



Visual Analysis and Measurement Systems Technologies

Issa Server
Issa Workstation

DICOM Conformance Statement for DICOM 3.0

Revision 2.1

Date: 01.03.2005

1 Introduction

1.1 Scope and Field of Application

This Conformance Statement specifies the compliance of the Issa applications from Vamstec to the guidelines set forward by the joint American College of Radiology and National Electrical Manufacturers (ACR-NEMA) committee on Digital Imaging and Communications in Medicine (DICOM) Part 3.0 standard, and is written in accordance with Part 2 of the NEMA Standard Publication No. PS3.2-1993.

The intended user of this document is involved with software design and system integration. It is understood that this individual is familiar with the concepts and terms used throughout this document. Readers unfamiliar with the DICOM 3.0 standard should consult the actual documentation prior to examining this conformance statement.

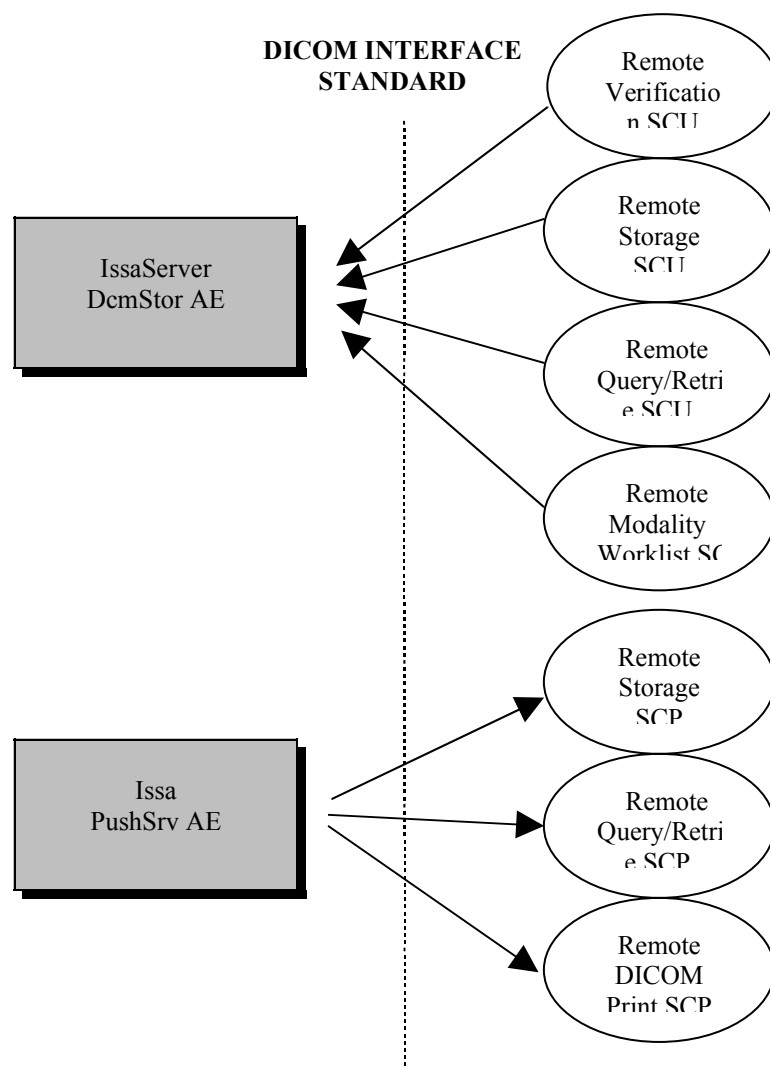
1.2 Theory of Operations

Issa is Windows platform product utilizing DICOM services in order to communicate with other DICOM compliant systems. Network part of Issa applications is implemented with two services: DcmStor and PushSrv. DcmStor provides capabilities to accept images from other DICOM compliant systems and supply modalities with work lists. PushSrv provides workstations with capabilities to export images to other DICOM systems and printing of images to hardcopy medium.

2 Implementation model

This section consists of an Application Data Flow Diagram describing how the DcmStor DICOM Server Application Entity (AE) works with remote DICOM devices, a functional definition of the AE and its Real-World Activities, and a description of the Real-World sequence of events of the AE.

2.1 Application Flow Diagram



If a remote DICOM AE wishes to verify that DcmStor is running at a site, it may initiate a Verification request. DcmStor uses the same criteria for accepting or denying the association request. If accepted, DcmStor replies to the remote AE that it is capable of accepting associations.

When a remote DICOM device selects a number of files to send to DcmStor acting as the local DICOM AE, a DICOM association is initiated. The local AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, information as to the local AE's capabilities are communicated

back to the remote AE, and the agreed upon transaction is started. The Real-World activity is that the files from the remote AE are stored to the local AE.

When a remote DICOM device wants to get list of stored studies in Issa system or to retrieve images from Issa system it will initiate DICOM association with DcmStor acting as the local DICOM AE. The local AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, information as to the local AE's capabilities are communicated back to the remote AE, and the agreed upon transaction is started. Also image retrievals will be processed by this AE as a C-MOVE SCP. The Real-World activity is that the list of studies is shown on remote AE and optionally retrieved by the remote AE.

When a remote DICOM device wants to get list of scheduled studies in Issa system it will initiate DICOM association with DcmStor acting as the local DICOM AE. The local AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, information as to the local AE's capabilities are communicated back to the remote AE, and the agreed upon transaction is started. The Real-World activity is that the list of scheduled studies is shown on remote AE.

When a remote DICOM device wants to get list of update the state of performed study in Issa system it will initiate DICOM association with DcmStor acting as the local DICOM AE. The local AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, information as to the local AE's capabilities are communicated back to the remote AE, and the agreed upon transaction is started. The Real-World activity is that the state of scheduled studies is changed.

When a user on Issa workstation selects images to send to remote DICOM device PushSrv acting as the local DICOM AE, a DICOM association is initiated. The remote AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, agreed upon transaction is started. The Real-World activity is that the files from the local AE are stored in the remote AE.

When a user on Issa workstation wants to retrieve list of studies or to retrieve images from remote DICOM device with PushSrv acting as the local DICOM AE, a DICOM association is initiated. The remote AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, agreed upon transaction is started. The Real-World activity is that the list of studies from remote AE is displayed on workstation and then selected studies can be retrieved from remote AE.

When a user on Issa workstation selects images to print on remote DICOM device PushSrv acting as the local DICOM AE, a DICOM association is initiated. The remote AE either accepts or denies the request based on the association parameters communicated in the request. If accepted, agreed upon transaction is started. The Real-World activity is that the files from the local AE are printed on the remote AE.

User on Issa workstation can create or read DICOM removable media. The user can choose to load images from DICOM removable media. They can also choose to export selected images or studies from system to removable DICOM media.

2.2 Functional Definitions of AE's

Issa Server application use DcmStor service that will act as a Service Class Provider (SCP) for Verification Service Class, Storage Service Class, Query/Retrieve Service Class, Modality Performed Procedure Step Class and the Modality Worklist Management Service Class.

DcmStor receives images from remote DICOM AE's and stores them locally. All images received using the C-STORE Service Class will be stored to a defined location in their entirety, with all private data elements remaining intact.

Any verification requests received using the C-ECHO Service Class will be responded to.

DcmStor will process requests from external devices to query the database for worklists, patient, study and series demographics, and image level information. It will handle C-MOVE requests from remote AEs for the retrieval of images. The DcmStor will act as SCU of Storage Service Class to transfer the requested images.

Upon receiving of DICOM MPPS message the status of scheduled studies will be updated in system database.

PushSrv will act as Service Class User (SCU) for Verification Service Class, Storage Service Class, Query/Retrieve Service Class and Print Management Service Classes.

PushSrv upon user selection of images from database will connect to one of configured remote system and transmit images using C-STORE Service Class.

It will connect on user action to remote system to query remote system for patient and study information. It can request retrieval of images from remote AE using C-MOVE requests.

In a case of user invoking Print job PushSrv SCU uses the SOP classes of a film session, a film box and image boxes for acquiring all the information which is required for a film session. The N-ACTION is used to print the film session.

2.3 Sequencing of Real-World Activities

The DcmStor DICOM Application Entity waits for association requests by listening on a configured TCP/IP port.

3 AE Specifications

This section lists the specifications of the DcmStor DICOM Application Entity acting as Verification Service Class Provider, Storage Service Class Provider, Query/Retrieve Service Class Provider, Modality Worklist Service Class Provider, Modality Performed Procedure Step Service Class Provider, and Storage Service Class User.

3.1 DcmStor Specification

The DcmStor AE provides Standard Conformance to the following DICOM 3.0 Service Object Pair (SOP) Classes as a Service Class Provider:

Verification	1.2.840.10008.1.1
CR Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
US Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
NM Image Storage	1.2.840.10008.5.1.4.1.1.5
US Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
Radiotherapy (RT) Image Storage	1.2.840.10008.5.1.4.1.1.481.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Patient Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

3.1.1 Association Acceptance Policies

3.1.1.1 General

The UID of the DICOM Application Context Name, which is always accepted, is:

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

The maximum PDU size offered by DcmStor during the DICOM Association negotiation process is:

Maximum PDU Offered	16 Kbytes
---------------------	-----------

3.1.1.2 Number of Associations

DcmStor is able to accept concurrent associations with multiple remote DICOM devices, and is only limited by the maximum connections allowed by the operating system and TCP/IP stack on which it is running.

3.1.1.3 Asynchronous Nature

Asynchronous operations window negotiation is not supported. All operations will be performed synchronously.

3.1.1.4 Implementation Identifying Information

DcmStor will present a single Implementation Class UID and Implementation Version:

Implementation UID	1.2.826.0.1.3680043.2.39.9.6
Implementation Version	VAMSTEC SCP_141

3.1.1.5 Real-World Activity – Verify Communication (SCP)

Associated Real-World Activity

DcmStor will response to request to indicate to the calling device that DcmStor is functional and can accept further DICOM associations.

Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are accepted by DcmStor.

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Verification 1.2.840.10008.1.1	Implicit VR Little Endian	SCP	None

SOP Specific Conformance for C-ECHO

DcmStor provides standard conformance to the DICOM Verification Service Class.

3.1.1.6 Real-World Activity – Receive Images (SCP)

Associated Real-World Activity

A remote system pushes (i.e., sends) images to DcmStor AE. Upon completion of the transfer, image files are stored to database.

Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are accepted by DemStor.

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Computed Radiography Image Storage 1.2.840.10008.5.1.4.1.1.1	See table below	SCP	None
Computed Tomography Image Storage 1.2.840.10008.5.1.4.1.1.2	“	SCP	None
Ultrasound Multi-frame Image Storage 1.2.840.10008.5.1.4.1.1.3	“	SCP	None
Magnetic Resonance Image Storage 1.2.840.10008.5.1.4.1.1.4	“	SCP	None
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.5	“	SCP	None
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6	“	SCP	None
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	“	SCP	None
X-Ray Angiography Image Storage 1.2.840.10008.5.1.4.1.1.12.1	“	SCP	None
X-Ray Radiofluoroscopy Image Storage 1.2.840.10008.5.1.4.1.1.12.2	“	SCP	None
X-Ray Bi-Planar Image Storage 1.2.840.10008.5.1.4.1.1.12.3	“	SCP	None
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.20	“	SCP	None
Positron Emission Tomo. Image Storage 1.2.840.10008.5.1.4.1.1.128	“	SCP	None
Radiotherapy (RT) Image Storage 1.2.840.10008.5.1.4.1.1.481.1	“	SCP	None
Digital X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.1	“	SCP	None
Digital X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.1.1	“	SCP	None
Digital Mammography X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.2	“	SCP	None
Digital Mammography X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	“	SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.3	“	SCP	None
Digital Intra-oral X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.3.1	“	SCP	None
VL Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1	“	SCP	None

VL Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.2	“	SCP	None
VL Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4	“	SCP	None

Transfer Syntaxes accepted:

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 Lossless	1.2.840.10008.1.2.5
Jpeg Lossless Non-Hierarchical	1.2.840.10008.1.2.4.70
Jpeg Lossy Baseline 8bit	1.2.840.10008.1.2.4.50
Jpeg Lossy Extended 12bit	1.2.840.10008.1.2.4.51

SOP Specific Conformance for C-STORE

DcmStor conforms to the SOP's of the Storage Service Class at Level 2 (full). No elements are dropped or coerced. If an image instance is received that is identified by a SOP Instance UID which is already used by an Instance stored in database then the actual received image will be discarded. The existing Instance is not superseded.

When a successful C-STORE operation has completed, DcmStor will return a successful operation C-STORE Response.

If a C-STORE operation cannot be completed successfully, the C-STORE Response will contain a status code defining the reason for the failure, as well as whether the failure was transient or permanent.

The possible C-STORE Response status codes are given below:

0x0000 : Successful Operation.

0xA700 : Out of Resources. This may be due to insufficient disk space, too many current sessions, or lack of available memory. It is considered a transient error, meaning that the Remote DICOM AE should re-attempt the C-STORE event as some later time.

Presentation Context Acceptance Criterion for C-STORE

The DcmStor will accept any number of Storage Presentation Contexts per association request. Any single Abstract Syntax may be specified more than once in an association request, if the Transfer Syntaxes differ between the Presentation Contexts.

3.1.1.7 Real-World Activity – Query Issa Database(SCP)

Associated Real-World Activity

A remote system queries the Issa database to determine what studies are present on the system.

Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are accepted by DcmStor.

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Patient Root Query/Retrieve Model - FIND 1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	SCP	None

Study Root Query/Retrieve Model - FIND 1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	SCP	None
Patient/Study Root Query/Retrieve Model - FIND 1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian	SCP	None

SOP Specific Conformance for C-FIND

The DcmStor provides standard conformance to the DICOM Query/Retrieve Service Class as an SCP. All Required (R) and Unique (U) Study, Series, and Image level keys are supported for Patient Root, Study Root. In addition, certain Optional (O) keys are supported. The following tables outline the supported keys.

Patient Level Attributes

Attribute Name	Element Tag	Type
Patient Name	(0010,0010)	R
Patient ID	(0010,0020)	U
Patient Birth Date	(0010,0030)	O
Patient Sex	(0010,0040)	O

Study Level Attributes

Attribute Name	Element Tag	Type
Study Instance UID	(0020,000D)	U
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Study ID	(0020,0010)	R
Accession Number	(0008,0050)	O
Referring Physician	(0008,0090)	O

Series Level Attributes

Attribute Name	Element Tag	Type
Series Instance UID	(0020,000E)	U
Series Number	(0020,0011)	R
Modality	(0008,0060)	O

Image Level Attributes

Attribute Name	Element Tag	Type
SOP Instance UID	(0008,0018)	U
SOP Class UID	(0008,0016)	O
Image Number	(0020,0013)	O

3.1.1.8 Real-World Activity – Retrieve Images from Issa (SCP)

Associated Real-World Activity

The DcmStor will respond to retrieve requests that are sent to it by an SCU. The DcmStor will establish a new Association with the Remote AE specified in the Move Destination for the C_STORE sub-operations. The DcmStor will propose the transfer syntax used when the object was initially accepted by the server.

Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are accepted by DcmStor.

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Patient Root Query/Retrieve Model - MOVE 1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	SCP	None
Study Root Query/Retrieve Model - MOVE 1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	SCP	None
Patient/Study Root Query/Retrieve Model - MOVE 1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian	SCP	None

SOP Specific Conformance for C-MOVE

The DcmStor provides standard conformance to the DICOM Query/Retrieve Service Class as an SCP. The DcmStor will try to establish an association with the move destination specified in the Move request. One or more of the Presentation Contexts listed in the Store section of this document may be negotiated in this association.

3.1.1.9 Real-World Activity – Modality Worklist (SCP)

Associated Real-World Activity

The DcmStor will respond to Modality Worklist retrieve requests that are sent to it by an SCU. Data in Modality worklist is populated with data entered by the users on Issa FrontDesk stations or by Issa HL7 interface from HL7 ORM messages.

Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are accepted by DcmStor.

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Modality Worklist Information Model – FIND 1.2.840.10008.5.1.4.1.1.31	Implicit VR Little Endian	SCP	None

SOP Specific Conformance for C-FIND

The following table lists the Attributes that it can return in a Modality Worklist C-FIND Response. It also specifies the types of matching supported for an Attribute's value as well as whether a default or actual value is returned for an Attribute. The default value 'UNKNOWN' is used only if specific scheduling information is not available in database.

Scheduled procedure step Attributes

Attribute Name	Tag	Match	Return
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0010)	SQ	1
>Modality	(0008,0060)	SV	1
>Scheduled Station AE Title	(0040,0001)	WC	1
>Scheduled Procedure Step Sequence Start Date	(0040,0002)	DR	1
>Scheduled Procedure Step Sequence Start Time	(0040,0003)	DR	1

>Scheduled Procedure Step ID	(0040,0009)		1
>Scheduled Station Name	(0040,0010)	SV	2
>Scheduled Performing Physician's Name	(0040,0006)	WC	2
>Scheduled Procedure Step Description	(0040,0007)		1C
>Pre-Medication	(0040,0012)		2C
>Comments on Scheduled Procedure Step	(0040,0400)		3
Requested Procedure			
Requested Procedure ID	(0040,1001)		1
Requested Procedure Description	(0032,1060)		1C
Study Instance UID	(0020,000D)	SV	1
Requested Procedure Code Sequence	(0032,1064)		1C
>Code Value	(0008,0100)		
>Coding Scheme Designator	(0008,0102)		1C
>Code Meaning	(0008,0104)		3
Imaging Service Request			
Accession Number	(0008,0050)	SV	2
Referring Physician Name	(0008,0090)		2
Requesting Physician	(0032,1032)		2
Requesting Service	(0032,1033)		3
Visit Admission			
Admitting Diagnosis Description	(0008,1080)		3
Patient Identification			
Patient Name	(0010,0010)	WC	1
Patient ID	(0010,0020)	WC	1
Patient Demographic			
Patient Birth Date	(0010,0030)		2
Patient Sex	(0010,0040)		2

3.2 PushSrv Specification

The PushSrv AE provides Standard Conformance to the following DICOM 3.0 Service Object Pair (SOP) Classes as a Service Class User:

Verification	1.2.840.10008.1.1
CR Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
US Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
NM Image Storage	1.2.840.10008.5.1.4.1.1.5
US Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angio. Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
Radiotherapy (RT) Image Storage	1.2.840.10008.5.1.4.1.1.481.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1

Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Basic Grayscale Print Management Meta	1.2.840.1000.8.5.1.1.9

3.2.1 Association Establishment Policies

3.2.1.1 General

The UID of the DICOM Application Context Name, which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

The maximum PDU size offered by PushSrv during the DICOM Association negotiation process is:

Maximum PDU Offered	16 Kbytes
---------------------	-----------

3.2.1.2 Number of Associations

PushSrv currently initiates one session at a time to a remote DICOM AE for C-STORE requests and one for Print Management.

3.2.1.3 Asynchronous Nature

Asynchronous operations window negotiation is not supported. All operations will be performed synchronously.

3.2.1.4 Implementation Identifying Information

PushSrv will present a single Implementation Class UID and Implementation Version:

Implementation UID	1.2.826.0.1.3680043.2.39.9.6
Implementation Version	VAMSTEC SCP_141

3.2.1.5 Real-World Activity – Store Images (SCU)

Associated Real-World Activity

The associated Real-World activity is a C-STORE request initiated when user selects images in Issa application to send to remote DICOM device. If the process successfully establishes an association to a remote Application Entity, it will transfer each image one after another via the open association. If the C-STORE Response from the remote Application contains a status other than “Success” or “Warning”, the association is aborted.

Proposed Presentation Contexts

The PushSrv application will propose one of Presentation Contexts as shown in the following table:

Presentation Context Table – Proposed

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Computed Radiography Image Storage 1.2.840.10008.5.1.4.1.1.1	See Above Table	SCU	None
Computed Tomography Image Storage 1.2.840.10008.5.1.4.1.1.2	“	SCU	None
Ultrasound Multi-frame Image Storage 1.2.840.10008.5.1.4.1.1.3	“	SCU	None
Magnetic Resonance Image Storage 1.2.840.10008.5.1.4.1.1.4	“	SCU	None
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.5	“	SCU	None
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6	“	SCU	None
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	“	SCU	None
X-Ray Angiography Image Storage 1.2.840.10008.5.1.4.1.1.12.1	“	SCU	None
X-Ray Radiofluoroscopy Image Storage 1.2.840.10008.5.1.4.1.1.12.2	“	SCU	None
X-Ray Bi-Planar Image Storage 1.2.840.10008.5.1.4.1.1.12.3	“	SCU	None
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.20	“	SCU	None
Positron Emission Tomo. Image Storage 1.2.840.10008.5.1.4.1.1.128	“	SCU	None
Radiotherapy (RT) Image Storage 1.2.840.10008.5.1.4.1.1.481.1	“	SCU	None
Digital X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.1	“	SCU	None
Digital X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.1.1	“	SCU	None
Digital Mammography X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.2	“	SCU	None
Digital Mammography X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	“	SCU	None
Digital Intra-oral X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.3	“	SCU	None
Digital Intra-oral X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.3.1	“	SCU	None

VL Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1	“	SCU	None
VL Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.2	“	SCU	None
VL Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4	“	SCU	None

Transfer Syntax:

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 Lossless	1.2.840.10008.1.2.5
Jpeg Lossless Non-Hierarchical	1.2.840.10008.1.2.4.70
Jpeg Lossy Baseline 8bit	1.2.840.10008.1.2.4.50
Jpeg Lossy Extended 12bit	1.2.840.10008.1.2.4.51

The proposed presentation context used to send image is the same as the presentation context under which image was received and stored in database. Images that are in a database but are not received through DICOM connection will be sent using Secondary Capture - Explicit Little Endian presentation context, with demographic data generated based on data available in database.

SOP Specific Conformance for C-STORE

PushSrv conforms to the SOP's of the Storage Service Class at Level 2 (full). No elements are dropped or coerced. The PushSrv will not change private attributes during the send operation. Private attributes can be modified in Issa application. Upon a image change request all private attributes not recognized within the application will be removed when the new object instance is created.

3.2.1.6 Real-World Activity – Printing (SCU)

Associated Real-World Activity

The user selects the desired images and then select Print to Dicom printer in menu. After selection of printer and output format he or she clicks on Print button.

Proposed Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Basic Grayscale Print Management Meta 1.2.840.1000.8.5.1.1.9	Implicit VR Little Endian	SCU	None

SOP Specific Conformance for Printing

The PushSrv provides standard conformance to the DICOM Print Service Classes by supporting a number of distinct Service Classes described in the following subsections.

SOP Class Name SOP Class	UID
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Printer	1.2.840.10008.5.1.1.16

SOP Specific Conformance for Basic Film Session

PushSrv includes the following N-Create attributes for the Basic Film Session SOP class:

Attribute Name	Tag
Number of Copies	(2000,0010)
Print Priority	(2000,0020)
Medium Type	(2000,0030)
Film Destination	(2000,0040)
Film Session Label	(2000,0050)

N-Set and N-Action are not used; however, N-Delete is used to delete the complete Basic Film Session SOP instance hierarchy.

SOP Specific Conformance for Basic Film Box

PushSrv includes the following N-Create attributes for the Basic Film Box SOP class:

Attribute Name	Tag
Image Display Format	(2010,0010)
Referenced Film Session Sequence	(2010,0500)
> Referenced SOP Class UID	(0008,1150)
> Referenced SOP Instance UID	(0008,1155)
Film Orientation	(2010,0040)
Film Size ID	(2010,0050)
Magnification Type	(2010,0060)
Border Density	(2010,0100)
Empty Image Density	(2010,0110)
Trim	(2010,0140)

The N-Set is currently unused; however, the N-Action is used to print a complete Basic Film Box SOP instance and N-Delete is used to delete it after printing.

SOP Specific Conformance for Basic Grayscale Image Box

PushSrv includes the following N-Set attributes for the Basic Grayscale Image SOP class:

Attribute Name	Tag
Image Position	(2020,0010)
Preformatted Grayscale Image Sequence	(2020,0110)
> Samples Per Pixel	(0028,0002)
> Photometric Interpretation	(0028,0004)
> Rows	(0028,0010)
> Columns	(0028,0011)
> Pixel Aspect Ratio	(0028,0034)
> Bits Allocated	(0028,0100)
> Bits Stored	(0028,0101)
> High Bit	(0028,0102)
> Pixel Representation	(0028,0103)
> Pixel Data	(7FE0,0010)

Please note that PushSrv only supports 8-bit printing.

SOP Specific Conformance for Printer

PushSrv uses N-GET for the Printer SOP class to get information from the SCP.

3.2.1.7 Real-World Activity – Query Images (SCU)

Associated Real-World Activity

The user opens Query dialog in Issa, enter the partial values for search criteria and click on Query button.

Proposed Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Study Root Query/Retrieve Model - FIND 1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	SCU	None

SOP Specific Conformance for C-FIND

PushSrv supports C-Find response values as defined in DICOM v.3.0 Part 4. All Required (R) and Unique (U) Study, Series, and Image level keys are supported for Patient Root, Study Root, and Patient/Study Only Query/Retrieve information models. In addition, certain

Optional (O) keys are supported. Keys supported in Study Root retrieve:

Attribute Name	Element Tag	Type
Patient ID	(0010,0020)	U
Patient Name	(0010,0010)	R
Patient Birth Date	(0010,0030)	O
Patient Sex	(0010,0040)	O
Study ID	(0020,0010)	R
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	O
Study Instance UID	(0020,000D)	U
Series Instance UID	(0020,000E)	U
Series Number	(0020,0011)	R
Modality	(0008,0060)	R
Image SOP Instance UID	(0008,0018)	U
Image Number	(0020,0013)	R

3.2.1.8 Real-World Activity – Retrieve Images (SCU)

Associated Real-World Activity

The user selects one or more studies from the list in the Query dialog, then clicks Retrieve.

Proposed Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Extended Negotiation
Study Root Query/Retrieve Model - MOVE 1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	SCU	None

SOP Specific Conformance for C-FIND

PushSrv provides standard conformance.

3.3 Media Interchange

Issa application conforms to DICOM Media Storage Service and File Format (PS 3.10) and the Media Storage Application Profiles (PS 3.11). Support for a particular Application Profile and role is dependent upon the type of removable media hardware with which the system is equipped.

The following application profiles are supported by Issa:

Application Profile	Real World Activity	FSR	FSC	FSU
STD-GEN-CD	General Purpose CD-R Interchange	Yes	Yes	No
STD-US-ID-SF-CDR	Ultrasound Image Display Media Interchange	Yes	Yes	No
STD-US-ID-MF- CDR	Ultrasound Image and Multi-frame Image Display Media Interchange	Yes	Yes	No
STD-XABC-CD	Basic Cardiac X-Ray Angiographic Studies on CD-R Media	Yes	Yes	No
STD-XA1K-CD	1024 X-Ray Angiographic Studies on CD-R Media	Yes	Yes	No
STD-CTMR-CD	CT/MR Studies on CD-R	Yes	Yes	No

Issa through its supported application profile (above), supports the real world activities listed below.

Real World Activity	Role	SC Option
Display Directory of CD-R disk	FSR	Interchange
Read Image(s) from CD-R disk	FSR	Interchange
Create CD-R disk of images	FSC	Interchange

3.3.1 Real World Activity: Display Directory of CD-R Disk

Issa assumes the role of FSR when reading the CD-R disk directory. Reading this directory will display an overview of the patients, studies, series and images, organized in groups of information, selectable by the user.

3.3.2 Real World Activity: Read Images from CD-R Disk

When reading images from a CD-R, Issa will assume the role of FSR. DICOM Part 10 Volume image import is standard.

Issa can only import and read images from the following SOP classes:

CR Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
US Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
NM Image Storage	1.2.840.10008.5.1.4.1.1.5
US Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3

Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
Radiotherapy (RT) Image Storage	1.2.840.10008.5.1.4.1.1.481.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4

The following transfer syntaxes are supported by Issa when importing and reading CD-R images:

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 Lossless	1.2.840.10008.1.2.5
Jpeg Lossless Non-Hierarchical	1.2.840.10008.1.2.4.70
Jpeg Lossy Baseline 8bit	1.2.840.10008.1.2.4.50
Jpeg Lossy Extended 12bit	1.2.840.10008.1.2.4.51

3.3.3 Real World Activity: Write Images

The user call option Write Dicom CD from menu and then selects and add one or more study to list of studies. DICOM CD media will be create after the click on Write CD button.

Issa assumes the role of FSC when writing the CD-R disk.

4 Communication Profiles

4.1 Supported Communication Stacks

DcmStor provides DICOM 3.0 TCP/IP Network Communication Support as defined in Part 8 of the Standard.

4.2 Section 4.2: TCP/IP Stack

DcmStor inherits the TCP/IP stack from the operating system on which it is running. WinSock or other private TCP/IP stacks are inherited in the Windows environment.

4.2.1 Physical Media Support

DcmStor is indifferent to the physical medium over which TCP/IP executes.

5 Extensions

5.1 *Standard Extended/Specialized Private SOPs*

Not Applicable

6 Configuration

6.1 Configurable Parameters

DcmStor is configurable. The configuration dialog within the Dicom Server Monitor application cover configuration of port and storage directory. Accepted LocalAE and RemoteAE are configured in dicom.cfg file.

PushSrv is configured from Issa application. It is possible to configure remote device host name/IP address, port, LocalAE and RemoteAE.

6.1.1 Port Configuration Parameters

By default, a port is defined on port number 104. User can change default port to any other in Dicom Server Monitor application.

The total number of concurrent connections is a function of the Windows version on which DcmStor is running.

6.1.2 Storage parameters

The user can configure the destination to which incoming files are to be stored. The destination can be to the local disk, or other removable or fixed devices connected to the machine on which DcmStor is running. It is also possible to designate any other reachable device on the Local Area Network (LAN) connected to the computer.

DcmStor will store incoming files with the DICOM Part 10 Meta Header.

7 Section 7 - Extended Character Sets

DcmStor does not support extended character sets.