DICOM Conformance Statement for:

Silhouette Family Workstations (DcS)

Author:	Stephen Wheeler
Document Number:	1997-01391
Version:	1.6
Status:	Approved
Created:	September 30, 1997
Updated:	June 2nd 1999
Updated by:	Stephen Wheeler
Stored:	Silhouette rcs (doc/dicom/dcConf.doc)

Approvers:		**Signature**	**Date**
Author	Stephen Wheeler	_____	_____
Silhouette Product Manager	Michelle Pommells	_____	_____
Reviewers:			
Silhouette Senior Software Developer	Harald Zachmann		
Silhouette Member	Irena Kryzhanovski		
IAP/CN Team Leader	Cezary Klimczak		
QA Specialist	Joan Medley		

Foreword

This document specifies DICOM Conformance for a broad range of products. Coupled with DICOM ’s broad coverage, verification of correctness of an implementation can not be determined solely based on this document.

The user or integrator of ISG Technologies Inc products should keep the following issues in mind:

1. Test procedures should be used to verify that data transferred into an ISG workstation is correct. This is often done with the aid of phantom scans using a variety of clinical protocols.
2. Test procedures should be used to verify connectivity. Issues such as database full and broken connections should be verified.
3. When data is exported from an ISG Technologies Inc. workstation, Private attributes may be present in the Information Object. These should be discarded if any of the data is to be altered by the destination Application Entity.
4. ISG Technologies Inc maintains a list of DICOM Applications that have been verified for connectivity and inter-operability correctness. The current list is available from the appropriate Product Manager.
5. The current version of this DICOM Conformance Statement is also available on the ISG Technologies Inc web page at http://www.isgtec.com

Revision History

Rev 1.0 (Draft)

Created DICOM conformance statement for Silhouette based on IAP/DM template for DcS.

Rev 1.1 (Approved)

Adjusted due to comments from Azeem Esmail and Harald Zachmann.

Rev 1.2 (Draft)

No changes.

Rev 1.3 (Draft)

Update DICOM conformance statement to include Silhouette R2.5.2, 3DVirtuoso VA30 (2.5.2) releases. Handling of RGB images has changed slightly (see section 9.2).

Rev 1.4 (Approved)

Updated due to review comments. Added coercion of Curved Reformat images to section 9.2.

Rev 1.5 (Approved)

Stated that coercion of Curved Reformat images in section 9.2 applies to Silhouette 2.5.2, 3Dvirtuoso VA30 (2.5.2).

Rev 1.6 (Approved)

Updated Revision History.

Table of Contents

1 Introduction

1.1 Purpose of this Document

This document is the DICOM Conformance Statement for the ISG product Silhouette. The document is formatted according to NEMA PS3.2(1996).

This document addresses only the DICOM capabilities of the components comprising the Silhouette Family of workstations and their interaction with the dcserver.

1.2 Related Documents

NEMA PS3.1-8(1997), the DICOM Standard

1.3 Definitions

dcserver	The executable name of the Application Entity
Silhouette	ISG post-processing workstation Application.

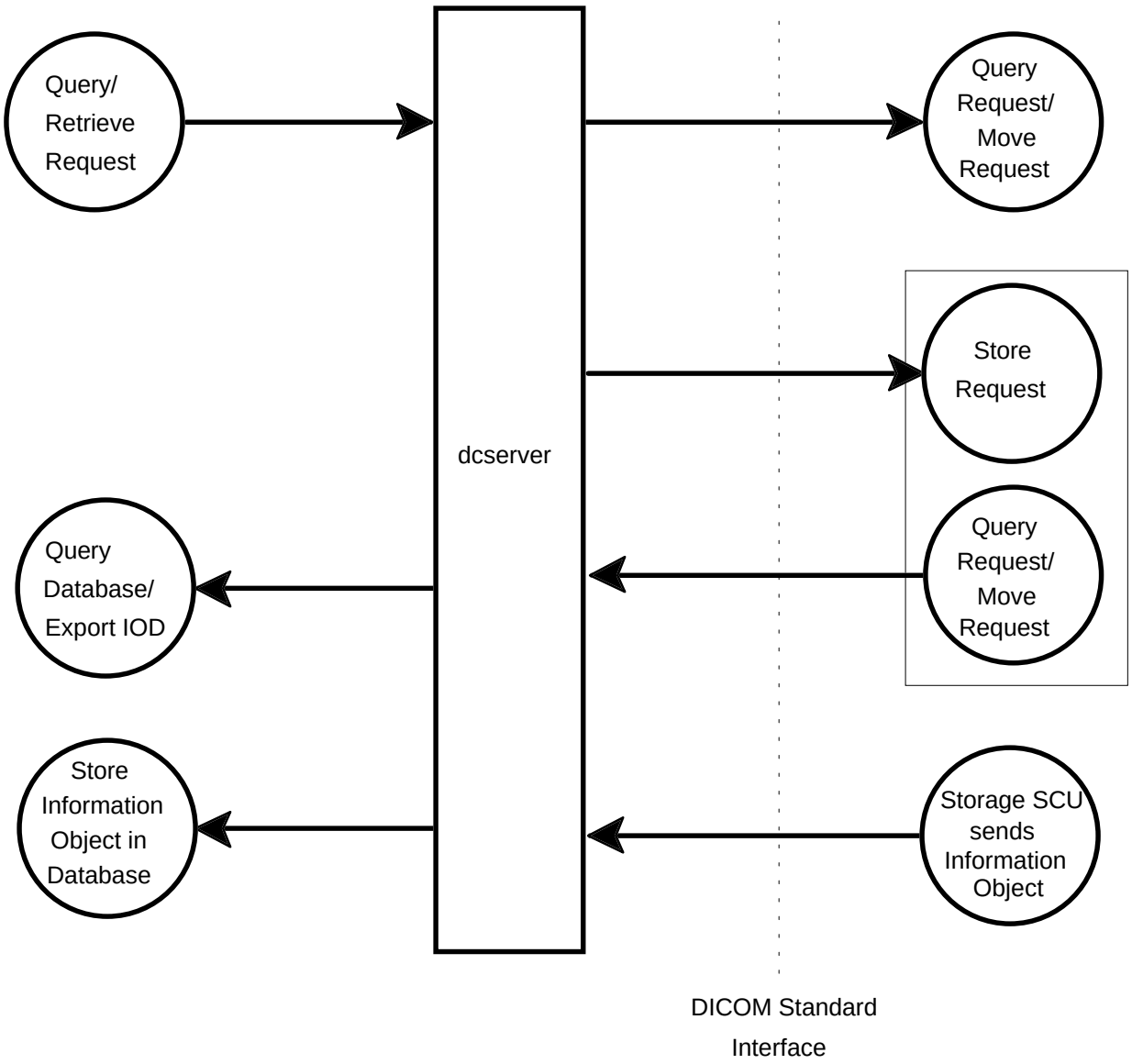
1.4 Acronyms and Abbreviations

DICOM	Digital Imaging and Communications in Medicine
DcS	The ISG DICOM Image Transfer Server
NEMA	North American Electrical Manufacturers Association

2 Implementation Model

The Silhouette DICOM Image Transfer Server is implemented as a single Application Entity. It can accept associations from Remote Application Entities for the purpose of storing Information Objects in the Local Application Entity database and providing Query and Move access to the Silhouette database. The Application Entity can originate associations for Query and Retrieve of Information Objects stored in Remote Application Entities. If a Remote Application Entity initiates a Move operation, an association is originated to service the required Store sub-operations.

The *dcserver* also accepts commands from a user interface component. The user interface causes Query and Move operations to be initiated by *dcserver* using DICOM associations.



2.1 Application Data Flow

The *dcserver* is expected to be running on the Silhouette workstation. A Remote Application Entity initiates an association for Storage Services. Upon notification of acceptance of the association parameters, the Remote Application Entity sends Information Objects to the *dcserver* that stores them in a local database for future use by the Silhouette software.

The Silhouette user initiates Query and Retrieve requests using the *dcserver* component, generally by interaction with a user interface. The *dcserver* component initiates an association with the Remote Application Entity and uses the Query or Retrieve Service Classes to issue commands. The Remote Application Entity responds as a Query/Retrieve Service Class Provider performing C-FIND and C-MOVE operations as required. The *dcserver* component passes the status responses for these commands to the Silhouette user interface for interpretation and display.

2.2 Functional Definitions of Application Entities

The *dcserver* component operates as a daemon. The startup sequence of the Silhouette system initiates its execution. The *dcserver* is left running whether the Silhouette software is operational or not.

The *dcserver* uses a configuration file that contains information used to validate association attempts from Remote Application entities. The *dcserver* then listens on the configured port for association requests.

An association request for Storage Services from a Remote Application Entity causes *dcserver* to validate the request according to the configuration parameters set at execution time. The Remote Application Entity then sends the Information Object Instance. The *dcserver* stores the received Information Object Instance in its local database if the data does not already exist. The data remains in the database until removed by some action external to this Application Entity.

An association request from a Remote Application Entity for Query or Move Services causes *dcserver* to validate the request according to the configuration parameters set at execution time. The Remote Application Entity then sends the Query or Retrieve request. The *dcserver* searches the local database for the instance(s) specified. If the request was C_FIND, then a response is returned for each match. If the request was C_MOVE, then an association is originated to the destination Application Entity specified in the C_MOVE message. Incremental responses are sent to the C_MOVE originator to indicate progress of the request.

A request from the Silhouette user interface causes the *dcserver* component to initiate an association with a Remote Application Entity. The Service Classes offered are specified in the configuration file. The user can then initiate Query and Retrieve requests to *dcserver* that are sent to the Remote Application Entity. The Silhouette user interface displays the responses from the Remote Application Entity.

Association and release requests are logged to the UNIX syslog daemon (*syslogd)* as *local7.info* messages. Various error and warning indications are also logged using *syslogd*.

2.3 Sequencing of Real-World Activities

Not applicable

2.4 Application Entity Specifications

The Silhouette DICOM Image Transfer capability consists of two logical components. The SCU portion originates associations for Store, Query and Retrieve operations. The SCP portion accepts associations for Store, Query and Retrieve operations. The two components are configured with the same Application Entity Title for use in the Silhouette Application. They are treated as a single Application Entity in this description.

The following DICOM V3.0 SOP Classes as an SCP:*dcserver* Application Entity provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Patient Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

The *dcserver* Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Patient Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4

Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

3 Association Policies

3.1 Association Establishment Policies

3.1.1 General

The User of the Silhouette User Interface can select which Application Entity to associate with for Query and Retrieve operations. The configuration file contains the configuration parameters such as host name, port number and specific SOP Classes to negotiate for each accessible Application Entity.

The *dcserver* Application Entity always proposes or accepts the Verification SOP Class.

3.1.2 Number of Associations

The *dcserver* can initiate multiple associations concurrently. A configuration parameter is provided to limit the number of associations that can be originated. Currently, the Silhouette Workstation limits the number of concurrent originating associations to a maximum of 3.

3.1.3 Asynchronous Nature

This release does not support Multiple outstanding transactions.

3.1.4 Implementation Identifying Information

The *dcserver* Implementation Class UID is 2.16.124.113531.1.1. The version name is formatted as follows:

ISG DRS <major.minor.revision>

For example:

ISG DRS 1.0.D would represent Release 1, incremental release D for the Silhouette Family.

3.2 Association Initiation by Real World Activity

This section details the action of the *dcserver* SCU component as a result of user initiated activity on the Silhouette User Interface.

3.2.1 Query Request

3.2.1.1 Associated Real World Activity

The user of the Silhouette Application selects the Query operation button on the user interface. Wild card or specific information can be specified by the user for Patient Name, Patient ID and/or Study ID.

3.2.1.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Query request. The configuration file contains 1 of the listed Abstract Syntax's.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Patient Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query / Retrieve 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 SOP Specific Conformance for Patient Root Query/Retrieve Model - FIND

- The *dcserver* does not use Relational Queries.
- The *dcserver* does not use Extended Negotiation.

The Keys supported are listed below:

Patient Level Keys

Description	Tag	Type
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	U
Patient's Birth Date	(0010,0030)	O
Patient's Birth Time	(0010,0032)	O
Patient's Sex	(0010,0040)	O
Other Patient IDs	(0010,1000)	O
Other Patient Names	(0010,1001)	O
Ethnic Group	(0010,2160)	O
Patient Comments	(0010,4000)	O

Study Level Keys

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U
Referring Physician's Name	(0008,0090)	O
Study Description	(0008,1030)	O
Name of Physician(s) Reading Study	(0008,1060)	O
Admitting Diagnoses Description	(0008,1080)	O
Patient's Age	(0010,1010)	O
Patient's Size	(0010,1020)	O
Patient's Weight	(0010,1030)	O
Occupation	(0010,2180)	O
Additional Patient History	(0010,21B0)	O
Other Study Numbers	(0020,1070)	O
Interpretation Author	(4008,010C)	O

Series Level Keys

Description	Tag	Type
Modality	(0008,0060)	R

Series Number	(0020,0011)	R
Series Instance UID	(0020,000E)	U

Image Level Keys

Description	Tag	Type
Image Number	(0020,0013)	R
SOP Instance UID	(0008,0018)	U

3.2.1.4 SOP Specific Conformance for Study Root Query/Retrieve Model - FIND

- The *dcserver* does not use Relational Queries.
- The *dcserver* does not use Extended Negotiation.

The Keys supported are listed below:

Study Level Keys

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	R
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U
Referring Physician's Name	(0008,0090)	O
Study Description	(0008,1030)	O

Name of Physician(s) Reading Study	(0008,1060)	O
Admitting Diagnoses Description	(0008,1080)	O
Patient's Birth Date	(0010,0030)	O
Patient's Birth Time	(0010,0032)	O
Patient's Sex	(0010,0040)	O
Other Patient IDs	(0010,1000)	O
Other Patient Names	(0010,1001)	O
Patient's Age	(0010,1010)	O
Patient's Size	(0010,1020)	O
Patient's Weight	(0010,1030)	O
Ethnic Group	(0010,2160)	O
Occupation	(0010,2180)	O
Additional Patient History	(0010,21B0)	O
Patient Comments	(0010,4000)	O
Other Study Numbers	(0020,1070)	O
Interpretation Author	(4008,010C)	O

Series Level Keys

Description	Tag	Type
Modality	(0008,0060)	R
Series Number	(0020,0011)	R
Series Instance UID	(0020,000E)	U

Image Level Keys

Description	Tag	Type
Image Number	(0020,0013)	R
SOP Instance UID	(0008,0018)	U

3.2.2 Move Request

3.2.2.1 Associated Real World Activity

The user selects one or more studies and/or series within studies from a list presented as a result of a previous Query operation.

The user of the Silhouette Application then selects the Transfer operation button on the user interface to initiate the move operation. The Destination Application Entity Title is selectable on the user interface.

3.2.2.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Move request.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Patient Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.2.3 SOP Specific Conformance for Patient Root Query/Retrieve Model - MOVE

This implementation supports transfers against the Patient Query/Retrieve Information Model described in Section C.6.1.1 of NEMA PS3.4 (1996) Annex C using the C-MOVE SCU behavior described in Section C.4.2.2 of NEMA PS3.4 (1996) Annex C.

3.2.2.4 SOP Specific Conformance for Study Root Query/Retrieve Model - MOVE

The Silhouette workstation application does not support Study Root Query/Retrieve Model as a SCU. The dcserver application entity does support Study Root Query/Retrieve Model as a SCP (see section 3.3.3).

3.2.3 Store Request

3.2.3.1 Associated Real World Activity

The *dcserver* Application Entity initiates an association for C_STORE if it has received a valid C_MOVE message from a Remote Application Entity. The SOP Class UID of the Information Object to be sent over the C_STORE context is used to verify that a valid Presentation Context exists prior to issuing the C_STORE message. A mismatch results in no message being sent but the association remains active.

3.2.3.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Store request. The configuration file contains one or more of the listed Abstract Syntax's.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.2.3.3 SOP Specific Conformance for C-STORE

This implementation supports transfers as an SCU as described in NEMA PS3.4 (1996) Annex B.

The status returned by the accepting Application Entity is used to indicate success or failures of the C_MOVE sub-operation that initiated the transfer. In no case is the Information Object deleted from the local database.

Extended negotiation is not used by *dcserver* for this SOP Class.

The specific Information Object Definitions are specified in Annex A of this document.

3.3 Association Acceptance Policy

Parameters in the *dcserver* configuration file determine association acceptance. Association acceptance can be controlled on the basis of Called Application Entity Title, Calling Application Entity Title and SOP Class UID matching. Acceptance control ranges from no limitations to very specific acceptance policies.

A configuration parameter can be set to limit the number of accepted associations to a specific value.

3.3.1 Storage Association Request

3.3.1.1 Associated Real-World Activity

The *dcserver* stores image Information Object Instances received on the accepted association into its attached database.

3.3.1.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.1.3 SOP Specific Conformance for SOP Class Verification

The *dcserver* Application Entity conforms to the DICOM Verification Service Class as a SCP.

3.3.1.4 SOP Specific Conformance for SOP Class Storage

The *dcserver* Application Entity conforms to the DICOM Storage Service Class as a SCP for the Abstract Syntax's listed in the table in section 3.3.1.2 at conformance level 2. Storage Conformance level 2 requires the Application Entity to retain all Type 1, Type 2 and Type 3 attributes. Annex A of this document specifies the attributes retained from each of the SOP Class Information Objects listed in section 3.3.1.2.

The received Information Object Instance is stored in a database until some external application causes the data to be deleted. The Silhouette Application accesses the stored data for display and other manipulation.

Private attributes are discarded.

In the case where the database is full, a status of 0xD000 is returned to the Storage SCU and the Information Object is discarded. A blank image may be inserted into Silhouette's database in the case of full database. The recovery action is to provide more storage space or to start the database server as appropriate. The returned value can be set to 0x0000 by setting a variable in the configuration file. The variable can apply to all associations or to specific Application entities.

If the Information Object Instance does not match any accepted Abstract Syntax, a status code of 0xA800 is returned. Recovery consists of altering the configuration of the remote or local Application Entity.

The attribute 0x00000902 contains a descriptive message to explain error returns.

Annex B of this document describes the validations and coercion performed on incoming Information Objects. Failure of a validation results in the return of status C000 in the C-STORE response message.

3.3.1.5 Presentation Context Acceptance Criterion

The *dcserver* always accepts the Verification SOP Class.

The *dcserver* accepts Storage SOP Class Presentation Contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.3.1.2.

3.3.1.6 Transfer Syntax Selection Policies

The *dcserver* presently supports only the default DICOM Little-Endian Transfer Syntax. When support for DICOM Explicit VR encoding is implemented, *dcserver* will choose the most efficient Transfer Syntax based on the machine platform it is operating on. For Big-Endian systems this is DICOM Explicit VR, Big-Endian.

3.3.2 Query Association Request

3.3.2.1 Associated Real-World Activity

The *dcserver* searches the attached database for the requested Information Objects described in the C_FIND identifier and returns a response for each match.

3.3.2.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.2.3 SOP Specific Conformance for SOP Class Verification

The *dcserver* Application Entity conforms to the DICOM Verification Service Class as a SCP.

3.3.2.4 SOP Specific Conformance for Patient Root Query/Retrieve Model - FIND

The *dcserver* Application Entity conforms to the DICOM Patient Root Query/Retrieve Service Class as a SCP for the Abstract Syntax's listed in the table in section 3.3.2.2. The table in section 3.2.1.3 defines the accepted search keys.

A response is returned for each match found in the attached database.

Possible response status values are:

Refused	Out of resources	A700
Failed	Identifier does not match SOP Class	A900
	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	matching completed	0000
Pending	Matches are continuing	FF00

If the Information Object Instance does not match any accepted Abstract Syntax, a status code of 0xA800 is returned. Recovery consists of altering the configuration of the remote or local Application Entity.

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.2.5 SOP Specific Conformance for Study Root Query/Retrieve Model - FIND

The *dcserver* Application Entity conforms to the DICOM Study Root Query/Retrieve Service Class as a SCP for the Abstract Syntax's listed in the table in section 3.3.2.2. The table in section 3.2.1.4 defines the accepted search keys.

A response is returned for each match found in the attached database.

Possible response status values are:

Refused	Out of resources	A700
Failed	Identifier does not match SOP Class	A900
	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	matching completed	0000
Pending	Matches are continuing	FF00

If the Information Object Instance does not match any accepted Abstract Syntax, a status code of 0xA800 is returned. Recovery consists of altering the configuration of the remote or local Application Entity.

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.2.6 Presentation Context Acceptance Criterion

The *dcserver* always accepts the Verification SOP Class.

The *dcserver* accepts SOP Class contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.3.2.2.

3.3.2.7 Transfer Syntax Selection Policies

The *dcserver* presently supports only the default DICOM Little-Endian Transfer Syntax. When support for DICOM Explicit VR encoding is implemented, *dcserver* will choose the most efficient Transfer Syntax based on the machine platform it is operating on. For Big-Endian systems this is DICOM Explicit VR, Big-Endian.

3.3.3 Move Association Request

3.3.3.1 Associated Real-World Activity

The *dcserver* initiates an association to the destination Application Entity specified in the C_MOVE command message. The *dcserver* then extracts the requested Information Objects described in the C_MOVE identifier from the attached database and performs C_STORE operations on the destination association.

3.3.3.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.3.3 SOP Specific Conformance for SOP Class Verification

The *dcserver* Application Entity conforms to the DICOM Verification Service Class as a SCP.

3.3.3.4 SOP Specific Conformance for Patient Root Query/Retrieve Model - MOVE

The *dcserver* Application Entity conforms to the DICOM Patient Root Query/Retrieve Service Class as a SCP for the Abstract Syntax's listed in the table in section 3.3.3.2.

A response is returned for each Information Object sent to the destination Application Entity.

Possible response status values are:

Refused	Out of resources	A700
	Unable to perform sub-operations	A702
	Move Destination Unknown	A801
Failed	Identifier does not match SOP Class	A900
	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	sub-operations completed	0000
Warning	sub-operations completed, 1 or more failures	B000
Pending	Matches are continuing	FF00

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.3.5 SOP Specific Conformance for Study Root Query/Retrieve Model - MOVE

The *dcserver* Application Entity conforms to the DICOM Study Root Query/Retrieve Service Class as a SCP for the Abstract Syntax's listed in the table in section 3.3.3.2.

A response is returned for each Information Object sent to the destination Application Entity.

Possible response status values are:

Refused	Out of resources	A700
	Unable to perform sub-operations	A702
	Move Destination Unknown	A801
Failed	Identifier does not match SOP Class	A900
	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00

Success	sub-operations completed	0000
Warning	sub-operations completed, 1 or more failures	B000
Pending	Matches are continuing	FF00

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.3.6 Presentation Context Acceptance Criterion

The *dcserver* always accepts the Verification SOP Class.

The *dcserver* accepts SOP Class contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.3.3.2.

3.3.3.7 Transfer Syntax Selection Policies

The *dcserver* presently supports only the default DICOM Little-Endian Transfer Syntax. When support for DICOM Explicit VR encoding is implemented, *dcserver* will choose the most efficient Transfer Syntax based on the machine platform it is operating on. For Big-Endian systems this is DICOM Explicit VR, Big-Endian.

4 Communication Profiles

4.1 Supported Communication Stacks (Parts 8,9)

The TCP/IP Network Communication Support as defined in PS3.8 (1996) is supported.

4.1.1 OSI Stack

Not supported.

4.1.2 TCP/IP Stack

4.1.2.1 API

The *dcserver* implementation uses Berkeley style sockets.

4.1.2.2 Physical Media Support

The Application Entity is not dependent on the physical medium used for the TCP/IP network other than as it affects performance. The physical medium used for TCP/IP communication will be determined by the UNIX platform upon which *dcserver* operates.

4.1.3 Point-to-Point Stack

Not supported.

5 Extensions/Specialization's/Privatization's

5.1 Standard/Extended/Specialized/Private SOPs

Not applicable

5.2 Private Transfer Syntax's

No Private Transfer Syntax's are used by *dcserver*.

6 Configuration

6.1 AE Title/Presentation Address Mapping

The *dcserver* Application Entity maps Application Entity Titles to host name and port number via lookups in the configuration file. The IP address for host name is determined using standard UNIX system calls. The configuration file supports the use of IP addresses in place of host names, this is to reduce the dependence on system configuration files.

6.2 Configurable Parameters

i. ISG man page 'dcsconfig.7', supplied with the product, defines the available configuration parameters.

ii. The Query/Retrieve and Storage SOP Classes to accept are configurable, globally or Application Entity Title specific.

iii. The Query/Retrieve and Storage SOP Classes to propose are configurable, globally or Application Entity Title specific.

iv. The Transfer Syntax's are configurable for each SOP Class, globally or SOP Class specific.

v. A configuration parameter is supplied to control matching of Calling Application Entity Title to a value in the configuration file.

vi. A configuration parameter is supplied to control matching of Called Application Entity Title to a value in the configuration file.

vii. A configuration parameter is supplied to allow Application Entity Title specific association related tracing output to be created for connection troubleshooting.

viii. A configuration parameter is supplied to allow Application Entity Title specific DIMSE tracing output to be created for message troubleshooting.

ix. Application entity host names can be specified as either IP address or host name for lookup in /etc/hosts.

x. The number of associations that can be initiated for Silhouette products is 3.

xi. The number of associations that can be accepted is configurable.

xii. The port number to listen on for association requests is configurable.

xiii. A configuration parameter controls whether the *dcserver* exports graphic overlays generated within Silhouette as embedded overlays as specified in the DICOM standard, PS 3.3-1996, section C9.

7 Support of Extended Character Sets

Extended character sets are not supported by the Application Entity. Silhouette will accept most extended ASCII character sets into the database, however, the extended character element 0x00080005 is ignored and not stored with the images (see Annex A for Information Object Definitions). If necessary for export purposes, element 0x00080005 may be controlled through the use of a configuration parameter.

8 Annex A

This annex details the actual Information Object Definitions stored by the *dcserver* Application Entity. They contain Type 1, Type 2 and Type 3 attributes for conformance to Storage Conformance level 2 defined in DICOM Part 3, Information Object Definitions PS3.3 (1996).

The table numbers in this annex match those in DICOM Part 3, Information Object Definitions PS3.3 (1996).

8.1 Common Modules

Table C.7.1.1 -- Patient Module Attributes

Attribute Name	Tag	Type
Patient's Name	0010,0010	2
Patient ID	0010,0020	2
Patient's Birth Date	0010,0030	2
Patient's Sex	0010,0040	2
Patient's Birth Time	0010,0032	3
Other Patient ID	0010,1000	3
Other Patient Names	0010,1001	3
Ethnic Group	0010,2160	3
Patient Comments	0010,4000	3

Table C.7.2.1 -- General Study Module Attributes

Attribute Name	Tag	Type
Study Instance UID	0020,000D	1
Study Date	0008,0020	2
Study Time	0008,0030	2

Referring Physician's Name	0008,0090	2
Study ID	0020,0010	2
Accession Number	0008,0050	2
Study Description	0008,1030	3
Name of Physician(s) Reading Study	0008,1060	3

Table C.7.2.2 -- Patient Study Module Attributes

Attribute Name	Tag	Type
Admitting Diagnoses Description	0008,1080	3
Patient's Age	0010,1010	3
Patient's Size	0010,1020	3
Patient's Weight	0010,1030	3
Occupation	0010,2180	3
Additional Patient’s History	0010,21B0	3

Table C.7.3.1 -- General Series Module Attributes

Attribute Name	Tag	Type
Modality	0008,0060	1
Series Instance UID	0020,000E	1
Series Number	0020,0011	2
Laterality	0020,0060	2C
Series Date	0008,0021	3

Series Time	0008,0031	3
Performing Physicians’ Name	0008,1050	3
Protocol Name	0018,1030	3
Series Description	0008,103E	3
Operators' Name	0008,1070	3
Body Part Examined	0018,0015	3
Patient Position	0018,5100	2C
Smallest Pixel Value in Series	0028,0108	3
Largest Pixel Value in Series	0028,0109	3

Table C.7.4.1 -- Frame Of Reference Module Attributes

Attribute Name	Tag	Type
Frame of Reference UID	0020,0052	1
Position Reference Indicator	0020,1040	2

Table C.7.5.1 -- General Equipment Module Attributes

Attribute Name	Tag	Type
Manufacturer	0008,0070	2
Institution Name	0008,0080	3
Station Name	0008,1010	3
Institutional Department Name	0008,1040	3
Manufacturer's Model Name	0008,1090	3
Device Serial Number	0018,1000	3

Software Versions	0018,1020	3
Spatial Resolution	0018,1050	3
Date of Last Calibration	0018,1200	3
Time of Last Calibration	0018,1201	3
Pixel Padding Value	0028,0120	3

Table C.7.6.1 -- General Image Module Attributes

Attribute Name	Tag	Type
Image Number	0020,0013	2
Patient Orientation	0020,0020	2C
Image Date	0008,0023	2C
Image Time	0008,0033	2C
Image Type	0008,0008	3
Acquisition Number	0020,0012	3
Acquisition Date	0008,0022	3
Acquisition Time	0008,0032	3
Derivation Description	0008,2111	3
Images in Acquisition	0020,1002	3
Image Comments	0020,4000	3

Table C.7.6.2 -- Image Plane Module Attributes

Attribute Name	Tag	Type
Pixel Spacing	0028,0030	1

Image Orientation (Patient)	0020,0037	1
Image Position (Patient)	0020,0032	1
Slice Thickness	0018,0050	2
Slice Location	0020,1041	3

Table C.7.6.3 -- Image Pixel Module Attributes

Attribute Name	Tag	Type
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	1
Rows	0028,0010	1
Columns	0028,0011	1
Bits Allocated	0028,0100	1
Bits Stored	0028,0101	1
High Bit	0028,0102	1
Pixel Representation	0028,0103	1
Pixel Data	7FE0,0010	1
Planar Configuration	0028,0006	1C
Pixel Aspect Ratio	0028,0034	1C
Smallest Image Pixel Value	0028,0106	3
Largest Image Pixel Value	0028,0107	3

Table C.7.6.4 -- Contrast/Bolus Module Attributes

Attribute Name	Tag	Type
Contrast/Bolus Agent	0018,0010	2
Contrast/Bolus Route	0018,1040	3
Contrast/Bolus Volume	0018,1041	3
Contrast/Bolus Start Time	0018,1042	3
Contrast/Bolus Stop Time	0018,1043	3
Contrast/Bolus Total Dose	0018,1044	3

8.2 CT Storage IOD

Table C.8.2.1 -- CT Image Module Attributes

Attribute Name	Tag	Type
Image Type	0008,0008	1
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	1
Bits Allocated	0028,0100	1
Bits Stored	0028,0101	1
High Bit	0028,0102	1
Rescale Intercept	0028,1052	1
Rescale Slope	0028,1053	1
KVP	0018,0060	2
Acquisition Number	0020,0012	2
Scan Options	0018,0022	3
Data Collection Diameter	0018,0090	3
Reconstruction Diameter	0018,1100	3

Distance Source to Detector	0018,1110	3
Distance Source to Patient	0018,1111	3
Gantry/Detector Tilt	0018,1120	3
Table Height	0018,1130	3
Rotation Direction	0018,1140	3
Exposure Time	0018,1150	3
X-ray Tube Current	0018,1151	3
Exposure	0018,1152	3
Filter Type	0018,1160	3
Generator Power	0018,1170	3
Focal Spot	0018,1190	3
Convolution Kernel	0018,1210	3

8.3 MR Storage IOD

Table C.8.3.1 -- MR Image Module Attributes

Attribute Name	Tag	Type
Image Type	0008,0008	1
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	1
Bits Allocated	0028,0100	1
Scanning Sequence	0018,0020	1
Sequence Variant	0018,0021	1
Scan Options	0018,0022	2
MR Acquisition Type	0018,0023	2

Repetition Time	0018,0080	2C
Echo Time	0018,0081	2
Echo Train Length	0018,0091	2
Inversion Time	0018,0082	2C
Trigger Time	0018,1060	2C
Sequence Name	0018,0024	3
Angio Flag	0018,0025	3
Number of Averages	0018,0083	3
Imaging Frequency	0018,0084	3
Imaged Nucleus	0018,0085	3
Echo Number	0018,0086	3
Magnetic Field Strength	0018,0087	3
Spacing Between Slices	0018,0088	3
Number of Phase Encoding Steps	0018,0089	3
Percent Sampling	0018,0093	3
Percent Phase Field of View	0018,0094	3
Pixel Bandwidth	0018,0095	3
Nominal Interval	0018,1062	3
Beat Rejection Flag	0018,1080	3
Low R-R Value	0018,1081	3
High R-R Value	0018,1082	3
Intervals Acquired	0018,1083	3
Intervals Rejected	0018,1084	3
PVC Rejection	0018,1085	3
Skip Beats	0018,1086	3
Heart Rate	0018,1088	3

Cardiac Number of Images	0018,1090	3
Trigger Window	0018,1094	3
Reconstruction Diameter	0018,1100	3
Receiving Coil	0018,1250	3
Transmitting Coil	0018,1251	3
Acquisition Matrix	0018,1310	3
Phase Encoding Direction	0018,1312	3
Flip Angle	0018,1314	3
SAR	0018,1316	3
Variable Flip Angle Flag	0018,1315	3
dB/dt	0018,1318	3
Temporal Position Identifier	0020,0100	3
Number of Temporal Positions	0020,0105	3
Temporal Resolution	0020,0110	3

8.4 SC Storage IOD

Table C.8.6.1 -- SC Image Equipment Module Attributes

Attribute Name	Tag	Type
Conversion Type	0008,0064	1
Modality	0008,0060	3
Secondary Capture Device ID	0018,1010	3
Secondary Capture Device Manufacturer	0018,1016	3
Secondary Capture Device Manufacturer’s Model Name	0018,1018	3

Secondary Capture Device Software Version	0018,1019	3
Video Image Format Acquired	0018,1022	3
Digital Image Format Acquired	0018,1023	3

Table C.8.6.2 -- SC Image Module Attributes

Attribute Name	Tag	Type
Date of Secondary Capture	0018,1012	3
Time of Secondary Capture	0018,1014	3

9 Annex B

This Annex describes the coercion, validity checks and import behaviour performed on Information Objects being imported via *dcserver*.

9.1 Validity Checks

- Invalid or missing orientation vector values (0x00200037) results in rejection of MR and CT Information Objects.
- A missing Photo Interpretation attribute (0x00280004) results in rejection of any modality Information Object.
- Missing Bits Allocated, Bits Used and High Bit attributes result in rejection of any modality Information Object.
- Photo Interpretation values (0x00280004) other than MONOCHROME1, MONOCHROME2, PALETTE COLOR or RGB are rejected.

9.2 Coercion

- Patient orientation value (0x00200020) is coerced based on the orientation vector value (0x00200037) for CT and MR Information Objects.
- Palette and RGB* colour images are converted to greyscale.

  *Note: In Silhouette R2.5.2, 3Dvirtuoso VA30 (2.5.2), RGB images with High Bit of 7, Bits Used of 8, and Bits Allocated of 8 are not converted.

- If Pixel Padding Value (0x00280120) is present, the pixel values are adjusted accordingly.
- In Silhouette R2.5.2, 3Dvirtuoso VA30 (2.5.2), Image position (0x00200032) and Image orientation (0x00200037) are set to zero for Curved Reformat images.

9.3 Import Behaviour

Silhouette performs some basic organization on imported images prior to database insertion. In most cases this should match the intended organization of the image hierarchy, however under some conditions the presentation in Silhouette and the presentation on external workstations may differ. Further, the presentation within Silhouette may not match the DICOM hierarchy. Thus, DICOM Q/R operations may return a hierarchy which does neither matches the hierarchy presented in the Silhouette DICOM user interface nor matches the Silhouette patient selection window.

Silhouette will organize objects based on certain DICOM tags. There are three possible configurations to control the insertion behaviour of Silhouette/*dcserver*. The insertion criterion presented in the following sections 9.3.1, 9.3.2 and 9.3.3 represents the default insertion behaviour. Section 9.3.4 represents a less restrictive insertion criterion. Section 9.3.5 represents the least restrictive insertion criterion that most closely matches the DICOM hierarchy representation.

9.3.1 Import Behaviour (historic) for CT modality images:

Attribute Level	Attribute Name	DICOM tag
Patient	Patient Name	0010,0010
Patient	Patient Id	0010,0020
Study	StudyUID	0020,000D
Series	SeriesUID	0020,000E
Series	ModalityStr	0008,0060
Series	Body Part	0018,0015
Series	FrameUID	0020,0052
Series	Manufacturer	0008,0070
Series	Institution	0008,0080
Series	Department	0008,1040
Series	Series Number	0020,0011
Series	Contrast Agent	0018,0010
Series	Image Type	0008,0008
Image	SOPInstanceUID	0008,0018
Image	Image Number	0020,0013

9.3.2 Import Behaviour (historic) for MR modality images:

Attribute Level	Attribute Name	DICOM tag
Patient	Patient Name	0010,0010
Patient	Patient Id	0010,0020
Study	StudyUID	0020,000D
Series	SeriesUID	0020,000E
Series	ModalityStr	0008,0060
Series	Body Part	0018,0015
Series	FrameUID	0020,0052
Series	Manufacturer	0008,0070
Series	Institution	0008,0080
Series	Department	0008,1040
Series	Series Number	0020,0011
Series	Contrast Agent	0018,0010
Series	Image Type	0008,0008
Series	Repetition Time	0018,0080
Series	Echo Time	0018,0081
Series	Inversion Time	0018,0082
Series	Number of Averages	0018,0083
Series	Image Frequency	0018,0084
Series	Imaged Nucleus	0018,0085
Series	Scanning Sequence	0018,0020
Series	Sequence Variant	0018,0021
Series	Scan Options	0018,0022
Series	Flip Angle	0018,1314

Image	SOPInstanceUID	0008,0018
Image	Image Number	0020,0013

9.3.3 Import Behaviour (historic) for SC modality images:

Attribute Level	Attribute Name	DICOM tag
Patient	Patient Name	0010,0010
Patient	Patient Id	0010,0020
Study	StudyUID	0020,000D
Series	SeriesUID	0020,000E
Series	ModalityStr	0008,0060
Series	Body Part	0018,0015
Series	FrameUID	0020,0052
Series	Manufacturer	0008,0070
Series	Institution	0008,0080
Series	Department	0008,1040
Series	Series Number	0020,0011
Series	Contrast Agent	0018,0010
Series	Image Type	0008,0008
Series	Conversion Type	0008, 0064
Series	Secondary Capture Device ID	0018,1010
Series	Secondary Capture Device Manufacturer	0018,1016
Series	Secondary Capture Device Manufacturer's Model Name	0018,1018
Series	Secondary Capture Device Software Version	0018,1019
Series	Video Image Format Acquired	0018,1022
Series	Digital Image Format Acquired	0018,1023

Image	SOPInstanceUID	0008,0018
Image	Image Number	0020,0013

9.3.4 Less restrictive (mild) Import Behaviour for all modality images:

Attribute Level	Attribute Name	DICOM tag
Patient	Patient Name	0010,0010
Patient	Patient Id	0010,0020
Study	StudyUID	0020,000D
Series	SeriesUID	0020,000E
Series	ModalityStr	0008,0060
Series	FrameUID	0020,0052
Series	Image Type	0008,0008
Image	SOPInstanceUID	0008,0018
Image	Image Number	0020,0013

9.3.5 Least restrictive (pure) Import Behaviour for all modality images:

Attribute Level	Attribute Name	DICOM tag
Patient	Patient Name	0010,0010
Patient	Patient Id	0010,0020
Study	StudyUID	0020,000D
Series	SeriesUID	0020,000E
Series	ModalityStr	0008,0060
Series	FrameUID	0020,0052
Image	SOPInstanceUID	0008,0018