HCP DICOM *Net*®
DICOM Conformance Statement

Version 4.00.00

32-bit version for Windows NT/2000/XP

Table of Contents

Chapter 1 Introduction

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

1.1 Scope and field of application

The scope of this DICOM Conformance Statement is to facilitate data exchange between the HCP DICOM NET Server and medical equipment of other vendors. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the HCP DICOM NET Server into an environment of medical devices.

This Conformance Statement should be read in conjunction with the DICOM standard and its addenda [DICOM].

1.2 Intended Audience

This Conformance Statement is intended for:

- (Potential) customers,
- System integrators of medical equipment,
- Marketing staff interested in system functionality,
- Software designers implementing DICOM interfaces.

It is assumed that the reader is familiar with the DICOM standard.

1.3 Contents and structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2.

1.4 Used definitions, terms and abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement.
For a description of these, see NEMA PS 3.3 and PS 3.4.
The word SoftLink in this document refers to SoftLink International Pvt. Ltd.

1.5 References

[DICOM] The Digital Imaging and Communications in Medicine (DICOM) standard:
NEMA PS 3.X
National Electrical Manufacturers Association (NEMA) Publication Sales 1300 N. 17th Street, Suite 1847 Rosslyn, Va. 22209, United States of America

1.6 Important note to the reader

This Conformance Statement by itself does not guarantee successful interoperability of HCP DICOM NET Server with all

types of medical equipment from all vendors. The user (or user's agent) should be aware of the following issues:

- **Interoperability**

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into a networked environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of "HCP DCIOM NET Server with all types of medical equipment from all vendors. It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates HCP DICOM NET Server with medical equipment from other vendors.

- **Validation**

SoftLink equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement. When HCP DICOM NET equipment is linked to medical equipment from other vendors, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

- **New versions of the DICOM Standard**

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. SoftLink plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, SoftLink reserves the right to make changes to its products or to discontinue its delivery. The user should ensure that any other medical equipment provider linking to SoftLink equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into SoftLink equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

1.7 General Acronyms and Abbreviations

The following acronyms and abbreviations are used in the document.

- ACC American College of Cardiology
- AE Application Entity
- ACR American College of Radiology
- ANSI American National Standard Institute
- BOT Basic Offset Table
- CD-R CD Recordable
- CD-M CD Medical
- DCR Dynamic Cardio Review
- DICOM Digital Imaging and Communication in Medicine
- DIMSE DICOM Message Service Element
- DIMSE-C DICOM Message Service Element-Composite
- DIMSE-N DICOM Message Service Element-Normalized
- ELE Explicit VR Little Endian
- EBE Explicit VR Big Endian
- FSC File Set Creator
- GUI Graphic User Interface
- HIS Hospital Information System

- HL7 Health Level Seven
- ILE Implicit VR Little Endian
- IOD Information Object Definition
- ISIS Information System - Imaging System
- NEMA National Electrical Manufacturers Association
- PDU Protocol Data Unit
- RIS Radiology Information System
- RWA Real World Activity
- SC Secondary Capture
- SCM Study Component Management
- SCP Service Class Provider
- SCU Service Class User
- SOP Service Object Pair
- TCP/IP Transmission Control Protocol/Internet protocol
- UID Unique Identifier
- WLM Worklist Management

Chapter 2 Implementation model

This document is the DICOM Conformance statement for the SoftLink HCP DICOM NET V4.0.

The HCP DICOM NET is primarily intended for archiving and viewing of X-Ray Angiographic multi-frame, SC, US multi-frame, US single-frame, CT, MR and CR images. Images from the local file system as well as CD media can be reviewed.

All of the DICOM features presented in this document are optional and may not be available on different version of HCP DICOM NET.

The HCP DICOM NET consists of a Server that handles the Storage, Storage Commitment and Query Retrieve of Images and a several Clients that can read and write media.

2.1 Application Data Flow Diagram

The HCP DICOM NET related Implementation Model is shown in Figure1.

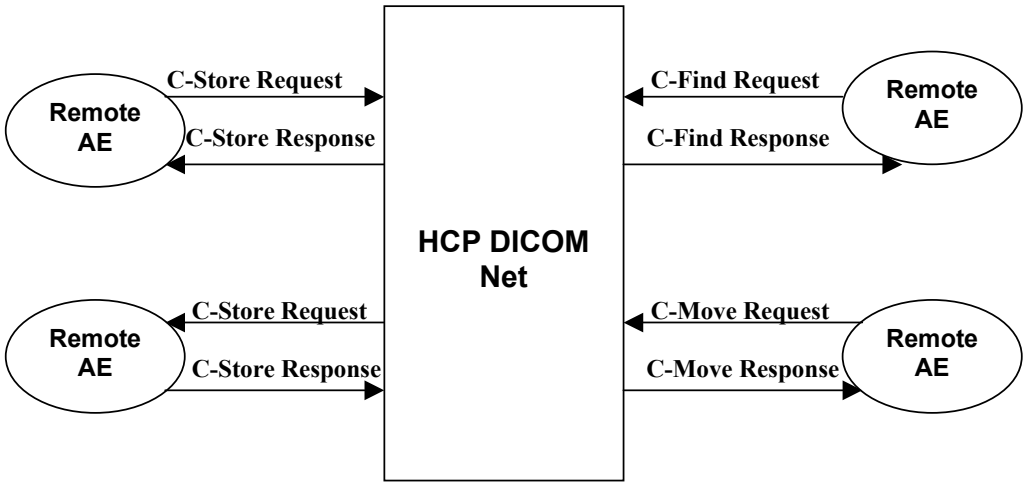

Figure 1: Application data flow diagram

2.2 Functional Definition of Application Entities

2.2.1 Imaging Import Application Entity

A utility program called **HCPDownloader** accepts an association with a remote DICOM AE when the remote system requests image storage using the DICOM Storage service class. Images are stored based on the study information of the Image.

2.2.2 Imaging Export Application Entity

A utility program called **Modality Emulator** can start an association with a remote DICOM AE and request image storage using the DICOM Storage service class. Images are transferred based on the study information of the Image.

2.2.3 Query Retrieval Application Entity

A utility program called **HCPQR** accepts an association with a remote DICOM AE when the remote system queries a Dicom study using the DICOM Query Retrieval service class. As a result of query processing HCPQR can transfer the resultant study to remote using the DICOM Query Retrieval service class.

2.2.4 Storage Commitment Application Entity

The HCP DICOM NET accepts an association with a remote DICOM AE when the remote system requests image Storage Commitment.

2.2.5 Media Application Entity

The Media AE in the HCP DICOM NET clients (viewers) supports the following functions;

- Read the DICOMDIR file that represents the contents of the (image) data as recorded. This information is displayed as an ordered list of icon images together with pertinent identifying information (patient name, etc.).
- Read the selected image from CD-R device and display it on the monitor of the View Station. This information is displayed as an ordered list of frames of the selected image or as a dynamic review of the selected image.
- Initialization of the CD-R Media, writing a DICOM File-set onto the media.
- Creation of images onto a Media.
- Creation of a DICOMDIR file that represents the contents of the (image) data as recorded.

2.3 Sequencing of Real World Activities

All Real-World Activities as specified in Figure 2.1 may occur independently from each other.

Chapter 3 AE Specifications

The Network capabilities of the HCP DICOM NET consists of the following DICOM Application Entities:

- An Imaging Import AE
- An Imaging Export AE
- A Query Retrieval AE

3.1 Association Establishment Policies

3.1.1 General

The HCP DICOM NET always proposes the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1
The maximum length PDU negotiation is included in all association establishment requests. The default maximum length PDU for an association initiated by the HCP DICOM NET is: 16 KB.

3.1.2 Number of Associations

The number of associations for the storage and Query Retrieve SCP service that may be active simultaneously is 4.

3.1.3 Asynchronous nature

DICOM asynchronous mode is not supported meaning that only one transaction may be out-standing over an association at any given point in time.

3.1.4 Implementation identifying information

The Implementation Class UID is: 1.3.46.670589.7.11.1.1
The implementation version name: “HCPDICOMNET”

3.2 HCP DICOM NET Imaging Import AE

3.2.1 AE Specifications

The HCP DICOM NET Imaging Import Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCP specified in Table 3.1.

Table 3-1: Supported SOP Classes as SCP by Import AE and as SCU by Export AE

SOP Class Name	UID
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1
SC Image Storage	1.2.840.10008.5.1.4.1.1.7
US multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
CR image Storage	1.2.840.10008.5.1.4.1.1.1
NM image Storage	1.2.840.10008.5.1.4.1.1.5

3.2.2 Association Acceptance Policy

3.2.2.1 Associated Real World Activity

The **HCPDownloader** is always ready to accept a new transport connection. The **HCPDownloader** will accept the presentation context associated with the Image Storage request and reply with a C-STORE response when the complete image has been received on the established association.

3.2.2.2 Accepted Presentation Context

The following table illustrates the Acceptable presentation contexts for the Image Storage request.

Table 3-2: Accepted Presentation Context by the Import AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
X-RAY Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	ILE ELE JPEG Baseline Coding Process 1 JPEG Lossless First-Order Prediction (Process 14) (Sel. Value 1)	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.70	SCP	None
Secondary Capture Image Storage	1.2.8s40.10008.5.1.4.1.1.7	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
US multi-frame Image Storage	1.2.840.10008.5.1.4.1.3.1	ILE ELE RLE JPEG Baseline Coding Process 1 JPEG Lossless First-Order Prediction (Process 14) (Sel. Value 1)	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.70	SCP	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	ILE ELE RLE JPEG Baseline Coding Process 1 JPEG	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None

		Lossless First-Order Prediction (Process 14) (Sel. Value 1)	**1.2.840.10008.1.2.4.70**		
CT Image Storage	**1.2.840.10008.5.1.4.1.1.2**	**ILE ELE**	**1.2.840.10008.1.2 1.2.840.10008.1.2.1**	**SCP**	**None**
MR Image Storage	**1.2.840.10008.5.1.4.1.1.4**	**ILE ELE**	**1.2.840.10008.1.2 1.2.840.10008.1.2.1**	**SCP**	**None**
CR Image Storage	**1.2.840.10008.5.1.4.1.1.1**	**ILE ELE**	**1.2.840.10008.1.2 1.2.840.10008.1.2.1**	**SCP**	**None**
NM Image Storage	**1.2.840.10008.5.1.4.1.1.5**	**ILE ELE**	**1.2.840.10008.1.2 1.2.840.10008.1.2.1**	**SCP**	**None**

SOP Specific Conformance

The HCPDownloader cannot handle the import of images from different patients in one association.

The HCP DICOM NET conforms to the SOP's of the Storage Service Class at level 2 (full). No data elements are discarded or coerced by the HCP DICOM NET. Private Tags are not processed while converting the imported images for DICOM Storage. The HCP DICOM NET can modify the following Attributes:

Patient Name	0010,0010
Patient Sex	0010,0040
Patient Birthdate	0010,0030
Patient ID	0010,0020
Accession Number	0008,0050

C-Store Status Responses that are returned by the HCP DICOM NET Import AE are:

FAILURE	A800	Illegal SOP Class
FAILURE	A700	Out of Resource
SUCCESS	0000	Success

3.3 HCP DICOM NET Imaging Export AE

3.3.1 AE Specifications

The HCP DICOM NET Imaging Export Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCU specified in Table 3.1.

3.3.2 Association Initiation Policy

3.3.2.1 Associated Real World Activity

The **Modality Emulator** can make a new transport connection. The **Modality Emulator** can propose the presentation context in the association request for Image Storage and expects a

C-STORE response when the complete image has been transferred on the established association.

3.3.2.2 Proposed Presentation Context

The following table illustrates the possible presentation contexts for the Image Storage request.

Table 3-3: Proposed Presentation Context by the Export AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
X-RAY Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	ILE JPEG Baseline Coding Process 1 JPEG Lossless First-Order Prediction (Process 14) (Sel. Value 1)	1.2.840.10008.1.2 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.70	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	ILE	1.2.840.10008.1.2	SCU	None
US multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	ILE RLE JPEG Baseline Coding Process 1 JPEG Lossless First-Order Prediction (Process 14) (Sel. Value 1)	1.2.840.10008.1.2 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.70	SCU	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	ILE RLE JPEG Baseline Coding Process 1 JPEG Lossless First-Order Prediction (Process 14) (Sel. Value 1)	1.2.840.10008.1.2 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.70	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	ILE	1.2.840.10008.1.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	ILE	1.2.840.10008.1.2	SCU	None
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	ILE	1.2.840.10008.1.2	SCU	None

3.4 HCP DICOM NET Query Retrieval AE

3.4.1 AE Specifications

The HCP DICOM NET Query Retrieval Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCP specified in Table 3.2.

Table 3-4: Supported SOP Classes as SCP by the Query Retrieval AE

SOP Class Name	UID
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4. 1.2.1.1
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4. 1.2.1.2

3.4.2 Association Acceptance Policy

3.4.2.1 Associated Real World Activity

The **HCPQR** is always ready to accept a new transport connection. Remote AE can make a Query to **HCPQR** for a dicom study using C-FIND request on the established association to which **HCPQR** will respond with appropriate C-FIND response. Remote AE can retrieve a particular study by initiating C-MOVE request to **HCPQR** on an established association. As a part of handling this C-MOVE request **HCPQR** will start a new association with the **Destination AE** whose title was proposed in the C-MOVE request. **HCPQR** will act as a SCU for image storage and **Destination AE** will act as corresponding SCP for image storage. On completion of image transfer the respective association initiators will release both the associations. Destination AE should have been configured in HCP DICOM NET Server.

3.4.2.2 Accepted Presentation Context

The following table illustrates the acceptable presentation contexts for the Image Query Retrieval request.

Table 3-4: Proposed Presentation Context by the Query Retrieval AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

3.4.3 SOP Specific Conformance

3.4.3.1 Patient Root Query/Retrieve Information Model - FIND

Following table lists key attributes that can be part of C-FIND Request.

Table 3-5: Attributes supported for Patient Root C-FIND

Query Level	Attribute Tag	Attribute Description
PATIENT	(0010,0010)	Patient Name
PATIENT	(0010,0020)	Patient ID
STUDY	(0008,0020)	Study Date
STUDY	(0020,000D)	StudyInstanceUID

3.4.3.2 Patient Root Query/Retrieve Information Model - MOVE

Following table lists key attributes that can be part of C-Move Request.

Table 3-5: Attributes supported for Patient Root C-MOVE

Query Level	Attribute Tag	Attribute Description
PATIENT	(0010,0010)	Patient Name
PATIENT	(0010,0020)	Patient ID
STUDY	(0008,0020)	Study Date
STUDY	(0020,000D)	StudyInstanceUID

3.5 HCP DICOM NET AE Media Specifications

The HCP DICOM NET AE provides Standard Conformance to the DICOM Media Storage Service and File Format (PS 3.10) and the Media Storage Application Profiles (PS 3.11).

The supported Application Profiles, their Roles and the Service Class (SC) options, all defined in DICOM terminology, are listed in Table 3-20.

Table 3-20: Supported Application Profiles

Application Profile	Identifier	Real World Activity	Role	SC Option
Basic Cardiac X-RAY Angiographic Studies on CD-R media	STD-XABC-CD	Write images(s) on CD-R disk	FSC	Interchange
	STD-XABC-CD	Read image (s) from CD-R disk	FSR	Interchange

3.5.1 AE Specification: DICOM Recording

3.5.1.1 Application Entity Title

The Application Entity title is registered into the DICOM File Meta Information header and is supported by the CD-writer (CD write option) acting as a FSC.

Application Entity Title: "HCPDNPRO_FSU"

3.5.1.2 RWA Transfer of an Examination

The SOP instances as provided by the RWA are written to the CD-R media and a corresponding DICOMDIR is created.

3.5.1.3 Application Profile(s) for this RWA

Refer to Table 3-20 for the list of Application Profiles that invoke this AE.

3.5.1.4 DICOMDIR Keys

In the DICOMDIR file a Basic Directory IOD is present, containing Directory records at the patient, study, series and image level.

3.5.2 AE Specification: DICOM Reading

3.5.2.1 Application Entity Title

Not applicable.

3.5.2.2 RWA Review and Analysis of Examination

The "DICOM Reader" AE will act as a FSR using the Interchange option when reading the directory of the medium and when reading the requested images.

Reading images send to the HCP DICOM NET and viewed on the viewer will only be properly displayed for XA: 512*512, 512*1024, 1024*512 and 1024*1024 8 bits uncompressed or lossless JPEG. For SC: 512*512, 512*1024, 1024*512 and 1024*1024 8 bits and 1280*1024 8 bit (uncompressed). For US uncompressed as well as data encoded in RLE Lossless as weill as lossy JPEG is supported

3.5.2.3 Application Profile(s) for this RWA

Refer to Table 3-20 for the list of Application Profiles that invoke this AE.

Chapter 4 Communication Profiles

4.1 Supported Communication Stacks

TCP/IP is the only protocol stack supported.

4.2 TCP/IP Stack

The TCP/IP stack as supported by the underlying Operating System.

4.3 API

The API is the WinSock 2 interface as supported by the underlying Operating System.

4.3.1 Physical Media Support

Supported physical medium include:

- IEEE 802.3-1995 (Fast Ethernet) 100BASE-TX.
- IEEE 802.3-1995 10BASE-TX

Chapter 5 Extensions/Specialization/ Privatization

The viewer can write complete studies to one or more CDs depending on the study size. Further more one viewer can review and upload:

- Multi CD study’s

Chapter 6 Configuration

6.1 AE Title / Presentation Address mapping

The Network and Media AE title as well as the IP Address and the TCP listen port associated with this AE are configurable.

Chapter 7 Support of Extended Character Set

The HCP DICOM NET supports Extended Character Set “ISO_IR 100” which is the Latin alphabet No 1, supplementary set.