AGFA HEALTHCARE
DICOM Conformance Statement

Agfa HealthCare Engage Suite

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Document Information

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Issued by:
Agfa HealthCare
V&V Connectivity
Septestraat 27
B-2640 Mortsel
Belgium

tel: +32 3 444 9367
email: connectivity@agfa.com

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Conformance Statement Overview

The Agfa HealthCare Engage Suite product, further referred to as 'Engage Suite' throughout the rest of this document, is a system that provides services for safe storage and retrieve of DICOM evidence objects such as Images, Key Image Notes, Presentation States, Structured Reports and others.

Engage Suite is part of Agfa HealthCare's Integrated Care Portfolio. It is a platform that enables web and mobile access to clinical data from disparate healthcare systems, including PACS, Labs & EMR systems. It is designed to bring together patients, referring physicians, physicians in point-of-care locations as well as healthcare institutions and other healthcare providers (such as home nursing agencies) to facilitate care coordination. It extends available healthcare IT systems (including Agfa Healthcare Enterprise Imaging PACS, Orbis HIS or EMR systems) to outside the enterprise boundaries.

This DICOM Conformance Statement is valid for following Engage Suite versions:
- Engage Suite 2016.0
- Engage Suite 2.2017-1
- Engage Suite 2.2017-1 SU01
- Engage Suite 2.2017-3
- Engage Suite 2.2017-4
- Engage Suite 2.2018-1
- Engage Suite 2.2018-2
- Engage Suite 2.2019-1
- Engage Suite 2.2019-2
- Engage Suite 2.2019-3
- Engage Suite 3.6

Engage Suite supports the following network services:

Table 1.1-1: Network Services Supported

SOP Classes	User of Service (SCU)	Provider of Service (SCP)	Display
Transfer			
US Image Storage	Yes	Yes	Yes
US Multi-frame Storage	Yes	Yes	Yes
Computed Radiography Image Storage	Yes	Yes	Yes
Digital X-Ray Image Storage – For Presentation	Yes	Yes	Yes
Digital X-Ray Image Storage – For Processing	Yes	Yes	Yes
Digital Mammography X-Ray Image Storage – For Presentation	Yes	Yes	Yes
Digital Mammography X-Ray Image Storage – For Processing	Yes	Yes	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	Yes	Yes	Yes
Digital Intra-oral X-Ray Image Storage – For Processing	Yes	Yes	Yes
CT Image Storage	Yes	Yes	Yes
MR Image Storage	Yes	Yes	Yes
Enhanced MR Image Storage	Yes	Yes	Yes
Secondary Capture Image Storage	Yes	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	Yes	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes	Yes
VL Endoscopic Image Storage	Yes	Yes	Yes
VL Microscopic Image Storage	Yes	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	Yes	Yes	Yes
VL Photographic Image Storage	Yes	Yes	Yes

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SOP Classes	User of Service (SCU)	Provider of Service (SCP)	Display
Positron Emission Tomography Image Storage	Yes	Yes	Yes
RT Image Storage	Yes	Yes	Yes
Raw Data Storage	Yes	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Color Secondary Capture Image Storage	Yes	Yes	Yes
Grayscale Softcopy Presentation State Storage	Yes	Yes	Yes
Hardcopy Grayscale Image Storage SOP Class	Yes	Yes	Yes
Hardcopy Color Image Storage SOP Class	Yes	Yes	Yes
Basic Text SR	Yes	Yes	Yes
Enhanced SR	Yes	Yes	Yes
Comprehensive SR	Yes	Yes	Yes
Key Object Selection Document	Yes	Yes	Yes
Workflow Management			
Modality Worklist – FIND	No	Yes	N/A
Storage Commitment Push Model SOP Class	No	Yes	N/A
Query/Retrieve			
Patient Root Q/R – FIND	Yes	Yes	N/A
Patient Root Q/R – MOVE	Yes	Yes	N/A
Study Root Q/R – FIND	Yes	Yes	N/A
Study Root Q/R – MOVE	Yes	Yes	N/A
Patient/Study Only Q/R – FIND	No	Yes	N/A
Patient/Study Only Q/R – MOVE	No	Yes	N/A

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1   INTRODUCTION

1.1   Revision Record

DICOM Conformance Statement Template NodeID: 8818332		
DICOM Conformance Statement Agfa HealthCare Engage Suite		
Revision Number	**Date**	**Reason for Change**
1.0	October 28th 2015	Initial version
1.1	October 30th 2015	Update after review cycle
1.2	May 18th 2016	Update document title and chapter 1.2 to indicate that the document is also valid for Agfa HealthCare Portal 2015-0 SU01 Add Query/Retrieve Server AE SCU information (chapter 2.1.2.2) Add MPPS Server AE specification (chapter 2.2.4) Update table 2.4-2 Configuration Parameters
5	February 6, 2017	Update document for Engage Suite Update Revision Number to be in line with the Livelink version
6	March 7, 2017	Minor update after review cycle – remove MPPS reference as it is N/A
7 – 8	September 13, 2017	Indicate that this document is also valid for Engage Suite 2.2017-1 SU01 and 2.2017-3
9	October 9, 2017	Indicate that this document is also valid for Engage Suite 2.2017-4
10	October 25, 2017	Update supported Display capabilities (table 1.1-1)
11	March 08, 2018	Document is also valid for Engage Suite 2.2018-1
12	July 09, 2018	Document is also valid for Engage Suite 2.1018-2
13	January 21, 2019	Document is also valid for Engage Suite 2.2019-1
14	May 15, 2019	Update Implementation Version Name dcm4che-1.1 to dcm4che-2.0
15	July 30, 2019	Document is also valid for Engage Suite 2.2019-2
16	October 14, 2019	Document is also valid for Engage Suite 2.2019-3
17	January 14,2021	Document is also valid for Engage Suite 3.6

1.2   Purpose and Intended Audience of this Document

This document is a DICOM Conformance Statement for the DICOM Services of the Agfa HealthCare Engage Suite, further referred to as Engage Suite.

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 and the IHE Technical Framework.

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.

Although the use of this conformance statement in conjunction with the DICOM 3.0 standard is intended to facilitate communication with Engage Suite, it is not sufficient to guarantee, by itself, the inter-operation of the connection. The following issues need to be considered:

1.3   General Remarks

1.3.1   Integration and Validation Activities

The integration of any device into a system of interconnected devices goes beyond the scope of the DICOM 3.0 standard and this conformance statement when *interoperability* is desired. The responsibility for analyzing the applications requirements and developing a

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solution that integrates the Agfa equipment with other vendors' systems is the user's responsibility and should not be underestimated.

However, the Conformance Statement facilitates a first level validation for interoperability between different applications supporting the same DICOM functionality. The comparison of different conformance statements is the first step towards assessing interconnectivity between Agfa and non-Agfa equipment.

In some circumstances it might be necessary to perform a validation to make sure that functional interoperability between the Agfa equipment and non-Agfa devices works as expected. The user should ensure that any non-Agfa provider accepts responsibility for any validation required for their connection with the Agfa equipment.

1.3.2   Future Evolution

As the DICOM 3.0 standard evolves to meet the user's growing requirements and to incorporate new features and technologies, Agfa will follow the evolution of the standard. This evolution of the standard may require changes to devices that have implemented DICOM 3.0. The user should ensure that any non-Agfa provider, who connects with Agfa devices, also plans for future evolution of the DICOM standard. A refusal to do so may result in the loss of functionality and/or connectivity between the different products.

1.4   Acronyms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard. Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
ACSE	Association Control Service Element
DICOM	Digital Imaging and Communications in Medicine
HIS/RIS	Hospital Information System / Radiology Information System
IHE	Integrating the Healthcare Enterprise
IE	Information Entity
IOD	(DICOM) Information Object Definition
ISO	International Standard Organization
MPPS	Modality Performed Procedure Step
MSPS	Modality Scheduled Procedure Step
MWL	Modality Worklist
N/A	Not Applicable
PDU	DICOM Protocol Data Unit
Q/R	Query Retrieve
SCN	Study Content Notification
SCP	DICOM Service Class Provider (DICOM server)
SCU	DICOM Service Class User (DICOM client)
SOP	DICOM Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
TLS	Transport Layer Security

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UID	Unique Identifier
VR	Value Representation

1.5   Related Documents

➢   ACR-NEMA Digital Imaging and Communications in Medicine (DICOM) V3.0

➢   IHE Radiology Technical Framework

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2   NETWORKING

2.1   Implementation Model

2.1.1   Application Data Flow Diagram

Engage Suite is logically divided in different DICOM Application Entities: Storage Server, Query/Retrieve Server and Modality Worklist Server.

The Storage Server AE implements the DICOM Storage Service Class and the Verification Service Class.

The Query/Retrieve Server AE implements Query/Retrieve Services.

The Modality Worklist Server AE implements the Verification Service Class and the Basic Work list Management Service Class.

2.1.2   Functional Definitions of AE's

2.1.2.1   Functional Capability of Storage Server Application Entity

The Engage Suite 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.

DICOM Instances received in a Storage Request are filed on local (attached/mounted) file system(s). A subset of attributes from received Instances is also stored in records local database.

2.1.2.2   Functional Capability of Query/Retrieve Server Application Entity

The Engage Suite Query/Retrieve Server Application Entity SCP waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Query/Retrieve Server AE expects it to be a DICOM application.

The Query/Retrieve Server AE SCP will accept Associations with Presentation Contexts for SOP Classes of the Verification and Query/Retrieve Service Classes.

Once received a Retrieve (Move) request, Query/Retrieve Server AE SCP will initiate a new association and send the requested instances to the Move Destination AE.

The Engage Suite Query/Retrieve SCU Server Application Entity IAN notification queries the source PACS to get the study information. Query SCU would do a C-Find to source and Engage Suite PACS to find out if the study needs to be pulled. If the study is nominated to be pulled, Engage Suite issues a C-Move command to move study from source PACS to Engage Suite PACS.

2.1.2.3   Functional Capability of Modality Worklist Server Application Entity

The Engage Suite Modality Worklist Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Modality Worklist Server AE expects it to be a DICOM application.

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The Modality Worklist Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Modality Worklist Service Classes.

When a Modality Worklist Find request is received, Modality Worklist Server AE will query the local database for a list of Scheduled Procedure Steps matching the query and will return a pending C-FIND response for each match.

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2.2   AE Specifications

2.2.1   Storage Server Application Entity Specification

2.2.1.1   SOP Classes Supported

This Application Entity provides Standard Conformance to the following SOP Class(es):

Table 2.2-1: SOP Classes for Engage Suite Storage Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	No	Yes
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	No	Yes
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	No	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	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
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	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
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	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
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes

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2.2.1.2   Association Establishment Policies

2.2.1.2.1   General

The Engage Suite Storage Server AE can both accept and propose Association Requests. The Engage Suite Storage Server AE will accept Association Requests for the Verification, Storage, and Storage Commitment Push Model Services. It will propose Associations only for the Storage Commitment Push Model Service.

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

Table 2.2-2: DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

2.2.1.2.2   Number of Associations

Engage Suite Storage Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the Application Server configuration file*.*

Table 2.2-3: Number of Associations as an Association Initiator

Maximum number of simultaneous associations initiated	10 (Configurable)

Table 2.2-4: Number of Associations as an Association Acceptor

Maximum number of simultaneous associations accepted	(See note 1)

Note 1:

The maximum number of associations accepted by <AE #1> is manually configurable at run time, and limited to the value that has been configured. The maximum configurable value may be limited by the available system resources. By default, the value is set at 10. Refer to the section on Configurations for a complete list of configuration parameters.

2.2.1.2.3   Asynchronous Nature

Engage Suite Storage Server does not support asynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous). Asynchronous mode of operation is not supported.

Table 2.2-5: Asynchronous Nature as an Association Initiator

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

Storage Server allows a single outstanding operation on any association. Therefore, Storage Server does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

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2.2.1.2.4   Implementation Identifying Information

Table 2.2-6: 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

2.2.1.3   Association Acceptance Policy

2.2.1.3.1   Activity – Receive Images

2.2.1.3.1.1   Description and Sequencing of Activity

A remote peer DICOM Application Entity, acting as a Storage SCU, establishes an association with Engage Suite Storage Server that accepts these Associations for the purpose of receiving supported SOP Class Instances.

In the default configuration any Calling and Called AET will be accepted. But when the Called AET does not correspond to the actual Storage Server AET, only a Presentation Context for the Verification SOP Class will be accepted and the SCU can only verify the DICOM Association, but cannot invoke any other related DICOM service.

The Storage Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason / Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4).

Table 2.2-7: Association Rejection Reasons

Result	Source	Reason	Description
2 - rejected transient	provider	2 – local limit exceeded	The (configurable) maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
1 - rejected permanent	user	2 - application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.
1 - rejected permanent	user	3 – calling AE title not recognized	The Association request contained an unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

2.2.1.3.1.2   Accepted Presentation Contexts

Table 2.2-8: Presentation Contexts accepted by Storage Server

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Storage Commitment Push Model	1.2.840.10008.1.20.1	Transfer Syntaxes for Non-Image Storage Services		SCP	None
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.9	Transfer Syntaxes for Image Storage Services		SCP	None

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Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	Transfer Syntaxes for Image Storage Services		SCP	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Transfer Syntaxes for Image Storage Services		SCP	None
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Transfer Syntaxes for Image Storage Services		SCP	None
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Transfer Syntaxes for Image Storage Services		SCP	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Transfer Syntaxes for Image Storage Services		SCP	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Transfer Syntaxes for Image Storage Services		SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Transfer Syntaxes for Image Storage Services		SCP	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Transfer Syntaxes for Image Storage Services		SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Transfer Syntaxes for Image Storage Services		SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Transfer Syntaxes for Image Storage Services		SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Transfer Syntaxes for Image Storage Services		SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Transfer Syntaxes for Image Storage Services		SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Transfer Syntaxes for Image Storage Services		SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Transfer Syntaxes for Image Storage Services		SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Transfer Syntaxes for Image Storage Services		SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Transfer Syntaxes for Image Storage Services		SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Transfer Syntaxes for Image Storage Services		SCP	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Transfer Syntaxes for Non-Image Storage Services		SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Transfer Syntaxes for Image Storage Services		SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Transfer Syntaxes for Image Storage Services		SCP	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Transfer Syntaxes for Image Storage Services		SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Transfer Syntaxes for Image Storage Services		SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Transfer Syntaxes for Image Storage Services		SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Transfer Syntaxes for Image Storage Services		SCP	None
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Transfer Syntaxes for Non-Image Storage Services		SCP	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Transfer Syntaxes for Non-Image Storage Services		SCP	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Transfer Syntaxes for Non-Image Storage Services		SCP	None

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Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Transfer Syntaxes for Non-Image Storage Services		SCP	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Transfer Syntaxes for Non-Image Storage Services		SCP	None

Table 2.2-9: Accepted Transfer Syntaxes for Non-Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

Table 2.2-10: Accepted Transfer Syntaxes for Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline	1.2.840.10008.1.2.4.50
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG Lossless, Non-Hierarchical	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG-LS Lossy (Near-Lossless) Image	1.2.840.10008.1.2.4.81
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91

If the Called AET is not corresponding to the actual Storage Server AET, only the Presentation Context for the Verification SOP Class will be accepted.

2.2.1.3.1.3   SOP Specific Conformance for Verification and Storage SOP Class

2.2.1.3.1.3.1 Specific Conformance for Verification SOP Class

Engage Suite Storage Server provides standard conformance to the DICOM Verification Service Class as a SCP. The status code for the C-ECHO is described in the following table:

Table 2.2-11: C-Echo Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The C-ECHO request is accepted

2.2.1.3.1.3.2 Specific Conformance for Storage SOP Classes

The associated Activity with the Storage service is the storage of medical DICOM data received over the network on a designated storage repository. The Engage Suite Storage Server AE will return a failure status if it is unable to store the received instance(s).

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The Engage Suite Storage Server AE does not have any dependencies on the number of Associations used to send images to it. Images belonging to more than one Study or Series can be sent over a single or multiple Associations. Images belonging to a single Study or Series can also be sent over different Associations. There is no limit on either the number of SOP Instances or the maximum amount of total SOP Instance data that can be transferred over a single Association.

The Engage Suite Storage Server AE is configured to retain the original DICOM data in DICOM Part 10 compliant file format. The Engage Suite Storage Server AE is Level 2 (Full) conformant as a Storage SCP. In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files. In addition to saving all Elements in files, a subset of the Elements are stored in the Engage Suite Query/Retrieve Server database to support query and retrieval requests and also allow updating of Patient, Study, and Series information by user input, or demographic and Study related messages.

If the received instance is a duplicate of a previously received instance, the old file and database information will not be overwritten with the new one.

The average throughput performance has been determined to be between 2 and 6 Mega Bytes per second on a 100 Megabit Ethernet network. Actual performance will depend greatly on the performance of the C-STORE SCU, the number of simultaneous active Associations, and the underlying network performance.

Table 2.2-12: Storage Server C-STORE Response Status

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 the internal database or a file system operation. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.
Warning	Coercion of Data Elements	B000	This status is returned if one or more Attribute values were coerced/ modified on reception. Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response. Warning indication message is output to the Service Log.
Warning	Data Set does not match SOP Class	B007	This status is returned if the C-STORE Request specifies Attributes that are not specific as part of the Storage SOP class. Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response. Warning indication message is output to the Service Log.

Table 2.2-13: Engage Suite Storage Server Service Communication Failure Reasons

Exception	Reason
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout), i.e. the STORAGESCP AE is waiting for the next C-STORE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received then they are maintained in the database. They are not automatically discarded because of a later failure.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). I.e. The STORAGE-SCP AE is waiting for the next C-STORE Data Set PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If a C-STORE Data Set has not been fully received then the data already received is discarded. If some Composite SOP Instances have already been successfully received over the Association then they are maintained in the database.

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Exception	Reason
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received then they are maintained in the database. They are not automatically discarded because of a later failure.

2.2.2 Query/Retrieve Server Application Entity Specification

2.2.2.1 SOP Classes Supported

This Application Entity provides Standard Conformance to the following SOP Class(es):

Table 2.2-14: SOP Class(es) for Query/Retrieve Server

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Patient/Study Only Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	No	Yes
Patient/Study Only Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	No	Yes
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	Yes	No
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	Yes	No
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	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
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	No
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	No
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	No
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	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
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	No
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	No

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SOP Class Name	SOP Class UID	SCU	SCP
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	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
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	No

2.2.2.2   Association Establishment Policies

2.2.2.2.1   General

The Engage Suite Query/Retrieve Server AE can both accept and propose Association Requests. The Query/Retrieve Server AE will accept Association Requests for the Verification and Query/Retrieve Services. It will propose Associations for Verification and Storage Services.

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

Table 2.2-15: DICOM Application Context Name

Application Context Name	1.2.840.10008.3.1.1.1

2.2.2.2.2   Number of Associations

Engage Suite Query/Retrieve Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured in the Application Server configuration file.

Table 2.2-16: Number of Associations as an Association Initiator

Maximum number of simultaneous associations initiated	10 (Configurable)

Table 2.2-17: Number of Associations as an Association Acceptor

Maximum number of simultaneous associations accepted	(See note 1)

Note 1:

The maximum number of associations accepted by <AE #1> is manually configurable at run time, and limited to the value that has been configured. The maximum configurable value may be limited by the available system resources. By default, the value is set at 10. Refer to the section on Configurations for a complete list of configuration parameters.

2.2.2.2.3   Asynchronous Nature

Engage Suite Query/Retrieve Server does not support asynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous). Asynchronous mode of operation is not supported.

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Table 2.2-18: Asynchronous Nature as an Association Initiator

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

Query/Retrieve Server allows a single outstanding operation on any association. Therefore, Query/Retrieve Server does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

2.2.2.2.4　Implementation Identifying Information

Table 2.2-19: DICOM implementation Class and Version for Query/Retrieve Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

2.2.2.3　Association Initiation Policies

2.2.2.3.1　Activity - Send Images Requested by an External Peer AE

2.2.2.3.1.1　Description and Sequencing of Activity

The Engage Suite Query/Retrieve Server AE will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer. The Query/Retrieve Server AE will send the Association Request to the specific C-MOVE destination, and upon successful negotiation of the required Presentation Context the image transfer is started. In all cases an attempt will be made to transmit all the indicated images in a single Association but this may not always be possible. The Association will be released when all the images have been sent.

If an error occurs during transmission over an open Association then the image transfer is halted. The Query/ Retrieve Server AE will not attempt to independently retry the image export.

2.2.2.3.1.2　Proposed Presentation Contexts

Table 2.2-20: Presentation Contexts Proposed by Query/Retrieve Server

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	**UID**			
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	Transfer Syntaxes for Image Storage Services	SCU	None
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	Transfer Syntaxes for Image Storage Services	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Transfer Syntaxes for Image Storage Services	SCU	None

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Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	**UID**			
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Transfer Syntaxes for Image Storage Services	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Transfer Syntaxes for Image Storage Services	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Transfer Syntaxes for Image Storage Services	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Transfer Syntaxes for Image Storage Services	SCU	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Transfer Syntaxes for Image Storage Services	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Transfer Syntaxes for Image Storage Services	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Transfer Syntaxes for Image Storage Services	SCU	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Transfer Syntaxes for Image Storage Services	SCU	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Transfer Syntaxes for Image Storage Services	SCU	None
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Transfer Syntaxes for Image Storage Services	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Transfer Syntaxes for Image Storage Services	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Transfer Syntaxes for Image Storage Services	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Transfer Syntaxes for Image Storage Services	SCU	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Transfer Syntaxes for Image Storage Services	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Transfer Syntaxes for Image Storage Services	SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Transfer Syntaxes for Image Storage Services	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Transfer Syntaxes for Image Storage Services	SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Transfer Syntaxes for Image Storage Services	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Transfer Syntaxes for Image Storage Services	SCU	None
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Transfer Syntaxes for Non-Image Storage Services	SCU	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Transfer Syntaxes for Non-Image Storage Services	SCU	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Transfer Syntaxes for Non-Image Storage Services	SCU	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Transfer Syntaxes for Non-Image Storage Services	SCU	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Transfer Syntaxes for Non-Image Storage Services	SCU	None

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Table 2.2-21: Proposed Transfer Syntaxes for Non-Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

Table 2.2-22: Proposed Transfer Syntaxes for Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline	1.2.840.10008.1.2.4.50
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG Lossless, Non-Hierarchical	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG-LS Lossy (Near-Lossless) Image	1.2.840.10008.1.2.4.81
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91

If the Called AET is not corresponding to the actual Storage Server AET, only the Presentation Context for the Verification SOP Class will be accepted.

2.2.2.3.1.3   SOP Specific Conformance for Image & SR SOP Classes

When a SOP Instance is selected for export from Engage Suite Query/Retrieve Server, its contents will be exported as it was originally received unless some of the Patient demographic and Study information Elements were altered.

The Patient demographic and Study information can be entered or altered by several means: manually (through the web interface) or from HL7 messaging. The replacement behavior depends on which specific DICOM and HL7 services are supported. Also, this behavior is configurable. Values can be altered without changing the SOP Instance UID unless otherwise noted.

The Query/Retrieve Server AE will exhibit the following behavior according to the Status Code value returned in a C-STORE Response from a destination C-STORE SCP:

Table 2.2-23: Engage Suite Query/Retrieve Server AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote Storage SCP has successfully stored the exported SOPInstance. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Refused	Out of Resources	A700-A7FF	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Error	Cannot Understand	C000-CFFF	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.

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Service Status	Further Meaning	Error Code	Behavior
Warning	Data Set does not match SOP class	B007	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Elements Discarded	B006	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Attribute List Error	0107	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Attribute Value Out of Range	0116	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
*	*	Any other status code	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.

Table 2.2-24: Engage Suite Query/Retrieve Server AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Logs
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Logs
Association A-Aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The TCP/IP Socket is closed. Error indication message is output to the Service Logs.

2.2.2.4   Association Acceptance Policies

2.2.2.4.1   Activity - Handling Query and Retrieval Requests

2.2.2.4.1.1   Description and Sequencing of Activity

The Query/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected. It can be configured to only accept Associations from certain Application Entities.

If Query/Retrieve Server AE receives a query (C-FIND) request then the response(s) will be sent over the same Association used to send the C-FIND-Request.

If Query/Retrieve Server AE receives a retrieval (C-MOVE) request then the responses will be sent over the same Association used to send the C-MOVE-Request.

The Query/Retrieve Server AE will send the requested SOP Instances to the C-MOVE Destination over a newly created Association and report in the C-MOVE-Response any success or failure status of each attempt to send a Composite SOP Instance.

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The Query/Retrieve Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason / Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4).

Table 2.2-25: Association Rejection Reasons

Result	Source	Reason	Description
2 - rejected transient	provider	2 - local limit exceeded	The (configurable) maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
1 - rejected permanent	user	2 - application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.
1 - rejected permanent	user	3 – calling AE title not recognized	The Association request contained an unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

2.2.2.4.1.2   Accepted Presentation Contexts

Table 2.2-26: Accepted Presentation Contexts for Engage Suite Query/Retrieve Server AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational queries
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Patient Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational Retrieve
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational queries
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational retrieve
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Patient/Study Only Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational queries
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Patient/Study Only Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational-retrieve
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

If the Called AET is not corresponding to the actual Query/Retrieve Server AET, it will only accept the Presentation Context for the Verification SOP Class.

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2.2.2.4.1.1   SOP Specific Conformance

2.2.2.4.1.1.1 Specific Conformance for Verification SOP Class

Engage Suite Storage Server provides standard conformance to the DICOM Verification Service Class as a SCP. The status code for the C-ECHO is described in the following table:

Table 2.2-27: C-Echo Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The C-ECHO request is accepted

2.2.2.4.1.1.2 Specific Conformance for Query SOP Classes

The Query/Retrieve Server AE supports hierarchical and relational queries. Not all attributes are returned by default. Only those attributes requested in the query identifier are returned.

Query responses always return values from the Query/Retrieve Server database. Exported SOP Instances are always updated with the latest values kept in the database prior to export. Thus, a change in Patient demographic information will be contained in both the C-FIND Responses and any Composite SOP Instances exported to a C-MOVE Destination AE.

Patient Root Information Model: All required search keys on each of the four levels (Patient, Study, Series, and Image) are supported. However, the Patient ID (0010,0020) key must have at least a partial value if the Patient's Name (0010,0010) is not present in a Patient Level query.

Study Root Information Model: All the required search keys on each of the three levels (Study, Series, and Image) are supported. If no partial values are specified for Study attributes then either the Patient ID (0010,0020) key or the Patient's Name (0010,0010) must have at least a partial value specified.

Patient/Study Only Information Model: All the required search keys on the Patient and Study levels are supported. The Patient ID (0010,0020) key must be at least partially stated if the Patient's Name (0010,0010) is not present in a Patient Level query.

Table 2.2-28: Patient Root C-FIND SCP Supported Elements

Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
Patient Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Issuer of Patient ID	0010,0021	LO	NONE
Patient's Birth Date	0010,0030	DA	S,U,R
Patient's Sex	0010,0040	CS	S,*,U
Study Level			
Study Instance UID	0020,000D	UI	S,L
Study ID	0020,0010	SH	S,*,U
Study Date	0008,0020	DA	S,U,R
Study Time	0008,0030	TM	S,U,R
Accession Number	0008,0050	SH	S,*,U
Referring Physician's Name	0008,0090	PN	S,*,U

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Attribute Name	Tag	VR	Types of Matching
Modalities In Study	0008,0061	CS	S,*,U
Series Level			
Series Instance UID	0020,000E	UI	S,L
Series Number	0020,0011	IS	S,*,U
Modality	0008,0060	CS	S,*,U
Performed Procedure Step Start Date	0040,0244	DA	S,U,R
Performed Procedure Step Start Time	0040,0245	TM	S,U,R
Image Level			
SOP Instance UID	0008,0018	UI	S,L
SOP Class UID	0008,0016	UI	S,L
Instance Number	0020,0013	IS	S,*,U
Completion Flag	0040,0A91	CS	S,*,U
Verification Flag	0040,0A93	CS	S,*,U

Table 2.2-29: Study Root C-FIND SCP Supported Elements

Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
Study Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Issuer of Patient ID	0010,0021	LO	NONE
Patient's Birth Date	0010,0030	DA	S,U,R
Patient's Sex	0010,0040	CS	S,U
Study Instance UID	0020,000D	UI	S,L
Study ID	0020,0010	SH	S,*,U
Study Date	0008,0020	DA	S,U,R
Study Time	0008,0030	TM	S,U,R
Accession Number	0008,0050	SH	S,*,U
Referring Physician's Name	0008,0090	PN	S,*,U
Modalities In Study	0008,0061	CS	S,*,U
Series Level			
Series Instance UID	0020,000E	UI	S,L
Series Number	0020,0011	IS	S,*,U
Modality	0008,0060	CS	S,*,U
Performed Procedure Step Start Date	0040,0244	DA	S,U,R
Performed Procedure Step Start Time	0040,0245	TM	S,U,R
Image Level			
SOP Instance UID	0008,0018	UI	S,L
SOP Class UID	0008,0016	UI	S,L
Instance Number	0020,0013	IS	S,*,U
Completion Flag	0040,0A91	CS	S,*,U
Verification Flag	0040,0A93	CS	S,*,U

Types of Matching supported by the C-FIND SCP:

An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, an "*" indicates wildcard matching, a 'U' indicates Universal Matching, and an 'L'

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indicates that UID lists are supported for matching. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned (i.e. universal matching).

Table 2.2-30: Engage Suite Query/Retrieve Server C-FIND Response Status

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response on a query of the internal database. The appropriate Status will be sent in the C-FIND Response. Error indication message is output to the Service Log.
Cancel	Matching terminated due to Cancel Request	FE00	The C-FIND SCU sent a Cancel Request. This has been acknowledged and the search for matches has been halted. Cancel indication message is output to the Service Log.
Pending	Matches are continuing and current match is supplied	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. Pending indication message is output to the Service Log.

2.2.2.4.1.1.3 Specific Conformance for Query/Retrieve SOP Classes

Exported SOP Instances are always updated with the latest values kept in the database prior to export.

Table 2.2-31: Engage Suite Query/Retrieve Server C-MOVE Response Status

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response on a query of the internal database. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Error	Unable to perform suboperations	A702	C-STORE sub-operations cannot be performed due to failure of an Association Request or a C-STORE Request. Error indication message is output to the Service Log.
Error	Move Destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to Query/Retrieve SCP AE. Error indication message is output to the Service Log.
Error	Identifier does not match SOP Class	A900	The C-MOVE identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class or retrieval level. Error indication message is output to the Service Log.
Error	Unable to process	Cxxx	The Move Destination AET is missing in the C-MOVE Request. Error indication message is output to the Service Log.
Pending	Matches are continuing and current match is supplied	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. Pending indication message is output to the Service Log.

Table 2.2-32: Engage Suite Query/Retrieve Server Service Communication Failure Behavior

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Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout), i.e. the Query/Retrieve Server SCP AE is waiting for the next C-FIND or C-MOVE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout), i.e. the Query/ Retrieve Server AE is waiting for the next message PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log.

2.2.3   Modality Worklist Server Application Entity Specification

2.2.3.1   SOP Classes Supported

Engage Suite Modality Worklist Server Application Entity provides Standard Conformance to the following SOP Classes:

Table 2.2-33: SOP Classes for Engage Suite Modality Worklist Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	No	Yes
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	No	Yes

2.2.3.2   Association Establishment Policies

2.2.3.2.1   General

Engage Suite Modality Worklist Server AE can both accept and propose Association Requests. The Modality Worklist Server AE will accept Association Requests for the Verification and Modality Worklist Services. It will propose Associations for Verification and Storage Services.

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

Table 2.2-34: DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

2.2.3.2.2   Number of Associations

Engage Suite Modality Worklist Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the attribute "MaxClients" in the Application Server configuration file (i.e. jboss-service.xml for JBoss application server).

Table 2.2-35: Number of Associations

Maximum number of simultaneous associations initiated	10 (Configurable)

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2.2.3.2.3   Asynchronous Nature

Engage Suite Modality Worklist Server does not support asynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous). Asynchronous mode of operation is not supported.

Table 2.2-36: Asynchronous Nature as an Association Initiator

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

2.2.3.2.4   Implementation Identifying Information

Table 2.2-37: DICOM implementation Class and Version for Modality Worklist Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

2.2.3.3   Association Initiation Policies

The Modality Worklist Server AE does not initiate Associations.

2.2.3.4   Association Acceptance Policies

2.2.3.4.1   Activity – External Peer AE requests MWL query

2.2.3.4.1.1   Description and Sequencing of Activity

The Modality Worklist Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected. It can be configured to only accept Associations from certain Application Entities.

When Modality Worklist SCUs query the Modality Worklist Server AE the queries run against the MWL items in the local database.

The Modality Worklist Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason / Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4).

Table 2.2-38: Association Rejection Reasons

Result	Source	Reason	Description
2 - rejected transient	provider	2 – local limit exceeded	The (configurable) maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
1 - rejected permanent	user	2 - application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.
1 - rejected permanent	user	3 – calling AE title not recognized	The Association request contained an unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

2.2.3.4.1.2   Proposed Presentation Contexts

Table 2.2-39: Accepted Presentation Contexts for Engage Suite Query/Retrieve Server AE

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Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Modality Work list Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

If the Called AET is not corresponding to the actual Modality Worklist Server AET, only the Presentation Context for the Verification SOP Class will be accepted.

2.2.3.4.1.3   SOP Specific Conformance

2.2.3.4.1.3.1 Specific Conformance for Verification SOP Class

Engage Suite Storage Server provides standard conformance to the DICOM Verification Service Class as a SCP. The status code for the C-ECHO is described in the following table:

Table 2.2-40: C-Echo Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The C-ECHO request is accepted

2.2.3.4.1.3.2 Specific Conformance for Modality Worklist SOP Class

Return attributes depend on the information provided by the connected HIS/RIS. Not all attributes are returned by default. Only those attributes requested in the query identifier are returned. Query responses always return values from the Modality Worklist Server database.

Table 2.2-41: Modality Worklist C-FIND SCP Supported Elements

Attribute Name	Tag	VR	Types of Matching
Specific Character Set	0008,0005	CS	NONE
Scheduled station AE title	0040,0001	AE	S
Scheduled Procedure Step Start Date	0040,0002	DA	S,R
Scheduled Procedure Step Start Time	0040,0003	TM	S,R
Scheduled Performing Physician's Name	0040,0006	PN	S,*
Modality	0008,0060	CS	S
Accession Number	0008,0050	SH	S
Patient's Name	0010,0010	PN	S,*
Patient's ID	0010,0020	LO	S
All others			NONE

Types of Matching supported by the C-FIND SCP:

An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, an "*" indicates wildcard matching, a "U" indicates Universal Matching. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned.

Table 2.2-42: Modality Worklist Server C-FIND Response Status

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Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	Success indication message is output to the Service Log.
Error	Processing Failure	0110	This is treated as a permanent Failure. The appropriate Status will be sent in the C-FIND Response. Error indication message is output to the Service Log.
Canceled	Matching terminated due to cancel request	FE00	This status is returned if a Cancel Request is received from the SCU during the processing of a Modality Work list request. A cancel indication message is output to the Service Log.
Pending	Matching is continuing	FF00	This status is returned with each matching response. A pending indication message is output to the Service Log.

Table 2.2-43: Modality Server Service Communication Failure Behavior

Exception	Behavior
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log.

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2.3   Network Interfaces

Engage Suite provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8 of the DICOM Standard. Engage Suite inherits its TCP/IP stack from the computer system upon which it executes.

2.3.1   Physical Medium Support

Engage Suite is indifferent to the physical medium over which TCP/IP executes; it inherits this from the Java Runtime Environment.

2.3.2   Additional Protocols

There are no additional protocols required.

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2.4   Configuration

2.4.1   AE Title/ Presentation Mapping

2.4.1.1   Local AE Titles

The AE title would depend on the client ID for the customer for which the PACS is installed.

Table 2.4-1: AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
Storage Server	<CLIENTID>_ARC	2104
Query/Retrieve Server	<CLIENTID>_ARC	2104
Modality Worklist	<CLIENTID>_ARC	2104

2.4.1.2   Remote AE Titles

Remote AE Titles, TCP/IP Addresses and ports can be configured through web interface. In the default configuration, Association Requests with any Calling AET will be accepted.

2.4.2   Configuration Parameters

Table 2.4-2: Configuration Parameter Table

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
Listening Port	Yes	2104
Maximum number of simultaneous Associations	Yes	10
Time-out waiting for A-ASSOCIATE RQ on open TCP/IP connection (ARTIM timeout)	Yes	5s
Time-out waiting on an open association for the next message (DIMSE timeout)	Yes	no timeout
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 (Closíng timeout)	Yes	500ms
Maximum PDU size the AE can receive	Yes	16352
Maximum PDU size the AE can send	No	65535
Pack Command and Data PDVs in one PDU	Yes	FALSE
Accepted TLS Ciphers	Yes	-
Storage Server AE		
Accepted Called AETs	Yes	<CLIENT_ID>_ARC
Accepted Calling AETs	Yes	ANY
Storage Directory Path Prefix	Yes	/opt/mphrx/customer/data/dicom/
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
Query/Retrieve AE SCP		
Accepted Called AETs	Yes	<CLIENT_ID>_ARC
Accepted Calling AETs	Yes	ANY

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Parameter	Configurable (Yes/No)	Default Value
Send optional C-MOVE RSPs with Pending Status to the C-OVE SCU during the retrieve process	Yes	true
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
Query/Retrieve AE SCU		
Accepted Calling AETs	Yes	DCMQR
Modality Worklist AE		
Accepted Called AETs	Yes	<CLIENT_ID>_ARC
Accepted Calling AETs	Yes	ANY

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3   MEDIA INTERCHANGE

Engage Suite does not support Media Storage.

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4   SUPPORT FOR EXTENDED CHARACTER SETS

Engage Suite supports ISO_IR 100 (ISO 8859-1 Latin 1) as an extended character set.

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5   SECURITY

5.1   Security Profiles

Engage Suite supports secure DICOM communication in conformance with the Basic TLS Secure Transport Connection Profile. At default configuration, the TLS option is deactivated.

5.2   Association Level Security

Engage Suite can be configured to accept Association Requests from only a limited list of Calling AE Titles.

In the default configuration, Association requests with any Calling AET and any Called AET will be accepted. However, if the Called AET is not correspondent to any of the actual Storage Server AETs, only acceptance of the Presentation Context for Verification SOP Class will be returned in the Association Acceptance Response (A-ASSOCIATE AC).

5.3   Application Level Security

Engage Suite web module can be configured to require user authentication in order to access to the user interface functionalities.

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6   ANNEXES

6.1   IOD Contents

6.1.1   Created SOP Instance(s)

Engage Suite does not create SOP instances

6.1.2   Usage of Attributes from received IODs

6.1.3   Attribute Mapping

6.1.4   Coerced/ Modified Fields

Attribute coercion is configurable for IOD's received by the Storage Server. Attributes can either be mapped or may be filled with "fixed values" depending on the existence or the content(s) of one or more other Attributes.

Patient Information, Patient Demographics and Study Information could either be modified manually using the web based system management tool or updated automatically by information received from HIS/RIS.

The coerced/modified Attribute values are provided when a remote Query/Retrieve SCU queries information or when SOP Instances are sent to remote Storage SCP. Attribute coercion will be indicated in the appropriate Service Response Status.

6.2   Data Dictionary of Private Attributes