DICOM Conformance Statement

Encompass Store Server

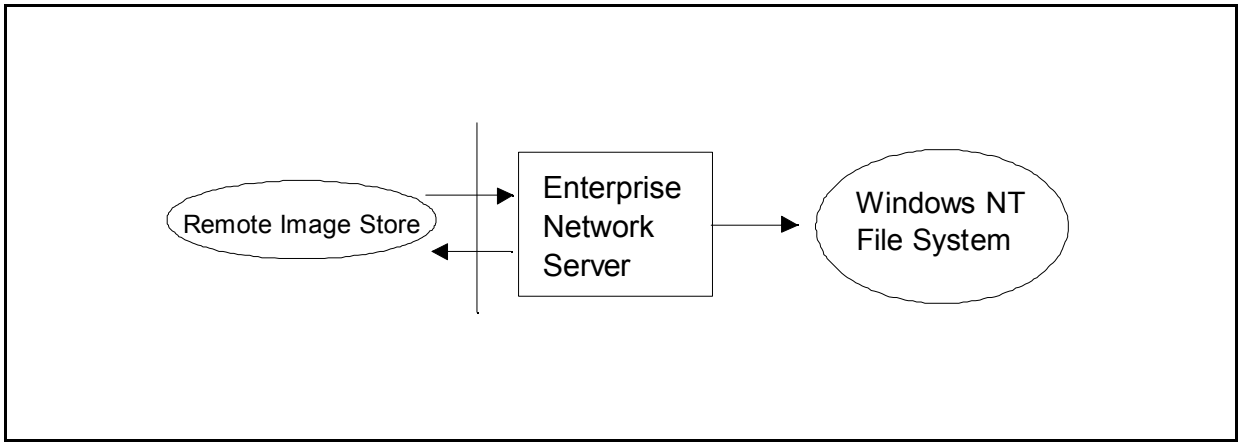
The Heartlab Encompass Store Server application entity (AE) , to be known as the ENS in this document, is an image storage server application that accepts and stores DICOM- compliant x-ray angiographic and cardiac ultrasound studies on an IP network. The images are stored on a designated local or network accessable Microsoft Windows NT file system.

1. Implementation Model

The Encompass Store Server application listens on a designated IP socket for incoming DICOM network association requests. If the association requests that it wants to verify the DICOM connection (C-Echo) or store a supported image (C-Store), then the association is accepted. The remote application entity is allowed to store the image.

The Store Server also has the capability to initiate a DICOM network verification with a remote application entity.

1.1 Application Data Flow Diagram



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1.2 Functional Definition of AE

The Heartlab Encompass Store Server AE performs these function(s):

- Provides a C-STORE service in the SCP role.
- Provides a C-ECHO service in the SCP and SCU roles.
- Compresses the stored images (For XA), SOP Instances, as DICOM Part 10, lossless, 2:1 compressed JPEG, 8 bit gray scale image files. Note: During conversion, all private tags are removed.
- Images stored using the Ultrasound and Ultrasound Multi-Frame SOP classes are stored as received. However, the received Data Sets do have a Heartlab Inc. generated Meta File Object prefix in the stored file.
- Places all images, SOP instances, onto system storage provided by the Microsoft Windows NT® File System.

1.3 Sequencing of Real World Activities

Once installed and configured, the Heartlab Network Server has no user interaction requirements.

2. AE Specifications

Only the Heartlab Encompass Store Server Application Entity is described in this document.

2.1 The Heartlab Encompass Store Server Application Entity (ENS)

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 2-1

Supported SOP Classes as an SCU	SOP Class UID
Verification Service Class	1.2.840.10008.

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

Table 2-2

Supported SOP Classes as an SCP	SOP Class UID
Verification Service Class	1.2.840.10008.1.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-Frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7
JPEG Process 1, baseline, lossy (8 bit)	1.2.840.10008.1.2.4.50

RLE Lossless, PackBits	1.2.840.10008.1.2.5
Little Endian Explicit Transfer Syntax	1.2.840.10008.1.2.1
Big Endian Explicit Transfer Syntax	1.2.840.10008.1.2.2
JPEG Lossless Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70

2.1.1 Association Establishment Policies

Application Context Name	1.2.840.10008.3.1.1.1

2.1.1.1 General

The maximum length PDU negotiation is handled in association establishment requests.

There is no maximum length PDU for an association. It is determined by the association requests. However, the default is 8 Kbytes.

There is no maximum number of supported Presentation Context Items that can be presented to the AE. However, only the Presentation Contexts listed in Table 2-2 will result in a successful association negotiation. If any Proposed Presentation Contexts are present that are not in Table 2-2, then the association request will be rejected.

The user info items supported by this product are:

* Maximum PDU Length.
* Implementation UID

2.1.1.2 Number Of Associations

The Encompass Store Server will support only one open association at any given time. Multiple command may be issued on one association. It is also possible to have multiple application entities existing on a system. The restriction is that each Store Server will have to listen for incoming association requests on different IP network endpoints.

2.1.1.3 Asynchronous Nature

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

2.1.1.4 Implementation Identifying Information

The Implementation UID root for this application entity is:

ENS Implementation UID	1.2.840.113815

Heartlab may append specific version identifiers to the UID root.

The suffix portion is subject to change.

2.1.2 Association Initiation By Real World Activity

The ENS only attemps to initiate a new association when performing a Verification Service as an SCU.

For SCP services, the ENS listens for association requests on an IP network endpoint and waits for remote Application Entities to initiate an association.

2.1.2.1 Real-World Activity "Verify Remote AE Connection"

2.1.2.1.1 Association Real World Activity

The user can initiate a C-ECHO-RQ accross the network to a remote application entity for the purposes on verifying that a DICOM association is possible and working correctly.

2.1.2.1.2 Proposed Presentation Contexts

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax Name	Transfer Syntax UID	Role	Extended Negotiation?L
Verification"	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None"

2.1.2.1.3 SOP Specific Conformance Statement for "Verify Remote AE Connection"

There is nothing unusual about the "Verify Remote AE Connection" as an SCU.

2.1.2.2 Real-World Activity "Store Image"

2.1.2.2.1 Associated Real-World Activity

The ENS recieves incoming Verification, XA, US, and SC IODs, converts the XA images to transfer syntax 1.2.840.10008.1.2.4.70 and stores them on a user preselected directory in the system's Microsoft Windows NT file sytem. If the association is idle longer than the watchdog timeout period, then the server will abort the association and go back to listening for more association requests.

2.1.2.2.2 Proposed Presentation Contexts

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax Name	Transfer Syntax UID	Role	Extended Negotiation?
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU and SCP	None
Ultrasound Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Ultrasound Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Ultrasound Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	JPEG Baseline Lossy Compressed	1.2.840.10008.1.2.4.50	SCP	None
Ultrasound Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	RLE Compressed[1]	1.2.840.10008.1.2.5	SCP	None
Ultrasound Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Ultrasound Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Ultrasound Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG Baseline Lossy Compressed	1.2.840.10008.1.2.4.50	SCP	None
Ultrasound Storage	1.2.840.10008.5.1.4.1.1.3.1	RLE Compressed[1]	1.2.840.10008.1.2.5	SCP	None
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Ultrasound Multi-frame Storage	1.2.840.10008.5.1.4.1.1.6	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

(Retired)					

Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	JPEG Baseline Lossy Compressed	1.2.840.10008.1.2.4.50	SCP	None
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	RLE Compressed[1]	1.2.840.10008.1.2.5	SCP	None
Ultrasound Multi-frame Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Ultrasound Multi-frame Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Ultrasound Multi-frame Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Ultrasound Multi-frame Storage	1.2.840.10008.5.1.4.1.1.6.1	JPEG Baseline Lossy Compressed	1.2.840.10008.1.2.4.50	SCP	None
Ultrasound Multi-frame Storage	1.2.840.10008.5.1.4.1.1.6.1	RLE Compressed[1]	1.2.840.10008.1.2.5	SCP	None
XRAY Angio 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
XRAY Angio Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
XRAY Angio Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
XRAY Angio Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Lossless JPEG Compressed	1.2.840.10008.1.2.4.70	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
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	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Lossless JPEG Compressed	1.2.840.10008.1.2.4.70	SCP	None

[1] Note DICOMstore will choose lossy JPEG first when both JPEG and RLE are presented

2.1.2.2.3 SOP Specific Conformance Statement for "Store Image"

This implementation accepts multiple C-ECHO and C-STORE operations over an association.

If something goes wrong with the transmission of a C-ECHO or C-STORE the ENS will respond with an A-ABORT and close the association.

All C-ECHO-RQ will be responded to with a successful C-ECHO-RSP.

All normal C-STORE-RQ will be responded to with a successful C-STORE-RSP.

The association supports an "association watchdog timer". The default is 60 seconds but is user selectable. When the association is idle the timer starts. If the association is idle long enough for the timer to expire, then the ENS send an A-ABORT and closes the association.

3 COMMUNICATION PROFILES

3.1 Supported Communication Stacks(Parts 8 and 9)

3.1.1 TCP/IP Stack

The DICOM UpperLayer (Part 8) is supported using TCP/IP via Windows Sockets 2.

3.1.2 API

Not applicable to this product.

3.1.3 Physical Media Support.

This supports any networking physical media that supports TCP/IP via Windows Sockets 2 running on Microsoft Windows NT. Additionally, secondary storage media supported is the same as that supported by Microsoft Windows NT.

3.1.4 Point-to-Point Stack

A 50-pin (part 9) ACR-NEMA connection is not supported by this product.

5. Extensions/Specializations/Privitizations of SOP Classes and Transfer Syntaxes

None.

6. Configuration

The following parameters are necessary for configuring the ENS

* Local IP address or hostname

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* Local Port number to use.
* Local AE Title
* Disk Drive to use to store images.
* Idle association watchdog timer value (optional)

To send a C-ECHO verification to a remote application entity, the following information is needed:

* Remote IP address or hostname
* Remote Port number to use
* Remote AE Title

7. Support of Extended Character Sets

Not applicable.

8. Support for STD-XABC as a File Set Creator (FSC)

The ENS acts as a FSC under the STD-XABC when writing Part 10 image files to the designated file system. To comply with Part 11 of the DICOM Standard, Media Storage Application Profiles, the ENS creates files containing the following tags:

Attribute Name	Tag	Note
PatientName	(0010,0010)	
Patient_ID	(0010,0020)	
Patient_DOB	(0010,0030)	
Patient sex	(0010,0040)	
Patient birth time	(0010,0032)	
Other patient ID	(0010,1000)	
Other patient name	(0010,1001)	
Patient height	(0010,1020)	
Patient weight	(0010,1030)	
Patient ethnic group	(0010,2160)	
Patient comments	(0010,4000)	
StudyDate	(0008,0020)	
StudyTime	(0008,0030)	
Study Description	(0008,1030)	
Study Instance UID	(0020,000D)	
Study ID	(0020,0010)	
Accession number	(0008,0050)	
Referring MD	(0008,0090)	(study)
Modality	(0008,0060)	
Performing MD	(0008,1050)	
Series Instance UID	(0020,000E)	

Series Number	(0020,0011)	
Laterality	(0020,0060)	
Series date	(0008,0021)	
Series time	(0008,0031)	
Protocol name	(0018,1030)	(series)
Series description	(0008,103E)	
Body part examined	(0018,0015)	(series)
Patient position	(0018,5100)	(series)
Operator	(0008,1070)	
Institution Address	(0008,0081)	
Station Name	(0008,1010)	
Institution Department Name	(0008,1040)	
Manufacturer	(0008,0070)	
Manufacturer's Model Name	(0008,1090)	
Device Serial Number	(0018,1000)	
SOP Class UID	(0008,0016)	
SOP Instance UID	(0008,0018)	
Image comments	(0020,4000)	
Institution name	(0008,0080)	
frame increment pointer	(0028,0009)	required
Radiation setting SC/GR	(0018,1155)	(low/high)
KVP peak kilo voltage of X-ray generator	(0018,0060)	
Exposure	(0018,1152)	
Positioner motion for multi frame cine	(0018,1500)	(Dynamic/Static)
Positioner primary angle	(0018,1510)	
Positioner secondary angle	(0018,1511)	
Frame Time	(0018,1063)	
Image type	(0008,0008)	required
Pixel intensity	(0028,1040)	required
Samples per pixel	(0028,0002)	
Photometric Interpretation	(0028,0004)	
Planar 0 or 1	(0028,0006)	
Number Frames	(0028,0008)	
Number Rows	(0028,0010)	
Number Columns	(0028,0011)	
Aspect Ratio	(0028,0034)	
Bits allocated	(0028,0100)	
Bits stored	(0028,0101)	
High Bit	(0028,0102)	
Pixel representation	(0028,0103)	
Image number	(0020,0013)	
Patient orientation	(0020,0020)	
Image date	(0008,0023)	
Image time	(0008,0033)	

Image type	(0008,0008)	
Acquisition number	(0020,0012)	
Acquisition date	(0008,0022)	
Acquisition time	(0008,0032)	
Derivation description	(0008,2111)	
Images in acquisition	(0020,1002)	
Calibration image	(0050,0004)	
Rotation	(0020,0037)	
Pixel size	(0028,0030)	in mm
Pixel Data	(7FE0,0010)	

9. Support for STD-US as a File Set Creator (FSC)

The ENS acts as a FSC under the STD-US when writing Part 10 image files to the designated file system. ENS writes the SOP Instances unchanged to the designated file system, except for substituting a Heartlab Inc. Meta File Object.

This document was approved by:

Signatures:

1. Suzanne Townsend on 2007/06/07 9:15:00 PM GMT+1

Approval Completion Date: 2007/06/07 9:24:33 PM GMT+1
Document ID/Node ID: 16744284
Source Version: 3
PDF Version: 4

Applied Categories and Attributes: