Electronic Medical Record

DICOM Conformance Statement

Conformance Statement Overview

This document describes the conformance of MDoffice EMR (part of the MDoffice Application Suite) covering versions 10.3.15.05.03 and later with the DICOM standards through MDoffice DICOM Server version 1.0 integration platform. The DICOM Server, implemented as an SCP (Service Class Provider) to provide relevant services (refer to page 5. Network Services) to any compatible SCU (Service Class User).

Transfer Syntax

Full support is provided for all commonly used transfer syntaxes, for both off-line and network use.

Transfer Syntax	UID
Implicit VR Little-endian	1.2.840.10008.1.2
Explicit VR Little and Big-endian	1.2.840.10008.1.2.1/2
Lossless JPEG	1.2.840.10008.1.2.4.57/70
Lossless JPEG	1.2.840.10008.1.2.4.80/81
JPEG 2000	1.2.840.10008.1.2.4.90/91
Extended 8 & 12 bit JPEG	1.2.840.10008.1.2.4.51
Run-Length-Encoding	1.2.840.10008.1.2.5

Network Services

Full support for the following network services as Service Class Provider (SCP):

SOP Classes		Service Class Provider	Service Class User
Name	UID		
QUERY/RETRIEVE			
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	YES	NO
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	YES	NO
Patient Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.1.3	YES	NO
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	YES	NO
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	YES	NO
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	YES	NO
TRANSFER			
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	YES	NO
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	YES	NO
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	YES	NO
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	YES	NO
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	YES	NO
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	YES	NO
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	YES	NO
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	YES	NO
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	YES	NO
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	YES	NO
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	YES	NO
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	YES	NO
X-Ray Angiographic BiPlane Image Storage	1.2.840.10008.5.1.4.1.1.12.3	YES	NO
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	YES	NO
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	YES	NO

SOP Classes		Service Class Provider	Service Class User
Name	UID		
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	YES	NO
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	YES	NO
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	YES	NO
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	YES	NO
DX Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1	YES	NO
DX Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	YES	NO
DX Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	YES	NO
DX Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	YES	NO
DX Intra-Oral Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	YES	NO
DX Intra-Oral Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1		
WORKFLOW MANAGEMENT			
Modality Worklist	1.2.840.10008.5.1.4.31	YES	NO
OTHERS			
Verification Service	1.2.840.10008.1.1	YES	NO

Contents

1. Introduction

1.1 Document Revision

Version	Author	Date	Notes
1.0	Alex Ramil Aguel	September 27, 2015	Initial Revision

1.2 Corporate

MDoffice Inc. is part of Eli Global, a fast growing global organization.

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1.3 Notice

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1.4 Trademarks

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1.5 Audience

This document is written for the people that need to understand how MDoffice EMR will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product.

This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

1.6 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between MDoffice and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

1.7 Terms and Definitions

Term / Abbreviation	Definition
DICOM	Digital Imaging and Communications in Medicine
Electronic Medical Record (EMR)	Digital version of the traditional paper-based medical record for an individual. It represents a medical record within a single facility, such as a doctor's office or a clinic.
Service Object Pair Class (SOP)	The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.
Unique Identifier (UID)	A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.
Application Entity (AE)	An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.
Service Class Provider (SCP)	Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).
Service Class User (SCU)	Role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)
Transfer Syntax	Set of encoding rules able to unambiguously represent one or more Abstract Syntaxes. In particular, it allows communicating Application Entities to negotiate common encoding techniques they both support (e.g., byte ordering, compression, etc.).
Information Object Definition (IOD)	The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

1.8 DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.
Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.
For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* - which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

1.9 References

[1] Digital Imaging and Communication in Medicine (DICOM) 3.0, NEMA PS 3.1-15, 2011

[2] MDoffice EMR User Manual

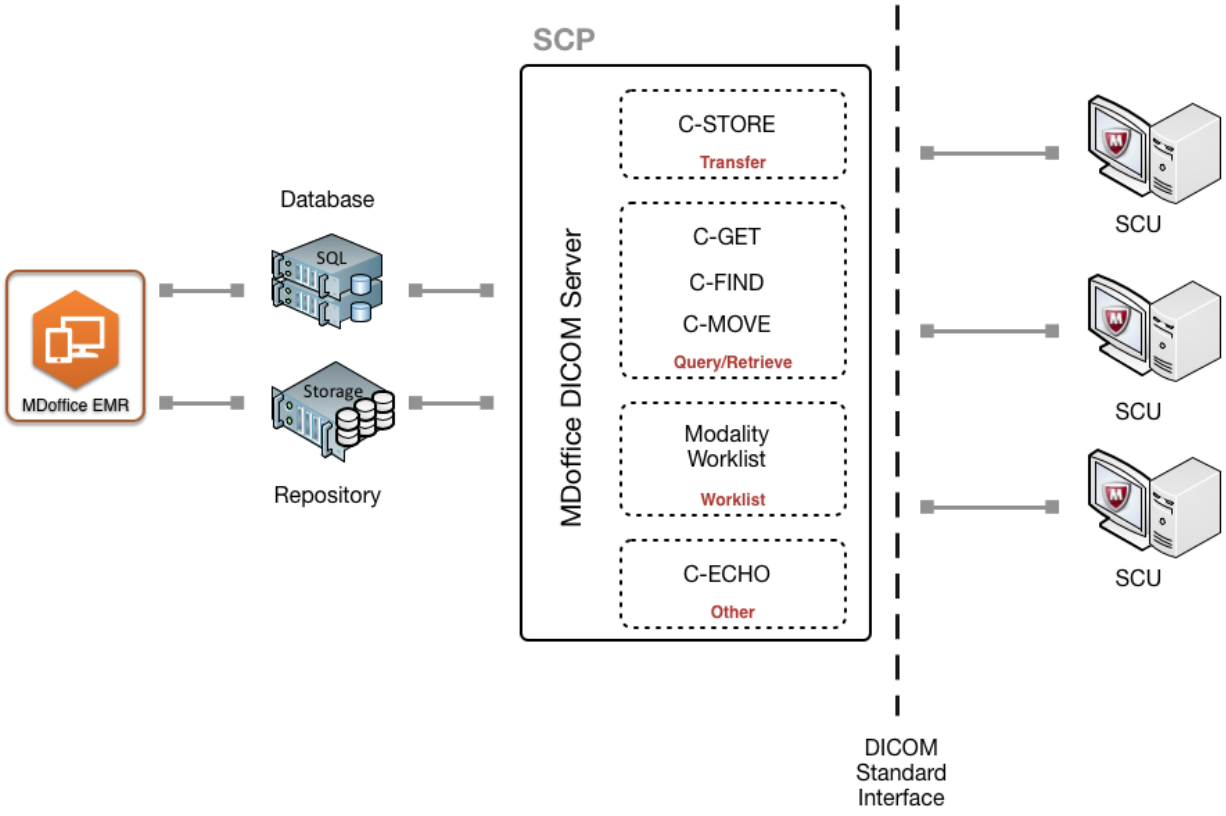
2. Networking

2.1 IMPLEMENTATION MODEL

The Implementation model consists of three sections:

- **Application Data Flow Diagram** - specifying the relationship between the Application Entities and the "external world" or Real-World activities
- **Functional Description of AEs** - functional description of each Application Entity.
- **Sequencing of Real World Activities** - sequencing constraints among Application Entities.

2.1.1 Application Data Flow



2.1.2 Functional Description of AEs

MDoffice DICOM Server implements one unified SCP that handles different services (shown in diagram 2.1.1) and waits for connection from any SCU using the designated IP address and port. Once the SCU connects, it will accept association with Presentation Context for supported SOP Classes including Verification, Storage and Retrieve/Query.

DICOM instances received from C-STORE request will be stored in the repository and database will be updated with relevant information.

2.1.3 Sequencing of Real World Activities

No particular sequencing required.

2.2 APPLICATION ENTITY SPECIFICATIONS

2.1.2 DICOM Server SCP

The unified MDoffice DICOM Server runs in a single instance providing different DICOM Services.

2.1.2.1 SOP Classes

SOP Classes		Service Class Provider	Service Class User
Name	UID		
QUERY/RETRIEVE			
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	YES	NO
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	YES	NO
Patient Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.1.3	YES	NO
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	YES	NO
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	YES	NO
Study Root Query/Retrieve Information Model – GET	1.2.840.10008.5.1.4.1.2.2.3	YES	NO
TRANSFER			
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	YES	NO
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	YES	NO
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	YES	NO
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	YES	NO
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	YES	NO
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	YES	NO
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	YES	NO
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	YES	NO
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	YES	NO
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	YES	NO
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	YES	NO
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	YES	NO

SOP Classes		Service Class Provider	Service Class User
Name	UID		
X-Ray Angiographic BiPlane Image Storage	1.2.840.10008.5.1.4.1.1.12.3	YES	NO
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	YES	NO
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	YES	NO
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	YES	NO
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	YES	NO
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	YES	NO
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	YES	NO
DX Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1	YES	NO
DX Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	YES	NO
DX Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	YES	NO
DX Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	YES	NO
DX Intra-Oral Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	YES	NO
DX Intra-Oral Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1		
WORKFLOW MANAGEMENT			
Modality Worklist	1.2.840.10008.5.1.4.31	OPTION	NO
OTHERS			
Verification Service	1.2.840.10008.1.1	YES	NO

2.1.2.2 Association Policies

2.1.2.2.1 General

The DICOM Server can accept association from any SCUs for Verification, Storage, Query/Retrieve and Worklist Management.

Application Context Name	1.2.840.10008.3.1.1.1

2.1.2.2.2 Number of Associations

Accepts multiple simultaneous association from peer Application Entities limited only by the available resources of the underlying equipment and operating system.

2.1.2.2.3 Asynchronous Nature

Asynchronous mode of operation is not supported.

2.1.2.2.4 Implementation Identifying Information

The application UID of this Application Entity is:

Implementation Class UID	2.16.840.1.114536.1
Implementation Version Name	MDoffice-1.0

2.1.2.3 Association Initiation Policies

This Application Entity never initiate an association so it is not applicable in this context.

2.1.2.4 Association Acceptance Policies

The following policies are applicable whenever an association is requested to DICOM Server:

2.1.2.4.1 Description and Sequencing of Activities

No specific sequencing of activities required.

2.1.2.4.2 Accepted Presentation Contexts

DICOM server will accept any presentation context as listed in the table below:

Transfer Syntax	UID
Implicit VR Little-endian	1.2.840.10008.1.2
Explicit VR Little and Big-endian	1.2.840.10008.1.2.1/2
Lossless JPEG	1.2.840.10008.1.2.4.57/70
Lossless JPEG	1.2.840.10008.1.2.4.80/81
JPEG 2000	1.2.840.10008.1.2.4.90/91
Extended 8 & 12 bit JPEG	1.2.840.10008.1.2.4.51
Run-Length-Encoding	1.2.840.10008.1.2.5

2.3 Network Interfaces

2.3.1 Physical Network Interfaces

Multiple network interfaces are supported. The following physical network interfaces will be available depending on installed hardware options:

- Ethernet 1000BaseT
- Ethernet 100BaseT
- Ethernet 10BaseT
- Wifi 802.11

2.3.2 Additional Protocols

None.

2.3.3 IPv4 and IPv6 Support

Supported depending on the underlying infrastructure configuration where DICOM Server is running.

2.4 AE Title/Presentation Address Mapping

2.4.1 Local AE Titles / Ports

The local AE Titles and TCP ports are configurable through the DICOM Server's INI configuration file.

Application Entity	Default AE Title	Default TCP Port
Storage Server	MDoffice	104
Query/Retrieve Server	MDoffice	104
Modality Worklist	MDoffice	104

3. Media Interchange

Currently no support for Media Storage

4. Support of Extended Character Sets

Only supports ISO_IR 100 (ISO 8859-1 Latin 1) as an extended character set

5. Security

5.1 Security Profiles

DICOM Server optionally can support secure DICOM communication in conformance with the Basic TLS Secure Transport Connection Profile. This is disabled by default and can be configured depending on the target mode operation.

5.2 Association Level Security

This Application Entity can be configured to only accept association from listed AE Titles and specific IP addresses.

To turn on SECURITY, you must enable DicomSecurityOn flag in the startup INI file as follows:

Values:
Y = enable association security
N = disable association security.

And then you can configure the access list via the SECURITY Panel in the DICOM Server.

IP	Workstation	Status	Action
112.210.2.125	MDoffice	Allow	Update
112.210.14.39	Mdoffice	Denied	Update

6. Annexes

6.1 Created IOD Instances

6.2 Usage of Attributes from received IOD's

6.3 Attribute Mapping

6.4 Coerced/Modified Fields

Attribute coercion is configurable for IOD's received by the Storage Server. Attributes can either be mapped or may be filled with "fixed values" depending on the existence or the content(s) of one or more other Attributes.

7. Appendix A. Implementation Statements of IHE Integration Profiles

DICOM Server has implemented the following DICOM services:

- DICOM XY Image Storage SCP
- DICOM Encapsulated PDF Storage SCP
- DICOM Modality Worklist SOP Class SCP
- DICOM Study Root Query/Retrieve Information Model - FIND SCP
- DICOM Study Root Query/Retrieve Information Model - GET SCP
- DICOM Study Root Query/Retrieve Information Model - MOVE SCP
- DICOM Patient Root Query/Retrieve Information Model - FIND SCP
- DICOM Patient Root Query/Retrieve Information Model - GET SCP
- DICOM Patient Root Query/Retrieve Information Model - MOVE SCP