

resolution  web

2.7 DICOM Conformance Statement
(including 2.7.2 and 2.7.3)

October 28, 2011

DCM27-CS16

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1. Overview

This DICOM conformance statement specifies the behavior and functionality of the ResolutionMD (ResMD) application from Calgary Scientific. ResMD is a computer software product used for the anytime and anywhere display and analysis of medical images. It is a server-based application that is accessed from zero-footprint browser based web clients or a mobile smartphone client running on the iPhone, iPad, iPod Touch or Android based devices. The application conforms to aspects of the DICOM 3.0 standard to allow interoperability with other DICOM 3.0 compliant systems. ResMD takes advantage of several network services defined in 3.7 of the DICOM standards for the purpose of loading and rendering the images. Images are not permanently stored within ResMD. ResMD is integrated with other DICOM-compliant PACS (Picture Archiving and Communication System) in order to enable users to display DICOM medical images and is able to save modified versions of those images back to a PACS.

SOP Classes	User of Service (SCU)	Provider of Service (SCP)	Display
Transfer			
<i>Basic Text SR</i>	Yes	Yes	Yes
<i>Computed Radiology Image Storage</i>	Yes	Yes	Yes
<i>CT Image Storage</i>	Yes	Yes	Yes
<i>Digital Mammography X-Ray Image Storage – for Presentation</i>	Yes	Yes	Yes
<i>Digital Mammography X-Ray Image Storage – for Processing</i>	Yes	Yes	Yes
<i>Digital X-Ray Image Storage - for Presentation</i>	Yes	Yes	Yes
<i>Digital X-Ray Image Storage - for Processing</i>	Yes	Yes	Yes
<i>Enhanced CT Image Storage</i>	Yes	Yes	Yes
<i>Enhanced MR Image Storage</i>	Yes	Yes	Yes
<i>MR Image Storage</i>	Yes	Yes	Yes

<i>Nuclear Medicine Image Storage</i>	Yes	Yes	Yes
<i>Positron Emission Tomography Image Storage</i>	Yes	Yes	Yes
<i>Secondary Capture Image Storage</i>	Yes	Yes	Yes
<i>Ultrasound Image Storage</i>	Yes	Yes	Yes
<i>Ultrasound Multi-Frame Image Storage</i>	Yes	Yes	Yes
<i>X-Ray Angiographic Image Storage</i>	Yes	Yes	Yes
Query / Retrieve			
<i>Patient Root Query / Retrieve IM - Find</i>	Yes	No	N/A
<i>Patient Root Query / Retrieve IM - Move</i>	Yes	No	N/A
<i>Study Root Query / Retrieve IM - Find</i>	Yes	No	N/A
<i>Study Root Query / Retrieve IM - Move</i>	Yes	No	N/A

Table 1: Supported Network Services

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3. Introduction

ResolutionMD (ResMD) provides interactive, high-quality visualization and display of DICOM medical images. It reads and displays 2D images and transforms them into reconstructed 2D or 3D volumes to display a high-definition, interactive view of medical data. ResMD software supports several image formats, specifically DICOM version 3.0 image files. ResMD reads and displays uncompressed monochrome DICOM images of all major modalities and image SOP classes and can request that modified versions of DICOM objects be stored in an external PACS via the DICOM Storage Service Class.

ResMD is primarily intended as an image display and viewing solution. ResolutionMD is able to act as an SCU for the purposes of saving modified image series or secondary captures back to a DICOM image storage system. It is recommended that users leverage their existing PACS system or third party systems such as DCM4Chee to act as a C-Store provider or to provide DICOM Query / Retrieve functionality in conjunction with ResMD.

3.1. Revision History

Revision Number	Date	Reason for Change
3.0	October 28, 2011	Update to reflect current conformance status of ResolutionMD 2.7, 2.7.2 and 2.7.3 based solutions.
2.0	November 30, 2010	Update to reflect current conformance status of ResolutionMD 2.5
1.0	March 5, 2010	Update to reflect current conformance status of ResolutionMD 2.4 (including 2.4.1 and 2.4.2) release

3.2. Audience

This conformance statement is intended for use to evaluate possible interoperability between ResolutionMD and other applications.

This document is written for the people that need to understand how ResolutionMD 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. 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.

3.3. Remarks

This DICOM Conformance Statement documents the conformance of the ResolutionMD software with the Digital Imaging and Communications in Medicine (DICOM) standard. This document is essential in order to evaluate whether or not another DICOM compliant device can communicate with this software product. This statement is conformant with the recommended format as described in PS 3.2 of the DICOM standard.

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.

Networking

3.4. Implementation Model

3.4.1. Application Data Flow

ResolutionMD implements an Application Entity (AE) which acts either as a Storage Service Class User (SCU), a C-FIND / C-MOVE Service Class User (SCU) or a C-STORE Service Class Provider (SCP). This AE sends queries (C-FIND) initiated from ResolutionMD users to specific or all DICOM servers (Remote AE) identified within the ResolutionMD configuration. The query results are returned to ResolutionMD from the Remote and displayed to the requesting user.

When a user requests images for retrieval (C-MOVE), ResolutionMD sends a move request to specified or all Remote AE. ResolutionMD then acts as the SCP to receive the requested images (C-STORE) into ResolutionMD server memory and displays to the users 2D, 3D or MIP/ MPR representations of the images. No DICOM data is transferred to the end user device accessing the ResolutionMD server application and image data is never stored persistently on the user device or on the ResolutionMD server.

ResolutionMD also provides a Storage SCU capability when ResolutionMD manipulated images are saved back to a PACS system.

The application data flow for ResolutionMD can be seen in Figure 1.

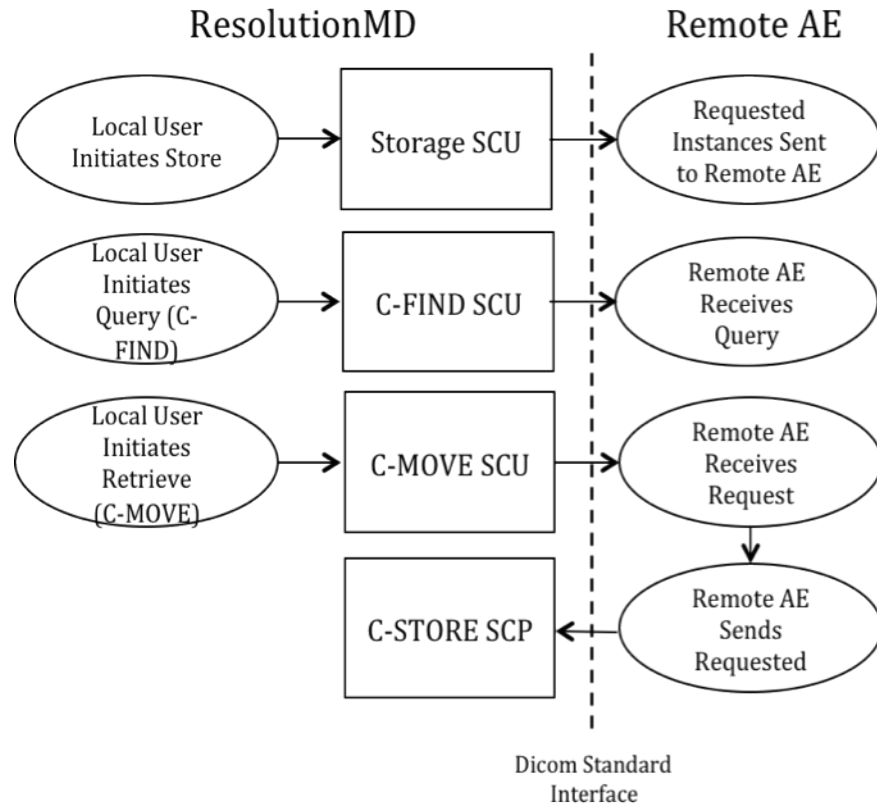


Figure 1: ResolutionMD Data Flow

3.4.2. Function Definition of Application Entities

3.4.2.1. Network Related Functions

- 1) ResMD supports storage of received SOP instances from remote SCU AE.
- 2) ResMD storage SCU transmits the stored instances to a remote AE triggered following a user initiated storage request to a pre-programmed remote AE.
- 3) ResMD acts as an SCU for the C-Find and C-Move.
- 4) ResMD acts as an SCP for the C-Store service.

3.4.3. Sequencing of Real World Activities

As shown in Figure 1, the local user must initiate the retrieve C-Move before the C-Store.

3.5. AE Specification

3.5.1. Application Entity Specifications

This section outlines the specifications for each of the Application Entities that are relevant to ResolutionMD solution.

3.5.1.1. Storage SOP Classes

ResMD Application Entity provides Standard Conformance to the following Storage SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
<i>Basic Text SR</i>	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
<i>Computed Radiology Image Storage</i>	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
<i>CT Image Storage</i>	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
<i>Digital Mammography X-Ray Image Storage – for Presentation</i>	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
<i>Digital Mammography X-Ray Image Storage – for Processing</i>	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
<i>Digital X-Ray Image Storage - for Presentation</i>	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
<i>Digital X-Ray Image Storage - for Processing</i>	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
<i>Enhanced CT Image Storage</i>	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
<i>Enhanced MR Image Storage</i>	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
<i>MR Image Storage</i>	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
<i>Nuclear Medicine Image Storage</i>	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
<i>Positron Emission Tomography Image Storage</i>	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
<i>Secondary Capture Image Storage</i>	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
<i>Ultrasound Image Storage</i>	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes

<i>Ultrasound Multi-Frame Image Storage</i>	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
<i>X-Ray Angiographic Image Storage</i>	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes

Table 2-1: Storage SOP Classes

3.5.1.2. Query/Retrieve SOP Classes

ResMD Application Entity provides Standard Conformance to the following Query/Retrieve SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
<i>Patient Root Query / Retrieve IM - Find</i>	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
<i>Patient Root Query / Retrieve IM - Move</i>	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
<i>Study Root Query / Retrieve IM - Find</i>	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
<i>Study Root Query / Retrieve IM - Move</i>	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

Table 2-2 : Query/Retrieve SOP Classes

3.5.1.3. Transfer Syntaxes

ResMD supports the following transfer syntaxes in the listed order for each SOP class:

Full Syntax List	
<i>JPEG Lossless Non-Hierarchical 1st Order Prediction</i>	1.2.840.10008.1.2.4.70
<i>JPEG Lossless Non-Hierarchical (14)</i>	1.2.840.10008.1.2.4.57
<i>JPEG-LS Lossless</i>	1.2.840.10008.1.2.4.80
<i>JPEG-LS Lossy (near lossless)</i>	1.2.840.10008.1.2.4.81
<i>JPEG 2000 Lossless Only</i>	1.2.840.10008.1.2.4.90
<i>JPEG 2000</i>	1.2.840.10008.1.2.4.91
<i>JPEG Baseline</i>	1.2.840.10008.1.2.4.50
<i>JPEG Extended (2 & 4)</i>	1.2.840.10008.1.2.4.51

<i>Deflated Explicit VR Little Endian</i>	1.2.840.10008.1.2.1.99
<i>Explicit VR Big Endian</i>	1.2.840.10008.1.2.2
<i>Explicit VR Little Endian</i>	1.2.840.10008.1.2.1
<i>Implicit VR Little Endian</i>	1.2.840.10008.1.2

Table 2-3: Transfer Syntaxes

3.5.2. Association Establishment Policies

Association acceptance and establishment policies are described below for ResolutionMD.

3.5.2.1. General

3.5.2.2. Number of Associations

The number of simultaneous active associations is limited only by the specifications of the machine running ResolutionMD and by the limits of performance on the network to which it is attached.

3.5.2.3. Asynchronous Nature

The Query / Retrieve function does support multiple outstanding transactions to defined AE. Asynchronous communication is supported.

3.5.2.4. Implementation Identifying Information

Currently, the ResolutionMD DICOM uses the OFFIS DCMTK as a baseline toolkit to support DICOM functionality. The original DCMTK Implementation Class UID and Version Name are being used.

<i>Implementation Class UID</i>	1.2.276.0.7230010.3
<i>Implementation Version Name</i>	OFFIS_DCMTK_354

Table 2-4: DICOM Implementation Class and Version for ResolutionMD

3.5.3. Association Acceptance Policy

This real world activity is used when ResolutionMD wishes to verify connectivity between the ResolutionMD Application Entity and a remote Application Entity.

3.6. Network Interfaces

ResolutionMD operates over the TCP/IP protocol stack of the OS on the server on which it is hosted. ResolutionMD is indifferent to the physical medium over which it operates.

3.7. Configuration

ResolutionMD Application Entities can be configured for Presentation Addresses and Application Entity Titles within the application. This and all other configuration is accessed via the ResolutionMD configuration capabilities that are outlined in the ResolutionMD installation and administration guides.

3.7.1. AE Title/Presentation Address Mapping

ResolutionMD Application Entities can be configured for Presentation Addresses and Application Entity Titles within the application.

4. Media Interchange

None are supported.

5. Security

ResolutionMD supports SSL connections directly between web or mobile clients and the ResolutionMD application on a centralized server. Organizations should ensure that these as well as other security precautions such as firewalls or virtual private networks are in place to ensure security and privacy of image information. ResolutionMD should be operated in an environment with strong focus and attention to security and it is the responsibility of the deploying organization to ensure their IT network is secure.