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DICOM Conformance Statement

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1 Introduction

1.1 Purpose

This document is meant to formally describe the DICOM capabilities of this product. XDS-I Source Adaptor adds XDS-I.b capabilities to PACS systems. It provides DICOM interfaces to register images to a IHE XDS infrastructure and to transfer them via the XDS Affinity Domain, and WebService interfaces to allow the retrieve of registered images with any XDS-I.b Consumer. The ConsumerApplication is a Web-Application to display DICOM images registered in a IHE XDS infrastructure. It also provides a functionality to store extramural DICOM studies to a local PACS system.

1.2 Intended Audience

This document is intended for network administrators, hospital staff or software designers who are responsible for system integration and/or software design. The terms used in this document are defined according to the DICOM and XDS standard. It is thus assumed that the user is familiar with the terminology and concepts that are used in the DICOM 3.0 standard and the IHE ITI/RAD framework. If not, readers are asked to first read the appropriate parts of the DICOM standard and the IHE ITI/RAD framework themselves.

1.3 Remarks

The document should help to validate the integration of eHealth Solutions within a DICOM environment. It is not intended to replace the validation with other DICOM equipment to ensure proper exchange of information. The interoperability of the integration has to be secured separately. The user should be aware of the following important issues:

- The comparison of different Conformance Statements should be the first step towards the assessment of the interoperability within a DICOM environment.
- Test procedures should be defined to validate the desired level of connectivity.

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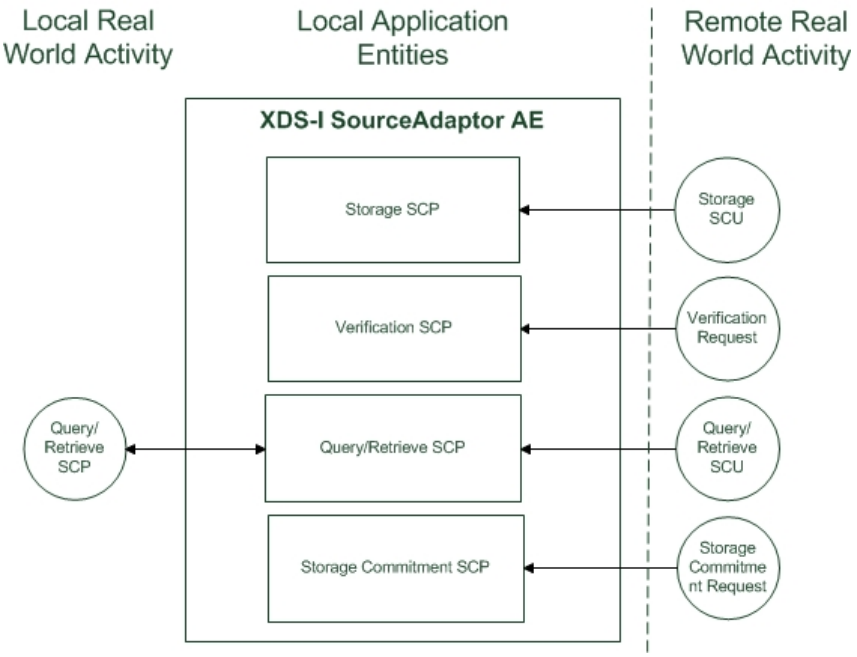
2 Implementation Model

2.1 Application Data Flow Diagram

2.1.1 XDS-I Source Adaptor Application Data Flow Diagram

The XDS-I Source Adaptor is implemented as a single AE which provides a set of different services. For each of these services the XDS-I Source Adaptor can act in a specific role.

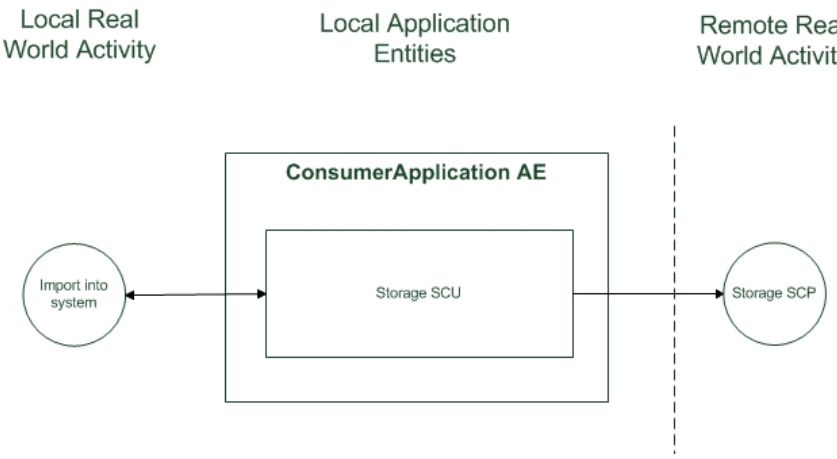
Figure 1: XDS-I Source Adaptor Application Data Flow Diagram.



2.1.2 Consumer App Data Flow Diagram

Provides a web based user interface for displaying DICOM instances. It also provides the functionality to store images to a local PACS system.

Figure 2: Consumer App Data Flow Diagram.



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2.2 Functional Definition of AEs

2.2.1 XDS-I Source Adaptor

The XDS-I Source Adaptor AE waits for another application to connect and then initiates a DICOM association. When another application connects, the XDS-I Source Adaptor AE expects it to be a DICOM application. XDS-I Source Adaptor AE implements several DICOM Service Classes. In total the following services are provided by this AE:

- Verification SCP answers communication tests from remote applications – C-ECHO
- Storage SCP implements the answer to external C-STORE requests. It is able to receive incoming DICOM image files sent by remote DICOM applications (e.g., PACS systems) and register them to a XDS infrastructure or transfer them via the XDS Affinity Domain if additional information is provided (see Section 8.1). Currently the XDS-I Source Adaptor only supports DICOM instances with ImplicitVRLittleEndian and ExplicitVRLittleEndian TransferSyntax.
- The Query/Retrieve SCP implements the answer to C-FIND, C-MOVE and C-GET requests. Remote applications can request queries on Patient-, Study-, Series- or Image-level using the Patient Root or Study Root query model. The XDS-I Source Adaptor forwards the request to the desired DICOM System. In case of a C-Move request the XDS-I Source Adaptor replaces the move-destination with its own AET. The incoming C-Store then will be forwarded to the move-destination provided by the calling system. In this case the XDS-I Source Adaptor acts as a DICOM proxy.

2.2.2 The Consumer App

The **Consumer App** AE is able to render images available in a XDS infrastructure. Currently Structured Reports and Presentation States are not supported. It also implements the C-Store SCU to store DICOM instances to local PACS systems.

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3 Application Entity Specification

3.1 XDS-I Source Adaptor

3.1.1 Supported SOP Classes for XDS-I Source Adaptor AE

Table 1: Supported Storage SOP classes.

SOP Class Name	SOP Class UID	SCP	SCU
Stored Print Storage	1.2.840.10008.5.1.1.27	Y	Y
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	Y	Y
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	Y	Y
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Y	Y
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Y	Y
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Y	Y
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Y	Y
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Y	Y
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Y	Y
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Y	Y
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Y	Y
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Y	Y
Legacy Converted Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.2	Y	Y
Ultrasound Multiframe Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Y	Y
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Y	Y
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Y	Y
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Y	Y
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Y	Y
Enhanced MR Color Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.4.3	Y	Y
Legacy Converted Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.4	Y	Y
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Y	Y
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Y	Y
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Y	Y
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Y	Y
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Y	Y
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Y	Y
Multiframe Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Y	Y
Multiframe Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Y	Y
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Y	Y
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	Y	Y
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Y	Y
Waveform Storage – Trial (Retired)	1.2.840.10008.5.1.4.1.1.9.1	Y	Y
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Y	Y
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Y	Y
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Y	Y
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Y	Y
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Y	Y
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Y	Y
General Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.2	Y	Y
Arterial Pulse Waveform Storage	1.2.840.10008.5.1.4.1.1.9.5.1	Y	Y
Respiratory Waveform Storage	1.2.840.10008.5.1.4.1.1.9.6.1	Y	Y

Table 1: Supported Storage SOP classes.

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Table 1: Supported Storage SOP classes.

SOP Class Name	SOP Class UID	SCP	SCU
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	Y	Y
Standalone VOILUT Storage	1.2.840.10008.5.1.4.1.1.11	Y	Y
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Y	Y
Color Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.2	Y	Y
Pseudo-Color Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.3	Y	Y
Blending Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.4	Y	Y
XA/XRF Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.5	Y	Y
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Y	Y
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	Y	Y
X-Ray Fluoroscopy Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Y	Y
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	Y	Y
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Y	Y
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	Y	Y
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	Y	Y
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	Y	Y
Breast Projection X-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.13.1.4	Y	Y
Breast Projection X-Ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.13.1.5	Y	Y
Intravascular Optical Coherence Tomography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.14.1	Y	Y
Intravascular Optical Coherence Tomography Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.14.2	Y	Y
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Y	Y
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Y	Y
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Y	Y
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Y	Y
Deformable Spatial Registration SOP Class	1.2.840.10008.5.1.4.1.1.66.3	Y	Y
Segmentation SOP Class	1.2.840.10008.5.1.4.1.1.66.4	Y	Y
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Y	Y
Real World Value Mapping Storage	1.2.840.10008.5.1.4.1.1.67	Y	Y
Surface Scan Mesh Storage	1.2.840.10008.5.1.4.1.1.68.1	Y	Y
Surface Scan Point Cloud Storage	1.2.840.10008.5.1.4.1.1.68.2	Y	Y
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Y	Y
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Y	Y
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Y	Y
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Y	Y
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	Y	Y
VL Slide Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Y	Y
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Y	Y
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	Y	Y
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Y	Y
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	Y	Y
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	Y	Y
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	Y	Y
VL Whole Slide Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.6	Y	Y
VL Multi-frame Image Storage – Trial (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Y	Y
Lensometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.1	Y	Y
Autorefraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.2	Y	Y
Keratometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.3	Y	Y
Subjective Refraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.4	Y	Y

Table 1: Supported Storage SOP classes.

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Table 1: Supported Storage SOP classes.

SOP Class Name	SOP Class UID	SCP	SCU
Visual Acuity Measurements Storage	1.2.840.10008.5.1.4.1.1.78.5	Y	Y
Spectacle Prescription Report Storage	1.2.840.10008.5.1.4.1.1.78.6	Y	Y
Ophthalmic Axial Measurements Storage	1.2.840.10008.5.1.4.1.1.78.7	Y	Y
Intraocular Lens Calculations Storage	1.2.840.10008.5.1.4.1.1.78.8	Y	Y
Macular Grid Thickness and Volume Report	1.2.840.10008.5.1.4.1.1.79.1	Y	Y
Ophthalmic Visual Field Static Perimetry Measurements Storage	1.2.840.10008.5.1.4.1.1.80.1	Y	Y
Ophthalmic Thickness Map Storage	1.2.840.10008.5.1.4.1.1.81.1	Y	Y
Corneal Topography Map Storage	1.2.840.10008.5.1.4.1.1.82.1	Y	Y
Text SR Storage – Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.1	Y	Y
Audio SR Storage – Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.2	Y	Y
Detail SR Storage – Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.3	Y	Y
Comprehensive SR Storage – Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.4	Y	Y
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	Y	Y
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Y	Y
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	Y	Y
Comprehensive 3D SR Storage	1.2.840.10008.5.1.4.1.1.88.34	Y	Y
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	Y	Y
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	Y	Y
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	Y	Y
Chest CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.65	Y	Y
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67	Y	Y
Radiopharmaceutical Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.68	Y	Y
Colon CAD SR	1.2.840.10008.5.1.4.1.1.88.69	Y	Y
Implantation Plan SR Document Storage	1.2.840.10008.5.1.4.1.1.88.70	Y	Y
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Y	Y
Encapsulated CDA Storage	1.2.840.10008.5.1.4.1.1.104.2	Y	Y
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Y	Y
Legacy Converted Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.128.1	Y	Y
PET Curve Storage	1.2.840.10008.5.1.4.1.1.129	Y	Y
Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.130	Y	Y
Basic Structured Display Storage	1.2.840.10008.5.1.4.1.1.131	Y	Y
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Y	Y
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Y	Y
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Y	Y
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Y	Y
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Y	Y
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Y	Y
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Y	Y
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Y	Y
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Y	Y
DICOS CT Image Storage	1.2.840.10008.5.1.4.1.1.501.1	Y	Y
DICOS Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.501.2.1	Y	Y
DICOS Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.501.2.2	Y	Y
DICOS Threat Detection Report Storage	1.2.840.10008.5.1.4.1.1.501.3	Y	Y
Eddy Current Image Storage	1.2.840.10008.5.1.4.1.1.601.1	Y	Y
Eddy Current Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.601.2	Y	Y
RT Beams Delivery Instruction Storage – Trial (Retired)	1.2.840.10008.5.1.4.34.1	Y	Y
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7	Y	Y

Table 1: Supported Storage SOP classes.

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SOP Class Name	SOP Class UID	SCP	SCU
Generic Implant Template Storage	1.2.840.10008.5.1.4.43.1	Y	Y
Implant Assembly Template Storage	1.2.840.10008.5.1.4.44.1	Y	Y
Implant Template Group Storage	1.2.840.10008.5.1.4.45.1	Y	Y

Table 1: Supported Storage SOP classes.

3.1.2 Association Establishment Policies

3.1.2.1 General

The XDS-I Source Adaptor AE supports plain TCP and TLS encrypted communication. For each kind of transport the server provides an arbitrary number of listen ports. All these ports are equivalent and provide the same services. The maximum PDU size accepted is 16384.

3.1.2.2 Number of Associations

The XDS-I Source Adaptor has a configured association limit on each listen port.

3.1.2.3 Asynchronous Nature

The XDS-I Source Adaptor 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). An asynchronous mode of operation is not supported.

Table 2: Implementation Classes

Class	Value
Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

3.2 Consumer App

3.2.1 Supported SOP Classes for Consumer App AE

Table 3: Supported SOP Classes for the **Consumer App** AE.

SOP Class Name	SOP Class UID	SCP	SCU
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Y	Y
Digital X-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Y	Y
Digital X-Ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Y	Y
Digital Mammography X-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Y	Y
Digital Mammography X-Ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Y	Y
Digital Intraoral X-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Y	Y
Digital Intraoral X-Ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Y	Y
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Y	Y
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Y	Y
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Y	Y
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Y	Y
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Y	Y

*Table 3: Supported SOP Classes for the **Consumer App** AE.*

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*Table 3: Supported SOP Classes for the **Consumer App** AE.*

SOP Class Name	SOP Class UID	SCP	SCU
Enhanced MR Color Image Storage	1.2.840.10008.5.1.4.1.1.4.3	Y	Y
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Y	Y
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Y	Y
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Y	Y
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Y	Y
Multiframe Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Y	Y
Multiframe Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Y	Y
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Y	Y
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Y	Y
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Y	Y
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	Y	Y
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	Y	Y
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	Y	Y
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Y	Y
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Y	Y
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Y	Y
VL Slide Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Y	Y
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Y	Y
Ophthalmic Photography 8Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Y	Y
Ophthalmic Photography 16Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	Y	Y
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	Y	Y
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Y	Y
Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.130	Y	Y
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Y	Y
Hardcopy Grayscale Image Storage SOP Class (Retired)	1.2.840.10008.5.1.1.29	Y	Y
Hardcopy Color Image Storage SOP Class (Retired)	1.2.840.10008.5.1.1.30	Y	Y
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Y	Y
Ultrasound Multiframe Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Y	Y
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Y	Y
X-Ray Angiographic BiPlane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Y	Y
VL Image Storage Trial (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Y	Y
VL Multiframe Image Storage Trial (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Y	Y

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4 Communication Profiles

4.1 Supported Communication Stacks

XDS-I Source Adaptor and **Consumer App** provide plain TCP (see DICOM 2011 PS 3.8, 9) and TLS encrypted communication (see DICOM 2011 PS 3.15, B.1). They uses dcm4che for their communications.

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5 Security Profiles

5.1 Audit Trail Message Format Profile

To help assure healthcare privacy and security in automated systems, information about the data usage needs to be collected. This data will be reviewed by administrative staff to verify that healthcare data is being used in accordance with the healthcare provider's data security requirements and to establish accountability for data use. This data collection and review process is called security auditing and the data itself comprises the audit trail. Audit trails can be used for surveillance purposes to detect when interesting events might be happening that warrant further investigation.

Auditing in eHealth Solutions is implemented according to the IHE profile Audit Trail and Node Authentication (part Audit Trail) which is based on RFC 3881 (audit message XML format) and DICOM 2011 PS 3.15, A.5. Auditing is restricted to events regarding patients, documents, user authentications and audit configuration modifications:

- search for patients or documents
- creation and modification of patients
- import, modification and export of documents

The processing of audit messages works asynchronously – events are recorded immediately, however, the resulting audit messages are queued and sent to an Audit Record Repository via TCP or WebServices in periodic time intervals (the frequency of the intervals is configurable). If required, audit messages can be analyzed with an Audit Record Viewer. To use audit messages for effective system analyses, it is necessary that each audit message can be uniquely associated with a certain event. To this end each audit message provides various information. The most important values are:

- event ID,
- date and time of the event,
- status of the event,
- user IDs,
- application IDs,
- object IDs,
- audit trail ID (used to aggregate audit messages in order to reconstruct audit trails), and
- audit source ID.

Within eHealth Solutions, the events recorded by audit messages are primarily identified via event IDs. However, since most event IDs represent a group of events rather than a single event, it is often necessary to explore audit messages in detail to identify the reported events. In the following, the event IDs used by eHealth Solutions as well as some short instructions on how to identify events are listed below:

110106 (Export):
: This event ID indicates that a DICOM study was registered to the XDS infrastructure.

110104 (DICOM Instances Transferred):
: The event ID `110104` is used to state the end of a transfer of DICOM images from the XDS-I Source to a XDS-I consumer.

110103 (DICOM Instances Accessed):
: This event ID is used in audit messages which are generated if DICOM images are received by the Consumer.

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To support the analysis of audit messages within eHealth Solutions, audit messages are organized in so-called audit trails. An audit trail represents a group of audit messages which have been created during the execution of a certain action (e.g., registering a DICOM study). Since it might happen that several sub-actions have to be performed in order to complete an action within an audit trail, audit messages are classified into sub and main audit messages. Thereby, sub audit messages are used to audit necessary sub-actions whereas main audit messages are used to audit sufficient sub-actions. To distinguish between different audit trails, each audit trail is equipped with a unique audit trail ID.

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6 Configuration

The eHealth Solutions XDS-I SourceAdaptor and the **Consumer App** uses a global XML based configuration. The configuration is provided by the ConfigurationRepository which is queried periodically by the services. If the ConfigurationRepository is unavailable a local cached configuration is used.

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7 Supported Character Sets

All character sets from DICOM 2011 PS 3.3, C.12.1.1.2 are supported with and without code extension techniques.

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8 Mapping from DICOM to XDS

For proper processing of DICOM studies in eHealth Solutions, it is important to map the DICOM metadata in a corresponding way. This section provides an overview of correlations between DICOM tags and XDS fields.

Table 4: Mapping of Document Metadata

DICOM Tag	DICOM Name	VR	XDS	O/R	Adjustable
0008,0012 0008,0013	InstanceCreationDate InstanceCreationTime	DA TM	CreationTime	R[1]	true
0008,0020 0008,0030	StudyDate StudyTime	DA TM	ServiceStartTime	R O[2]	true
0008,0080	InstitutionName	LO	Institution.Name	R	true
0008,1030	StudyDescription	LO	Title	R	true
0008,1048	PhysiciansOfRecord	PN[3]	KOS Author	O	true
0008,1050	PerformingPhysicianName	PN[3]	Author	R	true
0008,2218 › 0008,0100 › 0008,0102 › 0008,0104	AnatomicRegionSequence CodeValue CodingSchemeDesignator CodeMeaning	SQ SH SH LO	EventCodes Value CodingScheme DisplayName	O R[4] R[4] R[4]	false false false false
0032,4000	StudyComments	LT	Comments	O	true

Table 5: Mapping of Patient Metadata

DICOM Tag	DICOM Name	VR	XDS	O/R	Adjustable
0010,0010	PatientName	PN[3]		R	false
0010,0020	PatientID	LO	SourcePatientID	R	false
0010,0021	Issuer of Patient ID	LO	Assigning Authority	O	
0010,0024 › 0040,0032 › 0040,0033	Issuer of Patient ID Qualifiers Sequence Attribute Universal Entity ID Universal Identity ID Type	SQ UT CS	Assigning Authority Assigning Authority OID Assigning Authority OID Type	O O C	
0010,0030	PatientBirthDate	DA	Birthdate	R	false
0010,0040	PatientSex	CS	Gender	O	false (mapped to "Other" if not provided)
0010,1010	PatientAge	AS	Age	O	false

[1] Can be defaulted to current time.
[2] When missing, the value is set to 00:00:00.
[3] At least the family name and given name are required. See DICOM PS 3.5, table 6.2-1 for details and section 6.2.1.1 for examples.
[4] Only required if `AnatomicRegionSequence` is set in DICOM.

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Note

The `SourcePatientID Assigning Authority` is determined in the following priority order:

1. If the Assigning Authority can be resolved from the `InstitutionName` and the resolved Assigning Authority is configured to map to a Patient Assigning Authority via the **Patient assigning authority mapping**, this value is used.
2. If `Universal Identity ID Type` (0040,0033) is set to **ISO**, `Universal Entity ID` (0040,0032) is used.
3. If the Patient ID contains an Assigning Authority, the `Issuer of Patient ID` (0010,0021) is used.
4. The Assigning Authority gets resolved from the `InstitutionName`. The corresponding tag can be configured in the **XDS-I.b Configuration** (see eHealth Solutions *Configuration Instructions*).

The remaining metadata (`ClassCodes`, `Confidentiality Codes`, `ContentTypeCodes`, `FormatCodes`, `PracticeSettingCodes`) have to be mapped in the `XDI-Source` configuration. In addition, eHealth Solutions offers the possibility to overwrite DICOM tags for certain AETs (Called as well as Calling) by default. This allows for a better handling of shortcomings, for instance, when source systems do not support the usage of certain tags.

8.1 Additional Information about Specific Tags

Using the DIMSE-C service `C-STORE` you can store information which is then validated by the Source Adaptor in order to trigger a document transfer if necessary. In case a document transfer is triggered, the recipient and the sender have to be submitted. For this purpose you have the options described in:

- Recipient
- Sender

Note

If it is not intended to resolve the recipient and sender, it is strongly recommended to remove these DICOM tags from the study. If the tags are only partially or incorrectly filled, this can lead to an error during the registration of studies.

8.1.1 Recipient

By means of `C-STORE` you can specify the recipient in the tag `Intended Recipients of Results Identification Sequence`. If no `Intended Recipients of Results Identification Sequence` is submitted, eHealth Solutions will extract the recipient from the tag `Referring Physician Identification Sequence`.

Table 6 lists the DICOM tags that are related to the recipient:

Table 6: DICOM Tag Options for the Recipient

DICOM Tag	Attribute	Value Representation	Value Multiplicity
(0040,1011)	Intended Recipients of Results Identification Sequence	Sequence (SQ)	1*
(0040, 1101)	Person Identification Code Sequence		
(0008,0082)	Institution Code Sequence (optional)		
(0008,0096)	Referring Physician Identification Sequence	Sequence (SQ)	1

Table 6: DICOM Tag Options for the Recipient

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Table 6: DICOM Tag Options for the Recipient

DICOM Tag	Attribute	Value Representation	Value Multiplicity
(0040, 1101)	Person Identification Code Sequence		
(0008,0082)	Institution Code Sequence		

The information in the tag `Intended Recipients of Results Identification Sequence` or respectively `Referring Physician Identification Sequence` is validated against the Healthcare Provider Directory and eHealth Solutions will check if subordinate tags contain retrievable data:

- (0040, 1101) Person Identification Code Sequence
  Submission of the individual provider identification.
  - (0008, 0100) Code Value
  - (0008, 0102) Coding Scheme Designator
  - (0008, 0119) Long Code Value
- (0008,0082) Institution Code Sequence
  Submission of the organizational provider.
  - (0008, 0100) Code Value
  - (0008, 0102) Coding Scheme Designator
  - (0008, 0119) Long Code Value

If both the `Person Identification Code Sequence` and the `Institution Code Sequence` are specified, the organizational provider is interpreted to be the parent organization of the individual provider.

All retrieved data is added to the XDS Document Metadata.

If the validation fails (e.g., the tag exists but is empty), an error message is issued and the DICOM studies are not registered.

Note

If the images are sent to the AET of eHealth Solutions Source the images are just registered. In case the images are sent to a different AET the Source tries to find an HPD entry with this AET and will do a document transfer to it.

8.1.2 Sender

You can specify the sender in the tag `Performing Physician Identification Sequence`. If no `Performing Physician Identification Sequence` is submitted, eHealth Solutions will consider the tag `Physician(s) of Record Identification Sequence` for validation of the sender.

Table 7 lists the DICOM tags that are related to the sender:

Table 7: DICOM Tag Options for the Sender

DICOM Tag	Attribute	Value Representation	Value Multiplicity
(0008,1052)	Performing Physician Identification Sequence	Sequence (SQ)	1
(0040, 1101)	Person Identification Code Sequence		
(0008,0082)	Institution Code Sequence		

Table 7: DICOM Tag Options for the Sender

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Table 7: DICOM Tag Options for the Sender

DICOM Tag	Attribute	Value Representation	Value Multiplicity
(0008,1049)	Physician(s) of Record Identification Sequence	Sequence (SQ)	1
(0040, 1101)	Person Identification Code Sequence		
(0008,0082)	Institution Code Sequence		

The information in the tag `Performing Physician Identification Sequence` or `Physician(s) of Record Identification Sequence` is validated against the Healthcare Provider Directory and eHealth Solutions will check if subordinate tags contain retrievable data:

- (0040, 1101) Person Identification Code Sequence
  Submission of the individual provider identification.
  - (0008, 0100) Code Value
  - (0008, 0102) Coding Scheme Designator
  - (0008, 0119) Long Code Value
- (0008,0082) Institution Code Sequence
  Submission of the organizational provider.
  - (0008, 0100) Code Value
  - (0008, 0102) Coding Scheme Designator
  - (0008, 0119) Long Code Value

If the validation fails (e.g., the tag exists but is empty), a warning is displayed and the DICOM studies are not registered.

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