KODAK^{TM} 1000 Distributed Medical Image Servers

DICOM Conformance Statement

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Revision -

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Approvals:

Functional Group	Printed Name	Signature	Date
Author/Owner	Felix Laura		
Software Engineering Technical Lead			
Quality Engineering	Tim Tinker		
DICOM V&V Engineer	Wayne Tyler III		

Revision History

Date	Rev	Editor	Comments
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9/28/1998	1.1	Vincent Arrigali	Reworked Conformance to handle removal of Generic DICOM functionality in version 1.0
3/17/1999	2.0	Felix Laura	Modified to reflect changes in the 2.0 feature set.

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0 INTRODUCTION

0.1 Scope and Field of Application

This document is the DICOM Conformance Statement for the *Kodak*^{TM} 1000 Distributed Medical Image Server product line of Eastman Kodak Company. The purpose of this document is to describe how the *Kodak*^{TM} Image Server application collaborates in a DICOM network with other Medical Imaging applications that conform to the DICOM 3.0 standard.

0.2 Important Considerations for the Reader

This DICOM Conformance Statement by itself is not sufficient to guarantee successful connectivity between the *Kodak*^{TM} 1000 Distributed Medical Image Server and equipment from other vendors. The following considerations should be made:

- The integration of equipment from different vendors (including Kodak) goes beyond the scope of the DICOM 3.0 standard and the DICOM Conformance Statements from Kodak and other vendors. It is the responsibility of the user (or user's agent) to assess the application requirements and to design a solution that integrates Kodak equipment with equipment from other vendors.
- When the comparison of this DICOM Conformance Statement with a DICOM Conformance Statement from another vendor indicates that connectivity should be possible, it is the responsibility of the user (or user's agent) to verify this by carrying out validation tests and to check whether all required functionality (such as cutlines) is met.
- With regard to the future evolution of the DICOM 3.0 standard Eastman Kodak Company reserves the right to make changes to the *Kodak*^{TM} 1000 Distributed Medical Image Server architecture described in this document. The user (or user's agent) should ensure that any equipment connected via DICOM to Kodak equipment also follows the future evolution of the DICOM 3.0 standard. Failure to do so may result in (partial) loss of connectivity.

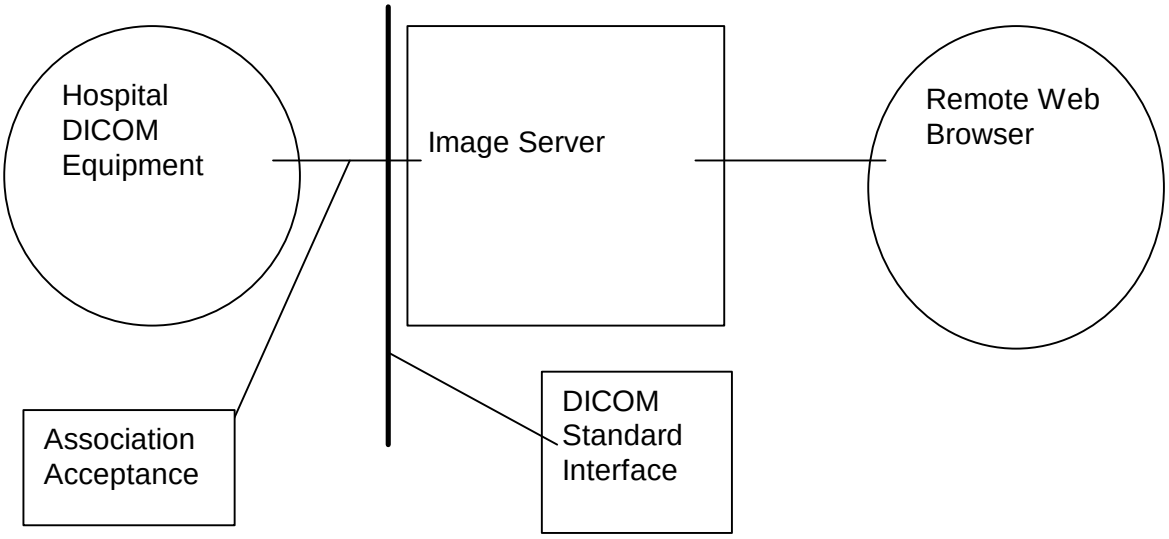
1 Definitions, Acronyms, Abbreviations

ACR-NEMA	American College of Radiology - National Electrical Manufacturers Association.
AE	Application Entity
ANSI	American National Standards Institute
CR	Computed Radiography
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element-Composite
DIMSE-N	DICOM Message Service Element-Normalized
HIS	Hospital Information System
IOD	Information Object Definition
KESPR	*Kodak*^{TM} *Ektascan* Storage Phosphor Reader
LUT	Look-up Table
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
PACS	Picture Archive and Communication System
PDU	Protocol Data Unit
QCW	Quality Control Workstation for *Kodak Digital Science*^{TM} Computed Radiography System 400
RIS	Radiology Information System
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair

2 IMPLEMENTATION MODEL

2.1 Application Data Flow Diagram

The Image Server product acts as a translator between hospital radiology equipment that store image information using the DICOM standard and the internet browsers that display data using the HTML standard. To accomplish this translation the Image Server provides a DICOM storage class provider interface that accepts images from hospital devices. The Image Server then provides the HTML web browsers access to that information.



2.2 Functional Definitions

The Image Server supports DICOM devices by providing a storage class provider. The Image Server waits for a request for an association. Upon arrival of an association request the SCP negotiates the presentation context. After successful association, the Image Server SCP will accept store requests, and transfer the DICOM image data to local disk. At the end of the transfer the Image Server will return a result indicating the success or failure of the store request.

3 AE Specification

3.1 Image Server AE

This Application Entity provides conformance to the following DICOM V3.0 SOP Classes:

SOP Class Name	SOP Class UID	Role
Verification	1.2.840.10008.1.1	SCP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCP
Ultrasound Image Storage – RETIRED*	1.2.840.10008.5.1.4.1.1.6	SCP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	SCP
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	SCP

*Note: The use of these SOP classes is deprecated and support for them will be dropped in a future release.

3.1.1 Association Establishment Policies

3.1.1.1 General

The Image Server AE runs as a service process, listening on a configurable TCP port (normally 1604). The AE will always propose a single, configurable maximum PDU size (normally 2048 bytes). The AE will accept any proposed maximum PDU size between a configurable minimum and maximum (normally 512 and 262,144 bytes).

3.1.1.2 Number of Associations

The number of simultaneous associations that the Image Server AE can handle is limited only by the system resources of the underlying operating system and defaults to 10.

3.1.1.3 Asynchronous Nature

The Image Server AE does not perform asynchronous operations window negotiations.

3.1.1.4 Implementation Identifying Information

The Image Server AE will provide an Implementation Class UID of “1.2.840.113564.10.1”.

3.1.2 Association Initiation by Real-World Activity

3.1.2.1 Communication Channel Verification

3.1.2.1.1 Associated Real-World Activity

The Image Server AE will not attempt a C-ECHO DIMSE-C service to any application entities. However, the Image Server AE will respond appropriately to echo requests presented by other modalities.

3.1.2.1.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax			Extended
Name	UID	Name List	UID List	Role	Negotiation
Verification Service Class	1.2.840.10008.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

3.1.2.1.2.1 SOP Specific Conformance Statement for Verification SOP Class
The Image Server AE meets the requirements of the Verification Service Class as defined in Annex A of PS 3.4.

3.1.2.2 New Examination

3.1.2.2.1 Associated Real-World Activity
The Image Server does not route DICOM images to other devices, and as such will not generate any New Examination requests over DICOM.

3.1.3 Association Acceptance Policy
If an external DICOM AE requests an association with Image Server AE but indicates an incorrect called AE title, the Image Server AE will accept the association.

3.1.3.1 Communications Channel Verification

3.1.3.1.1 Associated Real-World Activity
This activity is initiated by an external DICOM Application Entity wishing to verify the existence of a DICOM communications channel.

3.1.3.1.2 Presentation Context Table

Presentation Context Table					
Abstract Syntax		Transfer Syntax			Extended
Name	UID	Name List	UID List	Role	Negotiation
Verification Service Class	1.2.840.10008.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		

3.1.3.1.2.1 SOP Specific Conformance for Verification Service Class
The Image Server AE meets the requirements of the Verification Service Class as defined in Annex A of PS 3.4.

3.1.3.1.3 Presentation Context Acceptance Criterion
The Image Server AE will only accept presentation contexts from those DICOM application entities for which it has been configured to do so. If the Image Server AE is configured to store original images only, or original and compressed, the Image Server AE will not accept the JPEG contexts. This is required, because the Image Server could not get the original image data if the source only transferred the JPEG.

3.1.3.1.4 Transfer Syntax Selection Policies
The Image Server AE will choose a transfer syntax from the ordered list presented in the table in section 2.1.3.1.2.

3.1.3.2 New Examination

3.1.3.2.1 Associated Real-World Activity

This activity is initiated by an imaging modality desiring to store newly acquired exam imagery.

3.1.3.2.2 Presentation Context Table

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		
Ultrasound Image Storage - RETIRED	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		

		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	None
		DICOM Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		JPEG Baseline Transfer Syntax	1.2.840.10008.1.2.4.50		
		JPEG Extended Transfer Syntax	1.2.840.10008.1.2.4.51		

3.1.3.2.2.1 General Conformance for Image Storage Service Class

Image Server AE acts as a Level 2 SCP. In some configurations the image data may be stored in a compressed format.

This version of the Image Server currently does not generate new instance UIDs when it internally compresses an image using JPEG Lossy Compression. Site administrators should take this into consideration when choosing to employ lossy compression.

3.1.3.2.3 Presentation Context Acceptance Criterion

The Image Server AE will accept all presentation contexts, which negotiate a supported transfer syntax.

3.1.3.2.4 Transfer Syntax Selection Policies

The Image Server AE will choose a transfer syntax from the ordered list presented in the table in section 3.1.3.2.2.

3.1.3.3 Query

3.1.3.3.1 Associated Real-World Activity

This activity is initiated by an external DICOM Application Entity wishing to query the Image Server AE for DICOM information objects. The Image Server does not accept DICOM queries in this release.

3.1.3.4 Request Image(s)

3.1.3.4.1 Associated Real-World Activity

This activity is initiated by an external DICOM Application Entity wishing to move DICOM information objects from the Image Server AE to another DICOM AE. The Image Server does not accept move requests in this release.

4 Communication Profiles

4.1 Supported Communication Stacks

4.2 OSI Stack

4.2.1 Physical Media Support

This implementation supports any physical media that the underlying hardware (*Microsoft*^{TM} Windows NT) supports, provided there exists a TCP/IP stack implementation for the physical media.

4.3 TCP/IP Stack

4.3.1 API

While not strictly applicable because this implementation is a software package not intended to be integrated into different environments, this implementation uses the *Microsoft*^{TM} Windows Winsock libraries.

4.4 Point-to-Point Stack

This implementation supports the Point-to-Point protocol that emulates a TCP/IP stack and provides connectivity over a serial port to a modem as well as *Microsoft*^{TM} Windows RAS connections.

5 Extensions/Specializations/Privatizations

5.1.1 Standard Extended/Specialized/Private SOPs

When storing images in compressed DICOM part 10 format all the specifications of the standard section C.7.6.1.1.5 are implemented with the exception of changing the SOP instance UID. The SOP instance UID remains the same as in the original image.

5.1.2 General Image IOD

The General Image IOD is extended with the following data elements. These elements are encoded as specified in Section 7.8 of PS 3.5. The Implementor Identification is encoded as “Kodak Image Server”.

5.1.2.1 Image Quality

Tag	Name	VR	VM
(0029,xx00)	Image Quality	US	1

This data element is a value between 1 and 100 indicating the Q factor used to during jpeg compression when the DICOM file is stored in compressed format. If the image data is expanded at a later time, this value will remain in the file so that the amount of loss associated with the pixel data can be determined.

5.2 Private Transfer Syntaxes

Image Server AE neither proposes nor accepts any private transfer syntaxes.

6 Configuration

6.1 AE Title/Presentation Address Mapping

AE Title/Presentation Address mapping is accomplished through a table lookup mechanism that returns one presentation address when given an AE Title. It is permitted for different AE Titles to map to the same presentation address.

6.2 Configurable Parameters

The following parameters are configurable:

- TCP listening port number
- Application Entity Title

7 Support of Extended Character Sets

The Image Server AE supports all character sets specified in Section C.12.1.1.2 of PS3.3.