DICOM Conformance Statement

Software Version 2.6

HEIDELBERG EYE EXPLORER®

HEYEX 2 and HEYEX PACS

September 2022

Article No. 260001-001 GL.AE22

HEIDELBERG ENGINEERING

Legal Manufacturer
MedicalCommunications GmbH
Max-Jarecki-Str. 8
69115 Heidelberg/Germany
Telephone: +49 (0) 6221 75 31 0
Fax: +49 6221 7531 119

Distributed by:
Heidelberg Engineering GmbH
Max-Jarecki-Str. 8
69115 Heidelberg/Germany
Telephone: +49 (0) 6221 64 63 0
Fax: +49 (0) 6221 64 63 62

US Corporate Office
Heidelberg Engineering Inc.
10 Forge Parkway
Franklin, MA 02038
Telephone: +1 508 530 7900
Fax: +1 508 530 7901

Email: info@HeidelbergEngineering.com
Internet: http://www.HeidelbergEngineering.com

1 Conformance Statement Overview

Note: HEIDELBERG EYE EXPLORER (HEYEX 2 / HEYEX PACS) is a variant of Ashvins.

This document describes the conformance of Ashvins with the DICOM 3.0 standard.

The system entitled Ashvins is a medical image and document storage system. Ashvins receives medical instances from modalities of different types and stores these objects on storage facilitys. Ashvins may also actively retrieve images from modalities.

The interface between Ashvins and remote applications connected to Ashvins is compliant with DICOM, i.e. remote application may send images to Ashvins using the C- STORE DIMSE-C service from one of the SOP Classes in the Storage Service Class.

Ashvins queries the contents of remote database providers using the C-FIND DIMSE-C service. Ashvins also retrieves images from a service provider using the C-MOVE DIMSE C-service.

Ashvins provides the following DICOM data exchange features:

Receiving images from remote systems such as acquisition or viewing stations and storing them in databases.

Copying images from the database to remote databases and vice versa. For this purpose, users can query remote databases.

Printing images from the database on a DICOM printer.

Reading and writing DICOM CD/DVD disks.

Furthermore, Ashvins allows remote systems to query the Ashvins database and to retrieve images from it.

The following table provides an overview of the network services supported by Ashvins.

Network services

SOP Class name	SOP Class UID	SCU	SCP
Transfer			
CR Image Storage – STORE	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
CT Image Storage – STORE	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Enhanced CT Image Storage - STORE	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
MR Image Storage – STORE	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage – STORE	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
US Image Storage – STORE	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
SC Image Storage – STORE	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
X-Ray Angiographic Image – STORE	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image – STORE	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
X-ray Angio Biplane Image Storage – STORE	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
X-ray Angio Biplane Image Storage – STORE	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
NM Image Storage – STORE	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes

SOP Class name	SOP Class UID	SCU	SCP
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
VL Endoscopic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
RT Image Storage – STORE	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage – STORE	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage – STORE	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage – STORE	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage – STORE	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Brachy Treatment Record Storage – STORE	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
RT Treatment Summary Record Storage – STORE	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
Positron Emission Tomography Image Storage – STORE	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Raw Data Storage – STORE	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Multi-Frame Grayscale Byte Secondary Capture	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-Frame Grayscale Word Secondary Capture	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Ophthalmic Photography 8 Bit Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	Yes
Ophthalmic Photography 16 Bit Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	Yes
Ophthalmic Tomography Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes
Ophthalmic Thickness Map Storage SOP Class	1.2.840.10008.5.1.4.1.1.81.1	Yes	Yes
Corneal Topography Map Storage SOP Class	1.2.840.10008.5.1.4.1.1.82.1	Yes	Yes
Stereometric Relationship Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	Yes
Lensometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.1	Yes	Yes

SOP Class name	SOP Class UID	SCU	SCP
Autorefraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.2	Yes	Yes
Keratometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.3	Yes	Yes
Subjective Refraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.4	Yes	Yes
Visual Acuity Measurements Storage	1.2.840.10008.5.1.4.1.1.78.5	Yes	Yes
Spectacle Prescription Report Storage	1.2.840.10008.5.1.4.1.1.78.6	Yes	Yes
Ophthalmic Axial Measurements Storage	1.2.840.10008.5.1.4.1.1.78.7	Yes	Yes
Intraocular Lens Calculations Storage	1.2.840.10008.5.1.4.1.1.78.8	Yes	Yes
Macular Grid Thickness and Volume Report Storage	1.2.840.10008.5.1.4.1.1.79.1	Yes	Yes
Ophthalmic Visual Field Static Perimetry Measurements Storage SOP Class	1.2.840.10008.5.1.4.1.1.80.1	Yes	Yes
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Structured reporting			
Basic Text SR – STORE	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Enhanced SR – STORE	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Comprehensive SR – STORE	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	Yes	Yes
Mammography CAD SR – STORE	1.2.840.10008.5.1.4.1.1.88.50	Yes	Yes
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
X-Ray Radiation Dose SR - STORE	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Radiopharmaceutical Radiation Dose SR - STORE	1.2.840.10008.5.1.4.1.1.88.68	Yes	Yes
Query/Retrieve			
Patient Root Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Study Root Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Patient/Study Only Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	Yes
Patient Root Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Study Root Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Patient/Study Only Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	Yes
Workflow			
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Yes	Yes
Verification	1.2.840.10008.1.1	Yes	Yes
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	Yes
Basic Study Content Notification	1.2.840.10008.1.9	Yes	No
Print management			
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No
Basic Film Session	1.2.840.10008.5.1.1.1	Yes	No

SOP Class name	SOP Class UID	SCU	SCP
Basic Film Box	1.2.840.10008.5.1.1.2	Yes	No
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	Yes	No

The following table lists the Supported Media Storage Application Profiles with roles.

Supported Media Storage Application Profiles with roles

Media storage application profile	Write files (FSC or FSU)	Read files (FSR)
Compact Disc – Recordable		
General purpose	CD-R option	Yes
DVD		
General purpose DVD-RAM	Option	Yes
DVD interchange with MPEG2 MP@ML	Option	Yes
General purpose DVD interchange with JPEG	Option	Yes
General purpose DVD interchange with JPEG 2000	Option	Option
USB and flash memory		
General Purpose USB Media Interchange with JPEG	Yes	Yes
General Purpose USB Media Interchange with JPEG-2000	No	Option
General Purpose MultiMedia Card Interchange with JPEG	No	Yes
General Purpose MultiMedia Card Interchange with JPEG-2000	No	Option
General Purpose CompactFlash Interchange with JPEG	No	Yes
General Purpose CompactFlash Interchange with JPEG-2000	No	Option
General Purpose Digital Card Interchange with JPEG	No	Yes
General Purpose Digital Card Interchange with JPEG-2000	No	Option

2 Table of Contents

3 Introduction

3.1 Revision history

Version	Date	Author	Comments
1.0	10/2010	MW, DB	Initial Revision
1.1	09/2011	DB	Add SOP Classes
1.2	11/2012	MW, RF	Add SOP Classes, Revision
2.0	02/2015	MW, RF	Revision
2.2	03/2016	MW	Revision
2.5	10/2018	AG	Add AE and SOP Classes, Revision
2.6	20/2019	AG	Revision
2.7	05/2020	AG	Revision, Services added
3.0	08/2021	AG	Revision
3.3	09/2021	AG	Revision, changes in chap. 4.9.1
3.4	11/2021	AG	Added Clinical Trial Modules usage
5.0	03/2022	MW	Added the BCP 195 TLS profile description

3.2 Purpose of this Document and Audience

This document is written for those who need to understand how Ashvins will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture as well as integrators who need to have a detailed understanding of the DICOM features of the products. This document contains some basic DICOM definitions so that any reader may understand how these products implement DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 Remarks

3.3.1 Interoperability

This Conformance Statement alone does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. Please note the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity between Ashvins and other DICOM equipment.
- This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information.
- The DICOM standard will evolve to meet the user's future requirements. Heidelberg Engineering reserves the right to make changes to its products or to discontinue its delivery.

Ashvins has participated in an industry-wide testing program sponsored by Integrating the Healthcare Enterprise (IHE). The IHE Integration Statement for Ashvins, together with the IHE Technical Framework, may facilitate the process of validation testing.

3.4 Terms and Definitions

Abstract Syntax	The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (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. A single device may have multiple Application Entities.
Application Entity Title (AET)	The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.
Association	A network communication channel set up between Application Entities.
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.
C-ECHO	DICOM service used to verify end-to-end communications with a peer DICOM service user
C-STORE	C-STORE is a DICOM service and is used to send, for example, images from a modality to a PACS
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).
Module	A set of Attributes within an Information Object Definition that are logically related to each other.
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 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).
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).
Unique Identifier (UID)	A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier.

Abbreviations

Abbreviation	Definition
AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communication in Medicine
EPDF	Encapsulated Document Format
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
IOD	Information Object Definition
IHE	Integrating the Healthcare Enterprise
IS	Information System (HIS, RIS, PACS within hospital)
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
OP	Ophthalmic Photography
OPT	Ophthalmic Tomography
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	DICOM Service-Object Pair
SPS	Scheduled Procedure Step
UID	Unique Identifier (unique string in entire network)
VR	Value Representation

3.5 Basics of DICOM Communication

This section describes the basic terminology used in this Conformance Statement. This section is not a substitute for DICOM training. Many DICOM terms are used in a simplified manner.

When two Application Entities (devices) want to communicate with each other via the DICOM protocol, they must first agree on several parameters during an initial network “handshake”. One of the two devices must initiate an Association (a connection to the other device), and inquire whether specific services, information, and encoding can be supported by the other device (Negotiation).

DICOM specifies a number of network services and types of information objects, each called Abstract Syntax for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted Transfer Syntaxes. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called Presentation Contexts. The receiving Application Entity accepts those Presentation Contexts which it also supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on Roles – in which one assumes the role of the Service Class User (SCU – client) and the other the role of the Service Class Provider (SCP – server). Typically, the SCU initiates the connection, e.g., the client system calls the server. The Association Negotiation finally enables the exchange of the maximum network packet (PDU) size.

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include, e.g., queries for worklists or transfer of image objects to an archive. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate Information Object Definition and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a Response Status indicating success, failure, or that query or retrieve operations are still in process.

3.6 References

Digital Imaging and Communication in Medicine (DICOM) 3.0

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow Diagram

Ashvins behaves like a single Application Entity. However, Ashvins can have multiple Application Entity Titles (see 4.4.1 AE Title/Presentation Address Mapping).

Fig. 1: Application Data Flow Diagram

4.1.2 Functional Definition of AEs

The Ashvins application entity acts as a service class user for transfer, verification, print management, and query retrieve service classes. The Ashvins application entity acts as a service class provider for verification, storage commitment, transfer service classes, and query retrieve service classes.

4.1.3 Sequencing of Real-World Activities

Not applicable.

4.2 AE Specifications

4.2.1 ASHVINS Application Entity

The Ashvins Application Entity provides standard conformance to the following DICOM SOP classes:

Supported SOP classes

SOP Class name	SOP Class UID	SCU	SCP
Transfer			
CR Image Storage – STORE	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
CT Image Storage – STORE	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Enhanced CT Image Storage - STORE	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
MR Image Storage – STORE	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage – STORE	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
US Image Storage – STORE	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
SC Image Storage – STORE	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
X-Ray Angiographic Image – STORE	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image – STORE	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
X-ray Angio Biplane Image Storage – STORE	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
X-ray Angio Biplane Image Storage – STORE	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
NM Image Storage – STORE	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
VL Endoscopic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
RT Image Storage – STORE	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage – STORE	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage – STORE	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage – STORE	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage – STORE	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Brachy Treatment Record Storage – STORE	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes

SOP Class name	SOP Class UID	SCU	SCP
RT Treatment Summary Record Storage – STORE	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
Positron Emission Tomography Image Storage – STORE	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Raw Data Storage – STORE	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Multi-Frame Grayscale Byte Secondary Capture	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-Frame Grayscale Word Secondary Capture	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Ophthalmic Photography 8 Bit Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	Yes
Ophthalmic Photography 16 Bit Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	Yes
Ophthalmic Tomography Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes
Ophthalmic Thickness Map Storage SOP Class	1.2.840.10008.5.1.4.1.1.81.1	Yes	Yes
Corneal Topography Map Storage SOP Class	1.2.840.10008.5.1.4.1.1.82.1	Yes	Yes
Stereometric Relationship Storage SOP Class	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	Yes
Lensometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.1	Yes	Yes
Autorefraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.2	Yes	Yes
Keratometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.3	Yes	Yes
Subjective Refraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.4	Yes	Yes
Visual Acuity Measurements Storage	1.2.840.10008.5.1.4.1.1.78.5	Yes	Yes
Spectacle Prescription Report Storage	1.2.840.10008.5.1.4.1.1.78.6	Yes	Yes
Ophthalmic Axial Measurements Storage	1.2.840.10008.5.1.4.1.1.78.7	Yes	Yes
Intraocular Lens Calculations Storage	1.2.840.10008.5.1.4.1.1.78.8	Yes	Yes
Macular Grid Thickness and Volume Report Storage	1.2.840.10008.5.1.4.1.1.79.1	Yes	Yes
Ophthalmic Visual Field Static Perimetry Measurements Storage SOP Class	1.2.840.10008.5.1.4.1.1.80.1	Yes	Yes
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Structured reporting			
Basic Text SR – STORE	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Enhanced SR – STORE	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Comprehensive SR – STORE	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	Yes	Yes
Mammography CAD SR – STORE	1.2.840.10008.5.1.4.1.1.88.50	Yes	Yes
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
X-Ray Radiation Dose SR - STORE	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Radiopharmaceutical Radiation Dose SR - STORE	1.2.840.10008.5.1.4.1.1.88.68	Yes	Yes
Query/Retrieve			

SOP Class name	SOP Class UID	SCU	SCP
Patient Root Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Study Root Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Patient/Study Only Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	Yes
Patient Root Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Study Root Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Patient/Study Only Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	Yes
Workflow			
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	No	Yes
Verification	1.2.840.10008.1.1	Yes	Yes
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	Yes
Basic Study Content Notification	1.2.840.10008.1.9	Yes	No
Print management			
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No
Basic Film Session	1.2.840.10008.5.1.1.1	Yes	No
Basic Film Box	1.2.840.10008.5.1.1.2	Yes	No
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	Yes	No

4.2.1.1 Association Policies

The following points must be satisfied for communication to be established:

- The Application Entity title
- The local Application Entity title
- The foreign IP Address
- The foreign DICOM Port

Ashvins will offer a configurable PDU size on associations initiated by Ashvins. Ashvins will accept any PDU size offered on associations initiated by remote applications if it is smaller or equal to its own PDU size. The PDU size of Ashvins can be configured. The default value is 65000.

The DICOM application context name is 1.2.840.10008.3.1.1.1.

4.2.1.2 Number of Associations

The number of simultaneous associations supported by Ashvins as a service class provider and service class user is, in principle, not limited. The practical maximum number of supported associations is determined by the amount of resources (CPU, memory, hard disk size).

Number of Associations as an Association Initiator for Ashvins

Number of Associations	Value
Maximum number of simultaneous associations	no limit

Number of Associations as an Association Acceptor for Ashvins

Number of Associations	Value
Maximum number of simultaneous associations	5

By default, a restriction to five simultaneous associations is configured, but can be changed according to the needs of the user.

4.2.1.3 Asynchronous Nature

Ashvins does support asynchronous operations and performs asynchronous window negotiation.

4.2.1.4 Implementation Identifying Information

DICOM Implementation Class and Version

Type	Value
Implementation Class UID	1.2.276.0.30.2
Implementation Version Name	Ashvins

4.2.1.5 Association Initiation Policy

Ashvins initiates associations as a result of the following events:

- Ashvins initiates an image storage request
- Ashvins initiates a verification procedure
- Ashvins initiates a query or move request

4.2.1.5.1 Association Acceptance Policy

The Ashvins Application Entity accepts association requests from all applications independent of the called or calling AE Title. For further information, please refer to (3.4.1 “AE Title/Presentation Address Mapping”, p. 30). The AE Title of Ashvins is defined by the user and is fully configurable per individual DICOM Partner.

The configuration is made in the user interface of Ashvins. Ashvins accepts associations for the following purposes:

- to allow remote applications to verify application level communication with Ashvins.
- to allow remote applications to store images in the Ashvins database.
- to allow remote applications to query the local Ashvins database.
- to allow remote applications to move images from the local storage of Ashvins to a destination defined by an AE Title which have to be configured in the user interface of Ashvins.

4.2.2 Exporting Images

4.2.2.1 Description and Sequencing of Activities

Exporting images involves the transfer of images from Ashvins to a remote system.

4.2.2.2 Proposed Presentation Contexts

Each time an association is initiated, Ashvins proposes several presentation contexts to be used on that association:

Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the Transfer SOP Classes listed in (“Supported SOP classes”, p. 13)		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
		JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51	SCU	None
		JPEG Lossless (Process 14)	1.2.840.10008.1.2.4.70	SCU	None
JPEG 2000 transfer syntaxes are only supported as an Option to the main application and must be purchased separately		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	SCU	None
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91	SCU	None
MPEG2 transfer syntaxes are only supported for Multi Frame objects such as VL Endoscopic		MPEG2 MP @ ML Image Compression	1.2.840.10008.1.2.4.100	SCU	None
MPEG2 transfer syntaxes are only supported for Multi Frame objects such as VL Endoscopic		MPEG2 Main Profile @ High Level	1.2.840.10008.1.2.4.101	SCU	None
Storage Commitment Push Model SOP Class		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.2.3 SOP Specific Conformance for SOP Class(es)

When exporting images, Ashvins can convert the transfer syntax of the exported images from any syntax to any of the above- mentioned transfer syntaxes as shown in table (“Transfer Syntax Conversion”, p. 18). "+" indicates a possible conversion:

Transfer Syntax Conversion

Source Transfer Syntax									
Destination Transfer Syntax	Implicit VR Little Endian	Explicit VR Little Endian	Explicit VR Big Endian	JPEG Baseline (Process 1)	JPEG Extended (Process 2 & 4)	JPEG Lossless (Process 14)	JPEG 2000 (Lossless Only)	JPEG 2000	MPEG2
Implicit VR Little Endian	+	+	+	+	+	+	+	+	
Explicit VR Little Endian	+	+	+	+	+	+	+	+	
Explicit VR Big Endian	+	+	+	+	+	+	+	+	

Source Transfer Syntax									
JPEG Baseline (Process 1)	+	+	+	+	+	+	+	+	
JPEG Extende d (Process 2 & 4)	+	+	+	+	+	+	+	+	
JPEG Lossless (Process 14)	+	+	+	+	+	+	+	+	
JPEG 2000 Image Compre ssion (Lossles s Only)	+	+	+	+	+	+	+	+	
JPEG 2000 Image Compre ssion	+	+	+	+	+	+	+	+	
MPEG2									+

Please note that Ashvins might change invalid data elements of an image on export.

Ashvins will recalculate and insert the Group Length elements in the image header.

4.2.2.4 DICOM Command Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Storage complete	0000	Continues with next image or releases association if no further image is to be sent.
Warning or Error	Storage failure	≠0000	Continues with next image or releases association if no further image is to be sent. The failure is logged and reported to the user.

4.2.2.5 DICOM Communication Failure Behavior

Exception	Behavior
Timeout	The association is aborted using A-ABORT and command is marked as failed. The failure is logged.
Link failure	The failure is logged.
Abort	The A-ABORT Request is acknowledged, and the abort is logged.

Storage Commitment N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The request for storage comment is considered successfully sent. A timer is started that will expire if no N-EVENT-REPORT for the Transaction UID is received within a configurable timeout period.
*	*	Any other status code	The Association is aborted using A-ABORT and the request for storage comment is marked as failed.

Storage Commitment Communication Failure Behavior

Exception	Behavior
Timeout	The association is aborted using A-ABORT and command is marked as failed. The failure is logged.
Association aborted	The association is aborted using A-ABORT and the storage commitment request job is marked as failed.
Association rejected	The association is aborted using A-ABORT and the storage commitment request job is marked as failed.

4.2.2.6 Storage Commitment Notifications (N-EVENT-REPORT)

Ashvins AE is capable of receiving an N-EVENT-REPORT notification if it has successfully negotiated.
Upon receipt of a N-EVENT-REPORT the timer associated with the Transaction UID will be canceled.

The behavior when receiving Event Types within the N-EVENT-REPORT is summarized in the Table below.

Storage Commitment N-EVENT-REPORT Behavior

Event Type	Event Type ID	Behavior
Storage Commitment Request Successful	1	Entry in Database is marked as successful. If archiving is configured images are marked as Archived.
Storage Commitment Request Complete - Failures Exist	2	Entry in Database is marked as

Storage Commitment N-EVENT-REPORT Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The request for storage comment is considered successfully sent. A timer is started that will expire if no N-EVENT-REPORT for the Transaction UID is received within a configurable timeout period.
*	*	Any other status code	The Association is aborted using A-ABORT and the request for storage comment is marked as failed.

4.2.3 Query/Retrieve

4.2.3.1 Description and Sequencing of Activities

Query/Retrieve involves the inquiry of information from a remote systems database as well as the transfer of images from a remote system to Ashvins initiated by Ashvins.

4.2.3.2 Proposed Presentation Contexts

Each time an association is initiated, Ashvins proposes a number of presentation contexts to be used on that association:

Proposed Presentation Context for Query/Retrieve

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the Query/Retrieve SOP Classes listed in (“Networking services”, p. 5)		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.3.3 SOP Specific Conformance to C-FIND SOP Classes

Ashvins provides standard conformance to the supported Query/Retrieve SOP Classes as an SCU.

4.2.3.4 Request Identifier for FIND-SCU

Attribute Name	Tag	Matching Type
Common to all query levels		
Specific Character Set	0008,0005	S
PATIENT Level		
Patient's Name	0010,0010	S, *, U
Patient ID	0010,0020	S, *, U (UNIQUE)
Patient's Birth Date	0010,0030	S, *
STUDY Level		
Study Date	0008,0020	S, *, R
Study Time	0008,0030	NONE
Accession Number	0008,0050	NONE
Referring Physicians Name	0008,0090	NONE
Study Description	0008,1030	NONE
Study Instance UID	0020,000D	UNIQUE
Study ID	0020,0010	NONE
SERIES Level		
Series Date	0008,0021	NONE
Series Time	0008,0031	NONE
Modality	0008,0060	S
Series Description	0008,103E	NONE
Body Part Examined	0018,0015	NONE
Series Instance UID	0020,000E	S, (UNIQUE)

Attribute Name	Tag	Matching Type
Common to all query levels		
Specific Character Set	0008,0005	S
Series Number	0020,0011	NONE
Number of Series Related Instances	0020,1209	NONE
IMAGE Level		
SOP Instance UID	0008,0018	S, (UNIQUE)
Instance Number	0020,0013	NONE
Image Comments	0020,4000	NONE
Presentation Label	0070,0080	NONE

Matching Types

Abbreviation	Description
U	Universal Matching
S	Single Value Matching
*	Wildcard Matching
R	Range Matching
NONE	indicates that no matching is supported, but that values for this Element are requested to be returned
UNIQUE	indicates that this is the Unique Key for that query level

4.2.3.5 Response Status for Query Request

Service Status	Further Meaning	Error Code	Reason
Pending	Success and Pending	FF00	Query returned result and more results will be send
Success	Success and last result	0000	Query was successful and this is the last result
Failed	Failed	A700	Query was impossible

4.2.4 Move remote Images

4.2.4.1 SOP Classes

MOVE-SCU provide Standard Conformance to the following SOP Class(es):

SOP Classes and Presentation Context for Move SCU

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the Query/Retrieve - MOVE SOP Classes listed in (“Networking services”, p. 5)		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.4.2 SOP Specific Conformance Move SCU

Ashvins provides standard conformance to the supported Move SOP Classes as an SCU.

4.2.4.3 Request Identifier for MOVE-SCU

Attribute Name	Tag	Unique, Matching or Return Key
Patient Level		
Patient ID	0010,0020	S
STUDY Level		
Study Instance UID	0020,000D	U
SERIES Level		
Series Instance UID	0020,000E	U
IMAGE Level		
SOP Instance UID	0008,0018	U

4.2.4.4 Response Status for MOVE-SCU Request

Service Status	Further Meaning	Status Code	Behavior
Success	Success and last result	0000	Retrieve was successful.
Pending	Success and Pending	FF00	Retrieval continues

4.2.5 Printing Images

4.2.5.1 Description and Sequencing of Activities

Printing images involves a print request from Ashvins being issued to a remote system.

4.2.5.2 Proposed Presentation Contexts

Each time an association is initiated, Ashvins proposes a number of presentation contexts to be used on that association:

Proposed Presentation Context for Printing Images

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the “Print management” SOP Classes listed in (“Networking services”, p. 5)		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.6 Communication Verification

4.2.6.1 Description and Sequencing of Activities

Ashvins issues a communication verification request to a remote system.

4.2.6.2 Proposed Presentation Contexts

Each time an association is initiated, Ashvins proposes a number of presentation contexts to be used on that association:

Proposed Presentation Context for Communication Verification

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.7 Association Acceptance Policy

This section describes the circumstances under which Ashvins will accept an association request from a remote system.

AE Titles and the mapping to IP addresses and port numbers are fully configurable. AE Titles are not mapped to hostnames. By default, any pair of AE Titles is accepted.

Ashvins can be restricted by configuration to accept only known remote systems which want to initiate an association. This can be further restricted so only systems initiating an association from a known IP address are accepted.

4.2.7.1 Presentation Context Acceptance Criterion

Ashvins accepts all contexts in the intersection of the proposed and acceptable presentation contexts. There is no check for duplicate contexts. Duplicate contexts are accepted.

4.2.7.2 Transfer Syntax Selection Policies

Ashvins prefers Explicit VR Little Endian above Implicit VR Little Endian transfer syntax and explicit Big Endian transfer syntax. If only explicit Big Endian and Implicit Little Endian are supposed, it will prefer explicit Big Endian.
The preferred transfer syntax can be configured by a system administrator per remote AE Title

4.2.8 Verify Application Level Communication

4.2.8.1 Associated Real-World Activity

Ashvins accepts associations from nodes that wish to verify application-level communication using the C-ECHO command.

4.2.8.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Verification

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.8.2.1 C-ECHO SCP Conformance

Ashvins provides standard conformance.

4.2.9 Storage Conformance

4.2.9.1 Associated Real-World Activity

Ashvins accepts associations from nodes that wish to store DICOM objects using the C-Store command.

4.2.9.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Storage

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the Transfer SOP Classes listed in (“Networking services”, p. 5)		Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCP	None

Acceptable Presentation Contexts for Storage

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
		JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51	SCP	None
		JPEG Lossless (Process 14)	1.2.840.10008.1.2.4.70	SCP	None
JPEG 2000 transfer syntaxes are only supported as an Option to the main application and have to be purchased separately		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	SCP	None
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91	SCP	None
MPEG2 transfer syntaxes are only supported for Multi Frame objects such as VL Endoscopic		MPEG2 MP@ML Image Compression	1.2.840.10008.1.2.4.100	SCP	None
MPEG2 transfer syntaxes are only supported for Multi Frame objects such as VL Endoscopic		MPEG2 Main Profile @ High Level	1.2.840.10008.1.2.4.101	SCP	None

4.2.9.3 C-STORE SCP Specific Conformance

In the event of a successful C-STORE operation, the image has been stored in the Ashvins database. The duration of the storage of the image is determined by the user of Ashvins.

Attributes are checked for DICOM Conformance, and attributes with invalid entries are changed to become valid.

No other attribute values are changed by the Application Entity.

The service status of C-STORE is returned by one of the following status codes in the following table (“Storage C-STORE Response Status”):

Storage C-STORE Response Status

Service Status	Further Meaning	Status Code	Reason
Success	Success	0000	Object was stored successfully.
Refused	Out of resources or missing attributes	A700	System might be out of storage space or a required attribute is missing

4.2.10 Query database of Ashvins

4.2.10.1 Associated Real-World Activity

Ashvins accepts associations from nodes that wish to query information about the objects in the Ashvins database using the C- FIND command, if these nodes are configured as DICOM partners in the Ashvins software which are allowed to use this service.

Default is all querying systems are allowed to do so.

4.2.10.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Query

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the Query SOP Classes listed in (“Networking services”, p. 5)		Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

For further information, please refer to (4.2.7.2 “Transfer Syntax Selection Policies”).

4.2.10.3 C-FIND SCP Specific Conformance

Ashvins provides baseline and extended behavior as defined in Part 4 C.4.1.3.1 of the DICOM standard. So the SCU can perform a hierarchical or a relational query. In the event of a successful C- FIND operation, Ashvins returns a response with state success.

The C-FIND is unsuccessful if Ashvins returns a response with the state "failed" or "refused".

Query C-Find Response Status

Service Status	Further Meaning	Error Code	Reason
Pending	Success and Pending	FF00	Query returned result and more results will be send

Service Status	Further Meaning	Error Code	Reason
Success	Success and last result	0000	Query was successful and this is the last result
Failed	Failed	A700	Query was impossible

The following attributes can be queried:

Attribute Name	Tag	Matching Type
Patient Level		
Patient's Name	0010,0010	U / S / *
Patient ID	0010,0020	U / S / *
Patient's Birth Date	0010,0030	U / S / R
Patient's Birth Time	0010,0032	U / S / R
Patient's Sex	0010,0040	U / S
Other Patient IDs	0010,1000	U / S / *
Other Patient Names	0010,1001	U / S / *
Ethnic Group	0010,2160	U / S / *
Patient Comments	0010,4000	U / S / *
Number of Patient Related Studies	0020,1200	NONE
Number of Patient Related Series	0020,1202	NONE
Number of Patient Related Instances	0020,1204	NONE
Study Level		
Study Date	0008,0020	U / S / R
Study Time	0008,0030	U / R
Accession Number	0008,0050	U / S / *
Modality in Studies	0008,0061	U / S
Referring Physician's Name	0008,0090	U / S / *
Study Description	0008,1030	U / S / *
Name of Physician(s) Reading Study	0008,1060	U / S / *
Study Instance UID	0020,000D	U / S / *
Study ID	0020,0010	U / S
Other Study Numbers	0020,1070	U / S
Number of Study Related Series	0020,1206	NONE
Number of Study Related Instances	0020,1208	NONE
Study Comments	0032,4000	U / S / *
Series Level		
Series Date	0008,0021	U / S / R
Series Time	0008,0031	U / R
Modality	0008,0060	U / S
Series Description	0008,103E	U / S / *
Performing Physician's Name	0008,1050	U / S / *

Attribute Name	Tag	Matching Type
Operators Name	0008,1070	U / S / *
Body Part Examined	0018,0015	U / S / *
Series Instance UID	0020,000E	U / S / *
Series Number	0020,0011	U / S / *
Number of Series Related Instances	0020,1209	NONE
Performed Procedure Step Start Date	0040,0244	U / S / R
Performed Procedure Step Start Time	0040,0245	U / R
Performed Procedure Step Description	0040,0254	U / S / *
Performed Procedure Step ID	0040,0253	U / S / *
Request Attributes Sequence	0040,0275	NONE
> Requested Procedure ID	0040,0009	NONE
> Scheduled Procedure Step ID	0020,1209	NONE
Image / Instance Level		
Image Type	0008,0008	U / S / *
SOP Class UID	0008,0016	U / S
Image Instance UID	0008,0018	U / S / *
Acquisition Date	0008,0022	U / S / R
Content Date	0008,0023	U / S / R
Acquisition Time	0008,0032	U / R
Content Time	0008,0033	U / R
Instance Number	0020,0013	NONE
Acquisition Number	0020,0012	NONE
Image Comments	0020,4000	U / S / *
Frame of Reference UID	0020,0052	U / S / *
Number of Frames	0028,0008	NONE
Image Height	0028,0010	NONE
Image Width	0028,0011	NONE
Bits Allocated	0028,0100	NONE
Bits Stored	0028,0101	NONE
Pixel Representation	0028,0103	NONE
Samples Per Pixel	0028,0002	NONE
Photometric Interpretation	0028,0004	NONE
Presentation Creation Date	0070,0082	NONE
Presentation Creation Time	0070,0083	NONE
Content Description	0070,0081	NONE
Presentation Label	0070,0080	NONE
Presentation Creators Name	0070,0084	NONE

Matching Types

Abbreviation	Description
U	Universal Matching
S	Single Value Matching
*	Wildcard Matching
R	Range Matching
NONE	no matching is supported, but values for this Element can be returned

The element 0008,0054 "Retrieve AE Title" is returned by Ashvins, if the query client is known to Ashvins. This means that the Ashvins application has a configured DICOM contact matching the querying client.

4.2.11 Move images from the Ashvins database

4.2.11.1 Associated Real-World Activity

Ashvins accepts associations from nodes that wish to move images from the local Ashvins database using the C-MOVE command if these nodes are configured as DICOM partners that are allowed to use this service in the Ashvins software.

Furthermore, the move destination must also be known to the Ashvins software, meaning the destination must be a configured DICOM partner.

4.2.11.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Retrieve

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any of the Query SOP Classes listed in (“Networking services”)		Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

For further information, please refer to (4.2.6.2 “Transfer Syntax Selection Policies”).

4.2.11.3 C-MOVE SCP Specific Conformance

Ashvins provides baseline and extended behavior as defined in Part 4 C.4.2.3.1 of the DICOM standard. So the SCU can issue a hierarchical or a relational move request.

In the event of a successful C-MOVE operation, Ashvins returns a response with state success.

In the event of a partly successful C-MOVE operation, Ashvins returns a response with state warning.

The C-MOVE is unsuccessful if Ashvins returns a response with the state failed or refused.

The attributes which can be used to specify the moved images is the same as the set of attributes supported for C-FIND. For further information, please refer to: 4.2.10.3 C-FIND SCP Specific Conformance

C-Move Response Status

Service Status	Further Meaning	Error Code	Reason
Pending	Success and Pending	FF00	Query returned result and more results will be send
Success	Success and last result	0000	Query was successful and this is the last result
Failed	Failed	A700	Query was impossible
Failed	Destination AE Unknown	A801	AE Title of the destination for the retrieve is unknown to the system; a DICOM contact must be configured. This code is also received if no Destination AE Title was mentioned in the request.
Failed Partly	Some image failed to be moved	B000	Not all objects could be moved to the destination

4.2.12 Storage Commitment (SCP)

4.2.12.1 Associated Real-World Activity

Ashvins accepts associations from nodes that wish to query the Ashvins for the existence of certain images.

4.2.12.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Retrieve

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

For further information, please refer to (4.2.6.2 “Transfer Syntax Selection Policies”).

4.2.12.3 SCP Conformance

Ashvins provides conformance for the Storage Commitment Push Service Class. In the event of a successful N-Action operation, the returned status has the following meaning:

Storage Commitment Response Status

Service Status	Further Meaning	Error Code	Reason
Failed	Failed	0110	The storage commitment request could not be processed
Success	Success	0000	The storage commitment request was successfully received

Attributes are checked for DICOM Conformance and attributes with invalid entries are changed to become valid.

In response to the N-Action command, Ashvins will initiate a new association back to the SCU and will send an N-EVENT REPORT with the status of the requested SOP Instance UIDs back to the SCU. Ashvins will include an SCP/SCU rule negotiation user item in the association request, where Ashvins will request the SCP role.

The stored SOP instances are listed in the Tag (0008,1199) Referenced SOP Sequence and the SOP instances for which the storage state could not be found will be listed in the Tag (0008,1198) Failed SOP Sequence.

4.2.13 Modality Worklist with Image Management Server (SCP)

4.2.13.1 Associated Real-World Activity

Image Management Server stores information about Modality Worklist Entries, which it receives from a third-party system (e.g. HIS/KIS) through HL7 Order Messages, in its database.
It accepts associations from nodes that wish to query the Modality Worklist.

4.2.13.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Modality Worklist

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

4.2.13.3 SCP Conformance

Image Management Server acts as SCP for the C-Find messages related to the Modality Worklist SOP Class identified through the UID: 1.2.840.10008.5.1.4.31.

In the event of a successful C-FIND operation, Image Management Server returns a response with state success.

The C-FIND is unsuccessful if Image Management Server returns a response with the state failed or refused.

Worklist C-Find Response Status

Service Status	Further Meaning	Error Code	Reason
Pending	Success and Pending	FF00	Query returned result and more results will be send
Success	Success	0000	Query was successful and this is the last result
Failed	Failed	A700	Query was impossible

Worklist C-Find Matching Keys

Attribute Name	Tag	Matching Type
Accession Number	0008,0050	U / S / *
Referring Physician's Name	0008,0090	U / S / *
Modality	0008,0060	U / S
Patient's Name	0010,0010	U / S / *
Patient ID	0010,0020	U / S / *
Patient's Birth Date	0010,0030	U / S / R
Patient's Sex	0010,0040	U / S
Other Patient IDs	0010,1000	U / S / *
Patients Weight	0010,1030	U / S
Ethnic Group	0010,2160	U / S / *
Patient Comments	0010,4000	U / S / *
Patient Comments	0010,4000	U / S / *
Medical Alerts	0010,2000	U / S / *
Pregnancy Status	0010,21C0	U / S
Contrast Allergies	0010,2110	U / S / *
Admission ID	0038,0010	U / S / *
Current Patient Location	0038,0300	U / S / *
Patients State	0038,0500	U / S / *
Scheduled Station AE Title	0040,0001	U / S / *
Scheduled Procedure Step Start Date	0040,0002	U / S / R
Scheduled Procedure Step Start Time	0040,0003	U / R
Scheduled Performing Physician's Name	0040,0006	U / S / *
Requested Procedure ID	0040,1001	U / S / *
Patient Transport Arrangements	0040,1004	U / S / *
Placer Order Number	0040,2016	U / S / *
Filler Order Number	0040,2017	U / S / *
Confidentiality	0040,3001	U / S / *
Requested Procedure Description	0032,1060	U / S / *

Matching Types

Abbreviation	Description
U	Universal Matching
S	Single Value Matching
*	Wildcard Matching
R	Range Matching

Worklist C-Find Return Keys

Attribute Name	Tag
Accession Number	0008,0050
Referring Physician's Name	0008,0090
Patient's Name	0010,0010
Patient ID	0010,0020
Patient's Birth Date	0010,0030
Patient's Sex	0010,0040
Other Patient IDs	0010,1000

Attribute Name	Tag
Patients Weight	0010,1030
Ethnic Group	0010,2160
Patient Comments	0010,4000
Medical Alerts	0010,2000
Pregnancy Status	0010,21C0
Contrast Allergies	0010,2110
Study Instance UID	0020,000D
Requesting Physician	0032,1032
Requested Procedure Description	0032,1060
Requested Procedure Code Sequence	0032,1064
> Code Value	0008,0100
> Coding Scheme Version	0008,0103
> Coding Scheme Designator	0008,0102
> Code Meaning	0008,0104
Admission ID	0038,0010
Special Needs	0038,0050
Current Patient Location	0038,0300
Patients State	0038,0500
Scheduled Procedure Step Sequence	0040,0100
> Modality	0008,0060
> Requested Contrast Agent	0032,1070
> Scheduled Station AE Title	0040,0001
> Scheduled Procedure Step Start Date	0040,0002
> Scheduled Procedure Step Start Time	0040,0003
> Scheduled Performing Physician's Name	0040,0006
> Scheduled Procedure Step Description	0040,0007
> Scheduled Protocol Code Sequence	0040,0008
>> Code Value	0008,0100
>> Coding Scheme Version	0008,0103
>> Coding Scheme Designator	0008,0102
>> Code Meaning	0008,0104
> Scheduled Procedure Step ID	0040,0009
> Scheduled Station Name	0040,0010
> Scheduled Procedure Step Location	0040,0011
> Pre-Medication	0040,0012
> Requested Procedure Priority	0040,1003
Requested Procedure ID	0040,1001
Patient Transport Arrangements	0040,1004
Placer Order Number	0040,2016
Filler Order Number	0040,2017
Confidentiality	0040,3001

Configuration

All of the above attributes can also be used for matching according to their value type.

If the Scheduled Station AE Title is omitted from the query it will be set by default, with the Calling AE Title used during association establishment. This default behavior can be switched off through a configuration setting.

Attributes not mentioned above will be returned unchanged. Ashvins supports case-insensitive matching for all text attributes, like PN VR attributes or CS VR attributes. The usage of the Specific Character Set (0008,0005) for queries or matching is not supported.

4.2.14 Modality Worklist Query (SCU)

4.2.14.1 Associated Real-World Activity

The user performs a Modality Worklist query. When ASHVINS queries for new worklist entries, ASHVINS opens an association to the Modality Worklist SCP. After the association has been established, a C-Find request with possible matching values will be send to the SCP. The Worklist SCP sends the matching worklist entries with a C-FIND responses to the Worklist SCU (Ashvins).

4.2.14.2 Presentation Context Table

Any of the following transfer syntaxes are acceptable:

Acceptable Presentation Contexts for Modality Worklist Query

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.14.3 Modality Worklist Query Conformance

Image Management Server acts as SCU for the C-Find messages related to the Modality Worklist SOP Class identified through the UID: 1.2.840.10008.5.1.4.31.

Unexpected attributes returned in a C-FIND response are ignored.

Worklist request identifier

Attribute Name	Tag	Matching Type
Accession Number	0008,0050	U / S / *
Modality	0008,0060	U / S
Patient's Name	0010,0010	U / S / *
Patient ID	0010,0020	U / S / *
Requested Procedure ID	0040,1001	U / S / *
Scheduled Station AE Title	0040,0001	U / S / *
Scheduled Procedure Step Start Date	0040,0002	U / S / R

Matching Types

Abbreviation	Description
U	Universal Matching
S	Single Value Matching
*	Wildcard Matching
R	Range Matching

4.3 Network Interfaces

4.3.1 Physical Network Interface

The Ashvins application provides DICOM TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

Ashvins inherits its TCP/IP stack from the operating system upon which it executes.

All network hardware is supported, which is provided by the operating system.

4.3.2 Additional Protocols

Ashvins supports the Basic Time Synchronization profile as an NTP Client. This is an inherited function of the Windows operating system.

Please refer to https://msdn.microsoft.com/en-us/library/cc773263(v=ws.10).aspx for details.

4.4 Configuration

Ashvins is highly configurable in many areas, but only the options of common interest for the DICOM communication are mentioned in this document.

The Ashvins system is configured by editing key/value pairs. This editing to be performed by service engineers only. For some configurable options, a user interface exists for trained users.

Specifically, the DICOM contacts for the DICOM communications can be configured by the user inside the user interface of Ashvins.

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles and Presentation Addresses

The local AE Titles are configurable per destination. Ashvins may have more than one AE Title. Ashvins may also have more than one AE Title per destination.

Ashvins listens for the C-STORE service on port 104 and for all other services on port 105. These port numbers are configurable.

4.4.1.2 Remote AE Titles and Presentation Addresses

For a detailed description of the configurable options, please contact MedicalCommunications.

4.4.1.3 Usage of Called AE Titles when storing Images to Ashvins

Ashvins can be configured to sort received images into different databases (called groups in Ashvins) according to the called AE Title used by the sender. This is done in the file aptitles.def (e.g.: set gCalled(Interest) { dummy "Interesting Cases"}).

All images sent to a non-configured called AE Title are placed in the local database.

4.4.1.4 Sending Images directly to a Folder of Ashvins

Ashvins can sort received images directly into a folder with the patients name as the title. To use this feature, the called AE Title must have a trailing dash, for example: Interest-

Now, the received image is stored in the database "Interesting Cases" and a folder in this database is created with the name of the patient to which the images belong.

4.4.2 Parameters Configuration

Parameter	Configurable	Default Value
Maximum PDU size	YES	60000
Supported SOP Classes	YES	Script
Usage of Value Representation UN	YES	On
Anonymization of images before storing them to a DICOM node	YES	Per receiving contact
Time-out waiting for TCP/IP messages	YES	1 h
Number of simultaneous connections to the DICOM server	YES	5

4.4.2.1 Anonymous Sending

If images are sent anonymously, the patient's name is replaced with the one configured by the user. The patient ID is replaced with a number configured by the user. Additionally, all private attributes are removed from the DICOM object to ensure that the original patient's name is not contained in a private attribute. Also, the Original Attribute Sequence 0400,0561 is removed. It is the user’s responsibility to ensure that the original patient's name is not burned in the pixel data of the image or part of the contents of an encapsulated PDF document.

Refer to the user manual for more details.

4.4.2.2 Security

Ashvins can be configured to restrict connection request based on AE Title or IP Address of sender.

Ashvins can be configured to use TSL transport layer encryption.

4.4.2.3 Support of Character Sets

The following character sets are supported:

Character Set Description	Defined Term
Default repertoire	ISO_IR 6 (default)
Latin alphabet No. 1	ISO_IR 100
Unicode UTF-8	ISO_IR 192

5 Media Interchange

5.1 Implementation Model

Ashvins is an application, which receives DICOM files from a file system. The DICOM files and objects must be in conformance with Part 10 of the standard. The processed modalities are listed below. Furthermore, Ashvins is an application, which stores DICOM objects as files in a file system in conformance with Part 10 of the standard.

5.1.1 Application Data Flow Diagram

(Fig. 2) shows the media interchange application data flow as a functional overview:

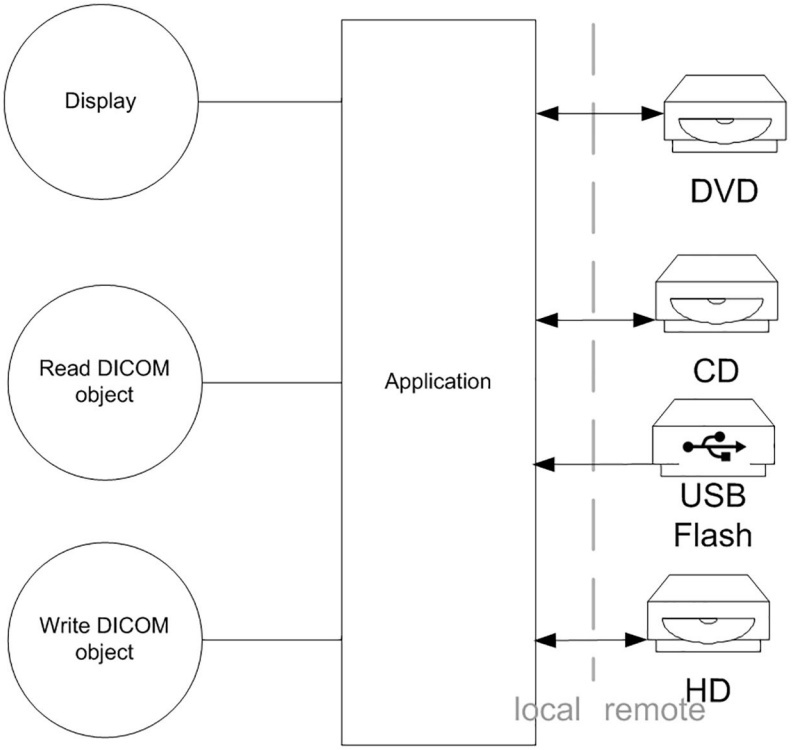

Fig. 2: Application Data Flow Diagram

5.1.2 Functional Definition of AEs

Ashvins acts as one AE for the DICOM media interchange. This Application Entity acts as an FSR (File Set Reader) when requested to display images or import DICOM objects. It acts as a FSC/FSU if it is requested to write DICOM objects.

5.1.3 Sequencing of Real-World Activities

When writing a CD or DVD, Ashvins will write the DICOM objects and will then create a DICOMDIR in the root of the Medium.

When reading images from media, Ashvins will first try to locate the DICOMDIR. If no DICOMDIR is found, Ashvins will look for files with the extension ".dcm".

5.1.4 File Meta Information for Implementation Class and Version

Description	Value
File Meta Information Version	0x0001
Implementation Class UID	1.2.276.0.30.3
Implementation Version Name	3.00

5.2 AE Specifications

5.2.1 Detailed Specification

- Ashvins provides standard conformance to DICOM interchange of Part 10 Header files.
- Ashvins supports multi-patient and multi-session CD-R / DVD disks, both for reading and writing.
- Ashvins supports multi-patient USB and Flash Memory for reading and writing.

AE related application profiles, real-world activities and roles

Supported APs	Real-World Activities	Roles	SC Option
STD-Display	Display Image	FSR	Interchange
STD-GEN-CD	General Purpose CD-R Interchange	FSR/FSC/FSU	Interchange
STD-GEN-DVD-RAM	General Purpose Interchange on DVD-RAM Media	FSR/FSC/FSU	Interchange
STD-CTMR-CD	CT/MR Studies on CD-R	FSR/FSC/FSU	Interchange
STD-CTMR-DVD-RAM	CT/MR Studies on DVD-RAM Media	FSR/FSC/FSU	Interchange
STD-CTMR-DVD	CT/MR Studies on DVD Media	FSR/FSC/FSU	Interchange
STD-GEN-USB-JPEG	General Purpose USB Media Interchange with JPEG	FSR/FSC/FSU	Interchange
STD-GEN-DVD-JPEG	General Purpose DVD Interchange with JPEG	FSR/FSC/FSU	Interchange
STD-GEN-MMC-JPEG	General Purpose MultiMedia Card Interchange with JPEG	FSR/FSC/FSU	Interchange
STD-GEN-CF-JPEG	General Purpose CompactFlash Interchange with JPEG	FSR/FSC/FSU	Interchange
STD-GEN-SD-JPEG	General Purpose Digital Card Interchange with JPEG	FSR/FSC/FSU	Interchange
STD-DVD-MPEG2- MPML	DVD Interchange with MPEG2 MP@ML	FSR/FSC/FSU	Interchange

Available optional profiles for the core application			
Supported APs	**Real-World Activities**	**Roles**	**SC Option**
STD-GEN-MIME	General Purpose MIME Interchange	FSR/FSC/FSU	Interchange
STD-GEN-DVD-J2K	General Purpose DVD Interchange with JPEG 2000	FSR/FSC/FSU	Interchange
STD-GEN-USB-J2K	General Purpose USB Media Interchange with JPEG-2000	FSR	Interchange
STD-GEN-MMC-J2K	General Purpose MultiMedia Card Interchange with JPEG-2000	FSR	Interchange
STD-GEN-CF-J2K	General Purpose CompactFlash Interchange with JPEG-2000	FSR	Interchange
STD-GEN-SD-J2K	General Purpose Digital Card Interchange with JPEG-2000	FSR	Interchange

5.2.1.1 File Meta Information for the Application Entity

Supported Transfer Syntaxes for File Set Read

Description	Value
Source Application Entity Title	not used
Private Information Creator UID	not used
Private Information	not used

5.2.1.2 Media Storage Application Profile

5.2.1.2.1 Supported Transfer Syntaxes for File Set Read

The following table (“Supported Transfer Syntaxes for File Set Read”) lists the supported transfer syntaxes for file set read.

Supported Transfer Syntaxes for File Set Read

Transfer Syntax	Description
1.2.840.10008.1.2	Implicit VR Little Endian
1.2.840.10008.1.2.1	Explicit VR Little Endian
1.2.840.10008.1.2.2	Explicit VR Big Endian
1.2.840.10008.1.2.4.50	JPEG Baseline (Process 1)
1.2.840.10008.1.2.4.51	JPEG Extended (Process 2 & 4)
1.2.840.10008.1.2.4.70	JPEG Lossless (Process 14)
1.2.840.10008.1.2.4.90	JPEG 2000 Image Compression (Lossless Only), optional
1.2.840.10008.1.2.4.91	JPEG 2000 Image Compression, optional
1.2.840.10008.1.2.4.100	MPEG2 MP@ML Image Compression
1.2.840.10008.1.2.4.101	MPEG2 Main Profile @ High Level

The supported SOP Classes for file set read are the same as listed in (4.2.1 “Supported SOP Classes”).

5.2.1.2.2 Options

Not applicable.

5.2.1.3 STD-GEN-MIME Application Profile

Ashvins supports as an option the general purpose MIME interchange profile for exchange of DICOM objects via email.

5.2.2 Support of Character Sets

The following character sets are supported:

Character Set Description	Defined Term
Default repertoire	ISO_IR 6 (default)
Latin alphabet No. 1	ISO_IR 100
Unicode UTF-8	ISO_IR 192

5.2.3 Security Profiles

Not applicable.

5.2.4 Standard Extended/Specialized/Private SOP Classes

Not applicable.

5.2.5 Private Transfer Syntaxes

Not applicable.

5.3 Augmented and Private Application Profiles

Not applicable.

5.4 Media Configuration

Refer to the "Installation and Configuration Guide for Ashvins" or the "User Handbook of Ashvins" for details.

6 Transformation of DICOM to CDA

Not applicable.

7 Support of Character Sets

The following character sets are supported:

Character Set Description	Defined Term
Default repertoire	ISO_IR 6
Latin alphabet No. 1	ISO_IR 100 (default)
Unicode UTF-8	ISO_IR 192

8 Security

8.1 Security Profiles

Incoming digital signatures are not verified or replaced by Ashvins.

It is possible to configure the support of BCP 195 TLS Secure Transport Connection Profile (see below).

8.2 Association Level Security

Ashvins accepts by default any AE Titles or any source IP Address for an initiating DICOM association.

You can configure Ashvins to accept or restrict the following:

- Accept only association requests originating from known AE Titles.
- Accept only association requests originating from known AE Titles from known IP addresses.
- Restrict the provided services based on the originating DICOM contact information. For example, an AE Title can be allowed to send images but not to query.

8.2.1 BCP 195 TLS Secure Transport Connection Profile

Ashvins supports the
Non-Downgrading BCP 195 TLS Secure Transport Connection Profile for **SCP** and
BCP 195 TLS Secure Transport Connection Profile for **SCU**.

8.2.1.1 SCP behavior

Ashvins accepts TLS connections on default port 2762 (other ports can be configured by the user of the system).

Only TLS 1.2 and TLS 1.3 will be offered by Ashvins as SCP.

Ashvins accepts Associations using the following Cipher Suites:

- TLS_DHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

Ashvins supports X.509 certificates, the server certificate can be configured by the user in the administrative web interface (SMC).

Default, if nothing is configured by the user, Ashvins will use a self-signed certificate.

If a certificate is configured by the user, we recommend using a certificate chain which is trusted inside the organization (e.g. the Root CA is provided by Active Directory to all clients or devices).

Ashvins is not accepting client (SCU) certificates.

When DHE is used by key exchange, the key length is at least 2048 bits.

8.2.1.2 SCU behavior

If configured, Ashvins establishes Associations using the following Cipher Suites:

- TLS_DHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

Ashvins SCU will downgrade the TLS profile if the server is not offering the latest TLS profile.

Ashvins does not support client certificates.

Default Ashvins will accept all SCP certificates event if outdated.

Ashvins can be configured to refuse connections to servers with expired certificates.

Ashvins can be configured to validate the certificate, in which case the certificate chain and the system name of server will be validated. Ensure that the Ashvins system trusts the certificate chain you use in your organization if the client validation is enabled.

Ashvins SCU can connect to any port using the TLS profile.

8.3 Application Level Security

Application level security for Ashvins relies on the means of the underlying operating system. Ashvins logs mission critical user and system actions according to the IHE basic security profile.

9 Annexes

9.1 IOD Contents

9.1.1 Created SOP Instance(s)

Abbreviations used in the following tables

Abbreviation	Description
ALWAYS	Always Present
ANAP	Attribute Not Always Present
AUTO	The attribute value is generated automatically
CONFIG	The attribute value source is a configurable parameter
EMPTY	Attribute is sent without a value
MWL	The attribute value source Modality Worklist
USER	The attribute value source is from User input
VNAP	Value Not Always Present (attribute sent zero length if no value is present)

Please note that all dates and times are encoded based on the locally configured calendar date and time.

9.1.2 Secondary Capture Image Storage SOP Class

Level	Module Name	Presence of Module
Patient	PatientModule	ALWAYS
Study	GeneralStudyModule	ALWAYS
Series	GeneralSeriesModule	ALWAYS
Equipment	SCEquipmentModule	VNAP
Image	GeneralImageModule	ALWAYS
	ImagePixelModule	ALWAYS
	SCImageModule	ALWAYS
Common	SOPCommonModule	ALWAYS

9.1.1 Key Object Selection Document Storage (KOS)

If configured, Ashvins will create and send Key Object Selection documents corresponding to workflows defined in Integrating the Healthcare Enterprise (IHE) profile Imaging Object Change Management (IOCM).

Generated objects will conform to the DICOM standard and contain all type 1 and type 2 attributes of the Key Object Selection Document Storage IOD.

9.1.2 Usage of Attributes from received IODs

For DICOM image objects, Ashvins checks the following attributes for existence:

Required Attributes for Images

Attribute Name	Tag	VR
Rows	0028,0010	US
Columns	0028,0011	US
Bits Allocated	0028,0100	US
Photometric Interpretation	0028,0004	CS
Pixel Data	7FE0,0010	OB or OW

9.1.3 Attribute Mapping

Ashvins does not map attributes by default. However, a mapping can be applied based on the specific configuration.

9.1.4 Coerced/Modified Fields

Ashvins changes any corrupt attribute value by default.

If any of the following UIDs is missing, Ashvins will create it:

- Study Instance UID
- Series Instance UID
- SOP Instance UID
- Frame of Reference UID

A modification can be applied based on the specific configuration.

Ashvins is able to modify the DICOM attributes in the DICOM object itself or modify only the database entries and leave the DICOM object itself unchanged.

9.1.5 Clinical Trial Modules

If one or more clinical studies was created in Ashvins, Clinical Trial Subject Module and Clinical Trial Study Module will also be filled within created DICOM IODs.

Ashvins will interpret the module information when it receives or imports DICOM objects and they contain the Clinical Trial Subject Module and Clinical Trial Study Module. The information is used to distinguish clinical and investigational data inside the Ashvins system.

9.1.5.1 Clinical Trial Subject Module

Attribute Name	Tag	VR	Presence of Value	Source
Clinical Trial Sponsor Name	0012,0010	LO	ALWAYS	DMWL or CONFIG
Clinical Trial Protocol ID	0012,0020	LO	ALWAYS	DMWL or CONFIG
Clinical Trial Protocol Name	0012,0021	LO	VNAP	DMWL or CONFIG
Clinical Trial Site ID	0012,0030	LO	VNAP	DMWL or CONFIG
Clinical Trial Site Name	0012,0031	LO	VNAP	DMWL or CONFIG
Clinical Trial Subject ID	0012,0040	LO	ANAP	DMWL

9.1.5.2 Clinical Trial Study Module

Attribute Name	Tag	VR	Presence of Value	Source
Clinical Trial Time Point ID	0012,0050	LO	VNAP	DMWL or CONFIG
Clinical Trial Time Point Description	0012,0051	ST	VNAP	DMWL or CONFIG

9.2 Data Dictionary of Private Attributes

Not applicable.

9.3 Coded Terminology and Templates

Not applicable.

9.4 Grayscale Image Consistency

Not applicable.

9.5 Standard Extended/Specialized/Private SOP Classes

Ashvins stores additional legacy data in the private tag group 0051, 7EE1 or 0011. This data must not be deleted by a DICOM SCP receiving the data such as a DICOM archive or portal. Ashvins expects the data to be present when retrieving/receiving DICOM files, e.g. from a DICOM archive or portal, that originated from Ashvins.

9.6 Private Transfer Syntaxes

Not applicable.