CAD-Server

DICOM V3.0
Conformance Statement

DICOM MergeCOM3 Advanced Integrator's Tool Kit
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Document Versions

Version	Date	Author	Changes
1.00	04-Nov-03	Peter Heinlein	First Draft
1.01	12-Mai-04	Peter Heinlein	Change of Address

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0 Introduction

This is a conformance statement for the “CAD-Server” for Computer-Aided Detection (CAD). The CAD-Server accepts digital mammograms as a Service Class Provider (SCP) of the Storage Service Class, performs CAD and exports CAD results as a Service Class User (SCU) of the Storage Service Class.

The CAD-Server processes images generated from secondary capture or generated from direct digital modalities depending on the license installed.

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 model for the CAD-Server is shown in the following Illustration:

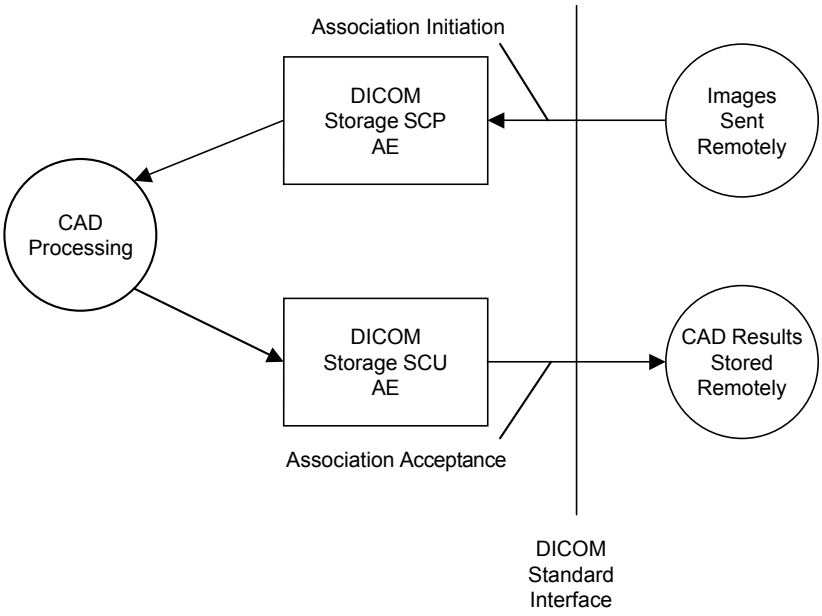

Figure 1.1-1 – Application data flow diagram

The CAD-Server application is composed of the following Application Entities (AE): The DICOM Storage SCP Application Entity and the DICOM Storage SCU AE.

The DICOM **Storage SCP** Application Entity provides DICOM protocol communication for images. The DICOM Storage SCP AE is automatically brought up when the CAD-Server is powered on.

Each image that is acceptable for CAD Processing is passed to CAD Processing. Upon completion of CAD Processing, the CAD results are passed to the DICOM Storage SCU. The Local DICOM Storage SCU is executed to initiate a push of the mammography CAD results to a Remote DICOM Storage SCP.

Images that are accepted by the Local DICOM Storage SCP are stored until CAD processing is completed and the CAD results are exported successfully.

1.2 Functional definition of Application Entities (AE)

DICOM Storage SCP AE

The DICOM Storage SCP AE waits for association requests from Remote AE:

- Answer to DICOM associations transmitting DICOM SOP Classes.

DICOM Storage SCU AE

The DICOM Storage SCU AE supports the following functions:

- Negotiates and establishes DICOM association with remote destination
- Stores DICOM Composite SOP Instance to remote destination

1.3 Sequencing of real-world activities

When CAD processing is triggered by digital images pushed from a remote application:

- The DICOM Storage SCP AE responds to DICOM association initiation, accepts an association and processes C-STORE requests
- It stores the image object to disk, and schedules the image for CAD processing.
- The CAD processing performs a license check and ignores images not suitable for CAD processing. Acceptable images are processed.
- Upon completion of CAD processing, the CAD results are formatted into a DICOM Structured Report (Mammography CAD SR) or equivalent object.
- The Local DICOM Storage SCU is executed, which initiates an association to a remote application and performs a C-STORE containing the structured report or equivalent object.
- The Local DICOM Storage SCU closes the association and exits.

2 AE specifications

2.1 DICOM Storage SCP AE

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

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Verification SOP Class	1.2.840.10008.1.1

2.1.1 Association establishment policies

2.1.1.1 General

The DICOM Storage SCP AE will initiate an association as an SCP of Storage Services when

- a remote SCU requests to send images over the network to the local Storage Service Class provider.

The PDU size is 28672 bytes.

2.1.1.2 Number of associations

For each remote AE, the DICOM Storage SCP AE will only open one association at the same time.

2.1.1.3 Asynchronous nature

The DICOM Storage SCP 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 DICOM Storage SCP AE is:

Implementation UID	1.2.276.0.69.25.1.1

2.1.2 Association initiation by real-world activity

The DICOM Storage SCP AE does not initiate associations.

2.1.3 Association Acceptance Policy

When the DICOM Storage SCP AE accepts an association, it will receive any images transmitted on that association and store the supported SOP Classes on disk. Any Remote DICOM AE can send images to the DICOM Storage SCP AE.

2.1.3.1 Real-world activity: “Receive Images”

The DICOM Storage SCP AE accepts an association when it receives a valid association request from a DICOM Storage SCU. Upon successful completion of storing the images, the real world activity “CAD processing” is triggered.

2.1.3.1.1 Associated real-world activity for “Receive Images”

The DICOM Storage SCP AE waits for any association. No operator is required to receive an image.

2.1.3.1.2 Accepted presentation contexts for “Receive Images”

Presentation Context Table – Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	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		
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	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		
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	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		
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	SCP	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		

2.1.3.1.2.1 SOP Specific DICOM Conformance Statement for Storage SOP Classes

The following attributed are required to be present with a valid value, in order for an image instance to be accepted or CAD processing:

Following are the status codes the Application may send back to the SCU Equipment after performing the requested Storage:

Service Status	Status Codes	Further Meaning	Application Behaviour When receiving Status Codes	Related Fields Processed if received
Refused	A7xx	Out of resources	Indicated that there was not enough space or some other internal resource to store the image. The user should attempt to recovery by removing some images from the MammoAorkstation database	(0000,0902)
Error	0110	Processing Failure	Indicates that an internal system call has failed while processing the image	(0000,0902)
Success	0000			None

Images sent in a JPEG-2000 transfer syntax are decompressed by the DICOM Storage SCP AE.

2.1.3.1.3 Presentation Context Acceptance Criterion

Only known SOP Classes are accepted.

2.2 DICOM Storage SCU AE

The DICOM Storage SCU 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
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50

2.2.1 Association establishment policies

2.2.1.1 General

The DICOM Storage SCU AE will initiate an association as an SCU of Storage Services when CAD Processing is finished, but does not accept associations.

PDU size is 28672 bytes.

2.2.1.2 Number of associations

The DICOM Storage SCU AE opens one Store association for each image to be sent to the storage station. For each remote AE, the DICOM Storage SCU AE will only open one association at the same time.

2.2.1.3 Asynchronous nature

The DICOM Storage SCU 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 DICOM Storage SCU 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 and Reports"

2.2.2.1.1 Associated real-world activity for "Send CAD Results"

When CAD processings is finished, the DICOM Storage SCU AE initiates an association for each image contained in the series. Every association is closed when the image has been sent (successfully or not) to the remote SCP. The DICOM Storage SCU AE supports JPEG 2000 compression. Compression can be configured by a Field Engineer and is invoked automatically.

2.2.2.1.2 Proposed presentation contexts for "Send CAD Results"

The presentation contexts that are proposed by DICOM Storage SCU AE the "Send CAD Results" real world activity are:

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	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		

2.2.2.1.2.1 SOP Specific Conformance Statement for Mammography CAD SR SOP Class

For the Structured Reporting SOP Classes , all Type 1 attributes shall be present with a valid value.

This implementation of the DICOM Storage SCU AE does not support the TID Mammmography CAD Document Template. CAD Results are stored in private attributes.

The DICOM Storage SCU 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.

DICOM Storage SCU AE will not attempt any extended negotiation.

2.2.3 Association Acceptance Policy

DICOM Storage SCU AE does not respond to attempts by a remote AE to open an association.

3 Communication profiles

3.1 Supported Communication Stacks

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

3.2 TCP/IP Stack

CAD-Server 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 CAD-Server 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 Field Engineer. The operator may set the following parameters:

- CAD-Server AE Title and receive SCP Port.
- Configuration of DICOM Store Destination.

5.1 AE title/presentation address mapping

Before communicating with a remote AE (DICOM Storage SCU AE) the administrator must register it in the SCU configuration. This task requires to specify the following information:

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

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

5.2 Configurable parameters

DICOM Storage SCU AE and DICOM Storage SCP AE:

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

- Local AE Title
- Local IP Address

The following fields are configurable for 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.