

Technical Publication

DICOM Conformance Statement
Patient Data Manager 1.0

Document Revision 1

September 8, 2011

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1 Conformance Statement Overview

This is a conformance statement for the Brainlab software Patient Data Manager. One main purpose of this software is to import and visualize DICOM data.

The DICOM import part of the application is

- Browse and display of DICOM files (e.g. removable media)
- Query remote DICOM archives
- Retrieve DICOM data from archives

SOP Classes	User Of Service (SCU)	Provider Of Service (SCP)
Transfer		
Enhanced CT Image	No	Yes
Enhanced MR Image	No	Yes
SC Multi Frame Grayscale Byte	No	Yes
SC Multi Frame Grayscale Word	No	Yes
SC Multi Frame Single Bit	No	Yes
SC Multi Frame True Color	No	Yes
Segmentation Storage	No	Yes
Standard CR	No	Yes
Standard CT	No	Yes
Standard Digital X-Ray Image for Image for Presentation	No	Yes
Standard Digital X-Ray Image for Image for Processing	No	Yes
Standard Grayscale Softcopy Image for Presentation State	No	Yes
Standard Hardcopy Color	No	Yes
Standard Hardcopy Grayscale	No	Yes
Standard Intra-oral X-Ray Image for Presentation	No	Yes
Standard Intra-oral X-Ray Image for Processing	No	Yes
Standard MG Image for Presentation	No	Yes
Standard MG Image for Processing	No	Yes
Standard MR	No	Yes
Standard NM	No	Yes
Standard NM Retired	No	Yes
Standard Ophthalmic 16 Bit	No	Yes
Standard Ophthalmic 8 Bit	No	Yes
Standard PET	No	Yes
Standard RT Image	No	Yes
Standard Secondary Capture	No	Yes
Standard US	No	Yes
Standard US Multi Frame	No	Yes
Standard US Multi Frame Retired	No	Yes
Standard US Retired	No	Yes
Standard Video Endoscopic	No	Yes

SOP Classes	User Of Service (SCU)	Provider Of Service (SCP)
Standard Video Microscopic	No	Yes
Standard Video Photographic	No	Yes
Standard VL Endoscopic	No	Yes
Standard VL Microscopic	No	Yes
Standard VL Photographic	No	Yes
Standard VL Slide Microscopic	No	Yes
Standard X-Ray Angio	No	Yes
Standard X-Ray Angio Biplane	No	Yes
Standard X-Ray RF	No	Yes

Table 1-1: Services supported by Patient Data Manager

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disc – Recordable		
General Purpose CD–R	No	Yes

Table 1-2: Media Services supported by Patient Data Manager

The DICOM Processing Service is embedded into the Brainlab Workflow Services.

Brainlab Workflow Service	User Of Service (SCU)	Provider Of Service (SCP)
Notify	No	Yes
Find Entities	Yes	No
Request Instances	Yes	No

Table 1-3: Brainlab Workflow Services supported by the Processing Service

The Brainlab Workflow services are described in the DICOM Proxy Conformance Statement (see [2]) and are not part of this conformance statement.

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3 Introduction

3.1 Revision History

Document Version	Date of Issue	Author	Description
1	Sep 08, 2011	Kerschbaumer Samuel	Initial version

3.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [1]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

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

3.4 Abbreviations

There are a variety of terms and abbreviations used in the document that are defined in the DICOM Standard. Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
CD	Compact Disk
CD-R	Compact Disk Recordable
DVD	Digital Versatile Disc
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
HD	Hard Disk
IOD	(DICOM) Information Object Definition
ISO	International Standard Organization
MOD	Magneto Optical Disk
PDU	DICOM Protocol Data Unit
Q/R	Query and Retrieve
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM server)
SOP	DICOM Service-Object Pair

3.5 References

- [1] Digital Imaging and Communications in Medicine (DICOM) 3.0, NEMA PS 3.1-3.18 – 2006
- [2] DICOM Conformance Statement DICOM Proxy 2.1, Brainlab, April 4, 2011

4 Networking

4.1 Implementation Model

The Patient Data Manager is embedded in the Brainlab workflow infrastructure. This infrastructure is provided by the DICOM Proxy. It provides the DICOM Storage, Query/Retrieve and Worklist interfaces to communicate with the world outside. The Patient Data Manager communicates only with the DICOM Proxy.

The Patient Data Manager uses the following activities to interact with the DICOM Proxy:

- *Notify*
The DICOM Proxy notifies registered applications about received DICOM instances.
- *Find Entities*
The DICOM Proxy provides the DICOM Query/Retrieve C-FIND service as SCP
- *Request Instances*
The DICOM Proxy provides the DICOM Query/Retrieve C-GET service as SCP

Please refer to [2] for a detailed description of these activities. This DICOM Conformance Statement concentrates on the Patient Data Manager and how it finds and reads DICOM instances.

The DICOM Processing Service then is an implementation of:

- Patient Browser
 - Search for a patient and select it for treatment
- Image Viewer
 - Query and Retrieve the Studies, Series and Instances of the selected patient and show the received entities.

4.1.1 Application Data Flow Diagram

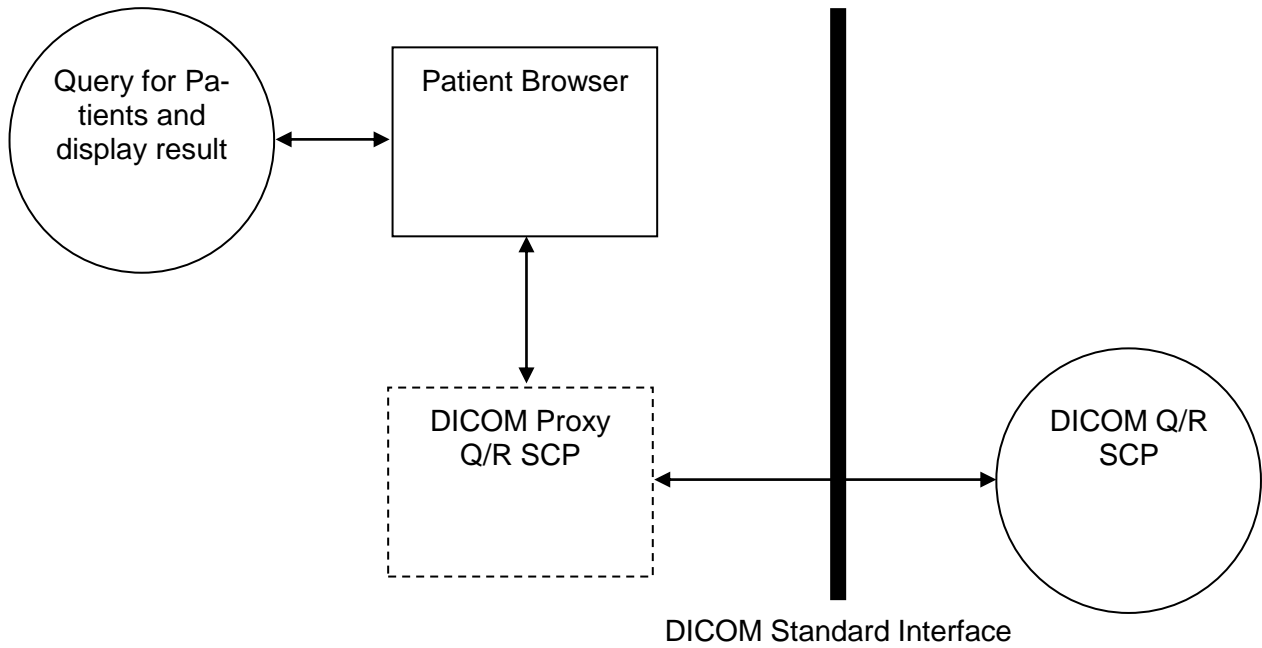


Figure 4-1: Patient Browser Application flow diagram

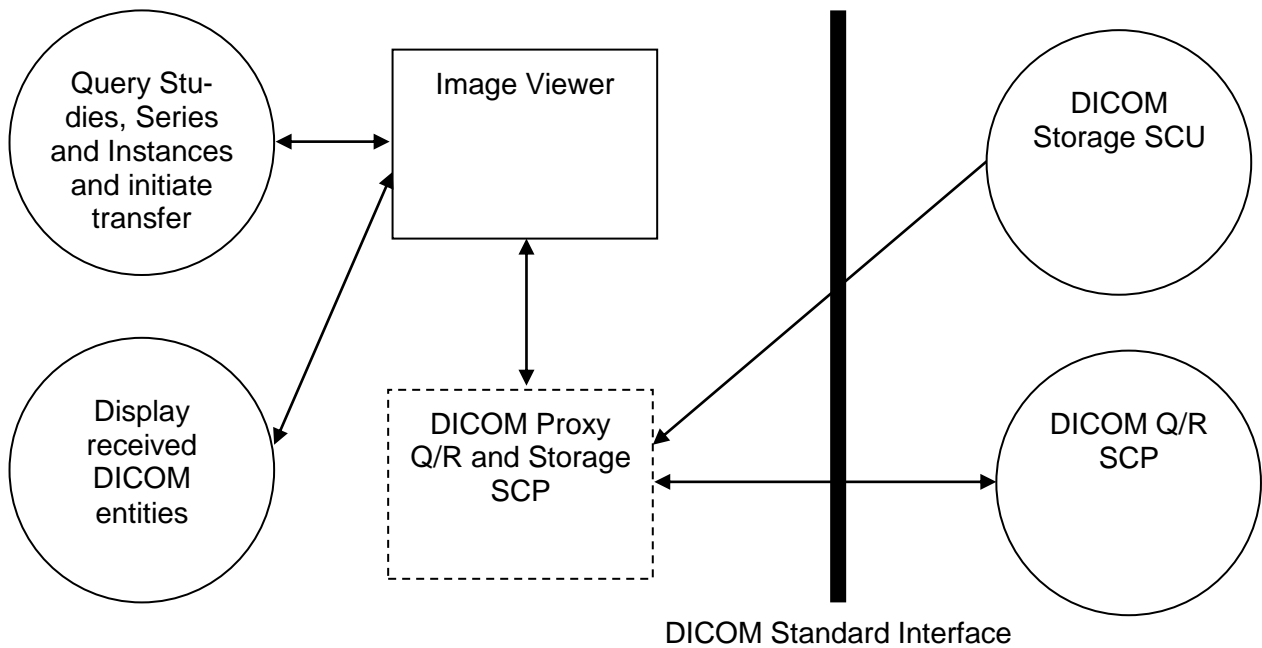


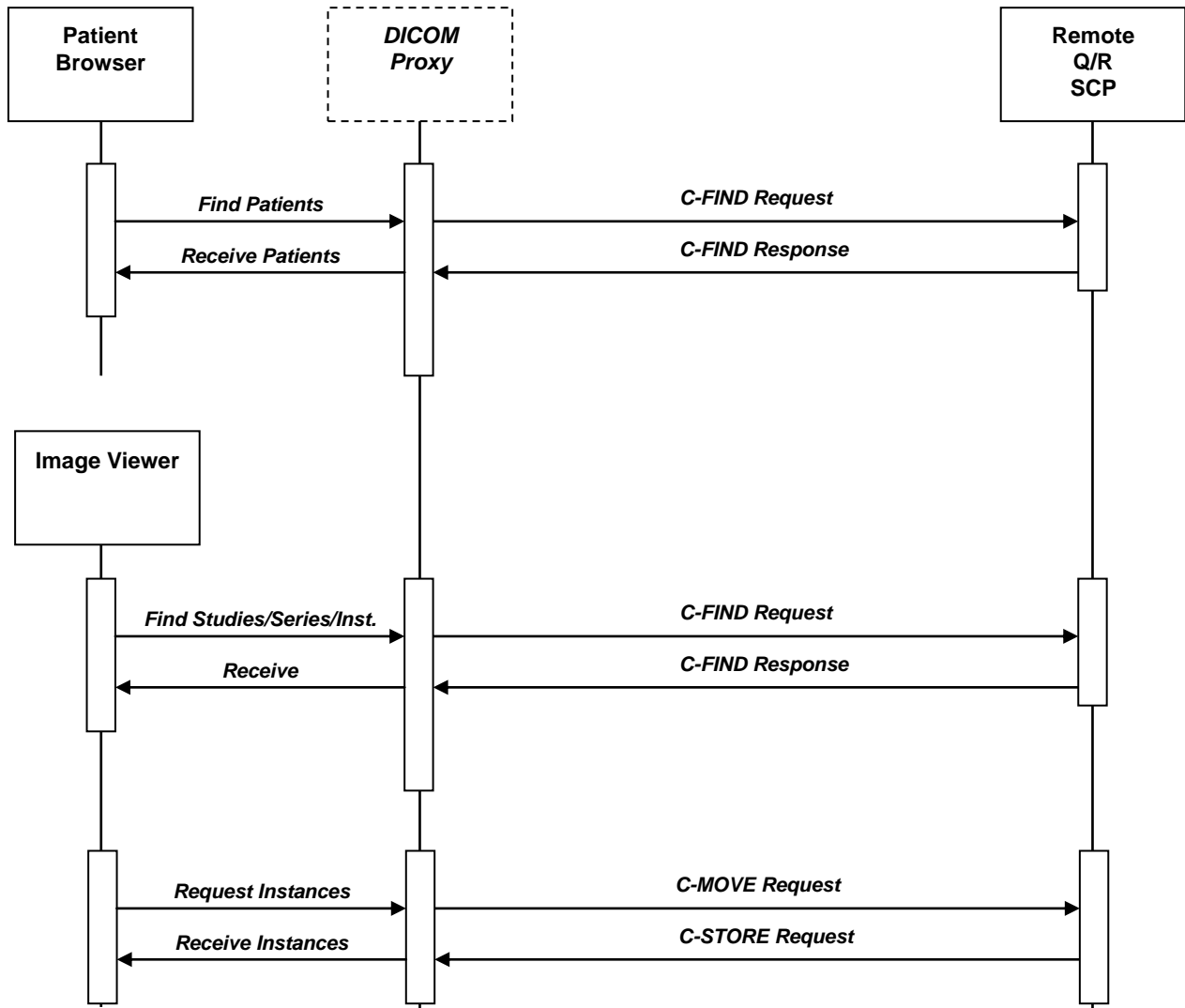
Figure 4-2: Image Viewer Application flow diagram

4.1.2 Functional Definition of Application Entity (AE)

Some communications and data transfer with remote AEs are accomplished utilizing the DICOM protocol over a network using the TCP/IP protocol stack.

- If the Image Viewer requests instances it accepts an association from the DICOM Proxy accepting any kind of DICOM objects which contain an image module or Segmentation instances.

4.1.3 Sequencing Of Real World Activities



Patient Data Manager is embedded in a sequencing of real world activities as follows:

1. *User queries for Patients via Patient Browser*
 - a. DICOM Proxy uses C-FIND requests to find the patients
 - b. Results are transferred to the Patient Browser
2. *ImageViewer is opened*
 - a. ImageViewer queries for studies, series and instances
 - b. Series are transferred upon user request or according to prefetching rules.
 - i. DICOM Proxy uses C-MOVE requests to transfer the series.
 - ii. DICOM Proxy receives C-STORE requests and forwards data to the Image Viewer

4.2 Application Entity Specifications

4.2.1 Patient Browser

4.2.1.1 SOP Classes and Transfer Syntaxes

The Patient Browser queries the Proxy using the Brainlab Workflow Services.
The Proxy forwards the queries using the following standard DICOM Service Class:

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.33.3.0.0
Implementation Version Name	PatientSelect3.0

4.2.1.3 Association Initiation Policy

The Patient Browser initiates an association in these cases:

1. Search for a Patient: The user searches for a patient for further treatment.

4.2.1.3.1 Activity – Search for a Patient

4.2.1.3.1.1 Associated Real-World Activity

The user want to select a patient for further treatment. The Patient Browser contacts the DICOM Proxy to give it a list of patients which match the specified filter criteria. The Proxy forwards the request to an associated Q/R server. Please refer to the DICOM Proxy's conformance statement for the Proposed Presentation Contexts and SOP Specific Conformance.

4.2.1.4 Association Acceptance Policy

The Patient Browser accepts no associations.

4.2.2 Image Viewer Specification

4.2.2.1 SOP Classes and Transfer Syntaxes

The Image Viewer queries and retrieves instances from the Proxy using the Brainlab Workflow Services.

The Image Viewer imports DICOM image data. It provides Standard Conformance to the following DICOM V3.0 SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP	Transfer Syntax
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes	COMP
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes	COMP
SC Multi Frame Grayscale Byte	1.2.840.10008.5.1.4.1.1.7.2	No	Yes	COMP
SC Multi Frame Grayscale Word	1.2.840.10008.5.1.4.1.1.7.3	No	Yes	COMP
SC Multi Frame Single Bit	1.2.840.10008.5.1.4.1.1.7.1	No	Yes	COMP
SC Multi Frame True Color	1.2.840.10008.5.1.4.1.1.7.4	No	Yes	COMP
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes	RLE
Standard CR	1.2.840.10008.5.1.4.1.1.1	No	Yes	COMP
Standard CT	1.2.840.10008.5.1.4.1.1.2	No	Yes	COMP
Standard Digital X-Ray Image for Image for Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes	COMP
Standard Digital X-Ray Image for Image for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes	COMP
Standard Grayscale Softcopy Image for Presentation State	1.2.840.10008.5.1.4.1.1.11.1	No	Yes	COMP
Standard Hardcopy Color	1.2.840.10008.5.1.1.30	No	Yes	COMP
Standard Hardcopy Grayscale	1.2.840.10008.5.1.1.29	No	Yes	COMP
Standard Intra-oral X-Ray Image for Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes	UNCOMP
Standard Intra-oral X-Ray Image for Processing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes	UNCOMP
Standard MG Image for Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes	COMP
Standard MG Image for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes	COMP
Standard MR	1.2.840.10008.5.1.4.1.1.4	No	Yes	COMP
Standard NM	1.2.840.10008.5.1.4.1.1.20	No	Yes	COMP
Standard NM Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes	COMP
Standard Ophthalmic 16 Bit	1.2.840.10008.5.1.4.1.1.77.1.5.2	No	Yes	COMP
Standard Ophthalmic 8 Bit	1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes	COMP
Standard PET	1.2.840.10008.5.1.4.1.1.128	No	Yes	COMP
Standard RT Image	1.2.840.10008.5.1.4.1.1.481.1	No	Yes	COMP
Standard Secondary Capture	1.2.840.10008.5.1.4.1.1.7	No	Yes	COMP
Standard US	1.2.840.10008.5.1.4.1.1.6.1	No	Yes	COMP
Standard US Multi Frame	1.2.840.10008.5.1.4.1.1.3.1	No	Yes	COMP
Standard US Multi Frame Retired	1.2.840.10008.5.1.4.1.1.3	No	Yes	COMP
Standard US Retired	1.2.840.10008.5.1.4.1.1.6	No	Yes	UNCOMP
Standard Video Endoscopic	1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes	COMP
Standard Video Microscopic	1.2.840.10008.5.1.4.1.1.77.1.2.1	No	Yes	COMP
Standard Video Photographic	1.2.840.10008.5.1.4.1.1.77.1.4.1	No	Yes	COMP
Standard VL Endoscopic	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes	COMP
Standard VL Microscopic	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes	COMP
Standard VL Photographic	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes	COMP
Standard VL Slide Microscopic	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes	UNCOMP

SOP Class Name	SOP Class UID	SCU	SCP	Transfer Syntax
Standard X-Ray Angio	1.2.840.10008.5.1.4.1.1.12.1	No	Yes	COMP
Standard X-Ray Angio Biplane	1.2.840.10008.5.1.4.1.1.12.3	No	Yes	COMP
Standard X-Ray RF	1.2.840.10008.5.1.4.1.1.12.2	No	Yes	COMP

Table 4-1: Supported Storage SOP Classes

Patient Data Manager supports the following transfer syntax lists. In an association negotiation the syntaxes are proposed in the order of appearance in the list.

Transfer Syntax Name	Transfer Syntax UID	SCU	SCP	Extended Negotiation
Uncompressed Transfer Syntax List (UNCOMP)				
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	Yes	Yes	None
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	Yes	Yes	None
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	Yes	Yes	None
Compressed Transfer Syntax List (COMP)				
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	Yes	Yes	None
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	Yes	Yes	None
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	Yes	Yes	None
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70	No	Yes	None
RLE Lossless	1.2.840.10008.1.2.5	No	Yes	None
RLE Transfer Syntax List (RLE)				
RLE Lossless	1.2.840.10008.1.2.5	No	Yes	None
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	Yes	Yes	None
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	Yes	Yes	None
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	Yes	Yes	None
Only Implicit Transfer Syntax List (IMPL)				
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	Yes	Yes	None

Table 4-2: Supported Transfer Syntaxes

4.2.2.2 Association Policies

4.2.2.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.31.1.0.0
Implementation Version Name	ImageViewer1.0

4.2.2.3 Association Initiation Policy

The Image Viewer initiates an association in these cases:

1. Find studies, series and instances: Gives the user an overview of the available DICOM data for the selected patient.
2. Retrieve Instances: Transfers the Instances to the ImageViewer for viewing and further treatment.

4.2.2.3.1 Activity – Find studies, series and instances

4.2.2.3.1.1 Associated Real-World Activity

The ImageViewer queries the list of studies of the selected immediately after the start. If a study is not older than a specified date or the study is selected manually by the user, the series and instance information are also queried. Please refer to the DICOM Proxy's conformance statement for the Proposed Presentation Contexts and SOP Specific Conformance.

4.2.2.3.2 Activity – Retrieve Instances

4.2.2.3.2.1 Associated Real-World Activity

The ImageViewer retrieves a number of ImageSeries automatically if they match the configured prefetch rules. Further image series are retrieved on users request. Please refer to the DICOM Proxy's conformance statement for the Proposed Presentation Contexts and SOP Specific Conformance.

4.2.2.4 Association Acceptance Policy

The ImageViewer accepts no associations.

5 Media Interchange

Patient Data Manager supports DICOM media interchange for import of DICOM data:

- For import Patient Data Manager supports media interchange application profiles. To reflect this, the support for the Standard General Purpose CD-R Interchange is added to provide the supported SOP Classes. Nevertheless Patient Data Manager is able to import DICOM files even without the existence of any DICOMDIR by scanning a given file system located on any media (e.g. HD, MOD, CD, DVD, Tapes, USB Drive) for any kind of DICOM files.

5.1 Implementation Model

5.1.1 Application Data Flow Diagram

With Patient Data Manager the user may browse DICOM file sets and import selected entities.

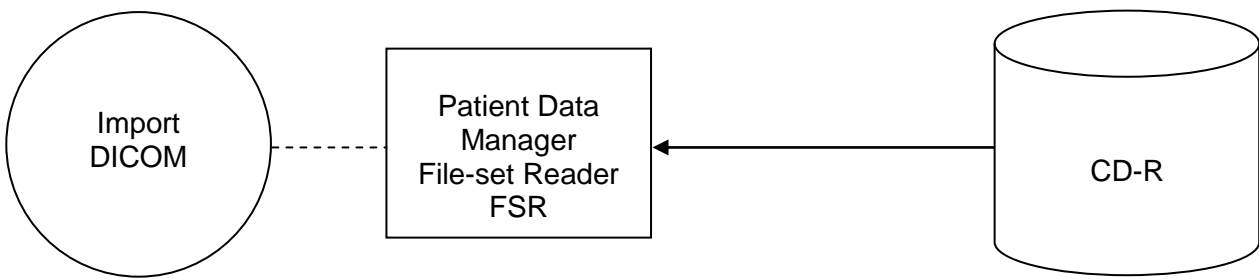


Figure 5-1: The media interchange application flow diagram

5.1.2 Functional Definition of Application Entity (AE)

Some communications and data transfer with remote AEs are accomplished utilizing the file system provided by the operating system upon which Patient Data Manager executes.

- File Set Reader:
Patient Data Manager loads DICOM data from the file. The reader supports the same SOP classes as the Storage SCP (see Table 4-1).

5.1.3 Sequencing Of Real World Activities

Not necessary.

5.1.4 File Meta Implementation Identifying Information

Patient Data Manager provides the same information as in chapter 4.2.1.2.1.

5.2 Application Entity Specifications

Patient Data Manager supports the following Media Interchange Profiles:

AE Related Application Profiles, Real-World Activities, and Roles			
Supported APs	Real World Activity	Roles	SC Option
STD-GEN-CD	Import DICOM	FSR	Interchange

Table 5-1: Supported Media Interchange Profiles.

5.2.1.1 File Meta Information for the Application Entity

The Source Application Entity Title included in the File Meta Header is configurable. It is the same as the local AET of the network configuration (see section **Error! Reference source not found.**)

5.2.1.2 Real-World Activities

5.2.1.3 Activity – Import DICOM

Patient Data Manager acts as an FSR using the Interchange option

- When requested to provide a directory listing it will read the File-set and display the DICOM-DIR directory entries for all SOP Instances in the File-set.
- When requested to import the selected entries from directory listing, only those SOP Instances are loaded that correspond to the Application Profile STD-GEN-CD.
- For the list of Application Profiles invoking this AE see Table 5-1. The supported SOP Classes see Table 4-1.

5.2.1.3.1 Media Storage Application Profiles

Patient Data Manager supports the STD-GEN-CD Application Profile.

5.2.1.3.1.1 Options

Supported transfer syntaxes for the media profiles:

Transfer Syntax Name	Transfer Syntax UID
DICOM Implicit VR Little Endian	1.2.840.10008.1.2
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2
JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression	1.2.840.10008.1.2.4.50
JPEG Extended (Process 2 & 4): Default Transfer Syntax for Lossy JPEG 12 Bit Image Compression (Process 4 only)	1.2.840.10008.1.2.4.51
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70
RLE Lossless	1.2.840.10008.1.2.5

Table 5-2: Supported Media Profile Transfer Syntaxes

The Offline-Media Application Entity supports the SOP Classes and Transfer Syntaxes listed in the Table below:

SOP Classes	Transfer Syntaxes
All SCP SOP Classes listed in Table 4-1	All SCP Transfer Syntaxes listed in Table 5-2

For further information see section 8.1.1 on acceptance of SOP Instances (i.e. whether Patient Data Manager is able to import and convert the DICOM data).

5.3 Augmented And Private Application Profiles

Patient Data Manager does not support any augmented or private application profiles.

6 Support Of Extended Character Sets

Patient Data Manager supports the

- ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set)

7 Security Profiles

No security profiles are supported.

8 Annexes

8.1 IOD Contents

8.1.1 Usage Of Attributes From Received IODs

This section describes the requirements on the DICOM data, which can be displayed.

8.1.1.1 Images

Patient Data Manager accepts all images of the SOP Classes in Table 4-1. Though, there are some restrictions and special conversions:

- Images with an attribute (0028,0030) Pixel Spacing containing different values for x and y distance¹ will be ignored.

8.1.1.2 Segmentation Storage

Patient Data Manager accepts the Segmentation Storage SOP Class. Though, there are some restrictions:

- Segmentation Storage objects with Segmentation Type (0060,3020) "BINARY" are not supported if the value of the Columns attribute (0028, 0011) is not a multiple of 8.

8.2 Data Dictionary Of Private Attributes

None supported.

8.3 Coded Terminology And Templates

None supported.

8.4 Grayscale Image Consistency

Not supported.

8.5 Standard Extended/Specialized/Private Sop Classes

None supported.

8.6 Private Transfer Syntaxes

None supported.

¹ To be more precise: If the difference between both values is greater than 0.001 mm.

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