Myrian®

DICOM Conformance Statement

Revision 1.11

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0 CONFORMANCE STATEMENT OVERVIEW

Myrian® provides the following DICOM data exchange features:

- It receives images sent to it by remote systems (e.g. workstations or imaging modalities) and stores them in a database.
- It allows the operator to copy images from the database to remote databases and vice versa. For this purpose the operator is able to query remote databases.
- It allows the operator to print images stored in the database on a DICOM printer.
- It is able to read and write DICOM CD-RW disks.
- It is able to read DICOM DVD-RW disks.

Myrian® allows the operator also to view, analyze and process the images stored in the database.

The following table presents an overview of all network services and the applicable SOP Classes as provided by Myrian® :

SOP Class			
Name	*UID*	*SCU*	*SCP*
Storage			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammography X-Ray Image Storage			
– for Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
– for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra Oral X-Ray Image Storage			
– for Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes
– for Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes
Nuclear Medicine Image Storage (retired)	1.2.840.10008.5.1.4.1.1.5	Yes	Yes
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes

Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Positiron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	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 MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Workflow Management			
Verification	1.2.840.10008.1.1	Yes	Yes
Print Management			
Basic Grayscale Print Management (Meta)	1.2.840.10008.5.1.1.9	Yes	No
> Basic Film Session	1.2.840.10008.5.1.1.1	Yes	No
> Basic Film Box	1.2.840.10008.5.1.1.2	Yes	No
> Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	Yes	No
> Printer	1.2.840.10008.5.1.1.16	Yes	No
Basic Color Print Management (Meta)	1.2.840.10008.5.1.1.18	Yes	No
> Basic Film Session	1.2.840.10008.5.1.1.1	Yes	No
> Basic Film Box	1.2.840.10008.5.1.1.2	Yes	No
> Basic Color Image Box	1.2.840.10008.5.1.1.4.1	Yes	No
> Printer	1.2.840.10008.5.1.1.16	Yes	No
Presentation LUT	1.2.840.10008.5.1.1.23	Yes	No

The following table lists the Supported Media Storage Application Profiles (with roles).

Media Storage Application Profile	*Write Files (FSC / FSU)*	*Read Files (FSR)*	*Supported Media*
General Purpose CD-R	YES/YES	YES	CD
General Purpose DVD-JPEG	NO/NO	YES	All DVD

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2 INTRODUCTION

This Conformance Statement specifies the compliance of Intrasense products to the DICOM v3.0 standard. As described in the DICOM Standard PS 3.2 (Conformance), the purpose of this document is to outline the level of conformance to the DICOM standard and to enumerate the supported DICOM Service Classes, Information Objects and communications Protocols supported by this implementation. DICOM Storage service classes are used to both import and export images that are relevant to the case being studied. DICOM Query/Retrieve service classes are used to look for relevant data, and pull it back for processing (SCU), and also to provide a data source for remote modalities (SCP). DICOM Print service classes are used when softcopy images are inadequate, and must be in a hardcopy format for archival purposes, among others.

2.1 REVISION HISTORY

Version	*Date*	*Authors*	*Changes from previous revisions*
0.1	07/07/05	Frédéric Banégas	Initial version
0.2	08/14/05	JC Arnulfo	First Release : added all Myrian DICOM compliant features
1.0	08/18/05	Frédéric Banégas	Document identification, Proofreading, Approval
1.1	14/05/08	FGDLB	Supported SOP Classes update
1.2	09/07/09	FGDLB	Changed push description
1.3	16/12/09	FGDLB	Added support of Enhanced CT and MR formats
1.4	12/07/10	FGDLB	Added support of JPEG2000
1.5	16/02/2011	FGDLB	Added more info about multithreaded store
1.6	20/07/2011	Colette Maurin	Update of version number of References (§7.3)
1.7	11/08/2011	FGDLB	Updates about DCMTK 3.6.0
1.8	16/02/2012	FGDLB	Added C-FIND and C-MOVE SCPs
1.9	03/04/2012	FGDLB	Updated C-STORE
1.10	30/05/2016	FGDLB	Removed C-FIND and C-MOVE SCPs
1.11	25/08/2016	FGDLB	Removed last references to C-FIND and C-MOVE SCPs

2.2 AUDIENCE

The intended user of this document is involved with software design and system integration. It is understood that this individual is familiar with the concepts and terms used throughout this document. Readers unfamiliar with the DICOM 3.0 standard should consult the actual documentation prior to examining this conformance statement.

2.3 Remarks

Readers should note the following points:

- This document on its own should not be interpreted as a guarantee of connectivity between Myrian® and any equipment and/or applications offered by other vendors. Integration of Myrian® with the equipment and/or applications of different vendors are outside the scope of the DICOM 3.0 standard and product conformance statements. Integration and interoperability of different equipment/applications are the sole responsibility of the user.

- In the case of any possible connectivity inferred by a user to exist between Myrian® and another product, the user is responsible for testing and verifying the inferred connectivity.
- Future changes to the DICOM 3.0 standard may require alterations to be made to Myrian®. Intrasense reserves the right to modify the Myrian® architecture as needed, in order to meet changing standards.
- The user should ensure that any existing DICOM equipment also changes with the future developments of the DICOM standards. Failure to keep pace with any alterations in the DICOM standards may result in decreased or lost connectivity.
- All trade names mentioned in this document are recognized.

2.4 DEFINITIONS, TERMS AND ABBREVIATIONS

AE	DICOM Application Entity
ASCII	American Standard Code for Information Interchange
CT	Computed Tomography
DICOM	Digital Imaging and Communications In Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element – Composite
DIMSE-N	DICOM Message Service Element – Normalized
HTML	HyperText Markup Language
IOD	DICOM Information Object Definition
MR	Magnetic Resonance
PDU	DICOM Protocol Data Unit
SC	Secondary Capture
SCP	DICOM Service Class Provider
SCU	DICOM Service Class User
SOP	Service / Object Pair
TCP/IP	Transmission Control Protocol / Internet Protocol
UID	Unique Identifier
UIF	User Interface
XML	Extensible Markup Language

2.5 REFERENCES

Digital Imaging and Communications in Medicine (DICOM), NEMA Standards Publications PS 3.1 – 3.18.

3 NETWORKING

3.1 IMPLEMENTATION MODEL

3.1.1 Application Data Flow Diagram

All DICOM interaction by all Intrasense applications is controlled through one Application Entity (AE). This primary AE is responsible for all communication that is initiated by the application (SCU), as well as for receiving images from remote AEs (SCP). The application receiving images is an executable (dbms) running in the background. Images received are stored on disk, and may be further processed into a volume format that is used by the Intrasense application.

The following figures show the interaction between the Intrasense AEs and remote AEs.

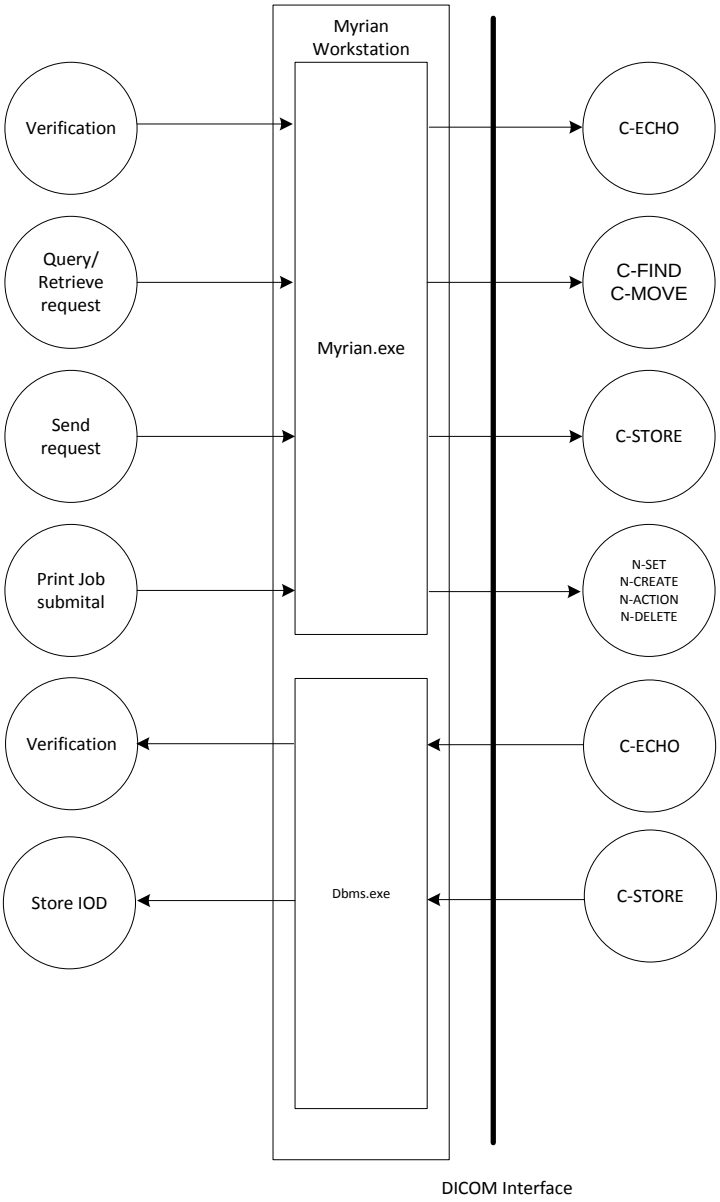

Figure 3.1-1 : FUNCTIONAL OVERVIEW

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3.1.2 Functional Definitions of AE's

There are three main tasks that are initiated by the user:

The first task initiated by the user is **Query/Retrieve**. Queries are first performed at the Study level, and individual results can be expanded to the Series level. A set of images may be retrieved from either of these levels.

The second task is **Export Images**. Images generated by the applications can be exported, as well as the original images that were used for analysis.

The third task is **Print**. Only images that are generated by the applications are printed. Both Grayscale and Color printing is allowed, and the type used is a configurable parameter for each printer.

There are two tasks that are initiated by a remote AE.

The first task is **Storage**. It will accept connections for most image storage classes, and will write out the images that it receives in the format as defined in PS 3.10. The AE that handles this connection is always actively listening for connections. All communications and image transfer with the remote application is accomplished utilizing the DICOM protocol over a network using the TCP/IP protocol stack.

The second task is Query/Retrieve. It will accept connections for queries on database, and accept to transfer data to declared modalities.

Below is a table of the functions supported by Myrian® application entities:

SCU	*SCP*
• Verification • Storage • Query/Retrieve • Basic Grayscale Print • Basic Color Print	• Verification • Storage

3.1.3 Sequencing of Real-World Activities

Not applicable.

3.2 AE SPECIFICATIONS

There is only one AE that is used in the Intrasense software. It is used for initiating all communication with remote AEs, as well as for receiving images from remote AEs. It is defined as the Primary AE.

3.2.1 Primary AE specification

3.2.1.1 SOP Classes

The Myrian® DICOM services provide support for the following DICOM 3.0 SOP Classes as an SCU:

SOP Classes as SCU	
SOP Class UID	*SOP Class Name*
Verification	
1.2.840.10008.1.1	Verification
Storage	
1.2.840.10008.5.1.4.1.1.1	CR Image Storage
1.2.840.10008.5.1.4.1.1.1.1	DX Image Storage (Presentation)
1.2.840.10008.5.1.4.1.1.1.1.1	DX Image Storage (Raw)
1.2.840.10008.5.1.4.1.1.1.2	MG Storage (Presentation)
1.2.840.10008.5.1.4.1.1.1.2.1	MG Storage (Raw)
1.2.840.10008.5.1.4.1.1.1.3	DX Intra Oral X-Ray Image Storage (Presentation)
1.2.840.10008.5.1.4.1.1.1.3.1	DX Intra Oral X-Ray Image Storage (Processing)
1.2.840.10008.5.1.4.1.1.2	CT Image Storage
1.2.840.10008.5.1.4.1.1.3	US Multi-Frame Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.3.1	US Multi-Frame Image Storage
1.2.840.10008.5.1.4.1.1.4	MR Image Storage
1.2.840.10008.5.1.4.1.1.5	NM Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6	US Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6.1	US Image Storage
1.2.840.10008.5.1.4.1.1.7	SC Image Storage

1.2.840.10008.5.1.4.1.1.12.1	XA Image Storage
1.2.840.10008.5.1.4.1.1.12.2	RF Image Storage
1.2.840.10008.5.1.4.1.1.20	NM Image Storage
1.2.840.10008.5.1.4.1.1.128	Standard PET Image Storage
Query/Retrieve	
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query/Retrieve Model – FIND
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query/Retrieve Model – MOVE
Print Management	
1.2.840.10008.5.1.1.9	Basic Grayscale Print Management
1.2.840.10008.5.1.1.18	Basic Color Print Management

The Myrian® DICOM services provide support for the following DICOM 3.0 SOP Classes as an SCP:

SOP Classes as SCP	
SOP Class UID	*SOP Class Name*
Verification	
1.2.840.10008.1.1	Verification
Storage	
1.2.840.10008.5.1.4.1.1.1	CR Image Storage
1.2.840.10008.5.1.4.1.1.1.1	DX Image Storage (Presentation)
1.2.840.10008.5.1.4.1.1.1.1.1	DX Image Storage (Raw)
1.2.840.10008.5.1.4.1.1.1.2	MG Storage (Presentation)
1.2.840.10008.5.1.4.1.1.1.2.1	MG Storage (Raw)
1.2.840.10008.5.1.4.1.1.1.3	DX Intra Oral X-Ray Image Storage (Presentation)
1.2.840.10008.5.1.4.1.1.1.3.1	DX Intra Oral X-Ray Image Storage (Processing)
1.2.840.10008.5.1.4.1.1.2	CT Image Storage
1.2.840.10008.5.1.4.1.1.3	US Multi-Frame Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.3.1	US Multi-Frame Image Storage
1.2.840.10008.5.1.4.1.1.4	MR Image Storage
1.2.840.10008.5.1.4.1.1.5	NM Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6	US Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6.1	US Image Storage
1.2.840.10008.5.1.4.1.1.7	SC Image Storage
1.2.840.10008.5.1.4.1.1.12.1	XA Image Storage
1.2.840.10008.5.1.4.1.1.12.2	RF Image Storage
1.2.840.10008.5.1.4.1.1.20	NM Image Storage
1.2.840.10008.5.1.4.1.1.128	Standard PET Image Storage

3.2.1.2 Association Policies

The Primary AE will initiate associations to remote AE's in order to perform a Query/Retrieve, and may query all the remote DICOM AE's listed in the configuration. The Primary AE will also initiate associations in order to store existing or created images to a remote DICOM AE. The Primary AE will accept associations from remote DICOM AE's in order to receive DICOM pushes.

3.2.1.2.1 General

The following DICOM Application Context Name is always proposed:

DICOM 3.0 Application Context Name	1.2.840.10008.3.1.1.1

The services shall offer a maximum PDU size of 16kB (16384 bytes) upon association initiation, and accept maximum PDU sizes up to 16kB (16384 bytes) on associations initiated by remote applications. There is no limit on the number of Presentation Context Items that will be proposed.

3.2.1.2.2 Number of Associations

The Primary AE will initiate many associations simultaneously while performing query, retrieve, storage or storage commitment services. The Primary AE will also accept many simultaneous associations as a SCP. The number of associations is limited only by available resources. The Primary AE will spawn a new thread for each association initiated and to handle each connection request it receives.

3.2.1.2.3 Asynchronous Nature

The Primary AE may create multiple simultaneous associations, but will have only one outstanding operation on each association. Similarly, the Primary AE will allow multiple simultaneous associations, but only one operation may be outstanding on each association. Therefore, the Primary AE does not propose or accept Asynchronous operations negotiation in the association.

3.2.1.2.4 Implementation Identifying Information

The implementation Class UID and Implementation Version Name of the MYRIAN AE are (the ones of the current DCMTK version used):

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.0
Implementation Version Name	OFFIS_DCMTK_360

Table 3.2-1 : DICOM IMPLEMENTATION CLASS AND VERSION FOR “MYRIAN” AE

3.2.1.3 Association Initiation Policy

Myrian® initiates associations for the following activities:

• DICOM communication verification between Myrian® and a remote system

• Sending images from the local Myrian® database to a remote system (MOVE SCU and SCP).

• Queries of remote database contents.

• Retrieval of images from a remote database to the local

• Print images.

3.2.1.3.1 Verify Communication with a Remote System

3.2.1.3.1.1 Description and Sequencing of Activities

In the Preferences/DICOM window, the user enters an IP address and clicks the Echo button.

3.2.1.3.1.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Extended Negotiation*
Name	*UID*	*Name List*	*UID List*		
Verification	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.1.3.2 SOP Specific Conformance Statement for SOP Verification Class

Myrian® provides standard conformance for DICOM communication verification.

3.2.1.3.3 Send Images to a Remote System

3.2.1.3.3.1 Description and Sequencing of Activities

In the Export window, the user selects the « DICOM Server » destination. The list of known DICOM servers appears. The user selects one of them. The DICOM Server list is editable in the Preferences/DICOM window.

3.2.1.3.3.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax		*Transfer Syntax*	*Role*	*Extended Negotiation*
Name	*UID*			
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	See below	SCU	NONE
CT Image Storage	1.2.840.10008.5.1.4.1.1.2			
DX Image Storage (Presentation)	1.2.840.10008.5.1.4.1.1.1.1			
DX Image Storage (Raw)	1.2.840.10008.5.1.4.1.1.1.1.1			
DX Intra Oral X-Ray Image Storage (Presentation)	1.2.840.10008.5.1.4.1.1.1.3			
DX Intra Oral X-Ray Image Storage (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1			
MR Image Storage	1.2.840.10008.5.1.4.1.1.4			
US Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6			
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1			
US Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3			
US Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1			
SC Image Storage	1.2.840.10008.5.1.4.1.1.7			
MG Storage (Presentation)	1.2.840.10008.5.1.4.1.1.1.2			
MG Storage (Raw)	1.2.840.10008.5.1.4.1.1.1.2.1			
NM Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5			
NM Image Storage	1.2.840.10008.5.1.4.1.1.20			
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1			
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2			
Standard PET Image Storage	1.2.840.10008.5.1.4.1.1.128			

Transfer Syntaxes for Send To Remote System	
Name	*UID*
Implicit VR, Little Endian	1.2.840.10008.1.2
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Explicit VR, Big Endian	1.2.840.10008.1.2.2
Explicit VR, JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
Explicit VR, JPEG Baseline (Process 4)	1.2.840.10008.1.2.4.51
Explicit VR, JPEG Extended (Process 3 & 5) (retired)	1.2.840.10008.1.2.4.52
Explicit VR, JPEG Spectral Selection, Non-Hierarchical (Process 6 & 8) (retired)	1.2.840.10008.1.2.4.53
Explicit VR, JPEG Spectral Selection, Non-Hierarchical (Process 7 & 9) (retired)	1.2.840.10008.1.2.4.54
Explicit VR, JPEG Full Progression, Non-Hierarchical (Process 10 & 12) (retired)	1.2.840.10008.1.2.4.55
Explicit VR, JPEG Full Progression, Non-Hierarchical (Process 11 & 13) (retired)	1.2.840.10008.1.2.4.56
Explicit VR, JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57
Explicit VR, JPEG Lossless, Non-Hierarchical (Process 15) (retired)	1.2.840.10008.1.2.4.58
Explicit VR, JPEG Extended, Hierarchical (Process 16 & 18) (retired)	1.2.840.10008.1.2.4.59
Explicit VR, JPEG Extended, Hierarchical (Process 17 & 19) (retired)	1.2.840.10008.1.2.4.60
Explicit VR, JPEG Spectral Selection, Hierarchical (Process 20 & 22) (retired)	1.2.840.10008.1.2.4.61
Explicit VR, JPEG Spectral Selection, Hierarchical (Process 21 & 23) (retired)	1.2.840.10008.1.2.4.62
Explicit VR, JPEG Full Progression, Hierarchical (Process 24 & 26) (retired)	1.2.840.10008.1.2.4.63
Explicit VR, JPEG Full Progression, Hierarchical (Process 25 & 27) (retired)	1.2.840.10008.1.2.4.64
Explicit VR, JPEG Lossless, Hierarchical (Process 28) (retired)	1.2.840.10008.1.2.4.65
Explicit VR, JPEG Lossless, Hierarchical (Process 29) (retired)	1.2.840.10008.1.2.4.66
Explicit VR, JPEG Lossless, NH,FOP (Process 14)	1.2.840.10008.1.2.4.70
Explicit VR, JPEG LS Image Compression (Lossless)	1.2.840.10008.1.2.4.80
Explicit VR, JPEG LS Image Compression (Lossy)	1.2.840.10008.1.2.4.81
Explicit VR, JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
Explicit VR, JPEG 2000 Image Compression (Lossless or Lossy)	1.2.840.10008.1.2.4.91

Explicit VR, RLE Lossless	1.2.840.10008.1.2.5

3.2.1.3.3.3 SOP Specific Conformance for SOP Class(es)

Images stored in the Myrian® database that are to be sent to remote systems are converted to instances of the corresponding SOP Storage class(es). Images are then sent sequentially to the remote system(s). When sending multiple images to one remote system, all required SOP/transfer syntax couples are negotiated at association time. In addition, unencapsulated transfer syntaxes are also negotiated for each SOP class (like Implicit VR, Little Endian (ILE)), those unencapsulated transfer syntax will be used as a fallback if current transfer syntax of file is refused by remote modality. All images are then sent using the same association. If the SOP/transfer syntax couple of an image hasn't been accepted by remote modality, Myrian tries to send it using another transfer syntax accepted for their SOP class, and converts images to that transfer syntax, if that conversion is allowed.

3.2.1.3.4 Query a Remote Database

3.2.1.3.4.1 Description and Sequencing of Activities

The user clicks on the Remote exams list, selects an AE from the list of DICOM servers, enters the search criteria, and then clicks Search.

3.2.1.3.4.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Extended Negotiation*
Name	*UID*	*Name List*	*UID List*		
Study Root Query Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.1.3.4.3 SOP Specific Conformance Statement for SOP Verification Class

Myrian® supports C-Find response values as defined in DICOM v.3.0 Part 4. All Required (R) and Unique (U) Study, Series, and Image level keys are supported for the Study Root information models. In addition, certain Optional (O) keys are supported. For a Study Root Query/Retrieve the following keys are supported:

Study Root Query/Retrieve: Supported Keys			
Data Level	*Description*	*Tag*	*Type*
Study	Study Date	(0008,0020)	R
Study	Study Time	(0008,0030)	R
Study	Study Accession Number	(0008,0050)	R
Study	Patient's Name	(0010,0010)	R
Study	Patient ID	(0010,0020)	R
Study	Study ID	(0020,0010)	R
Study	Study Instance UID	(0020,000D)	U
Study	Study Referring ®'s Name	(0008,0090)	O
Study	Study Description	(0008,1030)	O
Study	Patient's Birth Date	(0010,0030)	O
Study	Patient's Sex	(0010,0040)	O
Study	Institutional Department Name	(0008,1040)	O
Series	Series Description	(0008,103E)	O
Series	Series Modalities	(0008,0061)	R
Series	Series Number	(0020,0011)	R
Series	Series Instance UID	(0020,000E)	U

Series	Number of Series Related Instances	(0020,1209)	O
Image	Image Number	(0020,0013)	R
Image	Image SOP Instance UID	(0008,0018)	U

Note that not all values listed are used by Myrian; however, any required value will be sent.

3.2.1.3.5 Retrieve from a remote system

3.2.1.3.5.1 Description and Sequencing of Activities

The user selects one or more studies from the Remote Exams list and clicks the « Import » button.

3.2.1.3.5.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Extended Negotiation*
Name	*UID*	*Name List*	*UID List*		
Study Root Query Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.1.3.5.3 SOP Specific Conformance Statement for SOP Verification Class

Myrian® provides standard conformance.

3.2.1.3.6 Print to a remote laser imager

3.2.1.3.6.1 Description and Sequencing of Activities

Printing is available from the scrapbook. The user selects the desired image(s) by clicking on the lower right-hand checkbox of each image and then clicks the « Print » button. He or she selects the appropriate printer, makes any necessary changes to the printer settings, and then clicks Print.

3.2.1.3.6.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Extended Negotiation*
Name	*UID*	*Name List*	*UID List*		
Basic Grayscale Print Management	1.2.840.1000.8.5.1.1.9	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Basic Color Print Management	1.2.840.1000.8.5.1.1.18	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.1.3.6.3 SOP Specific Conformance Statement for SOP Verification Class

Below (following page) are the mandatory print SOP classes supported by Myrian® for the Basic Grayscale Management Meta class.

Basic Grayscale Print Management Meta Class: Supported SOP Classes	
SOP Class Name	*SOP Class UID*
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Printer	1.2.840.10008.5.1.1.16
(Basic Grayscale Print Management Meta)	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta Class: Supported SOP Classes	
SOP Class Name	*SOP Class UID*
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Color Image Box	1.2.840.10008.5.1.1.4.1
Printer	1.2.840.10008.5.1.1.16
(Basic Color Print Management Meta)	1.2.840.10008.5.1.1.18

3.2.1.3.6.4 Conformance for SOP Class Basic Film Session

Myrian® includes the following N-Create attributes for the Basic Film Session SOP class:

Basic Film Session SOP class N-CREATE: Attributes	
Description	*Tag*
Number of Copies	(2000,0010)
Print Priority	(2000,0020)
Medium Type	(2000,0030)
Film Destination	(2000,0040)
Film Session Label	(2000,0050)
Memory Allocation	(2000,0060)

N-Set and N-Action are not used; however, N-Delete is used to delete the complete Basic Film Session SOP instance hierarchy.

3.2.1.3.6.5 Conformance for SOP Class Basic Film Box

The table below lists the N-Create attributes for the Basic Film Box SOP class, where A means the attribute is always sent and C means the attribute is only sent when not empty.

Basic Film Box SOP class N-CREATE: Attributes		
Description	*Tag*	*Usage*
Print Priority	(2000,0020)	C
Image Display Format	(2010,0010)	C
Referenced Film Session Sequence	(2010,0500)	A
> Referenced SOP Class UID	(0008,1150)	A
> Referenced SOP Instance UID	(0008,1155)	A
Film Orientation	(2010,0040)	C
Film Size ID	(2010,0050)	C
Magnification Type	(2010,0060)	A
Maximum Density	(2010,0130)	C
Configuration Information	(2010,0150)	A
Smoothing Type	(2010,0080)	C
Border Density	(2010,0100)	C
Empty Image Density	(2010,0110)	C
Minimum Density	(2010,0120)	C
Trim	(2010,0140)	C

The N-Set is currently unused; however, the N-Action is used to print a complete Basic Film Box SOP instance and N-Delete is used to delete it after printing.

3.2.1.3.6.6 Conformance for SOP Class Basic Grayscale Image Box

The following attributes are included in Myrian®'s N-Set for the Basic Grayscale Image SOP class. Again, "A" stands for attributes which are always sent to the printer, while "C" stands for attributes that are only sent when they contain data.

Basic Grayscale Image SOP Box: N-Set Attributes		
Description	*Tag*	*Usage*
Image Position	(2020,0010)	A
Preformatted Grayscale Image Sequence	(2020,0110)	A
Requested Image Size	(2020,0030)	C[1]
> Samples Per Pixel	(0028,0002)	A
> Photometric Interpretation	(0028,0004)	A
> Rows	(0028,0010)	A
> Columns	(0028,0011)	A
> Pixel Aspect Ratio	(0028,0034)	A
> Bits Allocated	(0028,0100)	A
> Bits Stored	(0028,0101)	A
> High Bit	(0028,0102)	A
> Pixel Representation	(0028,0103)	A
> Pixel Data	(7FE0,0010)	A
Requested Decimate/Crop Behavior	(2020,0040)	C[1]
Magnification Type	(2010,0060)	A
Smoothing Type	(2010,0080)	A
Polarity	(2020,0020)	A

3.2.1.3.6.7 Conformance for SOP Class Printer

Myrian® uses N-GET for the Printer SOP class to get information from the SCP.

3.2.1.3.7 Optional SOP Classes for Basic Grayscale Print Management Meta

These SOP classes are not yet supported by Myrian®.

3.3 NETWORK INTERFACES

3.3.1 Physical Network Interface

The Intrasense AEs provide DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8. The Intrasense AEs inherit their TCP/IP stack from the operation system upon which it executes. The Berkeley Sockets API is used to access the TCP/IP stack. The Intrasense AEs are indifferent to the physical medium over which TCP/IP executes; it inherits this from the operating system upon which it executes.

3.4 CONFIGURATION

The Intrasense AEs are configurable using text files located in the folder « Documents & Settings\All Users\Application Data\Intrasense\Settings ». The same configuration settings can be set in the User Interface. Configuration is loaded when the application starts. The DICOM settings are all located in the file called « _intrasense.txt », in the « DICOM » section.

```
[DICOM]
PORTSCP=5679
DICOMAE=MYRIAN
```

3.4.1 AE Title/Presentation Address Mapping

[1] Sent only the in case of "expected size" printing.

3.4.1.1 Local AE Titles.

Application Entity	*Default AE Title*	*Default TCP/IP Port*
Primary	MYRIAN	5679

Table 3.4-1: AE TITLE CONFIGURATION TABLE

3.4.2 Parameters

Not applicable.

4 MEDIA INTERCHANGE

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow Diagram

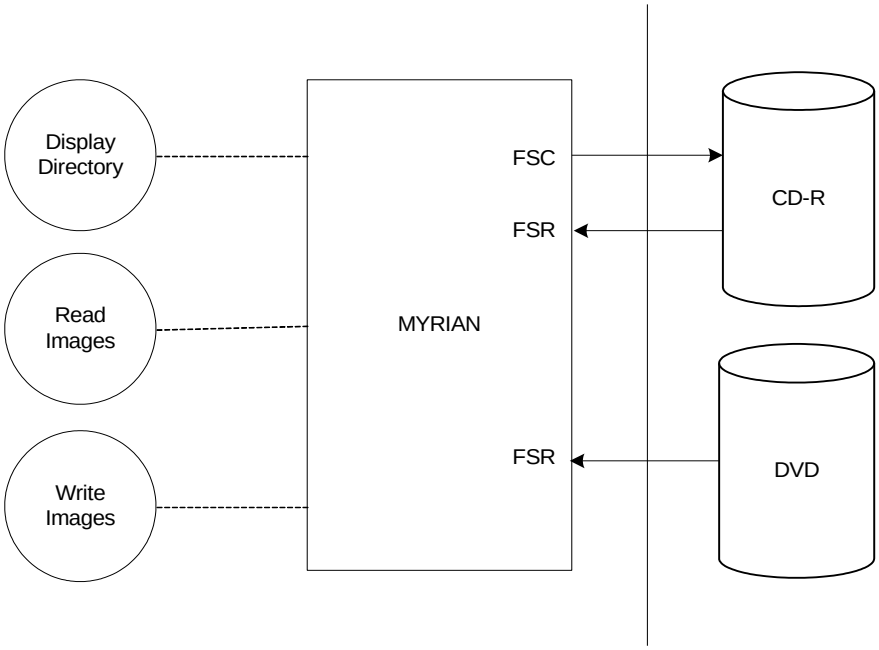

Figure 4.1-1: APPLICATION DATA FLOW DIAGRAM

4.1.2 Functional definitions of AE's

The MYRIAN AE can perform the CD-R Media Storage service as SCU, with the capabilities for :

RWA Display Directory (as FSR),

RWA Write Images (as FSC),

RWA Read Images (as FSR).

4.1.3 Sequencing of Real World Activities

To display the content of a DICO®IR directory, from the local exams list, click the « Import » button. Once in the Import dialog, click the DICO®IR button and select the file you want to list.

To export images to a CD-R, from the local exams list, select the « Export to CD » option. This will open the generic export window. Select a CD Writer and start the export procedure.

4.1.4 File Meta Information for Implementation Class and Version

See Implementation Identifying Information.

5 SUPPORT OF EXTENDED CHARACTER SETS

Any support for Character Sets beyond the Default Character Repertoire in Network and Media Services shall be described here.

- *The behavior when an unsupported character set is received shall be documented;*
- *Character set configuration capabilities, if any, shall be specified;*
- *Mapping and/or conversion of character sets across Services and Instances shall be specified;*
- *Query capabilities for attributes that include non-default character sets, both for the Worklist service class and Query service class shall be specified. Behavior of attributes using extended character sets by a C-FIND, both as SCU and SCP request and response, shall be specified. In particular the handling of Person Names (VR of PN) shall be specified;*
- *The presentation of the characters to a user, i.e. capabilities, font limitations and/or substitutions shall be specified.*

6 SECURITY

6.1 SECURITY PROFILES

Not applicable

6.2 ASSOCIATION LEVEL SECURITY

Not applicable

6.3 APPLICATION LEVEL SECURITY

Not applicable

7 Addendum

7.1 Definitions

Abstract Syntax: A DICOM term which is identical to a DICOM SOP Class; it identifies a set of SOPs which, when taken together, represent a logical grouping. An Abstract Syntax identifies one SOP Class or Meta SOP Class.

ACR: American College of Radiology.

Annotation Box: A DICOM name for annotation text printed on the film or other media.

ANSI: American National Standards Institute.

Application Entity (AE): A DICOM term for defining a particular user at an IP address.

Association: A DICOM term for a communication context which is used by two Application Entities that communicate to one another.

Association Negotiation: The software handshaking that occurs between two DICOM Application Entities to set up an Association.

Attribute: Each DICOM information object has its own set of characteristics or attributes. Each attribute has a name and may have a value (see IOD), depending on its category.

Big Endian: A term for encoding data where the most-significant byte appears first and remaining bytes follow in descending order of significance; sometimes known as “Motorola” format (see Little Endian). (The term is used because of an analogy with the story Gulliver's Travels, in which Jonathan Swift imagined a never-ending fight between the kingdoms of the Big-Endians and the Little-Endians, whose only difference is in where they crack open a hard-boiled egg.)

Calling (Requesting) AE Title: The name used by the receiver in a DICOM Association to indicate which Application Entity it received the data from. It is the AE Title of the AE that is initiating the transfer.

Called (Receiving) AE Title: The name used by the sender in a DICOM Association to indicate which Application Entity it wants to transmit its data to. It is the AE Title of the AE that is receiving the transfer.

Command Element: An encoding of a parameter of a command which conveys this parameter's value.

Command Stream: The result of encoding a set of DICOM Command Elements using the DICOM encoding scheme.

Composite Information Object: A DICOM information object (see IOD) whose attributes contain multiple real world objects.

Conformance: Conformance in the DICOM sense means to be in compliance with the parts of the DICOM Standard.

Conformance Statement: A document whose organization and content are mandated by the DICOM Standard, which allows users to communicate how they have chosen to comply with the Standard in their implementations (see Section 8).

Combined Print Image: a pixel matrix created by superimposing an image and an overlay, the size of which is defined by the smallest rectangle enclosing the superimposed image and overlay.

Data Dictionary: A registry of DICOM Data Elements which assigns a unique tag, a name, value characteristics, and semantics to each Data Element (see the DICOM Data Element Dictionary in DICOM **PS 3.6**).

Data Element: A unit of information as defined by a single entry in the data dictionary. An encoded Information Object Definition (IOD) Attribute that is composed of, at a minimum, three fields: a Data Element Tag, a Value Length, and a Value Field. For some specific Transfer Syntaxes, a Data Element also contains a VR Field where the Value Representation of that Data Element is specified explicitly.

Data Set: Exchanged information consisting of a structured set of Attribute values directly or indirectly related to Information Objects. The value of each Attribute in a Data Set is expressed as a Data Element.

Data Stream: The result of encoding a Data Set using the DICOM encoding scheme (Data Element Numbers and representations as specified by the Data Dictionary).

DICOM: Digital Imaging and Communications in Medicine.

DICOM File: A DICOM File is a file with a content formatted according to the requirements of DICOM **PS 3.10**.

DICOM File Format: The DICOM File Format provides a means to encapsulate in a File the Data Set

representing a SOP Instance related to a DICOM Information Object.

DIMSE: DICOM Message Service Element. This represents an abstraction of a common set of things that a user would do to a data element, would likely use over and over, and would appear in various different contexts.

DIMSE-C: DICOM Message Service Element—Composite.

DIMSE-C services: A subset of the DIMSE services which supports operations on Composite SOP Instances related to composite Information Object Definitions with peer DIMSE-service-users.

DIMSE-N: DICOM Message Service Element—Normalized.

DIMSE-N services: A subset of the DIMSE services which supports operations and notifications on Normalized SOP Instances related to Normalized Information Object Definitions with peer DIMSEservice-users.

Film Box: A Normalized Information Object which is the DICOM name for the equivalent of a sheet of physical film.

Film Session: A Normalized Information Object which is the DICOM name for the equivalent of a typical “study” or “series”.

Image Box: A Normalized Information Object which is the DICOM name for the equivalent of a typical “frame” or “image”.

Information Object Class or Information Object [Definition] (IOD): A software representation of a real object (e.g., CT Image, Study, etc.). An Information Object is generally a list of characteristics (Attributes) which completely describe the object as far as the software is concerned. The formal description of an Information Object generally includes a description of its purpose and the Attributes it possesses.

Information Object Instance or Instance (of an IOD): A software representation of a specific occurrence of a real object or entity, including values for the Attributes of the Information Object Class to which the entity belongs.

Little Endian: A term for encoding data where the least-significant byte appears first and remaining bytes follow in ascending order of significance; sometimes known as ”Intel” format (see Big Endian).

LUT: Lookup Table.

Message: A data unit of the Message Exchange Protocol exchanged between two cooperating DICOM Application Entities. A Message is composed of a Command Stream followed by an optional Data Stream.

Meta SOP Class: A collection or group of related SOP Classes identified by a single Abstract Syntax UID, which, when taken together, represent a logical grouping and which are used together to provide a high-level functionality, e.g., for the purpose of negotiating the use of the set with a single item.

Module: A logical group of the valid attributes of DICOM information objects.

NEMA: National Electrical Manufacturers Association.

Normalized Information Object: A DICOM Information Object (see IOD) whose attributes contain a single real world object. *Note: the differentiation of normalized versus composite information object definitions is not strongly enforced in DICOM 3.0*.

Presentation Context: A Presentation Context consists of an Abstract Syntax plus a list of acceptable Transfer Syntaxes. The Presentation Context defines both what data will be sent (Abstract Syntax) and how the data are encoded to be sent (Transfer Syntax).

Print Job SOP Class: A DICOM representation of a Print Job which consists of a set of IODs which describe a Print Job and a set of services which can be performed on those IODs.

Print Management Service Class or Print Service Class (PSC): A DICOM term for a logical grouping of Service Classes which all involve printing, also referred to as Print Management Service Class (an example of a Meta SOP Class).

Printer SOP Class: A DICOM representation of a Printer which consists of a set of IODs which describe a Printer and a set of services which can be performed on those IODs.

Protocol Data Unit (PDU): A data object which is exchanged by software protocol devices (entities, machines) within a given layer of the protocol stack.

Real-World Activity: Something which exists in the real world and which pertains to specific area of information processing within the area of interest of the DICOM Standard. A Real-World Activity may be represented by one or more SOP Classes.

Real-World Object: Something which exists in the real world and upon which operations may be performed which are within the area of interest of the DICOM Standard. A Real-World Object may be represented through a SOP Instance.

Service Class: A group of operations that a user might want to perform on particular Information Objects. Formally, a structured description of a service which is supported by cooperating DICOM Application Entities using specific DICOM Commands acting on a specific class of Information Object.

Service Class Provider (SCP, Provider, Server): A device which provides the services of a DICOM Service Class or Classes which are utilized by another device (SCU) and which performs operations and invokes notifications on a specific Association.

Service Class User (SCU, User, Client): A device which utilizes the DICOM Service Class or Classes which are provided by another device (SCP) and which invokes operations and performs notifications on a specific Association.

Service-Object Pair (SOP): The combination of a DICOM Information Object and the Service Class which operates upon that object.

SOP Class: A DICOM term which is identical to an Abstract Syntax; it identifies a set of SOPs which, when taken together, represent a logical grouping (see Meta SOP Class).

Storage Service Class (SSC): A DICOM term for a logical grouping of Service Classes which all involve storage of images.

Tag: A unique identifier for an element of information composed of an ordered pair of numbers (a Group Number followed by an Element Number), which is used to identify Attributes and corresponding Data Elements.

TCP/IP: Transmission Control Protocol / Internet Protocol.

Transfer Syntax: A part of the DICOM Presentation Context which specifies a set of encoding rules that allow Application Entities to unambiguously negotiate the encoding techniques (e.g., Data Element structure, byte ordering, compression) they are able to support, thereby allowing these Application Entities to communicate.

Unique Identifier (UID): A globally unique identifier (based on the structure defined by ISO 8824 for OSI Object Identifiers) which is assigned to every DICOM information object as specified by the DICOM Standard and which guarantees global unique identification for objects across multiple countries, sites, vendors and equipment.

Value Representation (VR): A VR is the defined format of a particular data element.

7.2 Abbreviations

Abbreviation	*Meaning*
ACR	American College of Radiology
ACSE	Association Control Service Element
AE	Application Entity
ANSI	American National Standards Institute
AP	Application Profile
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
DHCP	Dynamic Host Control Protocol
DICOM	Digital Imaging and Communications in Medicine
DIMSE DICOM	Message Service Element
DIMSE-C DICOM	Message Service Element-Composite
DIMSE-N DICOM	Message Service Element-Normalized
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
HISPP	Healthcare Informatics Standards Planning Panel
HL7	Health Level 7
IE	Information Entity
IEEE	Institute of Electrical and Electronics Engineers
IOD	Information Object Definition
ISO	International Standards Organization
ISP	International Standardized Profile
JIRA	Japanese Industry Radiology Apparatus
MSDS	Healthcare Message Standard Developers Sub-Committee
NEMA	National Electrical Manufacturers Association
NTP	Network Time Protocol
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
RWA	Real-World Activity
SCP	Service Class Provider
SCU	Service Class User
SNTP	Simple Network Time Protocol
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier

7.3 References

Référence	*Document*	*Version*
PS 3.2	Digital Imaging and Communications in Medicine (DICOM) Part 2: Conformance	2009
PS 3.3	Digital Imaging and Communications in Medicine (DICOM) Part 3: Information Object Definitions	2009
PS 3.4	Digital Imaging and Communications in Medicine (DICOM) Part 4: Service Class Specifications	2009
PS 3.5	Digital Imaging and Communications in Medicine (DICOM) Part 5: Data Structures and Encoding	2009
PS 3.6	Digital Imaging and Communications in Medicine (DICOM) Part 6: Data Dictionary	2009
PS 3.10	Digital Imaging and Communications in Medicine (DICOM) Part 10: Media Storage and File Format for Media Interchange	2009
PS 3.11	Digital Imaging and Communications in Medicine (DICOM) Part 11: Media Storage Application Profiles	2009
PS 3.15	Digital Imaging and Communications in Medicine (DICOM) Part 15: Security and System Management Profiles	2009
PS 3.16	Digital Imaging and Communications in Medicine (DICOM) Part 16: Content Mapping Resource	2009