GE Medical Systems

Technical Publications

Direction 2153416−100

Revision 0

PET ADVANCE CONFORMANCE STATEMENT for DICOM v3.0 (ID/Net v3.0)

- PET Advance (3.0: 1Q'96)

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GE Medical Systems

REVISION HISTORY

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LIST OF EFFECTIVE PAGES

SECTION	NUMBER	SECTION	NUMBER
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SECTION 1 − INTRODUCTION

1.0 OVERVIEW

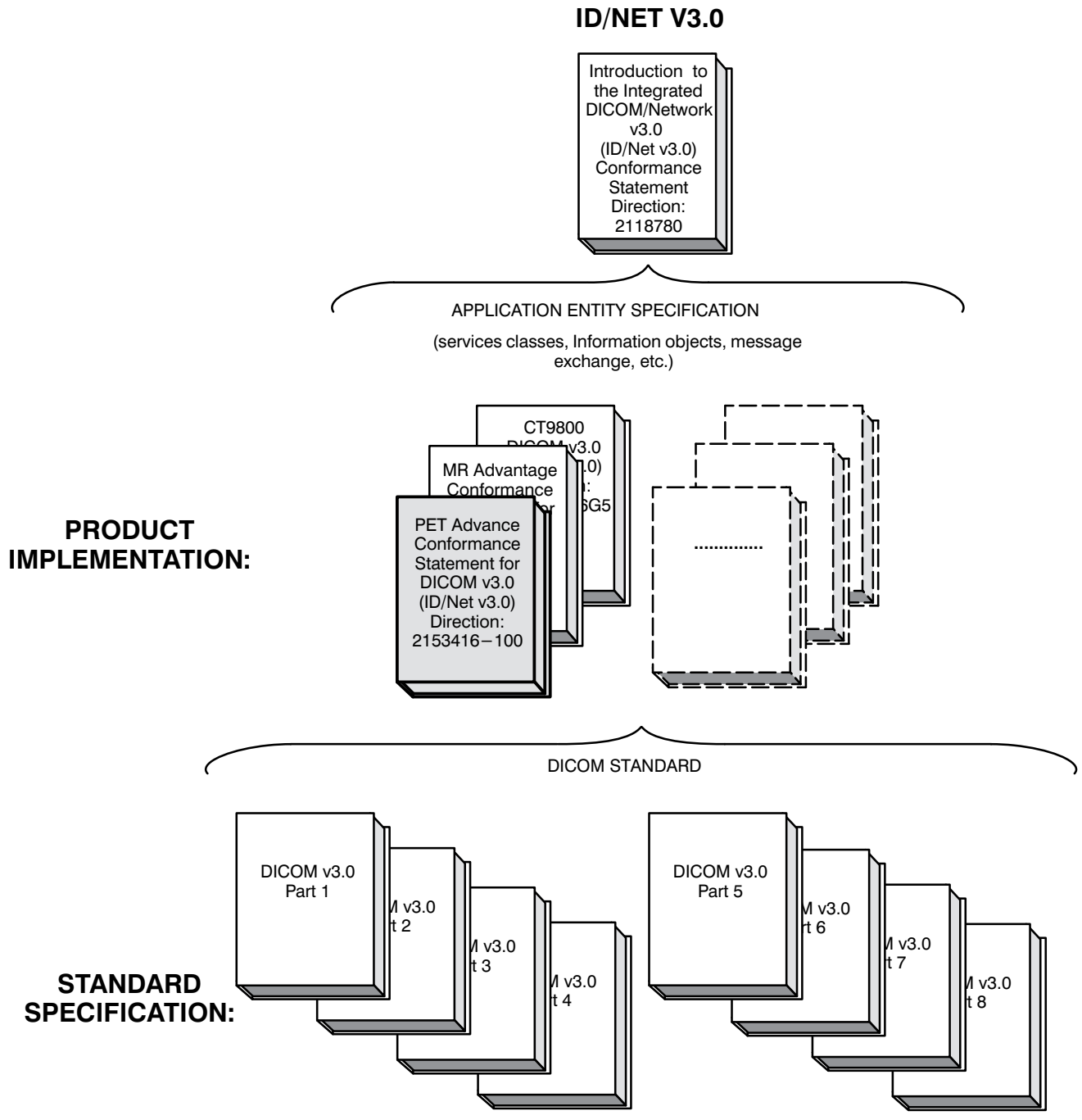
Section 1, *Introduction*, provides general information about the content and scope of this document.

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

1.1 OVERALL CONFORMANCE STATEMENT DOCUMENTATION 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



The Documentation Structure given in Illustration 1−1 shows the overall documentation structure for all of the GEMS ID/Net v3.0 Conformance Statements. ID/Net v2.0 documentation is also openly available, but the two documentation structures are independent of one another.

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

PET Advance
Conformance Statement for DICOM v3.0 (ID/Net v3.0)
Direction 2153416−100.

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 v3.0 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, OSI, etc.). 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
2101 L Street, N.W., Suite 300
Washington, DC 20037 USA
Phone: (202) 457−1965

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 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

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 ID/Net v3.0 implementations. This specification, called a Conformance Statement (previously an Implementation Profile), 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 the Technical Specification of 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.

1.4 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.
- **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 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.*

1.6 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.*

1.7 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.*

SECTION A (2) − CONFORMANCE STATEMENT

A.0 INTRODUCTION

This Conformance Statement (CS) specifies the GE PET Advance scanner compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product. Other sections of this document describe the Information Object data elements which are used by this implementation.

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

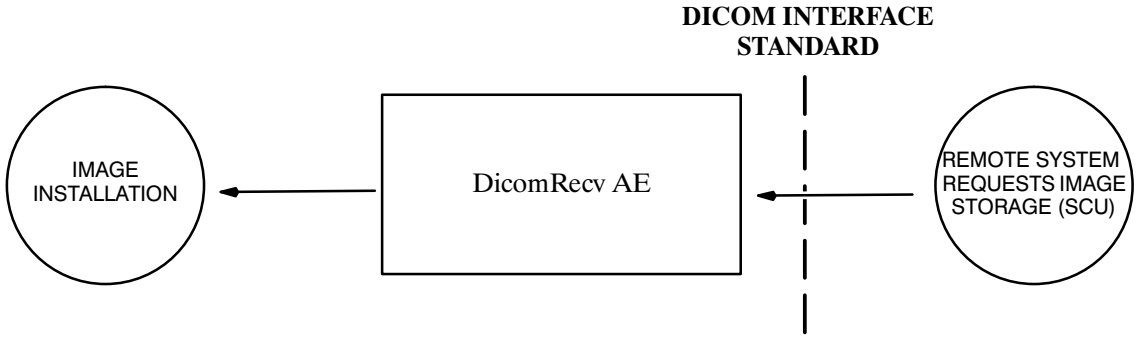
The ability to Receive DICOM CT/MR images onto the PET Advance scanner allows Advance users to co−register and fuse the anatomical detail of the CT/MR images with the Functional PET images. This leverages the strengths of both modalities and maximizes Patient Treatment planning and tracking.

A.1 IMPLEMENTATION MODEL

A.1.1 Application Data Flow Diagram

All DICOM functionality on the PET Advance scanner is handled by the DicomRecv Server Application Entity (AE). The DicomRecv server AE is listening to a pre−defined port for incoming connections. The Specific Application model for this device is shown in Ill. 2−1 .

ILLUSTRATION 2−1
SPECIFIC AE APPLICATION MODEL



There is no local real world event required for the DicomRecv AE to respond to an incoming DICOM Store. The DicomRecv AE is always prepared to respond to a Image Store by any remote DicomRecv AE. The DicomRecv Server AE will perform the Real−World Activity Image Installation after the remote AE sends an image to the PET Advance Scanner.

A.1.2 Functional Definition of AE's

Application Entity 1, DicomRecv

Supports the following functions:

- Responds to DICOM associations transmitting images to be stored.

A.1.3 Sequencing of Real−World Activities

Not applicable.

A.2 AE SPECIFICATIONS

A.2.1 DicomRecv AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP classes as an **SCP**:

SOP Class Name	SOP Class UID
Verification (Echo)	1.2.840.10008.1.1
CT Image Information Storage − STORE	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage − STORE	1.2.840.10008.5.1.4.1.1.4

Note: The GE PET Advance Scanner does not support any DICOM SOP Classes as an SCU.

A.2.1.1 Association Establishment Policies

A.2.1.1.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU offered by the DicomRecv AE is:

Maximum Length PDU	10 Kbytes

The SOP class Extended Negotiation is not supported.

The user info items supported by this product are:

- Maximum PDU Length and,
- Implementation UID

Note: Max PDU length is not configurable at run time.

A.2.1.1.2 Number of Associations

The DicomRecv AE can have a maximum of 4 DICOM associations open simultaneously to receive an image store or respond to an echo. It should be noted, however, that system response time for the association will degrade with increasing simultaneous incoming associations. The slow response could trigger timers in remote systems. The system administrator should be aware of this situation.

A.2.1.1.3 Asynchronous Nature

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

A.2.1.1.4 Implementation Identifying Information

The Implementation UID allows unique identification of a set of products that share the same implementation.

The Implementation UID for this ID/Net v3.0 Implementation is:

PET Advance Implementation UID	1.2.840.113619.6.8.1

A.2.1.2 Association Initiation by Real−World Activity

This AE does not attempts to initiate an new associations.

A.2.1.3 Association Acceptance Policy

A.2.1.3.1 Real−World Activity "Image Installation"

When the DicomRecv Server AE accepts an association, it will receive DICOM CT or MR images transmitted on that association and store the images on disk. The DicomRecv Server AE places no limitations on who may connect to it.

A.2.1.3.1.1 Associated Real−World Activity

This AE is indefinitely listening for associations. No operator action is required to receive an image.

The Real−World Activity associated with the C−STORE operation is a two−step storage of the DICOM CT/MR image received into the PET Advance Scanner Database.

First, DICOM CT/MR images are received and written to a Unix file (one file per image). A second process reads these Unix file, translates the data into the PET Advance Database format and then writes the image into the PET Advance Database.

A.2.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table − Accepted					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Little Endian	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Little Endian	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Little Endian	1.2.840.10008.1.2	SCP	None

A.2.1.3.1.2.1 SOP Specific Conformance for Verification SCP Class

The DicomRecv Server AE provides standard conformance to the DICOM Verification Service Class.

A.2.1.3.1.2.2 SOP Specific Conformance for Image Storage SOP Classes

The DicomRecv Server AE conforms to the SOP's of the Storage Service Class at Level 0 (local). A list of attributes saved can be found in the following table.

Attribute	Tag
SOP class UID	(0008, 0016)
SOP Instance UID	(0008, 0018)
Study Date	(0008, 0020)
Series Date	(0008, 0021)
Scan Date	(0008, 0022)
Image_date	(0008, 0023)
Study Time	(0008, 0030)
Series Time	(0008, 0031)

Attribute	Tag
Scan Time	(0008, 0032)
Image Time	(0008, 0033)
Accession Number	(0008, 0050)
Modality	(0008, 0060)
Manufacturer	(0008, 0070)
Institution Name	(0008, 0080)
Referring Physician Name	(0008, 0090)
Station ID	(0008, 1010)
Study Description	(0008, 1030)
Series Description	(0008, 103E)
Referring Physician	(0008, 1060)
Operator	(0008, 1070)
Manufacture Model Name	(0008, 1090)
Patient Name	(0010, 0010)
Patient ID	(0010, 0020)
Patient's Birth Date	(0010, 0030)
Patient's Sex	(0010, 0040)
Patient's Weight	(0010, 1030)
Other Patient History	(0010, 21B0)
Contrast Agent	(0018, 0010)
Slice Thickness	(0018, 0050)
Echo Number	(0018, 0086)
Patient Position	(0018, 5100)
Study Instance UID	(0020, 000D)
Series Instance UID	(0020, 000E)
Study identifier	(0020, 0010)
Series number	(0020, 0011)
Image Number	(0020, 0013)
Patient Position	(0020, 0032)
Image Orientation	(0020, 0037)
Frame Reference UID	(0020, 0052)
Landmark Name	(0020, 1040)
Slice Location	(0020, 1041)

Attribute	Tag
Rows	(0028, 0010)
Columns	(0028, 0011)
Pixel_Spacing	(0028, 0030)
Image.Bits_Allocated	(0028, 0100)
Pixel Padding Value	(0028,0120)
Smallest Image Pixel Value	(0028,0106)
Largest Pixel Value	(0028,0107)
Image.Pixel_Data	(7FE0,0010)
data size	(7FE0,0000)

If the DicomRecv Server AE returns one of the following status codes, then the C−STORE operator was unsuccessful and no image will be installed:

- 0110 (Processing Failure) Indicates that an internal system call has failed while processing the image.
- A700 (Out of Resources) Indicates that there was not enough disk space or some other internal resource (such as memory) to store the image. The user should attempt recovery by removing some images from the PET Advance scanner.

In the event of a successful C−STORE operation, the image has successfully been written to disk. The two−step storage discussed earlier implies that DICOM images maybe successfully received and still be rejected during step two's translation into the PET Advance Database.

Each C−STORE operator supports a "Session Timer". This timer starts when the association is established and stops when the association is ended. This timeout is 60 minutes.

A.2.1.3.1.3 Presentation Context Acceptance Criterion

No criterion.

A.2.1.3.1.4 Transfer Syntax Selection Policies

Only Little Endian transfer syntax is supported and there is no priority selection policy.

A.3 COMMUNICATION PROFILES

A.3.1 Supported Communication Stacks (parts 8,9)

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

A.3.2 OSI Stack

OSI stack not supported.

A.3.3 TCP/IP Stack

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

A.3.3.1 API

Not applicable to this product.

A.3.3.2 Physical Media Support

Ethernet v2.0, IEEE 802.3.

A.3.4 Point−to−Point Stack

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

A.4 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

A.4.1 Standard Extended/Specialized/Private SOP's

None

A.5 CONFIGURATION

A.5.1 AE Title/Presentation Address Mapping

No presentation mapping information needs to be set on the PET Advance scanner.

A.5.2 Configurable Parameters

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

- Local AE Title (the machine hostname)
- Local IP Address
- Local IP Netmask

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

Note: The local port on which the DICOM AE receives incoming TCP connections is port 104.

A.6 SUPPORT OF EXTENDED CHARACTER SETS

No extended character sets are supported.

GE Medical Systems

GE Medical Systems: Telex 3797371
P.O. Box 414, Milwaukee, Wisconsin 53201 U.S.A.
(Asia, Pacific, Latin America, North America)

GE Medical Systems — Europe: Telex 261794
Shortlands, Hammersmith, London W6 8BX U.K.