



GE Medical Systems

Technical Publications

2156879-100

Revision 2+

GEMNET-Cardiac Review Station V3.1.0 DICOM Conformance Statement

do not duplicate

Copyright © 1997 by General Electric Co.

TABLE OF CONTENTS

REVISION HISTORY	v
LIST OF EFFECTIVE PAGES	v
SECTION 1.	
INTRODUCTION	I-1
1.0. OVERVIEW	I-1
1.1. OVERALL CONFORMANCE STATEMENT DOCUMENT STRUCTURE	I-1
1.2. INTENDED AUDIENCE	I-3
1.3. scope and field of application	I-3
1.4. IMPORTANT REMARKS	I-4
1.5. REFERENCES	I-5
1.6. DEFINITIONS	I-5
1.7. SYMBOLS AND ABBREVIATIONS	I-5
SECTION 2.	
NETWORK CONFORMANCE STATEMENT	II-1
2.0. INTRODUCTION	II-1
2.1. IMPLEMENTATION MODEL	II-1
2.1.1. Application Data Flow Diagram	II-1
2.1.2. Functional Definition of AE's	II-2
2.1.2.1. GEMnet DCR500/DCR2000–CRS DICOM Network Server AE	II-2
2.1.3. Sequencing of Real–World Activities	II-3
2.2. AE Specifications	II-3
2.2.1. GEMnet DCR500/DCR2000–CRS DICOM Network Server AE Specification	II-3
2.2.1.1. Association Establishment Policies	II-4
2.2.1.1.1. General	II-4
2.2.1.1.2. Number of Associations	II-4
2.2.1.1.3. Asynchronous Nature	II-4
2.2.1.1.4. Implementation Identifying Information	II-5
2.2.1.2. Association Initiation Policy	II-5
2.2.1.2.1. Real–World Activity “Verification Requester” (for DCR2000 only)	II-5
2.2.1.2.1.1. Associated Real–World Activity	II-5
2.2.1.2.1.2. Proposed Presentation Contexts	II-5
2.2.1.2.1.3. SOP specific Conformance	II-5
2.2.1.2.1.4. Association Termination	II-5
2.2.1.2.2. Real–World “Transfer of images” (for DCR2000 only)	II-5
2.2.1.2.2.1. Associated Real–World Activity	II-5
2.2.1.2.2.2. Proposed Presentation Contexts	II-6
2.2.1.2.2.3. SOP specific Conformance	II-6
2.2.1.2.2.4. Association Termination	II-6
2.2.1.2.3. Real World Activity “Query Remote Database” (for DCR2000 only)	II-6
2.2.1.2.3.1. Associated Real–World Activity	II-6
2.2.1.2.3.2. Proposed Presentation Contexts	II-6
2.2.1.2.3.3. SOP specific Conformance	II-7

2.2.1.2.3.3.1.Private query key attributes :	II-7
2.2.1.2.3.4.Association Termination	II-7
2.2.1.2.4. Real World Activity “Retrieve Images from Remote Database” (for DCR2000 only)	II-8
2.2.1.2.4.1.Associated Real-World Activity	II-8
2.2.1.2.4.2.Proposed Presentation Contexts	II-8
2.2.1.2.4.3.SOP specific Conformance	II-8
2.2.1.2.4.4.Association Termination	II-8
2.2.1.2.5. Real World Activity “Private Migration Request” (for DCR2000 only)	II-8
2.2.1.2.5.1.Associated Real-World Activity	II-8
2.2.1.2.5.2.Proposed Presentation Contexts	II-8
2.2.1.2.5.3.SOP specific Conformance	II-9
2.2.1.2.5.4.Association Termination	II-9
2.2.1.3. Association Acceptance Policy	II-9
2.2.1.3.1. Real World Activity “Verification Responder”	II-9
2.2.1.3.1.1.Associated Real-World Activity	II-9
2.2.1.3.1.2.Presentation Context Table	II-9
2.2.1.3.1.3.SOP specific Conformance	II-9
2.2.1.3.1.4.Presentation Context Acceptance Criterion	II-9
2.2.1.3.1.5.Transfer Syntax Selection Policies	II-9
2.2.1.3.2. Real World “Image Receiver”	II-9
2.2.1.3.2.1.Associated Real-World Activity	II-10
2.2.1.3.2.2.Presentation Context Table	II-10
2.2.1.3.2.3.SOP specific Conformance	II-10
2.2.1.3.2.3.1. Image Reception	II-10
2.2.1.3.2.3.2. Image Installation	II-10
2.2.1.3.2.4.Presentation Context Acceptance Criterion	II-11
2.2.1.3.2.5.Transfer Syntax Selection Policies	II-11
2.3. Communication profiles	II-11
2.3.1. Supported Communication Stacks (parts 8,9)	II-11
2.3.2. TCP/IP Stack	II-11
2.3.2.1. API	II-11
2.3.2.2. Physical Media Support	II-11
2.3.3. Point-to-Point Stack	II-11
2.4. Extensions / specializations / privatizations	II-11
2.4.1. Standard Extended/Specialized/Private SOP	II-11
2.4.1.1. Standard Extended Query SOP Class	II-11
2.4.1.2. Private Migration SOP Class	II-12
2.4.2. Private Transfer Syntax	II-12
2.5. Configuration	II-13
2.5.1. AE Title/Presentation Address Mapping	II-13
2.5.2. Configurable Parameters	II-13
2.6. Support of extended character sets	II-13

SECTION 3.

MEDIA STORAGE CONFORMANCE STATEMENT III-1

3.0. INTRODUCTION	III-1
3.1. IMPLEMENTATION MODEL	III-1
3.1.1. Application Data Flow Diagram	III-1

3.1.2.	Functional Definition of AE's	III-2
3.1.3.	Sequencing Requirements	III-2
3.1.4.	File Meta Information Options (See PS3.10)	III-2
3.2.	AE SPECIFICATIONS	III-2
3.2.1.	GEMnet DCR500/DCR2000 CRS DMS AE AE Specification	III-2
3.2.1.1.	File Meta Information for the DMS AE Application Entity	III-2
3.2.2.	Real World Activities	III-3
3.2.2.1.	Real World Activity : Browse CD	III-3
3.2.2.1.1.	Media Storage Application Profile for the RWA: Browse CD	III-3
3.2.2.2.	Real World Activity : Restore CD	III-3
3.2.2.2.1.	Media Storage Application Profile for the RWA: Restore CD	III-3
3.2.2.3.	Real World Activity : Archive CD	III-3
3.2.2.3.1.	Media Storage Application Profile for the RWA: Archive CD	III-4
3.3.	Augmented and Private Application Profiles	III-4
3.3.1.	Augmented Application Profiles	III-4
3.3.1.1.	AUG-SC-STD-XABC-CD	III-4
3.3.1.1.1.	SOP Class Augmentations	III-4
3.3.1.1.2.	Directory Augmentations	III-5
3.3.1.1.3.	Other Augmentations	III-5
3.3.1.1.4.	Private Application Profiles	III-5
3.4.	EXTENSIONS, SPECIALIZATIONS, PRIVATIZATIONS of SOP CLASSES AND TRANSFER SYNTAXES	III-5
3.4.1.	Extensions, Specializations, and Privatizations of SOP Classes	III-5
3.4.1.1.	SOP Specific Conformance Statement for SOP Class "Media Storage Directory Storage"	III-5
3.4.2.	Private Transfer Syntax Specification	III-5
3.4.3.	Private Data Dictionary for the Basic Directory	III-5
3.4.4.	Private query key attributes :	III-5
3.5.	CONFIGURATION	III-5
3.6.	SUPPORT OF EXTENDED CHARACTER SETS	III-6

SECTION 4.

INFORMATION OBJECT IMPLEMENTATION OF DICOM OBJECTS PRODUCED BY THE CRS **IV-1**

4.0.	Basic Directory Information Object Implementation :	IV-1
4.0.1.	Introduction :	IV-1
4.0.2.	BASIC DIRECTORY IOD Implementation	IV-1
4.0.3.	BASIC DIRECTORY Entity-Relationship Model	IV-1
4.0.3.1.	GEMnet CRS Mapping of DICOM entities	IV-2
4.0.4.	IOD MODULE TABLE	IV-3
4.0.5.	Information Module Definition :	IV-3
4.0.5.1.	Common File Set Identification Modules :	IV-3
4.0.5.1.1.	File-Set Identification Module :	IV-3
4.0.5.2.	Common Directory Information Modules :	IV-3
4.0.5.2.1.	Directory Information Module :	IV-3
4.0.5.3.	Definition of Specific Directory Records :	IV-4
4.0.5.3.1.	Patient Directory Record Definition :	IV-4
4.0.5.3.2.	Study Directory Record Definition :	IV-4
4.0.5.3.3.	Series Directory Record Definition :	IV-4
4.0.5.3.4.	Image Directory Record Definition :	IV-5
4.0.5.4.	Private Data Dictionary for the Basic Directory :	IV-5

- 4.1. Secondary Capture Information Object Implementation : IV-6
 - 4.1.1. Introduction : IV-6
 - 4.1.2. SC Image IOD Implementation : IV-6
 - 4.1.3. SC attributes which have been modified from the source XA object, or which have been added to the source XA object : IV-6
 - 4.1.3.1. Attributes modified from the source XA object : IV-6
 - 4.1.3.2. Attributes added to the source XA object : IV-6

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	April 4, 1996	Add missing chapter 2.1.4.
1	August, 1997	Updated for DCR2000
2+	December, 1997	Made various changes to text for accuracy and usability. Private query key attributes added New Section 4

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION NUMBER	PAGE NUMBER	REVISION NUMBER	PAGE NUMBER	REVISION NUMBER
Title Page	2+				
Table of Contents i thru iv	2+				
Revision History v thru vi	2+				
Introduction 1-1 thru 1-6	2+				
Network Conformance Statement 2-1 thru 2-14	2+				
Media Storage Conformance Statement 3-1 thru 3-6	2+				
Information object implementation of Dicom objects produced by the CRS 4-1 thru 4-6	2+				

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 1. INTRODUCTION

1.0. OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1, *Introduction*, which describes the overall structure, intent, and references for the Conformance Statement.

Section 2, *Network Conformance Statement*, which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.

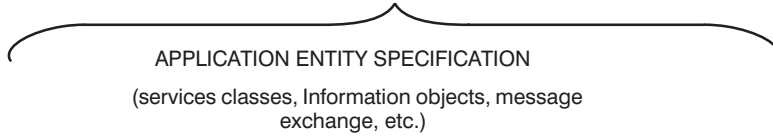
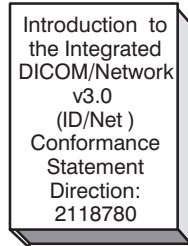
Section 3, *Media Storage Conformance Statement*, which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Media Storage features.

1.1. OVERALL CONFORMANCE STATEMENT DOCUMENT STRUCTURE

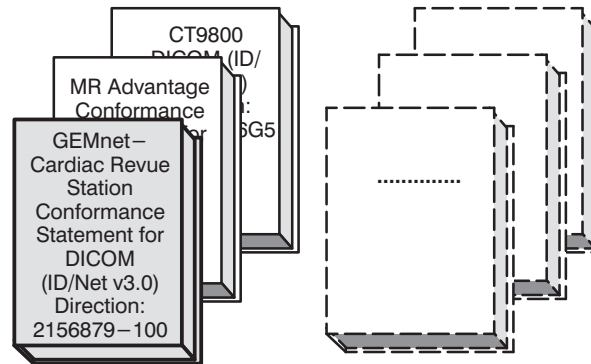
The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM Conformance Statements is shown in Illustration 1-1.

ILLUSTRATION 1-1
DOCUMENTATION STRUCTURE

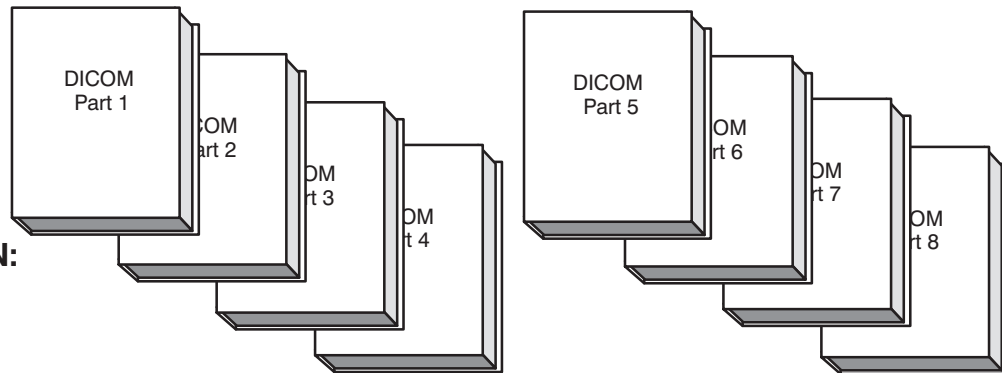
ID/NET V3.0



PRODUCT IMPLEMENTATION:



STANDARD SPECIFICATION:



This document specifies the DICOM implementation. It is entitled:

*GEMnet–Cardiac Revue Station
Conformance Statement for DICOM
Direction 2156879–100*

This Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEMS network interface. Introductory information, which is applicable to all GEMS Conformance Statements, is described in the document:

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780.*

This Introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading the individual products' GEMS Conformance Statements.

The GEMS Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information including Network Architecture and basic DICOM concepts, please refer to the *Introduction*.

For the convenience of software developers, there is “collector” Direction available. By ordering the collector, the Introduction described above and all of the currently published GEMS Product Conformance Statements will be received. The collector Direction is:

*ID/Net v3.0 Conformance Statements
Direction: 2117016*

For more information regarding DICOM, copies of the Standard may be obtained by written request or phone by contacting:

NEMA Publication
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209
USA
Phone: (703) 841–3200

1.2. INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM terminology they should first refer to the document listed below, then read the DICOM Standard itself, prior to reading this Conformance Statement document.

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780*

1.3. scope and field of application

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical image data exchanged using DICOM. The GEMS Conformance Statements are available to the public.

The reader of this Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEMS devices.

1.4. IMPORTANT REMARKS

The use of these Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful.** The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** – The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM), and of this introduction and associated Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** – Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications. Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.
- **Future Evolution** – GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these GEMS Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **To be informed of the evolution of the implementation described in this document, the User is advised to regularly check the GE Internet Server, accessible via anonymous ftp:**
(GE Internet Server Address: [ftp.med.ge.com](ftp://med.ge.com), 192.88.230.11)
- **Interaction** – It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.5. REFERENCES

A list of references which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

The information object implementation refers to the X-Ray Radiofluoroscopic Image Object Definition (DICOM Standard Supplement 6) to Part 3 (Information Object Definition)

1.6. DEFINITIONS

A set of definitions which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

1.7. SYMBOLS AND ABBREVIATIONS

A list of symbols and abbreviations which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 2.

NETWORK CONFORMANCE STATEMENT

2.0. INTRODUCTION

The GEMnet DRC500/DCR2000 – Cardiac Review Station (CRS) is part of the GEMnet DRC500/DCR2000 system. GEMnet is a digital image management system designed to eliminate the use of cine film in the cardiac catheterization lab. In addition to providing DICOM interchange on CD–R to support the cine replacement standard, GEMnet™ utilizes DICOM Networking to Query/Retrieve images from and store images to the remote database.

The GEMnet DRC500/DCR2000–CRS provides associated services for issuing query to retrieve images from remote Image Database. The GEMnet DRC500/DCR2000–CRS also provides services for sending image data to a remote Archive Manager for storage and archiving. DICOM protocols is the fundamental standard through which the GEMnet DRC500/DCR2000–CRS implements the mentioned services.

It is assumed that readers of this document are familiar with the DICOM standard and with the terminology and concepts used in that standard.

This conformance statement (CS) specifies the GE DCR500/DCR2000–Cardiac Revue Station compliance to DICOM for networking features. It details the DICOM Service Classes and roles which are supported by this product.

Note that the format of this section strictly follows the format of DICOM Standard Part 2 (Conformance) Annex A. Please refer to that part of the standard while reading this section.

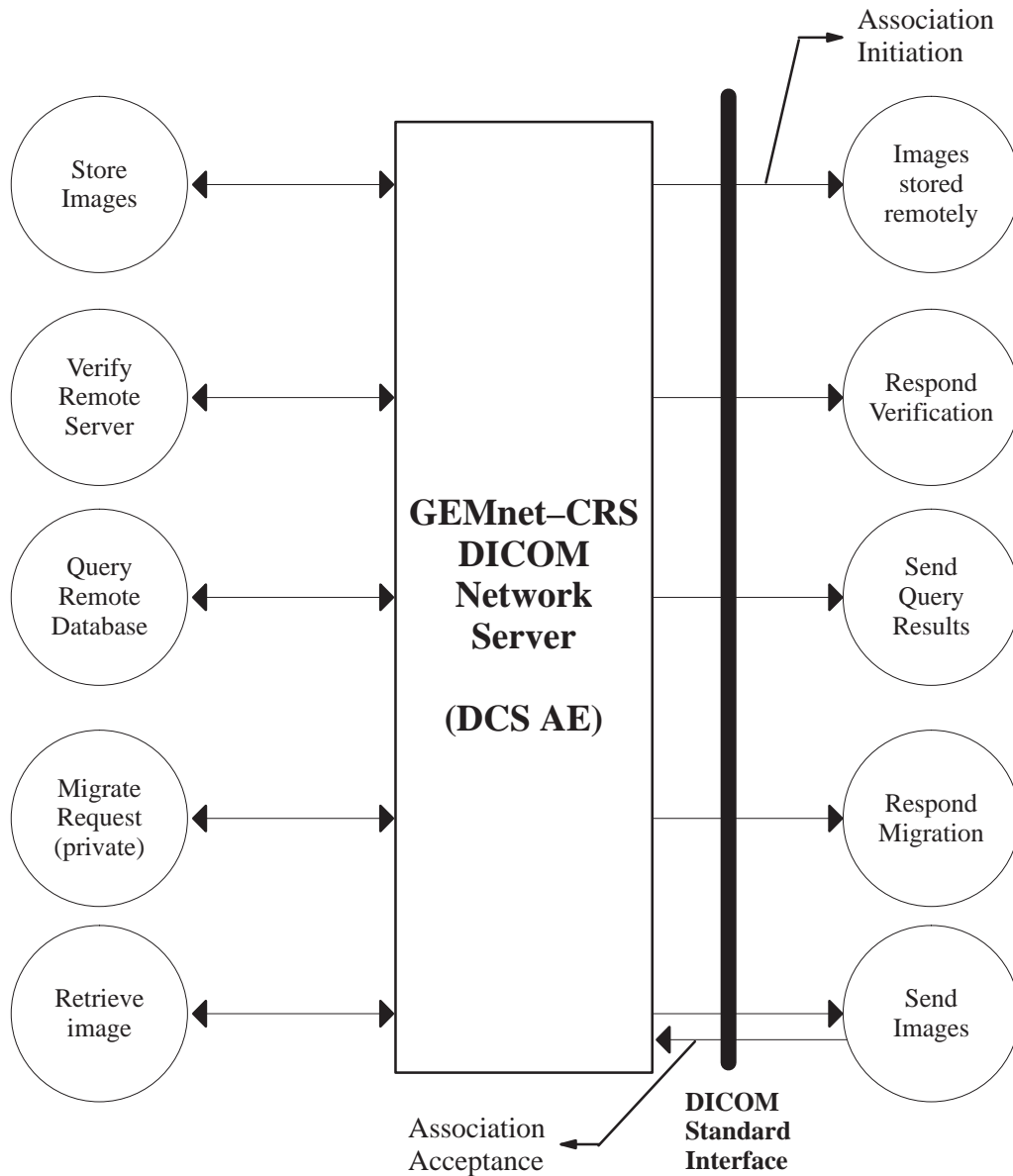
2.1. IMPLEMENTATION MODEL

2.1.1. Application Data Flow Diagram

The DICOM network functionality on the GEMnet DCR500/DCR2000–Cardiac Review Station system is handled by the DICOM Network Server Application Entity (AE). The DICOM Network Server AE is permanently listening to a predefined port for incoming connections. When the connection is established, images are transferred through the physical link and are installed on the GEMnet DCR500/DCR2000–Cardiac Review Station disks. No user action is required for the DICOM Network Server Application Entity to respond to an incoming DICOM Store request. The DICOM Network Server Application Entity will perform image installation after the remote AE has sent an image to the GEMnet DCR500/DCR2000–Cardiac Review Station.

The Application models are shown in Illustration NO TAG.

ILLUSTRATION 2-1
SPECIFIC DCS AE APPLICATION MODEL



2.1.2. Functional Definition of AE's

2.1.2.1. GEMnet DCR500/DCR2000-CRS DICOM Network Server AE

The “store” functionality supported by the DCS AE enables the user to store images from the local CRS disk on to the remote host. For each image, the DCS AE determines the appropriate Presentation Contexts from the headers of these files and proposes an appropriate association for the transfer of this image to the destination.

The “query” functionality supported by the DCS AE enables the CRS user to query any remote database of DICOM images. The DCS AE formulates a DICOM query request as specified by Part 4 of the DICOM standard with the search parameters provided by the user. The DCS AE receives the matched responses sent by the remote DICOM server on the same association.

The “retrieve” functionality supported by the DCS AE enables the CRS user to retrieve any of the images stored on the remote database to the local disk. The DCS AE formulates a DICOM move request as specified by Part 4 of the DICOM standard and submits the request on the established association. The DCS AE also waits indefinitely for the remote application to connect at the presentation address configured for its Application Entity Title. When the remote application connects, the DCS AE accepts the association with Presentation Context for SOP Classes of the Storage Service class. The DCS AE thus receives the images on these presentation contexts on a separately established association.

The “migrate” functionality supported by the DCS AE enables the CRS user to send a Migration request to a remote Archive Manager. The DCS AE opens an association with extended negotiation for this request. The DCS AE then formulates a migration request as specified by Part 4 of the DICOM standard and submits it on the established association.

2.1.3. Sequencing of Real–World Activities

Not Applicable

2.2. AE Specifications

2.2.1. GEMnet DCR500/DCR2000–CRS DICOM Network Server AE Specification

The GEMnet DCR500/DCR2000–CRS DICOM Network Server (DCS) AE provides standard conformance to the following DICOM V3.0 SOP Class as an SCU:

Service Class	SOP Class Name	SOP Class UID
Verification (*)	Echo	1.2.840.10008.1.1
Storage (*)	X–ray Angiography Image Storage	1.2.840.10008.5.1.4.1.1.12.1
	Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Query/Retrieve (*)	Study Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1
	Study Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2

(*): for DCR2000 only.

The GEMnet DCR500/DCR2000–CRS DCS AE provides standard conformance to the following DICOM V3.0 SOP Class as an SCP:

Service Class	SOP Class Name	SOP Class UID
Verification	Echo	1.2.840.10008.1.1
Storage	X–ray Angiography Image Storage	1.2.840.10008.5.1.4.1.1.12.1
	Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

The GEMnet DCR500/DCR2000–CRS DCS AE provides standard conformance to the following Private SOP Class as an SCU:

Service Class	SOP Class Name	SOP Class UID
Private (*)	Migration – N–ACTION	1.2.840.113619.4.10

(*): for DCR2000 only.

2.2.1.1. Association Establishment Policies

2.2.1.1.1. General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

The Maximum Length PDU negotiation is included in all association establishment requests.

The Maximum Length PDU for an association initiated by the GEMnet DCR500/DCR2000–CRS DCS AE is:

Maximum Length PDU	8 Kbytes
---------------------------	----------

Note: Maximum Length PDU is not configurable.

The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 1.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation UID

2.2.1.1.2. Number of Associations

The GEMnet DCR500/GEMnet DCR500/DCR2000–CRS DICOM Network Server AE will support at most two associations open simultaneously.

2.2.1.1.3. Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.1.1.4. Implementation Identifying Information

The Implementation UID for this GEMS Implementation is:

GEMnet DCR500/GEMnet DCR500/DCR2000–CRS DICOM Network Server Implementation UID	1.2.840.113619.6.51
--	---------------------

2.2.1.2. Association Initiation Policy

DCS AE will attempt to establish an association whenever it receives any of the following requests:

1. verify request to remote DICOM application,
2. transfer of images,
3. query remote database of DICOM images,
4. retrieve any of the images from the remote database, or
5. issue the migrate request to remote DICOM server.

2.2.1.2.1. Real–World Activity “Verification Requester” (for DCR2000 only)

2.2.1.2.1.1. Associated Real–World Activity

When the CRS user invokes the DICOM Query Retrieve Browser from the CRS Local Browser, the DCS AE will try to open an association with the remote Archive Manager. Upon successful establishment of the association, a C–ECHO RQ is sent to the remote server.

2.2.1.2.1.2. Proposed Presentation Contexts

TABLE 2–1
PRESENTATION CONTEXT TABLE FOR VERIFY REQUEST

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	SCU	None

2.2.1.2.1.3. SOP specific Conformance

If the remote DICOM server does not support the proposed Presentation Context, an appropriate error is logged and/or displayed to the operator.

2.2.1.2.1.4. Association Termination

The DCS AE will release the Association upon receiving the appropriate C–ECHO RSP from the remote server. The DCS AE may alternatively, abort the association upon not receiving the End response within the configurable time–out period specified in the configuration file.

2.2.1.2.2. Real–World “Transfer of images” (for DCR2000 only)

2.2.1.2.2.1. Associated Real–World Activity

DCS AE will attempt to establish an association whenever it receives a store request from the CRS operator. The DCS AE will parse the Meta–header of the DICOM file and propose the appropriate transfer syntax to the remote DICOM Server. Upon successful negotiation of the transfer syntax, a C–STORE RQ is sent to the remote server. The DICOM file could either be encoded as Implicit VR Little Endian or as Explicit VR Big Endian.

2.2.1.2.2.2. Proposed Presentation Contexts

The CRS AE will propose the following Presentation Contexts for the association.

TABLE 2–2
PRESENTATION CONTEXT TABLE FOR STORE REQUEST

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
X–ray Angio–graphy 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
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Secondary Cap–ture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.1.2.2.3. SOP specific Conformance

If the remote DICOM server does not support the proposed Presentation Contexts, an appropriate error is logged and/or displayed to the operator.

2.2.1.2.2.4. Association Termination

The DCS AE will release the association upon receiving the C–STORE RSP from the remote server. The DCS AE may alternatively, terminate the association upon receiving an abort request from the CRS operator.

The DCS AE may also terminate the association if there is no activity for a parameterized length of time.

2.2.1.2.3. Real World Activity “Query Remote Database” (for DCR2000 only)

2.2.1.2.3.1. Associated Real–World Activity

The DCS AE will try to establish an Association when the CRS operator initiates query from the CRS–Query Retrieve Browser. Upon successfully establishing the association, a C–FIND RQ is formulated and sent to the remote server.

The DCS AE is performing only STUDY level query.

2.2.1.2.3.2. Proposed Presentation Contexts

TABLE 2–3
PRESENTATION CONTEXT TABLE FOR QUERY REQUEST

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

2.2.1.2.3.3. SOP specific Conformance

If the remote DICOM server does not support the proposed Presentation Context, an appropriate error is logged and displayed to the operator.

The query request for the Study Root Query Retrieve Information Model is made up of the required and optional keys as given by the Table 3.1.2-4.

Notice : Modality attribute is being used at the STUDY level, not at the normal SERIES level.

TABLE 2-4
SEARCH KEYS FOR STUDY ROOT Q/R INFORMATION MODEL

Attribute Name	Tag	VR	VM	Req. Type	Description
Specific Character Set	0008, 0005	CS	1	O	value = "ISO IR_100"
Query Level	0008, 0052	CS	1	R	value = "STUDY"
Modality	0008, 0060	CS	1	R	value = "XA"
Study Instance UID	0020, 000D	UI	1	R	Value returned by remote server
Study Date	0008, 0020	DA	1	R	Operator Configurable
Performing Physician Name	0008, 1050	PN	1	O	Operator Configurable
Patient ID	0010, 0020	SH	1	R	Operator Configurable
Patient Name	0010, 0010	PN	1	R	Operator Configurable
Study Description	0008, 1030	LO	1	O	Value returned by remote server
Number of Study Related Images	0020, 1208	IS	1	O	Value returned by remote server
Media Location	0087, 0020	CS	1	O	Value returned by remote server- <i>Private</i>
ETTR	0087, 0050	IS	1	O	Value returned by remote server- <i>Private</i>

2.2.1.2.3.3.1. Private query key attributes :

	Tag	VR	VM	Notes
Private Data Element Creator	(0087,00xx)	LO	1	Enumerated value: 1.2.840.113708.794.1.1.2.0
Media Location	(0087,xx20)	CS	1	Defined terms: ONLINE – media is 1st tier magnetic disk LIBRARY – media is in automatic disk or tape library (jukebox) OFFLINE – media must be manually loaded into system
Estimated Retrieve Time	(0087,xx50)	IS	1	Estimated Retrieve Time in seconds; -1 indicates item is OFFLINE and time cannot be estimated

2.2.1.2.3.4. Association Termination

The association opened for the query requests will be closed either upon receiving the C-FIND RSP from the remote server or upon expiration of the time specified in the configuration file. In other words, this association cannot be terminated by the CRS user.

2.2.1.2.4. Real World Activity “Retrieve Images from Remote Database” (for DCR2000 only)

2.2.1.2.4.1. Associated Real-World Activity

The “retrieve” request is formulated and sent to the remote DICOM server whenever the user issues the request from the CRS Query Retrieve Browser. The C-MOVE RQ is formulated with the Study UID’s made available by the previously received query response and sent to the remote server. However, prior to this request, a Private Migration request is sent to the remote Archive Manager. Only upon a successful response to the migration request, is the C-MOVE RQ generated. The DCS AE expects to receive the C-MOVE-PEND messages for every successful C-STORE it generated.

2.2.1.2.4.2. Proposed Presentation Contexts

TABLE 2-5
PRESENTATION CONTEXT TABLE FOR RETRIEVE REQUEST

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

2.2.1.2.4.3. SOP specific Conformance

If the remote DICOM server does not support the proposed Presentation Context, an appropriate error is logged and displayed to the operator.

2.2.1.2.4.4. Association Termination

The association will be closed upon receiving the C-MOVE RSP from the remote DICOM server. Alternatively, the association can be aborted by the CRS user from the Query Retrieve Browser.

2.2.1.2.5. Real World Activity “Private Migration Request” (for DCR2000 only)

2.2.1.2.5.1. Associated Real-World Activity

Whenever the user issues a “retrieve” request from the Query Retrieve Browser, a “Migration” request is sent before the actual “retrieve” request. This migration request is formulated using the Study UID made available by the previously received query response and using the DICOM N-ACTION DIMSE service. The association for this service is opened using Extended Negotiation described in detail in Section NO TAG of this document.

2.2.1.2.5.2. Proposed Presentation Contexts

TABLE 2-6
PRESENTATION CONTEXT TABLE FOR MIGRATION REQUEST

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Study -Migration	1.2.840.113619.4.10	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	YES

2.2.1.2.5.3. SOP specific Conformance

If the remote DICOM server does not support the proposed Presentation Context, an appropriate error is logged and displayed to the operator.

The DCS AE supports Extended Negotiation for the Private Study Migration Class. Refer to Section NO TAG for more details about this class.

2.2.1.2.5.4. Association Termination

The association opened for the migrate requests will be closed either upon receiving the N–ACTION RSP from the remote server or upon expiration of the time specified in the configuration file.

2.2.1.3. Association Acceptance Policy

The DCS AE accepts association in response to the retrieve requests initiated by the CRS operator and in response to the “Auto–Push” and “Manual Push”. The “Auto–push” is the result of the automatic routing by the Acquisition system to the CRS via an Archive Manager. The “Manual Push” is a C–STORE initiated for a particular study by an Archive Manager operator. However, only one “Auto–Push” or “Manual Push” is serviced at a given time.

The DCS AE also accepts association in response to a verification request from any remote DICOM server.

2.2.1.3.1. Real World Activity “Verification Responder”

2.2.1.3.1.1. Associated Real–World Activity

The DCS AE waits indefinitely for the remote application to connect at the presentation address configured for its Application Entity Title. When the remote application connects, the DCS AE accepts the association with Presentation Context for SOP Class of the Verification Service class. The DCS AE will acknowledge the C–ECHO RQ by sending the C–ECHO RSP on the established association.

2.2.1.3.1.2. Presentation Context Table

TABLE 2–7
ACCEPTED PRESENTATION CONTEXT FOR VERIFICATION CLASS

Presentation Context Table – Accepted					
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

2.2.1.3.1.3. SOP specific Conformance

The GEMnet DCR500/DCR2000–CRS DCS AE provides standard conformance to the DICOM Verification Service Class.

2.2.1.3.1.4. Presentation Context Acceptance Criterion

The DCS AE will always accept a Presentation Context for the Verification SOP Class with the DICOM Default Transfer Syntax.

2.2.1.3.1.5. Transfer Syntax Selection Policies

Not Applicable.

2.2.1.3.2. Real World “Image Receiver”

2.2.1.3.2.1. Associated Real–World Activity

The DCS AE is indefinitely listening for associations. When the remote application connects, the DCS AE accepts the association with the Presentation Context for SOP Class of the Storage Service Class. Upon successful C–STORE operation, the image is stored on the local disk of the GEMnet DCR500/DCR2000–CRS and a C–STORE RSP sent to the remote host.

2.2.1.3.2.2. Presentation Context Table

TABLE 2–8
ACCEPTED PRESENTATION CONTEXT FOR STORAGE CLASS

Presentation Context Table – Accepted					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
X–ray Angiography 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
		Explicit VR Big Endian	1.2.840.10008.1.2.2	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
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

2.2.1.3.2.3. SOP specific Conformance

The GEMnet DCR500/DCR2000–CRS DCS AE conforms to the SOP’s of the Storage Service Class at level 2 (full) : No elements are coerced.

2.2.1.3.2.3.1. Image Reception

If the GEMnet DCR500/DCR2000–CRS DCS AE returns one of the following status codes, then the C–STORE operation was unsuccessful and no image is installed in the local database.

- A710 (Probable Disk Full) Indicates that the disk space has exceeded the minimum disk space threshold and store image to the local disk has failed.
- A712 (File System Error) Indicates that an internal system call has failed while processing the image.
- A700 (Cannot Allocate Memory) Indicates that there was not enough internal resource to store the image.
- C000 (Failed to Format Meta–Header) Indicates that there is a DICOM formatting failure.

In the event of a successful C–STORE operation, the image will have been successfully written to the local disk. Image installation is the final step to update the file to the local database.

2.2.1.3.2.3.2. Image Installation

The image installation process picks up each file deposited by the DCS AE and updates the local database. If the image installation process finds any element not encoded according to the DICOM standard, the image file will not be updated to the local database and the file will be deleted. In such cases, the image will therefore not appear in the Local Browser of the CRS and no message will be displayed on the CRS console.

Notice : The type–2 element Patient Name (0x0010, 0x0010) needs to exist and to contain a value in order to successfully install the image on the GEMnet DCR500/DCR2000–CRS.

2.2.1.3.2.4. Presentation Context Acceptance Criterion

No Criteria

2.2.1.3.2.5. Transfer Syntax Selection Policies

The DCS AE prefers to receive images encoded using the Explicit VR Big Endian Transfer Syntax. However, it may be configured to prefer the DICOM default Transfer syntax. If offered a choice of Transfer Syntaxes in the Presentation Context, the DCS AE will apply the following priority to the choice of Transfer Syntax:

1. Explicit VR Big Endian
2. Default Transfer Syntax

2.3. Communication profiles

2.3.1. Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

2.3.2. TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

2.3.2.1. API

Not applicable to this product.

2.3.2.2. Physical Media Support

The CRS supports an Asynchronous Transfer Mode (ATM) network interface using OC3c cables. These cables must be multi–mode fibre 62.5/125 with SC connectors. It supports Classical IP over AAL5 in accordance with RFC–1577 and signaling in accordance with ATM Forum UNI 3.1.

2.3.3. Point–to–Point Stack

A 50–pin ACR–NEMA connection is not applicable to this product.

2.4. Extensions / specializations / privatizations

2.4.1. Standard Extended/Specialized/Private SOP

2.4.1.1. Standard Extended Query SOP Class

The DCS AE provides Standard Extended Conformance to the supported DICOM Query SOP Class as an SCU. The extension occurs by the addition of private attributes as shown in the Table NO TAG.

TABLE 2–9
PRIVATE QUERY KEY ATTRIBUTES

Attribute Name	Tag	VR	VM	Description
Media Location	0087, 0020	CS	1	Expected Values – Offline, Library, Online
Estimated Time to Retrieve	0087, 0050	IS	1	In seconds.

2.4.1.2. Private Migration SOP Class

The Migration SOP Class is a private SOP Class defined by the remote Archive Manager to allow migration of a particular study from one storage level to another. In the GEMnet DCR500/DCR2000–CRS, the DCS AE uses this SOP Class to issue a Migration request for a study to become Online. In the case when the study is already on the local disk of the Archive Manager, the migration request ensures that the study remains Online.

The structure of the SOP Class Extended Negotiation for the Migration SOP Class is as given by the Table NO TAG.

TABLE 2–10
EXTENDED NEGOTIATION TABLE FOR MIGRATION REQUEST

Item Bytes	Field Name	Description
1–6	See DICOM Part 3.7	See DICOM Part 3.7
7–26	SOP Class UID	1.2.840.113619.4.101
27–28	association–type	The types of messages allowed on this association for the Migration Class. Always set to 1 – only Request messages shall occur (encoded as unsigned binary number)

The migrate request for the Private Migration SOP Class implementation comprises of the fields as given by the Table NO TAG .

TABLE 2–11
ACTION INFORMATION FOR MIGRATION REQUEST

Action Type Name	Action Type ID	Attribute Name	Tag	Req Type	Description
Migrate to Online	1	Transaction UID	0x0008, 0x1195	1	
		Query/Retrieve Level	0x0008, 0x0052	1	Always set to “STUDY”
		Study Instance UID	0x0020, 0x000D	1	

2.4.2. Private Transfer Syntax

Not Applicable

2.5. Configuration

2.5.1. AE Title/Presentation Address Mapping

The local AE Title is configurable. This must be configured by a GE Field Engineer during installation.

2.5.2. Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title
- Local IP address
- Local IP Netmask

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

Note: All configurations must be performed by a GE Field Engineer.

2.6. Support of extended character sets

The GEMnet DCR500/GEMnet DCR500/DCR2000–CRS AE's will support only the ISO–IR–100 (ISO 8859–1:1987 Latin alphabet N 1. supplementary set). Any incoming SOP instance that is encoded using another extended character set will not be installed in the local database.

Blank page

SECTION 3. MEDIA STORAGE CONFORMANCE STATEMENT

3.0. INTRODUCTION

This section of the conformance statement (CS) specifies the GEMnet DCR500/DCR2000-Cardiac Review Station compliance to DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles which are supported by this product.

Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

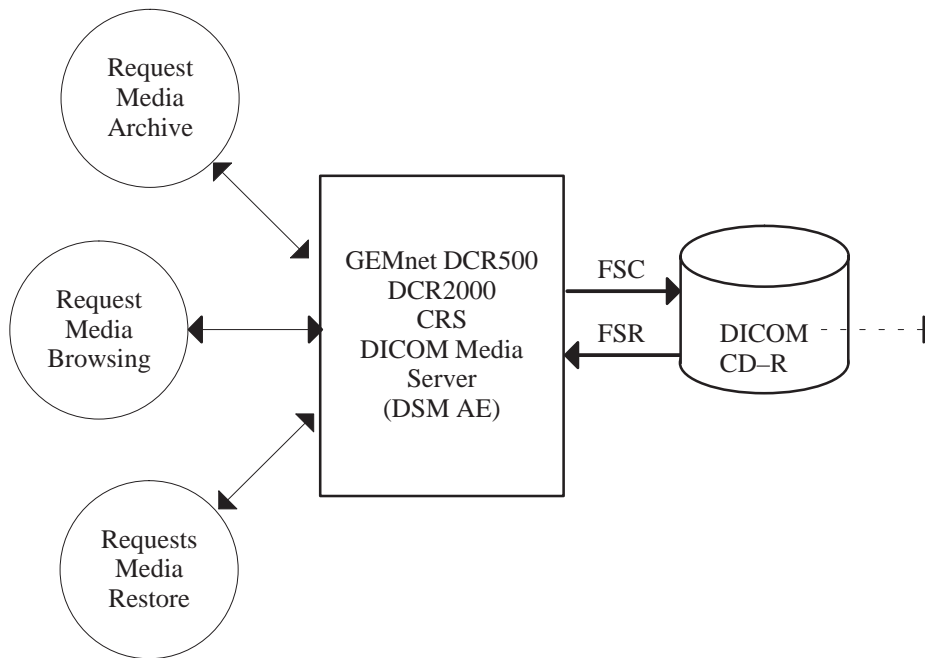
3.1. IMPLEMENTATION MODEL

3.1.1. Application Data Flow Diagram

The DICOM ARCHIVE/RESTORE functionality is handled by the DICOM Media Server Application Entity (AE). The DICOM Media Server Application Entity (AE) is commanded by the user to perform DICOM services operating on the DICOM media through the use of buttons and menu selections on the graphical user interface of the GEMnet DCR500/DCR2000-Cardiac Review Station. User can request the creation of a DICOM file set and the writing of this DICOM File Set on a blank CD-R by selecting images in the local browser and selecting "archive" button. User can request the reading of a DICOM file set written on a CD-R by selecting "Browse" in the CD-R menu, and then "restore selected items" in the CD-R Browser restore menu.

The Basic and Specific Application models for this device are shown in the following Illustration :

ILLUSTRATION 3-1
DMS AE IMPLEMENTATION MODEL



3.1.2. Functional Definition of AE’s

The CRS User can request the creation of a DICOM File Set and the writing of this DICOM File Set on a blank CD-R from the Local Browser. The DCR2000-CRS DICOM Media Server AE supports the following functions :

- Has access to patient demographics and pixel data in the local database
- Can generate a DICOM File Set (FSC)
- Can write a DICOM File Set on a CD-R.
- Can read a DICOM File Set (FSR) from a CD-R.

3.1.3. Sequencing Requirements

Non Applicable

3.1.4. File Meta Information Options (See PS3.10)

The File Meta-Information for this implementation is :

File Meta-Information Version	1
DCR2000-CRS DICOM Implementation UID	1.2.840.113 619.6.51
Implementation Version Name	1_2_5

3.2. AE SPECIFICATIONS

3.2.1. GEMnet DCR500/DCR2000 CRS DMS AE AE Specification

The GEMnet DCR500/DCR2000 CRS DICOM Media Server AE provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The application profiles and roles are listed in the table 3-1.

TABLE 3-1
DMS AE RELATED PROFILES, ACTIVITIES AND ROLES

Supported Application Profiles	Real World Activity	Roles	SC Option
STD-XABC-CD	BROWSE CD	FSR	Interchange
	RESTORE CD	FSR	Interchange
	ARCHIVE CD	FSC	Interchange
AUG-SC-STD-XABC-CD	BROWSE CD	FSR	Interchange
	RESTORE CD	FSR	Interchange
	ARCHIVE CD	FSC	Interchange

3.2.1.1. File Meta Information for the DMS AE Application Entity

Following are the values set in the File Meta Information for this AE Title :

Source Application Entity Title	arm
--	------------

3.2.2. Real World Activities

3.2.2.1. Real World Activity : Browse CD

The GEMnet DCR500/DCR2000–CRS DMS AE acts as a FSR using the interchange option when requested to Browse the CD.

When the GEMnet DCR500/DCR2000–CRS DMS AE is requested to provide a directory listing it reads the File Set and displays the whole DICOMDIR directory entries.

If the DICOMDIR file is not found in the File Set the CD is ejected from the drive.

3.2.2.1.1. Media Storage Application Profile for the RWA: Browse CD

For the list of application profiles that invoke this AE for the Browse CD Real World Activity, see Table 3.1.3–3. There are no extensions or specializations.

3.2.2.2. Real World Activity : Restore CD

The GEMnet DCR500/DCR2000–CRS DMS AE acts as an FSR using the interchange option when requested to copy SOP instances from the CD to the local database.

The user selects the SOP instances that he/she wants the GEMnet DCR500/DCR2000–CRS DMS AE to copy on the local database using the “Browser CD” RWA and clicking on the corresponding entries. Once selected, the SOP instances are all copied from the media to the local database.

All of the selected SOP instances are converted to the Explicit VR Big Endian Transfer Syntax before being installed in the local database.

If the SOP instance does not match the application profile (see Table 3.1.3–3), an error is displayed indicating the non–restored SOP instances or the corresponding directory entries.

3.2.2.2.1. Media Storage Application Profile for the RWA: Restore CD

For the list of application profiles that invoke this AE for the Browse CD Real World Activity, see Table 3.1.3–3. There are no extensions or specializations.

3.2.2.3. Real World Activity : Archive CD

The GEMnet DCR500/DCR2000–CRS DMS AE acts as an FSC using the interchange option when requested to copy SOP instances from the local database to the CD.

The user has to insert a blank writable CD into the drive. Then the user selects the entries in the local database that he wants the GEMnet DCR500/DCR2000–CRS DMS AE to copy onto the CD.

Before writing the CD, the GEMnet DCR500/DCR2000–CRS DMS AE checks for the following conditions:

- The inserted media is blank and writable. If the condition is not met, an error is displayed and the CD is ejected.
- The corresponding SOP instances are checked to filter out the SOP instances that do not match the Application Profile.
- The corresponding SOP instances, once set according to the transfer syntax defined by the application profile, may fit on one or more CDs. The user is advised of both the total number of CD’s needed and when another CD needs to be inserted.

The corresponding SOP instances are converted to the transfer syntax defined by the application profile and copied to the CD.

3.2.2.3.1. Media Storage Application Profile for the RWA: Archive CD

For the list of application profiles that invoke this AE for the Browse CD Real World Activity, see Table 3.1.3-3. There are no extensions or specializations.

3.3. Augmented and Private Application Profiles

3.3.1. Augmented Application Profiles

DCR2000-CRS DMS AE supports one augmented Application Profile: AUG-SC-STD-XABC-CD.

3.3.1.1. AUG-SC-STD-XABC-CD

This Application Profile is an augmentation of the STD-XABC-CD Standard application profile. The augmentation add support for SC SOP Class. There are no requirements or restrictions on SOP options for the IOD's belonging to STD-XABC-CD application profile.

3.3.1.1.1. SOP Class Augmentations

The following IODs are not part of the STD-XABC-CD :

TABLE 3-2
IODS AND TRANSFER SYNTAX FOR AUG-SC-STD-XABC-CD

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian	1.2.840.10008.1.2.2

The following restrictions are applied to the Secondary Capture Image Storage IOD belonging to the AUG-SC-STD-XABC-CD application profile :

TABLE 3-3
RESTRICTIONS ON SC IOD FOR AUG-SC-STD-XABC-CD

Attribute	Tag	Value
Modality	(0008, 0060)	XA
Photometric Interpretation	(0028, 0004)	MONOCHROME2
Rows	(0028, 0010)	512 or 1024
Columns	(0028, 0011)	512 or 1024
Bits Allocated	(0028, 0100)	8 or 16
Bits Stored	(0028, 0101)	8
High Bit	(0028, 0102)	7
Pixel Representation	(0028, 0103)	0000H

3.3.1.1.2. Directory Augmentations
See Section 3.4 for detailed description of additional keys.

3.3.1.1.3. Other Augmentations
None.

3.3.1.1.4. Private Application Profiles
No Private Application Profile

3.4. EXTENSIONS, SPECIALIZATIONS, PRIVATIZATIONS of SOP CLASSES AND TRANSFER SYNTAXES

This section describes the extension of SOP classes used in the scope of the STD-XABC-CD and AUG-SC-STD-XABC-CD Application profiles.

3.4.1. Extensions, Specializations, and Privatizations of SOP Classes

3.4.1.1. SOP Specific Conformance Statement for SOP Class “Media Storage Directory Storage”

The following keys are added as Type 3 data elements in the Basic Directory IOD :

Key Attribute	Tag	Directory Record Type
Series Description	(0008,103E)	SERIES
Image Comment	(0008,4000)	IMAGE
Number of frames	(0028, 0008)	IMAGE
Angle volume 1	(0019,xx01)	IMAGE
Angle volume 2	(0019,xx02)	IMAGE
Angle volume 3	(0019,xx03)	IMAGE

3.4.2. Private Transfer Syntax Specification
Not applicable

3.4.3. Private Data Dictionary for the Basic Directory
cf par. NO TAG

3.4.4. Private query key attributes :
cf par. NO TAG

3.5. CONFIGURATION

Not applicable.

3.6. SUPPORT OF EXTENDED CHARACTER SETS

The GEMnet DCR500/DCR2000-Cardiac Review Station will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming SOP instance that is encoded using another extended character set will not be installed in the local database.

SECTION 4.

INFORMATION OBJECT IMPLEMENTATION OF DICOM OBJECTS PRODUCED BY THE CRS

4.0. Basic Directory Information Object Implementation :

4.0.1. Introduction :

This section specifies the use of the DICOM Basic Directory IOD to represent the information included in directories produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

10.2 – IOD Description

10.3 – IOD Entity-Relationship Model

10.4 – IOD Module Table

10.5 – IOD Module Definition

4.0.2. BASIC DIRECTORY IOD IMPLEMENTATION

4.0.3. BASIC DIRECTORY ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Basic Directory interoperability schema is shown in Illustration 4.0-1. In this figure, the following diagrammatic convention is established to represent the information organization:

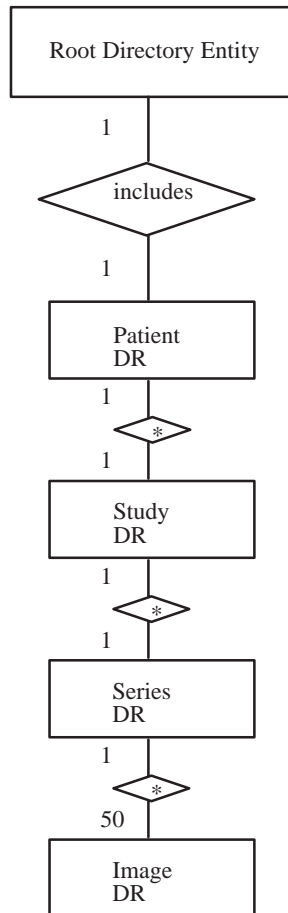
- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

4.0.3.1. GEMnet CRS Mapping of DICOM entities

TABLE 10.3-1
MAPPING OF DICOM ENTITIES TO GEMNET CRS ENTITIES

DICOM	GEMnet CRS Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

ILLUSTRATION 4.0-1
BASIC DIRECTORY ENTITY RELATIONSHIP DIAGRAM



4.0.4. IOD MODULE TABLE

Within an entity of the Basic Directory IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 4.0-2 identifies the defined modules within the entities which comprise the Basic Directory IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

**TABLE 4.0-2
BASIC DIRECTORY IOD MODULES**

Entity Name	Module Name	Reference
File Set Identification	File Set Identification	4.0.5.1.1
Directory Information	Directory Information	4.0.5.2.1

4.0.5. Information Module Definition :

Please refer to DICOM V3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Basic Directory Information Object.

The following modules are included to convey enumerated Values, Defined Terms and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

4.0.5.1. Common File Set Identification Modules :

4.0.5.1.1. File-Set Identification Module :

Attribute Name	Tag	Tp	Description
File-set ID	0004, 1130	2	

4.0.5.2. Common Directory Information Modules :

4.0.5.2.1. Directory Information Module :

Attribute Name	Tag	Tp	Description
Offset of the First Directory Record of the Root Directory Entity	0004, 1200	1	
Offset of the Last Directory Record of the Root Directory Entity	0004, 1202	1	
File-set Consistency Flag	0004, 1212	1	0000H
Directory Record Sequence	0004, 1220	2	
>Offset of the Next Directory Record	0004, 1400	1C	
>Record In-use Flag	0004, 1410	1C	FFFFH
>Offset of Referenced Lower-Level Directory Entity	0004, 1420	1C	
>Directory Record Type	0004, 1430	1C	PATIENT, STUDY, SERIES or IMAGE
>Record Selection Keys			cf 4.0.5.3.

4.0.5.3. Definition of Specific Directory Records :**4.0.5.3.1. Patient Directory Record Definition :**

Patient keys			
Attribute Name	Tag	Tp	Description
Specific Character Set	0008, 0005	1C	ISO_IR 100
Patient Group Length	0010, 0000		Retired element
Patient's Name	0010, 0010	2	Duplicated from the referenced SOP instances
Patient ID	0010, 0020	1	Duplicated from the referenced SOP instances
Date of Birth	0010, 0030	2	Duplicated from the referenced SOP instances
Sex	0010, 0040	2	Duplicated from the referenced SOP instances

4.0.5.3.2. Study Directory Record Definition :

Study keys			
Attribute Name	Tag	Tp	Description
Specific Character Set	0008, 0005	1C	ISO_IR 100
Study Date	0008, 0020	1	Duplicated from the referenced SOP instances
Study Time	0008, 0030	1	Duplicated from the referenced SOP instances
Accession Number	0008, 0050	2	Duplicated from the referenced SOP instances
Study Description	0008, 1030	2	Duplicated from the referenced SOP instances
Image Group Length	0020, 0000		Retired Element
Study Instance UID	0020, 000D	1C	Duplicated from the referenced SOP instances
Study ID	0020, 0010	1	Duplicated from the referenced SOP instances

4.0.5.3.3. Series Directory Record Definition :

Serie keys			
Attribute Name	Tag	Tp	Description
Specific Character Set	0008, 0005	1C	ISO_IR 100
Modality	0008, 0060	1	XA
Institution Name	0008, 0080	2	Duplicated from the referenced SOP instances
Institution Adress	0008, 0081	2	Duplicated from the referenced SOP instances
Series Description	0008, 103e	3	DICOMDIR extra element Duplicated from the referenced SOP instances
Performing Physician	0008, 1050	2	Duplicated from the referenced SOP instances
Image Group Length	0020, 0000	1	Retired element
Series Instance UID	0020, 000E	1	Duplicated from the referenced SOP instances
Series Number	0020, 0011	1	Duplicated from the referenced SOP instances

4.0.5.3.4. Image Directory Record Definition :

Image Keys			
Attribute Name	Tag	Tp	Description
Specific Character Set	0008, 0005	1C	ISO_IR 100
Image Type	0008, 0008	1	Duplicated from the referenced SOP instances
Referenced Image Sequence	0008, 1140	1C	Duplicated from the referenced SOP instances
Referenced SOP Class UID	0008, 1150	1C	Duplicated from the referenced SOP instances
Referenced SOP Instance UID	0008, 1155	1C	Duplicated from the referenced SOP instances
Private Group Length	0019, 0000		Retired element
Angle_value_1	0019, xx01	3	Positionner angle for L arm in degrees
Angle_value_2	0019, xx02	3	Positionner angle for P arm in degrees
Angle_value_3	0019, xx03	3	Positionner angle for C arm in degrees
Image Group Length	0020, 0000		Retired element
Image Number	0020, 0013	1	Duplicated from the referenced SOP instances
Image Comments	0020, 4000	3	DICOMDIR extra element Duplicated from the referenced SOP instances
Image Presentation Group Length	0028, 0000		Retired element
Number of frames	0028, 0008	3	DICOMDIR extra element Duplicated from the referenced SOP instances
Private Group Length	0050, 0000		Retired element
Calibration Image	0050, 0004	2	Duplicated from the referenced SOP instances
Storage Group Length	0088, 0000		Retired element
Icon Image Sequence	0088, 0200	3	
>Samples per Pixel	0028, 0002	1	1
>Photometric Interpretation	0028, 0004	1	MONOCHROME 2
>Rows	0028, 0010	1	128
>Columns	0028, 0011	1	128
>Bits Allocated	0028, 0100	1	8
>Bits Stored	0028, 0101	1	8
>High Bit	0028, 0102	1	7
>Pixel Representation	0028, 0103	1	0
>Pixel Data	(7FE0,0010)	1	

4.0.5.4. Private Data Dictionary for the Basic Directory :

Attribute Name	Tag	VR	VM
Private Creator GEMS_ACQU_01	0019, 00xx	LO	1
Angle_value_1	0019, xx01	DS	1
Angle_value_2	0019, xx02	DS	1
Angle_value_3	0019, xx03	DS	1

4.1. Secondary Capture Information Object Implementation :

4.1.1. Introduction :

This section defines the implementation of the DICOM v3.0 Secondary Capture Image IOD created by the GEMnet DCR500/DCR2000 Cardiac Review Station.

4.1.2. SC Image IOD Implementation :

GEMnet DCR500/DCR2000 Cardiac Review Station Secondary Capture Information Object content is strictly dependant on the XA object from which it has been generated : Some attributes are modified, and some attributes are added, but no attribute are removed.

Notice : As no attribute are removed, the Secondary Capture IOD may contain some XA modules which are not SC modules, or some XA attributes which are not SC attributes

4.1.3. SC attributes which have been modified from the source XA object, or which have been added to the source XA object :

4.1.3.1. Attributes modified from the source XA object :

Attribute Name	Tag	Value
Image Type	0008, 0008	DERIVED\SECONDARY
SOPClassUID	0008, 0016	1.2.840.10008.5.1.4.1.1.7
SOPInstanceUID	0008, 0018	
Series Description	0008, 1050	Screen Save
Image Comments	0020, 4000	Image X, with X = Image number on which the SC has been generated.
Number of frames	0028, 0008	1
Rows	0028, 0010	1024
Columns	0028, 0011	1024

4.1.3.2. Attributes added to the source XA object :

Attribute Name	Tag	Value
Conversion Type	0008, 0064	WSD
WindowCenter	0028, 1050	127
WindowWidth	0028, 1051	255