Telemis-Medical

DICOM Conformance Statement

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Telemis s.a.
Avenue Athena, 2
B-1348 Louvain-la-Neuve
Belgium

Tel. +32-10-48 00 11
Mail info@telemis.com
Web site https://www.telemis.com

About this document

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Contact information

Telemis s.a.
Avenue Athena, 2
B-1348 Louvain-la-Neuve
Belgium

Tel. +32-10-48 00 11
Mail info@telemis.com
Web site https://www.telemis.com

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1 INTRODUCTION

1.1 Intended Audience

The user of this document is involved with system integration and/or software design. We assume that the reader is familiar with the terminology and concepts that are used in the DICOM 3.0 standard.

Readers not familiar with DICOM 3.0 terminology should first read the appropriate parts of the DICOM standard itself, prior to reading this conformance statement.

1.2 Abbreviations and Acronyms

ASCII	American Standard Code for Information Interchange
AE	Application Entity
ANSI	American National Standards Institute
CR	Computed Radiography
CT	Computed Tomography
ECR	European Congress of Radiology
IE	Information Entity
IOD	Information Object Definition
ISO	International Standards Organization
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
SR	Structured Reporting
TCP/IP	Transmission Control Protocol / Internet Protocol
TLS	Transport Layer Security
UID	Unique Identifier
VM	Value Multiplicity
VR	Value Representation

1.3 Scope

This DICOM Conformance Statement documents the conformance of the Telemis-Medical software with the Digital Imaging and Communications in Medicine (DICOM) standard. This document is essential in order to evaluate whether or not another DICOM compliant device can communicate with this software product. This statement is conformant with the recommended format as described in PS 3.2 of the DICOM standard.

1.4 How to use this document

This Conformance Statement consists of the following sections:

2 Implementation model: The first section describes the Implementation Model. It explains the functional relation between the device and the DICOM services. A DICOM service is

implemented on a device by a software process, which is called an “Application Entity” (AE). Each AE has a unique name called the “AE Title” which is used to identify it to other AEs. The AE Title is configurable to avoid two devices with the same name on a network. The “bubble diagram” (Application Data Flow Diagram) shows the interaction of the AE with the outside world across the dashed line, i.e. the DICOM interface. This Application Data Flow Diagram depicts graphically the relationship of the DICOM AE with local functions at the workstation as well as the relationship with external activities.

One should compare this implementation model and its description with the model of the other devices that the Telemis-Medical software will connect to in order to determine connectivity.

3 AE Specifications: Each AE supports one or more Service Object Pair (SOP) classes. A SOP class consists of a combination of an object or information model with specific DICOM services. An example of such a SOP class is the CT Image Storage Class, which consists of the combination of the DICOM C_STORE command with the CT image object. Each of these classes is uniquely identified by an Identification number (UID), which is issued by the NEMA. The role of the AE is specified, which can be a client or server (compare with a speaker or listener). In DICOM terms, this is called a Service Class User or Service Class Provider (SCU or SCP).

In order to interconnect with another device, the SOP classes as well as their role (SCU or SCP) have to be matched, i.e. a SCU has to match a SCP at another device with an identical SOP class. Make sure to compare the UID itself, not the description because there are SOP classes which have the same name, but support a different (newer) object. Each SOP class supports a particular presentation context which is the combination of the SOP Class and the transfer syntax. The transfer syntax defines the encoding of the DICOM basic elements, i.e. its attributes and how the data is represented. The encoding of the data type, or Value Representation (VR), can be done in two ways – implicitly or explicitly. Explicit VR means that the transmitted data will include the VR information along with data and attribute tags. Implicit VR means the VR information will not be included, and the receiving application must determine the VR type from the Attribute Tag.

In addition, the data can be communicated in the Little Endian (Intel) or Big Endian (Motorola, Sparc, MIPS) byte ordering. This means that for certain 16 bit words, the two 8 bit bytes might have to be swapped to be able to interpret the information by a different device. The transfer syntaxes of two devices have to match in order to communicate.

4 Communication Profiles: This section specifies the communication options. There are two levels that have to be compared. The first one is the supported communication stack that the device supports, which usually is the OSI or TCP/IP stack. In addition, the physical media has to match. Note that in general, matching physical media can be achieved by standard off-the-shelf devices. For example, if one device supports standard Ethernet 10BaseT, it can be bridged to a Fast Ethernet, ATM, or whatever is supported.

5 Extensions/Specializations/Privatizations: This section specifies implementation specific extensions to the Standard SOP classes as well as so-called specialized and private SOP classes, which are essentially proprietary services that make use of the underlying DICOM infrastructure such as DICOM network communication and association negotiation.

6 Configuration: This section specifies how the system configuration of an implementation affects its behavior at the DICOM network interface. DICOM implementations often support a multitude of configuration options which might be helpful in solving communication or interoperability problems.

7 Support of Extended Character Sets: DICOM supports a large number of character sets, including ASCII (the default), some of the ISO 8859 character sets for use with most European languages and a number of character sets for use in the Far East. This section of the conformance statement specifies the character sets that an implementation actually supports. The supported character sets should be compared carefully if extended character sets are to be used, since the inability of a system to handle extended characters might affect the way names and identifiers can be entered, displayed, queried etc.

1.5 Warning to the reader

If another device matches this Conformance Statement based on the comparison with its own Conformance Statement, there is a chance, but no guarantee that they interoperate. DICOM only deals with communication; it is not a standard which specifies what is needed for certain applications to run on a device.

2 Implementation model

The *Telemis-Medical* system uses the protocol to enable the following functions:

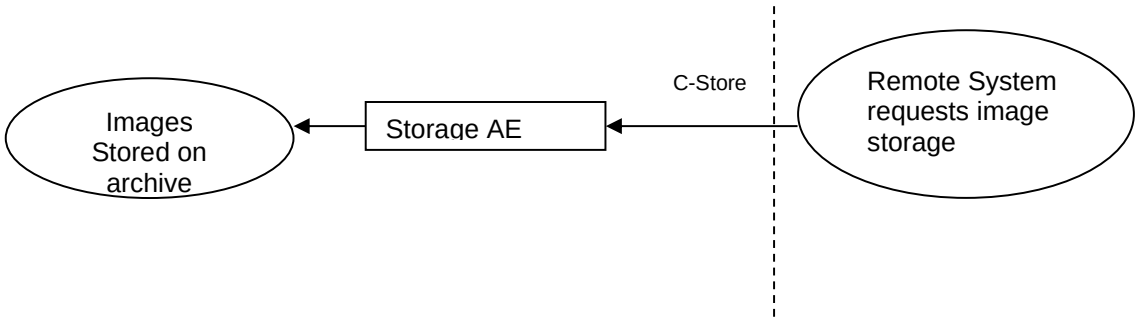
- Receiving of images for storage in its archive
- Retrieving images from its archive
- Answering to queries on data stored in its archive
- Querying other systems on data stored
- Retrieving images from other systems to store them in its archive.
- Receiving Modality Performed Procedure Step information
- Send print images to a DICOM-compatible printer/laser camera

The system provides a number of DICOM Standard with separate DICOM Application Entities (AEs):

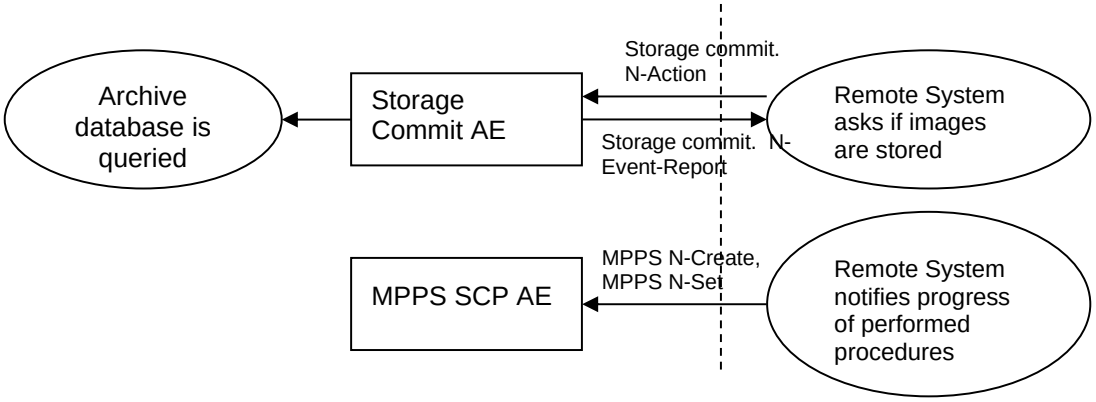
- SOP Instance Storage Application Entity (Storage SCP AE)
- SOP Instance Commitment Application Entity (Storage Commit SCP AE)
- Information Query and Data Retrieve Application Entity as an SCU (Q/R SCU AE)
- Information Query and Data Retrieve Application Entity as an SCP (Q/R SCP AE)
- Modality Procedure Step Application Entity as an SCP (MPPS SCP AE)
- Dicom Print Entity as an SCU (PRINT SCU AE)
- Dicom Image Availability Notification SCU (IAN SCU AE)

2.1 Application Data Flow Diagram

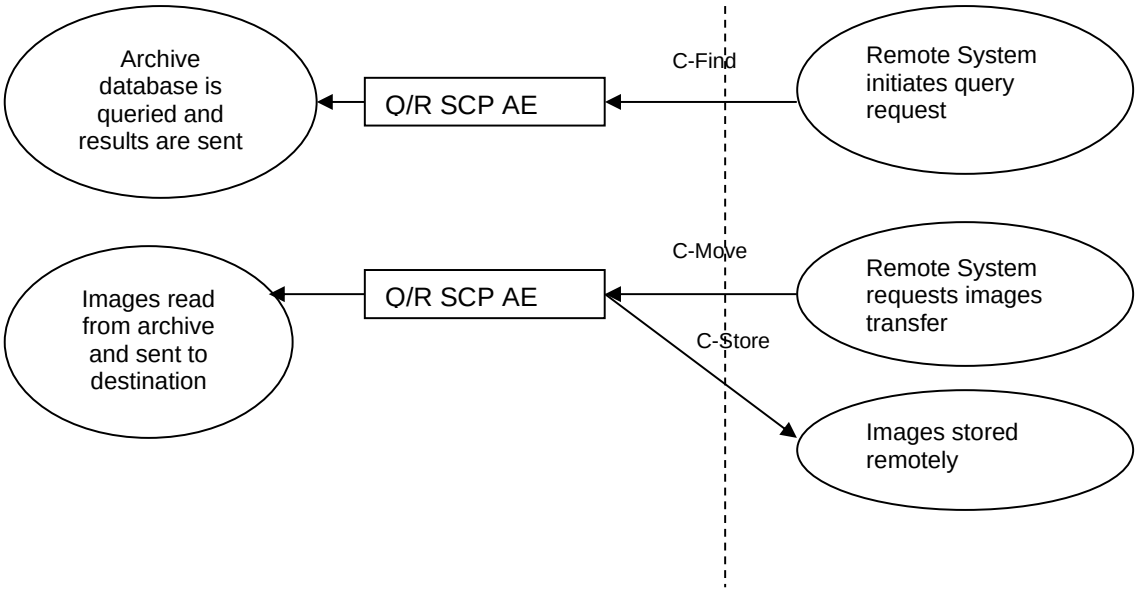
- Storage AE



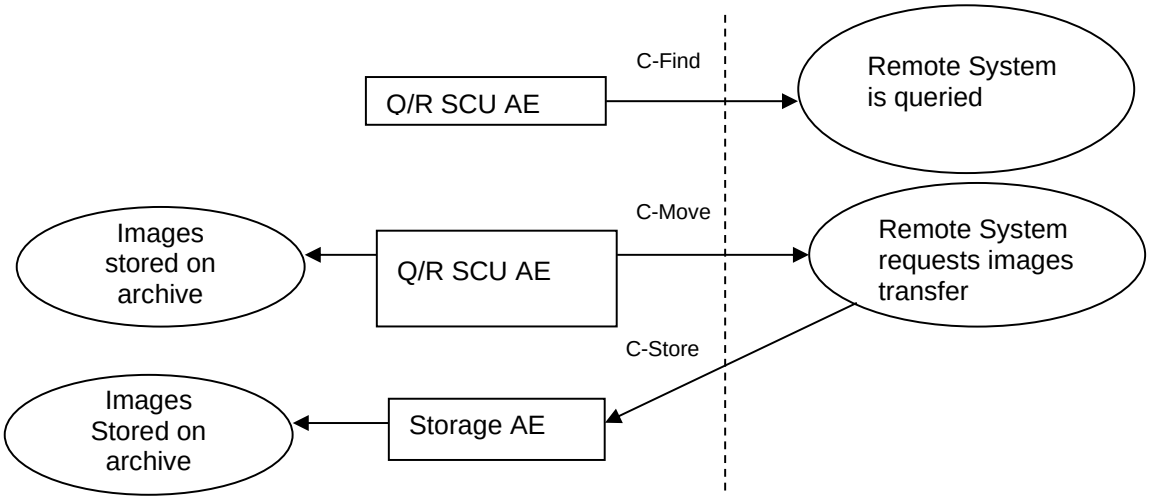
- Storage commit AE



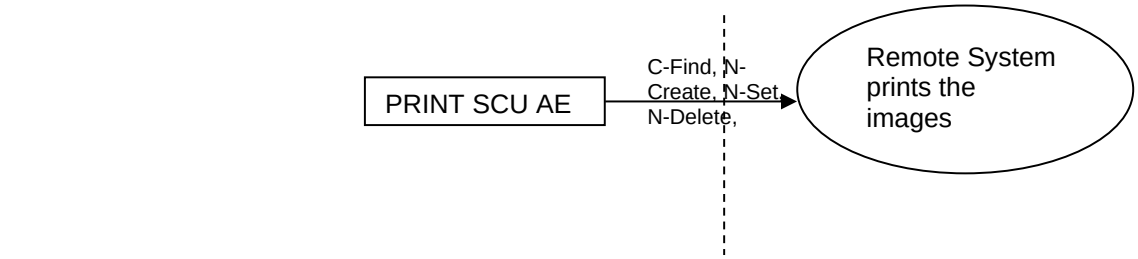
- Q/R SCP AE



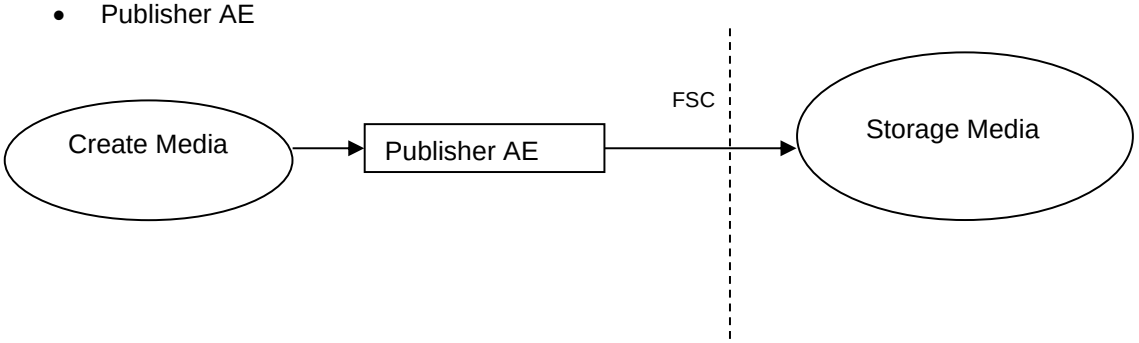
- Q/R SCP AE



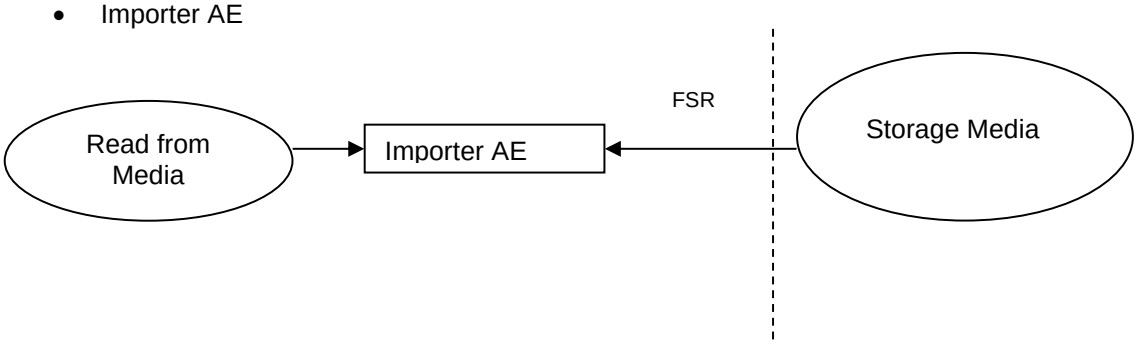
- Print AE



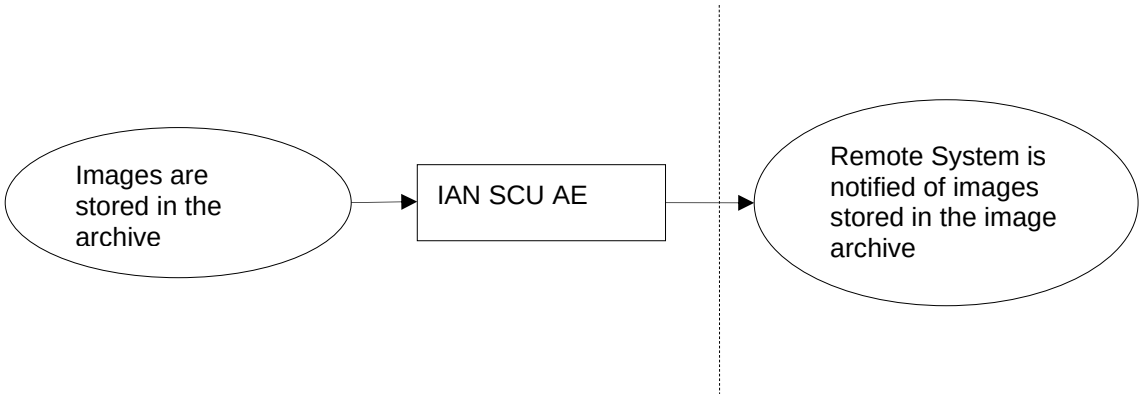
- Publisher AE



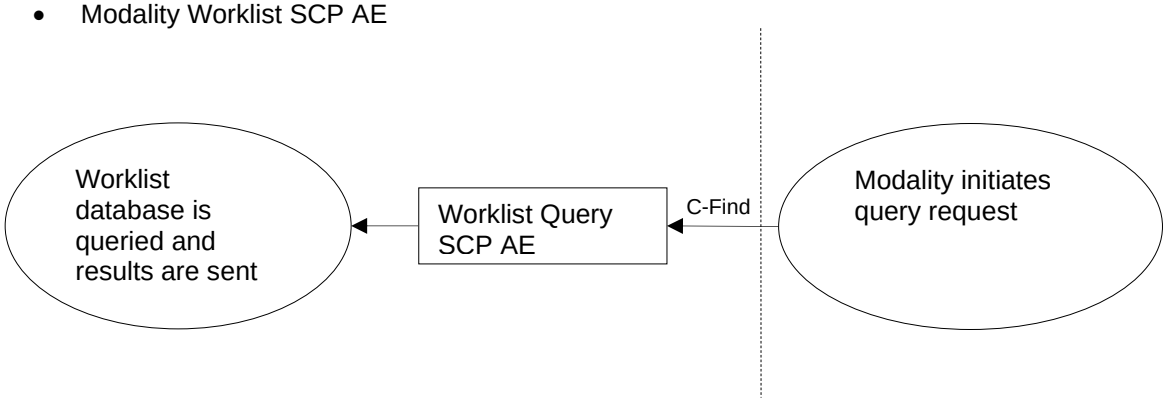
- Importer AE



- IAN SCU AE



- Modality Worklist SCP AE



2.2 Functional Definitions of AE's

2.2.1 Storage AE

Storage AE waits another application to connect at the presentation address configured for its AE title. It will accept associations with Presentation Contexts for Service Object Pair (SOP) classes of the Storage and Verification Service Classes. The Storage AE will receive images and store them into its archive.

2.2.2 Storage Commit AE

Storage Commit AE waits another application to connect at the presentation address configured for its AE title. It will accept associations with Presentation Contexts for Service Object Pair (SOP) classes of the Storage Commitment and Verification Service Classes. The Storage AE will receive images and store them into its archive. The Storage Commit AE will answer to the request by returning the corresponding list of documents stored in its archive

2.2.3 Q/R SCP AE

Q/R SCP AE waits for another application to connect at the presentation address configured for its AE title. It will accept associations with Presentation Contexts for Service Object Pair (SOP) classes of the Query-Retrieve and Verification Service Classes. It will query its archive database according to the request's parameters, and will send the results to the issuer. When performing Query-Retrieve Service Class (C-MOVE), it will issue a C-STORE (to the target AE) for every image in the request.

2.2.4 Q/R SCU AE

Q/R SCU AE can initiate Query-Retrieve Service Class as an SCU. It first queries information with a C-FIND and initiates a store of the corresponding images with a C-MOVE.

2.2.5 MPPS SCP AE

MPPS SCP AE waits for another application to connect at the presentation address configured for its AE title. It will accept associations with Presentation Contexts for Service Object Pair (SOP) classes of the Storage Commitment and Verification Service Classes.

When performing Study Management Service class (N-CREATE and N-SET), MPPS SCP AE will receive information on the Procedure Steps performed by a modality and will update its internal state, taking this information into account.

2.2.6 PRINT SCU AE

PRINT SCU AE is started when a user requests printing of images to a remote DICOM printer.

The Print SCU prints a single Film Box at the time as part of a print job over a single association. When the printing of the image is complete, the association is released and the PRINT SCU AE terminates. If the transmission to the printer fails for any reason, the association is aborted and the Print SCU terminates.

2.2.7 Publisher AE

The Publisher AE initializes a Removable Media (CD or DVD) and creates a new DICOM File-set onto this Removable Media. This can be initiated manually by the user or automatically according to user defined rules.

2.2.8 Importer AE

The Importer AE reads from Removable Media (CD or DVD) acting as an **FSR** to read in SOP instances as selected by the user when the "Read DICOM CD" command is used. The Importer AE application will only display files that match the supported SOP Classes in the supported Application Profiles.

2.2.9 IAN SCU AE

The IAN SCU AE is started when images are stored in the image archive and a DICOM MPPS has been received for these images. A DICOM Image Availability Notification will be sent containing references to each of the images stored.

2.2.10 Modality Worklist Query SCP AE

Modality Worklist Query SCP AE waits for another application to connect at the presentation address configured for its AE title. It will accept associations with Presentation Contexts for Service Object Pair (SOP) classes of the Query-Retrieve and Verification Service Classes. It will query its Worklist database according to the request's parameters and will send the results to the issuer.

2.3 Sequencing of Real World Activities

Not applicable.

3 AE SPECIFICATIONS

3.1 Storage AE

Verification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Storage

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-ray Image Storage For Present.	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
Digital Intra Oral X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra Oral X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
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
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Visible Light Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1
Multiframe Grayscale Byte Secondary Capture Image St.	1.2.840.10008.5.1.4.1.1.7.2
Multiframe Grayscale Word Secondary Capture Image St.	1.2.840.10008.5.1.4.1.1.7.3
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2

For the Mammography CAD SR Class, the system will not display the modifiers set to “Presentation Optional”.

3.1.1 Association Establishment Policies

3.1.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.1.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.1.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore, system will not perform asynchronous operations window negotiation.

3.1.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

- Implementation Class UID 2.16.56.465769650.1.4
- Implementation Name tmdcm-4.2.0

3.1.2 Association Initiation by Real-World Activity

This AE does never initiate any association.

3.1.3 Association acceptance policy

3.1.3.1 Real World Activity - Verification

3.1.3.1.1 Associated Real World Activity - Verification

The system will respond to **Verification** requests to provide an SCU with the ability to determine if the system is receiving DICOM requests.

3.1.3.1.2 Presentation Context Table - Verification

The system will accept any of the Presentation Contexts listed in the table below for Verification.

Abstract Syntax		**Presentation Context Table**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP class	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.1.3.1.3 SOP Specific Conformance - Verification

The system provides standard conformance to the DICOM **Verification** *Service Class.* The system returns one of the following status codes.

0000	Success	Operation performed properly.

3.1.3.1.4 Presentation Context Acceptance Criterion - Verification

The system will always accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in the table above.

3.1.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a **Verification** command, only the default DICOM transfer syntax is required/supported.

3.1.3.2 Real-World Activity - Image reception

The application entity accepts an association when it receives an association request from a remote DICOM Storage or Verification SCU.

3.1.3.2.1 Associated Real-World Activity - Image reception

The application entity waits for incoming associations. No operator action is required to receive DICOM data.

3.1.3.2.2 Presentation Context Table - Image reception

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
All SOP classes listed in 3.1		Explicit Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit Big Endian	1.2.840.10008.1.2.2	SCP	None
		Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		RLE Lossless	1.2.840.10008.1.5	SCP	None
		JPEG lossy 8 bit	1.2.840.10008.1.2.4.50	SCP	None
		JPEG extended lossy 12 bit	1.2.840.10008.1.2.4.51	SCP	None
		JPEG lossless	1.2.840.10008.1.2.4.5	SCP	None
		JPEG lossless first order prediction	1.2.840.10008.1.2.4.70	SCP	None
		JPEG 2000 lossless	1.2.840.10008.1.2.4.90	SCP	None
		JPEG 2000 lossy	1.2.840.10008.1.2.4.91	SCP	None

Notes:

1. For non-imaging objects, only Explicit Little Endian, Explicit Big Endian, and Implicit Little Endian are supported.
2. For Video Endoscopic Image Storage SOP class, the following transfer syntaxes are supported:
   - 1.2.840.10008.1.2.4.100: MPEG2 MP@ML
   - 1.2.840.10008.1.2.4.101: MPEG2 MP@HL
   - 1.2.840.10008.1.2.4.102: MPEG-4 AVC/H.264 High Profile / Level 4.1
   - 1.2.840.10008.1.2.4.103: MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1
3. For Video Photographic Image Storage SOP class, the following transfer syntax is supported:
   - 1.2.840.10008.1.2.4.101: MPEG2 MP@HL

3.1.3.2.3 SOP Specific Conformance to Storage SOP Class - Image reception

The application provides standard conformance to the DICOM V3.0 Storage Service Class as an SCP for the SOP Classes listed in the table above

The system conforms to the SOPs of the Storage Service Class at Level 2 (Full) with a Digital Signature support at level 1. Extended negotiation is not supported.

In case of a successful C-STORE, the stored image may be accessed by the system and viewed in the viewer.

The duration of the storage is depended on user-configuration. The system component periodically cleans the on-line storage layer. Implicitly, it removes from the on-line storage those studies which are least likely to be needed. This mechanism is triggered regularly on condition that the available free on-line space has reached a lower limit. It will clean up the on-line storage until the free space on it reaches another limit. This mechanism is controlled by user configurable parameters.

The following error/warning status codes can be sent by the Store SCP in the context of a C-STORE-RSP message:

Code	Name	Severity	Description
a700	refused: out of resources	failure	Application out of memory, file system or database write error (e. g. full)
a800	refused: SOP class not supported	failure	Received C-STORE-RQ for non-supported SOP class
a900	error: data set does not match SOP class	failure	SOP class or instance UID in C-STORE-RQ does not match UIDs in the received dataset
c000	error: cannot understand	failure	Received dataset without SOP class or instance UID; received Presentation State that failed syntax check; internal application error

3.1.3.2.4 Presentation Context Acceptance Criterion - Image reception

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

The application entity accepts incoming association requests on several port numbers defined in the configuration. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
Rejected permanent	provider, present. related	Temporary congestion	Resource limitation: process creation Failed
Rejected transient	user	app. context name not supported	Incorrect application context name
Rejected permanent	user	no reason	Private shutdown mechanism initiated.

3.1.3.2.5 Transfer Syntax Selection Policies - Image reception

The default behavior is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order. If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

3.2 Storage Commit AE

Verification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Storage Commitment

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class SOP	Class UID
Storage Commitment Push Model	1.2.840.10008.1.20.1

3.2.1 Association Establishment Policies

3.2.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.2.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.2.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore system will not perform asynchronous operations window negotiation.

3.2.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Class UID 1.2.276.0.7230010.3.0.3.6.0

3.2.2 Association Initiation by Real-World Activity

3.2.2.1 Remote system Requests Storage Commitment

A remote system requests confirmation for storage commitment from the system by sending a Storage Commitment N-ACTION Command.

3.2.2.1.1 Associated Real World Activity

The Real World activity associated with the N-ACTION command is retrieval of image information from the archive and sending this information to a remote system using an N-EVENT-REPORT command over another association.

3.2.2.1.2 Proposed Presentation Contexts

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.2.2.1.3 SOP Specific Conformance Statement for Storage Commitment Push model SOP Class

The system provides standard conformance to the DICOM V3.0 Storage Commitment Class as an SCU for the SOP Classes listed in the previous section.

The system does not support the optional Storage Media File-Set ID & UID.

The system supports the optional Retrieve AE Title (0008,0054) Attribute in the N-EVENT-REPORT. It returns the AE title of the corresponding Storage Application Entity where the instances can be retrieved.

3.2.3 Association acceptance policy

3.2.3.1 Real World Activity - Verification

3.2.3.1.1 Associated Real World Activity - Verification

The system will respond to **Verification** requests to provide an SCU with the ability to determine if the system is receiving DICOM requests.

3.2.3.1.2 Presentation Context Table - Verification

The system will accept any of the Presentation Contexts listed in the table below for Verification.

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Verification SOP class	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.2.3.1.3 SOP Specific Conformance - Verification

The system provides standard conformance to the DICOM **Verification** *Service Class.* The system returns one of the following status codes.

0000	Success	Operation performed properly.

3.2.3.1.4 Presentation Context Acceptance Criterion - Verification

The system will always accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in the table above.

3.2.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a **Verification** command, only the default DICOM transfer syntax is required/supported.

3.2.3.2 Real World Activity – Storage commitment

3.2.3.2.1 Associated Real World Activity – Storage commitment

The system stores images that are sent to it from an *SCU*. The request for storage commitment may then be transmitted to the system together with a list of references to one or more SOP instances. The system will receive and respond to DIMSE N-ACTION.

3.2.3.2.2 Presentation Context Table – Storage commitment

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Storage commitment	1.2.840.10008.1.20.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.2.3.2.3 SOP Specific Conformance – Storage commitment

The system supports the following elements for this SOP class as an SCP:

Action Type Name	Action Type ID	Attribute Name	Tag
Request Storage Commitment	1	Transaction UID	(0008,1195)
		Referenced SOP Sequence	(0008,1199)
		>Referenced SOP Class UID	(0008,1150)
		>Referenced SOP Instance UID	(0008,1155)
		Referenced Study Component Sequence	(0008,1111)
		>Referenced SOP Class UID	(0008,1150)

3.2.3.2.3.1 Storage Commitment Result

If the system determines that it has successfully completed storage commitment, it issues an N-EVENT-REPORT to the SCU including references to the successfully stored SOP Instances contained in the N-ACTION.

In the event that the system cannot commit to storing SOP Instances, it issues an N-EVENT-REPORT to the SCU including references to the failed SOP Instances contained in the N-ACTION. The N-EVENT-REPORT contains the Transaction UID value contained in the

initiating N-ACTION. The N-EVENT-REPORT is sent on a separate association from the N-ACTION operation.

The Storage AE may delete some instances based on available resources (e.g. available disk space). This check is performed regularly. The choice of the instances to delete is made by the Storage Application Entity: The instances with the highest likelihood of being unused will be deleted first.

The capacity of the archive depends on the available hardware on which the system is based.

The instances can be retrieved with the Query/Retrieve service class on the corresponding Q/R SCP Application Entity. Instances will be retrieved immediately and automatically if they are available without human aid on the system. Some instances will be retrieved with some delay if some human aid is required to retrieve these instances.

The SCP does not support the optional Storage Media File-Set ID & UID Attribute N-ACTION.

3.2.3.2.4 Presentation Context Acceptance Criterion – Storage commitment

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

The application entity accepts incoming association requests on several port numbers defined in the configuration. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
Rejected permanent	provider, present. related	Temporary congestion	Resource limitation: process creation Failed
Rejected transient	user	app. context name not supported	Incorrect application context name
Rejected permanent	user	no reason	Private shutdown mechanism initiated.

3.2.3.2.5 Transfer Syntax Selection Policies – Storage commitment

The default behavior is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order. If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

3.3 Q/R SCP AE

Verification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Query/Retrieve

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class	SOP Class UID
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2

The Query/Retrieve of Structured Reporting SOP Instances does not support the Optional Keys Concept Name Code Sequence or the Content Template Sequence.

3.3.1 Association Establishment Policies

3.3.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.3.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.3.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore, system will not perform asynchronous operations window negotiation.

3.3.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Class UID	2.16.56.465769650.1.4
Implementation Name	tmdcm-4.2.0

3.3.2 Association Initiation by Real-World Activity

3.3.2.1 Remote system Requests Image Transfer

A remote system requests image transfer from the system by sending C-MOVE Command.

3.3.2.1.1 Associated Real World Activity

The Real World activity associated with the C-MOVE command is retrieval of images from the disk and storage of the images to a remote system using a C-STORE command over one association.

3.3.2.1.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negociation**
Name	**UID**	**Name List**	**UID List**		
All SOP classes listed in 3.1		Explicit Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit Big Endian	1.2.840.10008.1.2.2	SCU	None
		Implicit Little Endian	1.2.840.10008.1.2	SCU	None

Notes:

1. For non-imaging objects, only Explicit Little Endian, Explicit Big Endian, and Implicit Little Endian are supported.
2. For Video Endoscopic Image Storage SOP class, the following transfer syntaxes are supported:
   - 1.2.840.10008.1.2.4.100: MPEG2 MP@ML
   - 1.2.840.10008.1.2.4.101: MPEG2 MP@HL
   - 1.2.840.10008.1.2.4.102: MPEG-4 AVC/H.264 High Profile / Level 4.1
   - 1.2.840.10008.1.2.4.103: MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1

3. For Video Photographic Image Storage SOP class, the following transfer syntax is supported:

- 1.2.840.10008.1.2.4.101: MPEG2 MP@HL

3.3.2.1.3 SOP Specific Conformance Statement for Storage SOP Classes

The system provides standard conformance to the DICOM V3.0 Storage Service Class as an SCU for the SOP Classes listed in the previous section.

Multiple C-STORE operations can be performed over a single association.

Upon receiving a C-STORE confirmation containing a successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Any premature termination of the C-STORE association will result in ending the C-MOVE operation.

3.3.3 Association acceptance policy

3.3.3.1 Real World Activity - Verification

3.3.3.1.1 Associated Real World Activity - Verification

The system will respond to **Verification** requests to provide an SCU with the ability to determine if the system is receiving DICOM requests.

3.3.3.1.2 Presentation Context Table - Verification

The system will accept any of the Presentation Contexts listed in the table below for Verification.

Abstract Syntax		**Presentation Context Table**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP class	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.3.3.1.3 SOP Specific Conformance - Verification

The system provides standard conformance to the DICOM **Verification** *Service Class.* The system returns one of the following status codes.

0000	Success	Operation performed properly.

3.3.3.1.4 Presentation Context Acceptance Criterion - Verification

The system will always accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in the table above.

3.3.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a **Verification** command, only the default DICOM transfer syntax is required/supported.

3.3.3.2 Real World Activity - Find

3.3.3.2.1 Associated Real World Activity - Find

The system will respond to query requests that are sent to it from an *SC*U.

3.3.3.2.2 Presentation Context Table - Find

The system will accept any of the Presentation Contexts listed in Table 3.46 for Query.

Abstract Syntax		**Presentation Context Table**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
FIND Study Root	1.2.840.10008.5.1.4.1.2.2.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None

Query Retrieve		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.3.3.2.3 SOP Specific Conformance - Find

SOP classes of the **Query/Retrieve** Service Class are implemented via the DIMSE **C-FIND** and **C-MOVE** services as defined in Part 7 of the DICOM standard.

The system implements the Study Root Query/Retrieve Information Model.

The system does not support priority processing.

By default, it supports all mandatory search keys. The following tables state the optional search keys which are supported by the system.

Optional query keys at Study level

Description	Tag
Modalities in Study	0008,0061
Referring Physician's Name	0008,0090
Patient's Birth Date	0010,0030
Patient's Sex	0010,0040
Number of Study Related Series	0020,1206
Number of Study Related Instances	0020,1208

Optional query keys at Series level

Description	Tag
Number of Series Related Instances	0020,1209
Request Attribute Sequence	0040,0275
>Requested Procedure ID	0040,1001
>Scheduled Procedure Step ID	0040,0009
Performed Procedure Step Start Date	0040,0244
Performed Procedure Step Start Time	0040,0245

Optional query keys at CompositeObjectInstance level

Description	Tag
SOP Instance UID	0008,0018
SOP Class UID	0008,0016
Rows	0028,0010
Columns	0028,0011
Bits Allocated	0028,0100
Number of Frames	0028,0008

For attributes with a PN Value Representation, the system performs case-insensitive matching.

The system does not support relational queries.

The system does not support the value(s) of Specific Character Set (0008,0005) in the Request Identifier. Matching is performed using the default character repertoire.

The following error/warning status codes can be sent by the system in the context of a C-FIND-RSP message:

Code	Severity	Name	Description
0xa700	Refused	Out Of Resources	Application out of memory, file system or database write error (e. g. full)
0xa800	Refused	SOP Class Not Supported	Received request for a non supported SOP class
0xa900	Failed	Identifier Does Not Match SOP Class	
0xc000	Failed	Unable To Process	
0xfe00	Cancel	Matching Terminated Due To Cancel Request	
0xff01	Pending	Warning Unsupported Optional Keys	
0x0110	Failed	Processing Failure	

0x0213	Failed	Resource Limitation	

3.3.3.2.4 Presentation Context Acceptance Criterion - Find

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

The application entity accepts incoming association requests on one port number defined in the configuration. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
Rejected permanent	provider, present. related	Temporary congestion	Resource limitation: process creation Failed
Rejected transient	user	app. context name not supported	Incorrect application context name
Rejected permanent	user	no reason	Private shutdown mechanism initiated.

3.3.3.2.5 Transfer Syntax Selection Policies - Find

The default behavior is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order (i. e. little endian on PC, big endian on SPARC). If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

3.3.3.3 Real World Activity – Move

3.3.3.3.1 Associated Real World Activity – Move

The system will respond to store requests that are sent to it from an *SC*U.

3.3.3.3.2 Presentation Context Table – Move

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	UID	Name List	UID List		
MOVE Study Root Query Retrieve	1.2.840.10008.5.1.4.1.2.2.2	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.3.3.3.3 SOP Specific Conformance – Move

The system will try to establish an association with the move destination specified in the **Move** request. One or more of the Presentation Contexts listed in the **Store** section of this document, may be negotiated in this association.

The system implements the Study Root Query/Retrieve Information Model.

The system does not support priority processing.

The following Storage Service Class SOP Classes are supported in the C-STORE sub-operations generated by the C-MOVE.

SOP Class Name	SOP Class UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-ray Image Storage For Present.	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
Digital Intra Oral X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra Oral X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
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
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5

Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Visible Light Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1
Multiframe Grayscale Byte Secondary Capture Image St.	1.2.840.10008.5.1.4.1.1.7.2
Multiframe Grayscale Word Secondary Capture Image St.	1.2.840.10008.5.1.4.1.1.7.3
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2

The following error/warning status codes can be sent by the system in the context of a C-FIND-RSP message:

Code	Severity	Name
0xa701	Refused	Out Of Resources Number Of Matches
0xa702	Refused	Out O Resources Sub Operations
0xa800	Failed	SOP Class Not Supported
0xa801	Failed	Move Destination Unknown
0xa900	Failed	Identifier Does Not Match SOP Class
0xc000	Failed	Unable To Process
0xfe00	Cancel	Sub Operations Terminated Due To Cancel Indication
0xb000	Warning	Sub Operations Complete One Or More Failures
0x0110	Failed	Processing Failure
0x0213	Failed	Resource Limitation

3.3.3.3.4 Presentation Context Acceptance Criterion – Move

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

The application entity accepts incoming association requests on a port number defined in the configuration. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
Rejected permanent	provider, present. related	Temporary congestion	Resource limitation: process creation Failed
Rejected transient	user	app. context name not supported	Incorrect application context name
Rejected permanent	user	no reason	Private shutdown mechanism initiated.

3.3.3.3.5 Transfer Syntax Selection Policies – Move

The default behavior is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order (i. e. little endian on PC, big endian on SPARC). If this transfer syntax is not available, the

explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

3.4 QR/SCU AE

Verification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Query/Retrieve

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCU:

SOP Class	SOP Class UID
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2

The Query/Retrieve of Structured Reporting SOP Instances does not support the Optional Keys Concept Name Code Sequence or the Content Template Sequence.

3.4.1 Association Establishment Policies

3.4.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.4.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.4.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore, system will not perform asynchronous operations window negotiation.

3.4.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Class UID 1.2.276.0.7230010.3.0.3.6.3

3.4.2 Association Initiation by Real-World Activity

3.4.2.1 Find

The system will issue Find requests in response to UI mediated requests from the user to retrieve DICOM information.

3.4.2.1.1 Associated Real World Activity

The system will negotiate requests to an SCP.

3.4.2.1.2 Proposed Presentation Contexts

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	UID	Name List	UID List		

FIND Study Root Query Retrieve	1.2.840.10008.5.1.4.1.2.2.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.4.2.1.3 SOP Specific Conformance Statement for SOP Class Study Root FIND

The system implements the Study Root Query/Retrieve Information Model.

By default, it supports all mandatory search keys. The following tables state the optional search keys which are supported by the system.

Optional query keys at Study level

Description	Tag
Modalities in Study	0008,0061
Referring Physician's Name	0008,0090
Patient's Birth Date	0010,0030
Patient's Sex	0010,0040

Optional query keys at Series level

Description	Tag
Request Attribute Sequence	0040,0275
>Requested Procedure ID	0040,1001
>Scheduled Procedure Step ID	0040,0009
Performed Procedure Step Start Date	0040,0244
Performed Procedure Step Start Time	0040,0245

Optional query keys at CompositeObjectInstance level

Description	Tag
SOP Instance UID	0008,0018

The system automatically adds a wildcard "*" to matching keys with a VR of PN. The user is not required to add one manually.

The system may not generate relational queries.

The system does not support the value(s) of Specific Character Set (0008,0005) in the Request Identifier. It encodes queries and interprets responses using the default character repertoire.

3.4.2.2 Move

The system will issue Move requests in response to UI mediated requests from the user to retrieve DICOM information, after a Find request.

3.4.2.2.1 Associated Real World Activity

The system will negotiate requests to an SCP.

3.4.2.2.2 Proposed Presentation Contexts

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
MOVE Study Root Query Retrieve Information Model	1.2.840.10008.5.1.4.1.2.2.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.4.2.2.3 SOP Specific Conformance Statement for SOP Class Study Root MOVE

The system will try to establish an association with the move destination specified in the **Move** request. One or more of the Presentation Contexts listed in the **Store** section of this document may be negotiated in this association.

The system implements the Study Root Query/Retrieve Information Model.

3.4.3 Association acceptance policy

This AE does not act as an SCP and never accepts any association. The C-STORE message asks to send the corresponding documents to the corresponding Storage AE described above.

3.5 MPPS AE

Verification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Study Management

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

3.5.1 Association Establishment Policies

3.5.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.5.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.5.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore system will not perform asynchronous operations window negotiation.

3.5.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Class UID 1.2.276.0.7230010.3.0.3.5.4

3.5.2 Association Initiation by Real-World Activity

This AE does never initiate any association.

3.5.3 Association acceptance policy

3.5.3.1 Real World Activity - Verification

3.5.3.1.1 Associated Real World Activity - Verification

The system will respond to **Verification** requests to provide an SCU with the ability to determine if the system is receiving DICOM requests.

3.5.3.1.2 Presentation Context Table - Verification

The system will accept any of the Presentation Contexts listed in the table below for Verification.

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Verification SOP class	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.5.3.1.3 SOP Specific Conformance - Verification

The system provides standard conformance to the DICOM **Verification** *Service Class.* The system returns one of the following status codes.

0000	Success	Operation performed properly.

3.5.3.1.4 Presentation Context Acceptance Criterion - Verification

The system will always accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in the table above.

3.5.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a **Verification** command, only the default DICOM transfer syntax is required/supported.

3.5.3.2 Real World Activity – MPPS notification

3.5.3.2.1 Associated Real World Activity – MPPS notification

The system will respond to MPPS-Create and MPPS-Set requests that are sent to it from an *SCU*.

3.5.3.2.2 Presentation Context Table – MPPS notification

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.5.3.2.3 SOP Specific Conformance – MPPS notification

Code	Name	Severity	Description
0110H	Processing Failure	Failure	Unspecified application failure

3.5.3.2.4 Presentation Context Acceptance Criterion – MPPS notification

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

The application entity accepts incoming association requests on port numbers defined in the configuration. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
Rejected permanent	provider, present. related	Temporary congestion	Resource limitation: process creation Failed
Rejected transient	user	app. context name not supported	Incorrect application context name
Rejected permanent	user	no reason	Private shutdown mechanism initiated.

3.5.3.2.5 Transfer Syntax Selection Policies – MPPS notification

The default behavior is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order

(i. e. little endian on PC, big endian on SPARC). If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

3.6 PRINT SCU AE

Verification

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

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Image Availability Notification

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

SOP Class	SOP Class UID
Instance Availability Notification SOP Class	1.2.840.10008.5.1.4.33

3.6.1 Association Establishment Policies

3.6.1.1 General

The maximum PDU length can be configured at installation time in the range 4096..131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.6.1.2 Number of Associations

The IAN SCU will only propose a single Association at a time.

3.6.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore, the system will not perform asynchronous operations window negotiation.

3.6.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Version Name	OFFIS_DCMTK_360
Implementation Class UID	1.2.276.0.7230010.3.0.3.6.0
DICOM Application Context Name	1.2.840.10008.3.1.1.1

3.6.2 Association Initiation by Real-World Activity

The application entity initiates an association with the selected remote Image Availability Notification SCP. The called application entity title can be specified during this operation.

3.6.2.1 Associated Real World Activity

3.6.2.2 Proposed Presentation Contexts

For each of the supported SOP classes, the software proposes as SCU a single presentation context containing the following transfer syntaxes, any of which is acceptable:

Presentation Context Table		Role	Ext. Neg.
Name List	UID List		
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		

DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.6.2.3 SOP Specific Conformance Statement for Printer SOP Class

Immediately after successful association negotiation, the Print SCU issues an N-GET-RQ message to retrieve the contents of the well-known Printer SOP Instance. The attribute identifier list element of the message remains empty, which means that the Print SCP is requested to transmit the contents of all attributes of the well-known Printer SOP Instance. If this request fails, the connection with the printer is released. Following retrieval of the well-known Printer SOP Instance, the association is released.

3.6.2.4 SOP Specific Conformance for Basic Film Session SOP Class

After retrieval of the well-known Printer SOP instance, a new association is established and, if this is successful, the Print SCU creates a Basic Film Session by issuing an NCREATE-RQ message. The following elements are sent as part of the N-CREATE DIMSE Service Element:

Attribute Name	Tag	Type	VR	VM
Number of Copies	(2000,0010)	U/M	IS	1
Print Priority	(2000,0020)	U/M	CS	1
Medium Type	(2000,0030)	U/M	CS	1
Film Destination	(2000,0040)	U/M	CS	1
Film Session Label	(2000,0050)	U/U	LO	1
Referenced Presentation LUT Sequence	(2050,0500)	U/MC	SQ	1
>Referenced SOP Class UID	(0008,1150)	U/MC	UI	1
>Referenced SOP Instance UID	(0008,1155)	U/MC	UI	1
Illumination	(2010,015E)	U/MC	US	1
Reflected Ambient Light	(2010,0160)	U/MC	US	1

If creation of the Basic Film Session fails, Print SCU releases the association with the printer. After successful completion of the print job, Print SCU uses an N-DELETE DIMSE Service Element to delete the Basic Film Session SOP instance before releasing the association. Other requests are never sent. In particular, Print SCU never sends an N-ACTION message on Basic Film Session level.

3.6.2.5 SOP Specific Conformance for Basic Film Box Class

After successful creation of the Basic Film Session SOP instance, the Print SCU creates a Basic Film Box. The following elements are sent as part of the N-CREATE DIMSE Service Element:

Attribute Name	Tag	Type	VR	VM
Image Display Format	(2010,0010)	M/M	ST	1
Referenced Film Session Sequence	(2010,0500)	M/M	SQ	1
> Referenced SOP Class UID	(0008,1150)	M/M	UI	1
> Referenced SOP Instance UID	(0008,1155)	M/M	UI	1
Film Orientation	(2010,0040)	U/M	CS	1
Film Size ID	(2010,0050)	U/M	CS	1
Magnification Type	(2010,0060)	U/M	CS	1
Max Density	(2010,0130)	U/M	US	1
Annotation Display Format ID	(2010,0030)	U/U	CS	1
Smoothing Type	(2010,0080)	U/U	CS	1
Border Density	(2010,0100)	U/U	CS	1
Empty Image Density	(2010,0110)	U/U	CS	1
Min Density	(2010,0120)	U/U	US	1
Trim	(2010,0140)	U/U	CS	1
Requested Resolution ID	(2020,0050)	U/U	CS	1
Referenced Presentation LUT Sequence	(2050,0500)	U/MC	SQ	1
> Referenced SOP Class UID	(0008,1150)	U/MC	UI	1
> Referenced SOP Instance UID	(0008,1155)	U/MC	UI	1
Illumination	(2010,015E)	U/MC	US	1

Reflected Ambient Light	(2010,0160)	U/MC	US	1

If creation of the Basic Film Box fails, the Print SCU releases the association with the printer. The Print SCU never creates more than a single Basic Film Box in the context of one association. The Print SCU uses an N-ACTION-RQ message to request processing of the print job from the Print SCP. After successful completion of the print job, the Print SCU uses an N-DELETE-RQ message to delete the Basic Film Box SOP instance before deleting the Basic Film Session SOP instance and releasing the association. Other requests are never sent.

As part of creation of the Basic Film Box SOP Instance, the Print SCP creates an Instance of the Basic Grayscale Image Box SOP Class. The Print SCU uses an N-SET DIMSE Service Element to update the Basic Grayscale Image Box SOP Instance. The following elements are sent as part of the N-SET DIMSE Service Element:

Attribute Name	Tag	Type	VR	VM
Image Position	(2020,0010)	M/M	US	1
Basic Grayscale Image Sequence	(2020,0110)	M/M	SQ	1
>Samples Per Pixel	(0028,0002)	M/M	US	1
>Photometric Interpretation	(0028,0004)	M/M	CS	1
>Rows	(0028,0010)	M/M	US	1
>Columns	(0028,0011)	M/M	US	1
>Pixel Aspect Ratio	(0028,0034)	MC/M		
>Bits Allocated	(0028,0100)	M/M	US	1
>Bits Stored	(0028,0101)	M/M	US	1
>High Bit	(0028,0102)	M/M	US	1
>Pixel Representation	(0028,0103)	M/M	US	1
>Pixel Data	(7FE0,0010)	M/M	OW	1
Polarity	(2020,0020)	U/M	CS	1
Magnification Type	(2010,0060)	U/U	CS	1
Smoothing Type	(2010,0080)	U/U	CS	1
Configuration Information	(2010,0150)	U/U	ST	1
Requested Image Size	(2020,0030)	U/U	DS	1
Requested Decimate/Crop Behavior	(2020,0040)	U/U	CS	1

If support for the Presentation LUT SOP Class has not been negotiated with the Print SCP, then Print SCU assumes that the printer uses a display curve related to the DICOM Grayscale Display Standard Function with viewing conditions (illumination and reflection) defined in a proprietary manner outside the print protocol. All images will be sent in P-values, with all Presentation LUTs “burned in” as if a Presentation LUT Shape of “IDENTITY” had been negotiated.

3.6.2.6 SOP Specific Conformance for Presentation LUT SOP Class

If support for the Presentation LUT SOP Class has been negotiated, Print SCU creates a Presentation LUT SOP instance immediately after association negotiation. The following elements may be sent as part of the N-CREATE request:

Attribute Name	Tag	Type	VR	VM
Presentation LUT Sequence	(2050,0010)	MC/M	SQ	1
>LUT Descriptor	(0028,3002)	MC/M	US/SS	3
>LUT Explanation	(0028,3003)	U/U	LO	1
>LUT Data	(0028,3006)	MC/M	OW/US/SS	1/ 1-n/ 1-n
Presentation LUT Shape	(2050,0020)	MC/M	CS	1

Print SCU never creates more than a single Presentation LUT as part of a single association. The Presentation LUT SOP instance is deleted with an N-DELETE request after completion of the print job and before release of the association.

3.6.3 Association acceptance policy

This AE does not act as an SCP and never accepts any association. The system as Print SCP is not implemented.

3.7 Publisher AE

The Publisher AE provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The supported Application Profiles and roles are listed in the following table:

Application profile supported	Real World Activity	Role	Service Class Option
STD-GEN-CD	Create DVD/CD	FSC	Interchange
STD-GEN-DVD-RAM	Create DVD/CD	FSC	Interchange

The supported SOP classes are the same as the Storage AE and are listed in 3.1.

3.8 Importer AE

The Importer AE provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The supported Application Profiles and roles are listed in the following table:

Application profile supported	Real World Activity	Role	Service Class Option
STD-GEN-CD	Display Directory	FSR	Interchange
STD-GEN-DVD-RAM	Display Directory	FSR	Interchange

The supported SOP classes are the same as the Storage AE and are listed in 3.1.

3.9 IAN SCU AE

Verification

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

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Print

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

SOP Class	SOP Class UID
Instance Availability Notification SOP Class	1.2.840.10008.5.1.4.33

3.9.1 Association Establishment Policies

3.9.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.9.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.9.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore, the system will not perform asynchronous operations window negotiation.

3.9.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Version Name OFFIS_DCMTK_354

Implementation Class UID	1.2.276.0.7230010.3.0.3.5.4
DICOM Application Context Name	1.2.840.10008.3.1.1.1

3.9.2 Association Initiation by Real-World Activity

3.9.2.1 Image Availability Notification

3.9.2.1.1 Associated Real World Activity

A Dicom MPPS message has been received for some images and these images are stored in the archive database.

3.9.2.1.2 Proposed Presentation Contexts

Abstract Syntax		Presentation Context Table		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Instance Availability Notification SOP Class	1.2.840.10008.5.1.4.33	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.9.2.1.3 SOP Specific Conformance Statement for Instance Availability Notification SOP Class

The system provides standard conformance to the DICOM V3.0 Instance Availability Notification SOP Class

3.9.3 Association acceptance policy

This AE does not act as an SCP and never accepts any association.

3.10 Modality Worklist Query

Verification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

Query

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Class(es) as an SCU:

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

3.10.1 Association Establishment Policies

3.10.1.1 General

The maximum PDU length can be configured at installation time in the range 4096...131072 bytes.
The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.10.1.2 Number of Associations

The maximum number of simultaneous associations accepted is configurable at run time.

3.10.1.3 Asynchronous Nature

The system will only allow a single outstanding operation on an association. Therefore, the system will not perform asynchronous operations window negotiation.

3.10.1.4 Implementation Identifying Information

The system will respond with the following implementation identifying parameters:

Implementation Name tmdcm-4.2.0
Implementation Class UID 2.16.56.465769650.1.4

3.10.2 Association Initiation by Real-World Activity

This AE does not act as an SCU and never initiates any association.

3.10.3 Association acceptance policy

3.10.3.1 Real World Activity - Verification

3.10.3.1.1 Associated Real World Activity - Verification

The system will respond to **Verification** requests to provide an SCU with the ability to determine if the system is receiving DICOM requests.

3.10.3.1.2 Presentation Context Table - Verification

The system will accept any of the Presentation Contexts listed in the table below for Verification.

Abstract Syntax		**Presentation Context Table**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP class	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.10.3.1.3 SOP Specific Conformance - Verification

The system provides standard conformance to the DICOM **Verification** *Service Class.* The system returns one of the following status codes.

0000	Success	Operation performed properly.

3.10.3.1.4 Presentation Context Acceptance Criterion - Verification

The system will always accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in the table above.

3.10.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a **Verification** command, only the default DICOM transfer syntax is required/supported.

3.10.3.2 Real World Activity - Find

3.10.3.2.1 Associated Real World Activity - Find

The system will respond to query requests that are sent to it from an *SCU*.

3.10.3.2.2 Presentation Context Table - Find

The system will accept any of the Presentation Contexts listed in Table 3.46 for Query.

Abstract Syntax		**Presentation Context Table**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Information Model -	1.2.840.10008.5.1.4.31	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		

FIND		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

3.10.3.2.3 SOP Specific Conformance - Find

SOP classes of the **Query** Service Class are implemented via the DIMSE **C-FIND** service as defined in Part 7 of the DICOM standard.

By default, it supports all mandatory search keys. The following tables state the optional search keys which are supported by the system.

Description	Tag
Scheduled Procedure Step Description	(0040,0007)
Scheduled Station Name	(0040,0010)
Scheduled Procedure Step ID	(0040,0009)
Requested Procedure ID	(0040,1001)
Requested Procedure Description	(0032,1060)
Study Instance UID	(0020,000D)
Study Date	(0008,0020)
Study Time	(0008,0030)
Accession Number	(0008,0050)
Referring Physician's Name	(0008,0090)
Series Date	(0008,0021)
Content Date	(0008,0023)
Acquisition Date	(0008,0022)
Series Time	(0008,0031)
Content Time	(0008,0033)
Acquisition Time	(0008,0032)
Patient's Name	(0010,0010)
Patient ID	(0010,0020)
Other Patient Ids	(0010,1000)
Patient's Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Performing Physician's Name	(0008,1050)
Series Instance UID	(0020,000E)

For attributes with a PN Value Representation, the system performs case-insensitive matching.

The system does not support relational queries.

The following error/warning status codes can be sent by the system in the context of a C-FIND-RSP message:

Code	Severity	Name	Description
0xa700	Refused	Out Of Resources	Application out of memory, file system or database write error (e. g. full)
0xa800	Refused	SOP Class Not Supported	Received request for a non supported SOP class
0xa900	Failed	Identifier Does Not Match SOP Class	
0xc000	Failed	Unable To Process	
0xfe00	Cancel	Matching Terminated Due To Cancel Request	
0xff01	Pending	Warning Unsupported Optional Keys	
0x0110	Failed	Processing Failure	
0x0213	Failed	Resource Limitation	

3.10.3.2.4 Presentation Context Acceptance Criterion - Find

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

The application entity accepts incoming association requests on one port number defined in the configuration. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
Rejected permanent	provider, present. related	Temporary congestion	Resource limitation: process creation Failed
Rejected transient	user	app. context name not	Incorrect application context

		supported	name
Rejected permanent	user	no reason	Private shutdown mechanism initiated.

3.10.3.2.5 Transfer Syntax Selection Policies - Find

The default behavior is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order (i. e. little endian on PC, big endian on SPARC). If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

4 Communication profiles

The system provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.1 OSI Stack

Not supported.

4.2 TCP/IP Stack

The system inherits its TCP/IP stack from the computer system upon which it executes.

4.2.1 Physical Media Support

The system is indifferent to the physical medium over which TCP/IP executes; it inherits the medium from the computer system upon which it executes.

4.3 Point-to-Point Stack

Not supported.

5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

None.

6 Configuration

6.1 AE Title/Presentation Address Mapping

The mapping from AE Title to TCP/IP addresses and ports is configurable and set at the time of installation.

6.2 Configurable Parameters

The following parameters are configurable at the installation of the system:

- DICOM port numbers
- Application entity titles
- Max PDU size

7 SUPPORT OF EXTENDED CHARACTER SETS

This application supports only ISO_IR 100 (ISO 8859-1 Latin 1) as extended character set.

8 SECURITY

8.1 Security Profiles

8.1.1 Security use Profiles

Not applicable

8.1.2 Security Transport Connection Profiles

Not applicable

8.1.3 Digital Signature Profiles

Not applicable

8.1.4 Media Storage Security Profiles

Not applicable

8.1.5 Attribute Confidentiality Profiles

Not applicable

8.1.6 Network Address Management Profiles

Not applicable

8.1.7 Time Synchronization Profiles

TM-Medical conforms to the IHE CT profile. It is possible to synchronize time with the NTP Timeserver using serviceability. The NTP Timeserver is an element of Hospital Infrastructure.

8.1.8 Application Configuration Management Profile

Not applicable

8.1.9 Audit Trail Profiles

The Audit Trail Component is a component of TM-Medical and can create messages according to the ATNA, IHE defined standard.

Actors are information systems or components of information systems that produce, manage, or act on categories of information required by operational activities in the enterprise. The Audit Trail Component allows security officers in an institution to audit activities, to detect non-compliant behavior in the enterprise, and to facilitate detection of improper creation, access, modification and deletion of Protected Health Information (PHI), where PHI data is considered as information records (Registration, Order, Study/Procedure, Reports and to a lesser degree Images/Presentation States), and not the flow of information between the systems. This includes information exported to and imported from every secured node in the “secured domain”. The messages will be created and sent to a syslog server according to the syslog protocol. The time that is used will be the local time of the system which is synchronized with the NTP Time Server. The timeserver and syslog server are elements of the Hospital infrastructure. The following messages will be created and sent to a central Audit Record Repository:

- Application Activity
- Begin Transferring DICOM Instances
- DICOM Instances Transferred
- User Authentication
- DICOM Instances Accessed

- DICOM export
- Patient record

8.2 Association Level Security

TM-Medical can accept associations from unknown AEs, it can be configured to use secure mode, then the incoming associations should follow secure mode.

8.3 Application Level Security

TM-Medical only allows the use of conventional (non-secure) DICOM communication.