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ACOM.CONVERT DICOM Conformance Statement

This document is a **preliminary** DICOM Conformance Statement and is based on the specification of the medical system under development. Consequently this Conformance Statement **may be adjusted** due to further development of the system.

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0 Preface

The intent of any DICOM conformance statement is to provide a knowledgeable user with the information required to determine whether and to what extent independent DICOM implementations may be able to inter-operate. However, the information contained in a DICOM conformance statement is not sufficient to ensure independent implementations will, in fact, be able to inter-operate.

The user or system integrator must be aware of the following potential issues related to inter-operation:

- Using only the information provided by this Conformance Statement does not guarantee interoperability of Siemens equipment with non-Siemens equipment. It is the user's (or system integrator's) responsibility to analyze thoroughly the application requirements and objectives to determine if they can be met by the connection of Siemens equipment to non-Siemens equipment.
- Siemens equipment has been tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance statement. It is the responsibility of the user (or system integrator) to specify and carry out additional validation testing, which covers a broad spectrum of potential interactions between the independent implementations.
- Siemens reserves the right to make changes to its products or to discontinue their delivery. Therefore, the user (or system integrator) should ensure that any future versions of Siemens or non-Siemens equipment are regression tested to verify that new software releases have not adversely impacted the ability to inter-operate.

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1 Media Storage Conformance Statement

1.1 Introduction

The application described in this conformance statement (*Cardio Recording Station*) provides standard DICOM interchange on CD-R to support the cine replacement standard. It also provides an implementation of a powerful Viewing Station for DICOM and other medical image data.

The application is designed to write previously acquired image sequences as X-Ray Angiographic (XA) IOD's as defined in the DICOM standard to CD-R exchange media and read different IODs such as e.g. CT, MR and X-ray Angiographic defined in the DICOM standard.

The implementation claims DICOM Media Interchange conformance in accordance to the NEMA standard PS3.2.

1.2 Implementation Model

The Cardio Recording Station (CRS) Media Creator generates a DICOM File Set of X-Ray Angiographic (XA) DICOM SOP instances and write this File Set to 120mm Compact Disc Recordable (CD-R) according to the specified Application Profiles.

The Cardio Recording Station (CRS) Image Reader reads a variety of DICOM SOP instances from several media like 120mm Compact Disc Recordable (CD-R), PC File Systems and 144MB Diskettes according to the specified Application Profiles.

1.2.1 Application Data Flow Diagram

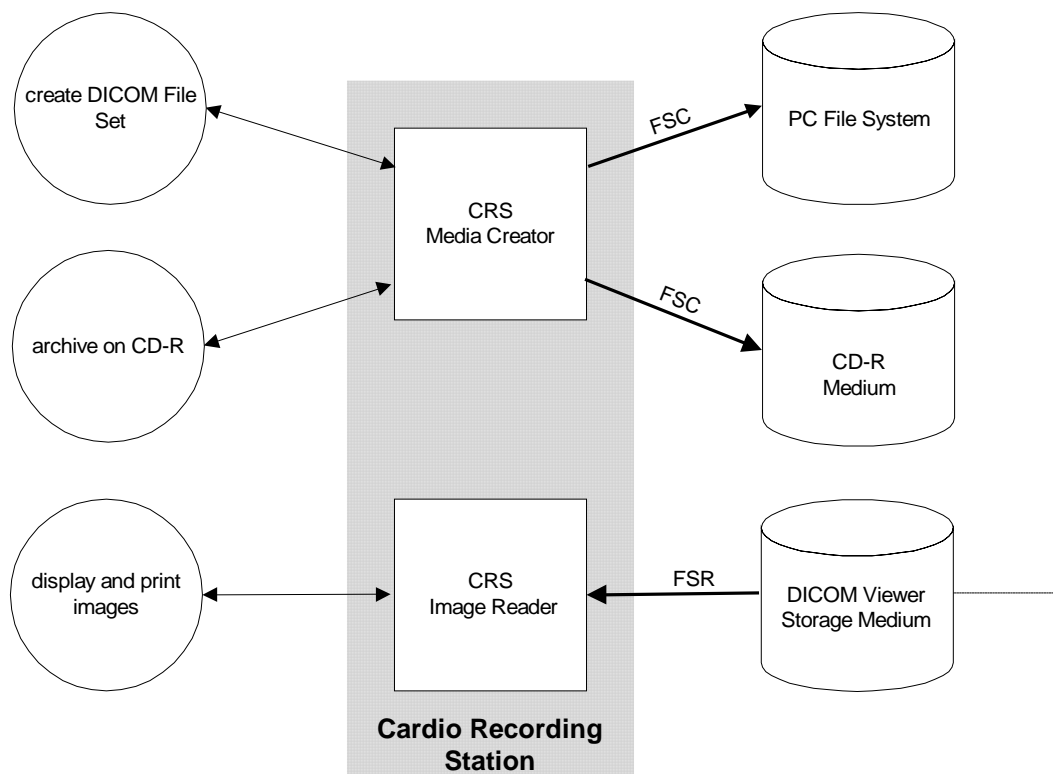
The Cardio Recording Station Media Storage application can be represented by two different Application Entities.

The CRS Media Creator describes the creation of a DICOM file set and automatically writing this file set to a blank CD-R media.

The CRS Image Reader describes a reading process. Initiated by the operator, the DVS Image Reader can read a variety of SOP Instances stored on one of several different media types for the purpose of viewing, image processing and printing.

Figure 1.2.1 shows the Application Data Flow Diagram.

Figure 1.2.1: the Application Data Flow Diagram



1.2.2 Functional definitions of Application Entities

1.2.2.1 CRS Media Creator

The AE "CRS Media Creator" supports the following functions:

- Creation of a DICOM File Set.
- Write DICOM File Set to CD-R.

1.2.2.2 CRS Image Reader

The AE "CRS Image Reader" supports the following functions:

- Read the DicomDIR file that represents the contents of the data as recorded. This information can be displayed as a set of icons annotated or not annotated by identifying information such as patient name, etc. or as a table listing the identifying information.
- Read a selected SOP Instance from several different devices for the purpose of displaying, image processing and printing.

1.2.3 Sequencing of Real World Activities

1.2.3.1 CRS Media Creator

All processes from the CRS Media Creator are initiated automatically :

Display directory:

After inserting a CD-R disc whose data conform to one of the supported application profiles the operator has to press a button to view the contents of the DICOMDIR file.

Create DICOM File Set

After the acquisition of the image sequences of one patient, the recorded XA sequences are stored on a PC File System.

Archive on CD-R

After inserting a blank CD-R the DICOM File set is written to the CD-R.

1.2.3.2 CRS Image Reader

All process from the CRS Image Reader are initiated by the operator :

Display directory:

After inserting a CD-R disc whose data conform to one of the supported application profiles the operator has to press a button to view the contents of the DICOMDIR file.

Display and process images

The operator has to select a SOP instance from one of the supported media types or select an image from the contents of the DICOMDIR file to view and process images.

Print images

After selecting a SOP instance for display the operator has to press a button to print the selected image on a standard paper printer.

1.2.4 File Meta Information

The CRS provides the following File Meta Information :

- File Meta Information Version is set to 1
- ImplementationClassUID is set to "1.2.276.0.19.1996.1"
- ImplementationVersionName is set to "4.31 "
- SourceApplicationEntityTitle is set to "MEDImage"

1.3 Application Entity Specifications

1.3.1 AE Specification: CRS Media Creator

The CRS Media Creator provides standard conformance to DICOM Interchange Option of the Media Storage Service Class (PS 3.4). The Application Profiles, roles and options are listed in Table 1.3.1.

Table 1. 3.1: Application Profiles, Activities and Roles of the CRS Media Creator

Application Profiles Supported	Real World Activity	Role	SC Option
STD-XABC-CD	Archive on CDR	FSC	Interchange
PRI-GEN-FILE	Create DICOM File Set	FSC	Interchange

1.3.1.1 Real-World Activities

1.3.1.1.1 Archive on CD-R

The CRS Media Creator will act as a FSC using Interchange Option when writing a DICOM File Set to a CD-R.

1.3.1.1.2 Create DICOM File Set

The CRS Media Creator will act as a FSC using Interchange Option when writing a DICOM File Set to a PC File System.

1.3.1.2 Application Profile

Refer to Table 1.3.1 for identifying and chapter 1.4 for the definition of the Application Profiles that invoke this AE.

1.3.2 AE Specification: CRS Image Reader

The CRS Image Reader provides standard conformance to DICOM Interchange Option of the Media Storage Service Class (PS 3.4). The Application Profiles, roles and options are listed in Table 1.3.2.

The supported SOP Classes for the STD_GEN_CD Profile are the same as for the Private PRI_READ_FILE Profile, and are listed in Table 1.4.4.

Table 1. 3.2: Application Profiles, Activities and Roles of the CRS Image Reader

Application Profiles Supported	Real World Activity	Role	SC Option
STD-XABC-CD	Display Directory Display and process Images	FSR	Interchange
STD-GEN-CD	Display Directory Display and Print Images	FSR	Interchange
PRI-READ-FILE	Display and Print Images	FSR	Interchange

1.3.2.1 Real-World Activities

1.3.2.1.1 Display Directory

The CRS Image Reader will act as a FSR using Interchange Option when reading the DICOMDIR file of the medium.

1.3.2.1.2 Display and Process Images

The CVS Image Reader will act as a FSR using Interchange Option when reading the requested images.

1.3.2.2 Application Profile

Refer to Table 1.3.2 for identifying and chapter 1.4 for the definition of the Application Profiles that invoke this AE.

1.4 Private Application Profiles

1.4.1 Private Application Profile: CRS Media Creator

1.4.1.1 Class and Profile Identification

This chapter defines an Application Profile Class for the VEPRO Cardio Recording Station and several Application Profiles defined within this class. The only difference between these profiles is the choice of media, supported by CRS. Table 1.4.1 lists the defined Application Profiles and its identifiers.

Table 1.4.1: Application Profiles defined within this Application Profile Class

Application Profiles Supported	Identifier	Description
General Purpose Image Interchange for PC File	PRI-GEN-FILE	writes XA DICOM SOP instances to PC File System

1.4.1.2 Clinical Context

This class of Application Profiles provides a multimedia data interchange facility for a wide area of different clinical environments.

1.4.1.2.1 Roles and Service Class Options

All Application Profiles defined within this Application Profile Class use the Media Storage Service Class defined in PS3.4 with the Interchange Option. The CRS Media Creator acts as a File Set Creator (FSC) as defined in PS 3.10.

1.4.1.3 General Class Profile

This section defines common characteristics of all Application Profiles defined within this Application Profile Class.

1.4.1.4 SOP Classes and Transfer Syntax's

Table 1.4.2 lists the SOP Classes and corresponding Transfer Syntax's common for all Application Profiles in this class. Table 1.3.1 lists the corresponding roles and options.

Table 1.4.2: SOP Classes and Transfer Syntax's

SOP Class	SOP Class UID	Transfer Syntax Definition	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Xray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
		Lossy JPEG Explicit VR Little Endian	1.2.840.10008.1.50
		Lossless JPEG Explicit VR Little Endian	1.2.840.10008.1.70

1.4.1.5 Physical Medium and Media Format

There are no common physical media to all defined Application Profiles.

1.4.1.6 Directory Information in DICOMDIR

There are no additional to the Directory IOD.

1.4.1.7 Specific Application Profiles

This section describes the different media supported by the CRS Media Creator as specific characteristics to the different Application Profiles.

1.4.1.7.1 PRI-GEN-FILE Profile

This Application Profile is private in the sense of PS 3.2. The only specific characteristic to the defined Application Profile Class is the support for PC File Systems as specified in PS 3.12.

1.4.2 Private Application Profile: CRS Image Reader

1.4.2.1 Class and Profile Identification

This chapter defines an Application Profile Class for the CRS Image Reader and several Application Profiles defined within this class. The only difference between these profiles is the choice of media, supported by CRS. Table 1.4.3 lists the defined Application Profiles and its identifiers.

Table 1.4.3: Application Profiles defined within this Application Profile Class

Application Profiles Supported	Identifier	Description
General Purpose Image Interchange for PC File	PRI-READ-FILE	Reads a variety of DICOM SOP instances from PC File System

1.4.2.2 Clinical Context

This class of Application Profiles provides a multimedia data interchange facility for a wide area of different clinical environments. Furthermore, several different modalities such as e.g. CT, MR and XA supported by the application, enhance it to a multi-modality-system.

1.4.2.2.1 Roles and Service Class Options

All Application Profiles defined within this Application Profile Class use the Media Storage Service Class defined in PS3.4 with the Interchange Option. The CRS Image Reader act as a File Set Reader (FSR) as defined in PS 3.10.

1.4.2.3 General Class Profile

This section defines common characteristics of all Application Profiles defined within this Application Profile Class.

1.4.2.3.1 SOP Classes and Transfer Syntax's

Table 1.4.4 lists the SOP Classes and corresponding Transfer Syntax's common for all Application Profiles in this class. Table 1.3.2 lists the corresponding roles and options.

Table 1.4.4: SOP Classes and Transfer Syntax's

SOP Class	SOP Class UID	Transfer Syntax Definition	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
		RLE Compressed	1.2.840.10008.1.2.5
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
		RLE Compressed	1.2.840.10008.1.2.5
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
		RLE Compressed	1.2.840.10008.1.2.5
Xray angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		Explicit VR Big Endian	1.2.840.10008.1.2.2
		Lossy JPEG Explicit VR Little Endian	1.2.840.10008.1.50
		Lossless JPEG Explicit VR Little Endian	1.2.840.10008.1.70

1.4.2.4 Physical Medium and Media Format

There are no common physical media to all defined Application Profiles.

1.4.2.5 Directory Information in DICOMDIR

There are no additional to the Directory IOD.

1.4.3 Specific Application Profiles

This section describes the different media supported by the CRS Image Reader as specific characteristics to the different Application Profiles.

1.4.3.1 PRI-READ-FILE Profile

This Application Profile is private in the sense of PS 3.2. The only specific characteristic to the defined Application Profile Class is the support for PC File Systems as specified in PS 3.12.

2 Network Conformance Statement

2.1 Introduction

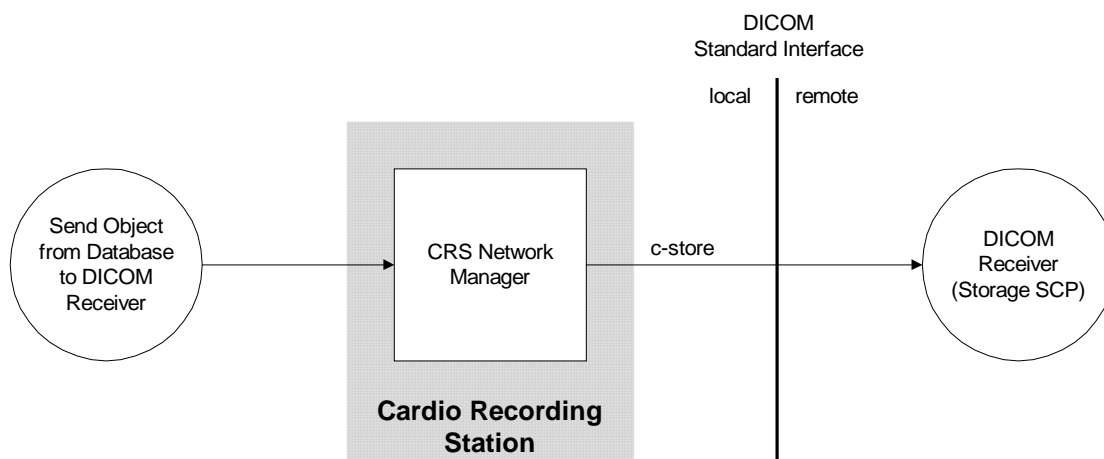
The application described in this conformance statement (*Cardio Recording Station*) allows the transfer of images between this application and other DICOM Application Entities (AEs). This application acts as a service class user (SCU) for both Storage Service Class and Verification Service Class.

2.2 Implementation Model

The Cardio Recording Station originates associations for Storage of DICOM Composite Information Objects in remote Application Entities.

2.2.1 Application Data Flow Diagram

The Cardio Recording Station (CRS) Network Manager initiates associations for DICOM Storage Service Class to remote AEs. For each image that should be sent, the image is read, converted to a DICOM Information Object (DIO), a new association to the remote DICOM AE is initiated and then the DIO is sent. After sending the association is closed.



2.2.2 Functional definitions of Application Entities

CRS Network Manager automatically sends all acquired images to a specific remote AE. Upon such a request, it initiates an association with the remote AE and transfers the data.

2.2.3 Real World Activities

2.2.3.1 Send Object

If configured by the operator, each acquired image object is sent automatically to a specific remote AE.

2.3 Application Entity Specifications

2.3.1 AE Specification: CRS Network Manager

The Cardio Recording Station Network Manager provides standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 2.3.1: SOP Classes as an SCU

SOP CLASS NAME	SOP CLASS UID
Verification	1.2.840.10008.1.1
Xray Angiographic Image Storage	1.2.840.10008. 5.1.4.1.1.12.1

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The Application Entity Title, the port number and the TCP/IP address are defined in the configuration file of the CRS for every remote Application Entity.

2.3.1.1.2 Number of Associations

CRS initiates only one association at a time.

2.3.1.1.3 Asynchronous Nature

This version of the Cardio Recording Station does not support asynchronous communication.

2.3.1.1.4 Implementation Identifying Information

The CRS provides the following Implementation Identifying Information :

- Default AE Title is set to “VTSERVER”
- ImplementationClassUID is set to “1.2.276.0.19.1996.1”
- ImplementationVersionName is set to “4.31 “
- SourceApplicationEntityTitle is set to “MEDImage”

2.3.1.2 Real-World Activity - Send Echo

The associated Real-World activity is a C-Echo request initiated by CRS. The user has to modify the CRS configuration files for testing the connection to a remote host.

2.3.1.2.1 Proposed Presentation Context

The CRS will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	none

2.3.1.2.2 SOP Specific Conformance to the Verification SOP Class

The CRS provides standard conformance to the DICOM Verification Service Class.

2.3.1.3 Real-World Activity - Send Image to a Remote Node

The associated Real-World activity is a C-Store request initiated by CRS Network Manager when a new image was acquired. CRS Network manager reads the image, converts it if necessary, initiates an association, sends it to the remote host, closes the association and deletes the sent image.

If the C-Store Response from the remote Application contains a status other than Success, the association is aborted. After a configurable time period, the transfer is started again. This happens until the C-Store succeeds or an configurable number of tries are reached. Then the image is moved to a 'bad' folder and a comment is written to a log file.

2.3.1.3.1 Proposed Presentation Context

The CRS Network Manager will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Xray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	none
Xray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Lossless JPEG Explicit VR Little Endian	1.2.840.10008.1.70	SCU	none

2.3.1.3.2 SOP Specific Conformance to the Storage SOP Classes

The CRS provides standard conformance to the DICOM IOD definitions (Standard IOD). No private elements are used.

2.4 Communication Profiles

2.4.1 Supported Communication Stacks

The CRS provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

2.4.1.1 OSI Stack

Not yet supported.

2.4.1.2 TCP/IP Stack

The CRS uses the TCP/IP Stack from MS Windows (WSock32.DLL).

2.4.1.3 API

The CRS uses the WSock32.DLL.

2.4.1.4 Physical Media Support

The CRS is independent of the physical medium over which TCP/IP executes. This feature is inherent in the MS Windows operating system.

2.4.1.5 Point-to-Point Stack

Not supported.

2.5 Extensions / Specializations / Privatizations

Not applicable.

2.6 Configuration

2.6.1 AE Title / Presentation Address Mapping

The CRS maps Application Entity Titles to TCP/IP address and port number via an internal configuration method.

2.6.2 Configurable Parameters

The following Parameters can be configured in the configuration files of the CRS :

- CRS AE Title
- Remote AE Title
- Remote TCP/IP Address
- TCP/IP Port Number
- C-STORE Retry Count and Interval

2.7 Support of Extended Character Set

The CRS supports display of characters using the Latin alphabet No. 1 supplementary set ISO-IR 100. Characters are displayed using this character set without regard to the value selected in the Specific Character Set attribute.

3 Appendix

3.1 Requirements for the Image-Pixel-Modules

- **Photometric Interpretation** (0x0028/0x0004) must be one of: “MONOCHROM1“, “MONOCHROM2“, “PALETTE COLOR“ or “RGB“.
- **Planar Configuration** (0x0028/0x0006) must be ‘0000’.
- **Bits Allocated** (0x0028/0x0100) must be ‘8’ or ‘16’.
- **Bits Stored** (0x0028/0x0101) must be between ‘0’ and ‘16’. If Bits Stored is greater than ‘8’, than the image-values will be resized to 8 bit per sample. If a window is specified, than the window is used. If it is not specified, than the maximum and minimum is used.