

DICOM Camera

DICOM Conformance Statement

Version 2.3.0



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1 CONFORMANCE STATEMENT OVERVIEW

The DICOM Camera system implements the necessary DICOM services to download work lists from an information system and save acquired photographic images to one or two network storage devices.

Table 1-1 provides an overview of the network services supported by the DICOM Camera.

**Table 1-1
NETWORK SERVICES**

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
VL Photographic Image Storage	Yes	No
Secondary Capture Image Storage	Yes	No
Video Photographic Image Storage	Yes	No
Workflow Management		
Modality Worklist Information Model - Find	Yes	No

The SOP Classes are categorized as shown in Table 1-2.

**Table 1-2
UID VALUES**

UID Value	UID Name	Category
1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.77.1.4.1	Video Photographic Image Storage	Transfer
1.2.840.10008.5.1.4.31	Modality Worklist Information Model - Find	Workflow Management

2 INTRODUCTION

2.1 Audience

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

2.2 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between the DICOM Camera 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.
- This DICOM conformance statement is valid for the two models of DICOM Camera, *DICOM Camera Std* and *DICOM Camera Pro*.

2.3 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

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.

Application Entity Title (AET) – The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context – The specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association – A network communication channel set up between Application Entities.

Attribute – A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

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.

Joint Photographic Experts Group (JPEG) – A set of standardized image compression techniques, available for use by DICOM applications.

Module – A set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU) – A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

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)

Service/Object Pair Class (SOP Class) – 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.

Service/Object Pair Instance (SOP Instance) – An information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag – A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

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.

Value Representation (VR) – The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

2.4 Basics of 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.

2.5 Abbreviations

AE	Application Entity
AET	Application Entity Title
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
HIS	Hospital Information System
HL7	Health Level 7 Standard
IOD	Information Object Definition
IPv4	Internet Protocol version 4
JPEG	Joint Photographic Experts Group
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
R	Required (Key Attribute)
RIS	Radiology Information System.
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
VL	Visible Light

VR Value Representation

2.6 References

- [DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.20, 2011, available free at <http://medical.nema.org/standard.html>
- User's Manual DICOM Camera
- Installation Manual DICOM Camera

3 NETWORKING

This section contains the networking related services of the DICOM Camera.

3.1 Implementation Model

The Implementation model consists of three sections: the Application Data Flow Diagram, specifying the relationship between the Application Entities and the "external world" or Real-World activities, a functional description of each Application Entity, and the sequencing constraints among them.

3.1.1 Application Data Flow

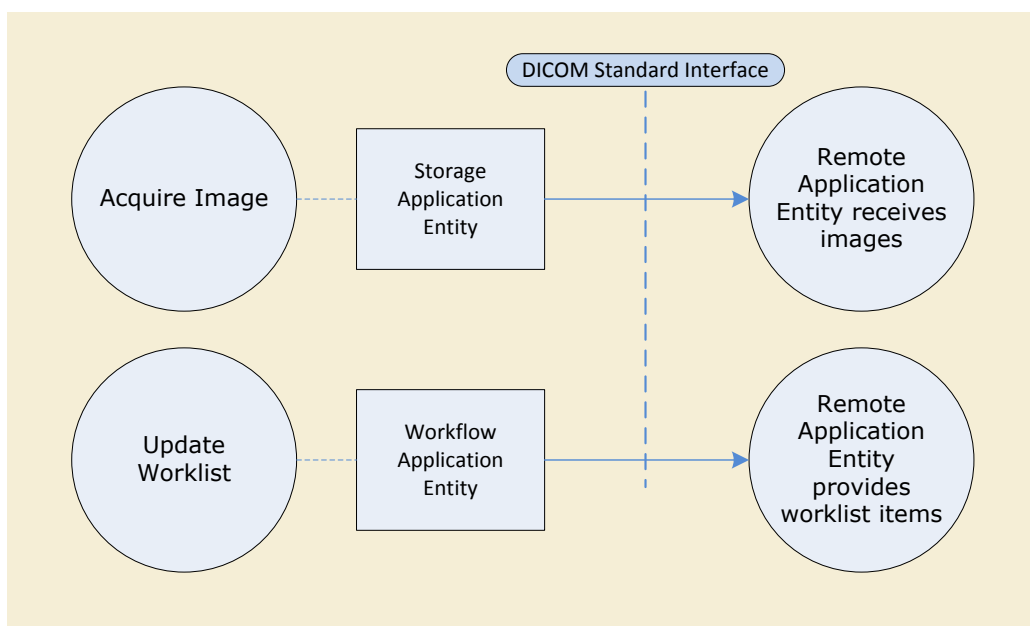


Figure 3-1
Application Data Flow Diagram

- The Storage Application Entity sends images (or videos) to a remote AE. It is associated with the local real-world activity "Acquire Image". "Acquire Image" is performed upon user pressing DICOM Camera capture button. Images are immediately stored to the configured destination. If a secondary destination is configured, images will be sent to both destinations. If the remote AE is not available, the images will be cached until the remote AE is available again.
- The Workflow Application Entity receives Worklist information from a remote AE. It is associated with the local real-world activities "Update Worklist". When the "Update Worklist" local real-world activity is performed the Workflow Application Entity queries a remote AE for worklist items and provides the set of worklist items matching the query request. "Update Worklist" is performed as a result of an operator request or can be performed automatically when the operator opens the worklist screen on the DICOM camera.

3.1.2 Functional Definition of AEs

3.1.2.1 Functional Definition of Storage Application Entity

The existence of a send-job queue entry with associated network destination will activate the Storage AE. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the image transfer is started. If the association cannot be opened, the related send-job is set to an error state and can be restarted by the administrator via the DICOM queue interface. By default, the Storage AE will perform an automatic retry 5 times after 1 minute each.

3.1.2.2 Functional Definition of Workflow Application Entity

Worklist Update attempts to download a Worklist from a remote node. If the Workflow AE establishes an Association to a remote AE, it will transfer all worklist items via the open Association. The results will be displayed on the DICOM camera's worklist screen and will be replaced with the next Worklist Update.

3.1.3 Sequencing of Real-World Activities

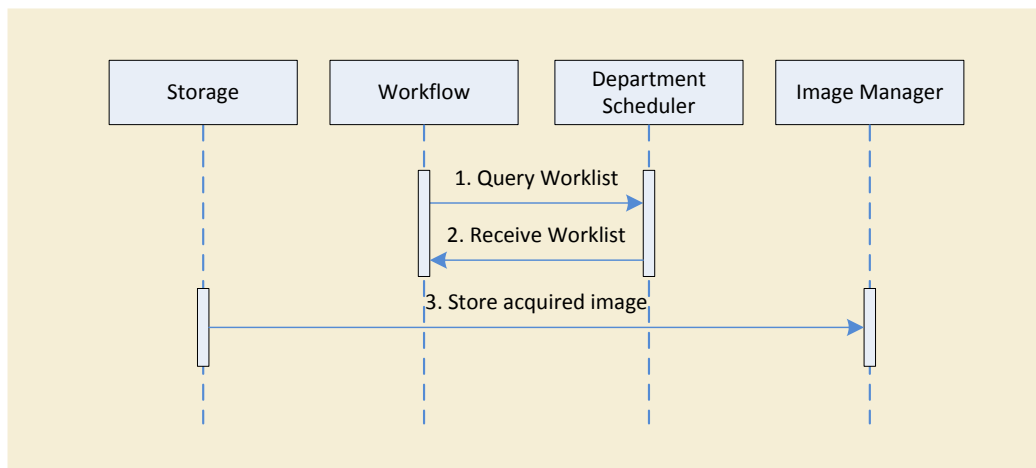


Figure 3-2
Sequencing Constraints

Under normal scheduled workflow conditions the sequencing constraints illustrated in Figure 3-2 apply:

1. Query Worklist
2. Receive Worklist
3. Acquire and store Images

Other workflow situations (e.g., unscheduled patient) will have other sequencing constraints.

3.2 AE Specifications

3.2.1 Storage Application Entity Specification

3.2.1.1 SOP Classes

The DICOM Camera provides Standard Conformance to the following SOP Classes:

**Table 3-1
SOP CLASSES FOR AE STORAGE**

SOP Class Name	SOP Class UID	SCU	SCP
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

3.2.1.2 Association Policies

3.2.1.2.1 General

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

**Table 3-2
DICOM APPLICATION CONTEXT FOR AE STORAGE**

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

3.2.1.2.2 Number of Associations

The DICOM Camera initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Only one job will be active at a time, the other(s) remain pending until the active job is completed or failed.

**Table 3-3
NUMBER OF ASSOCIATIONS INITIATED FOR AE STORAGE**

Maximum number of simultaneous Associations	1
---	---

3.2.1.2.3 Asynchronous Nature

The DICOM Camera does not support asynchronous communication (multiple outstanding transactions over a single Association).

**Table 3-4
ASYNCHRONOUS NATURE AS A SCU FOR AE STORAGE**

Maximum number of outstanding asynchronous transactions	1
---	---

3.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

**Table 3-5
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE STORAGE**

Implementation Class UID	2.16.840.1.113669.632.14.4.9.<version>
Implementation Version Name	DC_<version>

where <version> is in the form 1.1.5.0.1234

3.2.1.3 Association Initiation Policy

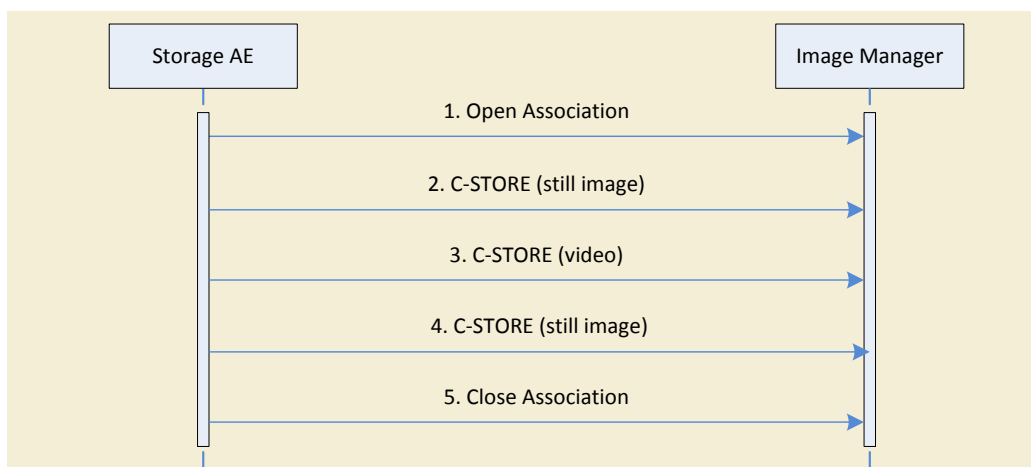
3.2.1.3.1 Activity – Send Images

3.2.1.3.1.1 Description and Sequencing of Activities

A user can select images and request them to be sent to multiple destinations (up to 2). Each request is forwarded to the job queue and processed individually. When the "Image Gallery" option is active, only selected images are sent after selection, otherwise each image is sent immediately.

The Storage AE is invoked by the DICOM Camera Server Service which is responsible for processing network archival tasks. If the service successfully establishes an Association to a remote Application Entity, it will transfer each marked instance one after another via the open Association. Status of the transfer is reported through the DICOM Camera Server GUI. Only one job will be active at a time. If the C-STORE Response from the remote Application contains a status other than Success or Warning, the Association is aborted and the related Job is switched to a failed state after 5 retries. It can be restarted any time by user interaction.

The Storage AE attempts to initiate a new Association in order to issue a C-STORE request. If the job contains multiple images then multiple C-STORE requests will be issued over the same Association.



**Figure 3-3
Sequencing of Activity – Send Images**

A possible sequence of interactions between the Storage AE and an Image Manager (e.g., a storage or archive device supporting the Storage SOP Class as an SCP) is illustrated in Figure 3-3:

1. The Storage AE opens an association with the Image Manager
2. An acquired photo is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).

3. A video is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
4. Another photo is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
5. The Storage AE closes the association with the Image Manager.

Note

Many other message sequences are possible depending on the number of images and videos to be stored.

3.2.1.3.1.2 Proposed Presentation Contexts

The DICOM Camera is capable of proposing the Presentation Contexts shown in the following table:

**Table 3-6
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY SEND IMAGES**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	E.N.
Name	UID	Name List	UID List		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		JPEG Baseline	1.2.840.10008.1.2.4.50		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		JPEG Baseline	1.2.840.10008.1.2.4.50		
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCU	None

Presentation Contexts for each SOP class will only be proposed if the Send Job contains instances for these SOP Classes.

3.2.1.3.1.3 SOP Specific Conformance for Image Storage SOP Classes

All Image Storage SOP Classes supported by the Storage AE exhibit the same behavior and are described together in this section. The behavior of Storage AE when encountering status codes in a C-STORE response is summarized in the Table below:

**Table 3-7
STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the SOP Instance.
Refused	Out of Resources	A700-A7FF	The Association is aborted using A-ABORT and the send job is marked as failed. This is a transient failure.
Error	Data Set does not match SOP Class	A900-A9FF	The Association is aborted using A-ABORT and the send job is marked as failed.
Error	Cannot Understand	C000-CFFF	The Association is aborted using A-ABORT

			and the send job is marked as failed.
--	--	--	---------------------------------------

The behavior of Storage AE during communication failure is summarized in the Table below:

**Table 3-8
STORAGE COMMUNICATION FAILURE BEHAVIOR**

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the send job is marked as failed.
Association aborted by the SCP or network layers	The send job is marked as failed.

A failed send job can be restarted by user interaction.

3.2.2 Workflow Application Entity Specification

3.2.2.1 SOP Classes

The DICOM Camera provides Standard Conformance to the following SOP Classes:

**Table 3-9
SOP CLASSES FOR AE WORKFLOW**

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

3.2.2.2 Association Policies

3.2.2.2.1 General

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

**Table 3-10
DICOM APPLICATION CONTEXT FOR AE STORAGE**

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

3.2.2.2.2 Number of Associations

The DICOM Camera initiates one Association at a time for a worklist request.

**Table 3-11
NUMBER OF ASSOCIATIONS INITIATED FOR AE STORAGE**

Maximum number of simultaneous Associations	1
---	---

3.2.2.2.3 Asynchronous Nature

The DICOM Camera does not support asynchronous communication (multiple outstanding transactions over a single Association).

**Table 3-12
ASYNCHRONOUS NATURE AS A SCU FOR AE STORAGE**

Maximum number of outstanding asynchronous transactions	1
---	---

3.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 3-13
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE STORAGE

Implementation Class UID	2.16.840.1.113669.632.14.4.9.<version>
Implementation Version Name	DC_<version>

where <version> is in the form 1.1.5.0.1234

3.2.2.3 Association Initiation Policy

3.2.2.3.1 Activity – Worklist Update

3.2.2.3.1.1 Description and Sequencing of Activities

The request for a Worklist Update is initiated by user interaction, i.e., dragging the worklist screen down, or automatically when switching to the worklist screen.

With worklist queries the DICOM Camera always requests all items for a Scheduled Procedure Step Start Date (actual date), Modality (XL) and Scheduled Station AE Title. Query for the Scheduled Station AE Title is configurable by the administrator.

Upon initiation of the request, the DICOM Camera will build an Identifier for the C-FIND request, will initiate an Association to send the request and will wait for Worklist responses. The results will be displayed in the worklist screen, which will be cleared with the next worklist update.

DICOM Camera will initiate an Association in order to issue a C-FIND request according to the Modality Worklist Information Model.

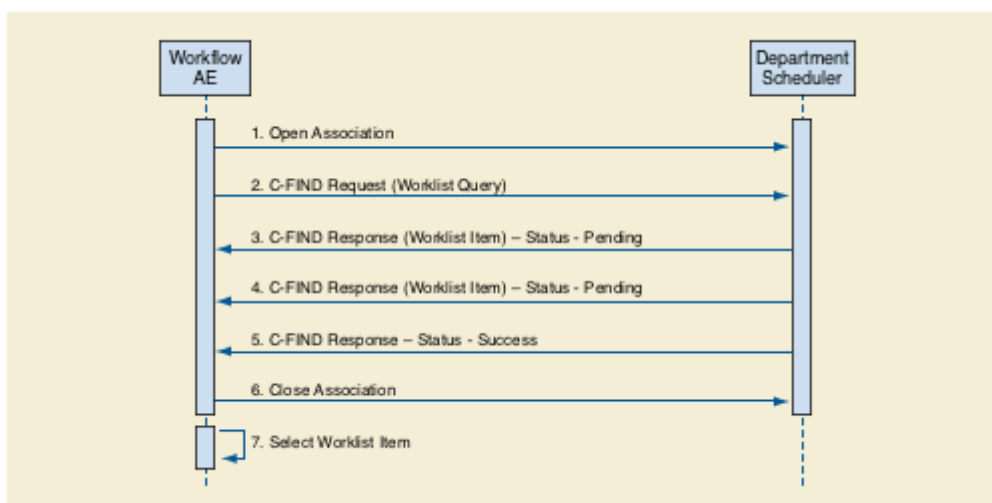


Figure 3-4
Sequencing of Activity – Worklist Update

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler (e.g., a device such as a RIS or HIS that supports the Modality Worklist SOP Class as an SCP) is illustrated in Figure 3-4:

1. The Worklist AE opens an association with the Departmental Scheduler
2. The Worklist AE sends a C-FIND request to the Departmental Scheduler containing the Worklist Query attributes.
3. The Departmental Scheduler returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
4. The Departmental Scheduler returns another C-FIND response containing the requested attributes of the second matching Worklist Item.
5. The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 2 Worklist items match the Worklist Query.
6. The Worklist AE closes the association with the Departmental Scheduler.
7. The user selects a Worklist Item from the Worklist and prepares to acquire new images.

3.2.2.3.1.2 Proposed Presentation Contexts

The DICOM Camera will propose the Presentation Contexts shown in the following table:

**Table 3-14
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY WORKLIST UPDATE**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	E.N.
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Bit Endian	1.2.840.10008.1.2.2		

Presentation Contexts for each SOP class will only be proposed if the Send Job contains instances for these SOP Classes.

3.2.2.3.1.3 SOP Specific Conformance Image for Modality Worklist

The behavior of DICOM Camera when encountering status codes in a Modality Worklist C-FIND response is summarized in the Table below. If any other SCP response status than "Success" or "Pending" is received by DICOM Camera, an error icon will be displayed on the screen of the DICOM Camera.

**Table 3-15
STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the matches. Worklist items are available for display or further processing.
Refused	Out of Resources	A700	The Association is aborted using A-ABORT and the worklist query is marked as failed.

Failed	Identifier does not match SOP Class	A900	The Association is aborted using A-ABORT and the worklist query is marked as failed.
Failed	Unable to Process	C000-CFFF	The Association is aborted using A-ABORT and the worklist query is marked as failed.
Pending	Matches are continuing	FF00	The worklist item contained in the Identifier is collected for later display or further processing.
Pending	Matches are continuing - Warning that one or more Optional Keys were not supported	FF01	The worklist item contained in the Identifier is collected for later display or further processing.
*	*	Any other status code	The Association is aborted using A-ABORT and the worklist is marked as failed.

The behavior of CICOM Camera during communication failure is summarized in the Table below:

**Table 3-16
STORAGE COMMUNICATION FAILURE BEHAVIOR**

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the worklist query is marked as failed.
Association aborted by the SCP or network layers	The worklist query is marked as failed.

Acquired images will always use the Study Instance UID specified for the Scheduled Procedure Step (if available). If an acquisition is unscheduled, a Study Instance UID will be generated locally.

The Table below provides a description of the DICOM Camera Worklist Request Identifier and specifies the attributes that are copied into the images. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made it filter out possible duplicate entries.

**Table 3-17
WORKLIST REQUEST IDENTIFIER**

Module Name Attribute Name	Tag	VR	M	R	C	D	IOD
SOP Common							
Specific Character Set	(0008,0005)	CS		x			
Scheduled Procedure Step							
Scheduled Procedure Step Sequence	(0040,0100)						
>Scheduled Station AET	(0040,0001)	AE	S		x		
>Scheduled Procedure Step Start Date	(0040,0002)	DA	R	x		x	

Module Name Attribute Name	Tag	VR	M	R	C	D	IOD
>Scheduled Procedure Step Start Time	(0040,0003)	TM		x		x	
>Modality	(0008,0060)	CS	S	x	x		x
>Scheduled Performing Physician's Name	(0040,0006)	PN		x		x	x
>Scheduled Procedure Step Description	(0040,0007)	LO		x		x	x
>Scheduled Station Name	(0040,0010)	SH		x			
Requested Procedure							
Requested Procedure ID	(0040,1001)	SH		x		x	x
Reason For The Requested Procedure	(0040,1002)	LO		x		x	x
Requested Procedure Description	(0032,1060)	LO		x		x	x
Study Instance UID	(0020,000D)	UI		x			x
Imaging Service Request							
Accession Number	(0008,0050)	SH		x		x	x
Referring Physician's Name	(0008,0090)	PN		x		x	x
Study Description	(0008,1030)	LO		x		x	x
Visit Identification							
Admission ID	(0038,0010)	LO		x		x	x
Visit Status							
Current Patient Location	(0038,0300)	LO		x			x
Patient Identification							
Patient Name	(0010,0010)	PN		x		x	x
Patient ID	(0010,0020)	LO		x		x	x
Patient Demographic							
Patient's Birth Date	(0010,0030)	DA		x		x	x
Patient's Sex	(0010,0040)	CS		x		x	x

The above table should be read as follows:

Module Name The name of the associated module for supported worklist attributes.

Attribute Name Attributes supported to build an DICOM Camera Worklist Request Identifier.

Tag DICOM tag for this attribute.

VR DICOM VR for this attribute.

- M** Matching keys for Worklist Update. A "S" will indicate that the DICOM Camera will supply an attribute value for Single Value Matching.
- R** Return keys. An "x" will indicate that the DICOM Camera will supply this attribute as Return Key with zero length for Universal Matching.
- C** Configurable Query Key. An "x" " " will indicate that the DICOM Camera will supply this attribute as matching key, if a value given in the configuration.
- D** Displayed keys. An "x" indicates that this worklist attribute is displayed to the user during a patient registration dialog. For example, Patient Name will be displayed when registering the patient prior to an examination.
- IOD** An "x" indicates that this Worklist attribute is included into all Object Instances created during image acquisition.

The default Query Configuration is set to "Modality" (XL) and "Date" (date of today). Optionally, additional matching for the Scheduled Station AET is configurable.

3.3 Network Interface

3.3.1 Physical network interface

The DICOM Camera communicates via Wi-Fi network with the DICOM Camera Server. DHCP can be used to obtain TCP/IP network configuration information. Only IPv4 connections are supported.

WPA2 Personal as well as WPA2 Enterprise (802.1.x) are supported. The DICOM Camera Server must be connected via Wi-Fi to the DICOM Camera and via LAN to the Worklist and Storage serves.

3.4 Configuration

The configuration of the Cameras only requires connection to Wi-Fi and entering the TCP/IP address of the DICOM Camera Server.

All remaining configuration for an arbitrary number of DICOM Cameras is done at the DICOM Camera Server.

4 SUPPORT OF CHARACTER SETS

DICOM Camera supports only ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set).

5 SECURITY

All communication between the DICOM Camera and the DICOM Camera Server via Wi-Fi is encrypted.

Encrypted DICOM communication according to Supplement 31 is not supported.

6 ANNEXES

6.1 IOD Contents

6.1.1 Created SOP Instances

Examples of DICOM Camera images and videos can be downloaded from:

<https://www.meso.biz/package/dicom-camera-sample-images/>

Table B.8.1-1 specifies the attributes of a VL Photographic Image transmitted by the DICOM Camera.

Table B.8.1-1 specifies the attributes of a Secondary Capture Image transmitted by the DICOM Camera.

Table B.8.1-1 specifies the attributes of a Video Photographic Image transmitted by the DICOM Camera.

The following tables use a number of abbreviations. The abbreviations used in the "Presence of ..." column are:

VNAP Value Not Always Present (attribute sent zero length if no value is present)

ANAP Attribute Not Always Present

ALWAYS Always Present

EMPTY Attribute is sent without a value

The abbreviations used in the "Source" column:

MWL the attribute value source Modality Worklist

USER the attribute value source is from User input

AUTO the attribute value is generated automatically

CONFIG the attribute value source is a configurable parameter

Note

All dates and times are encoded in the local configured calendar and time. Date, Time and Time zone are configured using the Service/Installation Tool.

6.1.1.1 VL Photographic Image IOD

**Table 6-1
IOD OF CREATED VL PHOTOGRAPHIC SOP INSTANCES**

IE	Module	Reference	Presence of Module
Patient	Patient	Table 6-4	ALWAYS
Study	General Study	Table 6-5	ALWAYS
Series	General Series	Table 6-6	ALWAYS
Equipment	General Equipment	Table 6-7	ALWAYS
Image	General Image	Table 6-9	ALWAYS
	Image Pixel	Table 6-10	ALWAYS
	SOP Common	Table 6-15	ALWAYS

6.1.1.2 Secondary Capture Image IOD

**Table 6-2
IOD OF CREATED SECONDARY CAPTURE SOP INSTANCES**

IE	Module	Reference	Presence of Module
Patient	Patient	Table 6-4	ALWAYS
Study	General Study	Table 6-5	ALWAYS
Series	General Series	Table 6-6	ALWAYS
Equipment	General Equipment	Table 6-7	ALWAYS
	SC Equipment	Table 6-8	ALWAYS
Image	General Image	Table 6-9	ALWAYS
	Image Pixel	Table 6-10	ALWAYS
	SOP Common	Table 6-14	ALWAYS

6.1.1.3 Video Photographic Image IOD

**Table 6-3
IOD OF CREATED VIDEO PHOTOGRAPHIC SOP INSTANCES**

IE	Module	Reference	Presence of Module
Patient	Patient	Table 6-4	ALWAYS
Study	General Study	Table 6-5	ALWAYS
Series	General Series	Table 6-6	ALWAYS

IE	Module	Reference	Presence of Module
Equipment	General Equipment	Table 6-7	ALWAYS
Image	General Image	Table 6-9	ALWAYS
	Cine	Table 6-12	ALWAYS
	Multi-frame	Table 6-13	ALWAYS
	Image Pixel	Table 6-11	ALWAYS
	SOP Common	Table 6-16	ALWAYS

6.1.1.4 Common Modules

**Table 6-4
PATIENT MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	From Modality Worklist or user input. Values supplied via Modality Worklist will be entered as received. Values supplied via user input will contain Last Name and First Name. Maximum 64 characters.	VNAP	MWL/USER
Patient ID	(0010,0020)	LO	From Modality Worklist or user input. Maximum 64 characters.	VNAP	MWL/USER
Patient's Birth Date	(0010,0030)	DA	From Modality Worklist or user input	ANAP	MWL/USER
Patient's Sex	(0010,0040)	CS	From Modality Worklist or user input	VNAP	MWL/USER
Current Patient Location	(0038,0300)	LO	From Modality Worklist	ANAP	MWL

**Table 6-5
GENERAL STUDY MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	From Modality Worklist or generated by device	ALWAYS	MWL/AUTO
Study Date	(0008,0020)	DA	<yyyymmdd>	ALWAYS	AUTO
Study Time	(0008,0030)	TM	<hhmmss>	ALWAYS	AUTO
Referring Physician's Name	(0008,0090)	PN	From Modality Worklist	VNAP	MWL
Study ID	(0020,0010)	SH	Requested Procedure ID from Worklist	VNAP	MWL
Accession Number	(0008,0050)	SH	From Modality Worklist or user input	VNAP	MWL/USER

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Description	(0008,1030)	LO	Requested Procedure Description from Worklist or user input	VNAP	USER
Admission ID	(0038,0010)	LO	From Modality Worklist or user input	VNAP	MWL/USER
Reason for the Requested Procedure	(0040,1002)	LO	From Modality Worklist	ANAP	MWL

**Table 6-6
GENERAL SERIES MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	From Worklist or Configuration	ALWAYS	MWL/ CONFIG
Series Instance UID	(0020,000E)	UI	Generated by device	ALWAYS	AUTO
Series Number	(0020,0011)	IS	A number unique within the Study	ALWAYS	AUTO
Series Date	(0008,0021)	DA	<yyyymmdd>	ALWAYS	AUTO
Series Time	(0008,0031)	TM	<hhmmss>	ALWAYS	AUTO
Performing Physician's Name	(0008,1050)	PN	from DICOM Camera Physician selection. Maximum 64 characters.	ANAP	USER/ CONFIG
Series Description	(0008,103E)	LO	Scheduled Procedure Step Description from Worklist	VNAP	MWL
Operator's Name	(0008,1070)	PN	from DICOM Camera Login. Maximum 64 characters.	ANAP	USER/ CONFIG

**Table 6-7
GENERAL EQUIPMENT MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	MESO	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	From Configuration	ANAP	CONFIG
Institution Address	(0008,0081)	LO	From Configuration	ANAP	CONFIG
Station Name	(0008,1010)	SH	From Configuration	ALWAYS	CONFIG
Institutional Department Name	(0008,1040)	LO	From Configuration	ANAP	CONFIG
Manufacturer's Model Name	(0008,1090)	LO	DICOM Camera	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	From DICOM Camera hardware	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Device ID	(0018,1003)	LO			
Software Version	(0018,1020)	LO	From DICOM Camera Model and Version	ALWAYS	CONFIG

**Table 6-8
SC EQUIPMENT MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Conversion Type	(0008,0064)	CS	DI	ALWAYS	AUTO

**Table 6-9
GENERAL IMAGE MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	incremented for each image in series	ALWAYS	AUTO
Image Type	(0008,0008)	CS	ORIGINAL\PRIMARY	ALWAYS	AUTO
Content Date	(0008,0023)	DA	<yyyymmdd>	ALWAYS	AUTO
Content Time	(0008,0033)	TM	<hhmmss>	ALWAYS	AUTO
Samples per Pixel	(0028,0002)	US	8	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	0	ALWAYS	AUTO
Rows	(0028,0010)	US	Image width in pixels	ALWAYS	AUTO
Columns	(0028,0011)	US	Image height in pixels	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO

**Table 6-10
IMAGE PIXEL MODULE OF CREATED SOP INSTANCES (SC AND VL)**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Lossy Image Compression	(0028,2110)	CS	01	ALWAYS	AUTO
Lossy Image Compression Method	(0028,2114)	CS	ISO_10918_1	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Photometric Interpretation	(0028,0004)	CS	YBR_FULL_422	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB		ALWAYS	AUTO

**Table 6-11
IMAGE PIXEL MODULE OF CREATED SOP INSTANCES (VIDEO PHOTOGRAPHIC)**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Lossy Image Compression	(0028,2110)	CS	01	ALWAYS	AUTO
Lossy Image Compression Method	(0028,2114)	CS	ISO_14496_10	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	YBR_PARTIAL_420	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB		ALWAYS	AUTO

**Table 6-12
CINE MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Frame Time	(0018,1063)	DS	Frame time in milliseconds	ALWAYS	AUTO
Cine Rate	(0018,0040)	IS	Display frame rate corresponding to Frame Time (0018,1063) value, in frames per second	ALWAYS	AUTO

**Table 6-13
MULTI-FRAME MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Frames	(0028,0008)	IS	Frame time in milliseconds	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	0x00181063: Frame Time only	ALWAYS	AUTO

**Table 6-14
SOP COMMON MODULE OF CREATED SC SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.7	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by DICOM Camera	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 100		

**Table 6-15
SOP COMMON MODULE OF CREATED VL PHOTOGRAPHIC SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.77.1.4	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by DICOM Camera	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 100		

**Table 6-16
SOP COMMON MODULE OF CREATED VIDEO PHOTOGRAPHIC SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.77.1.4.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by DICOM Camera	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 100		

6.1.2 Used Fields in Received IOD By Application

The DICOM Camera does not receive SOP Instances. The usage of attributes received via Modality Worklist is described in section 3.2.2.3.1.3

6.2 Standard Extended / Specialized / Private SOP Classes

No Specialized or Private SOP Classes are supported.

6.3 Private Transfer Syntaxes

No Private Transfer Syntaxes are supported.