

MAGNETOM Software Numaris 3 VB33D

MR

DICOM Conformance Statement

V 2.0

Status: released

12-Oct-2000

E.Seeberger

MRES

Copyright by SIEMENS AG B Med Erlangen

Copyright © Siemens AG 2000. All rights reserved.

Author		Approved by	
Name/Dept.:	.....	Name/Dept.:	.....
Date:	.....	Date:	.....
Signature:	.....	Signature:	.....

History

Document History

Version	Date of Issue	Author	Change & Reason of Change / CHARM ID
V 0.1	1. February 1999	E. Seeberger	Creation of the DICOM Conformance Statement.
V 1.1	15. September 2000	E. Seeberger	Update VB33D

Released Versions History

Version	Release Date	Product Version
V 1.0	1. March 1999	Release VB33A
V 2.0	12. October 2000	Release VB33D

Table of Contents

History	2
Table of Contents.	3
List of Tables	7
1 Introduction	8
1.1 Purpose	8
1.2 Scope	8
1.3 Definitions, Abbreviations.	8
1.3.1 Definitions	8
1.3.2 Abbreviations.	8
1.4 References	9
1.5 Connectivity and Interoperability	9
2 Implementation Model Storage	10
2.1 Application Data Flow Diagram.	10
2.2 Functional Definitions of Application Entities	10
2.3 Sequencing of real World Activities	11
3 Application Entity Specification Storage.	12
3.1 Storage AEs Specification.	12
3.1.1 Association Establishment Policies	12
3.1.1.1 General	12
3.1.1.2 Number of Associations	12
3.1.1.3 Asynchronous Nature.	13
3.1.1.4 Implementation Identifying Information	13
3.1.2 Association Initiation Policy	13
3.1.2.1 Associated Real-World Activity	13
3.1.2.1.1 Associated Real-World Activity -Send Image Objects to a remote Node	13
3.1.2.1.2 Proposed Presentation Contexts	14
3.1.2.1.3 SOP Specific Conformance Statement to Storage SOP classes	14
3.1.2.1.4 MR Image IOD Modules	14
3.1.2.1.5 Image Pixel Attribute Description for Grayscale Images	22
3.1.3 Association Acceptance Policy.	23
3.1.3.1 Associated Real-World Activity	23
3.1.3.1.1 Associated Real-World Activity - Receiving Image Objects from a remote Node	23
3.1.3.1.2 Proposed Presentation Contexts	23
3.1.3.1.3 SOP Specific Conformance Statement	24
3.1.3.1.4 Image Pixel Attribute Acceptance Criterion for Grayscale Images	24

Copyright © Siemens AG 2000. All rights reserved.

3.1.3.2	Presentation Context Acceptance Criterion	25
3.1.3.3	Transfer Syntax Selection Policies.	25
4	Implementation Model Query/Retrieve.	26
4.1	Application Data Flow Diagram	26
4.2	Functional Definitions of Application Entities	26
4.3	Sequencing of real World Activities	27
5	Application Entity Specification Query/Retrieve.	28
5.1	Query/Retrieve Service AEs Specification	28
5.1.1	Association Establishment Policies	29
5.1.1.1	General.	29
5.1.1.2	Number of Associations	29
5.1.1.3	Asynchronous Nature	29
5.1.1.4	Implementation Identifying Information.	29
5.1.2	Association Acceptance Policy	29
5.1.2.1	Real World Activity - Find SCP	30
5.1.2.1.1	Associated Real-World Activity - Find SCP	30
5.1.2.1.2	Proposed Presentation Contexts - Find SCP	30
5.1.2.1.3	SOP Specific Conformance Statement - Patient Root	31
5.1.2.1.4	SOP Specific Conformance Statement - Study Root	32
5.1.2.1.5	SOP Specific Conformance Statement - Patient/Study only	33
5.1.2.1.6	The C-Find SCP Status Codes	34
5.1.2.2	Real World Activity - Move SCP	34
5.1.2.2.1	Associated Real-World Activity - Move SCP	34
5.1.2.2.2	Proposed Presentation Contexts - Move SCP.	35
5.1.2.2.3	SOP Specific Conformance Statement - Move SCP.	36
6	Implementation Model Print.	37
6.1	Application Data Flow Diagram	37
6.2	Functional Definitions of Application Entities	37
6.3	Sequencing of real World Activities	38
7	Application Entity Specification Print	39
7.1	Print Management AE Specification	39
7.1.1	Basic Print Management Meta SOP Class	39
7.1.1.1	Basic film session SOP class.	39
7.1.1.1.1	Used attributes	39
7.1.1.1.2	Status handling.	40
7.1.1.2	Basic Film Box SOP class	40
7.1.1.2.1	Used attributes	41
7.1.1.2.2	Status handling.	42
7.1.1.3	Basic Grayscale Image Box SOP Class	43
7.1.1.3.1	Used attributes	43
7.1.1.3.2	Status handling.	44
7.1.1.4	Printer SOP Class	44

Copyright © Siemens AG 2000. All rights reserved.

7.1.1.4.1	Used attributes	44
7.1.2	Association Establishment Policies	45
7.1.2.1	General	45
7.1.2.2	Number of Associations	45
7.1.2.3	Asynchronous Nature.	45
7.1.2.4	Implementation Identifying Information	45
7.1.3	Association Initiation Policy	45
7.1.3.1	Associated Real-World Activity	46
7.1.3.1.1	Associated Real-World Activity	46
7.1.3.1.2	Proposed Presentation Contexts	46
7.1.3.1.3	SOP Specific Conformance Statement	47
8	Implementation Model Worklist	48
8.1	Application Data Flow Diagram.	48
8.2	Functional Definitions of Application Entities	48
8.3	Sequencing of real World Activities	48
9	Application Entity Specification Worklist	49
9.1	Modality Worklist Service AEs Specification.	49
9.1.1	Association Establishment Policies	49
9.1.1.1	General	49
9.1.1.2	Number of Associations	49
9.1.1.3	Asynchronous Nature.	49
9.1.1.4	Implementation Identifying Information	49
9.1.2	Association Initiation Policy	50
9.1.2.1	Real World Activity	50
9.1.2.1.1	Associated Real-World Activity	50
9.1.2.1.2	Proposed Presentation Contexts	50
9.1.2.1.3	SOP Specific Conformance Statement	51
10	Communication Profiles.	57
10.1	Supported Communication Stacks.	57
10.1.1	OSI Stack.	57
10.1.2	TCP/IP Stack	57
10.1.2.1	API	57
10.1.2.2	Physical Media Support.	57
10.1.3	Point-to-Point Stack	57
11	Extensions/Specializations/Privatizations	58
11.1	Private Elements for Storage SOP Classes	58
11.1.1	Registry of Image Annotation Attributes.	58
12	Configuration.	62
12.1	AE Title / Presentation Address Mapping.	62
12.1.1	DICOM Storage AE Title	62
12.1.2	DICOM Query/Retrieve AE Title	62

Copyright © Siemens AG 2000. All rights reserved.

12.1.3 DICOM Print AE Title . . . . .	.62
12.1.4 DICOM Modality Worklist AE Title . . . . .	.63
12.2 Configurable Parameters . . . . .	.63
13 Support of Extended Character Sets . . . . .	.64

List of Tables

Table 1:	Siemens MR DICOM Products	8
Table 2:	SOP Classes as an SCU	12
Table 3:	SOP Classes as SCP	12
Table 4:	Initiation presentation context	14
Table 5:	Acceptable presentation contexts	23
Table 6:	SOP Classes as an SCP.....	28
Table 7:	Patient level attributes	31
Table 8:	Study level attributes	31
Table 9:	Series level attributes.....	32
Table 10:	Image level attributes.....	32
Table 11:	Study level attributes	32
Table 12:	Series level attributes.....	33
Table 13:	Image level attributes.....	33
Tabelle 14:	C-Find return status	34
Table 15:	C-MOVE return status.....	36
Table 16:	Meta SOP Classe set as an SCU.....	39
Table 17:	Basic Film Session N-CREATE attributes.....	39
Table 18:	Basic Film Session SOP status	40
Table 19:	Film Box N-CREATE attributes	41
Tabelle 20:	Basic Film Box SOP status.....	42
Table 21:	Basic Grayscale Image Box N-SET attributes	43
Table 22:	Basic Grayscale Image Box SOP status	44
Table 23:	Printer N-EVENT report	44
Table 24:	Printer N-GET attributes	44
Table 25:	Presentation Context.....	46
Table 26:	SOP Classes as an SCU	49
Table 27:	Proposed presentation contexts	50
Table 28:	Scheduled Procedure Step Search Key Attributtes.....	51
Table 29:	Patient Identification Search Key Attributtes.....	51
Table 30:	SOP Common Return Key Attributtes	52
Table 31:	Scheduled Procedure Step Return Key Attributtes.....	52
Table 32:	Requested Procedure Return Key Attributtes.....	53
Table 33:	Imaging Service Request Return Key Attributtes	53
Table 34:	Visit Identification Return Key Attributtes	53
Table 35:	Visit Status Return Key Attributtes	54
Table 36:	Visit Relationship Return Key Attributte	54
Table 37:	Patient Identification Return Key Attributtes.....	54
Table 38:	Patient Demographic Return Key Attributte	54
Table 39:	Patient Medical Return Key Attributte	55
Table 40:	C-FIND Response Status.....	55

1 Introduction

1.1 Purpose

This DICOM Conformance Statement is written according to part PS 3.2 of [1].

The applications described in this DICOM Conformance Statement are the SIEMENS MR products using software VB33D. The MR DICOM network implementation acts as SCU and SCP for the DICOM Storage, as SCP for the Query/Retrieve service and as SCU for the DICOM Basic Print and Modality Worklist service.

1.2 Scope

This DICOM Conformance Statement refers to SIEMENS MR products using software VB33D. The following table relates VB33D software names to SIEMENS MR products.

Table 1: Siemens MR DICOM Products

Software Name	SIEMENS MR Product
Numaris VB33D	Magnetom Vision
Numaris VB33D	Magnetom Expert
Numaris VB33D	Magnetom Impact
Numaris VB33D	Magnetom Open
Numaris VB33D	Magnetom Open Viva

Copyright © Siemens AG 2000. All rights reserved.

1.3 Definitions, Abbreviations

1.3.1 Definitions

DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element with Composite information objects

1.3.2 Abbreviations

ACR	American College of Radiology
AE	DICOM Application Entity
ASCII	American Standard Code for Information Interchange
HIS	Hospital Information System
IOD	DICOM Information Object Definition

ISO	International Standard Organisation
R	Required Key Attribute
NEMA	National Electrical Manufacturers Association
O	Optional Key Attribute
RIS	Radiology Information System
PDU	DICOM Protocol Data Unit
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM server)
SOP	DICOM Service-Object Pair
U	Unique Key Attribute

1.4 References

- [1] Digital Imaging and Communications in Medicine (DICOM) 3.0, NEMA PS 3.1-14, 1998

1.5 Connectivity and Interoperability

The implementation of the Siemens DICOM interface has been carefully tested to assure correspondence with this Conformance Statement. But the Conformance Statement and the DICOM standard does not guarantee interoperability of Siemens modalities and modalities of other vendors. The user must compare the relevant DICOM Conformance Statements and if a successful interconnection should be possible, the user is responsible to specify an appropriate test suite and to validate the interoperability, which is required. A network environment may need additional functions out of the scope of DICOM.

2 Implementation Model Storage

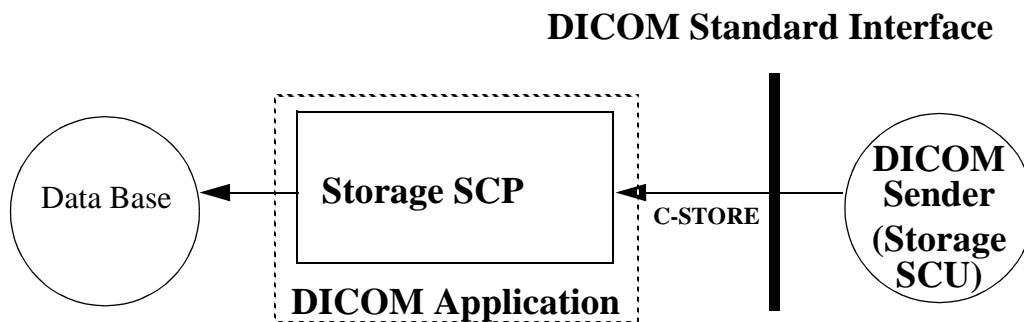
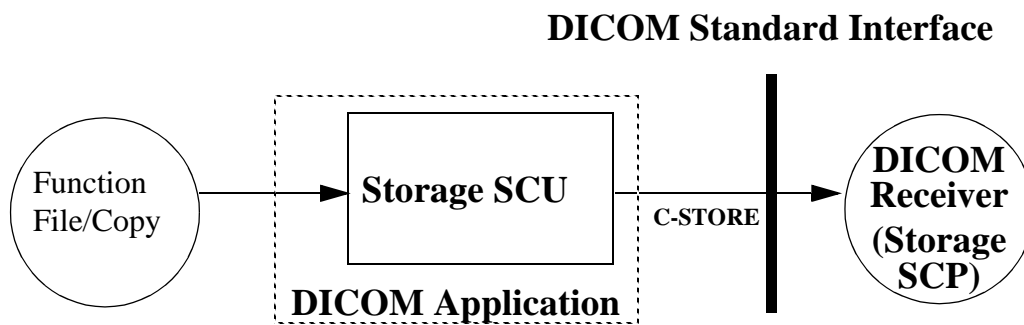
The Siemens MR DICOM Application Entity originates associations for Storage of DICOM Composite Information Objects in Remote Application Entities.

2.1 Application Data Flow Diagram

The Numaris DICOM network implementation is a UNIX application and acts as SCU and SCP for the C-Store DICOM network service.

These applications are started automatically and will be invoked via network.

The DICOM send service will be activated through the File/Copy platform. The images will be converted to DICOM 3.0.



2.2 Functional Definitions of Application Entities

All components of the Siemens MR DICOM Storage SCP application are operating as background daemon processes. They are existing, when the machine is powered on and waiting for tasks.

2.3 Sequencing of real World Activities

The MR acquisition system obtains DICOM Worklist information regarding scheduled procedures from HIS/RIS and includes this information in the series of the acquired DICOM MR images. If the DICOM Worklist information is not available from HIS/RIS it will be typed by user during the registration of the patient.

3 Application Entity Specification Storage

3.1 Storage AEs Specification

The MR Storage service class user application provides one AE being used when initiating associations to remote DICOM nodes.

SIEMENS MR DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 2: SOP Classes as an SCU

SOP Class Name	SOP Class UID
MR Image Information Object Storage	1.2.840.10008.5.1.4.1.1.4

SIEMENS MR DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as SCP:

Table 3: SOP Classes as SCP

SOP Class Name	SOP Class UID
MR Image Information Object Storage	1.2.840.10008.5.1.4.1.1.4
CT Image Information Object Storage	1.2.840.10008.5.1.4.1.1.2
SC (Secondary Capture) Image Information Object Storage	1.2.840.10008.5.1.4.1.1.7
Verification	1.2.840.10008.1.1

3.1.1 Association Establishment Policies

3.1.1.1 General

The configuration of the Siemens MR DICOM application defines the Application Entity Titles, the port numbers and of course the host name and net address.

3.1.1.2 Number of Associations

The Siemens MR DICOM application initiates several associations at a time, one for each transfer request being processed.

3.1.1.3 Asynchronous Nature

The Siemens MR DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

3.1.1.4 Implementation Identifying Information

The Siemens MR DICOM software provides a single Implementation Class UID of

- "1.3.12.2.1107.5.2.1.seriesnumber" - Magnetom Impact
 - "1.3.12.2.1107.5.2.2.seriesnumber" - Magnetom Expert
 - "1.3.12.2.1107.5.2.3.seriesnumber" - Magnetom Open
 - "1.3.12.2.1107.5.2.4.seriesnumber" - Magnetom Vision
- and an Implementation Version Name of
- "VB33A".

3.1.2 Association Initiation Policy

The Siemens MR DICOM application attempts to initiate a new association for

- DIMSE-C-STORE
- service operations.

3.1.2.1 Associated Real-World Activity

3.1.2.1.1 Associated Real-World Activity -Send Image Objects to a remote Node

The associated Real-World activity is a C-STORE request initiated by an internal server process. If the process successfully establishes an association to a remote Application Entity, it will transfer each image one after another via the open association. If the C-STORE Response from the remote Application contains a status other than Success the association is aborted.

The DICOM targets are configured at installation time.

3.1.2.1.2 Proposed Presentation Contexts

The Siemens MR DICOM application will propose Presentation Contexts as shown in the following table:

Table 4: Initiation presentation context

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
MR Image Storage Service class	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		

3.1.2.1.3 SOP Specific Conformance Statement to Storage SOP classes

The DICOM images created by Siemens MR DICOM application conform to the DICOM IOD definitions. But they will contain additional private elements which have to be discarded by a DICOM system when modifying the image.

The DICOM nodes are responsible for data consistency when modifying images. All unknown private attributes have to be removed upon modification!

3.1.2.1.4 MR Image IOD Modules

Patient Module

Attribute Name	Tag	Supported Values
Patient's Name	0010,0010	set by registration or worklist
Patient ID	0010,0020	set by registration or worklist
Patient's Birth Date	0010,0030	set by registration or worklist
Patient's Sex	0010,0040	set by registration or worklist

General Study Module

Attribute Name	Tag	Supported Values
Study Instance UID	0020,000D	set by internal data base or worklist
Study Date	0008,0020	set by registration
Study Time	0008,0030	set by registration
Referring Physician's Name	0008,0090	set by registration or worklist
Study ID	0020,0010	set by internal data base
Accession Number	0008,0050	set by registration or worklist
Study Description	0008,1030	set by registration
Name of Physician(s) Reading Study	0008,1060	set by registration

Patient Study Module

Attribute Name	Tag	Supported Values
Admitting Diagnoses Description	0008,1080	set by registration
Patient's Age	0010,1010	set by registration or worklist
Patient's Weight	0010,1030	set by registration or worklist

General Series Module

Attribute Name	Tag	Supported Values
Modality	0008,0060	MR
Series Instance UID	0020,000E	set by internal data base
Series Number	0020,0011	set by internal data base
Series Date	0008,0021	set by internal data base
Series Time	0008,0031	set by internal data base

Attribute Name	Tag	Supported Values
Performing Physicians' Name	0008,1050	set by registration
Series Description	0008,103E	set by acquisition
Operators' Name	0008,1070	set by registration
Body Part Examined	0018,0015	Defined terms: SKULL CSPINE TSPINE LSPINE SSPINE COCCYX CHEST CLAVICLEI BREAST ABDOMEN PELVISI HIP SHOULDER ELBOW KNEE ANKLE HAND FOOT EXTREMITY HEAD HEART NECK LEG ARM
Patient Position	0018,5100	set by registration
Requested Procedure ID	0040,1001	set by worklist. The attribute is coded not as sequence to be compatible with many worklist SCP's.

Frame of Reference Module

Attribute Name	Tag	Supported Values
Frame of Reference UID	0020,0052	set by acquisition
Position Reference Indicator	0020,1040	no value

General Equipment Module

Attribute Name	Tag	Supported Values
Manufacturer	0008,0070	SIEMENS
Institution Name	0008,0080	set by configuration
Station Name	0008,1010	set by configuration
Manufacturer's Model Name	0008,1090	MAGNETOM xxx
Device Serial Number	0018,1000	set by Siemens
Software Versions	0018,1020	VB33D
Date of Last Calibration	0018,1200	set by configuration
Time of Last Calibration	0018,1201	set by configuration

General Image Module

Attribute Name	Tag	Supported Values
Image Number	0020,0013	set by acquisition
Image Date	0008,0023	set by acquisition
Image Time	0008,0033	set by acquisition
Image Type	0008,0008	set by acquisition
Acquisition Number	0020,0012	set by acquisition
Acquisition Date	0008,0022	set by acquisition
Acquisition Time	0008,0032	set by acquisition

Attribute Name	Tag	Supported Values
Image Comments	0020,4000	set by registration

Image Plane Module

Attribute Name	Tag	Supported Values
Pixel Spacing	0028,0030	set by acquisition
Image Orientation	0020,0037	set by acquisition
Image Position	0020,0032	set by acquisition
Slice Thickness	0018,0050	set by acquisition
Slice Location	0020,1041 0020, 0050	set by acquisition perpendicular distance between visible sight and image plane center with configurable plus/minus sign

Image Pixel Module

Attribute Name	Tag	Supported Values
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	MONOCHROME2
Rows	0028,0010	set by acquisition
Columns	0028,0011	set by acquisition
Bits Allocated	0028,0100	16
Bits Stored	0028,0101	12
High Bit	0028,0102	11
Pixel Representation	0028,0103	0
Pixel Data	7FE0,0010	pixel data stream

Contrast/Bolus Module

Attribute Name	Tag	Supported Values
Contrast/Bolus Agent	0018,0010	NONE or APPLIED

MR Image Module

Attribute Name	Tag	Supported Values
Image Type	0008,0008	Defined terms for value 3: IMAGE ADDITION CARDIAC MAGNIFICATION PROJECTION IMAGE MIRROR MPR NEGATION NORMALIZATION ROAM ROTATION SCROLL SUBTRACTION
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	MONOCHROME2
Bits Allocated	0028,0100	16
Scanning Sequence	0018,0020	Enumerated values: RM = research mode EP = echo planar IR = Inversion Recovery

Copyright © Siemens AG 2000. All rights reserved.

Attribute Name	Tag	Supported Values
Sequence Variant	0018,0021	Defined terms: AN = angio OSP = oversampling MTC = magnetization transfer SK = segmented k-space NONE
Scan Options	0018,0022	Defined terms: RG = respiratory gating FS = fat saturation CG = cardiac gating PPG = peripheral pulse gating
MR Acquisition Type	0018,0023	Enumerated values: 2D = 2D image 3D = 3D image
Repetition Time	0018,0080	set by acquisition
Echo Time	0018,0081	set by acquisition
Echo Train Length	0018,0091	set by acquisition
Inversion Time	0018,0082	set by acquisition
Trigger Time	0018,1060	set by acquisition
Sequence Name	0018,0024	set by acquisition
Angio Flag	0018,0025	set by acquisition
Number of Averages	0018,0083	set by acquisition
Imaging Frequency	0018,0084	set by acquisition
Imaged Nucleus	0018,0085	set by acquisition
Echo Number	0018,0086	set by acquisition
Magnetic Field Strength	0018,0087	set by acquisition
Spacing Between Slices	0018,0088	set by acquisition
Percent Sampling	0018,0093	set by acquisition
Percent Phase Field of View	0018,0094	set by acquisition
Receiving Coil	0018,1250	set by acquisition

Attribute Name	Tag	Supported Values
Acquisition Matrix	0018,1310	set by acquisition
Phase Encoding Direction	0018,1312	set by acquisition
Flip Angle	0018,1314	set by acquisition
SAR	0018,1316	set by acquisition

Overlay Plane Module

Attribute Name	Tag	Supported Values
Overlay Rows	60xx,0010	set by acquisition
Overlay Columns	60xx,0011	set by acquisition
Overlay Type	60xx,0040	G
Origin	60xx,0050	1
Overlay Bits Allocated	60xx,0100	16
Bit Position	60xx,0102	12

VOI LUT Module

Attribute Name	Tag	Supported Values
Window Center	0028,1050	set by acquisition
Window Width	0028,1051	set by acquisition

SOP Common Module

Attribute Name	Tag	Supported Values
SOP Class UID	0008,0016	MR Storage SOP Class UID
SOP Instance UID	0008,0018	set by internal data base
Specific Character Set	0008,0005	ISO_IR 100

3.1.2.1.5 Image Pixel Attribute Description for Grayscale Images

The Siemens MR DICOM application supports the and monochrome 2 photometric interpretation with the unsigned integer 16 bit gray scale pixel and graphic overlay format. The lower 12 bits are used for pixel and the higher 4 bits are used for the graphic overlay:

Pixel plane

- + samples per pixel (attribute 0028, 0002) = 1
- + photometric interpretation (attribute 0028,0004) = "MONOCHROME2"
- + pixel representation (attribute 0028, 0103) = 0
- + bits allocated (attribute 0028, 0100) = 16
- + bits stored (attribute 0028,0101) = 12
- + high bit (attribute 0028,0102) = 11.

3.1.3 Association Acceptance Policy

The Siemens MR DICOM application attempts to accept a new association for

- DIMSE-C-ECHO
- DIMSE-C-STORE

service operations.

3.1.3.1 Associated Real-World Activity

3.1.3.1.1 Associated Real-World Activity - Receiving Image Objects from a remote Node

The daemon process `dtk_dircv` will accept an association and will receive any images transmitted on that association and store the images on disk in the own data base.

The DICOM nodes are configured at installation time.

3.1.3.1.2 Proposed Presentation Contexts

The Siemens MR DICOM application will propose Presentation Contexts as shown in the following table.

Table 5: Acceptable presentation contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
MR Image Storage Service class	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
CT Image Storage Service class	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		

Table 5: Acceptable presentation contexts

SC Image Storage Service class	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian Transfer Syntax,	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		

3.1.3.1.3 SOP Specific Conformance Statement

The Siemens MR DICOM application conforms to the Full Storage Service Class at Level 2 for original Siemens MR IOD's and Level 1 for foreign MR IOD's. In the event of a successful C-Store operation, the image has successfully been written on disk in the Siemens MR image format.

The MR DICOM Receiver "dtk_dircv" returns the status Success upon successful operation otherwise one of the following status codes is returned and the association aborted:

- Refused (A700):
This error status indicates a lack of Resources (e.g. not enough disk space) on the MR modality.
- Error (A900 or C000):
An error occurred while processing the image which makes it impossible to proceed. The image will not be stored and the association aborted.

3.1.3.1.4 Image Pixel Attribute Acceptance Criterion for Grayscale Images

The Siemens MR DICOM application accepts the monochrome 2 photometric interpretation pixel format and graphic overlay with unsigned integer and 16 bits allocated. Accepted values:

Pixel plane

- samples per pixel (attribute 0028, 0002) = 1
- photometric interpretation (attribute 0028,0004) = "MONOCHROME2"
- pixel representation (attribute 0028, 0103) = 0,1
- bits allocated (attribute 0028, 0100) = 16
- bits stored (attribute 0028,0101) = 12
- high bit (attribute 0028,0102) = 11

Overlay plane

- + rows (attribute 60xx, 0010) = same as attribute 0028, 0010
- + columns (attribute 60xx, 0011) = same as attribute 0028, 0011

- + overlay type (attribute 60xx, 0040) = "G"
- + origin (attribute 60xx, 0050) = 1,1
- + bits allocated (attribute 60xx, 0100) = 16
- + bit position (attribute 60xx, 0102) = 12
- + overlay data (attribute 60xx, 3000) = supported.

The Siemens MR DICOM application accepts also the monochrome 2 photometric interpretation pixel format with binary 2's complement integer and 16 bits allocated without graphic overlay. Accepted values:

Pixel plane

- samples per pixel (attribute 0028, 0002) = 1
- photometric interpretation (attribute 0028,0004) = "MONOCHROME2"
- pixel representation (attribute 0028, 0103) = 1
- bits allocated (attribute 0028, 0100) = 16
- bits stored (attribute 0028,0101) = 16
- high bit (attribute 0028,0102) = 15.

3.1.3.2 Presentation Context Acceptance Criterion

The Siemens MR DICOM application will accept any number of verification or storage SOP classes that are listed above. There is no limit on the number of presentation contexts accepted. In the event that the Siemens MR DICOM application runs out of resources, it will reject the association request.

3.1.3.3 Transfer Syntax Selection Policies

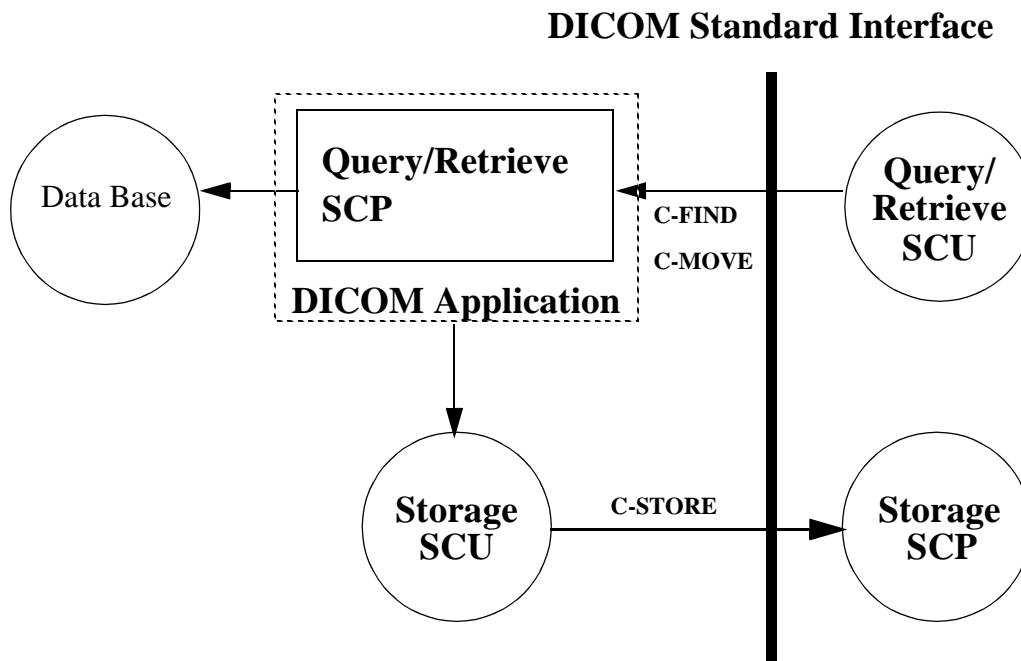
The Siemens MR DICOM application currently only supports the Implicit VR Little Endian, the Explicit VR Little Endian and Explicit VR Big Endian transfer syntax. Any proposed presentation context which includes one of these transfer syntaxes will be accepted. Any proposed presentation context that does not include one of these transfer syntaxes will be rejected. The Explicit VR Big Endian transfer syntax will be preferred.

4 Implementation Model Query/Retrieve

The query/retrieve service class defines an application-level class of services which facilitates the management of images and patient data against the well defined information model of DICOM and allows a DICOM AE to retrieve images from a remote DICOM node or to request a remote DICOM AE to initiate a transfer of images to another DICOM AE. The MR DICOM query/retrieve application supports the query/retrieve services to act as SCP.

4.1 Application Data Flow Diagram

The MR DICOM network implementation is a UNIX application and acts as SCP for the query/retrieve network service.



Copyright © Siemens AG 2000. All rights reserved.

4.2 Functional Definitions of Application Entities

The query/retrieve SCU requests the query/retrieve SCP to perform a match to the keys specified in the request and a C-MOVE DIMSE service initiates a C-STORE suboperation to transfer an image from a Storage SCU to a Storage SCP.

The query/retrieve SCP responds to C-FIND DIMSE services and a C-MOVE involves the Siemens MR DICOM query/retrieve SCP application to initiate a C-STORE suboperation to a Storage SCP.

All components of the Siemens MR DICOM query/retrieve SCP applications are operating as background daemon processes. They are launched at consol startup and respond to queries based on the records stored in the MR database.

4.3 Sequencing of real World Activities

not applicable.

5 Application Entity Specification Query/Retrieve

5.1 Query/Retrieve Service AEs Specification

The Query/Retrieve SCP responds to queries based on the records based on its database and images will be send to the requesting SCU or to a different storage destination.

SIEMENS MR DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as SCP:

Table 6: SOP Classes as an SCP

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

Note

See also the Storage DICOM Conformance Statement of the Siemens MR DICOM application to compare for conformance of the C-STORE sub-operation generated by the C-MOVE DIMSE service and compare also the Storage Service SOP classes described in the Storage DICOM Conformance Statement of the modality to which the images shall be transferred initiated by the C-MOVE DIMSE service.

5.1.1 Association Establishment Policies

5.1.1.1 General

The configuration of the Siemens MR DICOM query/retrieve application defines the Application Entity Titles, the port numbers and of course the host name and net address.

5.1.1.2 Number of Associations

The Siemens MR DICOM application initiates one/several association(s) at a time, one for each transfer request being processed.

5.1.1.3 Asynchronous Nature

The Siemens MR DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

5.1.1.4 Implementation Identifying Information

The Siemens MR DICOM software provides a single Implementation Class UID of

- "1.3.12.2.1107.5.2.1.seriesnumber" - Magnetom Impact
- "1.3.12.2.1107.5.2.2.seriesnumber" - Magnetom Expert
- "1.3.12.2.1107.5.2.3.seriesnumber" - Magnetom Open
- "1.3.12.2.1107.5.2.4.seriesnumber" - Magnetom Vision

and an Implementation Version Name of

- "VB33A".

5.1.2 Association Acceptance Policy

The Query/Retrieve SCU and SCP establish an association by using the DICOM association services. During association establishment the Query/Retrieve application entities negotiate the supported SOP classes to exchange the capabilities of the SCU and the SCP.

The following DIMSE-C operations are supported as SCP:

- C-FIND
- C-MOVE

5.1.2.1 Real World Activity - Find SCP**5.1.2.1.1 Associated Real-World Activity - Find SCP**

The associated Real-World activity is to respond to query requests to an SCU with the query model Patient Root, Study Root and Patient/Study Only.

5.1.2.1.2 Proposed Presentation Contexts - Find SCP

The Siemens MR DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Find	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Find	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient/Study Only Query/Retrieve Find	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Note

C-FIND Extended Negotiation will be supported by the SCP, also the Retrieve AE Title (0008,0054) in the response identifier.

5.1.2.1.3 SOP Specific Conformance Statement - Patient Root

The Siemens MR DICOM Query/Retrieve SCP supports hierarchical and relational queries with all mandatory and optional search keys. The following four tables describe the search keys for the four levels of query that the SCP supports for Patient Root.

Table 7: Patient level attributes

Attribute name	Tag	Usage SCU/SCP
Patient name	(0010,0010)	R
Patient id	(0010,0020)	U
Patient's birth date	(0010,0030)	O
Patient's sex	(0010,0040)	O
No. of patient related studies	(0010,1200)	O
No. of patient related series	(0020,1202)	O
No. of patient related images	(0020,1204)	O

Table 8: Study level attributes

Attribute name	Tag	Usage SCU/SCP
Study instance UID	(0020,000D)	U
Study id	(0020,0010)	R
Study date	(0008,0020)	R
Study time	(0008,0030)	R
Accession number	(0008,0050)	R
Referring physician's name	(0008,0090)	O
Patient's age	(0010,1010)	O
Patient's weight	(0010,1030)	O
Number of Study Related Images	(0010,1208)	O

Table 9: Series level attributes

Attribute name	Tag	Usage SCU/SCP
Series instance UID	(0020,000E)	U
Series number	(0020,0011)	R
Modality	(0008,0060)	R

Table 10: Image level attributes

Attribute name	Tag	Usage SCU/SCP
SOP instance UID	(0008,0018)	U
Image number	(0020,0013)	R

5.1.2.1.4 SOP Specific Conformance Statement - Study Root

The Siemens MR DICOM Query/Retrieve SCP supports hierarchical and relational queries with all mandatory and optional search keys. The following three tables describe the search keys for the three levels of query that the SCP supports for Study Root.

Table 11: Study level attributes

Attribute name	Tag	Usage SCU/SCP
Study instance UID	(0020,000D)	U
Study id	(0020,0010)	R
Study date	(0008,0020)	R
Study time	(0008,0030)	R
Accession number	(0008,0050)	R
Patient name	(0010,0010)	R
Patient id	(0010,0020)	R
Referring physician's name	(0008,0090)	O
Patient's birth date	(0010,0030)	O
Patient's sex	(0010,0040)	O
Patient's age	(0010,1010)	O

Table 11: Study level attributes

Attribute name	Tag	Usage SCU/SCP
Patient's weight	(0010,1030)	O
Number of Study Related Images	(0010,1208)	O

Table 12: Series level attributes

Attribute name	Tag	Usage SCU/SCP
Series instance UID	(0020,000E)	U
Series number	(0020,0011)	R
Modality	(0008,0060)	R

Table 13: Image level attributes

Attribute name	Tag	Usage SCU/SCP
SOP instance UID	(0008,0018)	U
Image number	(0020,0013)	R

Copyright © Siemens AG 2000. All rights reserved.

5.1.2.1.5 SOP Specific Conformance Statement - Patient/Study only

The Siemens MR DICOM Query/Retrieve SCP supports hierarchical and relational queries with all mandatory and optional search keys. The search keys for Patient/Study only are the same as for Patient Root.

5.1.2.1.6 The C-Find SCP Status Codes*Tabelle 14: C-Find return status*

Service Status	Meaning	Protocol Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

5.1.2.2 Real World Activity - Move SCP**5.1.2.2.1 Associated Real-World Activity - Move SCP**

The associated Real-World activity is to respond to retrieve requests to an SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class Conformance Statement describes the C-STORE service which is generated by the C-MOVE service.

5.1.2.2.2 Proposed Presentation Contexts - Move SCP

The Siemens MR DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Move	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Move	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient/Study Only Query/Retrieve Move	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Note

C-MOVE Extended Negotiation will be supported by the SCP.

Copyright © Siemens AG 2000. All rights reserved.

5.1.2.2.3 SOP Specific Conformance Statement - Move SCP

At association establishment time the C-MOVE presentation context shall be negotiated. The C-STORE sub-operations is done on a different association, specified in the C-MOVE request, to transfer images to them same or another SCP of the Storage Service Class.

The Move SCP returns following status codes:

Table 15: C-MOVE return status

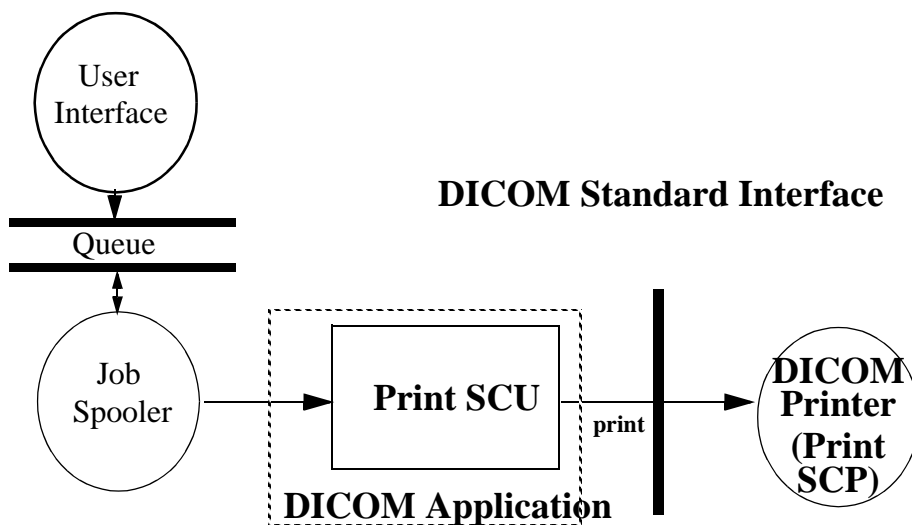
Service Status	Meaning	Protocol Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform suboperations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
Failed	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

6 Implementation Model Print

The Print Management Service Classes define an application-level class of services which facilitate the printing of images on a hardcopy medium. The print management SCU and print management SCP are peer DICOM print management application entities. The MR DICOM print application supports the print management DIMSE services to act as SCU.

6.1 Application Data Flow Diagram

The MR-DICOM network implementation is a UNIX application and acts as SCU for the print management network service.



Copyright © Siemens AG 2000. All rights reserved.

6.2 Functional Definitions of Application Entities

The user invokes a print job and the SCU uses the SOP classes of a film session, a film box and image boxes for acquiring all the information which is required for a film session. The N-ACTION is used to print the film session.

The MR DICOM Basic Print application offer the user the following features:

- + user functions are Filming/Setting (select documentation features), Filming/Setting/Configuration (film format and size properties, image quality properties), Filming/Interactive (expose the displayed image), Filming/List (expose images in batch jobs) and Filming/Jobcontrol (view, change the priority or restart film jobs),
- + selected images are allocated to film jobs. Jobs are spooled to the Print SCU. An image matrix size of 512 or 1024 is used,
- + the SCU invokes a print job by using the SOP classes of a film session, a film box and image boxes for acquiring all the information which is required for a film session. The N-Action is used to print the film session,

- + to report asynchronous error messages or warnings with the N-Event service the association between the SCU and the SCP is kept open,
- + in service mode the user is able to install a DICOM Basic Print camera node and he is able to create Print SCU LUTs additional to the defaults,
- + the default Print SCU LUTs are numbered from 1 - 17. The LUT index 1 represents the optimized LUT for MR images and the LUT index 10 with linear values. To achieve optimal image quality the Print SCP shall use a linear LUT.

6.3 Sequencing of real World Activities

Not applicable.

7 Application Entity Specification Print

7.1 Print Management AE Specification

The print management SCU invokes print management DIMSE services to transfer images from the local AE to the remote SCP AE to print the images with the defined film format and size on a selected network DICOM hardcopy printer.

7.1.1 Basic Print Management Meta SOP Class

SIEMENS MR DICOM products provide Standard Conformance to the following DICOM V3.0 Basic Print Management SOP Classes as an SCU:

Table 16: Meta SOP Classe set as an SCU

SOP Class Name	SOP Class UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Printer SOP Class	1.2.840.10008.5.1.1.16

7.1.1.1 Basic film session SOP class

The Basic Film Session information object definition describes all the user defined parameter which are common for all the films of a film session. The Basic Film Session refers to one or more Basic Film Boxes and that are printed on one hardcopy printer.

7.1.1.1.1 Used attributes

Table 17: Basic Film Session N-CREATE attributes

Attribute name	Tag	Usage SCU	Supported Values
Number of Copies	(2000,0010)	U	set by user

7.1.1.1.2 Status handling

The Basic Film Session SOP class uses following status codes:

Table 18: Basic Film Session SOP status

Service Status	Meaning	Protocol Codes
Failure	Film session SOP instances hierarchy does not contain film box SOP instances	C600
Failure	Unable to create print job, print queue is full	C601
Failure	Image position collision	C604
Failure	Image size is larger than images box size	C603
Warning	Film session printing is not supported	B601
Warning	Film box does not contain image box (empty page)	B602
Success	Film belonging to the film session are accepted for printing	0000

7.1.1.2 Basic Film Box SOP class

The Basic Film Box information object definition describes all the user defined parameter of one film of the film session. The Basic Film Box information description defines the presentation parameters which are common for all images on a given sheet of film.

The Basic Film Box refers to one or more Image Boxes.

(3) items for internal use, evaluated on the current session

(4) attribute "Max Density" in hundreds of OD, range from 0 ... 999 (user configurable)

7.1.1.2.2 Status handling

The Basic Film Box SOP class uses following status codes:

Tabelle 20: Basic Film Box SOP status

Service Status	Meaning	Protocol Codes
Failure	Unable to create print job; print queue is full	C602
Failure	Image position collision	C604
Failure	Image size is larger than image box size	C603
Warning	Film box does not contain image box (empty page)	B603
Success	Film accepted for printing	0000

7.1.1.3.2 Status handling

The Grayscale Image Box SOP class uses following status codes:

Table 22: Basic Grayscale Image Box SOP status

Service Status	Meaning	Protocol Codes
Failure	Insufficient memory in printer to store the image	C605
Success		0000

7.1.1.4 Printer SOP Class

The Printer SOP Class is the possibility to monitor the status of the hardcopy printer in a synchronous and an asynchronous way.

7.1.1.4.1 Used attributes

The SCU uses the mandatory N-EVENT Report DIMSE service to monitor the changes of the printer status in an asynchronous way.

Table 23: Printer N-EVENT report

Event type name	Event	Attributes	Tag	Usage SCU
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U
Failure	3	Printer Status Info	(2110,0020)	U

The N-GET Report DIMSE service is mandatory for the SCP and is used to get information from the hardcopy printer.

Table 24: Printer N-GET attributes

Attribute name	Tag	Usage SCU
Printer Status	(2110,0010)	U
Printer Status Info	(2110,0020)	U

7.1.2 Association Establishment Policies

7.1.2.1 General

The configuration of the Siemens MR DICOM print management SCU defines the Application Entity Titles, the port numbers and of course the host name and net address..

7.1.2.2 Number of Associations

The Siemens MR DICOM application initiates one association at a time, one for each association being processed.

7.1.2.3 Asynchronous Nature

The Siemens MR DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

7.1.2.4 Implementation Identifying Information

The Siemens MR DICOM software provides a single Implementation Class UID of

- "1.3.12.2.1107.5.2.1.seriesnumber" - Magnetom Impact
- "1.3.12.2.1107.5.2.2.seriesnumber" - Magnetom Expert
- "1.3.12.2.1107.5.2.3.seriesnumber" - Magnetom Open
- "1.3.12.2.1107.5.2.4.seriesnumber" - Magnetom Vision

and an Implementation Version Name of

- "VB33A".

7.1.3 Association Initiation Policy

The Print Management SCU and SCP establish an association by using the DICOM association services. During association establishment the Print Management application entities negotiate the supported SOP classes to exchange the capabilities of the SCU and the SCP.

The association is kept open until a timer expires to report asynchronous errors or warnings. This may be disabled by the user.

The association is closed if the user switched to another camera or he left the Exposure application.

7.1.3.1 Associated Real-World Activity

7.1.3.1.1 Associated Real-World Activity

The associated Real-World activity is to print over a network a set of images on a film sheet with one or more copies. The images are converted to a proper image size. If the response from the remote application contains a status other than success or warning the association is aborted.

7.1.3.1.2 Proposed Presentation Contexts

The Siemens MR DICOM application will propose Presentation Contexts as shown in the following table:

Table 25: Presentation Context

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic film session SOP class	1.2.840.10008.5.1.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
Basic film box SOP class	1.2.840.10008.5.1.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
Basic gray-scale image box SOP class	1.2.840.10008.5.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		

Printer SOP class	1.2.840.10008.5.1.1.16	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Big Endian Transfer Syntax,	1.2.840.10008.1.2.2		
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		

7.1.3.1.3 SOP Specific Conformance Statement

The Siemens MR DICOM SCU conforms to the DICOM Basic Greyscale Print Management Class.

The Print SCU application uses a setting platform to define the properties of the connected Print SCP, e.g.:

- film orientation
- supported film sizes of the connected Print SCP
- supported film formats of the Print SCP
- density and lookup table definition.

In the case of a failure return status of the Print SCP the current film job will be suspended.

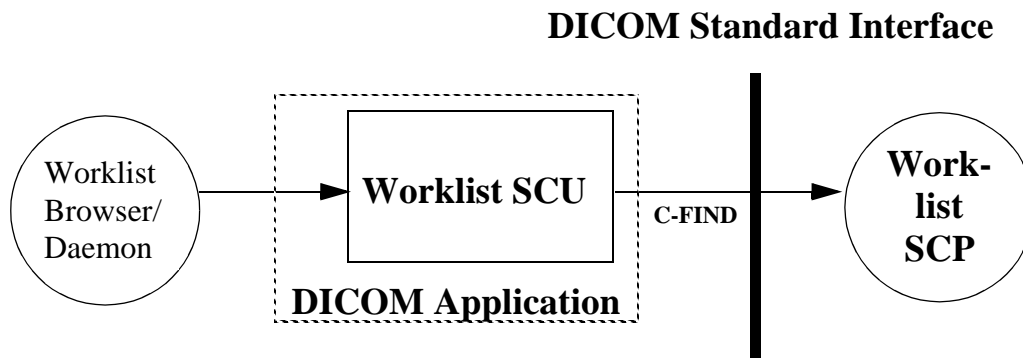
8 Implementation Model Worklist

The worklist service class defines an application-level class of service which facilitates the transfer of worklist entries from the information system to the imaging modality. The worklist is queried by the AE and supplies the SCU with the scheduled procedure steps which have to be performed on the modality. The MR DICOM worklist application supports the worklist service to act as SCU.

8.1 Application Data Flow Diagram

The MR DICOM network implementation is a UNIX application and acts as SCU for the worklist network service.

Figure 1: Application data flow diagram



8.2 Functional Definitions of Application Entities

The worklist SCU requests the worklist SCP to perform a match to the keys specified in the C-Find DIMSE service.

The worklist SCP responses to the C-FIND query and scheduled imaging service requests and patient demographic information will be downloaded from the information system to the modality.

8.3 Sequencing of real World Activities

The MR acquisition system obtains worklist information regarding scheduled procedures from HIS/RIS and includes this information in the series of the acquired DICOM MR images. If the worklist information is not available from HIS/RIS it will be typed by user during the registration of a patient.

9 Application Entity Specification Worklist

9.1 Modality Worklist Service AEs Specification

The worklist SCU requests that the remote SCP performs a match of all keys specified in the query against the information stored in its worklist database.

SIEMENS MR DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Class as an SCU:

Table 26: SOP Classes as an SCU

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

9.1.1 Association Establishment Policies

9.1.1.1 General

The configuration of the Siemens MR DICOM worklist application defines the Application Entity Titles, the port numbers and of course the host name and net address.

9.1.1.2 Number of Associations

The Siemens MR DICOM application initiates one/several association(s) at a time, one for each transfer request being processed.

9.1.1.3 Asynchronous Nature

The Siemens MR DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

9.1.1.4 Implementation Identifying Information

The Siemens MR DICOM software provides a single Implementation Class UID of

- "1.3.12.2.1107.5.2.1.seriesnumber" - Magnetom Impact
- "1.3.12.2.1107.5.2.2.seriesnumber" - Magnetom Expert
- "1.3.12.2.1107.5.2.3.seriesnumber" - Magnetom Open
- "1.3.12.2.1107.5.2.4.seriesnumber" - Magnetom Vision

and an Implementation Version Name of

- “VB33A”.

9.1.2 Association Initiation Policy

The modality worklist SCU establish an association by using the DICOM association services. During association establishment the negotiation of SOP classes to exchange the capabilities of the SCU and the SCP is not supported.

The following DIMSE-C operation is supported as SCU:

- C-FIND

9.1.2.1 Real World Activity

9.1.2.1.1 Associated Real-World Activity

The associated Real-World activity is to initiate query requests to an SCP by using the DICOM Worklist Information Model.

9.1.2.1.2 Proposed Presentation Contexts

The Siemens Magnetom DICOM application will propose Presentation Contexts as shown in the following table:

Table 27: Proposed presentation contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model- FIND	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Copyright © Siemens AG 2000. All rights reserved.

9.1.2.1.3 SOP Specific Conformance Statement

Search Key Attributes of the Worklist C-FIND

The Siemens Magnetom DICOM worklist SCU supports worklist queries with all required search keys. The following tables describe the search keys that the SCU supports.

Table 28: Scheduled Procedure Step Search Key Attributes

Attribute name	Tag	Values
Scheduled Procedure Step Sequence	(0040,0100)	
>Scheduled Station AE Title	(0040,0001)	own or all Application Entities
>Scheduled Procedure Step Start Date	(0040,0002)	configurable by user, default today/tomorrow
>Scheduled Procedure Step Start Time	(0040,0003)	configurable by user
>Modality	(0008,0060)	configurable by user, default MR
>Scheduled Performing Physician's Name	(0040,0006)	all names

Table 29: Patient Identification Search Key Attributes

Attribute name	Tags	Values
Patient's Name	(0010,0010)	all names
Patient ID	(0010,0020)	all IDs

Return Key Attributes of the Worklist C-FIND

The Siemens Magnetom DICOM worklist SCU supports worklist queries with return key attributes of type 1 and 2 and all attributes necessary for patient registration.

Table 30: SOP Common Return Key Attributes

Attribute name	Tag	Return Key Type	Comment
Specific Character Set	(0008,0005)	1C	

Table 31: Scheduled Procedure Step Return Key Attributes

Attribute name	Tag	Return Key Type	Comment
Scheduled Procedure Step Sequence	(0040,0100)	1	displayed
>Scheduled Station AE Title	(0040,0001)	1	displayed
>Scheduled Procedure Step Start Date	(0040,0002)	1	displayed
>Scheduled Procedure Step Start Time	(0040,0003)	1	displayed
>Modality	(0008,0060)	1	displayed
>Scheduled Performing Physician's Name	(0040,0006)	1	displayed
>Scheduled Procedure Step Description	(0040,0007)	1C	displayed
>Scheduled Station Name	(0040,0010)	2	displayed
>Scheduled Procedure Step Location	(0040,0011)	2	displayed
>Scheduled Action Item Code Sequence	(0040,0008)	1C	displayed
>>Code Value	(0008,0100)	1C	displayed
>>Coding Scheme Designator	(0008,0102)	1C	displayed
>>Code Meaning	(0008,0104)	3	displayed
>Pre-Medication	(0040,0012)	2C	displayed
>Scheduled Procedure Step ID	(0040,0009)	1	displayed
>Requested Contrast Agent	(0032,1070)	2C	displayed
Comments on the Scheduled Procedure Step	(0040,0400)	3	displayed

Table 32: Requested Procedure Return Key Attributes

Attribute name	Tag	Return Key Type	Comment
Requested Procedure ID	(0040,1001)	1	displayed
Requested Procedure Description	(0032,1060)	1C	displayed
Requested Procedure Code Sequence	(0032,1064)	1C	displayed
>Code Value	(0008,0100)	1C	displayed
>Code Scheme Designator	(0008,0102)	1C	displayed
>Code Meaning	(0008,0104)	3	displayed
Study Instance UID	(0020,000D)	1	moved to IOD
Referenced Study Sequence	(0008,1110)	2	displayed
>Referenced SOP Class UID	(0008,1150)	1C	displayed
>Referenced SOP Instance UID	(0008,1155)	1C	displayed
Requested Procedure Priority	(0040,1003)	2	displayed
Patient Transport Arrangements	(0040,1004)	2	displayed

Copyright © Siemens AG 2000. All rights reserved.

Table 33: Imaging Service Request Return Key Attributes

Attribute name	Tag	Return Key Type	Comment
Accession Number	(0008,0050)	2	moved to IOD
Requesting Physician	(0032,1032)	2	displayed
Referring Physician's Name	(0008,0090)	2	moved to IOD

Table 34: Visit Identification Return Key Attributes

Attribute name	Tags	Return Key Type	Comment
Admission ID	(0038,0010)	2	displayed

Table 35: Visit Status Return Key Attributes

Attribute name	Tags	Return Key Type	Comment
Current Patient Location	(0038,0300)	2	displayed

Table 36: Visit Relationship Return Key Attribute

Attribute name	Tags	Return Key Type	Comment
Referenced Patient Sequence	(0008,1120)	2	displayed
>Referenced SOP Class UID	(0008,1150)	2	displayed
>Referenced SOP Instance UID	(0008,1155)	2	displayed

Table 37: Patient Identification Return Key Attributes

Attribute name	Tags	Return Key Type	Comment
Patient's Name	(0010,0010)	1	moved to IOD
Patient ID	(0010,0020)	1	moved to IOD

Table 38: Patient Demographic Return Key Attribute

Attribute name	Tags	Return Key Type	Comment
Patients Birth Date	(0010,0030)	2	moved to IOD
Patient's Sex	(0010,0040)	2	moved to IOD
Patient's Weight	(0010,1030)	2	moved to IOD
Confidentiality constraint on patient data	(0040,3001)	2	displayed

Table 39: Patient Medical Return Key Attribute

Attribute name	Tags	Return Key Type	Comment
Patient State	(0038,0500)	2	displayed
Pregnancy Status	(0010,21C0)	2	displayed
Medical Alerts	(0010,2000)	2	displayed
Contrast Allergies	(0010,2110)	2	displayed
Special Needs	(0038,0050)	2	displayed

Note

all attributes marked with the comment "displayed" will be displayed in the worklist platform. All values of the attributes marked with the comment "moved to IOD" will be added to the MR image IOD or may be modified in the register platform.

Status Codes of the Worklist C-FIND

The worklist SCU interprets following status codes:

Table 40: C-FIND Response Status

Service Status	Meaning	Status Codes (0000,0900)	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier

Table 40: C-FIND Response Status

Service Status	Meaning	Status Codes (0000,0900)	Related Fields
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

10 Communication Profiles

10.1 Supported Communication Stacks

The Siemens MR DICOM application provide DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

10.1.1 OSI Stack

not supported.

10.1.2 TCP/IP Stack

The Siemens MR DICOM application uses the TCP/IP stack from the SUN-OS system upon which it executes. It uses the MergeCOM-3 subroutine library from Merge Technologies Inc. that is based on a Berkeley socket interface.

10.1.2.1 API

The Siemens MR DICOM application uses the MergeCOM library that is based on a TCP/IP socket interface.

10.1.2.2 Physical Media Support

The Siemens MR DICOM application is indifferent to the physical medium over which TCP/IP executes; it inherits this from the SUN-OS/Solaris system upon which it executes.

10.1.3 Point-to-Point Stack

not supported.

11 Extensions/Specializations/ Privatizations

11.1 Private Elements for Storage SOP Classes

11.1.1 Registry of Image Annotation Attributes

The following private attributes are defined for MR Image annotation. The attribute 0051, 1010 is multi-valued and represents the characters displayed from image viewer.

Tag	Private Owner Code	Name	VR	VM
(0051,0010)	SIEMENS CM VA0 CMS	Image Annotation owner	LO	1
(0051,1010)	SIEMENS CM VA0 CMS	Image Annotation character text	LO	43

Value	Name	Example(s)	Comments
1	Patient ID	123	First 12 characters of Patient ID (0010,0020)
2	PatientSexAndAge	M 33Y	Patient's Sex (0010,0040) and Age (0010,1010)
3	PatientPosition	F-SP-CR F-RI-CD H-SP	Patient Position (0018,5100), view direction and patient location.
4	ImageNumber	IMAGE 33	"IMAGE " prefix + Image Number (0020,0013)
5	not used		
6	DateOfMeasurement	07-OCT-1998	Acquisition Date (0008,0022)
7	TimeOfMeasurement	20:34	Acquisition Time(0008,0032)
8	TimeOfAcquisition	TA 05:12 TA 0.32 s TA 1:06:31	Total measurement time.
9	NumberOfAcquisitions	AC 1	Prefix "AC " + Number of Averages (0018,0083)
10	Comment Line 1	Squash accident	see below

Value	Name	Example(s)	Comments
11	Comment Line 2	Gadolinium	Comment Line1 and Comment Line 2 are concatenated and encoded as Image Comments (0020,4000). Max of 52 characters.
12	Installation Name	Hospital Anywhere	Institution Name (0008,0080)
13	Software Version	VB33D	Software Version(0018,1020)
14	Acquisition Matrix	210 *256os 512h*512 256 *256 s	Acquisition Matrix (0018,1310)
15	TypeOfMeasurement	tirm1-7 180	Sequence Name (0018,0024) and Flip Angle (0018,1314)
16	not used		
17	Repetition Time	TR 5100.0	Prefix "TR " + Repetition Time (0018,0080)
18	Echo Time	TE 30.0/1	Prefix "TE " + Echo Time (0018,0081) + "/" + Echo Number (0018,0086)
19	GatingAndTrigger	TD 300	Prefix "TD " + Trigger Time (0018,1060)
20	not used		
21	not used		
22	Slice Thickness	SL 4.0	Prefix "SL " + Slice Thickness (0018,0050)
23	Slice Position	SP 12.6	Prefix "SP " + Slice Location (0020,1041)
24	Image Orientation Line 1	Sag>Cor 45	Image Orientation and Position (0020,0037) and (0020,0032)
25	Image Orientation Line 2	>Tra -5	Image Orientation and Position (0020,0037) and (0020,0032)
26	FieldOfView	FoV 128*256	FOV of performed acquisition
27	not used		
28	not used		

Copyright © Siemens AG 2000. All rights reserved.

Value	Name	Example(s)	Comments
29	TablePosition	TP nnnn	The table position of the performed acquisition.
30	MipHeadLine	VOI	VOI defined for MIP
31	MipLine	Lin nnnn - nnnn	The line number to define the MIP volume of interest start and end point.
32	MipColumn	Col nnnn - nnnn	The column number to define the MIP volume of interest start and end point.
33	MipSlice	Sli nnnn - nnnn	The slice number to define the MIP volume of interest start and end point.
34	Study Number	SER 1-5	"SER " prefix + Study ID (0020,0010) + "-" + Series Number (0020,0011)
35	Contrast	+C	Contrast/Bolus Agent (0018,0010)
36	Patient Birthdate	28-JUN-1957	Patient's Birth Date (0010,0030)
37	SequenceInformation	*R 150	Format: "mrisud nnnn" - m: siemens sequence code - r: raw filter use code - i: image filter use code - s: sinc interpolated - u: uncompleted raw data - d: door open code - nnnn: Inversion Time (0018,0082)
38	SaturationRegions	2 SAT	Information about saturation region
39	not used		
40	Magnification Factor	MF 1.79	Information about magnification factor
41	Manufacturer Model	MAGNETOM Vision	Manufacturer's Model Name (0008,1090)
42	Patient Name	Miller, Valentin,, PhD	First 26 characters of Patient Name (0010,0010)

Value	Name	Example(s)	Comments
43	not used		

12 Configuration

12.1 AE Title / Presentation Address Mapping

The MR DICOM network unique Application Entity Titles are assigned using the following mechanism:

each application entity title starts with a unique 10 character string assigned for the local Siemens MR DICOM Application Entity Title. The default is a string which is also used as the first 10 characters of the PACSnet Logical Address (PLA) and builds the AE root. An example for such a string is '049SA1MR39'. But it is also possible to use a free defined AE root. The AE suffix is a 4 character string.

12.1.1 DICOM Storage AE Title

The suffix used for DICOM Storage SCU is: "DFOS".

The suffix used for DICOM Storage SCP is: "DIC1".

The default DICOM Storage SCP application provides the Application Entity Title:

e.g. 049SA1MR39DIC1

and the port number:

50082.

12.1.2 DICOM Query/Retrieve AE Title

The suffix used for DICOM Query/Retrieve SCP is: "DQRY".

The default DICOM Query/Retrieve application provides the Application Entity Title:

e.g. 049SA1MR39DQRY

and the port number:

50089.

12.1.3 DICOM Print AE Title

The suffix used for DICOM Print SCU is: "DBPR".

The default DICOM basic print application provides the Application Entity Title:

e.g. 049SA1MR39DBPR.

12.1.4 DICOM Modality Worklist AE Title

The suffix used for DICOM Modality Worklist SCU is: "DBWM".

The default DICOM Modality Worklist application provides the Application Entity Title:

e.g. 049SA1MR39DBWM.

12.2 Configurable Parameters

The Application Entity Titles, host names and port numbers are configured using the Siemens MR installation tool.

This installation tool also uses some default parameters:

- max PDU size set to 16384 Bytes (16 kB)
- time-out for accepting/rejecting an association request: 60 s
- time-out for responding to an association open/close request: 60 s
- time-out for accepting a message over network: 60 s

13 Support of Extended Character Sets

The Siemens MR DICOM application supports the ISO 8859 Latin 1 (ISO-IR 100) character set.

This document has been created using MedBook 1.0 with the adaptations of MR.

Copyright © Siemens AG 2000. All rights reserved.

Copyright © Siemens AG 2000. All rights reserved.