EXACT IMAGING

DICOM Conformance Statement

for ExactVu™ 2.5.5

Revision 1.0

1 Conformance Statement Overview

This is a DICOM Conformance Statement for ExactVu 2.5.5. ExactVu provides the capability to query modality worklist from a RIS scheduler, store ultrasound studies to, and query/retrieve MR studies including GSPS from a DICOM Image Manager. It can also read MR studies from a USB storage device or a CD/DVD through a USB port. The following DICOM SOP classes are supported by ExactVu:

Table Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
US Image Storage	Yes	No
Ultrasound Multiframe Image Storage	Yes	No
MR Image Storage	No	Yes
Enhanced MR Image Storage	No	Yes
MR Spectroscopy Storage	No	Yes
Grayscale Softcopy Presentation State Storage	No	Yes
Secondary Capture Image Storage	No	Yes
Key Object Selection Document	No	Yes
X-Ray Radiation Dose SR	No	Yes
Chest CAD SR	No	Yes
Mammography CAD SR	No	Yes
Basic Text SR	No	Yes
Enhanced SR	No	Yes
Comprehensive SR	No	Yes
Raw Data Storage	No	Yes
Procedure Log Storage	No	Yes
Multiframe Grayscale Byte Secondary Capture Image Storage	No	Yes
Multiframe Grayscale Word Secondary Capture Image Storage	No	Yes
Multiframe Single Bit Secondary Capture Image Storage	No	Yes
Multiframe True Color Secondary Capture Image Storage	No	Yes
Spatial Fiducials Storage	No	Yes
Spatial Registration Storage	No	Yes
Standalone Curve Storage	No	Yes
Hardcopy Color Image Storage	No	Yes
Hardcopy Grayscale Image Storage	No	Yes
Standalone Modality LUT Storage	No	Yes
Standalone Overlay Storage	No	Yes
Blending Softcopy Presentation State Storage	No	Yes
Color Softcopy Presentation State Storage	No	Yes
Encapsulated PDF Storage	No	Yes
Pseudocolor Softcopy Presentation Stage Storage	No	Yes
Deformable Spatial Registration Storage	No	Yes
Segmentation Storage	No	Yes
Workflow Management		
Modality Worklist Information Model - FIND	Yes	No

Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No

Table Media Services

Media Storage Application Profile	**Read/Write Files**
Compact Disk – Recordable	
General Purpose CD-R Interchange	FSR
General Purpose CD-R Interchange with JPEG	FSR
General Purpose CD-R Interchange with J2K	FSR
CT/MR Studies on CD-R	FSR
DVD	
General Purpose DVD Interchange	FSR
General Purpose DVD Interchange with JPEG	FSR
General Purpose DVD Interchange with J2K	FSR
CT/MR Studies on DVD Media	FSR
USB and Flash Memory	
General Purpose USB	FSR
General Purpose USB with JPEG	FSR
General Purpose USB with J2K	FSR
Network Drive	
A network drive mapped by a network-shared folder	FSR

Note: ExactVu serves as a DICOM File-Set Reader (FSR); however, it only reads MR studies with some extra specifications for its *FusionVu* functionality. Network Drive is NOT a standard Media storage Application Profile. ExactVu handles the network drive same as CD-R or DVD and serves as DICOM File-Set Reader (FSR).

2 Table of Contents

3 Introduction

3.1 Audience

This DICOM Conformance Statement is intended for following audiences:

- Hospital or clinical practice staff or Exact Imaging customers
- System integrator of medical equipment
- DICOM Software engineer or designer
- Marketing or Sales personnel with DICOM knowledge

3.2 Scope and field of Application

It is the intent of this document to provide an unambiguous specification for DICOM implementations of ExactVu. This specification includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of ExactVu medical data exchanged using DICOM.

The use of the DICOM Conformance Statement, in conjunction with the DICOM Standards, is intended to facilitate communication with the ExactVu high resolution micro-ultrasound system. However, **by itself, it is not sufficient to ensure that inter-operation will be successful**.

The reader of this DICOM Conformance Statement should be aware of the following important issues:

- Test procedures should be defined and conducted to validate the desired level of connectivity
- The DICOM standard will evolve over time to meet future real-world requirements

3.3 Definition, Terms and Abbreviation

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard. Abbreviations and terms used are as follows:

Term	Definition
EVu	High-resolution micro-ultrasound device from Exact Imaging Inc.
AE	DICOM Application Entity
ASCE	Association Control Service Element
FSR	File-Set Reader
GSPS or PR	Grayscale Softcopy Presentation State
IOD	Information Object Definition
ISO	International Standard Organization
MR or MRI	Magnetic Resonance Imaging
MWL	Modality Worklist
PDU	Protocol Data Unit
SCU	Service Class User
SCP	Service Class Provider
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow

ExactVu implements DICOM verification SCU, Storage SCU. It also implements Query /Retrieve - MOVE SCU and a temporary Storage SCP for image retrieving. Below is the application data flow diagram.

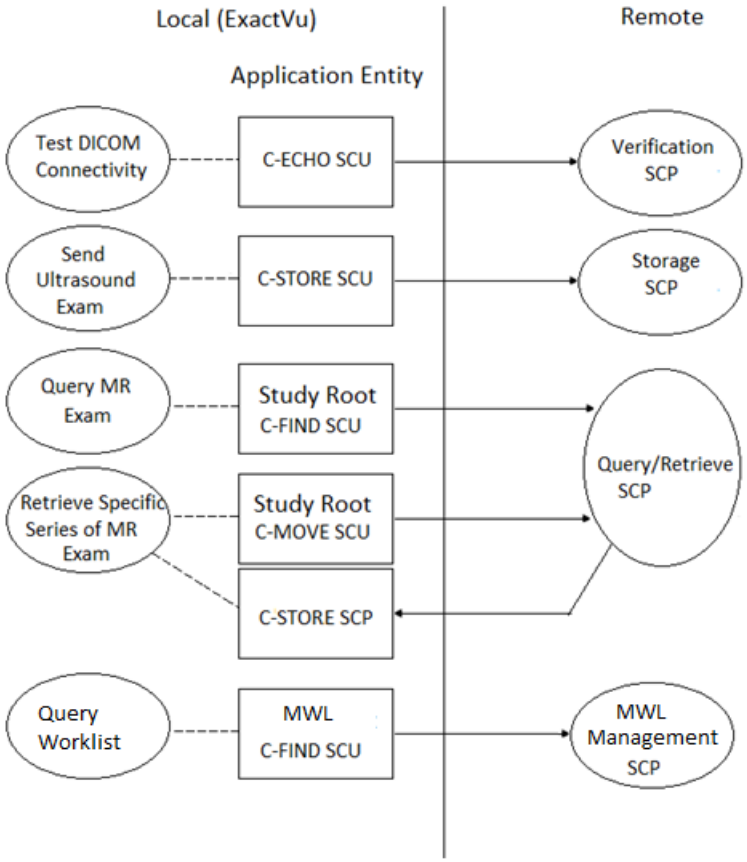

Figure 1: DICOM Standard Interface

4.1.2 Functional Definition of AEs

All communications and image transfer with remote application is accomplished using the DICOM protocol over a network using the TCP/IP protocol stack.

4.1.2.1 Verification SCU

The DICOM verification SCU (i.e., connectivity test) is available for testing and validation purposes of remote AEs. ExactVu opens an association and sends C-ECHO request to verify specified DICOM SCP

node. Upon receiving the response from SCP, or in case of failure, it closes the connection.

4.1.2.2 *Storage* SCU

DICOM Storage SCU is available to send local Ultrasound studies, which are selected either by the user or background archiving to the configured remote DICOM Storage SCP. ExactVu opens an association and send a single-framed or multi-framed image to the specific SCP. Upon receiving the response or in case of failure, it closes the connection.

4.1.2.3 Study-Root Query/Retrieve - FIND SCU

ExactVu searches different level information of the DICOM studies as a study-root Query/Retrieve - FIND SCU from the remote AE, i.e., a DICOM query/retrieve SCP by sending a C-FIND request and receiving the response.

4.1.2.4 Study-Root Query/Retrieve - MOVE SCU

ExactVu retrieves the DICOM SOP instances as a study-root Query/Retrieve - MOVE SCU from the remote AE, i.e., a DICOM query/retrieve SCP by sending a C-MOVE request and receiving the response. Once the response is successful, it will setup a temporary Storage SCP as described in 4.1.2.6.

4.1.2.5 Storage SCP

ExactVu initiates a temporary Storage SCP to accept the SOP instance sending, which is initiated by a C-MOVE request, from the remote AE. Once the receiving task is done or times out, the Storage SCP will be destroyed.

4.1.2.6 Modality Worklist - FIND SCU

ExactVu searches modality worklist as an MWL FIND SCU from the remote AE, i.e., a DICOM Modality Worklist Management SCP by sending an MWL FIND request and receiving the response.

4.1.3 Sequencing of Real-World Activities

Not applicable.

4.2 AE Specifications

4.2.1 Verification Application Entity Specification

4.2.1.1 SOP Classes

Verification provides e Standard Conformance to the following SOP Class:

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 General

ExactVu acts as verification SCU AE to test the DICOM connectivity to the remote AE.

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

This version of implementation only supports one simultaneous association.

Maximum number of simultaneous Associations	1

4.2.1.2.3 Asynchronous Nature

This version of implementation does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1

4.2.1.2.4 Implementation Identifying Information

ExactVu uses the following implementation identifying parameters:

Implementation Class UID	2.16.124.113639.1.0.2.5.2.0
Implementation Version	MergeCOM3_5_6_0

Note the Implementation Version may be updated with the release of the product software.

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Connectivity Verification

4.2.1.3.1.1 Description and Sequence of Activities

ExactVu initiates Associations only for the purpose of verifying a DICOM connection.

4.2.1.3.1.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name**	**UID**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.3.1.3 SOP Specific Conformance

ExactVu provides standard conformance to the DICOM Verification Service Class as an SCU.
The status code for the C-ECHO is as following:

Code	Status	Meaning
0000	Success	The C-ECHO request is accepted.

4.2.1.4 Association Acceptance Policy

Not applicable.

4.2.2 Storage Application Entities Specification

4.2.2.1 SOP Classes

Storage AEs provide Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No

4.2.2.2 Association Policies

4.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2 Number of Associations

The Storage SCU of the Storage AE initiates one association at a time for the destination.

Maximum number of simultaneous Associations	1

4.2.2.2.3 Asynchronous Nature

This version of implementation does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1

4.2.2.2.4 Implementation Identifying Information

ExactVu uses the following implementation identifying parameters:

Implementation Class UID	2.16.124.113639.1.0.2.5.2.0
Implementation Version	MergeCOM3_5_6_0

Note the Implementation Version may be updated with the release of the product software.

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity – Send Images

4.2.2.3.1.1 Description and Sequence of Activities

The images of a study selected manually by the user or automatically by the background archiving system can be sent to a remote AE. If Storage SCU successfully establishes an Association to a remote AE, it will transfer each SOP instance one after another via the open Association. After successful or a failed sending, the association will be closed.

4.2.2.3.1.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name**	**UID**		
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	SCU	None
US Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	SCU	None

4.2.2.3.1.3 SOP Specific Conformance for Storage SOP Class

ExactVu provides standard conformance to the DICOM Standard Storage Service Class as SCU for the storage SOP classes of US Image Storage and US Multiframe Image Storage as listed in the table in section 4.2.2.3.1.2. ExactVu sends the following attributes in C_STORE_RQ. All the mandatory attributes are sent.

Group	Element	Description
0008	0005	Specific Character Set
0008	0008	Image Type
0008	0016	SOP Class UID
0008	0018	SOP Instance UID
0008	0020	Study Date
0008	0021	Series Date
0008	0022	Acquisition Date
0008	0023	Content Date
0008	0030	Study Time
0008	0031	Series Time
0008	0032	Acquisition Time
0008	0033	Content Time
0008	0050	Accession Number
0008	0060	Modality
0008	0070	Manufacturer
0008	0080	Institution Name
0008	0090	Name of the patient's referring physician
0008	0201	Time zone offset from UTC
0008	1030	Study Description
0008	103E	Series Description
0008	1090	Manufacturer's Model Name

0010	0010	Patient's Name
0010	0020	Patient ID
0010	0021	Issuer of Patient ID
0010	0030	Patient's Birth Date
0010	0040	Patient's Sex
0020	000D	Study Instance UID
0020	000E	Series Instance UID
0020	0010	Study ID
0020	0011	Series Number
0020	0013	Instance Number
0020	9221	Dimension Organization Sequence
>0020	9164	Dimension Organization UID
0020	9222	Dimension Index Sequence
>0020	9164	Dimension Organization UID
>0020	9165	Dimension Index Pointer
>0020	9167	Functional Group Pointer
>0020	9421	Dimension Description Label
0028	0002	Samples per Pixel
0028	0004	Photometric Interpretation
0028	0006	Planar Configuration
0028	0010	Rows
0028	0011	Columns
0028	0030	Pixel Spacing
0028	0100	Bits Allocated
0028	0101	Bits Stored
0028	0102	High Bit
0028	0103	Pixel Representation
0028	6010	Representative Frame Number
0028	6020	Frame Numbers of Interest
0028	6022	Frame of Interest Description
0028	6023	Frame of Interest Type
5200	9229	Shared Functional Groups Sequence
>0028	9110	Pixel Measures Sequence
>>0028	0030	Pixel Spacing
5200	9230	Per Frame Functional Groups Sequence
>0020	9111	Frame Content Sequence
>>0018	9074	Frame Acquisition Date Time
>>0018	9151	Frame Reference Date Time
>>0020	9056	Stack ID
>>0020	9057	In Stack Position Number
>>0020	9128	Temporal Position Index
>>0020	9157	Dimension Index Values
7FE0	0010	Pixel Data

4.2.2.4 Association Acceptance Policy

Not applicable.

4.2.3 Query/Retrieve - FIND SCU

4.2.3.1 SOP Classes

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No

4.2.3.2 Association Policies

4.2.3.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.2 Number of Associations

This version of implementation only supports one simultaneous association.

Maximum number of simultaneous Associations	1

4.2.3.2.3 Asynchronous Nature

This version of implementation does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1

4.2.3.2.4 Implementation Identifying Information

ExactVu uses the following implementation identifying parameters:

Implementation Class UID	2.16.124.113639.1.0.2.5.2.0
Implementation Version	MergeCOM3_5_6_0

Note the Implementation Version may be updated with the release of the product software.

4.2.3.3 Association Initiation Policy

4.2.3.3.1 Activity – Search studies level information from remote AE

4.2.3.3.1.1 Description and Sequence of Activities

Query/Retrieve - FIND SCU initiates a new association when the user performs the query action from the user interface. Once the query succeeds or fails, the association will be closed.

4.2.3.3.1.2 Accepted Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name**	**UID**		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.3.3.1.3 SOP Specific Conformance for Query/Retrieve - FIND SCU SOP Class

ExactVu provides standard conformance to the DICOM Study Root Query/Retrieve Information Model – FIND SOP SCU Class.

The request identifiers specified by ExactVu are listed in the following table:

Name	Tag	Type of Matching
Patient's Name	0010,0010	S, *, U
Patient ID	0010,0020	S, *, U
Patient's Birth Date	0010,0030	S, *, U, R
Study Date	0008,0020	S, *, U, R
Accession Number	0008,0050	S, *, U

Types of Matching:
The types of Matching supported by the C-FIND SCU. An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, a n"*"indicates wild card matching, a 'U' indicates Universal Matching, and an 'L' indicates that UID lists are sent. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned (i.e., universal matching), and "UNIQUE" indicates that this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching is used depending on the query level

Note: ExactVu only query study level with request modality identifier as MR or PR for FusionVu feature.

4.2.3.4 Association Acceptance Policy

Query/Retrieve - FIND SCU does not accept associations.

4.2.4 Query/Retrieve - MOVE SCU

4.2.4.1 SOP Classes

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

4.2.4.2 Association Policies

4.2.4.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1

4.2.4.2.2 Number of Associations

This version of implementation only supports one simultaneous association.

Maximum number of simultaneous Associations	1

4.2.4.2.3 Asynchronous Nature

This version of implementation does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1

4.2.4.2.4 Implementation Identifying Information

ExactVu uses the following implementation identifying parameters:

Implementation Class UID	2.16.124.113639.1.0.2.5.2.0
Implementation Version	MergeCOM3_5_6_0

Note the Implementation Version may be updated with the release of the product software.

4.2.4.3 Association Initiation Policy

4.2.4.3.1 Activity – Send a retrieve request to remote AE

4.2.4.3.1.1 Description and Sequence of Activities

Query/Retrieve - MOVE SCU initiates a new association when the user performs MR study loading from the user interface. Once the C-MOVE responding succeeds, a temporary Storage SCP will be setup. the association will be closed after the retrieval success through the temporary Storage SCP.

4.2.4.3.1.2 Accepted Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name**	**UID**		
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.4.3.1.3 SOP Specific Conformance for Query/Retrieve - MOVE SCU SOP Class

ExactVu provides standard conformance to the DICOM Study Root Query/Retrieve Information Model – MOVE SOP SCU Class.

The retrieval is performed from the AE that was specified in the Retrieve AE attribute returned from the query performed by the FIND SCU. The instances are retrieved to local by specifying the destination as the AE Title of the temporary setup Storage SCP, which is described in section 4.2.5. This implies that the remote C-MOVE SCP must be preconfigured to determine the presentation address corresponding to the Storage SCP AE setup by ExactVu. The Storage SCP AE will accept storage requests addressed to it.
A retrieval can be performed at the STUDY, SERIES or IMAGE level depending on what level of entity has been selected. For FusionVu feature, ExactVu performs a retrieval for all instances in a specific study by the study instance UID.

The request identifiers for Query/Retrieve – Move SCU are listed in the table below:

Name	Tag	Unique, Matching or Return Key
Study Level		
Study Instance UID	0020,000D	U

4.2.4.4 Association Acceptance Policy

Query/Retrieve - MOVE SCU does not accept associations.

4.2.5 Storage SCP

4.2.5.1 SOP Classes

SOP Class Name	SOP Class UID
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40
Multiframe Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1
Multiframe Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3
Multiframe Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1
Multiframe True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1

Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8
Blending Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.4
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1
Pseudocolor Softcopy Presentation Stage Storage	1.2.840.10008.5.1.4.1.1.11.3
Deformable Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.3
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4

4.2.5.2 Association Policies

4.2.5.2.1 General

The Storage SCP accepts but never initiates associations.

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1

4.2.5.2.2 Number of Associations

This version of implementation supports multiple simultaneous association.

The Storage SCP AE listens to a specific port and accepts the associations initiated by the C-Store SCU on the PACS server side. For each Association a thread is created to receive SOP instances sent from remote AE, which is a sub-operation of ExactVu's Query/Retrieve - MOVE. Although the simultaneous associations requested by the peer AE is not limited, the SCP doesn't expect a lot of associations from a specific Storage SCU, i.e., the PACS server which provides SOP instances for sub-operations of a C-MOVE.

Maximum number of simultaneous Associations requested by the peer AE	Not limited

4.2.5.2.3 Asynchronous Nature

This version of implementation does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1

4.2.5.2.4 Implementation Identifying Information

ExactVu uses the following implementation identifying parameters:

Implementation Class UID	2.16.124.113639.1.0.2.5.2.0
Implementation Version	MergeCOM3_5_6_0

Note the Implementation Version may be updated with the release of the product software.

4.2.5.3 Association Initiation Policy

Storage SCP does not initiate associations.

4.2.5.4 Association Acceptance Policy

When the Storage SCP accepts an association, it will respond to the storage requests. For this temporary Storage SCP with the purpose receiving SOP instances for the C-MOVE sub-operations, ExactVu doesn't check called AE, user information etc.

4.2.5.4.1 Activity - Receive Storage Request

4.2.5.4.1.1 Description and Sequencing of Activities

As instances are received, they are saved to the local file system and the records are saved by ExactVu application so that the SOP instances can be load for Fusion.

4.2.5.4.1.2 Accepted Presentation Contexts

Note: There is no extended negotiation for all the accepted presentation contexts.

Presentation Context Table			
Abstract Syntax		**Transfer Syntax**	
Name	**UID**	**Name**	**UID**
MR Image	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
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99
		JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8-bit Image Compression	1.2.840.10008.1.2.4.50
		JPEG Baseline (Processes 2 & 4): Default Transfer Syntax for Lossy JPEG 12-bit Image Compression (Process 4 only)	1.2.840.10008.1.2.4.51
		JPEG Lossless, Nonhierarchical (Processes 14)	1.2.840.10008.1.2.4.57
		JPEG Lossless, Nonhierarchical, First- Order Prediction (Processes 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70
		JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
		JPEG-LS Lossy (Near- Lossless) Image Compression	1.2.840.10008.1.2.4.81
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	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
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99
		JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8-bit Image Compression	1.2.840.10008.1.2.4.50
		JPEG Baseline (Processes 2 & 4): Default Transfer Syntax for Lossy JPEG 12-bit Image Compression (Process 4 only)	1.2.840.10008.1.2.4.51
		JPEG Lossless, Nonhierarchical (Processes 14)	1.2.840.10008.1.2.4.57
		JPEG Lossless, Nonhierarchical, First- Order Prediction (Processes 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70
		JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
		JPEG-LS Lossy (Near- Lossless) Image Compression	1.2.840.10008.1.2.4.81
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91
Secondary Capture Image	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
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99
		JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8-bit Image Compression	1.2.840.10008.1.2.4.50
		JPEG Baseline (Processes 2 & 4): Default Transfer Syntax for Lossy JPEG 12-bit Image Compression (Process 4 only)	1.2.840.10008.1.2.4.51
		JPEG Lossless, Nonhierarchical (Processes 14)	1.2.840.10008.1.2.4.57
		JPEG Lossless, Nonhierarchical, First- Order Prediction (Processes 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.10008.1.2.4.70
		JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
		JPEG-LS Lossy (Near- Lossless) Image Compression	1.2.840.10008.1.2.4.81
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90

		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91
MR Spectroscopy	1.2.840.10008.5.1.4.1.1.4.2	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Raw Data	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-frame Grayscale Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Spatial Fiducials	1.2.840.10008.5.1.4.1.1.66.2	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Standalone Curve	1.2.840.10008.5.1.4.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Hardcopy Color Image	1.2.840.10008.5.1.1.30	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Standalone Modality LUT	1.2.840.10008.5.1.4.1.1.10	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Implicit VR Little Endian	1.2.840.10008.1.2

		Explicit VR Little Endian	1.2.840.10008.1.2.1
Blending Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.4	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.2	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Pseudocolor Softcopy Presentation Stage	1.2.840.10008.5.1.4.1.1.11.3	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Segmentation	1.2.840.10008.5.1.4.1.1.66.4	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1

4.2.5.4.1.3 SOP Specific Conformance for Storage SCP SOP Class

Storage SCP provides standard conformance to the Storage Service Class.

4.2.6 Modality Worklist FIND SCU

4.2.6.1 SOP Classes

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No

4.2.6.2 Association Policies

4.2.6.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1

4.2.6.2.2 Number of Associations

This version of implementation only supports one simultaneous association.

Maximum number of simultaneous Associations	1

4.2.6.2.3 Asynchronous Nature

This version of implementation does not support asynchronous communication (multiple outstanding transactions over a single Association).

Maximum number of outstanding asynchronous transactions	1

4.2.6.2.4 Implementation Identifying Information

ExactVu uses the following implementation identifying parameters:

Implementation Class UID	2.16.124.113639.1.0.2.5.2.0
Implementation Version	MergeCOM3_5_6_0

Note the Implementation Version may be updated with the release of the product software.

4.2.6.3 Association Initiation Policy

4.2.6.3.1 Activity – Search Modality Worklist information from remote AE

4.2.6.3.1.1 Description and Sequence of Activities

MWL - FIND SCU initiates a new association when the user performs the query action from the user interface. Once the query succeeds or fails, the association will be closed.

4.2.6.3.1.2 Accepted Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name**	**UID**		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.6.3.1.3 SOP Specific Conformance for Modality Worklist - FIND SCU SOP Class

ExactVu provides standard conformance to the DICOM Modality Worklist Information Model – FIND SOP SCU Class.

The request identifiers specified by ExactVu are listed in the following table:

Name	**Tag**	**Type of Matching**
Patient's Name	0010,0010	S, *, U
Patient ID	0010,0020	S, *, U
Patient's Birth Date	0010,0030	NONE
Patient Sex	0010,0040	S, *, U
Study Instance UID	0020,000D	NONE
Scheduled Station AE Title	0040,0001	S
Scheduled Procedure Step Start Date	0040,0002	S, R
Scheduled Procedure Step Start Time	0040,0003	NONE
Scheduled Performing Physician's Name	0040,0006	NONE

Scheduled Procedure Step Description	0040,0007	NONE
Scheduled Station Name	0040,0010	S, *, U
Requested Procedure ID	0040,1001	NONE
Specific Character Set	0008,0005	NONE
Accession Number	0008,0050	NONE
Modality	0008,0060	S, *, U

Types of Matching:
The types of Matching supported by the C-FIND SCU. An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, a n"*"indicates wild card matching, a 'U' indicates Universal Matching, and an 'L' indicates that UID lists are sent. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned (i.e., universal matching), and "UNIQUE" indicates that this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching is used depending on the query level

4.2.6.4 Association Acceptance Policy

Modality Worklist - FIND SCU does not accept associations.

4.3 Network Interfaces

4.3.1 Physical Network Interfaces

ExactVu uses the MergeCOM-3 Advanced DICOM Toolkit to communicate over the TCP/IP protocol stack on any physical interconnection media supporting the TCP/IP stack. The Toolkit inherits the TCP/IP stack from the host operating system upon which it executes, i.e., Windows 7 for ExactVu.

4.3.2 Additional Protocols

Not applicable.

4.4 Configuration

Any implementation's DICOM conformance may be dependent upon configuration, which takes place at the time of installation.

4.4.1 AE Title/Presentation Address Mapping

AE Titles on ExactVu can be configured from Preferences/Network Settings page. The parameters and default values are specified as following:

Service Class Name	Role	Remote Server (IP or Host Name)	Remote Port	Remote AE	Local AE	Local Port
Storage	SCU		104			Not applicable
Storage	SCP		104			105

Service Class Name	Role	Remote Server (IP or Host Name)	Remote Port	Remote AE	Local AE	Local Port
Study Root Query/Retrieve	SCU		104			Not applicable
Basic Worklist Management	SCU		104			Not applicable

Note:

1. Empty items in the above table means there is no default value.
2. The parameters specified in the above table are on the ExactVu side, which acts as an SCU. These parameters must match the corresponding parameters set in the DICOM server, i.e., the SCP. This means:
    - The remote server (SCP) and its port should be able to be connected to ExactVu.
    - The remote AE should be correctly set in the SCP.
    - The local AE from ExactVu should be allowed for the service class in the SCP.
    - The local port (and the local computer name or address) for Storage SCP should be known for the service class in the SCP.

5 Media Interchange

5.1 Implementation Model

ExactVu implements DICOM File-Set Reader.

5.1.1 Application Data Flow Diagram

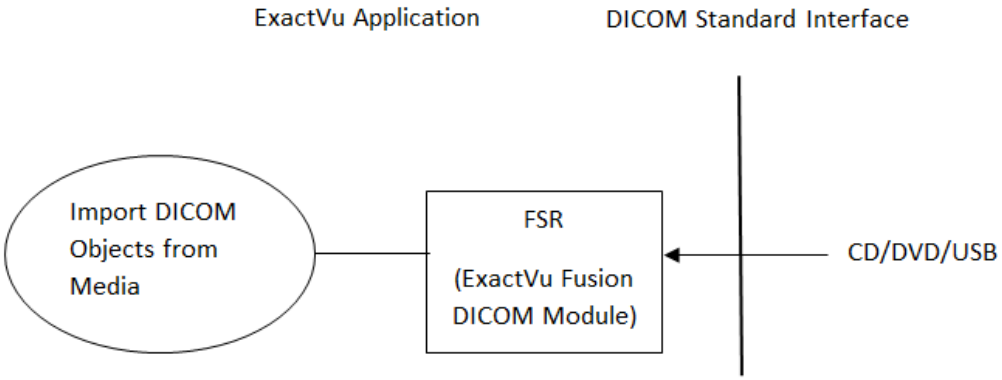

Figure 2: DICOM File-Set Reader Flow Diagram

5.1.2 Functional Definitions of AEs

ExactVu imports images and Presentation States from a removable media storage. The real-world

activity "Import DICOM Objects from Media" is performed when the user requests to read a MR study list and/or images from a CD/DVD or USB storage device.

5.1.3 Sequencing of Real World Activities

When the user selects to display MRI study list from a USB based CD/DVD drive, or from a USB storage device, ExactVu acts as a FSR to read the DICOMDIR from the DICOM file set on the media, i.e., CD/DVD or USB storage device, and build a study list to display to the user. When the user selects a MRI study to load, ExactVu reads MR images and Presentation States.

5.2 AE Specifications

Media Storage Application Profile	Identifier	Read/Write
Compact Disk – Recordable		
General Purpose CD-R Interchange	STD-GEN-CD	FSR
General Purpose CD-R Interchange with JPEG	STD-GEN-CD-JPEG	FSR
General Purpose CD-R Interchange with J2K	STD-GEN-CD-J2K	FSR
CT/MR Studies on CD-R	STD-CTMR-CD	FSR
DVD		
General Purpose DVD Interchange	STD-GEN-DVD	FSR
General Purpose DVD Interchange with JPEG	STD-GEN-DVD-JPEG	FSR
General Purpose DVD Interchange with J2K	STD-GEN-DVD-J2K	FSR
CT/MR Studies on DVD Media	STD-CTMR-DVD	FSR
USB and Flash Memory		
General Purpose USB	STD-GEN-USB	FSR
General Purpose USB with JPEG	STD-GEN-USB-JPEG	FSR
General Purpose USB with J2K	STD-GEN-USB-J2K	FSR
Network Drive		
A network drive mapped by a network-shared folder	ExactVu private	FSR

Note: FSR – File-set Reader, FSC – File-set Creator, FSU – File-set Updater

6 Transformation of DICOM to CDA

Not applicable.

7 Support of Character Sets

The following table lists the character sets used in ExactVu.

Character Set Description	Defined Term	ISO Registration Number	Code Element	Character Set	AE Role
Latin alphabet No. 2	ISO 2022 IR 101	ISO_IR 101	G2	Supplementary set of ISO 8859	Storage SCU, FSR
Default repertoire	ISO 2022 IR 6	ISO_IR 6	G0	ISO 646	FSR

8 Security

ExactVu does not support any specific security measures. It is assumed that ExactVu is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to ExactVu
- Firewall or router protections to ensure that ExactVu only has network access to approved external hosts and services
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN))
- Other network security procedures such as automated intrusion detection may be appropriate in some environments
- Additional security features may be established by the local security policy and are beyond the scope of this DICOM Conformance Statement

9 Annexes

Not applicable.

10 Revision History

Date	Author	Revision	Description of Change
31 October 2019	J. Li	1.0	Created and modified based on DICOM Conformance Statement for ExactVu 2.5.3 rev 1.0: • Added Modality Worklist. • Removed the Storage Commitment • Removed the series level attribute of study root query and retrieve. • Added more SOP classes in C-Store SCP at retrieval as ExactVu retrieves a whole study for fusion.