Technical Publications

Direction 2145457
Revision 0

Advantx® DRE Conformance Statement for DICOM V3.0 (ID/NET v3.0)

tABLE OF cONTENTS

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
D	14-October-1996	Final Draft
0	29-October-1996	Initial Release

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION NUMBER
Title Page	0
I thru iii	0
1-1 thru 1-5	0
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Introduction

OVERVIEW

Section 1, ***Introduction***, **provides general information about the content and scope of this document.**

Section 2, ***Conformance Statement***, **is the DICOM v3.0 Conformance Statement related to this product. Conformance Statements defines the subset of options selected from those offered by the DICOM v3.0 standard.**

Section 3, ***DRE XRAY Radiofluoroscopic Information Object Implementation*** **defines the technical specifications required to interoperate with a DICOM v3.0 network interface. They define the technical details of the Information Object Definitions (IOD's) listed in the Conformance Statement.**

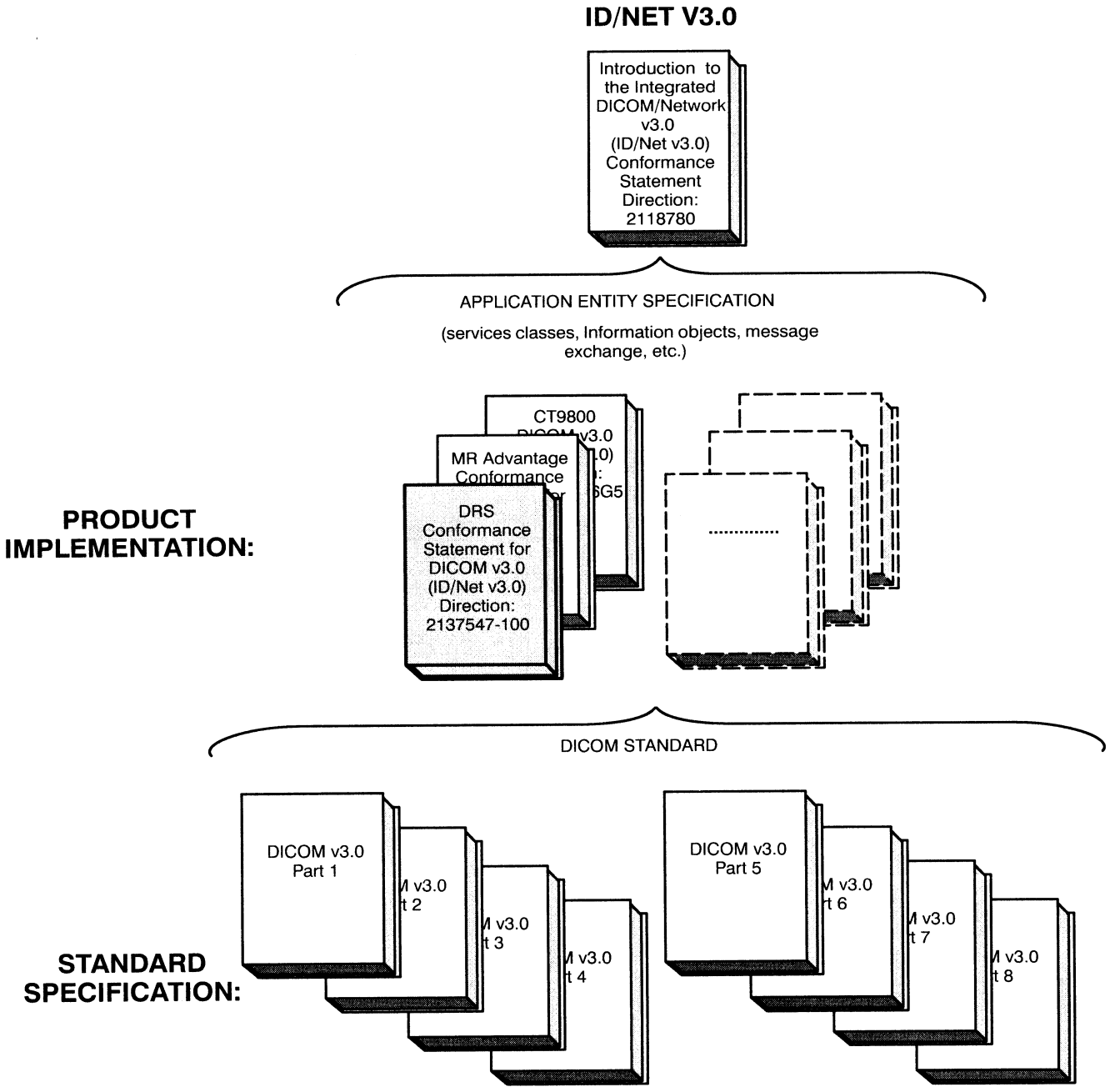
Section 4, ***Secondary Capture Image Information Object implementation***, **defines the technical specifications required to interoperate with a DICOM v3.0 network interface. They define the technical details of the Information Object definition (IOD's) listed in the Conformance statement.**

Section 5, ***Basic Grayscale Print Management***, **defines the technical specifications required to interoperate with a DICOM v3.0 network interface performing print. They define the technical details of the various Information Object definitions (IODs) listed in the Conformance statement.**

OVERALL CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the ID/Net v3.0 Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in Illustration 1-1.

ILLUSTRATION 1-1
DOCUMENTATION STRUCTURE



This document specifies the DICOM v3.0 implementation. It is entitled:

Advantx DRE-DICOM
Conformance Statement for DICOM v3.0 (ID/Net v3.0)
Direction 2145457

This Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GEMS ID/Net v3.0 network interface. Introductory information, which is applicable to all GEMS ID/Net v3.0 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' ID/Net v3.0 Conformance Statements.

The ID/Net v3.0 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 v3.0 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 ID/Net v3.0 Product Conformance Statements will be received. The collector Direction is:

ID/Net v3.0 Conformance Statements
Direction: 2117016

For more information regarding DICOM v3.0, copies of the Standard may be obtained by written request or phone by contacting:

ACR-NEMA/DICOM Representative
NEMA
1300 N. 17th St., Suite 1847
Rosslyn, VA 22209 USA Phone: (703) 841-3200

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 v3.0 Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM v3.0 terminology they should first refer to the document listed below, then read the DICOM v3.0 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

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 ID/Net v3.0 implementations. This specification, called a Conformance Statement, includes a DICOM v3.0 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical image data exchanged using DICOM v3.0. The GEMS ID/Net v3.0 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 ID/Net v3.0 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 v3.0 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 retransmit all of the private data elements which are sent by GEMS devices.

IMPORTANT REMARKS

The use of these Conformance Statements, in conjunction with the DICOM v3.0 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 v3.0), 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 v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. ID/Net v3.0 is based on DICOM v3.0 as specified in each ID/Net DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these ID/Net DICOM 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 kept informed of the evolution of the implementation described in this document, the user should register on the GE Internet Server, acessible via anonymous ftp, by entering his e-mail address (GE Internet Server Address : 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.**

REFERENCES

A list of references which is applicable to all ID/Net v3.0 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 v3.0 Standard Supplement 6) to Part 3 (Information Object Definition)

DEFINITIONS

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

SYMBOLS AND ABBREVIATIONS

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

CONFORMANCE STATEMENT

INTRODUCTION

This conformance statement (CS) specifies the GE Advantx DRE-DICOM compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product.

Advantx DRE-DICOM is an Integrated Digital R & F Imaging System. It uses DICOM services to export X-ray Radiofluroscopic images to remote workstations and to print images on networked DICOM printers.

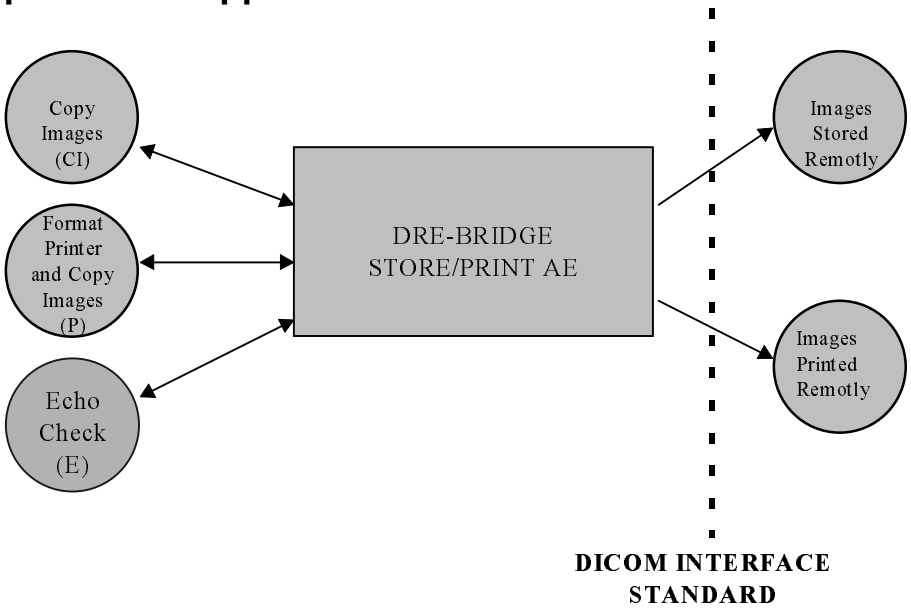
Note that the format of this section strictly follows the format of DICOM Standard Part 2 (Conformance) Annex A. Please refer to that part of the standard while reading this section.

IMPLEMENTATION MODEL

Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in Illustration 0–1:

Illustration 0–1
Specific AE Application Model



The DRE-BRIDGE STORE/PRINT Application Entity (AE) is an application which handles DICOM protocol communication. DRE-BRIDGE STORE/PRINT AE is automatically brought up when the DRE and BRIDGE systems are powered on.

All remote DICOM's AE must be manually configured on the BRIDGE, usually at the software installation time, by a GE field engineer.

There are 3 local real world activities, Copy Image (CI), Format Printer/Copy Images (P), and Echo Check (E) which can cause the DRE-BRIDGE STORE/PRINT to initiate DICOM associations.

(CI) consists of an operator selecting one image or a study of images to be sent to one of several remote devices(s). Selection of the images is done from the Operator console screens; selection of the remote device and visualization of the status of the transfer is also accomplished via the Operator console. The remote device receiving the image(s) can be any DICOM compliant device supporting the appropriate SOP Classes and roles.

(P) consists of an operator selecting one of several film sheet layout configurations (e.g. 1 image per sheet of film, or 4, 6, etc.). The operator may select to print a single film sheet or multiple film sheets for a study of images to one of several remote device(s). Selection of the images is done from the Operator console screens; selection of the remote device and visualization of the status of the transfer is also accomplished via the Operator console. The remote device receiving the image(s) for print can be any DICOM compliant device supporting the appropriate SOP Classes and roles. The DRE-BRIDGE STORE/PRINT AE also supports the optional DICOM feature Print Job. This feature enables the Advantx DRE to inform the operator when the actual film has been printed. Of course, this optional feature must be supported by the printer in order to take advantage of this information.

(E) consists of an operator scrolling through the network configurations screens for the purpose of selecting a remote storage and/or print device (i.e. remote DICOM AEs). When a remote device is selected and no other network activity is currently active, the DRE-BRIDGE STORE/PRINT AE performs a DICOM echo to verify that the remote device is operational. The appropriate status will be displayed (e.g. Online, etc.).

A status of NoEchoCheck does not indicate whether the node is or is not operational. It merely indicates that the node could not be checked due to network activity.

Functional Definition of AE's

The DRE-BRIDGE STORE/PRINT Application Entity supports the following functions:

Access to patient demographics and Pixel Data in the local database.
Build a DICOM format data set.
Manually initiates a DICOM association to send the image(s).

or

Access to printer format information.
Build DICOM messages to format the networked printer.

Access the pixel data in the local database to print the selected image(s). Initiate a DICOM association to format the printer with the desire information.

Sequencing of Real-World Activities
Not Applicable
AE SPECIFICATIONS
AE Specification
This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU**:**

SOP Class Name	SOP Class UID
X-Ray Radiofluoroscopic Image Storage	**1.2.840.10008.5.1.4.1.1.12.2**
Secondary Capture Image Storage	**1.2.840.10008.5.1.4.1.1.7**
Verification Service Class	**1.2.840.10008.1.1**
Basic Grayscale Print Management Meta SOP Class	**1.2.840.10008.5.1.1.9**
Print Job SOP Class	**1.2.840.10008.5.1.1.14**

X-Ray Radiofluoroscopic Image Storage, Secondary Capture Image Storage, the Verification Service Class, the Basic Grayscale Print Management Meta SOP Class, and the Print Job SOP Class are implemented as a Standard SOP Class.
Association Establishment Policies
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 DRE-BRIDGE STORE/PRINT AE is:

Maximum Length PDU	16 Kbytes

The SOP class Extended Negotiation is not supported.
The maximum number of Presentation Contexts Items that will be proposed is 3.
The user info items sent by this product are:
Maximum PDU Length
Implementation UID
Number of Associations
The DRE-BRIDGE-STORE/PRINT AE will initiate only one DICOM association at a time to perform an image storage, print, or verification as an SCU to a remote device.
Asynchronous Nature
Asynchronous mode is not supported. All operations will be performed synchronously.
Implementation Identifying Information
The Implementation UID for this ID/Net v3.0 Implementation is:

Advantx DRE-BRIDGE Implementation UID	1.2.840.113619.6.28

Association Initiation Policy
The DRE BRIDGE STORE/PRINT AE will initiate an association via interaction of the DRE user interface in one of three ways as described in the following sections. Real-World Activities "Copy Images (CI), Format Printer/Copy Images (P) & Echo Check (E)
Associated Real-World Activity "Copy Image"
The GE Advantx DRE has the capability to send images via the user interface. The operator selects a destination device and then selects the study of images or individual images for transfer. This interaction will cause the DRE to open an association using the Presentation Contexts defined in Table A of section 2.2.1.2.1.2.
Associated Real-World Activity "Print Image"
The GE Advantx DRE also has the capability to print films via the user interface. The operator selects the destination printer and desired format. The DRE supports the collation optional feature defined in the DICOM print services (see Section 5). If supported by the printer, the operator has the ability to print a complete study of images using multiple film sheets. If the printer does not support this optional feature, the operator is required to print individual film sheets one at a time. This interaction will cause the DRE to open an association using the Presentation Contexts defined in Table B of section 2.2.1.2.1.2.

Associated Real-World Activity "Verification"

The GE Advantx DRE has the capability to configure multiple destinations for the purpose of receiving DICOM images or to print images on a DICOM networked printer. While in these configuration screens the DRE will initiate an association to remote devices to perform the Verification service (i.e. Echo). The status of the remote device will be displayed to the operator. If the DRE has already initiated an association due to the CI or P activity, the verification will not be performed.

Proposed Presentation Contexts

Presentation Context Table (A) - Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded
Name	UID	Name List	UID List		Negotiation
XRAY RF Image Info Obj.	**1.2.840.10008.5.1.4.1.1.12.2**	**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**
Verification	**1.2.840.10008.1.1**	**Implicit VR Little Endian**	**1.2.840.10008.1.2**	**SCU**	**None**

Presentation Context Table (B) - Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded
Name	UID	Name List	UID List		Negotiation
Basic Grayscale Print Manage	**1.2.840.10008.5.1.1.9**	**Implicit VR Little Endian**	**1.2.840.10008.1.2**	**SCU**	**None**

ment Meta SOP Class					
Print Job SOP Class	1.2.840.10008.5.1.1.14	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

SOP Specific Conformance Statement for Image Storage SOP Classes

The GE Advantx DRE supports both the X-ray RF and Secondary Capture Storage SOP Classes. Per association only one class of images will be transferred based on the capabilities of the remote DICOM device as defined in the network configuration file for each device. If the remote node supports the X-ray RF class the DRE images will be transferred as X-ray images. If the remote DICOM device supports only the Secondary Capture class the DRE images will be transferred as Secondary Capture images.

Upon receiving a C-STORE confirmation containing an Error or a Refused status, this status will be displayed to the operator and the implementation will terminate the association. The current C-STORE is considered as failed.

Upon receiving a C-STORE confirmation containing a Warning Status, the proper status will be displayed to the operator and the image transfer is considered successful.

Each association negotiation supports an " Association Timer ". This timer starts when the association request is sent and stops when the association is established. This timer is configurable by the GE field engineer with the default set to 30 seconds.

Each C-STORE operation supports an “Operation Activity Timer”. This timer starts once a C-STORE request has been issued and stops when a C-STORE response has been received. This timer is configurable by the GE field engineer with the default set to 30 seconds.

SOP Specific Conformance Statement for the Print Management SOP Classes

The DRE BRIDGE STORE/PRINT AE provides standard conformance to both the Basic Grayscale Print Meta SOP class and the optional Print Job SOP Class.

The list of supported optional Attributes and DIMSE services, for each SOP Class, are documented in section 5.

Upon receiving a confirmation for any of the DIMSE services containing a Warning Status, the proper status will be displayed to the operator and the operation is considered successful.

Each association negotiation supports an " Association Timer ". This timer starts when the association request is sent and stops when the association is established. This timer is configurable by the GE field engineer with the default set to 30 seconds.

Each DIMSE operation supports an "Operation Activity Timer". This timer starts once a DIMSE request has been issued and stops when a DIMSE response has been received. This timer is configurable by the GE field engineer with the default set to 30 seconds.

SOP Specific Conformance Statement for the Verification SOP Class

The DRE BRIDGE STORE/PRINT AE provides standard conformance to the Verification SOP Class.

Association Acceptance Policy

The GE Advantx DRE does not accept DICOM associations.

COMMUNICATION PROFILES

Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

TCP/IP Stack

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

API

Not applicable to this product.

Physical Media Support

Ethernet v2.0, IEEE 802.3.

Point-to-Point Stack

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

EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

The GE Advantx DRE supports all DICOM SOP Classes as Standard SOP Class and therefore no extensions have been implemented. For the list of attributes supported for each SOP Class see sections 3, 4, and 5.

CONFIGURATION

AE Title/Presentation Address Mapping

The Local AE Titles are configurable. This must be configured by a GE Field Service Engineer during an installation.

Configurable Parameters
The following fields are configurable for this AE (local):
Local AE Titles (Store and Print)
Local IP Address
Local IP Netmask
The following fields are configurable for every remote DICOM AE:
Remote AE Titles
Responding TCP/IP Port
Remote IP Address
All configuration must be performed by a GE Field Engineer.

Configurable Parameters Beyond Network Configuration
The Advantx DRE provides extensive configurability for parameters beyond network addressing, mostly related to the print capabilities. The characteristics of the various DICOM networked printers typically vary. In order to operate effectively, quite often some customization is required. The Advantx DRE has the capability to customize most of the parameters used to perform DICOM printing. This customization is supported for each printer configured (i.e. the configuration files are able to be different for each printer). The configuration must be performed by a GE Field Engineer.
SUPPORT OF EXTENDED CHARACTER SETS
No extended character sets are supported.

RADIOFLUOROSCOPIC (RF) INFORMATION OBJECT IMPLEMENTATION

introduction

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

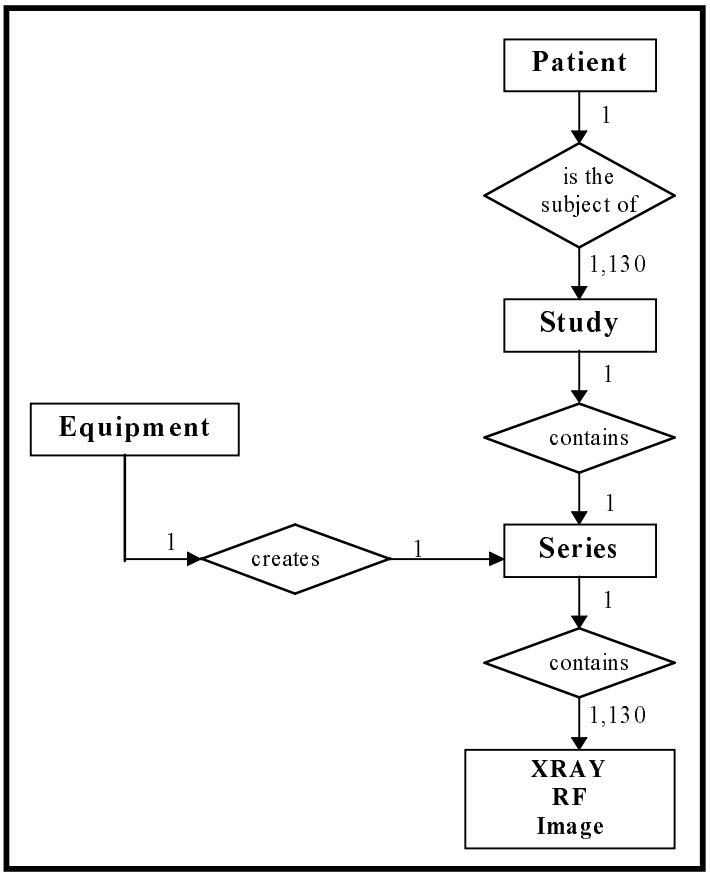
- **3.1 - IOD Description**
- **3.2 - IOD Entity-Relationship Model**
- **3.3 - IOD Module Table**
- **3.4 - Information Module Definition**

XRAY RF IOD IMPLEMENTATION

XRAY IOD ENTITY RELATIONSHIP MODEL

ILLUSTRATION 3-1

RF IMAGE ENTITY RELATIONSHIP DIAGRAM



The Entity-Relationship diagram for the RF Image interoperability schema is shown in Illustration 3-1. 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.
The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to 200 Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the RF Information Object.

IOD MODULE TABLE

Within an entity of the DICOM v3.0 RF Image Information Object Definition, 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 3-1 identifies the defined modules within the entities which comprise the DICOM v3.0 RF Image Information Object Definition. Modules are identified by Module Name.
See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 3-1

RF IMAGE INFORMATION OBJECT DEFINITION (IOD) MODULE TABLE

Entity Name	Module Name	Reference
Patient	Patient	0
Study	General Study	0
Series	General Series	0
Equipment	General Equipment	0
Image	General Image	0
	Image Pixel	0
	Contrast / Bolus	0
	XRAY Image Module	0
	XRAY Acquisition Module	0
	Display Shutter Module	0
	VOI LUT Module	0
	SOP Common	0

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 but it should be noted that they are the same ones as defined in DICOM Part 3.

INFORMATION MODULE DEFINITIONS

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 RF Information Object.

Patient Entity Module

Patient Module

TABLE 3-2

PATIENT MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Patient Name	**0010, 0010**	**2**	
Patient ID	**0010, 0020**	**2**	
Patient	**0010,**	**2**	**No value Zero length**

DOB	**0030**		
Patient sex	**0010, 0040**	**2**	**No value Zero length**

Study Entity Modules
General Study Module
TABLE 3-3
GENERAL STUDY ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Study Date	**0008, 0020**	**2**	
Study Time	**0008, 0030**	**2**	
Accession Number	**0008, 0050**	**2**	**No value Zero length**
Ref Physicians' Name	**0008, 0090**	**2**	**No value Zero length**
Study Instance UID	**0020, 000D**	**1**	
Study ID	**0020, 0010**	**2**	**1**

Series Entity Module
General Series Module
TABLE 3-5
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Modality	**0008, 0060**	**1**	**RF**
Performing Phy's Name	**0008, 1050**	**3**	
Series	**0020,**	**1**	

Instance UID	**000E**		
Series Number	**0020, 0011**	**2**	**1**
Patient Laterality	**0020, 0060**	**2C**	**No value Zero length**

Equipment Entity Module
General Equipment Module
TABLE 3-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Manufacturer	**0008, 0070**	**2**	**GEMS**
Institution Name	**0008, 0080**	**3**	
Station Name	**0008, 1010**	**3**	
Inst. Department Name	**0008, 1040**	**3**	
Mfg Model Name	**0008, 1090**	**3**	**Advantx-DRE**
S/W Versions	**0018, 1020**	**3**	**Example: DRE S/W Rev-9.0**

Image Entity Modules
General Image Module
TABLE 3-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Image Type	**0008, 0008**	**3**	**ORIGINAL/PRIMARY/SINGLE_PLANE**
Image Date	**0008, 0023**	**2C**	
Image Time	**0008,**	**2**	

	0033	**C**	
Image Number	**0020, 0013**	**2**	
Patient Orientation	**0020, 0020**	**2 C**	**No value, Zero length.**
Image Comments	**0020, 4000**	**3**	**No value, Zero length.**

Image Pixel Module

TABLE 3-8

IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Samples per Pixel	**0028, 0002**	**1**	**1**
Photometric Interpretation	**0028, 0004**	**1**	**MONOCHROME 2**
Rows	**0028, 0010**	**1**	**1024**
Columns	**0028, 0011**	**1**	**1024**
Pixel Aspect Ratio	**0028, 0034**	**1 C**	**Value is 1\1.So Attribute is not sent.**
Bits Allocated	**0028, 0100**	**1**	**8**
Bits Stored	**0028, 0101**	**1**	**8**
High Bit	**0028, 0102**	**1**	**7**
Pixel Representation	**0028, 0103**	**1**	**0**
Smallest Image Pixel value	**0028, 0106**	**3**	**0**
Largest Image Pixel Value	**0028, 0107**	**3**	**255**

Pixel Data	**7FE0, 0010**	**1**	

Contrast / Bolus Module

TABLE 3-12

Contrast/Bolus MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Contrast/Bolus Agent	**0018, 0010**	**2**	**No value Zero length**

The DRE does not manage the Attribute Contrast/Bolus Agent. However, since most x-ray procedures include contrast/bolus, it is always sent with a value of zero length.

XRAY Image Module

TABLE 3-12

XRAY IMAGE MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Lossy Image Comp.	**0008, 2110**	**1C**	**Value is 00H (No Lossy Comp). So the Attribute is not sent..**
Image Type	**0008, 0008**	**1**	**ORIGINAL/PRIMARY/SINGLE_PLANE**
Pixel Intensity Relationship	**0028, 1040**	**1**	**LIN**
Samples per Pixel	**0028, 0002**	**1**	**1**
Photometric Interpretation	**0028, 0004**	**1**	**MONOCROME 2**
Bits Allocated	**0028, 0100**	**1**	**8**
Bits Stored	**0028, 0101**	**1**	**8**
High Bit	**0028, 0102**	**1**	**7**
Pixel Representation	**0028, 0103**	**1**	**0000H**

XRAY Acquisition Module

TABLE 3-13
XRAY ACQUISITION MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
KVP	**0018, 0060**	**2**	**No value , zero length**
Radiation Setting	**0018, 1155**	**1**	**SC - For a Fluoro Image. GR - For a RAD shot**
Exposure	**0018, 1152**	**2C**	**No value , zero length**
Radiation Mode	**0018, 115A**	**3**	**CONTINUOUS**

Display Shutter Module

TABLE 3-14
XRAY DISPLAY SHUTTER MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Shutter Shape	**0018, 1600**	**1**	**RECTANGULAR CIRCULAR**
Shutter Left Vert Edge	**0018, 1602**	**1C**	
Shutter Right Vert Edge	**0018, 1604**	**1C**	
Shutter upper Horz Edge	**0018, 1606**	**1C**	
Shutter upper Horz Edge	**0018, 1608**	**1C**	
Center of Circular Shutter	**0018, 1610**	**1C**	
Radius of Circular Shutter	**0018, 1612**	**1C**	

VOI LUT Module

TABLE 3-15
XRAY VOI LUT MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
Window center	**0028, 1050**	**3**	
Window width	**0028, 1051**	**1C**	

SOP Common Module

TABLE 3-16
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Data Element	Type	Notes
SOP Class UID	**0008, 0016**	**1**	**1.2.840.10008.5.1.4.1.1.12.2**
SOP Instance UID	**0008, 0018**	**1**	

SECONDARY CAPTURE IMPLEMENTATION

INTRODUCTION

This section specifies the use of the DICOM v3.0 Secondary Capture Image IOD to represent the information included in Secondary Capture images produced by this implementation. Corresponding attributes are conveyed using the module construct.

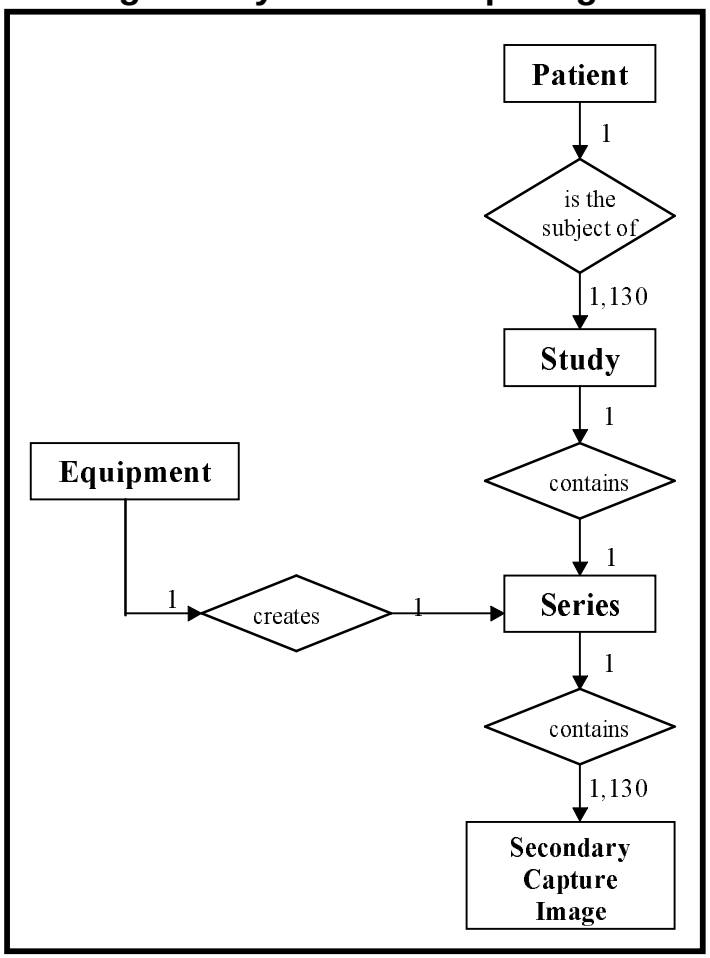
SC IMAGE IOD IMPLEMENTATION

This section defines the implementation of SC image information object. It refers to the DICOM V3.0 Standard, Part 3 (Information Object definition).

SC IMAGE IOD ENTITY-RELATIONSHIP MODEL

Illustration 0–1

SC Image Entity Relationship Diagram



The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 0–1. 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.
The relationships are fully defined with the maximum number of possible entities in the relationship shown.

Entities Description

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Secondary Capture Image Information Object Definition.

SC Image IOD Module Table

Within an entity of the DICOM v3.0 SC Image Information Object Definition, 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 0–1 identifies the defined modules within the entities which comprise the DICOM v3.0 SC Image Information object Definition. Modules are identified by Module Name.

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

Table 0–1
SC Image Information Object Definition (IOD) Module Table

Entity Name	Module Name	Reference	Notes
Patient	**Patient**	**0**	
Study	**General Study**	**0**	
Series	**General Series**	**0**	
Equipment	**General Equipment**	**0**	
	SC Equipment	**0**	
Image	**General Image**	**0**	
	Image Pixel	**0**	
	VOI LUT	**0**	
	SOP Common	**0**	

Module Library

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definition) for a description of each of the entities and modules contained within the SC Information Object.
See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

Patient Entity Module
Patient Module

Attribute Name	Data Element	Type	Notes
Patient's Name	**0010, 0010**	**2**	
Patient ID	**0010, 0020**	**2**	
Patients DOB	**0010, 0030**	**2**	**No value Zero length**
Patients sex	**0010, 0040**	**2**	**No value Zero length**

Study Entity Module
General Study

Attribute Name	Data Element	Type	Notes
Study Date	**0008, 0020**	**2**	
Study Time	**0008, 0030**	**2**	
Accession Number	**0008, 0050**	**2**	**No value Zero length**
Ref Physicians' Name	**0008, 0090**	**2**	**No value Zero length**
Study Instance UID	**0020, 000D**	**1**	
Study ID	**0020, 0010**	**2**	**1**

Series Entity Module
General Series

Attribute Name	Data Element	Type	Notes
Modality	**0008, 0060**	**1**	**OT**
Performing Phy's Name	**0008, 1050**	**3**	
Series Instance UID	**0020, 000E**	**1**	
Series Number	**0020, 0011**	**2**	**1**
Patient Laterality	**0020, 0060**	**2C**	**No value Zero length**

Equipment Entity Module
General Equipment

Attribute Name	Data Element	Type	Notes
Manufacturer	**0008, 0070**	**2**	**GEMS**
Institution Name	**0008, 0080**	**3**	
Station Name	**0008, 1010**	**3**	
Inst. Department Name	**0008, 1040**	**3**	
Mfg Model Name	**0008, 1090**	**3**	**Advantx-DRE**
S/W Versions	**0018, 1020**	**3**	**Example: DRE S/W Rev-9.0**

SC Equipment

Attribute Name	Data Element	Type	Notes
Modality	**0008, 0060**	**3**	**OT**

Conversion Type	**0008, 0064**	**1**	**DI**
SC Dev Mfg	**0018, 1016**	**3**	**E4M Corp**
SC Dev Model Name	**0018, 1018**	**3**	**DRE Dicom Bridge**
SC Dev S/W Version	**0018, 1019**	**3**	**Example: Bridge S/W Rev-1.0**

Image Entity Module
General Image

Attribute Name	Data Element	Type	Notes
Image Type	**0008, 0008**	**3**	**ORIGINAL/PRIMARY**
Image Date	**0008, 0023**	**2C**	
Image Time	**0008, 0033**	**2C**	
Image Number	**0020, 0013**	**2**	
Patient Orientation	**0020, 0020**	**2C**	**No value, Zero length**
Image Comments	**0020, 4000**	**3**	**No value, Zero length**

Image Pixel

Attribute Name	Data Element	Type	Notes
Samples per Pixel	**0028, 0002**	**1**	**1**
Photometric Interpretation	**0028, 0004**	**1**	**MONOCHROME 2**
Rows	**0028, 0010**	**1**	**1024**
Columns	**0028, 0011**	**1**	**1024**
Pixel Aspect Ratio	**0028, 0034**	**1C**	**Value is 1\1 So this attribute is not sent.**
Bits Allocated	**0028, 0100**	**1**	**8**
Bits Stored	**0028, 0101**	**1**	**8**
High Bit	**0028, 0102**	**1**	**7**
Pixel Representation	**0028, 0103**	**1**	**0**
Smallest img Pixel value	**0028, 0106**	**3**	**0**
Largest Img Pixel Value	**0028, 0107**	**3**	**255**
Pixel Data	**7FE0, 0010**	**1**	

VOI Lut

Attribute Name	Data Element	Type	Notes
Window center	**0028, 1050**	**3**	
Window width	**0028, 1051**	**1C**	

SOP Common

Attribute Name	Data Element	Typ	Notes

		e	
SOP Class UID	**0008, 0016**	**1**	**1.2.840.10008.5.1.4.1.1.7**
SOP Instance UID	**0008, 0018**	**1**	

Print service class IMPLEMENTATIOn

INTRODUCTION

This section specifies the use of the Basic Grayscale Print Management Meta-SOP Class and the Print Job Class. It represents the information which may be included by this implementation. Corresponding attributes are conveyed using the module construct. The total list of SOP Classes supported are:

Basic Film Session
Basic Film Box
Basic Grayscale Image Box
Printer
Print Job

Since printer's functionality vary, the information used for different printers may also vary due to the configuration capabilities mentioned earlier.

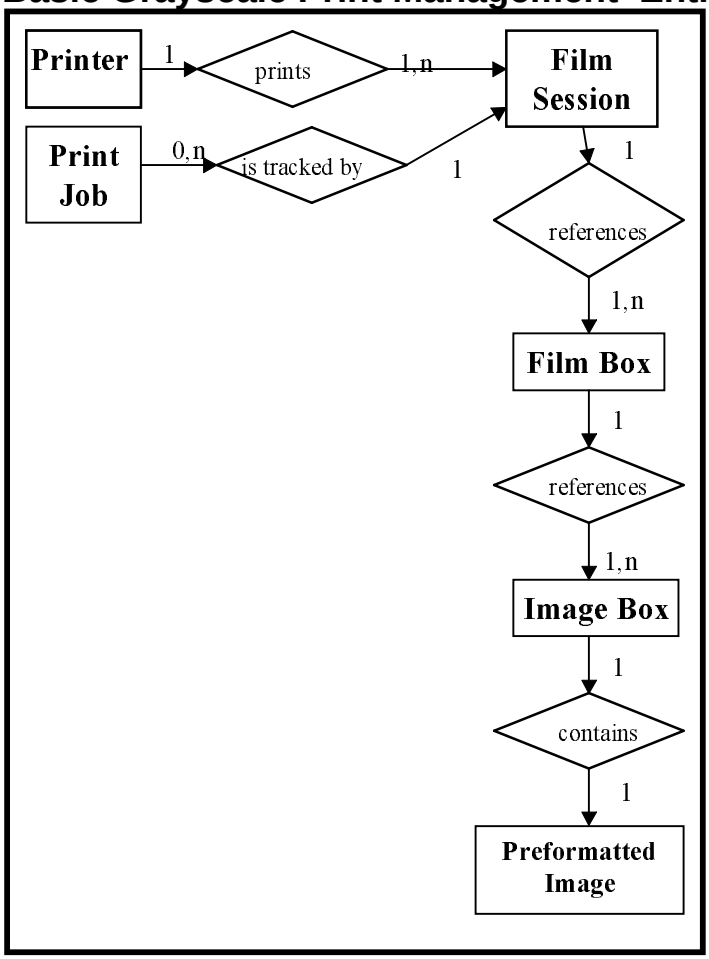
Basic Grayscale Print Management SOP Class IMPLEMENTATION

This section defines the implementation of Basic Grayscale Print Management Meta-SOP Class. It includes the DIMSE services supported for each SOP Class plus IOD information.. It refers to the DICOM V3.0 Standard, Part 3 (Information Object definition) and Part 4 (Service Class Specifications).

Basic Grayscale Print Management ENTITY-RELATIONSHIP MODEL

Illustration 5-1

Basic Grayscale Print Management Entity Relationship Diagram



The Entity-Relationship diagram for the Basic Grayscale Print Management SOP Class interoperability schema is shown in Illustration 5-1. 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.
The relationships are fully defined with the maximum number of possible entities in the relationship shown.

Entities Description

Refer to DICOM Standard Part 3 (Information Object Definitions) and Part 4 (Service Class Specifications) for a description of each of the entities contained within the Basic Grayscale Print Management SOP Class.

Basic Grayscale Print Management SOP Class Tables

Within an entity of the DICOM v3.0 Basic Grayscale Print Management SOP Class, 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.

The usage of attribute within a module is defined in relationship to the DIMSE service which is being used. Therefore, the following tables will convey the information supported by this implementation relative to the DIMSE services used within each SOP Class.

See DICOM v3.0 Part 3 and Part 4 for a complete definition of the entities, modules, and attributes.

Table 0–1
Print Service Class SOP Definitions

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	**1.2.840.10008.5.1.1.9**
Print Job SOP Class	**1.2.840.10008.5.1.1.14**

Table 0–2
Basic Grayscale Print Management Meta SOP Instance Definitions

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

Basic Film Session SOp Class

This SOP Class describes the presentation parameters which are common for all the films of the film session.

Basic Film Session DIMSE Service Group

DIMSE Service Element	Usage -	Notes

	SCU/ SCP	
N-CREATE	**M/M**	
N-DELETE	**U/M**	
N-ACTION	**U/U**	**Support for this DIMSE service allows the operator to select a study of images for printing.**

N-CREATE: For Film Session
The N-CREATE is used to create an instance of the Film Session. The parameters supported are based on the configuration files specific to each printer.
N-CREATE Attributes

Attribute Name	Data Element Tag	Usage - SCU/SCP	Notes and Examples (max of 8 entries)
Number of Copies	**2000,0010**	**U/M**	**1,2,n,n1,n2...**
Print Priority	**2000,0020**	**U/M**	**HIGH, MED, LOW**
Medium Type	**2000,0030**	**U/M**	**PAPER, CLEAR FILM, BLUE FILM**
Film Destination	**2000,0040**	**U/M**	**MAGAZINE, PROCESSOR**
Film Session Label	**2000,0050**	**U/U**	

N-DELETE: For Film Session
The N-DELETE is used to delete an active Film Session. The Film Session is deleted before releasing the association.
N-DELETE Attributes
N/A
N-ACTION: For Film Session
The N-ACTION is used to request printing for multiple sets of Film Sheets. It is used to print a complete study of images. This is an optional feature in DICOM and will be functional only if the printer (SCP) also supports

this feature. If not supported by the SCP, the operator must print using the image option (e.g. one film sheet at a time) instead of the print study option.

N-ACTION Attributes

Attribute Name	Action Type ID	Attribute	Tag	Usage: SCU/SCP
PRINT	**1**	**Referenced Print Job Sequence**	**2100, 0500**	**- /MC Required if Print Job SOP is supported.**
		> Referenced SOP Class UID	**0008, 1150**	**-/MC ; Required if Referenced Print Job Sequence (2100, 0500) is present.**
		> Referenced SOP Instance UID	**0008, 1155**	**-/MC ; Required if Referenced Print Job Sequence (2100, 0500) is present.**

If the SCP does not support the Print Job SOP Class, the Action Reply arguments are not contained in the N_ACTION response.

Basic Film Box SOP Class

The Basic Film Box describes the presentation parameters which are common for all images on a given film sheet.

Basic Film Box DIMSE Service Groups

DIMSE Service Element	Usage - SCU/SCP	Notes
N-CREATE	**M / M**	
N-ACTION	**M / M**	

N-CREATE: For Film Box

The N-CREATE is used to create an instance of the Film Box. The parameters supported are based on the configuration files specific to each printer.

N-CREATE Attributes

Attribute Name	Data Element Tag	Usage - SCU/SCP	Notes
Image Display Format	**2010, 0010**	**M/M**	**STANDARD\C,R Portrait: 1,1; 1,2; 2,2; 2,3; 2,4; 3,3; 3,4; 4,4; 4,5; 4,6 Landscape: 1,1; 2,1; 2,2; 3,2; 4,2; 3,3; 4,3; 4,4; 5,4; 6,4**
Referenced Film Session Seq.	**2010, 0500**	**M/M**	
> Referenced SOP Class UID	**0008, 1150**	**M/M**	
> Referenced SOP Instance UID	**0008, 1155**	**M/M**	
Film Orientation	**2010, 0040**	**U/M**	**PORTRAIT, LANDSCAPE**
Film Size ID	**2010, 0050**	**U/M**	**8INX10IN, 10INX12,14INX17IN, 24CMX30CM, ...**
Magnification Type	**2010, 0060**	**U/M**	**REPLICATE, BILINEAR, CUBIC, NONE**
Max Density	**2010, 0130**	**U/M**	
Configuration Information	**2010, 0150**	**U/M**	**This attribute is configurable by a GE Field Service Engineer based on the requirements of the**

			SCP.
Smoothing Type	2010,0080	U/U	
Boarder Density	2010,0100	U/U	
Empty Image Density	2010,0110	U/U	
Min Density	2010,0120	U/U	
Trim	2010,0140	U/U	YES, NO

N-ACTION: For Film Box

The N-ACTION is used to request printing for a single Film Sheet. It is not used if the N-ACTION at the Film Session is used (e.g. not used when printing a complete study of images).

N-ACTION Attributes

Attribute Name	Action Type ID	Attribute	Tag	Usage: SCU/SCP
PRINT	**1**	**Referenced Print Job Sequence**	**2100, 0500**	**- /MC Required if Print Job SOP is supported**
		> Referenced SOP class UID	**0008, 1150**	**- /MC Required if referenced Print Job seq. (2100,0500) is present.**
		> Referenced SOP instance UID	**0008, 1155**	**- /MC Required if referenced Print Job seq. (2100,0500) is present.**

If the SCP does not support the Print Job SOP Class, the Action Reply arguments are not contained in the N-ACTION response.

Basic Grayscale Image Box SOP Class

The Basic Image Box describes the presentations parameters and image pixel data which apply to a single image of a film sheet.

Basic Grayscale Image Box DIMSE Service Group

DIMSE Service Element	Usage SCU/SCP	Notes
N-SET	**M/M**	

N-SET: For Image Box

The N-SET is used to place the image on a film sheet. The parameters supported are based on the configuration files specific to each printer.

N-SET Attributes

Attribute Name	Data Element Tag	Usage SCU/SCP	Notes
Image Position	**2020, 0010**	**M/M**	
Preformatted Grayscale Image Seq.	**2020, 0110**	**M/M**	
> Samples Per Pixel	**0028, 0002**	**M/M**	**1**
> Photometric Interpretation	**0028, 0004**	**M/M**	**MONOCROME2**
> Rows	**0028, 0010**	**M/M**	**1024**
> Columns	**0028, 0011**	**M/M**	**1024**
> Pixel Aspect Ratio	**0028, 0034**	**M/M**	**1\1**
> Bits Allocated	**0028, 0100**	**M/M**	**8**
> Bits Stored	**0028, 0101**	**M/M**	**8**
> High Bit	**0028, 0102**	**M/M**	**7**
> Pixel Representation	**0028, 0103**	**M/M**	**0**
> Pixel Data	**7FE0, 0010**	**M/M**	
Polarity	**2020, 0020**	**U/M**	**NORMAL, REVERSE**
Magnification Type	**2010,0060**	**U/U**	**REPLICATE, BILINEAR, CUBIC,NONE** **Note: The value used is always the same as in**

			the associated Film Box.
Smoothing Type	**2010,0080**	**U/U**	**Note: The value used is always the same as in the associated Film Box.**

Printer SOP Class

The Printer SOP Class provides the capability to monitor the status of the printer.

Printer SOP DIMSE Service Group

DIMSE Service Elements	Usage - SCU/SCP	Reference	Notes
N-EVENT-REPORT	**M/M**	**0**	

N-EVENT-REPORT: For Printer SOP

The N-EVENT-REPORT is used to convey information about the printer to the SCU.

N-EVENT-REPORT Attributes

Event Type Name	Event Type ID	Attribute	Tag	Usage - SCU/SCP
NORMAL	**1**			
WARNING	**2**	**Printer Status Info**	**2110,0020**	**U/M**
FAILURE	**3**	**Printer Status Info**	**2110,0020**	**U/M**

PRINT JOB SOP CLASS

The Print Job SOP Class is used to monitor the status of the print process. For cases when the print request (i.e. N-ACTION) was made at the Film Session level, the print job monitors multiple film sheets (e.g. print a study of images). For cases when the print request was made of the Film Box level, the print job monitors a single film sheet.

Print JOB DIMSE Service Group

DIMSE Service Elements	Usage - SCU/SCP	Reference	Notes
N-EVENT-REPORT	**M/M**	**0**	
N-GET	**U/M**	**0**	

N-EVENT-REPORT: For Print Job

The N-EVENT-REPORT is used to convey information about the print job to the SCU.

N-EVENT-REPORT Attributes

Event Type Name	Event Type ID	Attribute	Tag	Usage - SCU/SCP
PENDING	**1**	**Execution Status Info**	**2100, 0030**	**U/M**
PRINTING	**2**	**Execution Status Info**	**2100, 0030**	**U/M**
DONE	**3**	**Execution Status Info**	**2100, 0030**	**U/M**
FAILURE	**4**	**Execution Status Info**	**2100, 0030**	**U/M**

N-GET: For Print Job

The N-GET is used to poll the printer for print job status. The Advantx DRE will periodically open an association and perform a N-GET via the operator print status screen interface.

The Advantx DRE supports one association at a time and will only perform the N-GET if no other network activity exists.

N-GET Attributes

Attribute Name	Data Element Tag	Usage - SCU/ SCP	Notes
Execution Status	**2100,0020**	**U/M**	**PENDING, PRINTING, DONE, FAILURE**
Execution Status Info	**2100,0030**	**U/M**	**If PENDING: Then QUEUED, NO SUPPLY MGZ, NO RECEIVE MGZ, SUPPLY EMPTY, RECEIVER FULL, FILM JAM. If FAILURE; Nothing is defined.**
Print Priority	**2000,0020**	**U/M**	**HIGH, MED, LOW**
Creation Date	**2100,0040**	**U/U**	**Date of print creation**
Creation Time	**2100,0050**	**U/U**	**Time of print creation**
Printer Name	**2110,0030**	**U/U**	**User defined name identifying the printer**
Originator	**2100,0070**	**U/U**	**DICOM AE Title that issued the print operation**