DICOM Conformance Statement (DCS)

Rev 1.2

Surgimap 2.2.14

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Revision History

Name	Date	Reason For Changes	Version
Raul Macule	07/08/2013	Creation	draft
Virginie Lafage	02/25/2014	Formatting	1.0
Dmitriy Loshakov	02/24/2017	Added Section 3.3.6, and Section 7	1.1
Dmitriy Loshakov	03/26/2018	Modified Sections 3.3.2, 6.2. Added 6.2.1.	1.2

1. INTRODUCTION

1.1 OBJECTIVE

This conformance statement specifies the compliance of Surgimap to DICOM, the DICOM Service Class and the roles that are supported.

Surgimap uses DICOM services to store images, to import images from other DICOM applications and to receive images pushed from other DICOM applications.

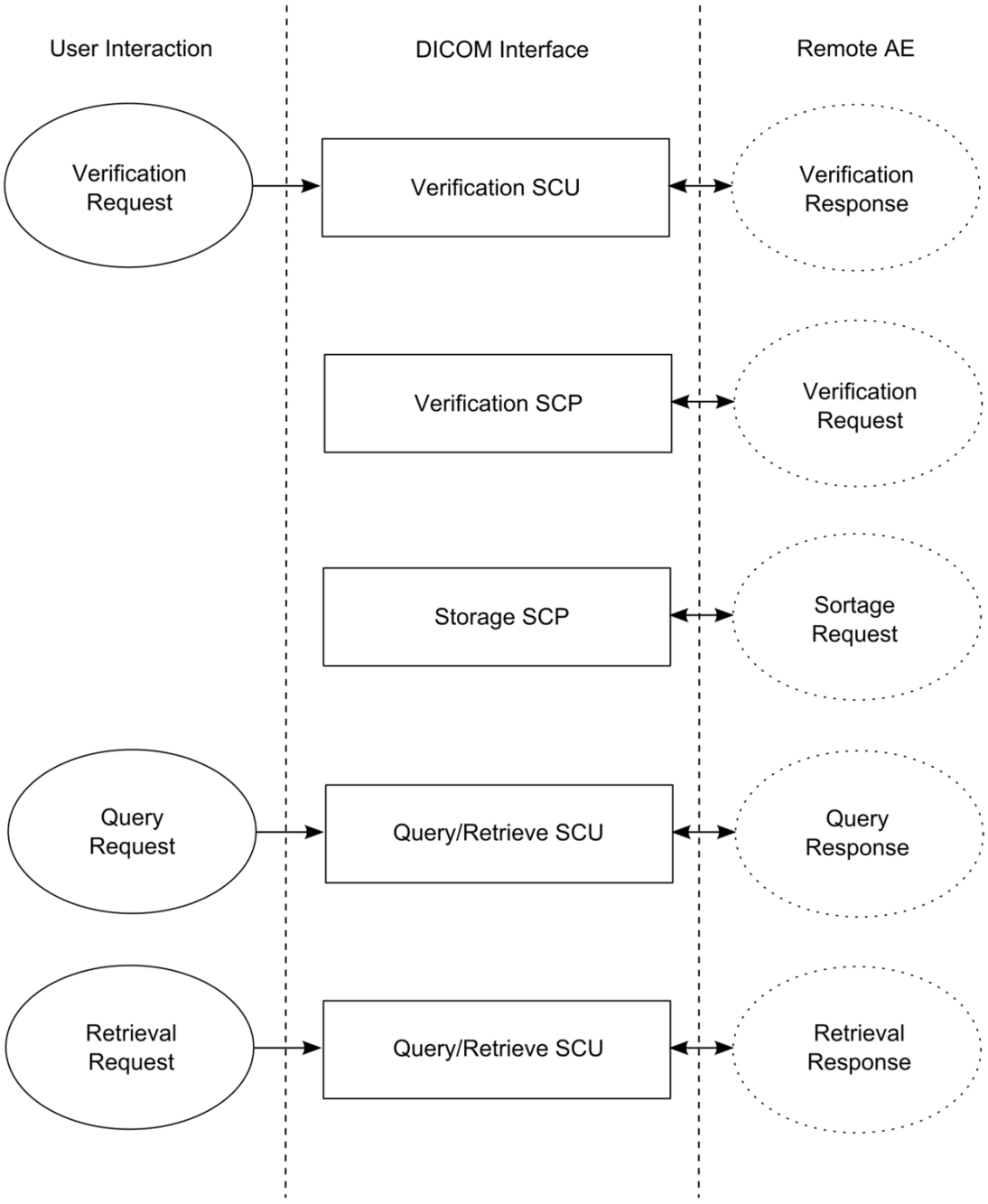
1.2 DEFINITION AND ABBREVIATIONS

[AE]	DICOM Application Entity
[ACN]	DICOM Application Context Name
[DICOM]	Digital Imaging and Communications in Medicine
[PDU]	Protocol Data Unit
[SCU]	DICOM Service Class User
[SCP]	DICOM Service Class Provider
[SOP]	Service Object Pair
[UID]	Unique Identifier

2. IMPLEMENTATION MODEL

The basic and specific application models for Surgimap are shown hereafter:

2.1 APPLICATION DATA FLOW DIAGRAM



2.2 FUNCTIONAL DEFINTIONS OF AE'S

Surgimap is related to the following real world activities:

- Request verification of the validity of DICOM connectivity
- Respond to verification request from remote hosts
- Receive and accept images from remote hosts
- Query Patients, Studies or Series from remote hosts
- Retrieve Patients, Studies or Series from remote hosts

2.3 FUNDAMENTAL DEFINITIONS OF AE'S

Surgimap supports the following functionalities:

- Access to patient demographics, specific image information and pixel data in the local database
- Respond a DICOM association to receive images from remote hosts
- Initiate a DICOM association to query items from remote hosts
- Store DICOM part 10 format files

2.4 SEQUENCING OF REAL-WORLD ACTIVITIES

Not Applicable

3. AE SPECIFICATIONS

3.1 SOP CLASSES SUPPORTED

Surgimap provides standard conformance to the following SCP class in the roles specified:

SOP Class Name	SOP Class UID	Roles
Verification SOP Class	1.2.840.10008.1.1	SCU/SCP
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	SCU
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	SCU
Storage Service Class	1.2.840.10008.4.2	SCP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCP
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCP
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	SCP
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	SCP
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	SCP

Table 1: SOP Classes Supported

3.2 ASSOCIATION ESTABLISHMENT POLICIES

3.2.1 GENERAL

Surgimap will propose and recognize the following Application Context Name (ACN). Maximum PDU size is configurable in the DICOM settings panel. The default value is 16384.

Application Context Name	1.2.840.10008.3.1.1

Table 2: Application Context Name

3.2.2 NUMBER OF ASSOCIATIONS

The maximum number of simultaneous associations is configurable in the DICOM Settings panel. The default value is 20. It can be set to virtually unlimited number, but might be confined due to system resource limitations.

3.2.3 ASYNCHRONOUS NATURE

Not supported.

3.2.4 IMPLEMENTATION IDENTIFYING INFORMATION

Surigmap uses the following Implementation Identifying Information

Implementation Version Name	OFFIS_DCMTK_355
Implementation Class UID	1.2.276.0.7230010.3.0.3.5.5

Table 3: Implementation identifying information

3.3 ASSOCIATION INITIATION POLICY BY REAL-WORLD ACTIVITY

Surgimap initiates an association for each one of the following activities:

- C-ECHO request
  Send Verification request to test the validity of a DICOM connection.
- C-FIND Request
  Get Patient/Study/Series list from a DICOM peer
- C-MOVE Request
- Send a request to transfer Images from a DICOM peer to local AE

3.3.1 VERIFICATION (C-ECHO SCU)

Surgimap will test the validity of a DICOM connection upon user request with the following proposed presentation contexts:

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class Name	**SOP Class UID**	**Name**	**UID**		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 4: presentation Context table for C-ECHO SCU

3.3.2 QUERY/RETRIEVE (C-FIND SCU)

Surgimap will initiate query requests to a DICOM SCP with the following proposed presentation contexts and attributes for reference:

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class Name	**SOP Class UID**			
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Table A	SCU	None

Table 5: Presentation Context Table for C-FIND SCU

Transfer Syntax	
Name	**UID**
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

Table 6: Transfer Syntax Table A

Level	Description	Element Tag	Type	Key
Study	Patient ID	(0010, 0020)	R	Use
	Patient Name	(0010, 0010)	R	Use
	Patient Age	(0010, 1010)	O	
	Patient Sex	(0010, 0040)	O	
	Patient Comments	(0010, 4000)	O	
	Study Instance UID	(0020, 000D)	U	Use
	Study ID	(0020, 0010)	R	
	Study Time	(0008, 0020)	R	Use
	Study Time	(0008, 0030)	O	
	Study Description	(0008, 1030)	O	
	Accession Number	(0008, 0050)	O	
	Modalities in Study	(0008, 0061)	O	
	Institution Name	(0008, 0080)	O	
	Referring Physician Name	(0008, 0090)	O	
	Performing Physician Name	(0008, 1050)	O	
	Number of Study Related Series	(0020, 1206)	O	
	Number of Study Related Instances	(0020, 1208)	O	
Series	Series Instance UID	(0020, 000E)	U	Use
	Series Number	(0020, 0011)	R	
	Series Date	(0008, 0021)	O	
	Series Time	(0008, 0031)	O	
	Series Description	(0008, 103E)	O	
	Modality	(0080, 0060)	R	
	Number of Series Related Instances	(0020, 1209)	O	
N/A	Imaging Service Request Comments	(0040, 2400)	O	

Table 7: Attribute for Reference Table for C-FIND SCU

Surgimap contains an application-specific option for Query / Retrieve operations that sends an additional tag with the C-FIND and C-MOVE operations (Imaging Service Request Comments (0040, 2400)). Please see sections 6.2 and 6.2.1 for more information regarding using this option. It is not enabled by default.

3.3.3 QUERY/RETRIEVE (C-MOVE SCU)

Surgimap will initiate retrieve requests to a DICOM SCP with the following proposed presentation contexts and attributes for reference:

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class Name	SOP Class UID			
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Table B	SCU	None

Table 8: Presentation Context Table for C-MOVE SCU

Transfer Syntax	
Name	UID
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70
JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical (Process 15)	1.2.840.10008.1.2.4.58
RLE Lossless	1.2.840.10008.1.2.5
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

Table 9: Transfer Syntax Table B

Level	Description	Element Tag	Type	Key
Series	Study Instance UID	(0020, 000D)	U	Use
	Series Instance UID	(0020, 000E)	U	Use

Table 10: Attribute for Reference Table for C-MOVE SCU

3.3.4 VERIFICATION (C-ECHO SCP)

Surgimap will respond to verifications requests that are sent from a DICOM SCU with the following proposed presentation contexts:

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class Name	SOP Class UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Table 11: Presentation Context Table for C-ECHO SCP

3.3.5 STORAGE (C-STORE SCP)

Surgimap will store images that are sent from a DICOM SCU with the following acceptable presentation contexts (see Table 12). Surgimap will select the first supported proposed transfer syntaxes.

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class Name	**SOP Class UID**			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Table C	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2			
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1			
MR Image Storage	1.2.840.10008.5.1.4.1.1.4			
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1			
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20			
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128			
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7			
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1			

Table 12: Presentation Context Table for C-STORE SCP

Transfer Syntax	
Name	**UID**
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70
JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical (Process 15)	1.2.840.10008.1.2.4.58
RLE Lossless	1.2.840.10008.1.2.5
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2

Table 13: Transfer Syntax Table C

3.3.6 REMOTE STORAGE (C-STORE SCP – HOST)

Surgimap is capable of acting as a Store SCP in order to push SOP Instances to other SCPs and SCUs. The following configuration options are offered to enable this functionality:

Parameter	Description
Alternate Proposal Mode	In the event that presentation contexts proposed by Surgimap to a SCP or SCU are not supported by the target, allow Surgimap to propose alternate presentation contexts that may allow the association to be established.
Halt on Failure	When sending a group of SOP Instances, the default behavior is to keep sending SOP Instances until there are none left to send. With this option enabled, if one SOP Instance in a group fails to send, we will halt the entire transfer and not send any further SOP Instances (if any are left).
Decompression	When sending SOP Instances that have compressed pixel data, the recipient SCP or SCU may not support the target transfer syntax. In this case, we may choose to decompress the pixel data and propose an alternate (compatible) transfer syntax for performing the transfer. The options are as follows: – Never decompress the pixel data – Only decompress to lossless format – Decompress to lossless or lossy format as necessary

Table 14: Remote Storage Parameters (Surgimap as C-STORE SCP Host)

Please refer to Table 12: Presentation Context Table for C-STORE SCP for presentation contexts proposed by Surgimap for push to SCPs or SCUs.

Surgimap is able to target other instances of Surgimap when acting as a C-STORE SCP Host with no special modifications required to the default settings on either end (Host or Client).

4. COMMUNICATION PROFILES

4.1 SUPPORTED COMMUNICATION STACKS

DICOM Upper Layer (Part 8) is supported using TCP/IP.

4.2 PHYSICAL MEDIA SUPPORT

DICOM is indifferent to physical medium over which TCP/IP executes (e.g. Ethernet, Fast-Ethernet, FDDI, ATM, etc.).

4.3 POINT-TO-POINT STACK

Not Applicable

5. EXTENSIONS/SPECIALIZATION/PRIVATIZATION

5.1 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOPS

None Supported.

5.2 PRIVATE TRANSFER SYNTAXES

None Supported.

6. CONFIGURATION

6.1 AE TITLE/PRESENTATION ADDRESS MAPPING

The local AE Title(s) and port are configurable in the settings tab.

6.2 CONFIGURATION PARAMETERS

The following parameters are configurable on the Basic Section:

- Local Port
- Local AE Title List
- Transfer Syntax
- Transfer Syntax Out
- Maximum Number of Associations
- Maximum Number of Patients
- Maximum Number of Studies
- DIMSE Timeout
- ACSE Timeout

The following parameters are configurable on the Advanced Panel:

- Single Process
- Support Patient Root
- Support Patient Study Only
- Support Study Root
- Refuse Multiple Storage Associations
- Ignore Store Data
- Keep DB Handle during Association
- File Pad
- Item Pad
- Maximum PDU
- Bit Preserving
- User Metaheader
- DIMSE Blocking Mode
- Correct UID Padding
- Push User Information

6.2.1 PUSH USER INFORMATION IMPLEMENTATION DETAILS

For Surgimap's Query and Retrieve operations (C-FIND and C-MOVE), "Push User Information" is an optional parameter that may be enabled to provide additional identifying information of the user using PACS functionality via a Surgimap client. If this option is enabled, the DcmDataset object that is sent for C-FIND and C-MOVE operations will contain an additional tag: DCM_ImagingServiceRequestComments (0040, 2400). The contents of this tag will contain the current logged-in Surgimap user's email address in the following format as a string: user=user@example.com . Utilizing this tag is implementation-specific on the PACS Server side, but the contents of it should typically show up in the Debug-level logs of the target PACS Server implementation. It is recommended to make a provision for it in the implementation if it is to be used for record keeping or other purposes.

7. DICOM AUTHORING

7.1 OVERVIEW

Surgimap supports DICOM Authoring utilizing the following input formats:

Format	Details
JPEG, BMP, PNG	Authoring a new DICOM with new tags and existing pixel data in the form of a JPEG, Bitmap, or PNG database entry.
Existing DICOM	Authoring a new DICOM with existing tags and new pixel data written in JPEG format (for adding measurements).

Table 15: DICOM Authoring – Inputs

7.2 MECHANISMS

Surgimap can author DICOMs during the process of exporting images from the Surgimap Database, or to enable the pushing of raw image data to PACS SCPs or SCUs. For exporting raw image data to a DICOM file or files, Surgimap supports the following mechanisms:

- Exporting to DICOM with Image Only
- Exporting to DICOM with Image and Measurements
- Exporting to DICOM Anonymized

For pushing raw image data to PACS SCPs or SCUs, Surgimap supports the following mechanisms:

- Pushing a DICOM with Image Only
- Pushing a DICOM with Image and Measurements
- Pushing a DICOM Anonymized

7.3 IMPLEMENTATION

7.3.1 OVERVIEW

Surgimap implements DICOM Authoring for new DICOMs using existing image data and new tags written from patient data extracted from the Surgimap Database. When authoring a new DICOM, the following tags are written:

Description	Element Tag
Patient Name	(0010, 0010)
Patient ID	(0010, 0020)
Study Description	(0008, 1030)
Study Instance UID	(0020, 000D)
Study Date	(0008, 0020)
Study Time	(0008, 0030)
Series Description	(0008, 103E)

Series Instance UID	(0020, 000E)
Pixel Spacing	(0028, 0030)
Manufacturer = “Surgimap – a Nemaris, Inc.. product”	(0008, 0070)
Pixel Data	(7FE0, 0010)

Table 16: DICOM Authoring – Tags for new DICOMs

7.3.2 ANONYMIZED DICOMS

When creating a DICOM with anonymized patient data, the following tags are modified to be deidentified:

Description	Element Tag
Patient Name	(0010, 0010)
Patient ID	(0010, 0020)

Table 17: DICOM Authoring – Anonymized Tags

7.3.3 MODIFYING EXISTING DICOMS

When modifying existing DICOMs, most commonly to add measurements to the pixel data, only the following DICOM tags are modified:

Description	Element Tag
Pixel Data	(7FE0, 0010)

Table 18: DICOM Authoring – Modified Tags for adding Measurements

7.3.4 TRANSFER SYNTAX

All DICOMs authored by Surgimap are written with the following transfer syntax(s):

Description	UID
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50

Table 19: Transfer Syntax Table D

This syntax is written and maintained for exporting to a DICOM file. For pushing to PACS SCPs and SCUs, it may be changed at the discretion of Surgimap's Store SCP to ensure compatibility with the target SCP or SCU (as per the Decompression setting in Section 3.3.6).

7.4 MEASUREMENTS

7.4.1 OVERVIEW

Surgimap is able to author a new DICOM or modify an existing DICOM to add measurements to the pixel data, most commonly used for exporting to a DICOM file or pushing to a PACS SCP or SCU. The following details how DICOM Authoring with Measurements may be utilized by the user:

- Measurements may be Inc.luded during export to a DICOM file
- Measurements may be Inc.luded during pushing to a PACS SCP or SCU
- Measurements are applied to the DICOM Pixel Data directly, and the pixel data is encoded using JPEG format

7.4.2 MEASUREMENT-SPECIFIC IMPLEMENTATION

The following procedures are followed when authoring DICOMs with Measurements:

- Applying Measurements to an existing DICOM retains all of the original DICOM tags except for Pixel Data, which is replaced with a new Pixel Data tag containing the image with Measurements applied.
- For Anonymized DICOM Authoring, certain measurement descriptor text is replaced with deidentified data to protect patient anonymity.