Technical Publication

DICOM CONFORMANCE STATEMENT

BrainLAB PatXfer 5

Revision 1.0

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0. Introduction

0.1 Purpose

This is a conformance statement for the BrainLAB software PatXfer. The DICOM part of the application is used to browse and display DICOM images (network files as well as Part 10 files) and to query and retrieve DICOM images from remote archives.
This DICOM Conformance Statement is written according to part PS 3.2 of [1].

0.2 Abbreviations

ACR	American College of Radiation
AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communications in Medicine
NEMA	National Electrical Manufactures Association
PDU	Protocol Data Unit
Q/R	Query and Retrieve
SCU	Service Class User
SCP	Service Class Provider
SOP	Service Object Pair
UID	Unique Identifier
VR	Value Representation

0.3 References

[1] Digital Imaging and Communications in Medicine (DICOM) 3.0, NEMA PS 3.1-3.13

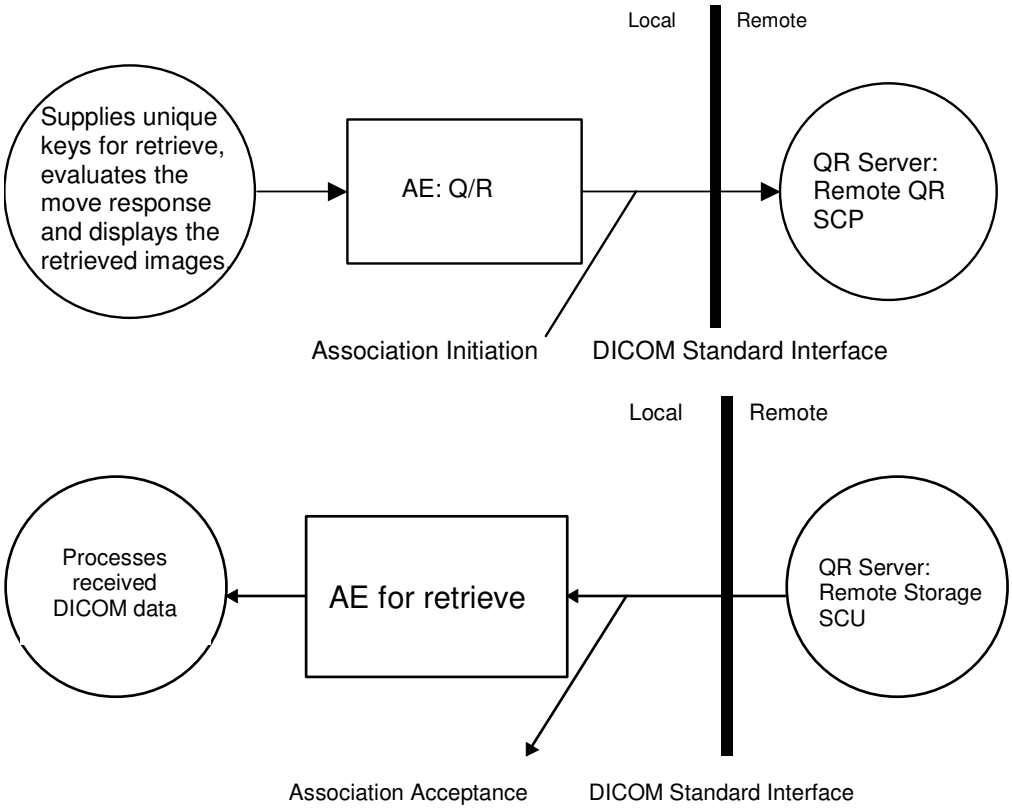
BrainLAB uses DICOM by Merge.

1. Implementation Model

The BrainLAB PatXfer is an implementation of

- A Query/Retrieve SCU to query remote DICOM archives and to initiate a storage request from the queried archives.
- A Storage SCP to retrieve images from a remote QR Server (which sends images initiated by a move request)
- Reading DICOM images from HDD, MOD, CD ROM or Floppy.

1.1 Application Data Flow Diagram



1.2 Functional definition of Application Entity (AE)

All communications and data transfer with remote AE's are accomplished utilizing the DICOM protocol over a network using the TCP/IP protocol stack.

- Query and Retrieve:
  PatXfer initiates an association as a Q/R SCU negotiating all models. The find request will be performed (depending on the negotiated models) on all DICOM levels (patient, study, series or instance). For a DICOM image series, a move request can be performed. The application supplies all unique keys for the requested level. The move response, indicating the storage-progress, is graphically evaluated.
- Storage SCP
  The Storage SCP will be started right before the move request is performed and stopped after the last image has been received.
  The Storage SCP will respond, if asked, with the Verification SOP Class UID as an SCP. PatXfer waits for an association to accept at the TCP/ IP port number that is configured within the software. When an association request is received with valid connection criteria, PatXfer responds with a list of SOP class UIDs that it will accept. It then waits for a storage request. If a storage request is received, then all incoming images, that are conformant to the association, are temporarily written to files on disk and then further processed within the software.

1.3 Sequencing of real World Activities

Not applicable.

2. Application Entity Specifications

2.1 Specifications

2.1.1 Query/Retrieve SCU AE

Before a query or retrieve request is performed, PatXfer sends out an Echo request in order to test the connection to the remote AE.

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

PatXfer provides Standard Conformance to the following DICOM v3.0 SOP Classes as a Query/Retrieve SCU.

SOP Class Name	SOP Class UID
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2

2.1.2 Storage SCP AE

SOP Class UID	SOP Class Name
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128

2.1.3 Transfer syntax

PatXfer supports the following transfer syntaxes. In an association negotiation the syntaxes are proposed in the order of appearance in the list.

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 Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70

2.2 Association establishment policies

2.2.1 General

The maximum PDU size is 28672 bytes.

- Query/Retrieve SCU
  PatXfer initiates an association as a Query/Retrieve SCU. Normally the first query opens this association. It remains open while further queries and retrieves can be performed. Before each find or query request an echo request is sent to test the current connection. The association will be closed automatically.
- Storage SCP
  The PatXfer application will wait for an association as a Storage SCP only in combination with the retrieve process to accomplish the storage request initiated by a move-request. If a storage request is received, then all incoming images are temporarily written to files on disk and then further processed with the software.

2.2.2 Number of associations

The number of simultaneous associations is restricted to 1.

2.2.3 Asynchronous nature

PatXfer does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.4 Implementation identifying information

The Implementation Class Unique Identifier (UID) for the BrainLAB PatXfer Application Entity is: 1.2.276.0.20.1.3

2.2.5 Application Entity Title

The default AET for the role as Query/Retrieve SCU and storage SCP is "PatXfer", but can be configured independently within the software.

2.3 Association Initiation by real-world activity

2.3.1 Query/Retrieve SCU

2.3.1.1 Real-world activity - Find

2.3.1.1.1 Associated real-world activity

A C-FIND is performed when the user queries the remote Query/Retrieve SCP for patients, studies or series.

- For the patient-root or patient-study-only model, the user can restrict the patient-query by the following tags:

Description	Tag (hex)
Patient's Name	0010,0010
Patient ID	0010,0020

- For the study-root model, the user can restrict the patient/study-query by the following tags:

Description	Tag (hex)
Patient's Name	0010,0010
Patient ID	0010,0020
Study date	0008,0020

2.3.1.1.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax	**Transfer**	**Syntax UID**	**Role**	**Extended Negotiation**
All FIND SOP Classes as defined in 2.1.1 (All standard DICOM FIND SOP Classes	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

2.3.1.1.3 SOP specific conformance for all FIND SOP Classes

All FIND SOP Classes are implemented according the DICOM standard. No extended negotiation is implemented.

2.3.1.2 Real-world activity - Move

2.3.1.2.1 Associated real-world activity

On user selection of a specific DICOM image series, a move request is performed. The storage target for receiving the DICOM data (the AET with which the move-request is equipped) “PatXfer” per default, but can be configured in the software.

2.3.1.2.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax	**Transfer**	**Syntax UID**	**Role**	**Extended Negotiation**
All MOVE SOP Classes as defined in 2.1.1 (All standard DICOM MOVE SOP Classes)	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

2.3.1.2.3 SOP specific conformance for all MOVE SOP Classes

All MOVE SOP Classes are implemented according the DICOM standard. No extended negotiation is implemented.

2.4 Association Acceptance by real-world activity

2.4.1 Storage SCP

2.4.1.1 Real world activity - Storage SCP

The PatXfer application accepts an association for the appropriate Storage Service Class that corresponds to the set of messages requested to be transferred. The association is closed by the Storage Service Class user, which initiated the association.
PatXfer is able to abort the association when an error occurs.

2.4.1.2 Associated real-world activity for Receive message operations

Once the association has been established, the PatXfer waits for transmission of conformant Storage Service messages.

Presentation Context Table				
Abstract Syntax	Transfer Syntax		Role	Extended Negotiation
	Name List	UID List		
All Storage SOP Classes declared above in 2.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		
	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70		

2.4.1.3 SOP specific conformance for all storage SOP Classes

All storage SOP Classes are implemented according the DICOM standard. No extended negotiation is implemented.

2.4.1.4 Presentation context acceptance criterion for Receive message operations

PatXfer will accept the verification or storage SOP classes that are listed above. In the event of receiving an unknown presentation context the PatXfer will reject the association request.

2.4.1.5 Transfer syntax selection policies for Receive message operations

PatXfer supports the Implicit VR Little Endian, the Explicit VR Little Endian, the Explicit VR Big Endian and then JPEG Lossless standard transfer syntax. Any proposed presentation context, which includes one of these transfer syntaxes will be accepted. Any proposed presentation context that does not include one of these transfer syntaxes will be rejected.

3. Communication profiles

3.1 Supported Communication Stacks

PatXfer supports the DICOM upper layer using TCP/IP.

3.2 TCP/IP Stack

The TCP/IP stack is inherited from the Windows® NT ™ Operating system.

3.3 Physical Media Support

Ethernet v2.0, IEEE 802.3

3.4 Point to Point Stack

The 50-pin ACR-NEMA connection is not applicable to this product.

4. Extensions/ specializations/ privatizations

4.1 Standard extended/ specialized/ private SOP's

None supported.

4.2 Private Transfer Syntaxes

None supported.

5. Configuration

5.1 AE title/ presentation address mapping

PatXfer can configure several nodes representing remote QR Servers. On the corresponding settings page, application-wide global parameter and node-specific parameter can be entered.

5.2 Configurable parameters

5.2.1 Listening Port number

The listening port number is an application-wide global parameters, which is valid for the QR SCU, as well as for the storage SCP.

5.2.2 AET for the QR SCU

The AET for the QR SCU is an application-wide global parameters. The default value is “PatXfer”.

5.2.3 AET for the Storage SCP

The AET for the Storage SCP is a node-specific parameter. The default value is equal to the AET for the QR SCU (“PatXfer”), but can also be entered separately.

5.2.4 Information of the remote system (QR Server)

The IP address, AET and listening port number of the remote QR Server (SCP) are node-specific parameters. Also the time-out is a node-specific parameter and can be adjusted. It means the timeout between two packages within a message.

5.3 Not configurable parameter

The time-out parameters for association request, reply, release, for connection acceptance and inactivity are 30 second and cannot be configured in the software.

6. Support of extended character sets

Not supported.

7. Information Object requirements

7.1 General Tags

(0008, 0018)	SOP Instance UID	Mandatory
(0008, 0020)	Study Date	Optional
(0008, 0060)	Modality	Mandatory
(0010, 0010)	Patient Name	Patient name or Id must be available.
(0010, 0020)	Patient ID	
(0010, 0030)	Patient's Birth Date	Optional
(0010, 0040)	Patient’s Sex	Optional
(0010, 1030)	Patient's Weight	Optional
(0020, 000D)	Study UID	Mandatory
(0020, 000E)	Series UID	Mandatory
(0020, 0011)	Study ID	Optional
(0020, 0012)	Series Number	Optional
(0020, 0013)	Acquisition Number	Optional
(0020, 0010)	Study ID	Optional
(0020, 0013)	Image Number	Optional
(0020, 0037)	Image Orientation	Mandatory
(0020, 0032)	Image Position	Mandatory
(0028, 0002)	Sample per Pixel	Mandatory
(0028, 0010)	Number of Rows	Mandatory

(0028, 0011)	Number of Columns	Mandatory
(0028, 0030)	Pixel Size	Mandatory
(0028, 0100)	Bits Allocated	Mandatory
(0028, 0101)	Bits Stored	Mandatory
(0028, 0102)	High Bit	Mandatory
(0028, 0103)	Pixel Representation	Mandatory
(7FE0, 0010)	Pixel Data	Mandatory

7.2 CT Images (additional tags)

(0008, 0060)	Modality	Mandatory: CT
(0018, 5100)	Patient Position	Optional
(0028, 1052)	Rescale Intercept	Mandatory
(0028, 1053)	Rescale Slope	Mandatory

7.3 MR Image (additional tags)

(0008, 0008)	Image Type	Optional
(0008, 0060)	Modality	Mandatory: MR
(0018, 5100)	Patient Position	Optional

7.4 PT Images (additional tags)

(0008, 0060)	Modality	Mandatory: PT
(0054, 1000)	PT Image Series	STATIC\IMAGE or WHOLE_BODY\IMAGE or DYNAMIC\IMAGE and TimeSlice=1
(0054, 0101)	TimeSlice	Mandatory: 1, if DYNAMIC
(0018, 5100)	Patient Position	Optional
(0054, 0410)	Patient Orientation Code Sequence	Optional
(0054, 0412)	> Patient Orientation Modifier Code	
(0008, 0100)	>> Code Value	F-10340 or F-10310

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