DICOM Conformance Statement

Surgery

Document Revision 7

May 7, 2018

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1 Conformance Statement Overview

This is a Conformance Statement for the Brainlab Surgery system. This system – dependent from purchased licenses and configuration – consists of several applications and performers.
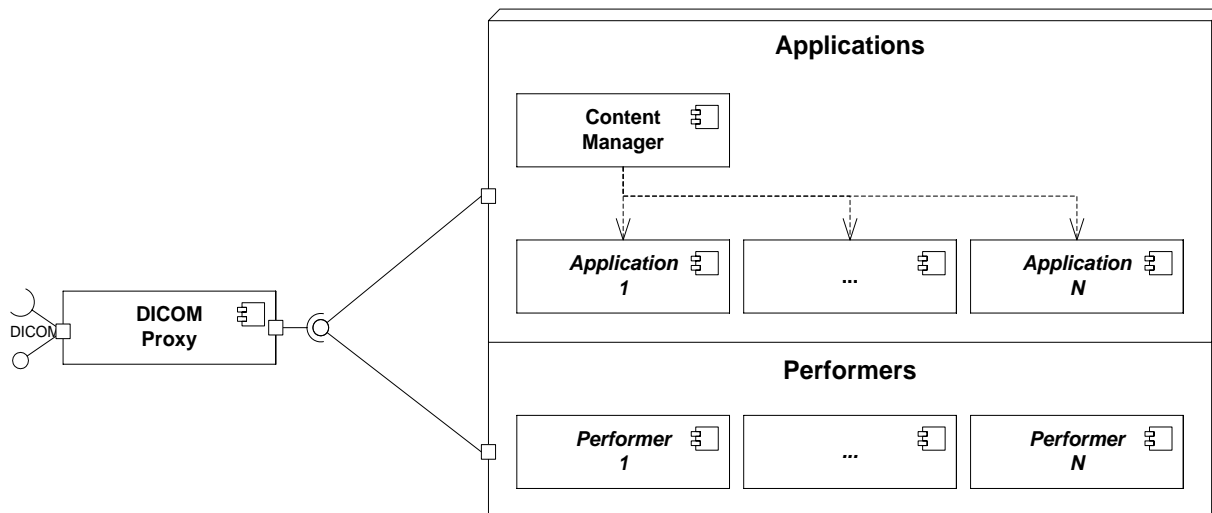

Figure 1-1: Overview of a Brainlab system running applications and performers

The Brainlab system is based on the following common management applications:

Management Application	Description
Content Manager	Manages applications on Brainlab systems. It allows a user to create and read screenshots.
DICOM Proxy	The interface between the Brainlab system and the outside DICOM world. No application or performer communicates directly with any remote DICOM node, but all communication will be done through the DICOM Proxy. If necessary the DICOM Proxy adjusts the DICOM communication to the capabilities and known specialties of the remote DICOM nodes. The DICOM Proxy itself (see [1] for its Conformance Statement) as well as the internal communication between the DICOM Proxy and the applications and performers is not part of this Conformance Statement.

Table 1-1: Common Management Applications

Applications have a user interface. The following applications are documented in this Conformance Statement:

Application	Description
Patient Selection	Allows the user to browse, load or save data in/to DICOM archives or on/to media (e.g., CD-ROM)
Image Viewer	Allows the user to display any kind of DICOM image data.
Fusion	Allows the user to overlap two different DICOM data sets by means of rigid or deformable spatial registrations
Smartbrush	Allows the user to create, read and update segmentations based on DICOM image data.
Cranial/ENT	Allows the user to perform an image guided cranial surgery.
Microscope	Allows the user to use a surgical microscope during image guided surgeries – typically in cranial surgeries.
Cranial EM / ENT EM	Allows the user to perform an image guided cranial/ENT surgery using electromagnetic tracking technologies.
Spine and Trauma 2D/ Fluoro Express	Allows the user to perform an image guided spine surgery with 2D image data.
Spine and Trauma 3D	Allows the user to perform an image guided spine surgery with 2D and 3D image data.
Spine & Trauma 3D Navigation	Allows the user to perform an image guided spine surgery with 3D image data
Registration Software Fluoro3D	Allows the user to create an IGS registration on CT images.
Automatic Image Registration (AIR)	Allows the user to create an IGS registration on CT images.
Knee/Hip	Image-less application. Allows navigated surgery based on interactively acquired geometric models of bone structures.
Angio Planning	Allows the user to register 3D CT/MR image data with segmented vessels to a 2D X-Ray Angio image data and then to segment a nidus in the 3D volume.
Object Manager	Allows the user to create, review and modify segmentation objects based on the Universal Atlas. Provides functionality to combine, subtract or intersect existing objects and to store the result as a new segmentation object.
Fibertracking	Allows the user to create, review and modify fiber bundles as surface segmentation objects. Allows to create simple manual ROIs as segmentation objects.
Trajectory/Stereotaxy	Allows the user to add, modify and remove trajectories (being represented as surface segmentation objects) in multi-modal, co-registered images using supplemental information such as objects and fiber bundles as well as to identify the name and status of the loaded plan for being able to perform a sufficient and safe review of the overall trajectory planning result. Provides functionality for creating/editing of an AC/PC system as well as localization of stereotactic frames.
Lead Localization	Allows the user to create, detect, modify and remove trajectories in multi-modal, co-registered images received via the DICOM Storage Service Class.
Guide	Allows the user to create, modify and remove simulation parameters as DICOM Segmentation instances based on loaded image sets received via the DICOM Storage Service Class.
Cranial Registration	Allows the user to register the patient with surface matching or paired point registration using optical tracking methods.
Cranial Navigation	Allows the user to perform an image guided cranial surgery using optical tracking methods.

Table 1-2: Applications

Performers don't have a user interface and perform their tasks in the background. The following performers are documented in this Conformance Statement:

Performer	Description
Auto Segmentation	Performs automatic organ segmentation.
Universal Atlas Performer	Performs deformable spatial registrations of datasets to the Brainlab Universal Atlas
Vessel Segmentation	Performs automatic vessel segmentation.
DTI Preprocessing Performer	Performs DTI Preprocessing for Fibertracking

Table 1-3: Performers

The table below addresses all supported network services used by the different application entities. For the SOP Classes in the Transfer section SCU and SCP have special meanings. Entities consuming data (e.g., for displaying images) are marked as SCP. Applications producing data (e.g., like spatial registrations) are marked as SCU. All created data will be initially stored to the DICOM Proxy, which then is responsible to forward created data to configured remote DICOM nodes.

Symbol:	Meaning:
■	User of Service (SCU)
◆	Provider of Service (SCP)
✦	Both (SCU/SCP)

SOP Classes	Content Manager	Patient Selection	Image Viewer	Fusion	Smartbrush	Cranial/ENT	Cranial Registration	Cranial Navigation	Microscope	Cranial EM / ENT EM	Spine and Trauma 2D/FluoroExpress	Spine and Trauma 3D	AIR	Spine & Trauma 3D Navigation	Registration Software Fluoro3D	Knee/Hip	Angio Planning	Auto Segmentation	Vessel Segmentation	UniversalAtlasPerf.	Object Manager	Fibertracking	DTI Preprocessing Performer	Trajectory/Stereotaxy	Lead Localization	Guide
Transfer																										
Breast Tomosynthesis Image Storage			♦																							
Computed Radiography Image Storage			♦																							
CT Image Storage			♦	✦	♦	♦	♦	♦	♦	♦		♦	✦	♦	♦		♦	♦	♦	♦	♦	♦		♦	♦	♦
Deformable Spatial Registration Storage				✦								♦		♦						■	♦	♦				
Digital Intra-oral X-Ray Image Storage - For Presentation			♦																							
Digital Intra-oral X-Ray Image Storage - For Processing			♦																							
Digital Mammography X-Ray Image Storage - For Presentation			♦																							
Digital Mammography X-Ray Image Storage - For Processing			♦																							
Digital X-Ray Image Storage - For Presentation			♦																							
Digital X-Ray Image Storage - For Processing			♦																							
Encapsulated PDF Storage					■											■										
Enhanced CT Image Storage			♦	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦		♦	♦	♦	♦	♦	♦		♦	♦	♦
Enhanced MR Color Image Storage			♦																							
Enhanced MR Image Storage			♦	♦	♦	♦	♦	♦	♦	♦		♦		♦			♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Enhanced PET Image Storage			♦																							
Enhanced SR Storage																										✦
Enhanced US Volume Storage			♦																							

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Legend: ◆ = red diamond, ◈ = purple diamond, ■ = blue square, ◆̃ = pink/brown diamond

SOP Classes	Content Manager	Patient Selection	Image Viewer	Fusion	Smartbrush	Cranial/ENT	Cranial Registration	Cranial Navigation	Microscope	Cranial EM / ENT EM	Spine and Trauma 2D/ FluoroExpress	Spine and Trauma 3D	AIR	Spine & Trauma 3D Navigation	Registration Software Fluoro3D	Knee/Hip	Angio Planning	Auto Segmentation	Vessel Segmentation	UniversalAtlasPerf.	Object Manager	Fibertracking	DTI Preprocessing Performer	Trajectory/Stereotaxy	Lead Localization	Guide
Enhanced XA Image Storage			◆																							
Enhanced XRF Image Storage			◆																							
Grayscale Softcopy Presentation State Storage			◈	◈	◆	◈	◈	◈	◈	◈		◈	◈	◈	◈						◈	◆		◈		
Intravascular Optical Coherence Tomography Image Storage - For Presentation			◆																							
Intravascular Optical Coherence Tomography Image Storage - For Processing			◆																							
Key Object Selection Document Storage		◈	◆	◈	◆	◆	◆	◆	◆	◆	◆	◆	◈	◆̃	◆̃		◆	◆	◆	◆	◆	◆	◈	◆	◆	◆
MR Image Storage			◆	◈	◆	◆	◆	◆	◆	◆		◆		◆			◆	◆	◆	◆	◆	◆		◆	◆	◆
MR Spectroscopy Storage			◆																							
Multi-frame Grayscale Byte Secondary Capture Storage			◆	◈	◆	◆	◆	◆	◆	◆	◈	◈									◆	◆		◆	◆	◆
Multi-frame Grayscale Word Secondary Capture Storage			◆	◈	◆	◆	◆	◆	◆	◆	◈	◈									◆	◆	■	◆	◆	◆
Multi-frame Single Bit Secondary Capture Storage																										
Multi-frame True Color Secondary Capture Storage	■		◆	◈	◆	■	■	■	■	■			■	■	■		◈				◆	◆	■	◆	◆	◆
Nuclear Medicine Image Storage			◆	◆	◆	◆	◆	◆	◆	◆											◆	◆		◆	◆	◆
Nuclear Medicine Image Storage (Retired)			◆																							
Ophthalmic Photography 16 Bit Image Storage			◆																							
Ophthalmic Photography 8 Bit Image Storage			◆																							

SOP Classes	Content Manager	Patient Selection	Image Viewer	Fusion	Smartbrush	Cranial/ENT	Cranial Registration	Cranial Navigation	Microscope	Cranial EM / ENT EM	Spine and Trauma 2D/ FluoroExpress	Spine and Trauma 3D	AIR	Spine & Trauma 3D Navigation	Registration Software Fluoro3D	Knee/Hip	Angio Planning	Auto Segmentation	Vessel Segmentation	UniversalAtlasPerf.	Object Manager	Fibertracking	DTI Preprocessing Performer	Trajectory/Stereotaxy	Lead Localization	Guide
Ophthalmic Tomography Image Storage			◆																							
Positron Emission Tomography Image Storage			◆	◆	◆	◆	◆	◆	◆	◆				◆							◆	◆		◆	◆	◆
Raw Data Storage			✶	◆		◆	◆	◆	◆	◆		✶		◆			✶			■	✶	◆	■	✶		
Secondary Capture Image Storage			◆																							
Segmentation Storage			◆	✶	✶	✶	✶	◆	◆	◆		✶		◆			✶	✶	✶		✶	✶		✶	✶	✶
Spatial Fiducials Storage						✶	✶	◆		✶		◆		◆												
Spatial Registration Storage			✶	✶	◆	✶	✶	◆	✶	✶		✶	✶	✶	✶						◆	◆	■			
Surface Segmentation Storage			✶	✶		✶	✶	◆	◆	✶				◆								✶		✶	✶	✶
Tractography Results Storage																										
Ultrasound Image Storage			◆																							
Ultrasound Image Storage (Retired)			◆																							
Ultrasound Multi-frame Image Storage			◆																							
Ultrasound Multi-frame Image Storage (Retired)			◆																							
Video Endoscopic Image Storage			◆																							
Video Microscopic Image Storage			◆																							
Video Photographic Image Storage			◆																							
VL Endoscopic Image Storage			◆																							
VL Microscopic Image Storage			◆																							
VL Photographic Image Storage			◆																							
VL Slide-Coordinates Microscopic Image Storage			◆																							

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SOP Classes	Content Manager	Patient Selection	Image Viewer	Fusion	Smartbrush	Cranial/ENT	Cranial Registration	Cranial Navigation	Microscope	Cranial EM / ENT EM	Spine and Trauma 2D/ FluoroExpress	Spine and Trauma 3D	AIR	Spine & Trauma 3D Navigation	Registration Software Fluoro3D	Knee/Hip	Angio Planning	Auto Segmentation	Vessel Segmentation	UniversalAtlasPerf.	Object Manager	Fibertracking	DTI Preprocessing Performer	Trajectory/Stereotaxy	Lead Localization	Guide
VL Whole Slide Microscopy Image Storage			◆																							
X-Ray 3D Angiographic Image Storage			◆	◆	◆	◆		◆	◆									◆	◆		◆	◆		◆	◆	◆
X-Ray 3D Craniofacial Image Storage			◆	◆	◆	◆		◆	◆									◆	◆		◆	◆		◆	◆	◆
X-Ray Angiographic Bi-Plane Image Storage (Retired)			◆																							
X-Ray Angiographic Image Storage			◆					◆			◆	◆					◆									
X-Ray Radiofluoroscopic Image Storage			◆								◆	◆					◆									
Query/Retrieve																										
Patient Root Query/Retrieve Information Model – FIND		■																								
Patient Root Query/Retrieve Information Model – GET		■																								
Study Root Query/Retrieve Information Model – FIND		■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■
Study Root Query/Retrieve Information Model – GET		■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■

Table 1-4: Supported network services

The next table addresses all supported Media Storage Application Profiles used by the different application entities.

Sym-bol:	Meaning:
■	Write Files (FSC or FSU)
◆	Read Files (FSR)
✶	Both (FSR/FSC or FSU)

Media Storage Application Profile	Patient Selection
Brainlab General Purpose Media Interchange	✶

Table 1-5: Supported media profiles

2 Table of Contents

3 Introduction

3.1 Revision History

Document Revision	Date of Issue	Author	Description
3	December 2013		First release
4	June 2014		Adjusted to Brainlab Elements 2.1, Bugfixes
5	May 2015		Fluoro Express supports storing images Fusion supports creation of deformed images
6	Dec 2016		Release of Revision 6 Added Elements: EM Cranial, Fibertracking, Object Manager, Trajectory, Lead Localization and Guide Updates of: EM ENT, Fusion, Universal Atlas Performer
	Apr 2018		Added Elements: Microscope, Spine & Trauma 3D Navigation, Registration Software Fluoro 3D, Cranial Navigation, Cranial Registration Updates of: Trajectory, AIR, Cranial EM and ENT EM
7	May 2018		Release of Revision 7

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 [2]. 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:

AC/PC	Anterior Commissure and Posterior Commissure
ADC	Apparent Diffusion Coefficient
AE	DICOM Application Entity
AET	Application Entity Title
CD	Compact Disk
CD-R	Compact Disk Recordable
DVD	Digital Versatile Disc
DTI	Diffusion Tensor Imaging
FA	Fractional Anisotropy
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
HD	Hard Disk
IGS	Image Guided Surgery
IOD	(DICOM) Information Object Definition
ISO	International Standard Organization
MOD	Magneto Optical Disk
PDU	DICOM Protocol Data Unit
Q/R	Query and Retrieve
RCS	Reference Coordinate System
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM server)
SOP	DICOM Service-Object Pair

3.5 References

[1] Brainlab, DICOM Conformance Statement DICOM Proxy 4.0, Feldkirchen: Brainlab, 2017.

[2] Digital Imaging and Communications in Medicine (DICOM) 3.0, vol. PS 3, NEMA, 2018b.

[3] IHE, IHE RO Technical Framework: Multimodality Image Registration for Radiation Oncology, IHE, 2012.

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow Diagram
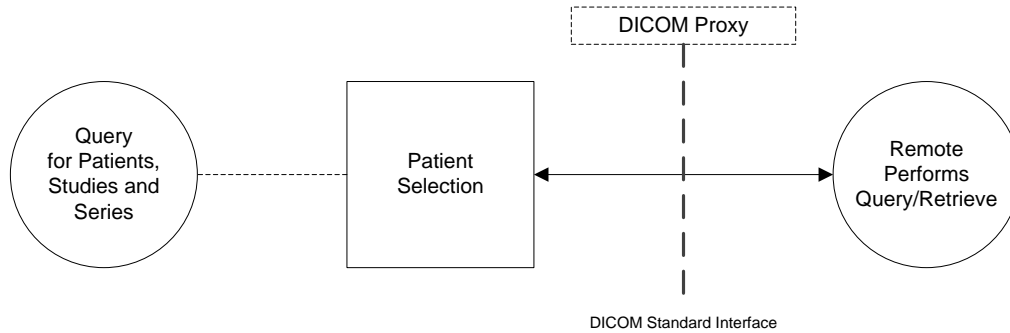

Figure 4-1: Patient Selection Application Data Flow Diagram

Brainlab applications in general support several data flows. Either they receive any DICOM data to display it, to process it and/or to create new DICOM data.
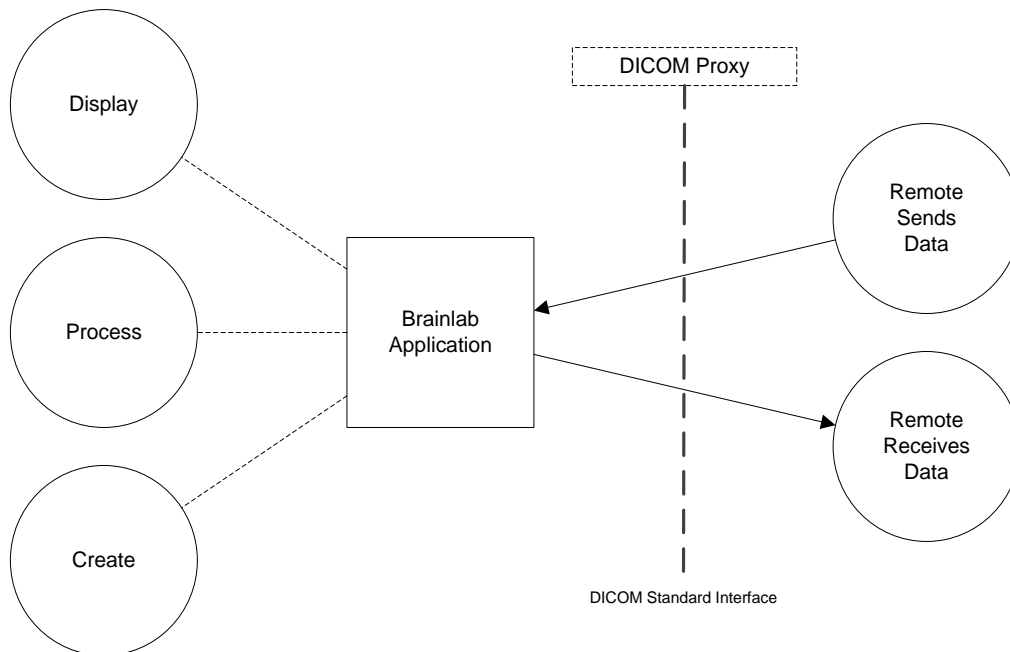

Figure 4-2: General Application Data Flow Diagram

Brainlab Performers only have one data flow. They process received DICOM data and create new DICOM data out of it.
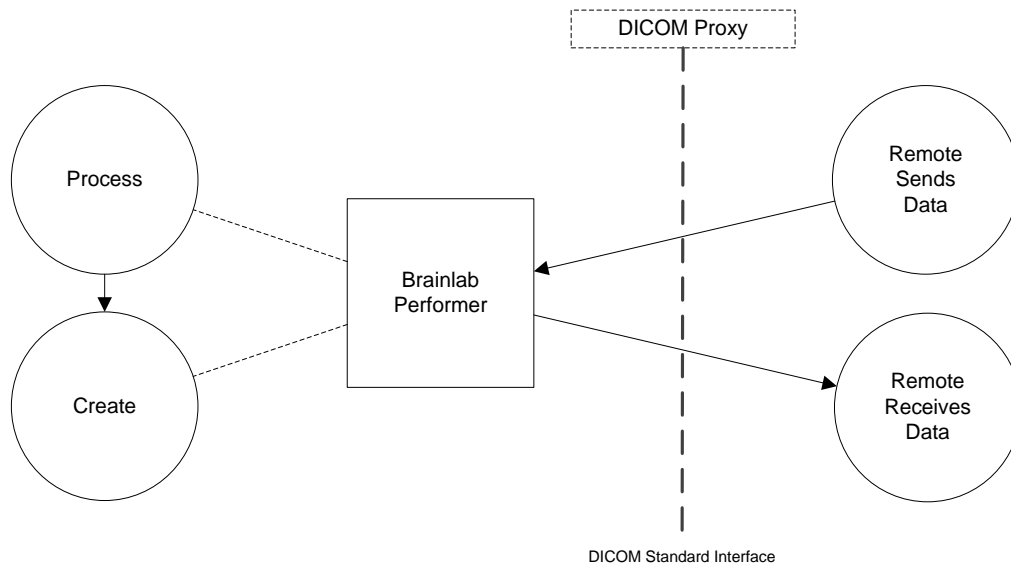
Figure 4-3: General Performer Data Flow Diagram

4.1.2 Functional Definition of Application Entity (AE)

All communication is done through the DICOM Proxy.
If there is an appropriate configuration for a remote node any DICOM command or message may be forwarded to the configured remote node. In this case the DICOM Proxy may act as protocol converter, i.e., it converts DICOM commands and messages in a DICOM format the remote node understands.
If there is no remote node configured the data will be retrieved from and stored in the local storage of the DICOM Proxy.

4.1.2.1 Management Applications

- **Content Manager**
  It allows the user to create screenshots. It stores them via the DICOM Storage Service Class as DICOM Secondary Capture.

4.1.2.2 Applications

- **Patient Selection**
  It allows the user to query remote archives using the DICOM Query/Retrieve FIND SOP Classes and to retrieve data using the DICOM Query/Retrieve GET SOP Class to generate previews.

- **Image Viewer**
  It displays all kind of DICOM image data received via the DICOM Storage Service Class. Additionally it is able to save changes, e.g., changes to the VOI LUT as Grayscale Presentation State.

- **Fusion**
  It allows the user to create or change spatial registrations between different volumetric image sets received via the DICOM Storage Service Class. Also supports processing of deformable spatial registrations resulting in artificially generated deformed images.

- **Smartbrush**
  It allows the user to create or change DICOM Segmentation instances based on loaded image sets received via the DICOM Storage Service Class. Additionally, it can save volumetric reports as DICOM Encapsulated PDF.

- **Cranial/ENT**
  It allows the user to perform an image guided surgery based on the DICOM data received via the DICOM Storage Service Class. Any instances created or changed during the surgery will be saved via the DICOM Storage Service Class.

- **Cranial Registration**
  It allows the user to create an IGS registration based on DICOM CT/MR image sets received via the DICOM Storage Service Class

- **Cranial Navigation**
  It allows the user to perform an image guided surgery based on the DICOM data received via the DICOM Storage Service Class. Any instances created or changed during the surgery will be saved via the DICOM Storage Service Class

- **Microscope**
  It allows the user to perform an image guided surgery based on the DICOM data received via the DICOM Storage Service Class. Any instances created or changed during the surgery will be saved via the DICOM Storage Service Class

- **Cranial EM/ENT EM**
  It allows the user to perform an image guided surgery based on the DICOM data received via the DICOM Storage Service Class. Any instances created or changed during the surgery will be saved via the DICOM Storage Service Class

- **Spine and Trauma 2D/ Fluoro Express**
  It allows the user to perform an image guided surgery based on the DICOM image sets received via the DICOM Storage Service Class.

- **Spine and Trauma 3D**
  It allows the user to perform an image guided surgery based on DICOM volumetric image sets received via the DICOM Storage Service Class.

- **Spine & Trauma 3D Navigation**
  It allows the user to perform an image guided surgery based on DICOM volumetric image sets received via the DICOM Storage Service Class.

- **Registration Software Fluoro3D**
  It allows the user to create an IGS registration based on DICOM CT image sets received via the DICOM Storage Service Class.

- **Automatic Image Registration**
  It allows the user to create an IGS registration based on DICOM CT image sets received via the DICOM Storage Service Class.

- **Knee/Hip**
  It allows the user to save a surgery report as DICOM Encapsulated PDF via the DICOM Storage Service Class.

- **Angio**
  It allows the user to create a projective registration from a 3D head CT/MR-Volume with segmented vessels to a 2D X-Ray Angio image series received via the DICOM Storage Service Class. It allows the user to create segmentation instances for detected anomalies. Any created registration, segmentation and image instances will be saved via the DICOM Storage Service Class.

- **Object Manager**
  It allows the user to create, review and adjust segmentation objects based on the Universal Atlas. It provides functionality to combine, subtract or intersect existing objects and to store the result as a new segmentation object. Created segmentation objects will be saved via the DICOM Storage Service Class.

- **Fibertracking**
  It allows the user to create, review and modify fiber bundles as surface segmentation objects. Additionally it allows to create manual ROIs as segmentation storage objects. Created (surface) segmentation objects will be saved via the DICOM Storage Service Class.

- **Trajectory/Stereotaxy**
  Allows the user to add, modify and remove trajectories in multi-modal, co-registered images using supplemental information such as objects and fiber bundles as well as to identify the name and status of the loaded plan for being able to perform a sufficient and safe review of the overall trajectory planning result. Provides functionality for creating/editing of an AC/PC system as well as localization of stereotactic frames.

- **Lead Localization**
  Allows the user to create, detect, modify and remove trajectories in multi-modal, co-registered images received via the DICOM Storage Service Class.

- **Guide**
  Allows the user to create, modify and remove simulation parameters as DICOM Segmentation instances based on loaded image sets received via the DICOM Storage Service Class.

4.1.2.3 Performer

- **Auto Segmentation**
  Background service to create organ segmentations based on DICOM volumetric image sets received via the DICOM Storage Service Class.

- **Universal Atlas Performer**
  Background service that creates deformable spatial registrations between DICOM volumetric image sets and the Brainlab Universal Atlas. The service is triggered automatically upon the arrival of new data, but can also be requested explicitly from other applications.

- **Vessel Segmentation**
  Background service to create vessel segmentations based on DICOM volumetric image sets received via the DICOM Storage Service Class.

- **DTI Preprocessing Performer**

Background service that imports Diffusion Tensor Imaging (DTI) data and creates DTI specific meta maps, e.g. ADC, colored FA and FA map, the corresponding fusions and a Diffusion Tensor for further processing with Fibertracking.

4.1.3   Sequencing Of Real World Activities

4.1.3.1   Standard Interactive Use Case

In the standard use case normally the user selects a patient in the Patient Selection Application or some data to work with (1). Afterwards, the application is started (2) and requests the data (3). The DICOM Proxy retrieves from the configured remote nodes[1] the requested data (4) and passes it through to the requesting application (5).
If the application creates any data it optionally will be sent to a remote system (6).
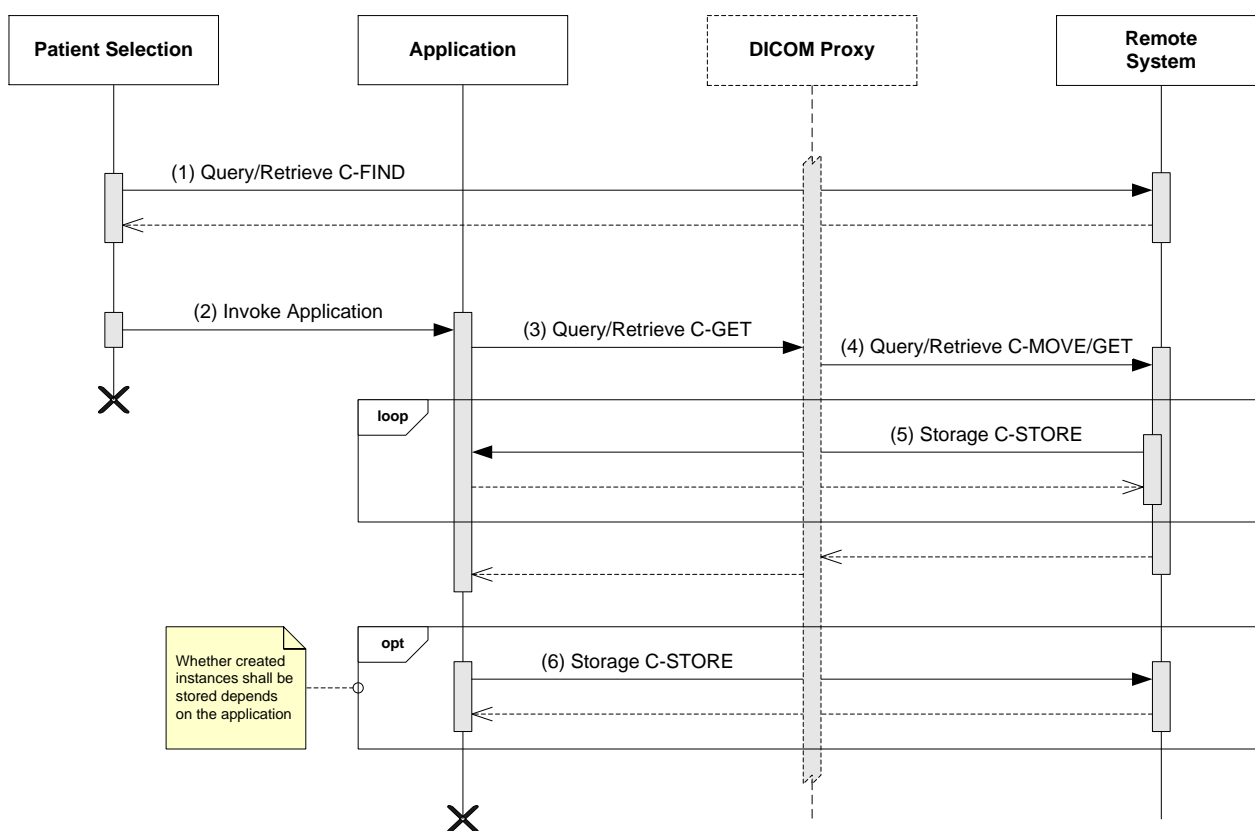
Figure 4-4: Simplified sequencing of the standard interactive use case.

The sequencing is not only possible between the Patient Selection and an Application but also between two or more different applications, i.e., it is possible to build a chain of applications, each performing a special task. This chain then is controlled by the Content Manager.

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[1]   The DICOM Proxy adjusts all queries to the addressed remote node, e.g., it automatically converts Query/Retrieve C-GET requests for nodes not supporting this command to C-MOVE requests.

4.1.3.2 Performer

In general a performer is invoked as soon as new data arrives at the DICOM Proxy (1). Via internal communication (not part of this Conformance Statement) the Performer is informed about the new data and - if it is able to process the data – requests it (3,4). The Performer processes the data (5) and, if the Performer creates new instances, it can send the created data to the DICOM Proxy, which may automatically forward it to a remote node (6).

Figure 4-5: Simplified sequencing of Performer activities.

4.2 Application Entity Specifications

4.2.1 Common Specifications

This section contains the specifications valid for all application entities in this Conformance Statement. In successive application entity sections only the differences or additional information will be described.

4.2.1.1 SOP Classes and Transfer Syntaxes

This section only defines the commonly used SOP Classes and Transfer Syntaxes. Whether they are supported as SCU or SCP will be described in the sub sections of the appropriate application entity.
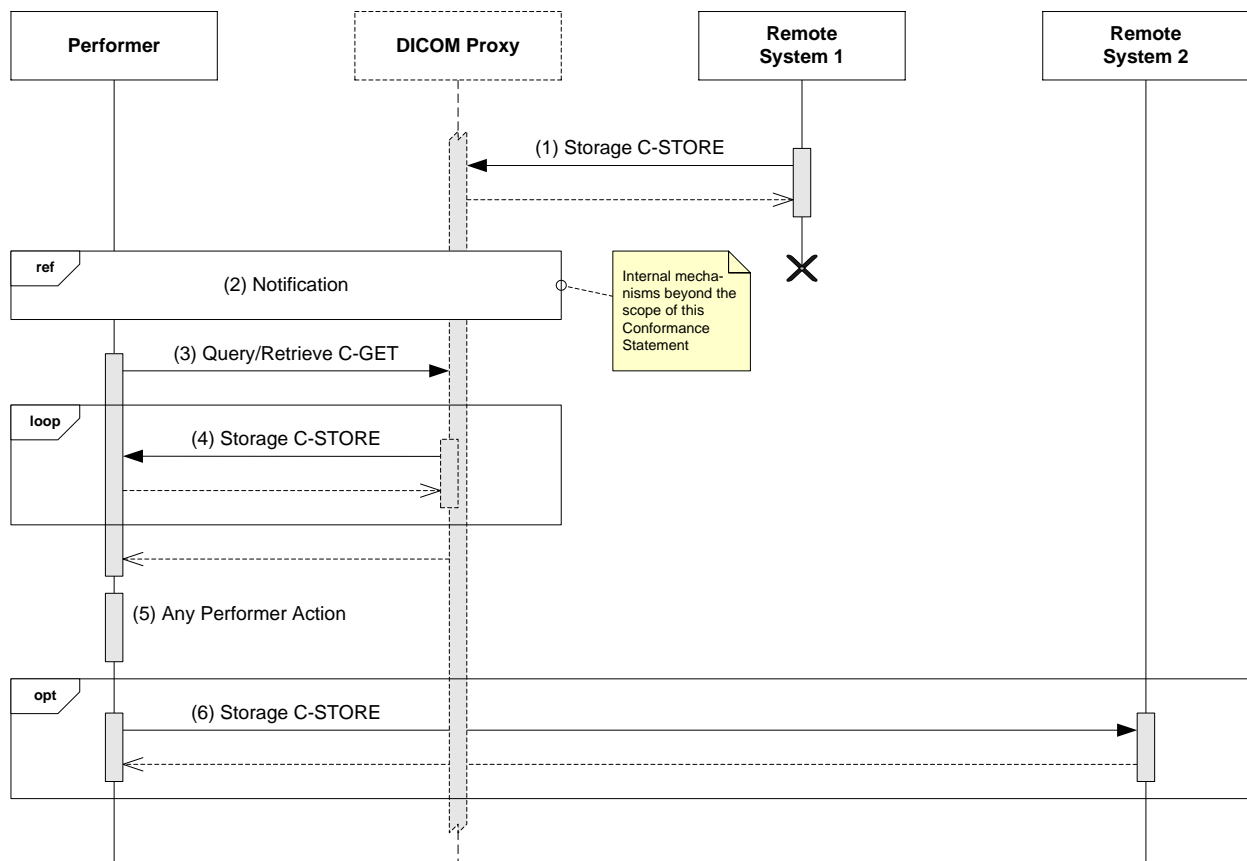
In the following table all transfer syntaxes supported by any of the applications are listed:

List Name / Transfer Syntax Name	List Short Name / Transfer Syntax UID
Transfer Syntax List With No Compression	**NOCOMP**
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2
DICOM Implicit VR Little Endian	1.2.840.10008.1.2
Transfer Syntax List With Lossless Compression	**COMP**
Include Transfer Syntax List NOCOMP	
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70
RLE Lossless	1.2.840.10008.1.2.5
Transfer Syntax List with RLE Compression	**RLE**
RLE Lossless	1.2.840.10008.1.2.5
Include Transfer Syntax List NOCOMP	
Transfer Syntax List With Lossy Compression	**LOSSY**
Include Transfer Syntax List NOCOMP	
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
Transfer Syntax List with MPEG2	**MPEG2**
Include Transfer Syntax List NOCOMP	
MPEG2 Main Profile @ Main Level	1.2.840.10008.1.2.4.100
Transfer Syntax List with MPEG4	**MPEG4**
Include Transfer Syntax List NOCOMP	
MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102

Table 4-1: Commonly supported Transfer Syntaxes (for association negotiation)

The transfer syntaxes are organized in so-called transfer syntax lists. For each presentation context specified by an application or performer, the name respectively short name of the transfer syntax list is mentioned instead of repeating all the transfer syntaxes.

Some applications and performers support the DICOM Storage Service Class. The following table contains the superset of supported Storage SOP Classes with the mapping to the accepted respectively proposed transfer syntax list.

SOP Class Name	SOP Class UID	Transfer Syntax List
Image Storage SOP Classes		
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	COMP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	COMP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	COMP
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	COMP
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	COMP
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	COMP
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	COMP
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	COMP
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	COMP
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	COMP
Enhanced MR Color Image Storage	1.2.840.10008.5.1.4.1.1.4.3	COMP
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	COMP
Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.130	COMP
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	COMP
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	COMP
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	COMP
Intravascular Optical Coherence Tomography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.14.1	COMP
Intravascular Optical Coherence Tomography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.14.2	COMP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	COMP
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	COMP
Multi-frame Grayscale Byte Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.2	COMP
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3	COMP
Multi-frame True Color Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.4	LOSSY
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	COMP
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	COMP
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	COMP
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	COMP
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	COMP
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	COMP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	COMP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	COMP
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	COMP
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	COMP
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	COMP
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	MPEG2
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	MPEG2
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	MPEG2/MPEG4

SOP Class Name	SOP Class UID	Transfer Syntax List
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	COMP
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	COMP
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	COMP
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	COMP
VL Whole Slide Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.6	COMP
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	COMP
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	COMP
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	COMP
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	COMP
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	COMP
Non-Image Storage SOP Classes		
Deformable Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.3	NOCOMP
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	NOCOMP
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	NOCOMP
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	NOCOMP
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	NOCOMP
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	RLE
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	NOCOMP
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	NOCOMP
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	NOCOMP

Table 4-2: Superset of supported Storage SOP Classes with Transfer Syntax mapping

Some applications and performers support the DICOM Query/Retrieve Service Class. The following table contains the superset of supported Query/Retrieve SOP Classes with the mapping to the accepted respectively proposed transfer syntax list.

SOP Class Name	SOP Class UID	Transfer Syntax List
FIND SOP Classes		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	NOCOMP
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	NOCOMP
GET SOP Classes		
Patient Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.1.3	NOCOMP
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	NOCOMP

Table 4-3: Superset of supported Query/Retrieve SOP Classes with Transfer Syntax mapping

The usage of these SOP Classes is specified in the sections with the detailed application specifications.

4.2.1.2   Association Policies

4.2.1.2.1   General

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

Application Context Name	1.2.840.10008.3.1.1.1

Table 4-4: Commonly proposed Application Context Name

4.2.1.2.2 Number of Associations

Maximum number of simultaneous Associations (Initiator)	10 (configurable)
Maximum number of simultaneous Associations (Acceptor)	10 (configurable)

Table 4-5: Commonly supported number of associations

4.2.1.2.3 Asynchronous Nature

Applications or performers by default do not support asynchronous communication (multiple out-standing transactions over a single association). However if it is supported it is mentioned in the section of the affected application entity.

4.2.1.2.4 Implementation Identifying Information

The implementation information for the application entities described in this document normally is hidden by the Brainlab DICOM Proxy (see [1] for its implementation identifying information). There-fore this information in the sections of the different application entities is purely informational.

4.2.1.3 Association Initiation Policy

Brainlab applications and performers initiate associations in these cases:

* *Find Studies, Series and Instances*
  Initiated by applications and performers to find related studies, series and instances

* *Get Studies, Series and Instances*
  Initiated by applications and performers to retrieve related studies, series and instances

If one of these activities is supported it is mentioned in the subsection of the appropriate application entity.

4.2.1.3.1 Activity – Find Studies, Series and Instances

4.2.1.3.1.1 Description and Sequencing of Activities

Brainlab applications or performers initiate an association with the intention to find studies, series or instances and to retrieve them, e.g., because they are related to or referenced by a loaded data set.

4.2.1.3.1.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	See Table 4-3 for the SOP Class / Transfer Syntax mapping	SCU	None
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1			

Table 4-6: Commonly proposed Presentation Contexts - Find Studies, Series and Instances.

4.2.1.3.1.3 SOP Specific Conformance

Brainlab applications and performers provide standard conformance to the Patient and Study Root Query/Retrieve Information Model – FIND SOP Classes. No extended negotiation is implemented.

A C-FIND can be executed on all levels. On a lower level, all key attributes of the higher levels are included in the query (i.e. no relational queries are performed).

Attribute Name	Tag	Types of Matching
Patient Level (Patient Root Q/R Information Model) / Study Level (Study Root Q/R Information Model)		
Patient's Name	(0010,0010)	S, *, U
Patient ID	(0010,0020)	S, *, U
Patient's Birth Date	(0010,0030)	U
Patient's Sex	(0010,0040)	U
Study Level		
Study Date	(0008,0020)	S, R, U
Accession Number	(0008,0050)	S, *, U
Referring Physician's Name	(0008,0090)	S, *, U
Study Instance UID	(0020,000D)	UNIQUE
Study Time	(0008,0030)	U
Study Description	(0008,1030)	U
Modalities in Study	(0008,0061)	U
SOP Classes in Study	(0008,0062)	U
Number of Study Related Series	(0020,1206)	U
Series Level		
Series Instance UID	(0020,000E)	UNIQUE
Series Number	(0020,0011)	U
Series Description	(0008,103E)	U
Series Date	(0008,0020)	U
Series Time	(0008,0021)	U
Modality	(0008,0060)	U
No. of Series Rel. Instances	(0020,1209)	U
Instance Level		
SOP Instance UID	(0008,0018)	UNIQUE
SOP Class UID	(0008,0016)	U
Instance Number	(0020,0013)	U
Instance Creation Date	(0008,0012)	U
Instance Creation Time	(0008,0013)	U
Arbitrary Search Keys as Requested by the Client	*	U

Table 4-7: Patient Root and Study Root Request Identifier for FIND-SCU

The types of Matching supported by the C-FIND SCU:

    "S"   Single value matching

    "R"   Range matching

"*"	Wildcard matching
"U"	Universal matching
"L"	UID list matching
"UNIQUE"	The unique key for the query level, (i.e. single value matching for levels below the current query level, either universal or single value matching for the current query level)

4.2.1.3.2   Activity – Get Studies, Series and Instances

4.2.1.3.2.1 Description and Sequencing of Activities

If the find operation doesn't provide icons for queried instances the Patient Selection automatically retrieves the instances and creates previews.

4.2.1.3.2.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1. 3	See Table 4-3 for the SOP Class / Transfer Syntax mapping	SCU	None
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2. 3			
All **SCP** Storage SOP Classes and SOP Class UIDs as defined in the respective application or performer specification		See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCP	None

Table 4-8: Patient Selection proposed Presentation Contexts – Find Patient

4.2.1.3.2.3 SOP Specific Conformance

The Patient Selection provides standard conformance to the DICOM Patient and Study Root Query/Retrieve - GET SOP Class and to the DICOM Storage SOP Classes. No extended negotiation is implemented.

4.2.1.4   Association Acceptance Policy

Brainlab applications and performers do not directly accept associations. All external communication is handled by the DICOM Proxy (see [1] for details).
Nevertheless in the sub sections of the different application entities the association acceptance will be described to define the SOP Classes they support.

4.2.1.4.1   Transfer Syntax Selection Policy

Brainlab applications and performers in general accept transfer syntaxes in with no compression (explicit before implicit) before those with lossless compression and at least those with lossy compression. At least the order of the transfer syntaxes in the assigned transfer syntax list is the order of acceptance.

4.2.2 Content Manager Specification

The Content Manager manages applications on Brainlab systems. It allows a user to create and read screenshots.

4.2.2.1 SOP Classes and Transfer Syntaxes

The Content Manager provides standard conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No

Table 4-9: SOP Classes supported by the Content Manager

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	1.2.276.0.20.1.1.32.<version>
Implementation Version Name	ContentManager

Current possible versions are: <version> = 1.0 | 2.0

4.2.2.3 Association Initiation Policy

The Content Manager initiates an association in this case:

- *Save Instances:*
  Initiated to store created screenshots as secondary capture images.

4.2.2.3.1 Activity – Save Instances

4.2.2.3.1.1 Description and Sequencing of Activities

The user creates a screenshot. This screenshot is saved to the DICOM Proxy as Multi-frame True Color SC Image.

4.2.2.3.1.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		Transfer Syntax	Role	Ext. Neg
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-10: Content Manager proposed Presentation Contexts – Save Instances

4.2.2.3.1.3 SOP Specific Conformance

The Content Manager provides standard conformance to the DICOM Storage SOP Classes.

4.2.3 Patient Selection Specification

The Patient Selection allows the user to browse, import or export data in/to DICOM archives or on/to media (e.g., CD-ROM).

4.2.3.1 SOP Classes and Transfer Syntaxes

The Patient Selection provides standard conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Storage			
All Image Storage SOP Classes and associated SOP Class UIDs as listed in Table 4-2		No	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Query/Retrieve			
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	Yes	No
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-11: SOP Classes supported by the Patient Selection

4.2.3.2 Association Policies

4.2.3.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.33.<version>
Implementation Version Name	PatientSelection

Current possible versions are: <version> = 4.0

4.2.3.3 Association Initiation Policy

The Patient Selection initiates an association in these cases:

- *Find Patient*
  The user searches for a patient and related data.

- *Display Preview*
  During the search, for all queried instances, previews will be generated. If the find operation doesn't provide an appropriate preview icon, the instances will be retrieved and a preview will be created.

- *Store Series Information:*
  Key Object Selection instances are created to persist either plan information for a group of series or internal information about one series.

4.2.3.3.1 Activity – Find Patient

See Common Specifications, section 4.2.1.3.1 (Activity – Find Studies, Series and Instances).

4.2.3.3.2 Activity – Display Preview

See Common Specifications, section 4.2.1.3.2 (Activity – Get Studies, Series and Instances), using Patient and Study Root Query/Retrieve Information Model – GET and restricted to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-11.

4.2.3.3.3 Activity – Store Series Information

4.2.3.3.3.1 Description and Sequencing of Activities

For each series in a patient selected for further treatment the Patient Selection creates a Key Object Selection instance containing internal information. This KOS instance then is stored in the DICOM Proxy to be available for other applications and performers.

4.2.3.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-12: Patient Selection proposed Presentation Contexts – Store Series Information

4.2.3.3.3.3 SOP Specific Conformance

The Patient Selection provides standard conformance to the DICOM Storage SOP Classes

4.2.4   Image Viewer Specification

The Image Viewer Allows the user to display any kind of DICOM image data.

4.2.4.1   SOP Classes and Transfer Syntaxes

The Image Viewer accepts the following SOP Classes for viewing:

SOP Class Name	SOP Class UID	SCU	SCP
Storage			
All Image Storage SOP Classes and associated SOP Class UIDs as listed in Table 4-2		No	Yes
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	No	Yes[3]
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Multi-frame True Color Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes[4]	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-13: Image Viewer supported SOP Classes

4.2.4.2   Association Policies

4.2.4.2.1   Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.31.<version>
Implementation Version Name	ImageViewer

Current possible versions are: <version> = 2.0, 2.1, 2.2, 3.0, 3.1, 3.2

4.2.4.3   Association Initiation Policy

The Image Viewer initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user created a new instance.

---

[3] Not for Image Viewer 3.0

4.2.4.3.1   Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.4.3.2   Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-13.

4.2.4.3.3   Activity – Save Instances

4.2.4.3.3.1 Description and Sequencing of Activities

The user created a new instance:
* A new VOI LUT for a series. Will be stored as Grayscale Presentation State.
* A new Spatial Registration.
* A kind of nD-Presentation State to re-display a series in 3D. Will be stored as Raw Data.
* A new trajectory. Will be stored as Surface Segmentation[4].

4.2.4.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-13	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-14: Image Viewer proposed Presentation Contexts – Store Instances

4.2.4.3.3.3 SOP Specific Conformance

The Image Viewer provides standard conformance to the DICOM Storage SOP Classes.

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[4] Image Viewer 2.x only

4.2.5 Fusion Application Specification

The Fusion Application allows the user to overlap two different DICOM data sets.

4.2.5.1 SOP Classes and Transfer Syntaxes

The Fusion Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	Yes	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-15: Fusion Application supported SOP Classes

4.2.5.2 Association Policies

4.2.5.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.44.<version>
Implementation Version Name	ImageFusion

Current possible versions are: <version> = 3.0

4.2.5.3 Association Initiation Policy

The Fusion Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user/application created a new instance

4.2.5.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.5.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-15.

4.2.5.3.3 Activity – Save Instances

4.2.5.3.3.1 Description and Sequencing of Activities

The user created a new instance:
- A new spatial registration
- A new Image Set. Will be stored as Key Object Selection Document.
- New artificial CT images
- New artificial MR images
- New artificial SC images
- A new linear Windowing for an imageset. Will be stored as Grayscale Presentation State.
- New objects in an image set. Will be stored as Segmentation.
- New segmentation objects. Will be saved as DICOM Segmentation Storage.

4.2.5.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-15	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-16: Fusion Application proposed Presentation Contexts – Save Instances

4.2.5.3.3.3 SOP Specific Conformance

The Fusion Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.6 SmartBrush Application Specification

The SmartBrush Application allows the user to create, read and update segmentations based on DICOM image data.

4.2.6.1 SOP Classes and Transfer Syntaxes

The SmartBrush Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Other			
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-17: SmartBrush Application supported SOP Classes

4.2.6.2 Association Policies

4.2.6.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.35.<version>
Implementation Version Name	Smartbrush

Current possible versions are: <version> = 2.0, 2.1, 2.5, 2.6

4.2.6.3 Association Initiation Policy

The SmartBrush Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Segmentation:*
  The user created a new or updated an existing segmentation and/or creates a volumetric report.

4.2.6.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.6.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-17.

4.2.6.3.3 Activity – Save Segmentation

4.2.6.3.3.1 Description and Sequencing of Activities

New instances will be created if the user
- draws new or updates existing objects in an image set. Will be stored as Segmentation.
- creates a volumetric report. Will be stored as Encapsulated PDF.

4.2.6.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1			

Table 4-18: SmartBrush Application proposed Presentation Contexts – Save Segmentation

4.2.6.3.3.3 SOP Specific Conformance

The SmartBrush Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.7 Trajectory/Stereotaxy Application Specification

Allows the user to add, modify and remove trajectories (being represented as surface segmentation objects) in multi-modal, co-registered images using supplemental information such as objects and fiber bundles as well as to identify the name and status of the loaded plan for being able to perform a sufficient and safe review of the overall trajectory planning result. Provides functionality for creating/editing of an AC/PC system as well as localization of stereotactic frames.

4.2.7.1 SOP Classes and Transfer Syntaxes

The Trajectory/Stereotaxy Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Other			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-19: Trajectory/Stereotaxy Application supported SOP Classes

4.2.7.2 Association Policies

4.2.7.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.73.<version>
Implementation Version Name	Trajectory

Current possible versions are: <version> = 1.0.1, 2.0

4.2.7.3   Association Initiation Policy

The Trajectory/Stereotaxy Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user/application created a new instance

4.2.7.3.1   Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.7.3.2   Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-17.

4.2.7.3.3   Activity – Save Instances

4.2.7.3.3.1 Description and Sequencing of Activities

The user created a new instance:
- A new linear Windowing for an image set. Will be stored as Grayscale Presentation State.
- New segmentation objects. Will be saved as Surface Segmentation Storage.
- New custom orientation. Will be saved as Spatial Registration Storage.
- New localization information. Will be saved as Raw Data Storage.

4.2.7.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-19: Trajectory/Stereotaxy Application supported SOP Classes	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-20: Trajectory/Stereotaxy Application proposed Presentation Contexts – Save Instances

4.2.7.3.3.3 SOP Specific Conformance

The Trajectory/Stereotaxy Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.8 Cranial/ENT Application Specification

The Cranial/ENT Application allows the user to perform an image guided cranial surgery.

4.2.8.1 SOP Classes and Transfer Syntaxes

The Cranial/ENT Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-21: Cranial/ENT Application supported SOP Classes

4.2.8.2 Association Policies

4.2.8.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.<appno>.<version>
Implementation Version Name	CranialENT

This Application Entity provides different implementation information based on the type of work

- For cranial surgery: <appNo> = 23
- For head registration   <appNo> = 25

Current possible versions are: <version> = 3.0, 3.1

4.2.8.3   Association Initiation Policy

The Cranial/ENT Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user created new or updated existing instances.

4.2.8.3.1   Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.8.3.2   Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-21.

4.2.8.3.3   Activity – Save Instances

4.2.8.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- plans registration markers. Will be stored as Spatial Fiducials.
- performs an IGS registration. Will be stored as Spatial Registration.
- draws objects with surgery tools. Will be stored as Segmentation.
- creates a new trajectory. Will be stored as Surface Segmentation.
- creates points. Will be stored as Surface Segmentation.

4.2.8.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1			
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5			

Table 4-22: Cranial/ENT Application proposed Presentation Contexts – Save Segmentation

4.2.8.3.3.3 SOP Specific Conformance

The Cranial/ENT Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.9 Cranial Registration Application Specification

Allows the user to register the patient with surface matching or paired point registration using optical tracking methods.

4.2.9.1 SOP Classes and Transfer Syntaxes

The Cranial Registration Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-23: Cranial Registration Application supported SOP Classes

4.2.9.2 Association Policies

4.2.9.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.96.<version>
Implementation Version Name	Cranial Registration

Current possible versions are: <version> = 3.0, 3.5

4.2.9.3 Association Initiation Policy

The Cranial Registration Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user created new or updated existing instances.

4.2.9.3.1   Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.9.3.2   Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-21.

4.2.9.3.3   Activity – Save Instances

4.2.9.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- plans registration markers. Will be stored as Spatial Fiducials.
- performs an IGS registration. Will be stored as Spatial Registration.
- Plans rescue registration markers. Will be stored as Spatial Fiducials

4.2.9.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5			

Table 4-24: Cranial Registration Application proposed Presentation Contexts – Save Segmentation

4.2.9.3.3.3 SOP Specific Conformance

The Cranial Registration Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.10 Cranial Navigation Application Specification

Allows the user to perform an image guided cranial surgery using optical tracking methods.

4.2.10.1 SOP Classes and Transfer Syntaxes

The Cranial Navigation Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	No	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-25: Cranial Navigation Application supported SOP Classes

4.2.10.2 Association Policies

4.2.10.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.97.<version>
Implementation Version Name	Cranial Navigation

Current possible versions are: <version> = 3.0, 3.5

4.2.10.3 Association Initiation Policy

The Cranial Registration Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user created new or updated existing instances.

4.2.10.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.10.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-21.

4.2.10.3.3 Activity – Save Instances

4.2.10.3.3.1   Description and Sequencing of Activities

New instances will be created if the user

- Changes the windowing of an image set. Will be stored as Grayscale Softcopy Presentation State.

4.2.10.3.3.2   Proposed Presentation Contexts

N/A

4.2.10.3.3.3   SOP Specific Conformance

The Cranial Registration Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.11 Microscope Application Specification

The Microscope application allows the user to perform an image guided cranial surgery with the use of a surgical microscope.

4.2.11.1 SOP Classes and Transfer Syntaxes

The Microscope application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-26: Microscope Application supported SOP Classes

4.2.11.2 Association Policies

4.2.11.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.85.<version>
Implementation Version Name	Microscope

Current possible versions are: <version> = 1.0, 1.5

4.2.11.3 Association Initiation Policy

The Microscope Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user created new or updated existing instances.

4.2.11.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.11.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-21.

4.2.11.3.3 Activity – Save Instances

4.2.11.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- updates an IGS registration. Will be stored as Spatial Registration.
- Changes the windowing of an image set. Will be stored as Grayscale Softcopy Presentation State.

4.2.11.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-27: Microscope Application proposed Presentation Contexts – Save Segmentation

4.2.11.3.3.3 SOP Specific Conformance

The Microscope application provides standard conformance to the DICOM Storage SOP Classes.

4.2.12 Cranial EM / ENT EM Application Specification

The Cranial EM / ENT EM Application allows the user to perform an image guided Cranial/ENT surgery.

4.2.12.1 SOP Classes and Transfer Syntaxes

The Cranial EM / ENT EM Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
Volumetric Other			
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-28: Cranial EM / ENT EM Application supported SOP Classes

4.2.12.2 Association Policies

4.2.12.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.<appNo>.<version>
Implementation Version Name	<name>

This Application Entity provides different implementation information based on the type of work.
- For navigation: <appNo> = 52 <name> = Navigation
- For head registration: <appNo> = 53 <name> = HeadRegistration

Current possible versions are: <version> = 1.0.0, 1.0.1, 1.1.0, 2.0.0, 2.0.1, 2.1.0

4.2.12.3 Association Initiation Policy

The Cranial EM / ENT EM Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user created new or updated existing instances.

4.2.12.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.12.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-28: Cranial EM / ENT EM Application supported SOP Classes.

4.2.12.3.3 Activity – Save Instances

4.2.12.3.3.1   Description and Sequencing of Activities

New instances will be created if the user

- plans registration markers. Will be stored as Spatial Fiducials.
- performs an IGS registration. Will be stored as Spatial Registration.
- creates a new trajectory. Will be stored as Surface Segmentation.
- changes the windowing of an image set. Will be stored as Grayscale Softcopy Presentation State.

4.2.12.3.3.2   Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All SCU Storage SOP Classes and SOP Class UIDs as listed in Table 4-28:	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-29: Cranial EM / ENT EM Application proposed Presentation Contexts

4.2.12.3.3.3   SOP Specific Conformance

The Cranial EM / ENT EM Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.13 Spine and Trauma 2D/ Fluoro Express Application Specification

The Spine and Trauma 2D and Fluoro Express Application allows the user to perform an image guided spine surgery with 2D image data.

4.2.13.1 SOP Classes and Transfer Syntaxes

The Spine and Trauma 2D and Fluoro Express Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Storage			
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Multi-frame Grayscale Byte SC Image*	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word SC Image*	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-30: Spine and Trauma 2D and Fluoro Express Application supported SOP Classes

(*) - only for version 3.2.0

4.2.13.2 Association Policies

4.2.13.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.17.<version>
Implementation Version Name	<name>

This Application Entity provides different implementation information based on the variant of the system:
- For Spine & Trauma 2D (main variant):   <name> = SpineTrauma2D
- For Fluoro Express: <name> = FluoroExpress

Current possible versions are: <version> = 3.1, 3.2

4.2.13.3 Association Initiation Policy

The Spine and Trauma 2D and Fluoro Express Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Image Instances:*
  The user acquired fluoroscopic images.

4.2.13.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.13.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-30.

4.2.13.3.3 Activity – Save image instances

4.2.13.3.3.1 Description and Sequencing of Activities

New image instances will be created if the user acquired and registered fluoroscopic images. These will be stored as Multi-frame Grayscale Byte SC Image or Multi-frame Grayscale Word SC Image.

4.2.13.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Multi-frame Grayscale Byte Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.2	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3		SCU	None

Table 4-31: Spine and Trauma 2D and Fluoro Express proposed Presentation Contexts – Save Image Instances

4.2.13.3.3.3 SOP Specific Conformance

The Spine and Trauma 2D and Fluoro Express Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.14 Spine and Trauma 3D Application Specification

The Spine and Trauma 3D Application allows the user to perform an image guided spine surgery with 2D and 3D image data.

4.2.14.1 SOP Classes and Transfer Syntaxes

The Spine and Trauma 3D Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	No	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	No	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-32: Spine and Trauma 3D Application supported SOP Classes

4.2.14.2 Association Policies

4.2.14.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.15.<version>
Implementation Version Name	Spine

Current possible versions are: <version> = 6.1.0, 2.5.0, 2.6.0

4.2.14.3 Association Initiation Policy

The Spine and Trauma 3D Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

BRAINLAB

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

4.2.14.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.14.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-32.

4.2.14.3.3 Activity – Save Instances

4.2.14.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- performs an IGS registration. Will be stored as Spatial Registration.
- creates a new trajectory. Will be stored as Surface Segmentation.
- creates a new linear Windowing for an image set. Will be stored as Grayscale Presentation State.
- creates new image instances, if the user acquired and registered fluoroscopic images. Will be stored as Multi-frame Grayscale Byte SC Image or Multi-frame Grayscale Word SC Image.
- creates a kind of nD-Presentation State to re-display a series in 3D (e.g. cropping, bonethreshold). Will be stored as Raw Data.

4.2.14.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1		SCU	None
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5		SCU	None
Multi-frame Grayscale Byte Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.2		SCU	None
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3		SCU	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66		SCU	None

Table 4-33: Spine and Trauma 3D Application proposed Presentation Contexts – Store Instances

4.2.15 Spine & Trauma 3D Navigation

The Spine & Trauma 3D Navigation allows the user to perform an image guided spine surgery with 3D image data.

4.2.15.1 SOP Classes and Transfer Syntaxes

The Spine & Trauma 3D Navigation accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	No	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	No	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	No	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-34: Spine & Trauma 3D Navigation supported SOP Classes

4.2.15.2 Association Policies

4.2.15.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.82.<version>
Implementation Version Name	Spine & Trauma 3D Navigation

Current possible versions are: <version> = 1.0.0

4.2.15.3 Association Initiation Policy

The Spine and Trauma 3D Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

4.2.15.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.15.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-32.

4.2.15.3.3 Activity – Save Instances

4.2.15.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- performs an IGS registration. Will be stored as Spatial Registration.
- creates a new linear Windowing for an imageset. Will be stored as Grayscale Presentation State.

4.2.15.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-31	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-35: Spine & Trauma 3D Navigation proposed Presentation Contexts – Store Instances

4.2.16 Registration Software Fluoro 3D

The Registration Software Fluoro 3D allows the user to create an IGS registration on XT/CT images.

4.2.16.1 SOP Classes and Transfer Syntaxes

The Registration Software Fluoro 3D accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	No	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-36: Registration Software Fluoro 3D supported SOP Classes

4.2.16.2 Association Policies

4.2.16.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.93.<version>
Implementation Version Name	Registration Software Fluoro 3D

Current possible versions are: <version> = 1.0 0

4.2.16.3 Association Initiation Policy

The Registration Software Fluoro 3D initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save IGS Registration:*
  The user created a new IGS registration.

4.2.16.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.16.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-38.

4.2.16.3.3 Activity – Save IGS Registration

4.2.16.3.3.1 Description and Sequencing of Activities

The user created a new instance:
- A new spatial registration
- A new linear Windowing for an imageset. Will be stored as Grayscale Presentation State.

4.2.16.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-36	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-37: Registration Software Fluoro 3D proposed Presentation Contexts – Save IGS Registration

4.2.16.3.3.3 SOP Specific Conformance

The Registration Software Fluoro 3D provides standard conformance to the DICOM Storage SOP Classes.

4.2.17 Automatic Image Registration (AIR) Application Specification

The Automatic Image Registration (AIR) Application allows the user to create an IGS registration on CT images.

4.2.17.1 SOP Classes and Transfer Syntaxes

The AIR Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-38: AIR Application supported SOP Classes

4.2.17.2 Association Policies

4.2.17.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.40.<version>
Implementation Version Name	AIR

Current possible versions are: <version> = 1.0, 1.1, 1.2, 1.3, 2.0

4.2.17.3 Association Initiation Policy

The AIR Application initiates an association in these cases:

- *Find Studies, Series and Instances*
   Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
   Initiated to retrieve related studies, series and instances

- *Save IGS Registration and CT:*
   The user created a new IGS registration and new artificial CT images.

4.2.17.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.17.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-38.

4.2.17.3.3 Activity – Save IGS Registration and CT

4.2.17.3.3.1 Description and Sequencing of Activities

The user created a new instance:
- A new spatial registration
- A new Image Set. Will be stored as Key Object Selection Document.
- New artificial CT images
- A new linear Windowing for an image set. Will be stored as Grayscale Presentation State.

4.2.17.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-38	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-39: AIR Application proposed Presentation Contexts – Save IGS Registration and CT

4.2.17.3.3.3 SOP Specific Conformance

The AIR Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.18 Knee/Hip Application Specification

The Knee/Hip image-less application allows navigated surgery based on interactively acquired geometric models of bone structures.

4.2.18.1 SOP Classes and Transfer Syntaxes

The Knee/Hip Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	No

Table 4-40: Knee/Hip Application supported SOP Classes

4.2.18.2 Association Policies

4.2.18.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.38.<version>
Implementation Version Name	Knee

Current possible versions are: <version> = 3.0

4.2.18.3 Association Initiation Policy

The Knee/Hip Application initiates an association in these cases:

- *Save Report:*
  The user wants to generate a surgery report.

4.2.18.3.1 Activity – Save Report

4.2.18.3.1.1 Description and Sequencing of Activities

The user generated a surgery report.

4.2.18.3.1.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		Transfer Syntax	Role	Ext. Neg
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-41: AIR Application proposed Presentation Contexts – Save Report

4.2.18.3.1.3 SOP Specific Conformance

The Knee/Hip Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.19 Angio Planning Application Specification

Allows the user to register 3D CT/MR image data with segmented vessels to a 2D X-Ray Angio image data and then to detect anomalies in the 3D volume.

4.2.19.1 SOP Classes and Transfer Syntaxes

The Angio Planning Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Other			
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-42: Angio Planning Application supported SOP Classes

4.2.19.2 Association Policies

4.2.19.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.45.<version>
Implementation Version Name	AngioPlanning

Current possible versions are: <version> = 1.0

4.2.19.3 Association Initiation Policy

The Angio Planning Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Results:*
  The user created new projective registrations to map CT/MR images to X-Ray Angio images, segmentations for detected anomalies and/or image series displaying color encoded blood flows derived from the X-Ray Angio image.

4.2.19.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.19.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-42.

4.2.19.3.3 Activity – Save Results

4.2.19.3.3.1 Description and Sequencing of Activities

The user created new projective registrations to map CT/MR images to X-Ray Angio images, segmentations for detected anomalies and/or image series displaying color encoded blood flows derived from the X-Ray Angio image.

4.2.19.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1			
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4			

Table 4-43: Angio Planning Application proposed Presentation Contexts – Save Results

4.2.19.3.3.3 SOP Specific Conformance

The Angio Planning Application provides standard conformance to the DICOM Storage SOP Classes. The Raw Data Storage SOP Class is extended with the Projective Registration Module (see Table 8-41).

4.2.20 Object Manager Application Specification

Allows the user to create, review and adjust segmentation objects based on the Universal Atlas. Provides functionality to combine, subtract or intersect existing objects and to store the result as a new segmentation object.

4.2.20.1 SOP Classes and Transfer Syntaxes

The Object Manager Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	No	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-44: Object Manager Application supported SOP Classes

4.2.20.2 Association Policies

4.2.20.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.72.<version>
Implementation Version Name	ObjectManagement

Current possible versions are: <version> = 1.0

4.2.20.3 Association Initiation Policy

The Object Manager Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Results:*
  The application created new or updated existing instances.

4.2.20.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.20.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in

4.2.20.3.3 Activity – Save Results

4.2.20.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- Creates new or modifies existing segmentation objects. Will be saved as DICOM Segmentation Storage.
- Modifies the windowing of an imageset. Will be stored as Grayscale Softcopy Presentation State.

4.2.20.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1			

Table 4-45: Object Manager Application proposed Presentation Contexts – Save Results

4.2.20.3.3.3 SOP Specific Conformance

The Object Manager Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.21 Fibertracking Application Specification

It allows the user to create, review and modify fiber bundles as surface segmentation objects. Additionally it allows to create manual ROIs as segmentation storage objects. Created (surface) segmentation objects will be saved via the DICOM Storage Service Class.

4.2.21.1 SOP Classes and Transfer Syntaxes

The Fibertracking Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	No	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-46: Fibertracking Application supported SOP Classes

4.2.21.2 Association Policies

4.2.21.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.60.<version>
Implementation Version Name	Fibertracking

Current possible versions are: <version> = 1.0

4.2.21.3 Association Initiation Policy

The Fibertracking Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Results:*
  The application created new or updated existing instances.

4.2.21.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.21.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in

4.2.21.3.3 Activity – Save Results

4.2.21.3.3.1 Description and Sequencing of Activities

New instances will be created if the user

- Creates new or modifies existing segmentation objects. Will be saved as DICOM Segmentation Storage.
- Modifies the windowing of an imageset. Will be stored as Grayscale Softcopy Presentation State.

4.2.21.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		Transfer Syntax	Role	Ext. Neg
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5			
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66			

Table 4-47: Fibertracking Application proposed Presentation Contexts – Save Results

4.2.21.3.3.3 SOP Specific Conformance

The Fibertracking Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.22 DTI Preprocessing Performer Application Specification

Background service that imports Diffusion Tensor Imaging (DTI) data and creates DTI specific meta maps, e.g. ADC, colored FA and FA map, the corresponding fusions and a Diffusion Tensor for further processing with Fibertracking.

4.2.22.1 SOP Classes and Transfer Syntaxes

The DTI Preprocessing Performer accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Volumetric Other			
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	No
Other			
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-48: DTI Preprocessing Performer supported SOP Classes

4.2.22.2 Association Policies

4.2.22.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.62.<version>
Implementation Version Name	DTIPreprocessingPerformer

Current possible versions are: <version> = 1.0

4.2.22.3 Association Initiation Policy

The DTI Preprocessing Performer Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Results:*
  The application created new instances.

4.2.22.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.22.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in

4.2.22.3.3 Activity – Save Results

4.2.22.3.3.1 Description and Sequencing of Activities

The performer creates new DICOM images and the corresponding spatial registrations. Additional information is stored as RAW Data Storage and Key Object Selection objects.

4.2.22.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1			
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4			
Multi-frame Grayscale Word Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.3			
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59			

Table 4-49: DTI Preprocessing Performer proposed Presentation Contexts – Save Results

4.2.22.3.3.3 SOP Specific Conformance

The DTI Preprocessing Performer provides standard conformance to the DICOM Storage SOP Classes.

4.2.23 Auto Segmentation Performer Specification

The Auto Segmentation Performer provides automatic organ segmentation in the background.

4.2.23.1 SOP Classes and Transfer Syntaxes

The Auto Segmentation Performer accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-50: Auto Segmentation Performer supported SOP Classes

4.2.23.2 Association Policies

4.2.23.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.27.<version>
Implementation Version Name	AutoSegmentation

Current possible versions are: <version> = 1.0 | 2.0

4.2.23.3 Association Initiation Policy

The Auto Segmentation Performer initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Segmentation:*
  The performer created a new segmentation.

4.2.23.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.23.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-50.

4.2.23.3.3 Activity – Save Segmentation

4.2.23.3.3.1 Description and Sequencing of Activities

The performer creates new objects for an image set. Will be stored as Segmentation.

4.2.23.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-51: Auto Segmentation Performer proposed Presentation Contexts – Save Segmentation

4.2.23.3.3.3 SOP Specific Conformance

The Auto Segmentation Performer provides standard conformance to the DICOM Storage SOP Classes.

4.2.24 Universal Atlas Performer Specification

The Universal Atlas Performer provides deformable spatial registrations between datasets and the Brainlab Universal Atlas.

4.2.24.1 SOP Classes and Transfer Syntaxes

The Universal Atlas Performer accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Volumetric Other			
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	Yes	No
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-52: Universal Atlas Performer supported SOP Classes

4.2.24.2 Association Policies

4.2.24.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.47.<version>
Implementation Version Name	UniversalAtlasPerformer

Current possible versions are: <version> = 1.1 / 2.0

4.2.24.3 Association Initiation Policy

The Universal Atlas Performer initiates an association in the following cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Registration:*
  The performer created a new deformable spatial registration.

4.2.24.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.24.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-54.

4.2.24.3.3 Activity – Save Registration

4.2.24.3.3.1   Description and Sequencing of Activities

The performer creates a new spatial deformable registration for an image set.

4.2.24.3.3.2   Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Deformable Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.3	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-53: Universal Atlas Performer proposed Presentation Contexts – Save Def. Spatial Registration

4.2.24.3.3.3   SOP Specific Conformance

The Universal Atlas Performer provides standard conformance to the DICOM Storage SOP Classes.

4.2.25 Vessel Segmentation Performer Specification

The Vessel Segmentation Performer provides automatic vessel segmentation in the background.

4.2.25.1 SOP Classes and Transfer Syntaxes

The Auto Segmentation Performer accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-54: Vessel Segmentation Performer supported SOP Classes

4.2.25.2 Association Policies

4.2.25.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.27.<version>
Implementation Version Name	VesselSegmentation

Current possible versions are: <version> = 1.0

4.2.25.3 Association Initiation Policy

The Vessel Segmentation Performer initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Segmentation:*
  The performer created a new segmentation.

4.2.25.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.25.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-54.

4.2.25.3.3 Activity – Save Segmentation

4.2.25.3.3.1 Description and Sequencing of Activities

The performer creates new objects for an image set. Will be stored as Segmentation.

4.2.25.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Ext. Neg**
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-55: Vessel Segmentation Performer proposed Presentation Contexts – Save Segmentation

4.2.25.3.3.3 SOP Specific Conformance

The Vessel Segmentation Performer provides standard conformance to the DICOM Storage SOP Classes.

4.2.26 Lead Localization Application Specification

Allows the user to create, detect, modify and remove trajectories in multi-modal, co-registered images received via the DICOM Storage Service Class.

4.2.26.1 SOP Classes and Transfer Syntaxes

The Lead Localization Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Other			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-56: Lead Localization Application supported SOP Classes

4.2.26.2 Association Policies

4.2.26.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.84.<version>
Implementation Version Name	LeadLocalization

Current possible versions are: <version> = 1.0.0

4.2.26.3 Association Initiation Policy

The Lead Localization Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user/application created new or updated existing instances

4.2.26.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.26.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-17.

4.2.26.3.3 Activity – Save Instances

4.2.26.3.3.1 Description and Sequencing of Activities

New instances will be created if the user:
- Modifies the linear Windowing for an imageset. Will be stored as Grayscale Presentation State.
- Creates new segmentation objects. Will be saved as Surface Segmentation Storage.

4.2.26.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-56: Lead Localization Application supported SOP Classes	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-57: Lead Localization Application proposed Presentation Contexts – Save Instances

4.2.26.3.3.3 SOP Specific Conformance

The Lead Localization Application provides standard conformance to the DICOM Storage SOP Classes.

4.2.27 Guide Application Specification

Allows the user to create, modify and remove simulation parameters as DICOM Segmentation instances based on loaded image sets received via the DICOM Storage Service Class.

4.2.27.1 SOP Classes and Transfer Syntaxes

The Guide Application accepts the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Volumetric Images			
CT Image	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Image	1.2.840.10008.5.1.4.1.1.4	No	Yes
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
NM Image	1.2.840.10008.5.1.4.1.1.20	No	Yes
NM Image Retired	1.2.840.10008.5.1.4.1.1.5	No	Yes
PET Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
Volumetric Other			
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Other			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	No	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	No

Table 4-58: Guide Application supported SOP Classes

4.2.27.2 Association Policies

4.2.27.2.1 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.20.1.1.77.<version>
Implementation Version Name	Guide

Current possible versions are: <version> = 2.0.0

4.2.27.3 Association Initiation Policy

The Lead Localization Application initiates an association in these cases:

- *Find Studies, Series and Instances*
  Initiated to find related studies, series and instances

- *Get Studies, Series and Instances*
  Initiated to retrieve related studies, series and instances

- *Save Instances:*
  The user/application created new or updated existing instances

4.2.27.3.1 Activity – Find Studies, Series and Instances

See Common Specifications, section 4.2.1.3.1.

4.2.27.3.2 Activity – Get Studies, Series and Instances

See Common Specifications, section 4.2.1.3.2, restricted to Study Root Query/Retrieve Information Model – GET and to all SCP Storage SOP Classes and SOP Class UIDs as listed in Table 4-17.

4.2.27.3.3 Activity – Save Instances

4.2.27.3.3.1 Description and Sequencing of Activities

New instances will be created if the user:
- modifies the linear Windowing for an imageset. Will be stored as Grayscale Presentation State.
- exports simulation parameters as object in an image set. Will be stored as Segmentation.

4.2.27.3.3.2 Proposed Presentation Contexts

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext. Neg**
All **SCU** Storage SOP Classes and SOP Class UIDs as listed in Table 4-58: Guide Application supported SOP Classes	See Table 4-2 for the SOP Class / Transfer Syntax mapping	SCU	None

Table 4-59: Guide Application proposed Presentation Contexts – Save Instances

4.2.27.3.3.3 SOP Specific Conformance

The Guide Application provides standard conformance to the DICOM Storage SOP Classes.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The applications and performers support the DICOM upper layer using TCP/IP and are indifferent to the physical medium over which TCP/IP executes. The applications and performers inherit this from the operating system upon which they are executed.

4.3.2 Additional Protocols

The usage of DNS and DHCP is possible and is based on the network configuration of the operating system upon which the applications and performers execute.

5 Media Interchange

5.1 Implementation Model

5.1.1 Application Data Flow Diagram
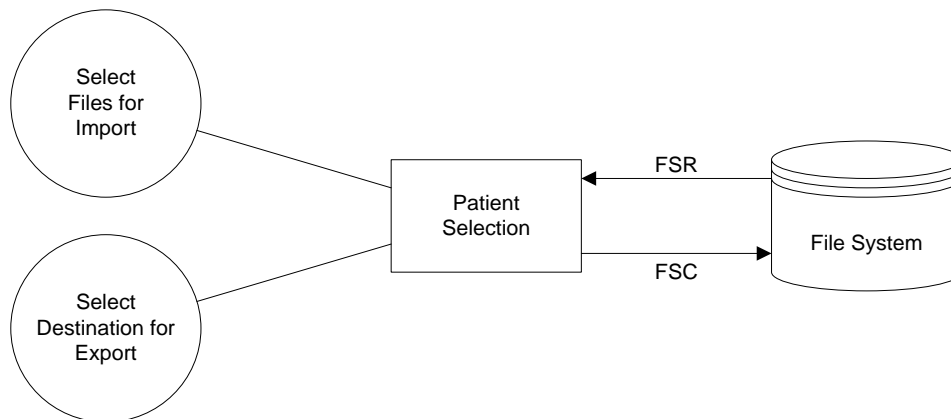
Figure 5-1: The Patient Selection Data Flow Diagram

5.1.2 Functional Definitions of AE's

5.1.2.1 Functional Definition of Patient Selection

- *Import:*
  The Patient Selection allows the user to select a DICOM medium, e.g. a CD, a DVD or a folder in the file system. If the medium contains a DICOMDIR it is evaluated and all indexed instances will be scanned and presented to the user.
  If there is no DICOMDIR, the application will scan the files beneath the selected folder and will present to the user all DICOM instances that are supported and valid.
  Finally the user can select one or more series and start the upload.

- *Export:*
  The Patient Selection also allows selecting one or more series for export. Then the user needs to specify a destination folder on the file system and can start the export. All DICOM instances will be saved as files to the destination folder.

5.1.3 Sequencing of Real-World Activities

Not necessary.

5.1.4 File Meta Information Options

See in 5.2 AE Specifications.

5.2 AE Specifications

5.2.1 Patient Selection Application Entity Specification

The Patient Selection provides standard conformance to the Media Storage Service Class. The application profiles and roles are listed below:

AE Related Application Profiles, Real-World Activities, and Roles			
Supported APs	**Real World Activity**	**Roles**	**Options**
BL-PRV-GEN	Select Files for Import	FSR	No DICOMDIR
	Select Destination File for Export	FSC	

Table 5-1: Patient Selection supported Media Interchange Profiles.

5.2.1.1 File Meta Information for the Application Entity

The Patient Selection does not change the original Implementation Class UID and Implementation Version Name and it does not write the Source Application Entity Title.

5.2.1.2 Real World Activities

5.2.1.2.1 Activity – Import

The Patient Selection allows browsing the file system by opening a folder selection dialog. After folder selection it scans the contents and presents a list of found patients. After patient selection all found and known DICOM instances are parsed and presented to the user.

5.2.1.2.1.1 Media Storage Application Profiles

The Patient Selection supports the BL-PRV-GEN Application Profile File System Reader.

5.2.1.2.1.1.1 Option - Supported SOP Classes and Transfer Syntaxes

SOP Class Name	SOP Class UID	Transfer Syntax	Transfer Syntax UID
All SOP Classes from Table 4-2		*All transfer syntaxes from Table 4-1*	

Table 5-2: Patient Selection supported SOP Classes and Transfer Syntaxes

5.2.1.2.1.1.2 Option - Physical Medium and Medium Format

The Patient Selection supports reading the PC File System (see [2] PS 3.12, Annex A).

5.2.1.2.1.1.3 Option - Basic Directory

The Patient Selection supports evaluating a DICOMDIR.

5.2.1.2.2 Activity - Export

The Patient Selection automatically provides different media (CD, DVD, USB …) or a configured download folder as export destinations.

5.2.1.2.2.1 Media Storage Application Profiles

The Patient Selection supports the BL-PRV-GEN Application Profile File System Creator.

5.2.1.2.2.1.1 Option - Supported SOP Classes and Transfer Syntaxes

SOP Class Name	SOP Class UID	Transfer Syntax	Transfer Syntax UID
All SOP Classes from Table 4-2		*All transfer syntaxes from Table 4-1*	

Table 5-3: Patient Selection supported SOP Classes and Transfer Syntaxes

The Patient Selection doesn't change the original transfer syntax.

5.2.1.2.2.1.2 Option - Physical Medium and Medium Format

The Patient Selection supports writing to the PC File System (see [2] PS 3.12, Annex A).

5.2.1.2.2.1.3 Option - Basic Directory

The Patient Selection Portal creates a DICOMDIR.

5.3 Augmented and Private Application Profiles

5.3.1 Augmented Application Profiles

None.

5.3.2 Private Application Profiles

5.3.2.1 Brainlab General Purpose Interchange Profile

5.3.2.1.1 Profile Identification

This section defines an Application Profile Class potentially inclusive of all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via any media. Objects from multiple modalities may be included on the same media.

See Table 4-2 for a detailed list of supported Media Storage SOP Classes.

Application Profile	Identifier	Description
Brainlab General Purpose Media Interchange	BL-PRV-GEN	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms.

Table 5-4: Brainlab General Purpose Media Interchange Profile.

This profile ought to enclose all DICOM non-secure standard media profiles on any interchange media with a file system as File System Reader (see [2] PS 3.11). The following list of implicitly supported profiles is thought only as example and not as complete:

- 1024 X-Ray Angiographic Studies on CD-R Media (STD-XA1K-CD)
- 1024 X-Ray Angiographic Studies on DVD Media (STD-XA1K-DVD)
- General Purpose CD-R Interchange (STD-GEN-CD)
- General Purpose Interchange on DVD-RAM Media (STD-GEN-DVD-RAM)
- General Purpose Interchange on BD Media (STD-GEN-BD)
- CT/MR Studies on CD-R (STD-CTMR-CD)
- CT/MR Studies on DVD-RAM Media (STD-CTMR-DVD-RAM)
- CT/MR Studies on DVD Media (STD-CTMR-DVD)
- General Purpose DVD Interchange with JPEG (STD-GEN-DVD-JPEG)
- General Purpose DVD Interchange with JPEG 2000 (STD-GEN-DVD-J2K)
- General Purpose USB Media Interchange with JPEG (STD-GEN-USB-JPEG)
- General Purpose USB Media Interchange with JPEG-2000 (STD-GEN-USB-J2K)
- …

5.3.2.1.2 Clinical Context

This Application Profile facilitates the interchange of images and related data on any media and Brainlab applications.

5.3.2.1.2.1 Roles and Service Class Options

This Application Profile uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File Set Creator (FSC), File Set Reader (FSR), and File Set Updater (FSU), defined in [2] PS 3.10.

5.3.2.1.2.1.1 File Set Creator

The role of File Set Creator shall be used by Application Entities which generate a File Set under this Image Interchange Class of Application Profiles.

Optionally, File Set Creators shall be able to generate the Basic Directory SOP Class in the DI-COMDIR file with all subsidiary Directory Records related to the Image SOP Classes stored in the File Set. The Application Entity acting as a File Set Creator generates a File Set under a BL-PRV-GEN Application Profile.

5.3.2.1.2.1.2 File Set Reader

The role of File Set Reader shall be used by Application Entities that receive a transferred File Set under the Image Interchange Class of Application Profiles.

Optionally File Set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Application Profile, for which a Conformance Statement is made, using the defined Transfer Syntax.

5.3.2.1.2.1.3 File Set Updater

The role of File Set Updater is used by Application Entities which receive a transferred File Set under the Image Exchange Class of Application Profiles and update it by the addition (or deletion) of images or information to (or from) the medium.

File Set Updaters shall be able to generate one or more of the SOP Instances defined for this Application Profile, for which a Conformance Statement is made, and optionally to read and update the DICOMDIR file.

5.3.2.2 BL-PRV-GEN Profile Class

5.3.2.2.1 SOP Classes and Transfer Syntaxes

This Application Profile is based on the Media Storage Service Class (see [2] PS 3.4).

IOD	SOP Class UID	Transfer Syntax	FSC	FSR	FSU
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional	Optional
Composite Instance Storage	Defined in Conformance Statement	Defined in Conformance Statement	Optional (see Note)	Optional (see Note)	Optional (see Note)

Table 5-5: BL-PRV-GEN SOP Classes and Transfer Syntaxes.

Note: For the Composite Instance Storage at least one of FSC, FSR or FSU must be supported to fulfill this profile.

5.3.2.2.2 Physical Medium and Medium Format

BL-PRV-GEN requires either the PC File System (see [2] PS 3.12, Annex A) or the ZIP File Media (see [2] PS 3.12, Annex V).

Furthermore this profile supports all media like CD, DVD, USB, CF, MMC or SD which seamlessly integrates into the OS file system for reading, writing and updating. It also supports filenames not fulfilling the 8 + 3 rule of the above mentioned PC File System.

5.3.2.2.3   Directory Information in DICOMDIR

Conformant Application Entities may include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File Set.

All DICOM files in the File Set incorporating SOP Instances defined for the specific Application Profile shall be referenced by Directory Records.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall be exactly one or no DICOMDIR file per File Set. The DICOMDIR file shall be in the root directory of the medium.

The Patient ID at the patient level shall be unique for each patient directory record in one File Set.

If there is no DICOMDIR this profile allows recursive scanning of file systems for DICOM instances.

Whether the DICOMDIR is supported and how a file system scan is performed needs to be described in the Conformance Statement.

5.3.2.2.4   Additional Keys

File Set Creators and Updaters are required to generate the mandatory elements specified in [2] PS 3.3.

5.3.2.2.5   Other Parameters

Not applicable.

5.3.2.2.6   Security Parameters

Not applicable.

6 Support of Character Sets

The applications and performers in common support the following character sets:

- ISO_IR 100 (ISO 8859-1; Latin Alphabet No. 1: Western European)

Character Sets	Content Manager	Patient Selection	Image Viewer	Fusion	Smartbrush	Cranial/ENT	Spine and Trauma 2D/i	Spine and Trauma 3D	Automatic Image Reg.	Knee/Hip	Angio	Auto Segmentation	Vessel Segmentation	Universal Atlas Performer	Object Manager	Fibertracking	Trajectory/Stereotaxy	Lead Localization	Guide
ISO_IR 100	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Table 6-1: Application and performer specific supported character sets

7 Security Profiles

7.1 Security Profiles

None supported

7.2 Association Level Security

None supported.

7.3 Application Level Security

None supported

8 Annexes

8.1 IOD Contents

8.1.1 Supported SOP Instances

8.1.1.1 Secondary Capture Image

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
Equipment	General Equipment	8.1.2.1.6	
	SC Equipment	8.1.2.2.1	
Frame of Reference	Frame of Reference	8.1.2.1.5	
	Synchronization		Not supported
Image	General Image	8.1.2.1.7	
	Image Pixel	8.1.2.1.8	
	Cine		Not supported
	Multi-frame	8.1.2.1.9	
	Frame pointers		Not supported
	Device		Not supported
	Multi-frame Functional Groups	8.1.2.2.5	If plane information is present
	Multi-frame Dimension		Not supported
	Specimen		Not supported
	SC Image	8.1.2.2.2	
	SC Multi-frame Image	8.1.2.2.3	
	SC Multi-frame Vector	8.1.2.2.4	
	VOI LUT		Not supported
	Common Instance Reference		Not supported
	SOP Common	8.1.2.5.1	
	Frame Extraction		Not supported

Table 8-1: Multi-frame Grayscale (Byte and Word) SC Image IOD

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported

IE	Module	Reference	Support
Equipment	General Equipment	8.1.2.1.6	
	SC Equipment	8.1.2.2.1	
Frame of Reference	Frame of Reference	8.1.2.1.5	
	Synchronization		Not supported
Image	General Image	8.1.2.1.7	
	Image Pixel	8.1.2.1.8	
	Cine		Not supported
	Multi-frame	8.1.2.1.9	
	Frame pointers		Not supported
	Device		Not supported
	Multi-frame Functional Groups	8.1.2.2.5	If plane information is present
	Multi-frame Dimension		Not supported
	Specimen		Not supported
	SC Image	8.1.2.2.2	
	SC Multi-frame Image	8.1.2.2.3	
	SC Multi-frame Vector	8.1.2.2.4	
	ICC Profile		Not supported
	Common Instance Reference		Not supported
	SOP Common	8.1.2.5.1	
	Frame Extraction		Not supported

Table 8-2: Multi-frame True Color SC Image IOD

8.1.1.2 Grayscale Softcopy Presentation State

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
	Presentation Series	8.1.2.4.4	
Equipment	General Equipment	8.1.2.1.6	
Presentation State	Presentation State Identification	8.1.2.4.5	
	Presentation State Relationship	8.1.2.4.6	
	Presentation State Shutter		Not supported
	Presentation State Mask		Not supported
	Mask		Not supported
	Display Shutter		Not supported
	Bitmap Display Shutter		Not supported
	Overlay Plane		Not supported
	Overlay Activation		Not supported
	Displayed Area	8.1.2.3.1	

IE	Module	Reference	Support
	Graphic Annotation		Not supported
	Spatial Transformation		Not supported
	Graphic Layer		Not supported
	Graphic Group		Not supported
	Modality LUT	8.1.2.4.1	
	Softcopy VOI LUT	8.1.2.4.3	
	Softcopy Presentation LUT	8.1.2.4.2	
	SOP Common	8.1.2.5.1	

Table 8-3: Grayscale Softcopy Presentation State IOD

8.1.1.3 Structured Report Documents

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	Key Object Document Series	8.1.2.6.2	
	Clinical Trial Series		Not supported
Equipment	General Equipment	8.1.2.1.6	
Document	Key Object Document	8.1.2.6.3	
	SR Document Content	8.1.2.6.1	
	SOP Common	8.1.2.5.1	

Table 8-4: Key Object Selection Document IOD

This Key Object Selection Document IOD is used to represent:

- Brainlab Treatment Plans
- Brainlab Slice Sets (sorted image series)

Both are represented using the template TID 2010 described in section 8.3.1.

8.1.1.4 Spatial Registration

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
	Spatial Registration Series	8.1.2.8.1	
Frame of Reference	Frame of Reference	8.1.2.1.5	
Equipment	General Equipment	8.1.2.1.6	

IE	Module	Reference	Support
Spatial Registration	Spatial Registration	8.1.2.8.2	
	Common Instance Reference	8.1.2.5.2	
	SOP Common	8.1.2.5.1	

Table 8-5: Spatial Registration IOD

Only Spatial Registration IODs are supported which are conform to the IHE-RO Profile "Multimodality Image Registration for Radiation Oncology 2012 (MMRO-II)" [3].

8.1.1.5 Deformable Spatial Registration

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
	Spatial Registration Series		
Equipment	General Equipment	8.1.2.1.6	
	Enhanced General Equipment	8.1.2.1.6	
Deformable Registration	Deformable Spatial Registration	8.1.2.9.2	
	Common Instance Reference	8.1.2.5.2	
	SOP Common	8.1.2.5.1	

Table 8-6: Deformable Spatial Registration IOD

8.1.1.6 Spatial Fiducials

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
	Spatial Fiducials Series	8.1.2.10.1	
Equipment	General Equipment	8.1.2.1.6	
Spatial Fiducials	Spatial Fiducials	8.1.2.10.2	
	Common Instance Reference	8.1.2.5.2	
	SOP Common	8.1.2.5.1	

Table 8-7: Spatial Fiducials IOD

8.1.1.7 Encapsulated Document

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	Encapsulated Document Series	8.1.2.13.1	
	Clinical Trial Series		Not supported
Equipment	General Equipment	8.1.2.1.6	
	SC Equipment	8.1.2.2.1	
Encapsulated Document	Encapsulated Document	8.1.2.13.2	
	SOP Common	8.1.2.5.1	

Table 8-8: Encapsulated PDF IOD

8.1.1.8 Segmentation

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Segmentation Series	8.1.2.11.1	
	Clinical Trial Series		Not supported
Frame of Reference	Frame of Reference	8.1.2.1.5	
Equipment	General Equipment	8.1.2.1.6	
	Enhanced General Equipment	8.1.2.1.6	
Image	General Image	8.1.2.1.7	
	Image Pixel	8.1.2.1.8	
	Segmentation Image	8.1.2.1.9	
	Multi-frame Functional Groups	8.1.2.11.3	
	Multi-frame Dimension		Not supported
	Specimen		Not supported
	Common Instance Reference	8.1.2.5.2	
	SOP Common	8.1.2.5.1	
	Frame Extraction		Not supported

Table 8-9: Segmentation IOD

8.1.1.9 Surface Segmentation

This IOD is used to represent Points, Point clouds, Trajectories and Fiber Bundles.

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	

IE	Module	Reference	Support
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
	Segmentation Series	8.1.2.11.1	
Frame of Reference	Frame of Reference	8.1.2.1.5	
Equipment	General Equipment	8.1.2.1.6	
	Enhanced General Equipment	8.1.2.1.6	
Surface	Surface Segmentation	8.1.2.12.1	
	Surface Mesh	8.1.2.14.1	
	Common Instance Reference	8.1.2.5.2	
	SOP Common	8.1.2.5.1	

Table 8-10: Surface Segmentation IOD

8.1.1.10 Raw Data

This IOD is the generic Raw Data module extended by Brainlab specific contents.

IE	Module	Reference	Support
Patient	Patient	8.1.2.1.1	
	Clinical Trial Subject		Not supported
Study	General Study	8.1.2.1.2	
	Patient Study	8.1.2.1.3	Not supported
	Clinical Trial Study		Not supported
Series	General Series	8.1.2.1.4	
	Clinical Trial Series		Not supported
Frame of Reference	Frame of Reference	8.1.2.1.5	
	Synchronization		Not supported
Equipment	General Equipment	8.1.2.1.6	
Raw Data	Acquisition Context		
	Specimen		Not Supported
	Raw Data	8.1.2.7	See there for specific contents
	Common Instance Reference	8.1.2.5.2	
	SOP Common	8.1.2.5.1	

Table 8-11: Raw Data IOD

8.1.2 Supported Modules

8.1.2.1 Common Composite Image Modules

8.1.2.1.1 Patient

Attribute Name	Tag	VR	Import	Export
Patient's Name	(0010,0010)	PN	Used to identify the patient (see 8.1.3.3)	
Patient ID	(0010,0020)	LO	Used to identify the patient (see 8.1.3.3)	
Patient's Birth Date	(0010,0030)	DA	Used to identify the patient (see 8.1.3.3)	
Patient's Sex	(0010,0040)	CS		

Table 8-12: Patient Module

8.1.2.1.2 General Study

Attribute Name	Tag	VR	Import	Exported
Study Instance UID	(0020,000D)	UI		
Study Date	(0008,0020)	DA		Generated for new studies with <CurrentDate>; otherwise as imported
Referring Physician's Name	(0008,0090)	PN		EMPTY for new studies; otherwise as imported
Study ID	(0020,0010)	SH		
Accession Number	(0008,0050)	SH		EMPTY for new studies; otherwise as imported
Study Description	(0008,1030)	LO		Generated for new studies; otherwise as imported

Table 8-13: General Study Module

8.1.2.1.3 Patient Study

Attribute Name	Tag	VR	Import	Exported
Patient's Height	(0010,1020)	DS		
Patient's Weight	(0010,1030)	DS		

Table 8-14: Patient Study Module

8.1.2.1.4 General Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS		
Series Instance UID;	(0020,000E)	UI		Generated for new series; otherwise as imported
Series Number	(0020,0011)	IS		Generated for new series; otherwise as imported
Series Date	(0008,0021)	DA		Generated with <Creation Date> for new series; otherwise as imported

Series Time	(0008,0031)	TM		Generated with <Creation Time> for new series; otherwise as imported
Series Description	(0008,103E)	LO		Generated for new series; otherwise as imported
Patient Position	(0018,5100)	DA		Written for any Image IOD if data originated from either one of CT, MR, XA or CR regarding the attribute (0008, 0060) Modality.

Table 8-15: General Series Module

8.1.2.1.5   Frame Of Reference

Attribute Name	Tag	VR	Import	Export
Frame of Reference UID	(0020,0052)	UI		

Table 8-16: Frame of Reference Module

Note: See section 8.1.3.4 for the usage of the Frame of Reference in Brainlab applications and performers.

8.1.2.1.6   (Enhanced) General Equipment

Attribute Name	Tag	VR	Import	Export
Manufacturer	(0008,0070)	LO		"Brainlab"
Manufacturer's Model Name	(0008,1090)	LO		<ApplicationName>
Device Serial Number	(0008,1000)	SH		<HostID> or <Serial Number>
Software Version(s)	(0018,1020)	LO		<ApplicationVersion>

Table 8-17: (Enhanced) General Equipment Module

8.1.2.1.7   General Image

Attribute Name	Tag	VR	Import	Export
Instance Number	(0020,0013)	IS		
Content Date	(0008,0023)	DA		<Current Date>
Content Time	(0008,0033)	TM		<Current Time>
Image Type	(0008,0008)	CS	Generally no constraints except: "DERIVED \SECONDARY\NAVIGATION" for Multi-frame Grayscale (Byte and Word) SC Images obtained and used in Spine & Trauma 2D/3D	

Table 8-18: General Image Module

8.1.2.1.8   Image Pixel

Attribute Name	Tag	VR	Import	Export
Samples per Pixel	(0028,0002)	US	See 8.1.3.1.1	
Photometric Interpretation	(0028,0004)	CS	See 8.1.3.1.1	
Rows	(0028,0010)	IS		

Columns	(0028,0011)	DA	See 8.1.3.2 for Segmentation IODs Otherwise: no limitation	
Bits Allocated	(0028,0100)	US	See 8.1.3.1.1	
Bits Stored	(0028,0101)	US		
High Bit	(0028,0102)	US		
Pixel Representation	(0028,0103)	US		
Planar Configuration	(0028,0006)	US		
Pixel Data	(7FE0,0010)	OW		

Table 8-19: Image Pixel Module

8.1.2.1.9   Multi-frame

Attribute Name	Tag	VR	Import	Export
Number of Frames	(0028,0008)	US	Generally no constraints except: 3 for Multi-frame Grayscale (Byte and Word) SC Images obtained and used in Spine & Trauma 2D/3D	
Frame Increment Pointer	(0028,0009)	AT		For SC Image IOD it points to (0018,2002) Frame Label Vector

Table 8-20: Multi-frame Module

8.1.2.1.10   Acquisition Context

Attribute Name	Tag	VR	Import	Export
Acquisition Context Sequence	(0040,0555)	SQ		EMPTY

Table 8-21: Acquisition Context Module

8.1.2.2   SC Modules

8.1.2.2.1   SC Equipment

Attribute Name	Tag	VR	Import	Export
Conversion Type	(0008,0064)	CS		"WSD"
Modality	(0008,0060)	CS		"OT"

Table 8-22: SC Equipment Module

8.1.2.2.2   SC Image

Attribute Name	Tag	VR	Import	Export
Pixel Spacing	(0028,0030)	DS		Not set if the SC Image is exported containing the Multi-frame Functional Groups Module. In this case Pixel Spacing is set within the (0028,9110) Pixel Measures Sequence. Otherwise set if x- and y-pixel sizes are given.

Table 8-20: SC Image Module

8.1.2.2.3   SC Multi-frame Image

Attribute Name	Tag	VR	Import	Export
Burned In Annotations	(0028,0301)	CS	Not imported	"YES" for screenshots "NO" otherwise
Rescale Intercept	(0028,1052)	DS		
Rescale Slope	(0028,1053)	DS		
Rescale Type	(0028,1054)	CS		
Presentation LUT Shape	(2050,0020)	CS	Not imported	

Table 8-21: SC Multi-frame Image Module

8.1.2.2.4   SC Multi-frame Vector

Attribute Name	Tag	VR	Import	Export
Frame Label Vector	(0028,2002)	SH	Not imported	

Table 8-22: Multi-frame Module

8.1.2.2.5   SC Multi-frame Functional Groups

Functional Group Macros	Belongs to Functional Group	Reference	Presence of Module
Pixel Measures	Per-Frame	Table 8-24	ALWAYS
Plane Position (Patient)	Per-Frame	Table 8-25	ALWAYS
Plane Orientation (Patient)	Per-Frame	Table 8-26	ALWAYS

Table 8-23: Multi-frame Functional Groups for Secondary Capture

Attribute Name	Tag	VR	Import	Export
Pixel Measures Sequence	(0028,9110)	SQ		
>Pixel Spacing	(0028,0030)	DS		
>Slice Thickness	(0018,0050)	DS		

Table 8-24: Pixel Measures Macro

Attribute Name	Tag	VR	Import	Export
Plane Position Sequence	(0020,9113)	SQ		
>Image Position (Patient)	(0020,0032)	DS		

Table 8-25: Plane Position (Patient) Macro

Attribute Name	Tag	VR	Import	Export
Plane Orientation Sequence	(0020,9116)	SQ		
>Image Orientation (Patient)	(0020,0037)	DS		

Table 8-26: Plane Orientation (Patient) Macro

8.1.2.3   Curve, Graphic and Waveform

8.1.2.3.1   Displayed Area

Attribute Name	Tag	VR	Import	Export
Displayed Area Selection Sequence	(0070,005A)	SQ	Not supported	
>Pixel Origin Interpretation	(0048,0301)	CS		"FRAME"
>Displayed Area Top Left Hand Corner	(0070,0052)	SL		1\1
>Displayed Area Bottom Right Hand Corner	(0070,0053)	SL		<WIDTH>\<HEIGHT>
>Presentation Size Mode	(0070,0100)	CS		"TRUE SIZE"
>Presentation Pixel Spacing	(0070,0101)	DS		

Table 8-27: Displayed Area Module

Note: Displayed area information is not used for importing.

8.1.2.4   Look Up Tables and Presentation States

8.1.2.4.1   Modality LUT Module

Attribute Name	Tag	VR	Imported	Exported
Rescale Intercept	(0028,1052)	DS		
Rescale Slope	(0028,1053)	DS		
Rescale Type	(0028,1054)	LO		

Table 8-28: Modality LUT Module

8.1.2.4.2   Softcopy Presentation LUT Module

Attribute Name	Tag	VR	Import	Export
Presentation LUT Shape	(2050,0020)	CS		"IDENTITY"

Table 8-29: VOI LUT Module

8.1.2.4.3   Softcopy VOI LUT Module

Attribute Name	Tag	VR	Import	Export
Softcopy VOI LUT Sequence	(0028,3110)	SQ		
>Referenced Image Sequence	(0008,1140)	SQ		
>Window Center	(0028,1050)	DS		
>Window Width	(0028,1051)	DS		

Table 8-30: Softcopy VOI LUT Module

8.1.2.4.4   Presentation Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS	Must be "PR"	"PR"

Table 8-31: Presentation Series Module

8.1.2.4.5 Presentation State Identification

Attribute Name	Tag	VR	Imported	Exported
Presentation Creation Date	(0070,0082)	DA		
Presentation Creation Time	(0070,0083)	TM		

Table 8-32: Presentation State Identification Module

8.1.2.4.6 Presentation State Relationship Module

Attribute Name	Tag	VR	Import	Export
Referenced Series Sequence	(0008,1115)	SQ		See note
>Series Instance UID	(0020,000E)	UI		
>Referenced Image Sequence	(0008,1140)	SQ		
>>*Include Image SOP Instance Reference Macro, Table 10-3* [2]				See note

Table 8-33: Presentation State Relationship Module

Note: Not all images might be referenced caused by inconsistent Modality LUTs of original images. In this case the majority of images with consistent Modality LUTs are referenced.

8.1.2.5 General Modules

8.1.2.5.1 SOP Common

Attribute Name	Tag	VR	Import	Export
SOP Class UID	(0008,0016)	DS		IOD specific
SOP Instance UID	(0008,0018)	DS		Generated
Specific Character Set	(0008,0005)	CS		"ISO_IR 100"
Instance Creation Date	(0008,0012)	DA		<Current Date>
Instance Creation Time	(0008,0013)	TM		<Current Time>

Table 8-34: SOP Common Module

8.1.2.5.2 Common Instance Reference

Attribute Name	Tag	VR	Import	Export
Referenced Series Sequence	(0008,1115)	SQ		
>Series Instance UID	(0020,000E)	UI		
>Referenced Instance Sequence	(0008,114A)	SQ		
>>Referenced SOP Class UID	(0008,1150)	UI		
>>Referenced SOP Instance UID	(0008,1155)	UI		

Table 8-35: Common Instance Reference Module

8.1.2.6 SR Document Modules

8.1.2.6.1 SR Document Content Module

Attribute Name	Tag	VR	Import	Export
Include 'Document Content Macro' Table C.17-5 [2] with a Value Type (0040,A040) of "CONTAINER"				

Include 'Document Relationship Macro' Table C.17-6 [2]				See Table 8-37
Value Type	(0040,A040)	CS		
Concept Name Code Sequence	(0040,A043)	SQ		
Specific Content Tags are not further described.				

Table 8-36: Content Document Macro

Attribute Name	Tag	VR	Import	Export
Content Sequence	(0040,A730)	SQ		
>Relationship Type	(0040,A010)	CS		

Table 8-37: SR Document Content - Document Relationship Macro

8.1.2.6.2   Key Object Document Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS	Must be "KO"	"KO"
Series Instance UID	(0020,000E)	UI		Generated for new series otherwise as imported
Series Number	(0020,0011)	IS		Generated for new series otherwise as imported
Series Date	(0008,0021)	DA		Generated with <Creation Date> for new series otherwise as imported
Series Time	(0008,0031)	TM		Generated with <Creation Time> for new series otherwise as imported
Series Description	(0008,103E)	LO		

Table 8-38: Key Object Document Series Module

8.1.2.6.3   Key Object Document Module

Attribute Name	Tag	VR	Import	Export
Instance Number	(0020,0013)	IS		
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>

Table 8-39: Key Object Document Module

8.1.2.7   Raw Data Module

Attribute Name	Tag	VR	Import	Export
Instance Number	(0020,0013)	IS		
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>
Creator-Version UID (0008,9123) and private attributes are listed in the sub-sections describing the specific contents.				

Table 8-40: Raw Data Module

8.1.2.7.1   Projective Registration

Attribute Name	Tag	VR	Import	Export
Creator-Version UID	(0008,9123)	UI	Must be present	1.2.276.0.20.1.45.1.0.0

Projective Registration Sequence	(0073,[01]-10)	SQ		Always 2 items: • Identity transformation of the 3D source. • Projective transformation of the 3D source to the 2D X-Ray target.
>Frame of Reference UID	(0020,0052)	UI		If existing, the target Frame of Reference UID
>Referenced Image Sequence	(0008,1140)	SQ		The target references
>>*Include 'Image SOP Instance Reference Macro' Table 10-3*				
>Matrix Registration Sequence	(0070,0309)	SQ		Always 1 item
>>Matrix Sequence	(0070,030A)	SQ		Always 1 item
>>>Frame of Reference Transformation Matrix	(3006,00C6)	DS		See 8.1.2.7.1.1
>>>Frame of Reference Transformation Matrix Type	(0070,030C)	1		"PROJECTIVE"

Table 8-41: Raw Data Module – Projective Registration Module

8.1.2.7.1.1 Frame of Reference Transformation Matrix

The Frame of Reference Transformation Matrix (3006,00C6) $^{A}M_{B}$ describes how to transform a point $\begin{pmatrix} ^{B}x & ^{B}y & ^{B}z \end{pmatrix}$ with respect to RCS_{B} into $\begin{pmatrix} ^{A}x & ^{A}y & ^{A}z \end{pmatrix}$ with respect to RCS_{A} according to the equation below:

$$\begin{bmatrix} ^{A}x \\ ^{A}y \\ ^{A}z \\ 1 \end{bmatrix} = \begin{bmatrix} M_{11} & M_{12} & M_{13} & T_{x} \\ M_{21} & M_{22} & M_{23} & T_{y} \\ M_{31} & M_{32} & M_{33} & T_{z} \\ 0 & 0 & -1/f & 1 \end{bmatrix} \begin{bmatrix} ^{B}x \\ ^{B}y \\ ^{B}z \\ 1 \end{bmatrix}$$

M is the rotational, scaling and shearing part, T is the translational part and f is the focal length for the projective transformation.
$\begin{pmatrix} ^{A}x & ^{A}y \end{pmatrix}$ is then used as the mapped pixel coordinate in the 2D image. The resulting 2D image is unitless.

8.1.2.8 Spatial Registration Modules

8.1.2.8.1 Spatial Registration Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS	Must be "REG"	"REG"

Table 8-42: Spatial Registration Series Module

8.1.2.8.2 Spatial Registration Module

Attribute Name	Tag	VR	Imported	Exported
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>
Registration Sequence	(0070,0308)	SQ		
>Frame of Reference UID	(0020,0052)	UI	Must be present (see 8.1.3.4)	Always set

>Referenced Image Sequence	(0008,1140)	SQ		Image References
>>*Include 'Image SOP Instance Reference Macro' Table 10-3* [2]				
>Matrix Registration Sequence	(0070,0309)	SQ		
>>Registration Type Code Sequence	(0070,030D)	SQ		Not set for IGS registrations
>>Matrix Sequence	(0070,030A)	SQ		Only one item
>>>Frame of Reference Transformation Matrix	(3006,00C6)	DS		
>>>Frame of Reference Transformation Matrix Type	(0070,030C)	CS		"RIGID"

Table 8-43: Spatial Registration Module

8.1.2.9   Deformable Spatial Registration Modules

8.1.2.9.1   Deformable Spatial Registration Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS	Must be "REG"	"REG"

Table 8-44: Deformable Spatial Registration Series Module

8.1.2.9.2   Deformable Spatial Registration Module

Attribute Name	Tag	VR	Imported	Exported
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>
Deformable Registration Sequence	(0064,0002)	SQ		
>Source Frame of Reference UID	(0064,0003)	UI	Must be present (see 8.1.3.4)	Always set
>Referenced Image Sequence	(0008,1140)	SQ		Image References
>>*Include 'Image SOP Instance Reference Macro' Table 10-3* [2]				
>Registration Type Code Sequence	(0070,030D)	SQ		
>> *Include 'Code Sequence Macro'* [2] *Table 8.8-1*				
>Pre Deformation Matrix Registration Sequence	(0064,000F)	SQ		
>>Frame of Reference Transformation Matrix	(3006,00C6)	DS		
>>Frame of Reference Transformation Matrix Type	(0070,030C)	CS		
>Post Deformation Matrix Registration Sequence	(0064,0010)	SQ		
>>Frame of Reference Transformation Matrix	(3006,00C6)	DS		
>>Frame of Reference Transformation Matrix Type	(0070,030C)	CS		
>Deformable Registration Grid Sequence	(0064,0005)	SQ		
>>Image Orientation (Patient)	(0020,0037)	DS		
>>Image Position (Patient)	(0020,0032)	DS		

>>Grid Dimensions	(0064,0007)	UL		
>>Grid Resolution	(0064,0008)	FD		
>>Vector Grid Data	(0064,0009)	UN		

Table 8-45: Deformable Spatial Registration Module

8.1.2.10 Spatial Fiducials Modules

8.1.2.10.1 Spatial Fiducials Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS	Must be "FID"	"FID"

Table 8-46: Spatial Fiducials Series Module

8.1.2.10.2 Spatial Fiducials Module

Attribute Name	Tag	VR	Imported	Exported
Include 'Content Identification Macro' [2] *Table 10-12*				See Table 8-48
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>
Include 'Content Identification Macro' Table 10-12 [2]				
Fiducial Set Sequence	(0070,031C)	SQ		
>Frame of Reference UID	(0020,0052)	UI	Must be present (see 8.1.3.4)	Always present
>Referenced Image Sequence	(0008,1140)	SQ		Image References
>>*Include 'Image SOP Instance Reference Macro' Table 10-3* [2]				
>Fiducial Sequence	(0070,031E)	SQ		
>>Fiducial Identifier	(0070,0310)	SH	"AM_n": Automatic Marker "IL_n": Intraop Landmark default: Manual Landmark	Automatic Marker: "AM_n" Manual Landmark: "ML_n" Intraop-Landmakr: "IL_n"
>>Shape Type	(0070,0306)	CS	"POINT"	"POINT"
>>Number of Contour Points	(3006,0046)	IS	1	1
>>Contour Data	(3006,0050)	DS	Only one item supported	Only one item supported
>>Graphic Coordinates Data Sequence	(0070,0318)	SQ	Not supported	Not supported

Table 8-47: Spatial Fiducials Module

Attribute Name	Tag	VR	Import	Export
Instance Number	(0020,0013)	IS		
Content Label	(0070,0080)	CS		"BL REG PT"

Table 8-48: Spatial Fiducials - Content Identification Macro

8.1.2.11 Segmentation Modules

8.1.2.11.1 Segmentation Series Module

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS		"SEG"

Series Number	(0020,000E)	UI		Generated

Table 8-49: Segmentation Series Module

8.1.2.11.2 Segmentation Image

Attribute Name	Tag	VR	Import	Export
Image Type	(0008,0008)	CS		"DERIVED\PRIMARY"
Content Label	(0070,0080)	CS		"BL SEG PT" or "SEG"
Content Description	(0070,0081)	LO		"Segmentation Objects"
Alternate Content Description Sequence	(0070,0081)	SQ		
Content Creator's Name	(0070,0084)	PN		
Samples Per Pixel	(0028,0002)	US		
Photometric Interpretation	(0028,0004)	CS		
Pixel Representation	(0028,0103)	US		
Bits Allocated	(0028,0100)	US		
Bits Stored	(0028,0101)	US		
High Bit	(0028,0102)	US		
Lossy Image Compression	(0028,2110)	CS		
Segmentation Type	(0062,0001)	CS	See 8.1.3.2	"FRACTIONAL"
Segmentation Fractional Type	(0062,0010)	CS		
Maximum Fractional Value	(0062,000E)	US		
Segment Sequence	(0062,0002)	SQ		
>Segment Number	(0062,0004)	US		
>Segment Label	(0062,0005)	LO		
>Segment Description	(0062,0006)	ST		
>Segment Algorithm Type	(0062,0008)	CS		
>Segment Algorithm Name	(0062,0009)	LO		
>Anatomic Region Sequence	(0008,2218)	SQ		Baseline CID 4031
>Segmented Property Category Code Sequence	(0062,0003)	SQ		Baseline CID 7150 (see section 8.3.4 for details)
>Segmented Property Type Code Sequence	(0062,000F)	SQ		Baseline CID 7151 (see section 8.3.3 for details)
>Recommended Display CIELab Value	(0062,000D)	US		

Table 8-50: Segmentation Image Module

8.1.2.11.3 Segmentation Multi-frame Functional Groups

Functional Group Macros	Belongs to Functional Group	Reference	Presence of Module
Pixel Measures	Shared	Table 8-52	ALWAYS
Plane Position (Patient)	Per-Frame	Table 8-53	ALWAYS
Plane Orientation (Patient)	Shared	Table 8-54	ALWAYS
Derivation Image	Shared	Table 8-55	ALWAYS
Frame Content Macro	Per-Frame	Table 8-56	ALWAYS
Segmentation	Per-Frame	Table 8-57	ALWAYS

Table 8-51: Segmentation - Multi-frame Functional Groups

Attribute Name	Tag	VR	Import	Export
Pixel Measures Sequence	(0028,9110)	SQ		
>Pixel Spacing	(0028,0030)	DS		
>Slice Thickness	(0018,0050)	DS		

Table 8-52: Segmentation - Pixel Measures Macro

Attribute Name	Tag	VR	Import	Export
Plane Position Sequence	(0020,9113)	SQ		
>Image Position (Patient)	(0020,0032)	DS		

Table 8-53: Segmentation - Plane Position (Patient) Macro

Attribute Name	Tag	VR	Import	Export
Plane Orientation Sequence	(0020,9116)	SQ		
>Image Orientation (Patient)	(0020,0037)	DS		

Table 8-54: Segmentation - Plane Orientation (Patient) Macro

Attribute Name	Tag	VR	Import	Export
Derivation Image Sequence	(0008,9124)	SQ		
>Derivation Description	(0008,2111)	ST		"Segmentation"
>Derivation Code Sequence	(0008 9215)	SQ		
>>Code Value	(0008,0100)	SH		"113076"
>>Coding Scheme Designator	(0008,0102)	SH		"DCM"
>>Code Meaning	(0008,0104)	LO		"Segmentation"
>Source Image Sequence	(0008,2112)	SQ	(see 8.1.3.4)	Image References
>>*Include 'Image SOP Instance Reference Macro' Table 10-3* [2]				
>>Purpose of Reference Code Sequence	(0040,A170)	SQ		
>>>Code Value	(0008,0100)	SH		"121322"
>>>Coding Scheme Designator	(0008,0102)	SH		"DCM"
>>>Code Meaning	(0008,0104)	LO		"Source Image for Image Processing Operation"

Table 8-55: Segmentation - Derivation Image Macro

Attribute Name	Tag	VR	Import	Export
Frame Content Sequence	(0020,9111)	SQ		
>Dimension Index Values	(0020,9157)	UL		

Table 8-56: Segmentation - Frame Content Macro

Attribute Name	Tag	VR	Import	Export
Segment Identification Sequence	(0062,000A)	SQ		
>Referenced Segment Number	(0062,000B)	IS		

Table 8-57: Segmentation Macro

8.1.2.12 Surface Segmentation Modules

8.1.2.12.1 Surface Segmentation

Attribute Name	Tag	VR	Import	Export
Include 'Content Identification Macro' [2] *Table 10-12*				See Table 8-59
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>
Segment Sequence	(0062,0002)	SQ		
>Segment Number	(0062,0004)	US		
>Segment Label	(0062,0005)	LO		Generated automatically or entered by user.
>Segment Algorithm Type	(0062,0008)	CS		For points, categories and trajectories: "MANUAL" For fiber bundles: "SEMIAUTOMATIC"
>*Include 'General Anatomy Mandatory Macro'* [2] *Table 10-5*				See Table 8-60
>Segmented Property Category Code Sequence	(0062,0003)	SQ		
>>*Include 'Code Sequence Macro'* [2] *Table 8.8-1*				For points, categories and trajectories: (BL-S14-3; BL-0001; undefined) For fiber bundles: (SRT, R-42019, Function)
>Segmented Property Type Code Sequence	(0062,000F)	SQ		
>>*Include 'Code Sequence Macro'* [2] *Table 8.8-1*				For points, categories and trajectories: (SRT, T-D0010, Entire body) For fiber bundles: (99BL-GEN, SEG-PT-0080, Fiber Structure)
>Surface Count	(0066,002A)	UL		
>Referenced Surface Sequence	(0066,002B)	SQ		
>>Referenced Surface Number	(0066,002C)	UL		
>>Segment Surface Generation Algorithm Identification Sequence	(0066,002D)	SQ		
>>>*Include 'Algorithm Identification Macro' Table 10-19*				See Table 8-61
>>Segment Surface Source Instance Sequence	(0066,002E)	SQ		
>>>*Include 'Image SOP Instance Reference Macro'* [2] *Table C.10-3*				Image References (see 8.1.3.4)
>Brainlab Type Code Sequence	(0067,[01]-01)	SQ	(see 8.1.3.5)	
>>*Include 'Code Sequence Macro'* [2] *Table 8.8-1*				For categories: (BL-S14-1, BL-0001, Category) For trajectories: (BL-S14-1, BL-0002, Trajectory Target Only) or (BL-S14-1, BL-0003, Trajectory Entry Only)

				or (BL-S14-1, BL-0004, Trajectory) For points: (BL-S14-1, BL-0005, Labeled Point) For fiber bundles: (99BL-S14-1, BL-0006, Fiber Bundle)

Table 8-58: Surface Segmentation Module

Attribute Name	Tag	VR	Import	Export
Instance Number	(0020,0013)	IS		
Content Label	(0070,0080)	CS		For points, categories and trajectories: "PT CAT TRAJ" For fiber bundles: "FIBER"

Table 8-59: Surface Segmentation – Content Identification Macro

Attribute Name	Tag	VR	Import	Export
Anatomic Region Sequence	(0008,2218)	SQ		
>*Include 'Code Sequence Macro'* [2] *Table 8.8-1*				For points, categories and trajectories: (BL-S14-2, BL-0001, undefined) For fiber bundles: (SRT, T-D1100, Head)

Table 8-60: Surface Segmentation – General Anatomy Mandatory Macro

Attribute Name	Tag	VR	Import	Export
Algorithm Family Code Sequence	(0066,002F)	SQ		
>*Include 'Code Sequence Macro'* [2] *Table 8.8-1*				For points, categories and trajectories: (BL-S14-2, BL-0001, undefined) For fiber bundles: (DCM, 123101, Neighborhood Analysis)
Algorithm Name	(0066,0036)			For points, categories and trajectories: "User defined item" For fiber bundles: "Fibertracking"
Algorithm Version	(0066,0031)			"undefined"

Table 8-61: Surface Segmentation – Algorithm Identification Macro

8.1.2.13 Encapsulated Document Modules

8.1.2.13.1 Encapsulated Document Series

Attribute Name	Tag	VR	Import	Export
Modality	(0008,0060)	CS		"DOC"

Series Instance UID	(0020,000E)	UI		Generated for new series; otherwise as imported
Series Number	(0020,0011)	IS		Generated for new series; otherwise as imported
Series Description	(0008,103E)	LO		Generated for new series; otherwise as imported

Table 8-62: Encapsulated Document Series Module

8.1.2.13.2 Encapsulated Document

Attribute Name	Tag	VR	Imported	Exported
Instance Number	(0020,0013)	IS		
Content Date	(0008,0023)	DA		Generated: <Current Date>
Content Time	(0008,0033)	TM		Generated: <Current Time>
Burned In Annotation	(0028,0301)	CS		
Source Instance Sequence	(0042,0013)	SQ		Attribute not always present
Document Title	(0042,0010)	ST		
Concept Name Code Sequence	(0040,A043)	SQ		See 8.3.2
MIME Type of Encapsulated Document	(0042,0012)	LO		"application/pdf"
Encapsulated Document	(0042,0011)	OB		

Table 8-63: Encapsulated Document Module

8.1.2.14 Common Surface IE Modules

8.1.2.14.1 Surface Mesh

Attribute Name	Tag	VR	Import	Export
Number of Surfaces	(0066,0001)	UL		
Surface Sequence	(0066,0002)	SQ		
>Surface Number	(0066,0003)	UL		
>Surface Processing	(0066,0009)	CS		"NO"
>Recommended Display Grayscale Value	(0062,000C)	US		Generated from Recommended Display CIELab Value (0062,000D)
>Recommended Display CIELab Value	(0062,000D)	US		
>Recommended Presentation Opacity	(0066,000C)	FL		
>Recommended Presentation Type	(0066,000D)	CS		"WIREFRAME" for trajectories and fiber bundles "POINTS" for points
>Finite Volume	(0066,000E)	CS		"NO"
>Manifold	(0066,0010)	CS		"NO"
>Surface Points Sequence	(0066,0011)	SQ		
>Surface Mesh Primitives Sequence	(0066,0013)	SQ		
>Surface Comments	(0066,0004)	LT		

Table 8-64: Surface Mesh Module

Attribute Name	Tag	VR	Import	Export
>>Number Of Surface Points	(0066,0015)	UL		
>>Point Coordinates Data	(0066,0016)	OF		
>>Fractional Anisotropy Values	(0067,[01]-03)	OF		Present if Brainlab Type Code Sequence (0067,[01]-01) is (99BL-S14-1, BL-0006, Fiber Bundle)

Table 8-65: Points Macro Attributes

Attribute Name	Tag	VR	Import	Export
Vertex Point Index List	(0066,0025)	OW		
Line Sequence	(0066,0028)	SQ		
>Primitive Point Index List	(0066,0029)	OW		

Table 8-66: Surface Mesh Primitives Macro

8.1.3   Usage of Attributes from Received IODs

8.1.3.1   Image IODs

8.1.3.1.1   General

In general the applications and performers support any kind of DICOM image, but there are some restrictions:

- Grayscale with 1 samples per pixel and 8 or 16 bits allocated
- Color with 3 samples per pixel, "RGB", "YBR_FULL" or "YBR_FULL_422", 8 bits allocated and unsigned pixel representation
- Palette color with 1 sample per pixel and 8 or 16 bits allocated

All other image formats are not supported and therefore will not be displayed.

8.1.3.1.2   CT Image Storage / Enhanced CT Image Storage

If one of the following criteria is fulfilled the dataset is not processed as CT but as 3D X-Ray:

- (0008,0060) Modality is "XA" and (0008,1090) Manufacturers Model Name is "XtraVision" and (0008,0008) Image Type contains either "3DRA_PROP", "3DRA_ROLL", "3DRX_PROP or "3DRX_ROLL"
- (0029,xx04) Private Creator with value "Navigation" exists
- (0008,0008) Image Type contains "BrainlabVario3DNavigation"
- (0008,0008) Image Type contains "Vario3D"
- (0029,xx04) Private Creator with value "ISOC 3D NAVIGATIONMATRIX.R. 1.0" exists
- (0008,0008) Image Type contains "ISOC_3D"
- (0008,1090) Manufacturers Model Name is "AXIOM-Artis" and (0018,1210) Convolution Kernel is "EE"
- (0008,0016) SOP Class UID contains "1.3.46.670589.2.4.1.1"
- The histogram area of the pixel data transformed by the Modality LUT significantly exceeds the Hounsfield range from -1024 to 3072 by more than 20%.

8.1.3.1.3   Positron Emission Tomography Image Storage

If one of the following criteria is supported the PET Image is accepted:

- (0054,1000) Series Type Value 1 is STATIC or WHOLE BODY
- (0054,1000) Series Type Value 1 is DYNAMIC and (0054,0101) Number of Time Slices is 1

8.1.3.1.4   Grayscale Softcopy Presentation State Storage

Brainlab applications only read modules marked as supported in Table 8-3 and as described in the referenced module sections.

8.1.3.2   Segmentation IODs

The applications do not support import of Segmentation instances with a Segmentation Type (0062,0001) of "BINARY" in combination with Columns (0028,0011) with a value which is not a multiple of 8.

8.1.3.3   Patient Identification

In all applications and performers a patient is considered as the same patient if (0010,0010) Patient's Name, (0010,0020) Patient ID and (0010,0030) Patient's Birth Date are the same. The name and id comparison is case insensitive. Which name components to compare is configurable, by default the full name with all components will be used.

If an application or performer isn't able to identify correctly the patient the according data set won't be loaded and this error is either stated in a dialog or a log file.

8.1.3.4   Frame of Reference and Image References

The usage of the Frame of Reference in the DICOM standard assumes that it is always accurate and well-defined. In fact, this is correct for e.g. spatial positions of DICOM objects, such as image positions.

However, since the content of e.g. images is the relevant information, it may happen that although the spatial / temporal relation is correctly defined, the spatial or temporal content is not well defined and therefore not correctly related.

As a consequence, Brainlab applications and performers will only use a Frame of Reference in non-image SOP classes if the corresponding Image SOP instances are referenced in addition to the Frame of Reference.

8.1.3.5   Brainlab Type Code Sequence

Brainlab utilizes the Surface Segmentation IOD to persist several internal content items. The Private Attribute (0067,[01]-01) Brainlab Type Code Sequence contains the information about the respective type of interpretation.

The following list shows the supported internal content items and their associated CID code-triplet which is encoded in (0067,[01]-01) Brainlab Type Code Sequence:

- Category: (BL-S14-1, BL-0001, Category)[5]

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[5] The ordering of the values inside each code-triplet is: (Coding Scheme Designator (0008,0102), Code Value (0008,0100), Code Meaning (0008,0104)).

- Trajectory:
    - (BL-S14-1, BL-0002, Trajectory Target Only) or
    - (BL-S14-1, BL-0003, Trajectory Entry Only) or
    - (BL-S14-1, BL-0004, Trajectory)
- Labeled Point: (BL-S14-1, BL-0005, Labeled Point)
- Fiber Bundle: (99BL-S14-1, BL-0006, Fiber Bundle)

Brainlab applications and performers will only import Surface Segmentation instances containing information about one of the supported internal content items, as listed above.

8.1.4 Attribute Mapping

No attribute mapping is performed.

8.1.5 Coerced/Modified fields

No coercion is performed.

8.2 Data Dictionary of Private Attributes

The Private Attributes added to SOP Instances are listed in the table below. Further details on usage of these private attributes are contained in Section 8.1.

How to read the Brainlab private tag data dictionary

Each section header contains the odd group, a unique number in-between the group and the private creator code:
 	
    (<oddgroup>,[<uniqueno>]) - <creatorcode>
 	
Throughout the document the private tags are addressed with the group, the unique number and the private element number.
 	
    (<oddgroup>,[<uniqueno>]-<element>)
 	
In real DICOM instances you get at minimum two attributes: one for the creator code reserving the slot for the private attributes and the private attributes themself:
 	
    (<oddgroup>,00<slot>) <creatorcode>
    (<oddgroup>,<slot><element1>) <value1>
    (<oddgroup>,<slot><element2>) <value2>
    …

8.2.1 (0073,[01]) - Brainlab-S23-ProjectiveFusion

Tag	Name	VR	VM
(0073,[01]-10)	Projective Registration Sequence	SQ	1

8.2.2 (0067,[01]) - Brainlab-S14-SSO

Tag	Name	VR	VM
(0067,[01]-01)	Brainlab Type Code Sequence	SQ	1
(0067,[01]-03)	Fractional Anisotropy Values	OF	1

8.3 Coded Terminology and Templates

8.3.1 TID 2010 Key Object Selection

The following specialized templates are used by Brainlab applications:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition / Remarks	Value Set Constraint
1			CONTAINER	(BL-0001, BL-S17-1, Plan)	1	M		Root node
	>	CONTAINS	IMAGE	Purpose of Reference shall not be present	0-n	M		
	>	CONTAINS	COMPOSITE	Purpose of Reference shall not be present	0-n	M		
	>	CONTAINS	TEXT	(BL-0002, BL-S17-1, Plan Title)	1	M		Brainlab plan title
	>	CONTAINS	TEXT	(BL-0003, BL-S17-1, Plan Id)	1	M		Brainlab plan id

Table 8-67: TID 2010 Key Object Selection – Brainlab Plan

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition / Remarks	Value Set Constraint
1			CONTAINER	DCID(7010) Key Object Selection Document Titles	1	M		Root node
	>	CONTAINS	IMAGE	Purpose of Reference shall not be present	1-n	MC		

Table 8-68: TID 2010 Key Object Selection – Brainlab Slice Set

8.3.2 CID 7020 Document Titles

The context group CID 7020 is extended by the following Brainlab specific codes.

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
BL-S16-1	BL-0001	Orthopedic Navigation Report
BL-S16-1	BL-0002	Object Volume Measurement Report

Table 8-69: CID 7020 Document Titles

8.3.3 CID 7151 Segmentation Property Types

The Context Group CID 7151 is extended by Brainlab specific codes. The value for Code Meaning will be displayed for all code sequences. No local dictionary is provided to look up alternative code meanings.

8.3.4 CID 7150 Segmented Property Type Categories

The Context Group CID 7150 is extended by Brainlab specific codes. The value for Code Meaning will be displayed for all code sequences. No local dictionary is provided to look up alternative code meanings.

8.4 Grayscale Image Consistency

Not supported.

8.5 Standard Extended/Specialized/Private SOP Classes

None

8.6 Private Transfer Syntaxes

None.

9 Indexes

9.1 Index of Tables

9.2 Index of Figures