

Technical Publications

Direction FB250691 Rev 2

EchoServer 7.0 CONFORMANCE STATEMENT for DICOM

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GE Ultrasound

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1. INTRODUCTION

1.1 OVERVIEW

EchoServer 7.0 is a server that supports DICOM Image Storage as an SCP for Ultrasound (incl. Retired), Ultrasound Multi-frame (incl. Retired) and Secondary Capture IODs.

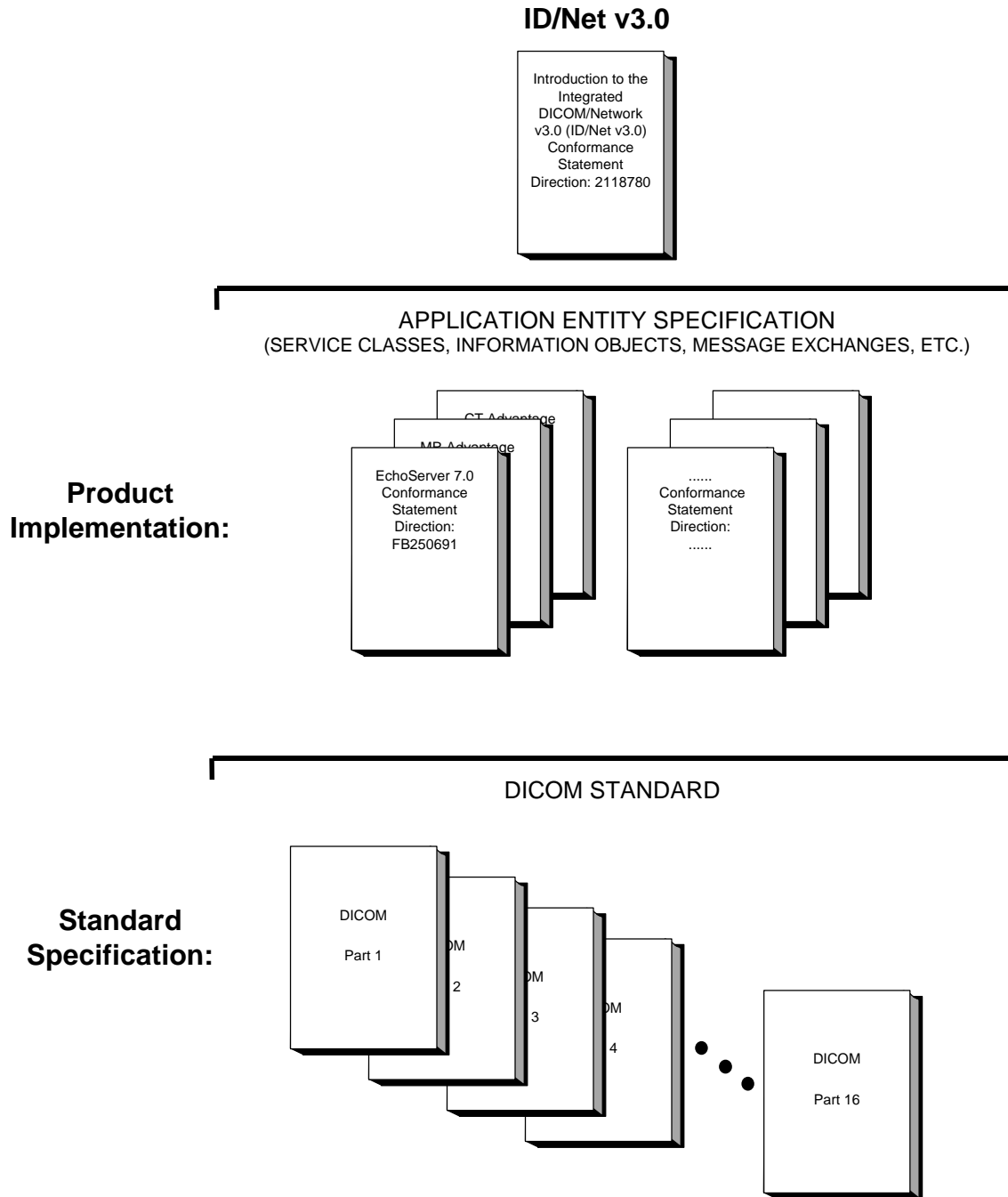
This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

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

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



This document specifies the DICOM implementation. It is entitled:

*EchoServer 7.0
Conformance Statement for DICOM
Direction FB250691*

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to inter-operate 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 more information regarding DICOM, copies of the Standard may be obtained on the Internet at <http://medical.nema.org>. Comments on the standard may be addressed to:

DICOM Secretariat
NEMA
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209
USA

1.3 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 DICOM Conformance Statement document.

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

1.4 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 data exchanged using DICOM. The GEMS Conformance Statements are available to the public.

The reader of this DICOM 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 DICOM 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.

1.5 IMPORTANT REMARKS

The use of these DICOM 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 DICOM 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. The GEMS protocol is based on DICOM as specified in each DICOM Conformance Statement. 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 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.

1.6 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 DICOM PS 3.3 (Information Object Definition).

1.7 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.*

1.8 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*.

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant **Networking** features for EchoServer 7.0. 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.

EchoServer is an ultrasound image database running on a commercial computer. DICOM image storage allows for the following DICOM functionality:

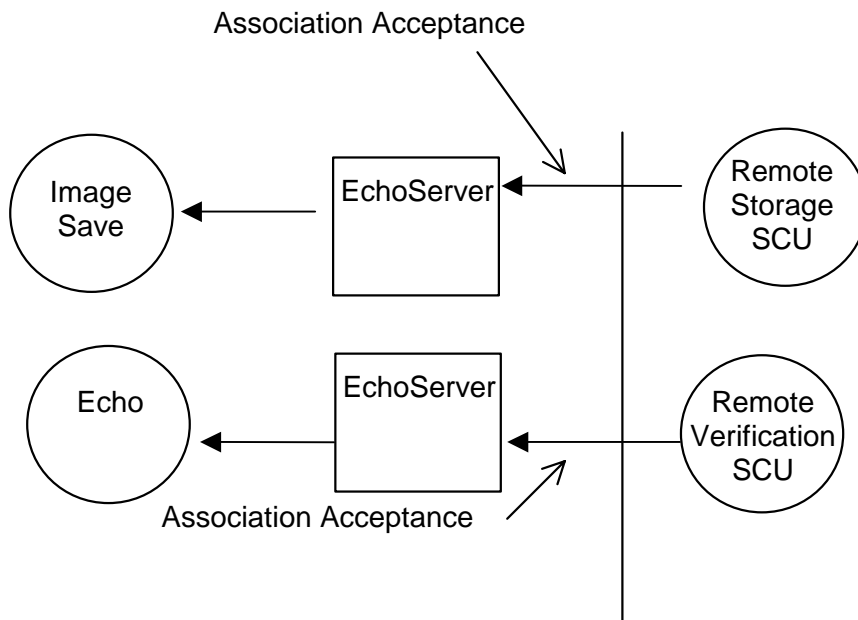
- Receiving DICOM Echo messages from a DICOM Verification client. This enables DICOM SCUs to verify the connection to EchoServer.
- Receiving DICOM images from a DICOM client and inserting them into the local database. This enable DICOM Storage SCUs to send ultrasound (incl. multi-frame) and secondary capture images to EchoServer. EchoServer will store the images in its database and make them available for EchoServer database clients.

2.2 IMPLEMENTATION MODEL

The EchoServer AE implements Image Storage and Verification as an SCP. EchoServer listens for incoming connections and acts according to the description below.

2.2.1 Application Data Flow Diagram

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



There are two local real-world activities that occur in EchoServer – **Image Save** and **Echo**.

Image Save - Storage Request from a remote SCU makes EchoServer accept a connection with the SCU and accepts the images from the SCU.

Echo - Verification Request from a remote SCU makes EchoServer accept a connection with the SCU and responds to the verification request from the SCU.

2.2.2 Functional Definition of AE's

Application Entity EchoServer supports the following functions:

- Responds to DICOM Storage requests from other devices.
- Responds to DICOM Verification requests from other devices.

2.2.3 Sequencing of Real-World Activities

Not applicable.

2.3 AE SPECIFICATIONS

2.3.1 EchoServer AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCP**:

SOP Class Name	SOP Class UID
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Verification SOP Class	1.2.840.10008.1.1

2.3.1.1 Association Establishment Policies

2.3.1.1.1 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 EchoServer is configurable.

Maximum Length PDU	Configurable to any number up to 999999
---------------------------	--

The SOP Class Extended Negotiation is not supported.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

2.3.1.1.2 Number of Associations

The EchoServer AE will accept multiple DICOM associations. The number is configurable (1-20).

2.3.1.1.3 Asynchronous Nature

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

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

EchoServer Implementation UID	1.2.840.113619.6.103
--------------------------------------	-----------------------------

The Implementation Version Name for this DICOM Implementation is:

EchoServer Implementation Version Name	ECHOSERVER_7
---	---------------------

Note: The Implementation Version Name and may change in the future without modification of this document.

2.3.1.2 Association Initiation Policy

The EchoServer AE does not initiate any associations.

2.3.1.3 Association Acceptance Policy

The EchoServer AE accepts a new association with a remote device due to two Real-World Activities:

- Image Save, initiated by a Remote Storage Request from a remote Storage SCU.

- Echo, initiated by a Remote Verification Request from a remote Verification SCU.

The EchoServer AE can be configured to reject associations from applications with an unknown AE Title. The list of known AE Titles is configurable (up to 20 AE Titles).

2.3.1.3.1 Real-World Activity “Image Save”

2.3.1.3.1.1 Associated Real-World Activity

The EchoServer accepts remote association requests from Storage SCUs.

2.3.1.3.1.2 Accepted Presentation Context Tables

The Accepted Presentation Context Table is:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See below.	See below.	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	See below.	See below.	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	See below.	See below.	SCP	None
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	See below.	See below.	SCP	None
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	See below.	See below.	SCP	None

Transfer Syntaxes accepted	
Name	UID
Jpeg Baseline	1.2.840.10008.1.2.4.50
RLE	1.2.840.10008.1.2.5
Jpeg Lossless Hier 14	1.2.840.10008.1.2.4.70
Jpeg Extended 2 4	1.2.840.10008.1.2.4.51
Explicit Little Endian	1.2.840.10008.1.2.1
Explicit Big Endian	1.2.840.10008.1.2.2
Implicit Little Endian	1.2.840.10008.1.2

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The EchoServer will accept images without patient id, but will not insert such images into the database, unless configured to create artificial patient ids if patient id in image is empty.

The EchoServer conforms to full conformance of the Storage SOP Class (level 2). All tags will be retained.

The EchoServer rejects images when the local receive buffer is full (the amount of free space needed to define the minimum receive buffer size is configurable).

The EchoServer accepts duplicated images (based on SOP Instance UID), but will not insert such images into the database. The image can automatically be deleted from the receive buffer if so configured.

The EchoServer will store the image in the same compression form as they are received.

EchoServer returns the following status codes:

Service Status	Status Codes	Further Meaning	Application Behavior	Related Fields Processed if received
Refused	A765	Out of resources	EchoServer rejects the association	(0000,0902)
Error	C065	Cannot Understand	EchoServer rejects the association	(0000,0902)
	0111	Processing Failure	EchoServer rejects the association	None
	A965	Data Set does not match SOP Class	EchoServer rejects the association	(0000,0901) (0000,0902)
Success	0000			None

2.3.1.3.1.3 Presentation Context Acceptance Criterion and Transfer Syntax Selection Policies

The application accepts all proposed Presentation Contexts that include at least one of the acceptable Presentation Contexts.

The application selects the first Transfer Syntax within each proposed Presentation Context that matches one of the accepted Transfer Syntaxes.

2.3.1.3.2 Real-World Activity “Echo”

2.3.1.3.2.1 Associated Real-World Activity

The EchoServer accepts remote association requests from Verification SCUs.

2.3.1.3.2.2 Accepted Presentation Context Table

Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

2.3.1.3.2.3 Transfer Syntax Selection Policies

Not applicable.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

2.4.2 TCP/IP Stack

The TCP/IP stack is inherited from a Windows operating system.

2.4.2.1 API

Not applicable to this product.

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

Not applicable to this product.

2.6 CONFIGURATION

2.6.1 AE Title/Presentation Address Mapping

The Local AE title is configurable.

2.6.2 Configurable Parameters

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

1. Local AE Title: The application name for the DICOM Server.
2. Local port number.
3. No of listen sockets: A number (in the range 1 to 20) indicating how many clients can connect to the server at the same time.
4. Log level: Normal (default) gives only errors and warnings. Medium gives all attributes in the transferred objects. Full gives all communication details.
5. Up to 20 remote AE Titles. If you have enabled security (see next setting) you have to add the AE Title of the sending client here.

6. Enable/disable availability for any remote AE Title. If you only want to allow specific clients to send images to the server, enable this setting (and add the AE Titles in the setting above).
7. Maximal PDU Length.
8. Association time-out. This is the number of seconds to wait between messages for one association.
9. Minimum amount of disk space. This is the number of bytes that you want as margin for the hard disk where the temporary directory is. If the disk has less space, no images will be accepted.
10. Network settings (IP address, subnet mask) are set through the operating system's settings.

2.7 SUPPORT OF EXTENDED CHARACTER SETS

EchoServer will fully support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. SOP Instances with other characters will be received, but not saved to the database.

2.8 CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

2.9 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network(VPN))