography Image Storage - For Presentation			
1.2.840.10008.5.1.4.1.1 .1	Computed Radiography Image Storage			
1.2.840.10008.5.1.4.1.1 .7	Secondary Capture Image Storage			

### 2.3.5.3.3 Real world activity “CD-R/CDROM reading”

In this fashion the Media Interchange acts as File-Set Reader (FSR) using the Interchange Option and the application entity supports any Basic Directory IOD made from tags either of type 1 (1C) or 2.

The user can browse a DICOM file set from a CD-R/CDROM by first clicking the DICOM CD button and then the Import CD button. At this point a new Dialog Window is displayed on the screen where there is the list of the studies burned on the CD-R/CDROM: the user may select one or more studies to import into the local database by clicking the Import Studies button.

#### 2.3.5.3.3.1 Media Storage Application Profile

Please see the 2.4.2.1 Section.

### 2.3.5.3.3.2 Options

Following are the SOP Classes supported by the “CD-R/CDROM reading” activity:

Presentation Context Table				
Abstract Syntax		Transfer Syntax		Role
UID	Name	Name List	UID List	
1.2.840.10008.1.3.10	Media Storage Directory Storage	Explicit VR Little Endian	1.2.840.10008.1.2.1	FSC
1.2.840.10008.5.1.4.1.1 .1.2	Digital Mammography Image Storage - For Processing			
1.2.840.10008.5.1.4.1.1 .1.2.1	Digital Mammography Image Storage - For Presentation			
1.2.840.10008.5.1.4.1.1 .1	Computed Radiography Image Storage			
1.2.840.10008.5.1.4.1.1 .7	Secondary Capture Image Storage			

### 2.3.6 Augmented And Private Application Profiles

No augmented or private application profiles are implemented by this application entity.

### 2.3.7 Extensions, Specializations And Privatizations Of SOP Classes And Transfer Syntaxes

No extensions, specialization or privatizations of SOP classes or transfer syntaxes are implemented by this application entity

## **3 Communication profiles**

### **3.1 Supported Communication Stacks**

DigitizingStation provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8.

### **3.2 TCP/IP Stack**

DigitizingStation uses the MergeCOM-3 Advanced DICOM Tool Kit to communicate over the TCP/IP protocol stack on any physical interconnection media supporting the TCP/IP stack. The tool kit inherits the TCP/IP stack from the operating system upon which it executes.

#### **3.2.1 Physical Media Support**

The DigitizingStation is indifferent to the physical medium over which TCP/IP executes; it inherits this from the operating system on which it exists.

## **4 Extensions/specializations/privatizations**

### **4.1 Standard extended/specialized/private SOPs**

None supported.

### **4.2 Private Transfer Syntaxes**

None supported.

## **5 Configuration**

The DICOM configuration is set by a image diagnost Field Engineer. The operator may set the following parameters:

- DigitizingStation AE Title and receive SCP Port.
- Adding or removing Destinations (DICOM Store, DICOM Media).
- Configuration of DICOM Modality Worklist Server.

### **5.1 AE title/presentation address mapping**

Before communicating with a remote AE (NETWORK AE) the operator must register it by using the DigitizingStation DICOM configuration. This task requires to specify the following information:

1. Remote AE Title
2. Remote IP Address
3. Listening TCP/IP Port Number

These information are used by the MergeCOM-3 Advanced DICOM Tool Kit to communicate over the TCP/IP protocol stack.

### **5.2 Configurable parameters**

NETWORK AE:

For this AE (local), the following fields are configurable:

- Local AE Title



- Local IP Address

Note: The local Port Number is not applicable because the product is never responding to an association request.

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

Note: All configurations must be performed by an image diagnost Field Engineer.

## **6 Support of extended character sets**

Not supported.