



ISG Technologies Inc.
Viewing Stations DICOM Conformance Statement
VR 3.1 for Windows

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1. Introduction

1.1 Purpose of this Document

This document is the DICOM Conformance Statement for VR 3.1 for Windows. The purpose of this document is to describe how the VR workstation interacts with other DICOM devices on the network.

1.2 Related Documents

The Digital Imaging and Communications in Medicine (DICOM) standard. NEMA PS 3.1-13 1996 and Supplements.

1.3 Definitions

DICOM terms are used throughout this Conformance Statement. For a description of these, consult the DICOM standard publication.

Word	Definition
dcserver	The executable name of the ISG DICOM Image Transfer Server
hcservice	The executable name of the ISG Hardcopy Server

1.4 Acronyms and Abbreviations

DICOM abbreviations are used throughout this Conformance Statement. For a description of these, consult the DICOM standard publication.

Acronym	Meaning
VR	Viewing and Reading workstation

1.5 Important note to the reader

The use of this conformance statement by itself does not guarantee successful interoperability of ISG products with equipment from other vendors. The user or integrator of ISG products should keep the following issues in mind:

1. Successful interoperability of the VR products with other devices may require functions which are not specified within the scope of DICOM. It is the user's or integrator's responsibility to ensure that the proper analysis and validation is performed to verify the connection.
2. 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.
3. Test procedures should be used to verify connectivity. Issues such as database full and broken connections should be verified.

4. ISG Technologies Inc maintains a list of DICOM Applications which have been verified for connectivity and inter-operability correctness. The current list is available from the appropriate Product Manager. The current version of this DICOM Conformance Statement is also available on the ISG Technologies Inc web page at <http://www.isgtec.com>
5. The DICOM standard will continually evolve to meet new user requirements. ISG will follow the changes in the standard by implementing new features as specified by the standard. ISG reserves the right to make changes to its products or to discontinue its delivery. The user or integrator should ensure that any non-ISG device providers, which connect with ISG devices, should also follow the standard. Failure to do so will likely result in future connectivity problems.

2. Implementation Model

The VR 3.1 workstation from ISG Technologies Inc is a medical diagnostic and review station. The workstation uses DICOM services to:

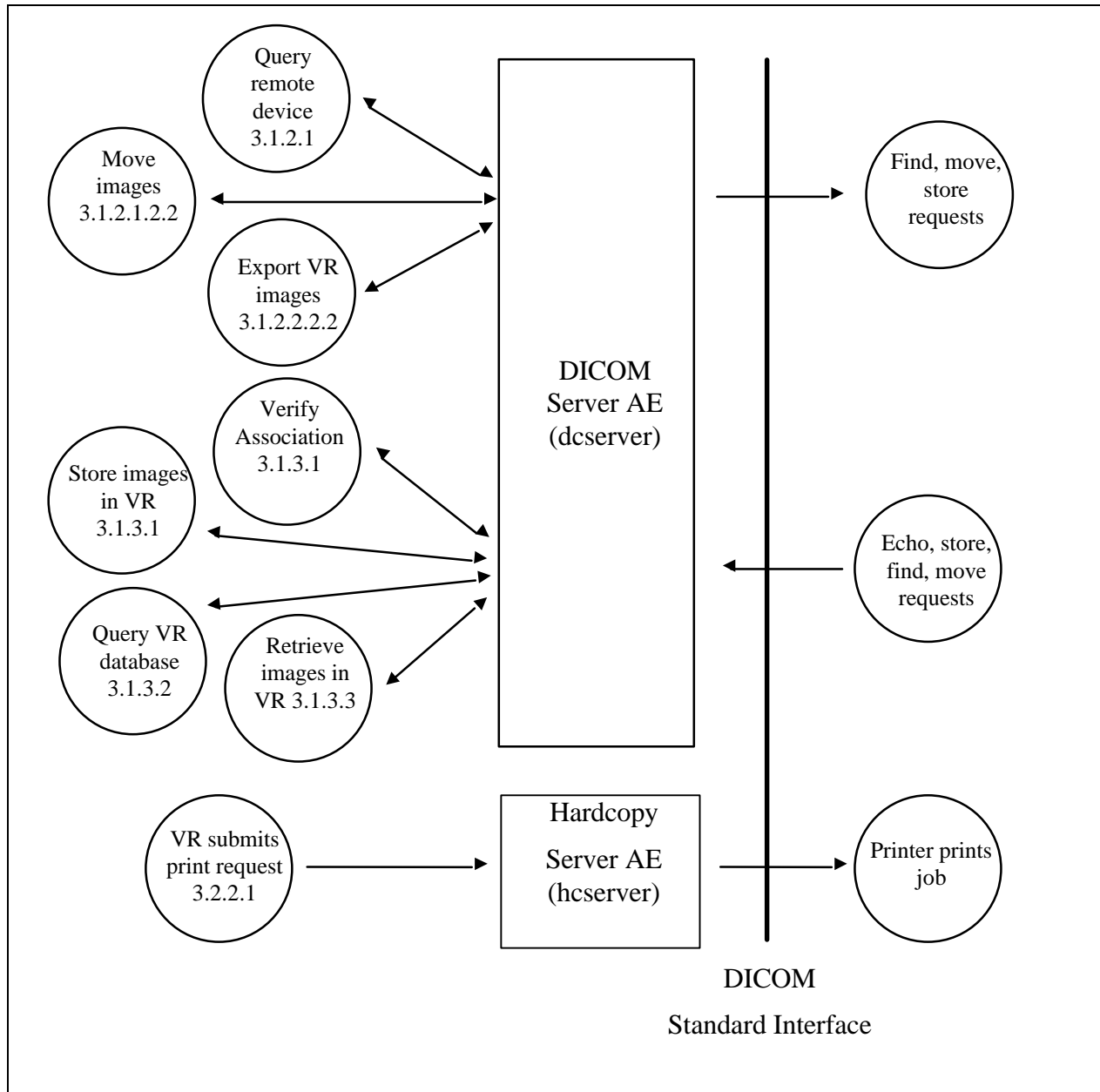
- import and export images
- query the content of other devices and initiate transfers
- print images

The DICOM services are implemented using two Application Entities. The DICOM SERVER AE is used for image transfers and is implemented by a Windows application called *dcserver*. The HARDCOPY SERVER AE is used for printing and is implemented by a Windows application called *hcserver*.

2.1 Application Data Flow Diagram

The diagram for the Implementation Model is shown in Figure 1.

Figure 1. VR Application Entity Implementation Model



The *dcserver* is expected to be running on the local 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 VR software.

The VR 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 VR User Interface for interpretation and display.

The *hcserver* can be running on the local or a remote workstation. The VR application using the *hcserver* requests printing to a print device. The *hcserver* initiates an association with a DICOM print SCP for the purpose of printing the job requested by the application. The *hcserver* can handle simultaneous associations with a number of DICOM print SCPs.

2.2 Functional Definitions of Application Entities

The *dcserver* component operates as a daemon. The startup sequence of the VR system initiates its execution. The *dcserver* is left running whether the VR 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 VR 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 VR User Interface displays the responses from the Remote Application Entity.

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

The *hcsrvr* uses a configuration file to determine the list of printer devices connected to the server and the properties of each printer.

Association and release requests are logged to the Window NT event log or a log file on Windows 95. Various error and warning indications are also logged using *syslogd*.

2.3 Sequencing of Real-World Activities

Not applicable.

3. Application Entity Specifications

3.1 Dcserver Application Entity Specification

The VR 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 VR Application. They are treated as a single Application Entity in this description.

The *dcserver* Application Entity provides Standard Conformance to the following DICOM V3.1 SOP Classes as an SCP:

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
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2

The *dcserver* Application Entity provides Standard Conformance to the following DICOM V3.1 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
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

SOP Class Name	SOP Class UID
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2

3.1.1 Association Establishment Policies

3.1.1.1 General

The User of the VR 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 maximum PDU size is 65536 bytes.

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

3.1.1.2 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. The default is 3.

Another configuration parameter is provided to limit the number of associations that *dcserver* can accept. The default is 10.

3.1.1.3 Asynchronous Nature

This release does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4 Implementation Identifying Information

The *dcserver* implementation class UID is 2.16.124.113531.1.1.

The *dcserver* implementation version name is ISG VR 3.1.

3.1.2 Association Initiation Policy

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

3.1.2.1 Query Request

3.1.2.1.1 Associated Real World Activity

The user of the VR 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, Study ID, Study Date range or Referring Physician.

Wild card queries can result in excessive number of responses. The user interface is able to restrict the number of patients displayed. A warning dialog is displayed to indicate that too many matches were found. A query cancel command is sent when the limit is reached.

The DICOM transfer utility defaults to using Study Root Query Model when initiating query request. The query model used can be change to Patient Root Query Model by changing a configuration parameter.

3.1.2.1.2 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 - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.1.2.1.2.1 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

Description	Tag	Type
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

* The keys marked with an asterisk are displayed in the DICOM transfer utility.

3.1.2.1.2.2 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
Number of Study Related Images	(0020,1208)	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

The keys marked with an asterisk are displayed in the DICOM transfer utility.

3.1.2.2 Move Request

3.1.2.2.1 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 VR Application then selects the Send operation button on the user interface to initiate the move operation. The Destination Application Entity Title is selectable on the User Interface.

3.1.2.2.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Move 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 - MOVE	1.2.840.10008.5.1.4.1.2. 1.2	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

3.1.2.2.2.1 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.

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

This implementation supports transfers against the Study Query/Retrieve Information Model described in Section C.6.2.1 of NEMA PS3.4 (1994) Annex C using the C-MOVE SCU behavior described in Section C.4.2.2 of NEMA PS3.4 (1994) Annex C.

3.1.2.3 Store Request

3.1.2.3.1 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.

3.1.2.3.2 Proposed Presentation Contexts

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

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	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	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4. 1.1.12.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4. 1.1.12.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.1.2.3.2.1 SOP Specific Conformance for Image Storage SOP Classes

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 which 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 *dcserver* can be configured to export private ISG data attributes. Group 29 is used for such attributes. The Private Data Creator element value is "Silhouette VRS 3.0"

3.1.3 Association Acceptance Policy

Parameters in the *dcs* 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.

3.1.3.1 Storage Association Request

3.1.3.1.1 Associated Real-World Activity

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

3.1.3.1.2 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
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	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
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG baseline	1.2.840.10008.1.2.4.50	SCP	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG extended	1.2.840.10008.1.2.4.51	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.1.3.1.2.1 SOP Specific Conformance for SOP Class Verification

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

3.1.3.1.2.2 SOP Specific Conformance for SOP Class Storage

The *dcserver* Application Entity conforms to the DICOM Storage Service Class as an SCP for the Abstract Syntax's listed in the table in section 3.1.3.1.2 at conformance level 2.

When a C-STORE operation is successful, the data has been stored in the database. The data is accessed through the VR application. The storage duration of the data is determined by the operator of the VR.

The received images are group and sorted into Patient/Study/Series folders depending on values in the image. This is not directly related to the DICOM behavior and is therefore not specified in this document.

In the case where the database is full, a status of 0xC001 is returned to the Storage SCU and the Information Object is discarded. The recovery action is to provide more storage space.

In the case where the image already exist in the VR database (same Image instance UID), a status of 0xD000 is returned to the Storage SCU and the Information Object is discarded. A different returned value can be specified in a configuration file. The behavior 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 (0000,0902) contains a descriptive message to explain error returns.

The *dcserver* performs some validation before storing the image. Failure of a validation results in the return of status 0xC001 in the C-STORE response message. The following validations are performed:

- Invalid or missing orientation vector values (0020,0037) results in rejection of MR and CT Information Objects.
- A missing Photo Interpretation attribute (0028,0004) 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 (0028,0004) other than MONOCHROME1, MONOCHROME2, PALETTE COLOR or RGB are rejected.
- Any attributes with a value longer than what DICOM specifies are rejected.

The storage implementation performs the following coercions:

- If Pixel Padding Value (0028,0120) is present, the pixel values are adjusted accordingly.

3.1.3.1.3 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 3.1.3.1.2.

3.1.3.1.4 Transfer Syntax Selection Policies

The *dcserver* presently supports only the default DICOM Little-endian Transfer Syntax.

3.1.3.2 Query Association Request

3.1.3.2.1 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.

3.1.3.2.2 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		
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

3.1.3.2.2.1 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 an SCP for the Abstract Syntax's listed in the table in section 3.1.3.2.2. The table in section 3.1.2.1.2.1 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 (0000,0902) contains a descriptive message to explain error returns.

3.1.3.2.2.2 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 an SCP for the Abstract Syntax's listed in the table in section 3.1.3.2.2. The table in section 3.1.2.1.2.2 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 (0000,0902) contains a descriptive message to explain error returns.

3.1.3.2.3 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 3.1.3.1.2.

3.1.3.2.4 Transfer Syntax Selection Policies

The *dcserver* presently supports only the default DICOM Little-endian Transfer Syntax.

3.1.3.3 Move Association Request

3.1.3.3.1 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.

3.1.3.3.2 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		
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

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
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

3.1.3.3.2.1 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 an SCP for the Abstract Syntax's listed in the table in section 3.1.3.3.2.

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 (0000,0902) contains a descriptive message to explain error returns.

3.1.3.3.2.2 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 an SCP for the Abstract Syntax's listed in the table in section 3.1.3.3.2.

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

	failures	
Pending	Matches are continuing	FF00

The attribute (0000,0902) contains a descriptive message to explain error returns.

3.1.3.3.3 Presentation Context Acceptance Criterion

The *dcserver* accepts SOP Class contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.1.3.3.2.

3.1.3.3.4 Transfer Syntax Selection Policies

The *dcserver* presently supports only the default DICOM Little-endian Transfer Syntax.

3.2 Hcserver Application Entity Specification

The *hcserver* represents a single Application Entity. It acts independently of other DICOM applications that may be running on the same system. The *hcserver* can support printing to multiple DICOM printers at the same time, each printer being uniquely identified by an Application Entity Title.

The *hcserver* provides standard conformance to the following DICOM 3.1 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18

3.2.1 Association Establishment Policies

3.2.1.1 General

The *hcserver* maintains a separate association with each DICOM SCP. It releases the association with the DICOM SCP if no operation is done on the association in a selected time period.

3.2.1.2 Number of Associations

There is no limit on the number of associations maintained simultaneously with one or different DICOM SCPs.

3.2.1.3 Asynchronous Nature

This release does not support asynchronous operations and will not perform asynchronous window negotiation.

3.2.1.4 Implementation Identifying Information

The *hcserver* implementation class UID is 2.16.124.113531.1.3.1.

The *hcserver* implementation version name is ISG_HCS_V1.0.96.

3.2.2 Association Initiation Policy

The *hcserver* maintains a list of valid print devices and can present that list to the applications upon request. When the application submits a print job designated for a listed print devices to the *hcserver*, the *hcserver* will request an association with the selected print device.

3.2.2.1 Print to remote printer

3.2.2.1.1 Associated Real World Activity

The application's print request causes the *hcserver* to initiate an association.

3.2.2.1.2 Proposed Presentation Contexts

The *hcserver* will propose one of the presentation contexts listed in the Presentation Context Table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic GrayScale Print Management	1.2.840.10008.5.1.1.9	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Basic Color Print Management	1.2.840.10008.5.1.1.18	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.2.1.2.1 SOP Specific Conformance to Basic GrayScale Print Management Meta SOP Class

The *hcserver* supports the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class:

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

The *hcserver* supports the following optional SOP class attributes and DIMSE services for the Basic Grayscale Print Management Meta SOP Class.

SOP Class	DIMSE Service	Optional Attribute	Tag
Basic Film Session SOP Class	N-CREATE	Number of Copies	(2000,0010)
		Print Priority	(2000,0020)
		Medium Type	(2000,0030)
		Film Destination	(2000,0040)
		Film Session Label	(2000,0050)
		Memory Allocation	(2000,0060)
Basic Film Box SOP Class	N-CREATE	Film Orientation	(2010,0040)
		Film Size ID	(2010,0050)
		Magnification Type	(2010,0060)
		Max Density	(2010,0130)
		Configuration Information	(2010,0150)
		Smoothing Type	(2010,0080)
		Border Density	(2010,0100)
		Empty Image Density	(2010,0110)

SOP Class	DIMSE Service	Optional Attribute	Tag
		Min Density	(2010,0120)
		Trim	(2010,0140)
	N-DELETE		
Basic Grayscale Image Box SOP Class	N-SET	Polarity	(2020,0020)
		Magnification type	(2010,0060)
		Smoothing type	(2010,0080)
		Requested Image Size	(2020,0030)
Printer SOP Class	N-GET		

3.2.2.1.2.1.1 Basic Film Session SOP Class attributes

The hcsrver supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Number of Copies	(2000,0010)	Integer string
Print Priority	(2000,0020)	HIGH,MED,LOW
Medium Type	(2000,0030)	PAPER,CLEAR FILM,BLUE FILM
Film Destination	(2000,0040)	MAGAZINE, PROCESSOR
Film Session Label	(2000,0050)	Long string
Memory Allocation	(2000,0060)	Integer string

3.2.2.1.2.1.2 Basic Film Box SOP Class attributes

The hcsrver supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Image Display Format	(2010,0010)	STANDARD, ROW, COL, SLIDE, SUPERSLIDE, CUSTOM
Film Orientation	(2010,0040)	PORTRAIT, LANDSCAPE
Film Size ID	(2010,0050)	8INX10IN, 10INX14IN, 14INX14IN, 24CMX24CM, 10INX12IN, 11INX14IN, 14INX17IN, 24CMX30CM
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Border Density	(2010,0100)	BLACK, WHITE, i where i represents the desired density in hundredths of OD
Empty Image Density	(2010,0110)	BLACK, WHITE, i where i represents the desired density in hundredths of OD
Min Density	(2010,0120)	Unsigned short
Max Density	(2010,0130)	Unsigned short
Trim	(2010,0140)	YES, NO

Attribute Name	Tag	Supported values
Configuration Information	(2010,0150)	SCP specific

3.2.2.1.2.1.3 Basic Grayscale Image Box SOP Class attributes

The hcserver supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Image Position	(2020,0010)	Unsigned short
Polarity	(2020,0020)	NORMAL, REVERSE
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Requested Image Size	(2020,0030)	Unsigned short
Preformatted Grayscale Image Sequence	(2020,0110)	
>Samples per Pixel	(0028,0002)	1
>Photometric Interpretation	(0028,0004)	MONOCHROME1, MONOCHROME2
>Planar configuration	(0028,0006)	1
>Rows	(0028,0010)	Unsigned short
>Columns	(0028,0011)	Unsigned short
>Pixel Aspect Ratio	(0028,0034)	1:1
>Bits Allocated	(0028,0100)	8
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	000H(unsigned integer)
>Pixel Data	(7FE0,0010)	Other Byte String

3.2.2.1.2.1.4 Printer SOP Class attributes

The hcserver makes use of the following attributes and attributes values in this SOP class:

Attribute Name	Tag	Supported values
Printer Status	(2110,0010)	NORMAL, WARNING FAILURE
Printer Status Info	(2110,0020)	SUPPLY EMPTY, SUPPLY LOW, RECEIVER FULL, FILM JAM
Printer Name	(2110,0030)	Long string
Manufacturer	(0008,0070)	Long string
Manufacturer Model Name	(0008,1090)	Long string
Device Serial Number	(0008,1000)	Long string

Attribute Name	Tag	Supported values
Software Versions	(0018,1020)	Long string(s)

3.2.2.1.2.2 SOP Specific Conformance to Basic Color Print Management Meta SOP Class

The *hcs*server supports the following mandatory SOP classes which are defined under the Basic Color Print Management Meta SOP Class:

SOP Class Name	SOP Class UID
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Color Image Box	1.2.840.10008.5.1.1.4.1
Printer	1.2.840.10008.5.1.1.16

The optional SOP class attributes and DIMSE services for the Basic Film Session, Basic Film Box and Printer SOP classes are listed in the SOP Specific Conformance section for the Basic Grayscale Print Management Meta SOP Class

The *hcs*server supports the following optional SOP class attributes and DIMSE services for the Basic Color Print Management Meta SOP Class.

SOP Class	DIMSE Service	Optional Attribute	Tag
Basic Color Image Box SOP Class	N-SET	Polarity	(2020,0020)

3.2.2.1.2.2.1 Basic Color Image Box SOP Class attributes

The *hcs*server supports the following attributes in this SOP class:

Attribute Name	Tag	Supported values
Image Position	(2020,0010)	Unsigned short
Polarity	(2020,0020)	NORMAL, REVERSE
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Requested Image Size	(2020,0030)	Unsigned short
Preformatted Color Image Sequence	(2020,0110)	
>Samples per Pixel	(0028,0002)	3
>Planar configuration	(0028,0006)	1
>Photometric Interpretation	(0028,0004)	RGB
>Rows	(0028,0010)	Unsigned short
>Columns	(0028,0011)	Unsigned short
>Pixel Aspect Ratio	(0028,0034)	1:1
>Bits Allocated	(0028,0100)	8

Attribute Name	Tag	Supported values
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	000H(unsigned integer)
>Pixel Data	(7FE0,0010)	Other Byte String

3.2.3 Association Acceptance Policy

The *hcserver* does not accept associations.

4. Communication Profiles

4.1 Supported Communication Stacks (Parts 8,9)

The VR DICOM services provide DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM standard.

4.1.1 TCP/IP Stack

The VR DICOM services inherit its TCP/IP stack from the Windows OS system upon which they execute.

4.1.1.1 API

The implementation uses Berkeley style sockets.

4.1.1.2 Physical Media Support

The implementation is not dependent on the physical medium used for the TCP/IP network.

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.

6. Configuration

6.1 Dcserver Application Entity Configuration

VR 3.1 Service Manual, supplied with the product, defines the available configuration parameters.

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

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

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

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

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

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

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

Application entity host names can be specified as either IP address or host name.

The number of associations that can be initiated is configurable.

The number of associations that can be accepted is configurable.

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

Mapping between attributes in DICOM Information Objects and the target database is runtime configurable.

6.2 Hcserver Application Entity Configuration

VR 3.1 Service Manual, supplied with the product, defines the available configuration parameters.

Application entity host names can be specified as either IP address or host name.

The destination printer host name and port number is configurable. Multiple printers can be configured.

The film layout formats supported per printer are configurable.

The association timeout per printer is configurable.

7. Support of Extended Character Sets

This implementation supports the following extended character set:

ISO-IR 100 = Latin alphabet No. 1, supplementary set.

Appendix

Revision History

Date	Revision	Changes
1998/11/03	1.1	Initial revision
1998/11/08	1.2	Approved version

Reviewer's Comments

Rev		Comments	Reviewer	Resolution
1.0				
	1	Use of Print server in Section 3.2.2 is confusing - change to Print device	Darek	Changed.