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DICOM Conformance Statement

MedDream DICOM WEB Viewer

Version 5.4.3

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2 Introduction

2.1 Revision History

Version	Date	Author	Changes
1.0	2016.11.15	Tomas Burba	Initial version

2.2 Audience

This document is intended for the following:

- Potential users
- System integrators of medical equipment

It is assumed that the reader is familiar with the DICOM standard.

2.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with other vendors' medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. However, by itself it is not guaranteed to ensure the desired interoperability and successful interconnectivity with existing DICOM systems.

The user should be aware of the following important issues:

- Test procedures should be defined to validate the desired level of connectivity.
- The DICOM standard will evolve to meet the users' future requirements.

2.4 Definitions and Terms

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Table 1. Definitions and Terms

Term	Description
Query Key	A input value for a query process. Query Keys denote the set of DICOM tags that are sent from the SCU to SCP and thus control the query result.
Transfer Syntax	The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.
Application Entity Title	The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.
Unique Identifier (UID)	A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.
Application Context	The specification of the type of communication used between Application Entities. Example: DICOM network protocol.
Module	A set of Attributes within an Information Object Definition that are logically related to each other.

	Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.
Tag	A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]
Negotiation	First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.
Service/Object Pair (SOP) Instance	An information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.
Protocol Data Unit (PDU)	A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.
Service/Object Pair (SOP) Class	The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.
Association	A network communication channel set up between Application Entities.
Information Object Definition (IOD)	The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.
Service Class Provider (SCP)	Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).
Attribute	A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).
Abstract Syntax	The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Ophthalmic Photography 8 Bit Image Storage SOP Class.
Application Entity (AE)	An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages.
Presentation Context	The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.
Value Representation (VR)	The format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.
Service Class User (SCU)	Role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

2.5 Abbreviations

The following acronyms are used in this document.

- AE — Application Entity
- AET — Application Entity Title
- DICOM — Digital Imaging and Communication in Medicine
- DIMSE — DICOM Message Service Element
- ILE — Implicit VR Little Endian
- ISO — International Standards Organization
- LUT — Look-up Table
- MWL — Modality Worklist
- NEMA — National Electrical Manufacturers Association
- PDU — Protocol Data Unit
- SCP — Storage Class Provider
- SCU — Storage Class User
- SOP — Service Object Pair
- TCP/IP — Transmission Control Protocol/Internet Protocol
- TLS — Transport Layer Security
- UID — Unique Identifier
- VR — Value Representation

2.6 References

NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at <http://medical.nema.org/>)

3 Networking

3.1 Implementation Model

3.1.1 Implementation Data Flow

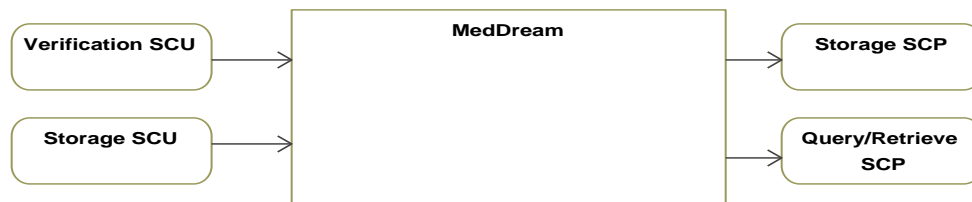


Figure 1. Data Flow Data Flow Diagram

3.1.2 Functional Definition of AEs

3.1.2.1 Functional Definition of Storage Server Application Entity

The MedDream Storage Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the STORAGE SCP AE expects it to be a DICOM application.

The STORAGE SCP AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Storage Service Classes. It might request an accompanying Association of the Storage Commitment Service Class.

DICOM Instances received in a Storage Request are filed on the local (attached/mounted) file system. No any attributes from received Instances are stored anywhere.

3.1.2.2 Functional Definition of Query/Retrieve Client Application Entity

The Query/Retrieve Client AE connects at the presentation address given as a Called Application Entity Title. It will propose Associations with Presentation Context for SOP Class of the Query/Retrieve Service Classes (study and patient root, FIND and MOVE).

When using the Client as a back-end for the Search function, the Query/Retrieve Client AE will wait on the same Association for a C-FIND response and then release the Association. The operator is provided with a set of studies matching the query request. Likewise with background use of the Client to obtain the study metadata.

When the Client is used to order retrieval of the entire study to MedDream, it will wait for a C-FIND response, then send a C-MOVE command and upon reception of its response release the Association.

3.1.2.3 Functional Definition of Storage Client Application Entity

The MedDream Storage Client Application Entity is a STORAGE SCU. It connects to the presentation address configured as the Called Application Entity Title and establishes an Association with Presentation Context of the Storage Service Class. Then it sends any supported DICOM Instances specified by the operator, over a Storage Request.

If a Storage Commitment is requested by the operator, the STORAGE SCU AE will itself accept Associations with Presentation Contexts for SOP Classes of the Storage Commitment Service Class.

3.1.3 Sequencing of Real-World Activities

3.1.3.1 Universal mode: DICOM ("QR") - HIS integration

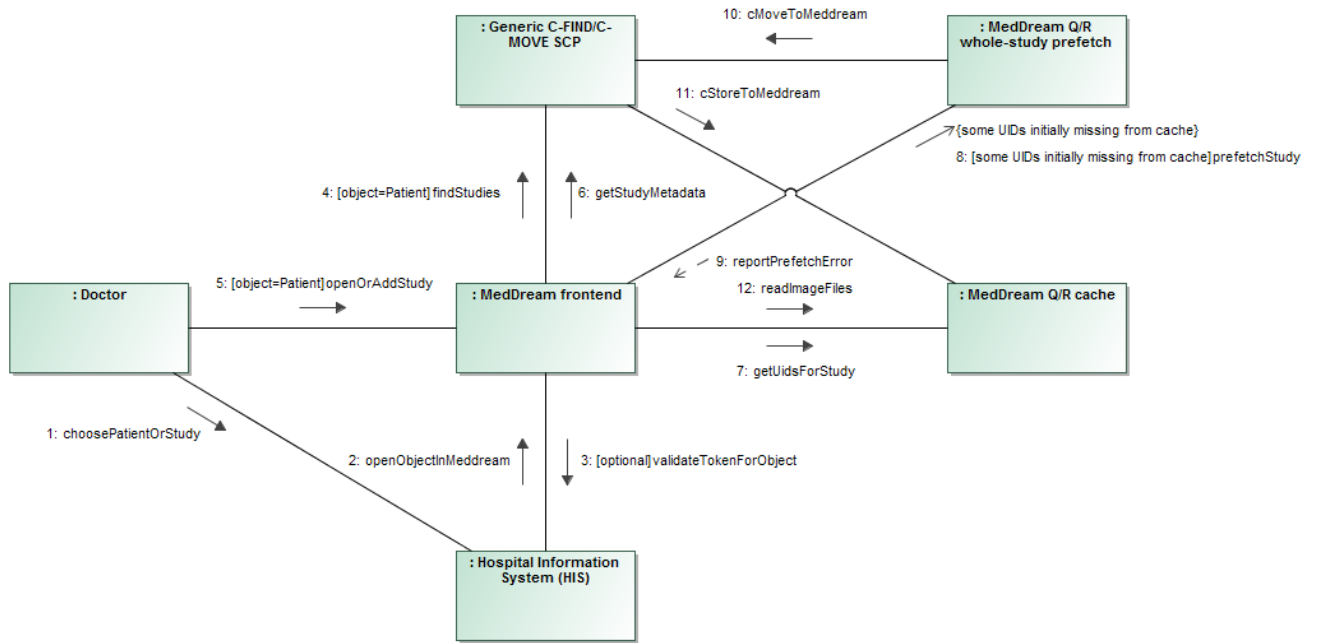


Figure 2. Universal mode: DICOM ("QR") - HIS integration

Table 2. Messages located in Universal mode: DICOM ("QR") - HIS integration

Message no.	Message	Condition	Documentation
1	choosePatientOrStudy		
2	openObjectInMeddream		The HIS presents links (URLs etc) that point to MedDream and specify an object. Supported object types: Study UID Patient ID Unlike in database-based integrations, presence of the object in the SCP can not be verified in advance as this operation takes too much time. (Otherwise it would be the next operation after this one.) As a result, there is no user-friendly error message.
3	validateTokenForObject	[optional]	To ensure authorized access, the URL may contain an access token generated by the HIS. external.php will then validate it using a service implemented at the HIS.
4	findStudies	[object=Patient]	
5	openOrAddStudy	[object=Patient]	There is no real authentication (no database to authenticate against). Any user/password can be set in external.php.
6	getStudyMetadata		
7	getUidsForStudy		The cache is repeatedly queried for UIDs belonging to this study. After the first check (7), if some images are not cached, a "prefetch" operation (8) begins in the background.

			As soon as some new UID becomes available (7) due to background transfer from the SCP (11), a corresponding image is read from cache (12) and its thumbnail is displayed.
8	prefetchStudy	[some UIDs initially missing from cache]	
9	reportPrefetchError		
10	cMoveToMeddream		
11	cStoreToMeddream		
12	readImageFiles		

3.1.3.2 Universal mode: DICOM ("QR") - interactive use

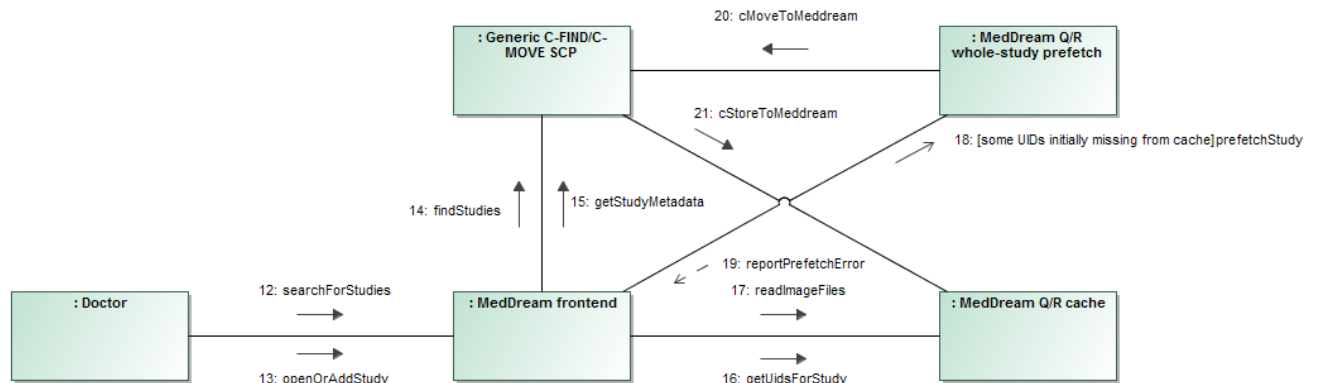


Figure 3. Universal mode: DICOM ("QR") - interactive use

Table 3. Messages located in Universal mode: DICOM ("QR") - interactive use

Message no.	Message	Condition	Documentation
12	searchForStudies		There is no real authentication (no database to authenticate against). Any user/password is accepted.
14	findStudies		
13	openOrAddStudy		
15	getStudyMetadata		
16	getUidsForStudy		The cache is repeatedly queried for UIDs belonging to this study. After the first check (16), if some images are not cached, a "prefetch" operation (18) begins in the background. As soon as some new UID becomes available (16) due to background transfer from the SCP (21), a corresponding image is read from cache (17) and its thumbnail is displayed.
18	prefetchStudy	[some UIDs initially missing from cache]	
19	reportPrefetchError		
20	cMoveToMeddream		
17	readImageFiles		
21	cStoreToMeddream		

3.2 AE Specification

3.2.1 Storage Server Application Entity Specification

3.2.1.1 SOP Classes

Application Entity provides Standard Conformance to the following SOP Classes:

Table 4. SOP Classes for Storage Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	NO	YES
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	NO	YES
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	NO	YES
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	NO	YES
Digital Mammography X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.2	NO	YES
Digital Mammography X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	NO	YES
Digital Intra – oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3	NO	YES
Digital Intra – oral X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.3.1	NO	YES
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	NO	YES
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	NO	YES
Color Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.2	NO	YES
Pseudocolor Softcopy Presentation Stage Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.3	NO	YES
Blending Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.4	NO	YES
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	NO	YES
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	NO	YES
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	NO	YES
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	NO	YES
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	NO	YES
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	NO	YES
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	NO	YES
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	NO	YES
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	NO	YES
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	NO	YES
Radiation Therapy Image Storage	1.2.840.10008.5.1.4.1.1.481.1	NO	YES
Radiation Therapy Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	NO	YES
Radiation Therapy Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	NO	YES
Radiation Therapy Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	NO	YES
Radiation Therapy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	NO	YES
Radiation Therapy Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	NO	YES
Radiation Therapy Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	NO	YES
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	NO	YES
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	NO	YES
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	NO	YES
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	NO	YES
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	NO	YES
Real World Value Mapping Storage	1.2.840.10008.5.1.4.1.1.67	NO	YES
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	NO	YES
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	NO	YES
Multiframe Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	NO	YES

Multiframe Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	NO	YES
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	NO	YES
Verification SOP Class	1.2.840.10008.1.1	NO	YES
VL endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	NO	YES
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	NO	YES
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	NO	YES
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	NO	YES
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	NO	YES
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	NO	YES
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	NO	YES
Ophthalmic Photography 8-Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	NO	YES
Ophthalmic Photography 16-Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	NO	YES
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	NO	YES
VL endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	NO	YES
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	NO	YES
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	NO	YES
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	NO	YES
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	NO	YES
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	NO	YES
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	NO	YES
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	NO	YES
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	NO	YES
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	NO	YES
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	NO	YES
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	NO	YES
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	NO	YES
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	NO	YES
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	NO	YES
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	NO	YES
Hanging Protocol Storage	1.2.840.10008.5.1.4.38.1	NO	YES

3.2.1.2 Associations Policies

3.2.1.2.1 General

The Storage Server AE accepts Association Requests for the Storage Service and the Verification Service. It might request an accompanying Association of the Storage Commitment Service Class, if asked so by the client. The DICOM standard application context name for DICOM 3.0 is always accepted and proposed:

Table 5. DICOM application context name for Verification Client AE

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.1.2.2 Number of Associations

Only a single Association should be active at the moment.

3.2.1.2.3 Asynchronous Nature

The Storage Server does not support asynchronous communication (multiple outstanding transactions over a single Association).

3.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 6. DICOM Implementation Class and Version for Storage Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

3.2.1.3 Association Initiation Policy

3.2.1.3.1 Activity - All interactions

3.2.1.3.1.1 Description and Sequence of Activity

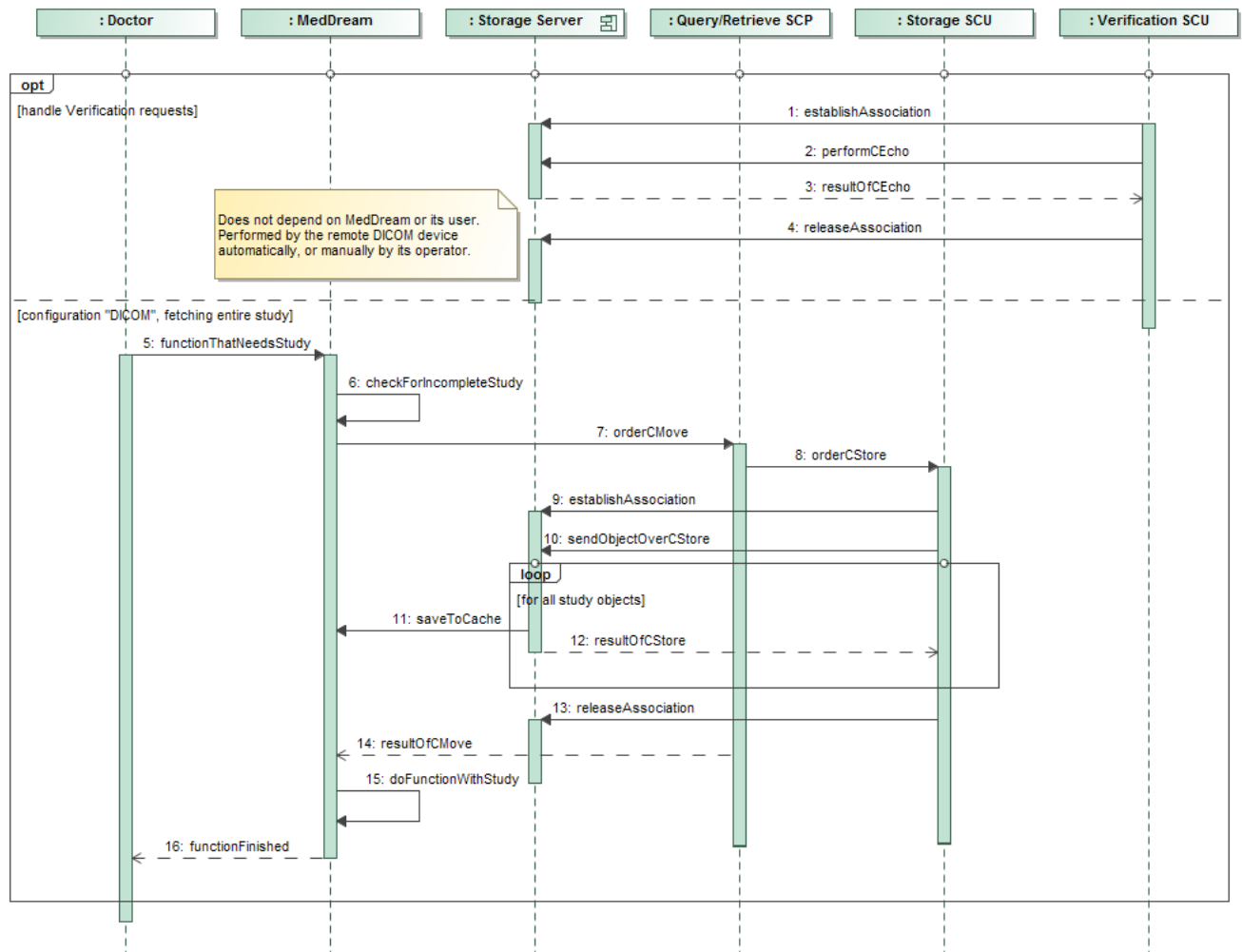


Figure 4. All interactions

3.2.1.3.1.2 Proposed Presentation Contexts

Table 7. Proposed Presentation Contexts for Storage Server AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Digital Mammography X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Digital Intra – oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None

X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG Baseline (Process 1):	1.2.840.10008.1.2.4.50	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	JPEG Lossless, Nonhierarchical (Processes 14)	1.2.840.10008.1.2.4.57	SCP	None
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless, Nonhierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG Baseline (Process 1):	1.2.840.10008.1.2.4.50	SCP	None
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Ophthalmic Photography 8-Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None
Ophthalmic Photography 16-Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCP	None

3.2.1.3.1.3 SOP Specific Conformance for SOP Classes

Table 8. Storage Server Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the system repository.
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response from a file system operation. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the console.

Table 9. Storage Server Communication Failure Behavior

Exception	Behavior
-----------	----------

Association aborted by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the console. Wrappers will detect the condition and might copy the message to the application logs.
---	--

3.2.2 Query/Retrieve Client Application Entity Specification

3.2.2.1 SOP Classes

Application Entity provides Standard Conformance to the following SOP Classes:

Table 10. SOP Classes for Query/Retrieve Client AE

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	YES	NO
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	YES	NO
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	YES	NO
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	YES	NO

3.2.2.2 Associations Policies

3.2.2.2.1 General

At a command from the operator, the MedDream Query/Retrieve Client AE attempts to establish an association with the specified Remote AE. When the association is established, a C-FIND request is made to retrieve a list of studies using the defined matching keys, or metadata of a study using its Study Instance UID. In the second case, after the response confirms existence of the study, an additional C-MOVE subrequest might be made to order the transfer of the entire study to the MedDream Storage Server AE. The MedDream Query/Retrieve Client waits for any C-FIND response. The established association remains active until a C-FIND response from the remote AE indicates the end of requested data items, or until a timeout period expires.

The MedDream Query/Retrieve Client AE itself does not accept Associations.

The DICOM standard application context name for DICOM 3.0 is always accepted and proposed:

Table 11. DICOM application context name for Verification Client AE

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.2.2.2 Number of Associations

Only a single Association is active at the moment. The results are displayed to the operator only after receiving them from SCP entirely.

3.2.2.2.3 Asynchronous Nature

The Query/Retrieve Client does not support asynchronous communication (multiple outstanding transactions over a single Association).

3.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 12. DICOM Implementation Class and Version for Query/Retrieve Client AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

3.2.2.3 Association Initiation Policy

3.2.2.3.1 Activity - All interactions

3.2.2.3.1.1 Description and Sequence of Activity

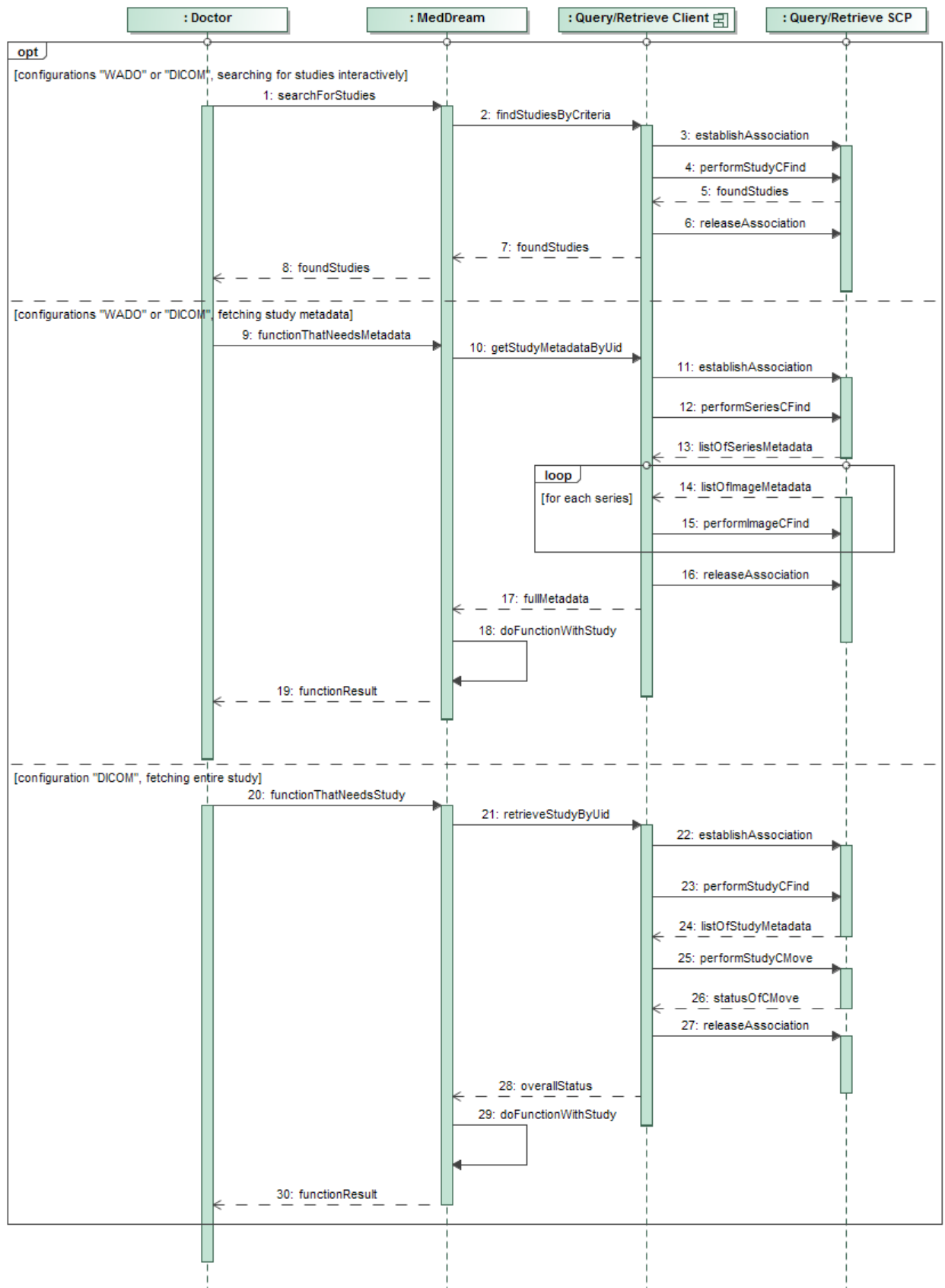


Figure 5. All interactions

3.2.2.3.1.2 Proposed Presentation Contexts

Table 13. Proposed Presentation Contexts for Query/Retrieve Client AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCU	None
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.10008.1.2	SCU	None
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

3.2.2.3.1.3 SOP Specific Conformance for SOP Classes

Table 14. Query/Retrieve Client Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	This is the last response and the Client will release the Association after collecting results.
Pending	Matching is continuing	FF00	The Client waits for another response.

Table 15. Query/Retrieve Client Communication Failure Behavior

Exception	Behavior
Association aborted by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the console. Wrappers will detect the condition and might copy the message to the application logs.

3.2.3 Storage Client Application Entity Specification

3.2.3.1 SOP Classes

Application Entity provides Standard Conformance to the following SOP Classes:

Table 16. SOP Classes for Storage Client AE

SOP Class Name	SOP Class UID	SCU	SCP
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	YES	NO
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	YES	NO
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	YES	NO
Digital Mammography X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.2	YES	NO
Digital Mammography X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	YES	NO
Digital Intra – oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3	YES	NO

Digital Intra – oral X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.3.1	YES	NO
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	YES	NO
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	YES	NO
Color Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.2	YES	NO
Pseudocolor Softcopy Presentation Stage Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.3	YES	NO
Blending Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.4	YES	NO
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	YES	NO
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	YES	NO
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	YES	NO
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	YES	NO
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	YES	NO
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	YES	NO
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	YES	NO
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	YES	NO
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	YES	NO
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	YES	NO
Radiation Therapy Image Storage	1.2.840.10008.5.1.4.1.1.481.1	YES	NO
Radiation Therapy Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	YES	NO
Radiation Therapy Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	YES	NO
Radiation Therapy Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	YES	NO
Radiation Therapy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	YES	NO
Radiation Therapy Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	YES	NO
Radiation Therapy Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	YES	NO
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	YES	NO
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	YES	NO
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	YES	NO
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	YES	NO
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	YES	NO
Real World Value Mapping Storage	1.2.840.10008.5.1.4.1.1.67	YES	NO
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	YES	NO
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	YES	NO
Multiframe Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	YES	NO
Multiframe Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	YES	NO
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	YES	NO
Verification SOP Class	1.2.840.10008.1.1	YES	NO
VL endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	YES	NO
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	YES	NO
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	YES	NO
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	YES	NO
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	YES	NO
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	YES	NO
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	YES	NO
Ophthalmic Photography 8-Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	YES	NO
Ophthalmic Photography 16-Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	YES	NO
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	YES	NO
VL endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	YES	NO
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	YES	NO
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	YES	NO
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	YES	NO

Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	YES	NO
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	YES	NO
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	YES	NO
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	YES	NO
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	YES	NO
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	YES	NO
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	YES	NO
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	YES	NO
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	YES	NO
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	YES	NO
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	YES	NO
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	YES	NO
Hanging Protocol Storage	1.2.840.10008.5.1.4.38.1	YES	NO

3.2.3.2 Associations Policies

3.2.3.2.1 General

The Storage Client AE proposes Association Requests for the Storage Service.

If a Storage Commitment is requested by the operator, the Storage Client AE will itself accept Associations with Presentation Contexts for SOP Classes of the Storage Commitment Service Class.

The DICOM standard application context name for DICOM 3.0 is always accepted and proposed:

Table 17. DICOM application context name for Verification Client AE

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.3.2.2 Number of Associations

Only a single Association is active at the moment. DICOM instances are sent one at a time.

3.2.3.2.3 Asynchronous Nature

The Storage Client does not support asynchronous communication (multiple outstanding transactions over a single Association).

3.2.3.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 18. DICOM Implementation Class and Version for Storage Client AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

3.2.3.3 Association Initiation Policy

3.2.3.3.1 Activity - All interactions

3.2.3.3.1.1 Description and Sequence of Activity

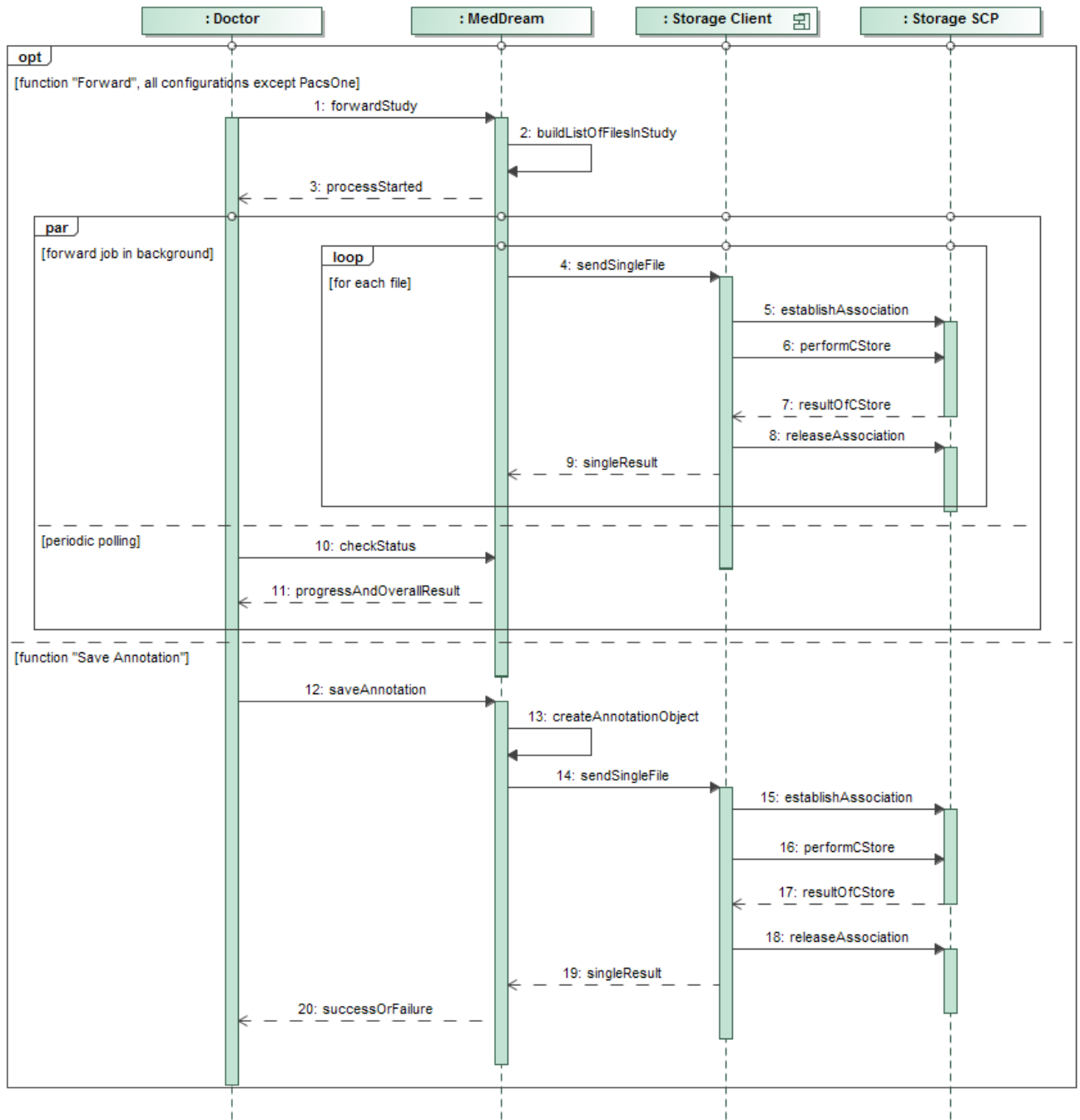


Figure 6. All interactions

3.2.3.3.1.2 Proposed Presentation Contexts

Table 19. Proposed Presentation Contexts for Storage Client AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Digital X-Ray Image Storage – for Presentation	1.2.840.1000 8.5.1.4.1.1.1.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
Digital Mammography X-Ray Image Storage – for Presentation	1.2.840.1000 8.5.1.4.1.1.1.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None

Digital Intra – oral X-Ray Image Storage – for Presentation	1.2.840.1000 8.5.1.4.1.1.1.3	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
X-Ray Angiographic Image Storage	1.2.840.1000 8.5.1.4.1.1.12 .1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.1000 8.5.1.4.1.1.12 .2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
CT Image Storage	1.2.840.1000 8.5.1.4.1.1.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
Ultrasound Multiframe Image Storage	1.2.840.1000 8.5.1.4.1.1.3. 1	JPEG Baseline (Process 1):	1.2.840.1 0008.1.2. 4.50	SCU	None
Enhanced MR Image Storage	1.2.840.1000 8.5.1.4.1.1.4. 1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
MR Image Storage	1.2.840.1000 8.5.1.4.1.1.4	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
MR Image Storage	1.2.840.1000 8.5.1.4.1.1.4	JPEG Lossless, Nonhierarchical (Processes 14)	1.2.840.1 0008.1.2. 4.57	SCU	None
NM Image Storage	1.2.840.1000 8.5.1.4.1.1.20	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
NM Image Storage	1.2.840.1000 8.5.1.4.1.1.20	Explicit VR Little Endian	1.2.840.1 0008.1.2. 1	SCU	None
Ultrasound Image Storage	1.2.840.1000 8.5.1.4.1.1.6. 1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
Ultrasound Image Storage	1.2.840.1000 8.5.1.4.1.1.6. 1	Explicit VR Big Endian	1.2.840.1 0008.1.2. 2	SCU	None
Secondary Capture Image Storage	1.2.840.1000 8.5.1.4.1.1.7	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.1000 8.5.1.4.1.1.7	JPEG Lossless, Nonhierarchical, First- Order Prediction	1.2.840.1 0008.1.2. 4.70	SCU	None
Secondary Capture Image Storage	1.2.840.1000 8.5.1.4.1.1.7	JPEG Baseline (Process 1):	1.2.840.1 0008.1.2. 4.50	SCU	None
Verification SOP Class	1.2.840.1000 8.1.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
Ophthalmic Photography 8-Bit Image Storage	1.2.840.1000 8.5.1.4.1.1.77 .1.5.1	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None
Ophthalmic Photography 16-Bit Image Storage	1.2.840.1000 8.5.1.4.1.1.77 .1.5.2	Implicit VR Endian: Default Transfer Syntax for DICOM	1.2.840.1 0008.1.2	SCU	None

3.2.3.3.1.3 SOP Specific Conformance for SOP Classes

Table 20. Storage Client Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Composite SOP Instance was successfully received and stored in the system repository by the SCP. Proceed to next step.
Warning	Data Element Coercion	B000	The SCP has corrected some Data Element(s) to avoid a conflict. Warning indication message is output to the console. Assume that the Instance has been stored successfully and proceed to next step.
Warning	Elements Discarded	B006	Some Data Element(s) were discarded by the SCP. Warning indication message is output to the console. Assume that the Instance has been stored successfully and proceed to next step.
Warning	Data Set does not match SOP Class	B007	Assume that the SCP has stored the Instance anyway. Warning indication message is output to the console. Proceed to next step.
Error	Others	Others	Any unrecognized Error Code is considered an indication that the Instance wasn't stored. Error indication message is output to the console. Do not include the Instance in the number of transferred Instances and their summary size but still proceed to the next step.

Table 21. Storage Client Communication Failure Behavior

Exception	Behavior
Association aborted by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the console. Wrappers will detect the condition and might copy the message to the application logs.

3.3 Network Interfaces

DICOM Upper Layer over TCP/IP is supported.

3.3.1 Physical Network Interface

MedDream DICOM WEB Viewer is indifferent to the physical medium over which TCP/IP executes. It inherits the TCP/IP stack from the operating system.

3.3.2 Additional Protocols

No additional protocols are supported.

3.3.3 IPv4 and IPv6 Support

Only IPv4 is explicitly supported and was tested.

3.4 Configuration

3.4.1 AE Title/Presentation Address Mapping

3.4.1.1 Local AE Titles

Application Entity	Default AE Title	Default TCP/IP Port
Storage Server	DCMRCV	
Query/Retrieve Client	DCMQR	
Storage Client	DCMSND	

3.4.1.2 Remote AE Title

The remote AE Titles and TCP ports are configurable in application settings.

3.4.2 Parameters

MedDream DICOM WEB Viewer configuration parameters relevant to DICOM communication are as follows.

Table 22. Configuration Parameter Table

Parameter	Configurable (Yes/No)	Default Value
Storage Server AE		
Listening Port	Yes	operator's choice
Accepted Called AETs	Yes	DCMRCV
Accepted Calling AETs	Yes	any
List of DICOM AETs that identify the location from which composite object instances received by this Storage Server may be retrieved on the network	No	unsupported
Storage Directory Path Prefix	Yes	operator's choice
Pack Command and Data PDVs in one PDU	Yes	false
Time-out waiting for the A-ASSOCIATE-AC PDU after transmission of the A-ASSOCIATE-RQ to open an association to the Storage Commitment SCU	Yes	5s
Time-out waiting for A-ASSOCIATE RQ on open TCP/IP connection - ARTIM timeout	Yes	5s
Time-out waiting for acceptance or rejection Response to an Association Open Request - Application Level timeout	No	no timeout
Time-out waiting on an open association for the next message after sending A-RELEASE RSP or A-ABORT RQ - closing timeout	No	500ms
Time-out waiting on an open association for the next message - DIMSE timeout	Yes	60s
Maximum PDU size the AE can receive	Yes	16384
Maximum PDU size the AE can send	Yes	16384
Support for the Basic TLS Secure Transport Connection Profile	Yes	Off
Accepted TLS Ciphers	Yes	-
Query/Retrieve Client AE		
Bind to Port	Yes	none
Proposed Calling AET	Yes	DCMQR
Proposed Called AET	Yes	any
Maximum PDU size the AE can receive	Yes	16384
Maximum PDU size the AE can send	Yes	16384
Time-out for receiving A-ASSOCIATE-AC	Yes	5s
Time-out for receiving C-FIND-RSP	Yes	60s
Time-out for receiving C-MOVE-RSP	Yes	600s
Time-out for TCP connect	Yes	no timeout
Time-out for receiving A-RELEASE-RP	Yes	5s
Support for the Basic TLS Secure Transport Connection Profile	Yes	Off
Accepted TLS Ciphers	Yes	-
Storage Client AE		
Bind to Port	Yes	none
Proposed Calling AET	Yes	DCMSND
Proposed Called AET	Yes	any
Maximum PDU size the AE can receive	Yes	16384
Maximum PDU size the AE can send	Yes	16384

Time-out waiting for A-ASSOCIATE RQ on open TCP/IP connection - ARTIM timeout	Yes	5s
Time-out waiting for acceptance or rejection Response to an Association Open Request - Application Level timeout	No	no timeout
Time-out waiting on an open association for the next message after sending A-RELEASE RSP or A-ABORT RQ - Closing timeout	No	500ms
Time-out waiting on an open association for the next message - DIMSE timeout	Yes	60s
Support for the Basic TLS Secure Transport Connection Profile	Yes	Off
Accepted TLS Ciphers	Yes	-

4 Media Interchange

MedDream DICOM WEB Viewer does not support Media Interchange.

5 Support of Extended Character Sets

MedDream DICOM WEB Viewer supports ISO_IR 192 (Unicode UTF-8) as an extended character set.

6 Security

The DICOM capabilities of the MedDream DICOM WEB Viewer do not support any specific security measures. It is assumed that the Software is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- firewall or router protections to ensure that the Software only has network access to approved external hosts and services;
- appropriate secure network channels (e.g. such as a Virtual Private Network) for any communication with external hosts and services outside the locally secured environment.

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.