



KODAK DIGITAL SCIENCETM
CX/DX Workstation

DICOM Conformance Statement

Version # 2.1.7

Date: November 23, 1998

Document # 3H8353

Copyright © Eastman Kodak Company, 1998

Eastman Kodak Company reserves the right to change any part of this document without prior notice. This publication is protected by Federal Copyright law, with all rights reserved.

Note: Publication of a DICOM Conformance Statement does not indicate product availability in all countries. Please contact your Kodak representative, or Kodak in your country, for information on availability of a specific product.

Functional Group	Printed Name	Signature	Date
Author/Owner	Wayne Tyler		
Software Engineering Technical Lead	Marty Potkalesky		
Quality Engineering	Tom Thoma		
Systems Integration	Wayne Tyler		

Revision History

Date	Rev	Editor	Comments
12/11/98	-	Wayne Tyler	Made corrections to the Conformance Statement.

Table of Contents

0	INTRODUCTION.....	6
0.1	PURPOSE OF THIS DOCUMENT.....	6
0.2	IMPORTANT CONSIDERATIONS FOR THE READER.....	6
1	DEFINITIONS, ACRONYMS, ABBREVIATIONS	7
2	IMPLEMENTATION MODEL	8
2.1	APPLICATION DATA FLOW DIAGRAM.....	8
2.2	FUNCTIONAL DEFINITIONS OF APPLICATION ENTITIES.....	10
2.3	SEQUENCING OF REAL-WORLD ACTIVITIES.....	11
3	APPLICATION ENTITY SPECIFICATIONS.....	12
3.1	DCSERVER APPLICATION ENTITY SPECIFICATION.....	12
3.1.1	<i>Association Establishment Policies</i>	<i>13</i>
3.1.1.1	General.....	13
3.1.1.2	Number of Associations	13
3.1.1.3	Asynchronous Nature	13
3.1.1.4	Implementation Identifying Information.....	13
3.1.2	<i>Association Initiation Policy</i>	<i>13</i>
3.1.2.1	Query Request	13
3.1.2.1.1	Associated Real World Activity.....	13
3.1.2.1.2	Proposed Presentation Contexts.....	14
3.1.2.2	Move Request	17
3.1.2.2.1	Associated Real World Activity.....	17
3.1.2.2.2	Proposed Presentation Contexts.....	17
3.1.2.3	Store Request.....	18
3.1.2.3.1	Associated Real World Activity.....	18
3.1.2.3.2	Proposed Presentation Contexts.....	18
3.1.3	<i>Association Acceptance Policy.....</i>	<i>19</i>
3.1.3.1	Storage Association Request	19
3.1.3.1.1	Associated Real-World Activity.....	19
3.1.3.1.2	Presentation Context Table	19
3.1.3.1.3	Presentation Context Acceptance Criterion.....	21
3.1.3.1.4	Transfer Syntax Selection Policies.....	21
3.1.3.2	Query Association Request.....	21
3.1.3.2.1	Associated Real-World Activity.....	21
3.1.3.2.2	Presentation Context Table	22
3.1.3.2.3	Presentation Context Acceptance Criterion.....	23
3.1.3.2.4	Transfer Syntax Selection Policies.....	23
3.1.3.3	Move Association Request	23
3.1.3.3.1	Associated Real-World Activity.....	23
3.1.3.3.2	Presentation Context Table	23
3.1.3.3.3	Presentation Context Acceptance Criterion.....	25
3.1.3.3.4	Transfer Syntax Selection Policies.....	25
3.2	HCSERVER APPLICATION ENTITY SPECIFICATION.....	25
3.2.1	<i>Association Establishment Policies</i>	<i>25</i>
3.2.1.1	General.....	25
3.2.1.2	Number of Associations	26
3.2.1.3	Asynchronous Nature	26
3.2.1.4	Implementation Identifying Information.....	26
3.2.2	<i>Association Initiation Policy</i>	<i>26</i>

Kodak Digital Science™ CX/DX Workstation DICOM Conformance Statement

3.2.2.1	Print to remote printer.....	26
3.2.2.1.1	Associated Real World Activity.....	26
3.2.2.1.2	Proposed Presentation Contexts.....	26
3.2.3	<i>Association Acceptance Policy</i>	30
4	COMMUNICATION PROFILES.....	31
4.1	SUPPORTED COMMUNICATION STACKS (PARTS 8,9)	31
4.1.1	<i>TCP/IP Stack</i>	31
4.1.1.1	API.....	31
4.1.1.2	Physical Media Support	31
5	EXTENSIONS/SPECIALIZATION'S/PRIVATIZATION'S	32
5.1	STANDARD/EXTENDED/SPECIALIZED/PRIVATE SOPs	32
5.2	PRIVATE TRANSFER SYNTAX'S	32
6	CONFIGURATION.....	33
6.1	DCSERVER APPLICATION ENTITY CONFIGURATION	33
6.2	HCSERVER APPLICATION ENTITY CONFIGURATION	33
7	SUPPORT OF EXTENDED CHARACTER SETS	34

0 Introduction

0.1 Purpose of this Document

This document is the DICOM Conformance Statement for the *Kodak Digital Science™ CX/DX Workstation* version 2.1.7. The purpose of this document is to describe how the workstation interacts with other DICOM devices on the network.

0.2 Important Considerations for the Reader

This DICOM Conformance Statement by itself is not sufficient to guarantee successful connectivity between the *Kodak Digital Science™ CX/DX Workstation* version 2.1.7 and equipment from other vendors. The following considerations should be made:

- The integration of equipment from different vendors (including Kodak) goes beyond the scope of the DICOM 3.0 standard and the DICOM Conformance Statements from Kodak and other vendors. It is the responsibility of the user (or user's agent) to assess the application requirements and to design a solution that integrates Kodak equipment with equipment from other vendors.
- When the comparison of this DICOM Conformance Statement with a DICOM Conformance Statement from another vendor indicates that connectivity should be possible, it is the responsibility of the user (or user's agent) to verify this by carrying out validation tests and to check whether all required functionality (such as cutlines) is met.
- With regard to the future evolution of the DICOM 3.0 standard Eastman Kodak Company reserves the right to make changes to *Kodak Digital Science™ CX/DX Workstation* version 2.1.7 architecture described in this document. The user (or user's agent) should ensure that any equipment connected via DICOM to Kodak equipment also follows the future evolution of the DICOM 3.0 standard. Failure to do so may result in (partial) loss of connectivity.

1 Definitions, Acronyms, Abbreviations

AE	Application Entity
DCSERVER	The executable name of the DICOM Image Transfer Server
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
HCSERVER	The executable name of the Hardcopy Server
LUT	Look-up Table
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
VR	Value Representation

2 Implementation Model

The *Kodak Digital Science™ CX/DX Workstation* version 2.1.7 is a medical diagnostic and review station. The workstation uses DICOM services to:

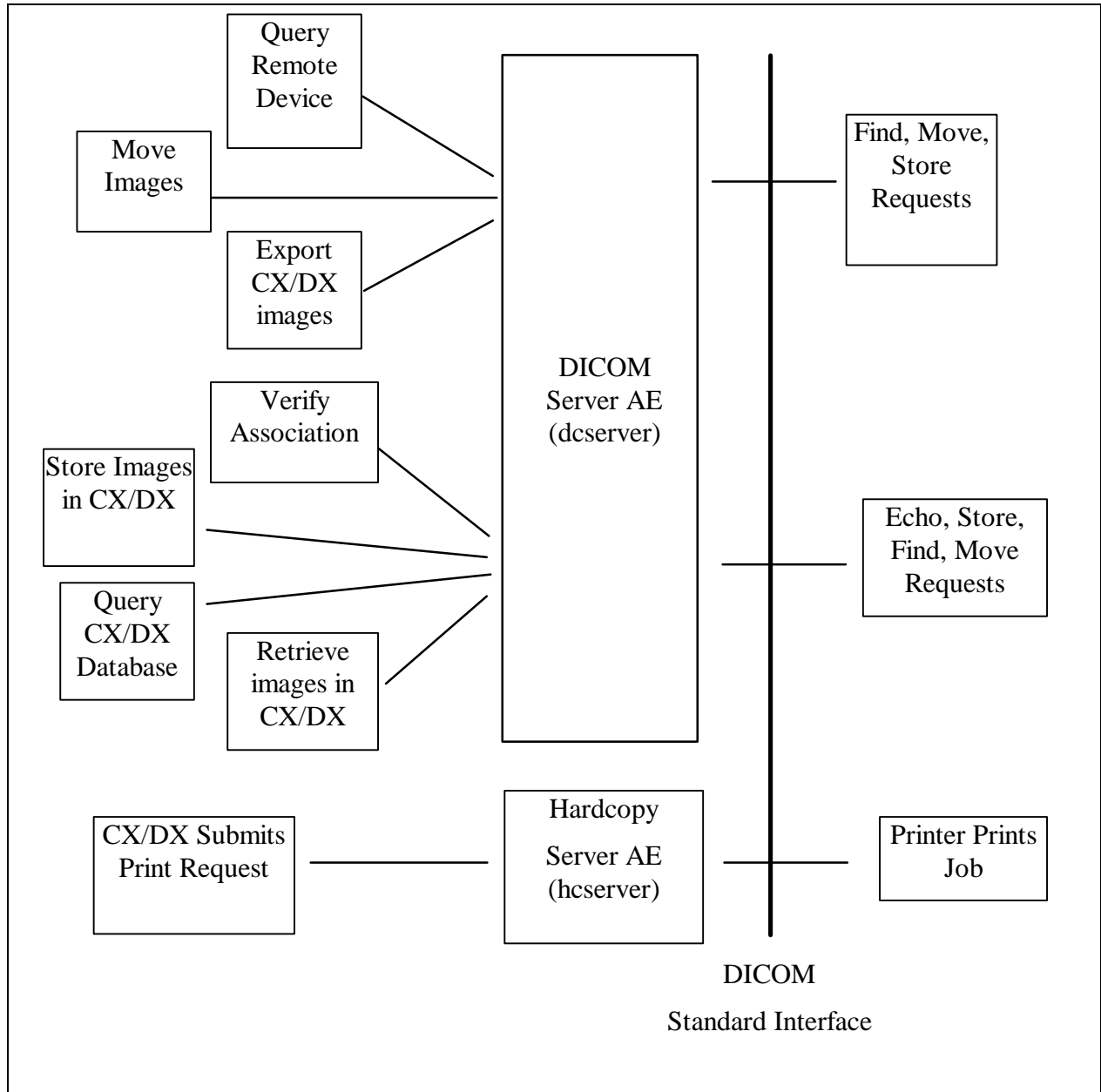
- import and export images
- query the content of other devices and initiate transfers
- print images

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

2.1 Application Data Flow Diagram

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

Figure 1. CX/DX workstation 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 CX/DX workstation software.

The CX/DX workstation 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 CX/DX workstation User Interface for interpretation and display.

The *hcserver* can be running on the local or a remote workstation. The CX/DX workstation 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 CX/DX workstation system initiates its execution. The *dcserver* is left running whether the CX/DX workstation 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 CX/DX workstation 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 CX/DX workstation User Interface displays the responses from the Remote Application Entity.

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

The *hcserver* 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 UNIX syslog daemon (*syslogd*) as *local7.info* messages. Various errors 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 CX/DX workstation 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 CX/DX workstation Application. They are treated as a single Application Entity in this description.

The *dcserver* Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as a 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
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
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
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

3.1.1 Association Establishment Policies

3.1.1.1 General

The User of the CX/DX workstation 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 CX/DX workstation 2.1.7.

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 CX/DX workstation User Interface.

3.1.2.1 Query Request

3.1.2.1.1 Associated Real World Activity

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

Wild card queries can result in excessive number of responses. The user interface restricts the number of patients displayed to the first 100. 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
Name	UID	Name	UID		Negotiation
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 *dcs* server does not use Relational Queries.

The *dcs* server 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

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
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 CX/DX workstation 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
Name	UID	Name	UID		Negotiation
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
Name	UID	Name	UID		Negotiation
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
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

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 data attributes. In such case the following data attributes are exported:

(0029,1013); (0029,1014); (0029,1017); (0029,1018); (0029,1019); (0029,101a); (0029,101b); (0029,101c); (0029,101d); (0029,1021); (0029,1022); (0029,1023); (0029,1024); (0029,1025); (0029,1027)

The Private Data Creator element is (0029,0010) and the value is “Silhouette V1.0”

3.1.3 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.

3.1.3.1 Storage Association Request

3.1.3.1.1 Associated Real-World Activity

The *dcserver* 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
Name	UID	Name	UID		Negotiation
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
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
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

3.1.3.1.2.1 SOP Specific Conformance for SOP Class Verification

The *dcs*server 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 *dcs*server Application Entity conforms to the DICOM Storage Service Class as an SCP for the Abstract Syntax's listed in the table in section 0 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 CX/DX workstation application. The storage duration of the data is determined by the operator of the CX/DX workstation.

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 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 are rejected.
- Any attribute with a value longer than what DICOM specifies is rejected.

The storage implementation performs the following coercions:

- If Pixel Padding Value (0028,0120) is present, the pixel values are adjusted accordingly.
- Pixel data overlay bits are masked out, i.e. when overlays are embedded in upper bits of allocated pixel data.

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 0.

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

Kodak Digital Science™ CX/DX Workstation DICOM Conformance Statement

The *dcs* server 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
Name	UID	Name	UID		Negotiation
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 *dcs* server 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 0. The table in section 0 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.

Kodak Digital Science™ CX/DX Workstation DICOM Conformance Statement

3.1.3.2.2 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 0. The table in section 0 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 0.

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
Name	UID	Name	UID		Negotiation
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

3.1.3.3.2.1 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 0.

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 0.

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

Kodak Digital Science™ CX/DX Workstation DICOM Conformance Statement

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.

3.1.3.3.3 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 0.

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 3.0 SOP Classes as an SCU:

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

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 servers and can present that list to the applications upon request. When the application submits a print job designated for a listed print server to the *hcserver*, the *hcserver* will request an association with the selected print server.

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
Name	UID	Name	UID		Negotiation
Basic GrayScale Print Management	1.2.840.10008.5.1.1.9	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)
		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 hcserver 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 hcserver 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
Configuration Information	(2010,0150)	SCP specific

3.2.2.1.2.1.3 Basic Grayscale Image Box SOP Class attributes

The hcsrver 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 hcsrver 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
Software Versions	(0018,1020)	Long string(s)

3.2.3 Association Acceptance Policy

The *hcs* server does not accept associations.

4 Communication Profiles

4.1 Supported Communication Stacks (Parts 8,9)

The CX/DX workstation 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 CX/DX workstation DICOM services inherit its TCP/IP stack from the SUN Solaris 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

The CX/DX workstation man page 'dcsconfig.7', 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 for lookup in /etc/hosts.

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

The CX/DX workstation man page 'PrnDICOM.7', supplied with the product, defines the available configuration parameters.

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

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

The film layout formats supported per printer is 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.

Kodak and Digital Science are Trademarks.