Lumify 1.8.x DICOM

Conformance Statement

Lumify 1.8.x
00068300000025 Rev A
2018-04-04

PHILIPS

0.1   Revision History

REVISION HISTORY
Description
000683000000025 Rev A (Initial Release)

1   CONFORMANCE STATEMENT OVERVIEW

The Philips Lumify 1.8.x Ultrasound systems implement the necessary DICOM® services to download worklists from an information system, save acquired US Images to a network storage device and inform the information system about the work actually done.

Table 1 provides an overview of the supported network services.

TABLE 1
NETWORK SERVICES

Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Image Storage	Yes	No
Ultrasound Multiframe Image Storage	Yes	No
Secondary Capture Image Storage*	Yes	No
Storage Commitment Push Model	Yes	No
Workflow Management		
Modality Worklist	Yes	No
Modality Performed Procedure Step	Yes	No

*Secondary Capture is only used for images acquired of analysis and calcs results pages. It is not configurable.

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3   INTRODUCTION

3.1   AUDIENCE
This document is intended for hospital staff, health care system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.2   REMARKS
DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between the Philips Healthcare Lumify 1.8.x ultrasound systems and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [DICOM]. However, by itself it is not guaranteed to ensure the desired interoperability and successful interconnectivity.

The user should be aware of the following important issues:

— The comparison of different conformance statements is the first step towards assessing interconnectivity between Philips Healthcare and non - Philips Healthcare equipment.
— Test procedures should be defined to validate the desired level of connectivity.
— The DICOM standard will evolve to meet the users' future requirements. Philips Healthcare is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

3.3   Important Note to the Reader
Interoperability

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into an IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment. It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

Validation

Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement. Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

New versions of the DICOM Standard

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery. The user should ensure that any non-Philips provider linking to Philips equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM

enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility.

3.4   DEFINITIONS, TERMS AND ABBREVIATIONS
Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communications in Medicine
IOD	(DICOM) Information Object Definition
ISO	International Standard Organization
MWL	Modality Worklist
R	Required Key Attribute for Modality Worklist Query Matching
O	Optional Key Attribute for Modality Worklist Query Matching
PDU	DICOM Protocol Data Unit
PDE	Patient Data Entry
SCP	DICOM Service Class Provider (DICOM server)
SCU	DICOM Service Class User (DICOM client)
SOP	DICOM Service-Object Pair
U	Unique Key Attribute for Modality Worklist Query Matching, or Optional Attribute
US	Ultrasound

3.5   REFERENCES
DICOM]   Digital Imaging and Communications in Medicine, Parts 1 - 20 (NEMA PS 3.1- PS 3.20),
        National Electrical Manufacturers Association (NEMA)
        Publication Sales 1300 N. 17th Street, Suite 1752 Rosslyn, Virginia. 22209, United States of America
        Internet: http://medical.nema.org/

Note that at any point in time the official standard consists of the most recent yearly edition of the base standard plus all the supplements and correction items that have been approved as Final Text.

4   NETWORKING

4.1   IMPLEMENTATION MODEL

4.1.1   Application Data Flow
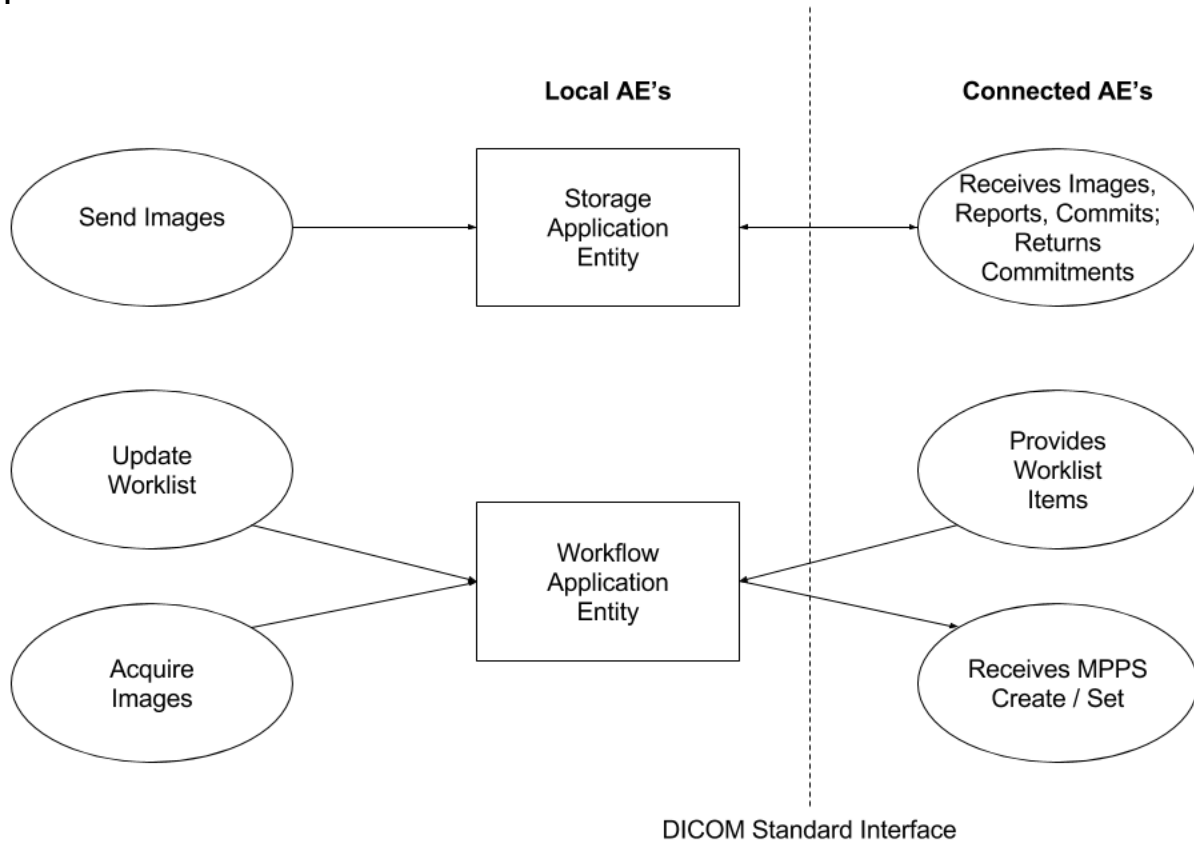
Figure 1
APPLICATION DATA FLOW DIAGRAM

The **Storage Application Entity** sends Images to a single remote AE. Acquisition of images is associated with the local real-world activity "Save Image" for single frame and "Save Loop" for loops or clips. Sending of images may occur automatically when configured to do so, either "as images are acquired" or "upon exam completion." The system can also be configured to automatically end and send an exam after a specified exam duration. In addition, exam data may be sent manually upon request of the user. If configured to send "as images are acquired", images are transferred immediately after acquisition and reports are transferred at the end of the exam. If configured for send "upon exam completion", images report images are transferred when the exam is ended.

The **Workflow Application Entity** receives Modality Worklist (MWL) information from and sends Modality Performed Procedure Step (MPPS) information to remote AEs. It is associated with the local real-world activities "Query Worklist" and "Acquire Images". 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. "Patient Search" is manually initiated.

4.1.2   Functional Definition of AEs

4.1.2.1   Functional Definition of Storage Application Entity
A Network Store queue 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 queue's Status is set to "Stopped" as displayed in the Export Queue. The user may select

"Retry Job" to attempt re-send. After the automatic retries have failed, the job is set to "Aborted." The user may "Delete Job" and re-send manually. Deleting a job does not remove the data, as it is still present on the system. Only the request to transfer the data is removed. Once any communication issues have been resolved, "Retry Job" may be selected or if the jobs were deleted, they may be queued again from the Review directory.

4.1.2.2   Functional Definition of Workflow Application Entity
"Query MWL" attempts to download a Modality Worklist from a Modality Worklist server with studies matching the search criteria by sending a C-Find Request containing user-definable Query parameters. Query parameters are stored in the "Setup MWL Server" Dialog.

Note: Either Broad Worklist Query or Patient Based Query can be configured at a time.

Settings that may be customized are:

- o   Start Date (Today, within 1 day, within 7 days, within 30 days)
- o   AE Title (This system, Any or Another specific)
- o   Modality (Ultrasound or All Modalities)
- o   Perform Patient Based Queries (Allows user to enter Patient Name, Patient ID (MRN), Accession Number and/or Requested Procedure ID to be queried.

When the Workflow AE establishes an association to a remote AE, a MWL C-Find-Rq message is sent to the MWL server. The server will transfer all matching worklist items via the open association. The results of a successful Worklist Update will overwrite the data in the Worklist display.

There is no queue management for Modality Worklist; Modality Worklist queries only occur on demand.

Modality Performed Procedure Steps are created and updated with the following real-world events:
- o   MPPS N-Create, Status = IN PROGRESS:
    - ▪   Acquisition of images will result in automated creation of an MPPS Instance managed by a remote AE.
- o   MPPS N-Set, Status = COMPLETE
    - ▪   Completion of the MPPS is performed as the result of an operator action of ending the exam.
- o   MPPS N-Set, Status = DISCONTINUED
    - ▪   "Cancel Exam" causes the "Discontinued" status to be sent.

4.1.3   Sequencing of Real-World Activities
The following sequence diagrams illustrate the order of network operations during a number of imaging scenarios. If Modality Worklist is not being used, the user enters patient identification manually at the start of exam and the Query/Retrieve Worklist steps do not occur. Figures 2 and 3 illustrate exam acquisition with send "as images are acquired" or "upon exam completion." Respectively.
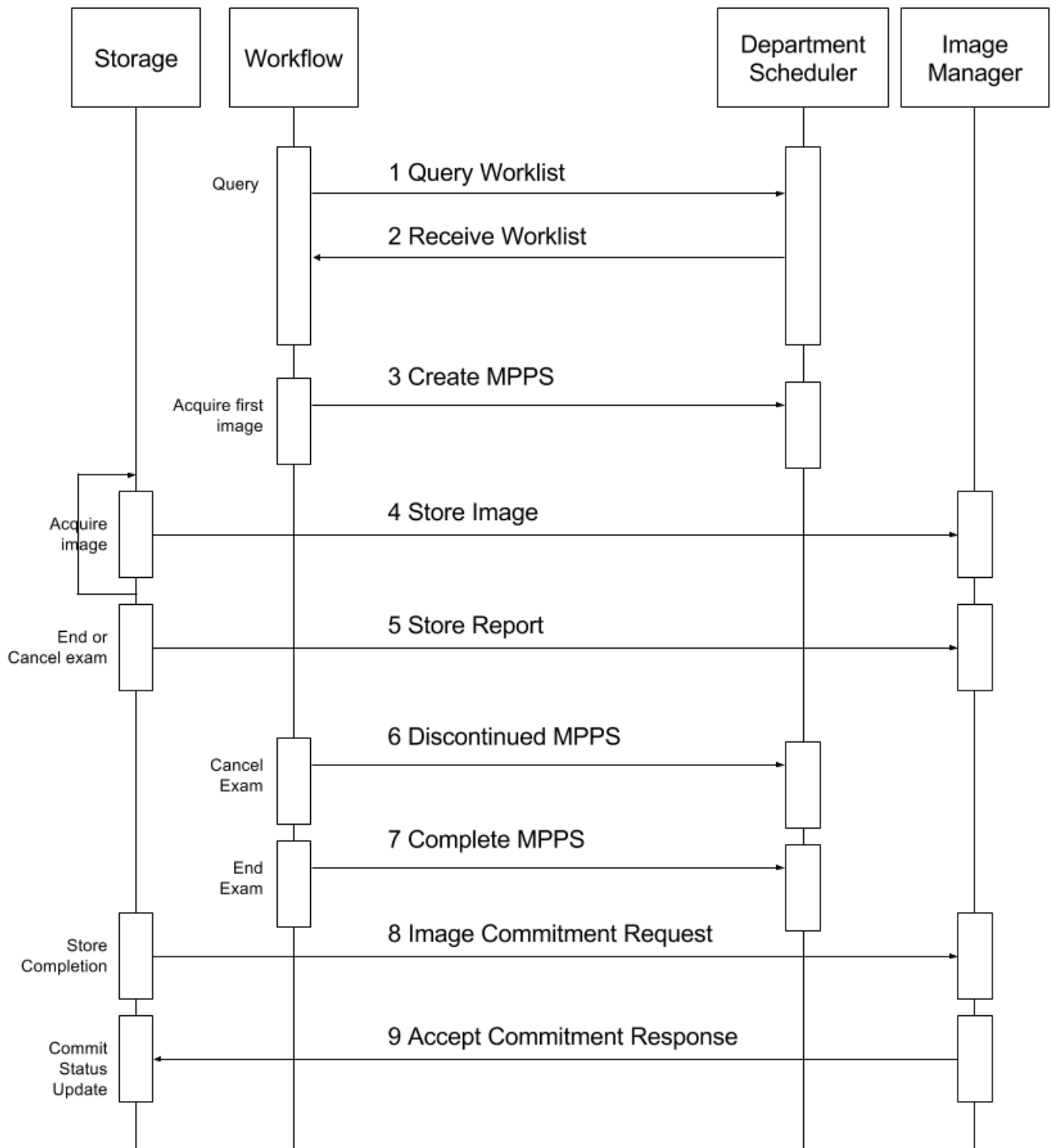
Figure 2
Sequencing Constraints – Configured to Send as Images are Acquired
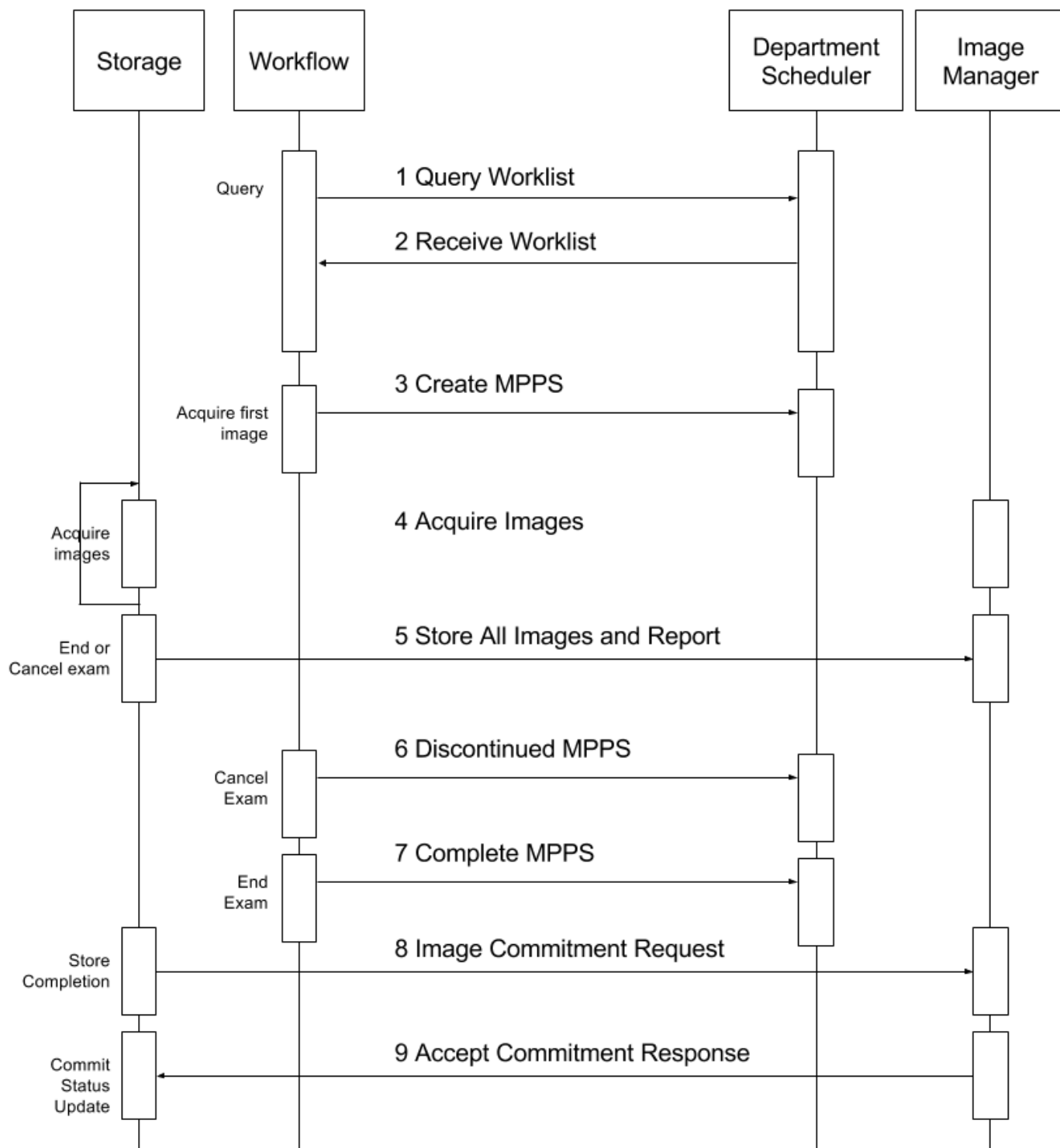
Figure 3
Sequencing Constraints – Configured to Send upon exam completion

Note: Lumify does not export images if "Cancel Exam" (resulting in step 6 "Discontinued MPPS") is selected and "Store at End of Exam" is configured. Images acquired during a cancelled exam are stored in the database and may be manually exported.

4.2   AE SPECIFICATIONS

4.2.1   Storage Application Entity Specification

4.2.1.1   SOP Classes

Table 1
SOP CLASSES FOR AE STORAGE

SOP Class Name	SOP Class UID	SCU	SCP
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
US Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No

4.2.1.2   Association Establishment Policy

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

Table 2
DICOM APPLICATION CONTEXT FOR AE STORAGE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2   Number of Associations
Lumify 1.8.x initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list.

TABLE 3
Number of Associations Initiated for AE Storage

Maximum number of simultaneous Associations	1

4.2.1.2.3   Asynchronous Nature
Lumify 1.8.x does not support asynchronous communication (multiple outstanding transactions over a single Association).

TABLE 4
Asynchronous Nature as a SCU for AE Storage

Maximum number of outstanding asynchronous transactions	1

4.2.1.2.4   Implementation Identifying Information
The implementation information for this Application Entity is:

TABLE 5
DICOM Implementation Class and Version for AE Storage

Implementation Class UID	1.3.46.670589.14.8100.180
Implementation Version Name	LUMIFY_1.8

4.2.1.3   Association Initiation Policy

4.2.1.3.1   Activity – Store Images and Loops

4.2.1.3.1.1   Description and Sequencing of Activities

Images may be sent from the selected studies from the Review directory. Each image is sent in its own association that is opened and closed. Additional images acquired during the exam will be sent using subsequent associations.

If the C-STORE response from the remote application contains a status other than Success or Warning, the association is retried until switched to a failed state.

If a device is configured for Storage Commitment service, the Storage AE will transmit a single Storage Commitment N-ACTION request for images and, if present, the report images. The Storage AE can only receive an N-EVENT-REPORT request in a separate subsequent association initiated by the SCP. It cannot receive N-EVENT-REPORT request messages on the same association as the N-ACTION request.

The sequence of interactions between the Storage AE and an Image Manager is illustrated in Figure 4 for the "Store" configuration option "After Each Print/Acquire". If the "At End Exam" configuration option is selected, no C-STORE is sent at the Acquire Image event and instead all image C-STOREs are sent after end exam.
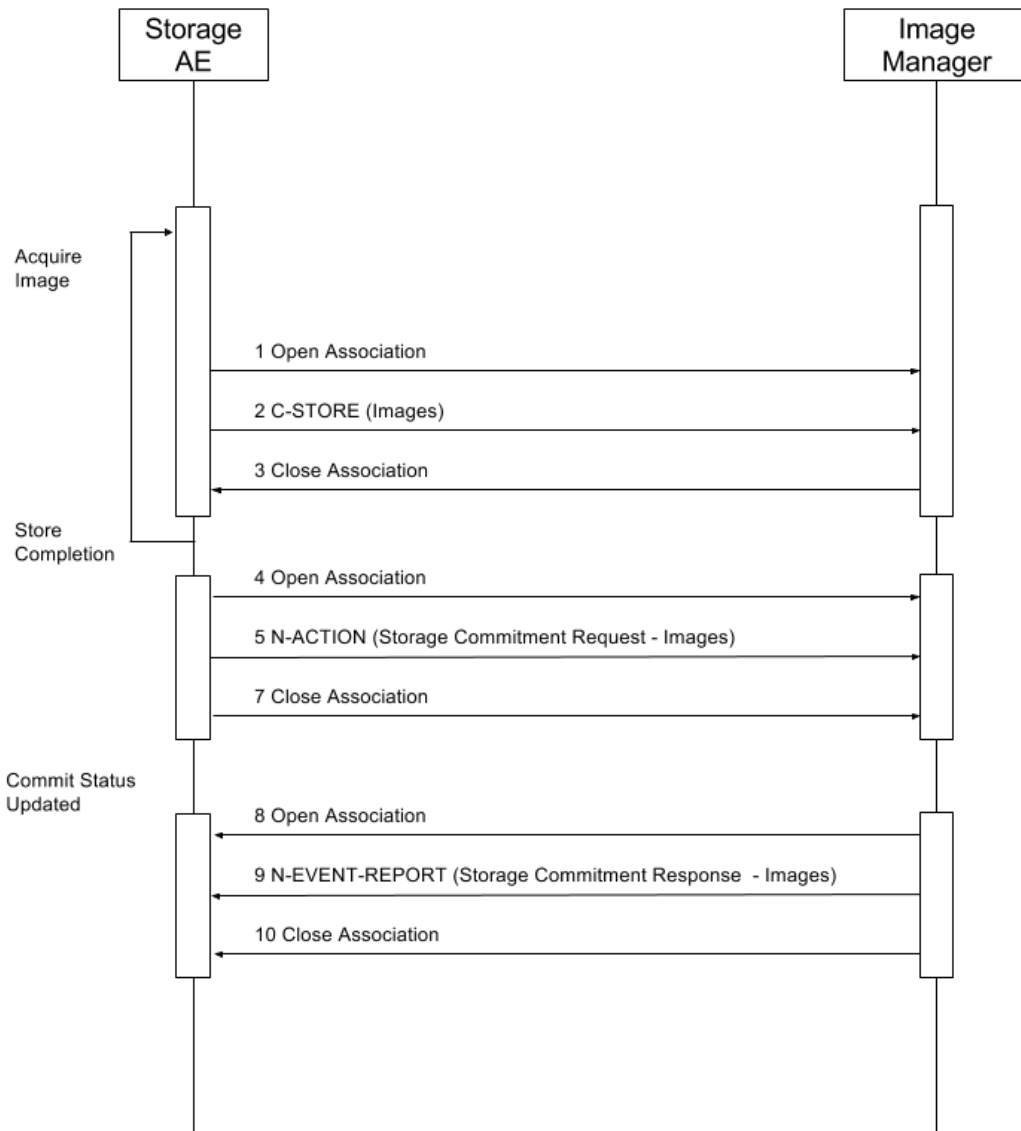
Figure 4
SEQUENCING OF ACTIVITY – SEND IMAGES AS THEY ARE ACQUIRED

4.2.1.3.1.2   Proposed Presentation Contexts

Lumify 1.8.x is capable of proposing the Presentation Contexts shown in the following table:

Table 6
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY SEND IMAGES

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5	SCU	None
US Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5	SCU	None

4.2.1.3.1.3   SOP Specific Conformance for Image SOP Classes

4.2.1.3.1.3.1   Image Storage SOP Classes

4.2.1.3.1.3.1.1   Storage (C-Store)

All SOP Classes supported by the Storage AE exhibit the same behavior, except where stated, and are described together in this section.

Table 7 describes C-Store response behavior.

Establishing the Association with Default settings

Table 7
STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP successfully stored the SOP Instance. If all SOP Instances scceed, the job is marked as complete.
*	*	Any other status code	The Association is aborted using A-ABORT and the transfer fails. The status is logged.

During Image Transfer

Table 8
STORAGE C-STORE COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the transfer fails. The status is logged.
Association aborted by the SCP or network layers	The Association is aborted using A-ABORT and the transfer fails. The status is logged.

The contents of US Image and US Multiframe Storage SOP Instances conform to the DICOM IOD definitions described in Section 8.1.

4.2.1.3.1.3.2   SOP Specific Conformance for Storage Commitment Push Modle SOP Class

4.2.1.3.1.3.2.1   Storage Commitment Notifications (N-ACTION)

The Storage AE will request storage commitment for the configured device. If "Send images as they are acquired" is selected, Storage Commitment is requested automatically by the system immediately after the instance is stored.

Table 9 summarizes the behavior of the Storage AE when receiving response status codes

Table 9
STORAGE COMMITMENT N-ACTION RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP successfully stored the SOP Instance. If all SOP Instances succeed, the job is marked as complete.
*	*	Any other status code	The Association is aborted using A-ABORT and the transfer fails. The status is logged.

Table 10 summarizes the behavior of Storage AE during communication failure.

Table 10
STORAGE COMMITMENT N-ACTION COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the transfer fails. The status is logged.
Association aborted by the SCP or network layers	The Association is aborted using A-ABORT and the transfer fails. The status is logged.

The Storage AE will request storage commitment using the attributes described in the following table.

Table 11
STORAGE COMMITMENT N-ACTION REQUEST MESSAGE CONTENTS

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU
Request Storage Commitment	1	Transaction UID	(0008,1195)	1
		Referenced SOP Sequence	(0008,1199)	1
		>Referenced SOP Class UID	(0008,1150)	1
		>Referenced SOP Instance UID	(0008,1155)	1

The N-ACTION request is retried if the N-ACTION has completed successfully but no N-EVENT-RESPONSE received within 96 hours. Further, the NACTION request is retried if N-EVENT-RESPONSE is received with one or more instances that fail commit; in that case, C-STORE requests are also resent for all instances that failed to commit.

4.2.1.4   Association Acceptance Policy

4.2.1.4.1   Activity – Receive Storage Commitment Response

4.2.1.4.1.1   Description and Sequencing of Activities
The Storage AE accepts associations for pending responses to a Storage Commitment Request only using SCP/SCU Role Negotiation of "SCP" explicitly stating that the association is initiated by the SCP to the SCU.

4.2.1.4.1.2   Accepted Presentation Contexts
Table 12 summaraizes the Presentation Contexts that the Storage AE accepts

Table 12
ACCEPTABLE PRESENTATION CONTEXTS FOR ACTIVITY RECEIVE STORAGE COMMITENT RESPONSE

Presentation Context Table					
Abstract Syntax		Transfer Syntax			Ext. Neg.
Name	UID	Name List	UID List	Role	
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

4.2.1.4.1.3   SOP Specific Conformance for Storage Commitment Push Model SOP Class

4.2.1.4.1.3.1   Storage Commitment Notifications (N-EVENT-REPORT)
The Storage AE can receive an N-EVENT-REPORT notification received from the SCP via an association requested by the SCP with reverse-role negotiation. Table 13 summarizes the behavior of Storage AE when receiving Event Types within the N-EVENT-REPORT.

Table 13
STORAGE COMMITMENT N-EVENT-REPORT BEHAVIOR

Event Type Name	Event Type ID	Behavior
Storage Commitment Request Successful	1	The commit status is set to complete for each object.
Storage Commitment Request Complete – Failures Exist	2	The commit status remains incomplete. The commit comment for each object is logged.

The reasons for returning specific status codes in an N-EVENT-REPORT response are summarized in Table 14

Table 14
STORAGE COMMITMENT N-EVENT-REPORT RESPONSE STATUS REASONS

Service Status	Further Meaning	Error Code	Reasons
Success	Success	0000	The storage commitment result has been successfully received

4.2.1.4.1.3.2 Storage Commitment Attributes (N-EVENT-REPORT)

Table 15 Lists the attribtues that are supported within the N-EVENT-REPORT

Table 15
STORAGE COMMITMENT N-EVENT-REPORT MESSAGE CONTENTS

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	None
		Referenced SOP Sequence	(0008,1199)	None
		>Referenced SOP Class UID	(0008,1150)	None
		>Referenced SOP Instance UID	(0008,1155)	None
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	None
		Referenced SOP Sequence	(0008,1199)	None
		>Referenced SOP Class UID	(0008,1150)	None
		>Referenced SOP Instance UID	(0008,1155)	None
		Failed SOP Sequence	(0008,1198)	None
		>Referenced SOP Class UID	(0008,1150)	None
		>Referenced SOP Instance UID	(0008,1155)	None

4.2.2   Workflow Application Entity Specification

4.2.2.1   SOP Classes
Lumify 1.8.x provides Standard Conformance to the following SOP Classes:

Table 16
SOP CLASSES FOR AE WORKFLOW

SOP Class Name	SOP Class UID	SCU	SCP
MWL Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step	1.2.840.1008.3.1.2.3.3	Yes	No

4.2.2.2   Association Establishment Policy

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

Table 17
DICOM APPLICATION CONTEXT FOR AE WORKFLOW

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2 Number of Associations
Lumify 1.8.x initiates one Association at a time for a Worklist request.

Table 18
NUMBER OF ASSOCIATIONS INITIATED FOR AE WORKFLOW

Maximum number of simultaneous Associations	1

4.2.2.2.3 Asynchronous Nature
Lumify 1.8.x does not support asynchronous communication.

Table 19
ASYNCHRONOUS NATURE AS A SCU FOR AE WORKFLOW

Maximum number of outstanding asynchronous transactions	1

4.2.2.2.4 Implementation Identifying Information
The implementation information for this Application Entity is:

Table 20
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE WORKFLOW

Implementation Class UID	1.3.46.670589.14.8100.180
Implementation Version Name	LUMIFY_1.8

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity – Worklist Update

4.2.2.3.1.1 Description and Sequencing of Activities
Worklist queries for Modality (US) or All Modalities may be initiated by the user.
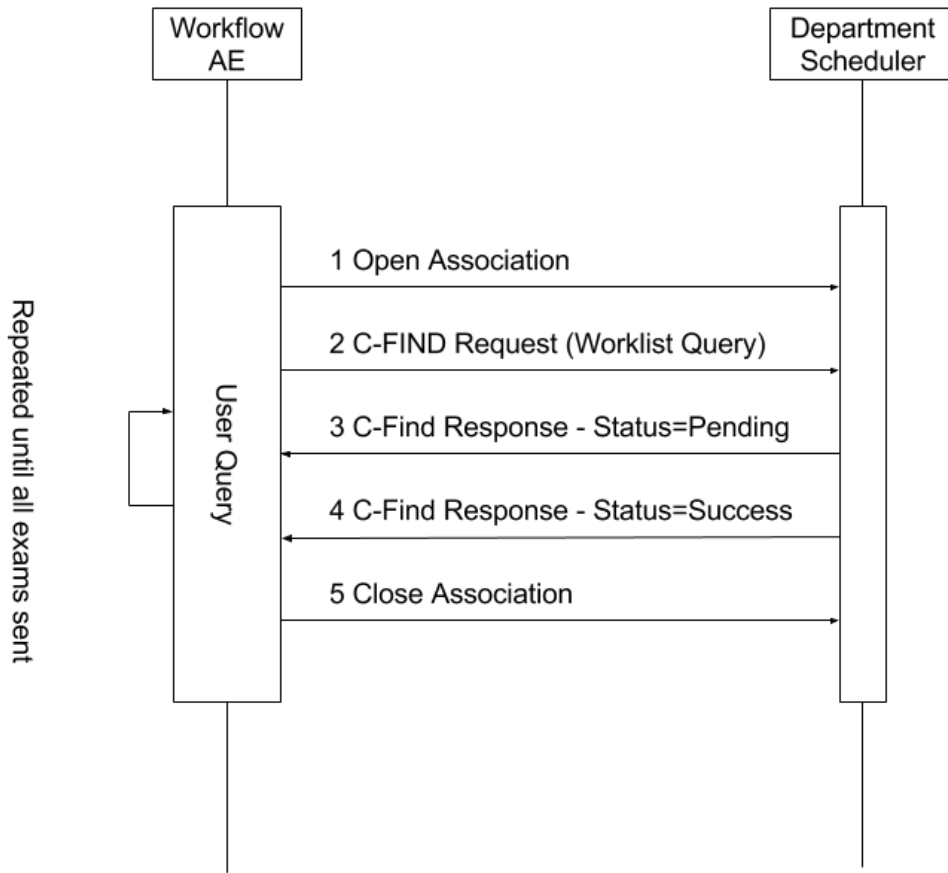
Figure 5
SEQUENCING OF ACTIVITY – WORKLIST UPDATE

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler (e.g. a device such as a RIS or HIS which supports the MWL SOP Class as an SCP) is illustrated in Figure 5:

4.2.2.3.1.2   Proposed Presentation Contexts
Lumify 1.8.x will propose Presentation Contexts as shown in the following table:

Table 21
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY WORKLIST UPDATE

Presentation Context Table					
Abstract Syntax		Transfer Syntax			
Name	UID	Name List	UID List	Role	Ext. Neg.
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Explicit VR Little Endian* Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None

*Note: If the worklist server accepts Explicit VR Little Endian and Implicit VR Little Endian then Lumify 1.8.x will use Explicit VR Little Endian Transfer Syntax.

4.2.2.3.1.3   SOP Specific Conformance for Modality Worklist

Table 22 summarizes the behavior of Lumify 1.8.x when encountering status codes in a MWL C-FIND response.

A message "query failed" will appear on the user interface if Lumify 1.8.x receives any other SCP response status than "Success" or "Pending."

Table 22
MODALITY WORKLIST C-FIND RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The system replaced the worklist from the response.
Refused	Out of Resources	A700	The Association is aborted using A-ABORT. The worklist is not replaced.
Failed	Identifier does not match SOP Class	A900	Same as "Refused" above.
Failed	Unable to Process	C000 – CFFF	Same as "Refused" above.
Cancel	Matching terminated due to Cancel request	FE00	The user is notified that a partial list was retrieved. The retrieved items can be displayed by user request.
Pending	Matches are continuing	FF00	Continue.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	Continue.
*	*	Any other status code.	Same as "Refused" above.

Table 23 summarizes the behavior of Lumify 1.8.x during communication failure.

Table 23
MODALITY WORKLIST COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	Same as Service Status "Refused" in the table above.
Association aborted by the SCP or network layers	Same as Service Status "Refused" in the table above.

Table 24 describes the Lumify 1.8.x Worklist Matching Keys and requested attributes. Unexpected attributes returned in a C-FIND response are ignored.

Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored.

Table 24
WORKLIST MATCHING KEYS

Module Name Attribute Name	Tag	VR	M	R	D	IOD
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)	SQ		x		
> Scheduled Station AE Title	(0040,0001)	AE	S	x		
> Scheduled Procedure Step Start Date	(0040,0002)	DA	S, R	x	x	
> Scheduled Procedure Step Start Time	(0040,0003)	TM		x	x	
> Modality	(0008,0060)	CS	S	x	x	x
> Scheduled Performing Physician's Name[1]	(0040,0006)	PN		x	x	
> Scheduled Procedure Step Description[2]	(0040,0007)	LO		x		x
> Scheduled Protocol Code Sequence[3]	(0040,0008)	SQ		x		x
> Scheduled Procedure Step ID	(0040,0009)	SH		x		x
Requested Procedure						
Requested Procedure ID	(0040,1001)	SH	S	x		x
Reason for the Requested Procedure[4]	(0040,1002)	LO		x	x	
Requested Procedure Description[5]	(0032,1060)	LO		x	x	x
Study Instance UID	(0020,000D)	UI		x		x
Referenced Study Sequence	(0008,1110)	SQ		x		x
Requested Procedure Code Sequence	(0032,1064)	SQ		x		
Names of Intended Recipients of Results	(0040,1010)	PN		x	x	
Imaging Service Request						
Accession Number	(0008,0050)	SH	S	x	x	x
Requesting Physician	(0032,1032)	PN		x		
Referring Physician's Name[6]	(0008,0090)	PN		x	x	x
Reason for the Imaging Service Request[7]	(0040,2001)	LO		x		
Patient Identification						
Patient's Name	(0010,0010)	PN	S, *	x	x	x
Patient ID	(0010,0020)	LO	S, *	x	x	x
Other Patient IDs	(0010,1000)	LO		x		x
Patient Demographic						
Patient's Birth Date	(0010,0030)	DA		x	x	x
Patient's Sex	(0010,0040)	CS		x	x	x
Patient Size	(0010,1020)	DS		x		x
Ethnic Group	(0010,2160)	SH		x		x
Patient's Weight	(0010,1030)	DS		x		x
Patient Comments	(0010,4000)	LT		x		x
Patient Medical						
Medical Alerts	(0010,2000)	LO		x		x
Additional Patient's History	(0010,21B0)	LT		x		x
Pregnancy Status	(0010,21C0)	US		x		x

* = Wildcard matching

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 a Lumify 1.8.x Worklist Request Identifier.

    Tag: DICOM tag for this attribute.

    VR: DICOM VR for this attribute.

    M: Matching keys for Worklist Update. An "S" indicates that Lumify 1.8.x supplies an attribute value for Single Value Matching, "R" indicates a Range Value and "*" is for Wildcard matching. See section 4.4.1.2.1 for setup location.

R:	Return keys. An "x" indicates that Lumify 1.8.x supplies this attribute as a Return Key with zero length for Universal Matching.
D:	Displayed keys. An "x" indicates that this worklist attribute is displayed to the user in the Patient Data Entry screen or Worklist Directory.
IOD:	An "x" indicates that this Worklist attribute's data is included into applicable Image Object Instances created during performance of the related Procedure Step.
Notes:	
1	Scheduled Performing Physician's Name sets the "Performed by" field in Patient Data Entry Screen.
2	Scheduled Procedure Step Description may be used to set "Study Description" field in the Patient Selection screen and is mapped to "Study Description" in images. It is the 2nd option for "Study Description" in Patient Data Entry Screen and images.
3	Scheduled Protocol Code Sequence: Code Meaning may be used to set "Study Description" field in the Patient Selection screen and is mapped to "Study Description" in images. It is the 3rd option for "Study Description" in Patient Data Entry Screen and images.
4	Reason for the Requested Procedure may be used to set "Study Description" field in the Patient Selection screen and is mapped to "Study Description" in images. It is the 4th option for "Study Description" in Patient Data Entry Screen and images. It is also the 1st option for "Indication" in the Patient Data Entry Screen.
5	Requested Procedure Description may be used to set "Study Description" field in the Patient Selection screen and is mapped to "Study Description" in images. It is the 1st option for "Study Description" in Patient Data Entry Screen and images.
6	Sets the "Referring Physician" in Patient Data Entry screens.
7	Reason for the Imaging Service Request may be used to set "Study Description" field in the Patient Selection screen and is mapped to "Study Description" in images. It is the 5th option for "Study Description" in Patient Data Entry Screen and images. It is also the 2nd option for "Indication" in the Patient Data Entry Screen.

4.2.2.3.2 Activity – Acquire Images

4.2.2.3.2.1 Description and Sequencing of Activities

An Association to the configured MPPS SCP system is established immediately after the first image is acquired to send the MPPS N-CREATE message with status of "IN PROGRESS".

The "End Exam" button causes a "COMPLETED" status in the N-SET message. An exam for which an MPPS Instance is sent with a status of "COMPLETED" can no longer be updated.

The "Cancel Exam" button causes a "DISCONTINUED" message. An exam for which an MPPS Instance is sent with a state of "DISCONTINUED" can also no longer be updated.

The system supports creation of "unscheduled cases" by allowing MPPS Instances to be communicated for locally registered Patients.

The system performs a single Performed Procedure Step at a time per Scheduled Procedure Step.

EPIQ/Affiniti will initiate an Association to issue:

- N-CREATE request according to the Create Modality Performed Procedure Step SOP Instance operation
- N-SET request to finalize the contents and state of the MPPS according to the Set Modality Performed Procedure Step Information operation.
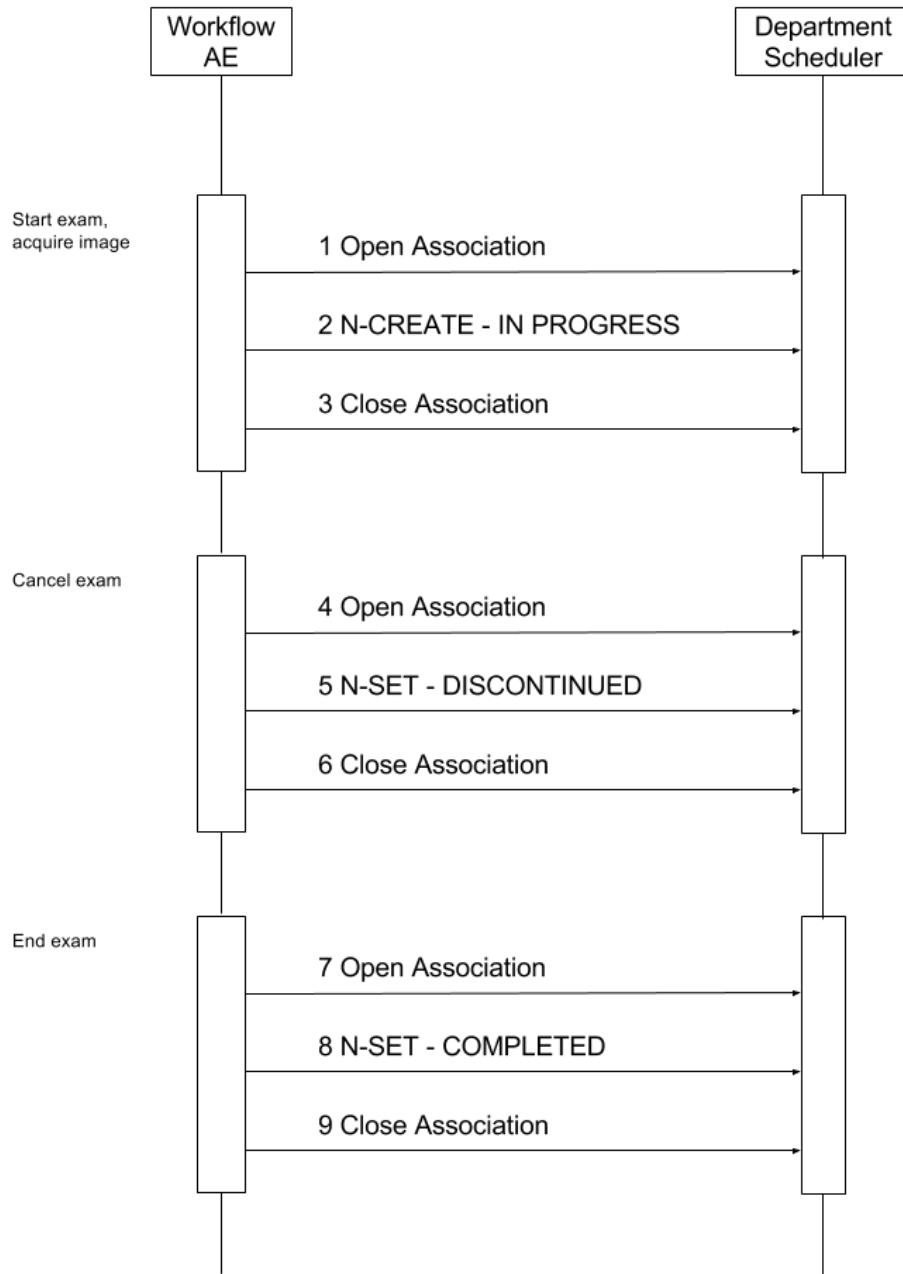
Figure 6
SEQUENCING OF ACTIVITY – ACQUIRE IMAGES

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler (e.g. a device such as a RIS or HIS which supports the MPPS SOP Class as an SCP) is illustrated in Figure 6.

Note: The Cancel and End Exam commands are mutually exclusive. They are both represented here for illustration purposes only. Actual workflow uses one or the other for a given exam.

4.2.2.3.2.2 Proposed Presentation Contexts

Lumify 1.8.x will propose Presentaton Contexts as shown in the following table:

Table 25
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY WORKLIST UPDATE

Presentation Context Table					
Abstract Syntax		Transfer Syntax			
Name	UID	Name List	UID List	Role	Ext. Neg.
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian* Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

*Note: If the worklist server accepts Explicit VR Little Endian and Implicit VR Little Endian then Lumify 1.8.x will use Explicit VR Little Endian Transfer Syntax.

4.2.2.3.2.3 SOP Specific Conformance for MPPS

The following table summarizes the behavior of Lumify 1.8.x when encountering status codes in an MPPS N-CREATE or N-SET response.

Table 26
MPPS N-CREATE / N-SET RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Failure	Processing Failure – Performed Procedure Step Object may no longer be updated	0110	The Association is aborted.
*	*	Any other status code.	Same as "Failure" above.

Table 26a
MPPS COMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	Same as Service Status "Refused" in the table above.
Association aborted by the SCP or network layers	Same as Service Status "Refused" in the table above.

Table 27 provides a description of the MPPS N-CREATE and N-SET request identifiers. Empty cells in the N-CREATE and N-SET columns indicate that the attribute is not sent.

Table 27
MPPS N-CREATE and N-SET REQUEST IDENTIFIERS

Attribute Name	Tag	VR	N-CREATE	N-SET
Specific Character Set	(0008,0005)	CS		
Modality	(0008,0060)	CS	US	
Referenced Patient Sequence	(0008,1120)	SQ	Zero Length	
Patient's Name	(0010,0010)	PN	As received from MWL or entered in PDE	
Patient ID	(0010,0020)	LO	As received from MWL or entered in PDE	
Patient's Birth Date	(0010,0030)	DA	As received from MWL or entered in PDE	
Patient's Sex	(0010,0040)	CS	As received from MWL or entered in PDE	
Study ID	(0020,0010)	SH	System Generated, starting at 1 for each patient and incrementing for each subsequent study	
Performed Station AE Title	(0040,0241)	AE	AE Title from configuration	
Performed Station Name	(0040,0242)	SH	AE Title from configuration	
Performed Location	(0040,0243)	SH	AE Title from configuration	
Performed Procedure Step Start Date	(0040,0244)	DA	Actual Start Date (on close of PDE Screen)	
Performed Procedure Step Start Time	(0040,0245)	TM	Actual Start Time (on close of PDE Screen)	
Procedure Code Sequence	(0008,1032)	SQ	Mapped from Requested Procedure Code Sequence (0032,1064) from MWL, Zero Length for unscheduled study	Mapped from Requested Procedure Code Sequence (0032,1064) from MWL, Zero Length for unscheduled study
Performed Procedure Step End Date	(0040,0250)	DA	Zero Length	Actual end date
Performed Procedure Step End Time	(0040,0251)	TM	Zero Length	Actual end time
Performed Procedure Step Status	(0040,0252)	CS	IN PROGRESS	COMPLETED or DISCONTINUED
Performed Procedure Step ID	(0040,0253)	SH	Auto generated in the format, <YYYYMMDDHHMMSS>	
Performed Procedure Step Description	(0040,0254)	LO	Set from "Study Description" field in PDE, else mapped from Requested Procedure Description in MWL.	Set from "Study Description" field in PDE, else mapped from Requested Procedure Description in MWL.
Performed Procedure Type Description	(0040,0255)	LO	Zero Length	
Performed Protocol Code Sequence	(0040,0260)	SQ	Zero length, or mapped from MWL Scheduled Protocol Code Sequence (0040,0008)	Same
Scheduled Step Attributes Sequence	(0040,0270)	SQ		

Attribute Name	Tag	VR	N-CREATE	N-SET
>Accession Number	(0008,0050)	SH	From MWL or user PDE input. MWL value may be edited.	
>Referenced Study Sequence	(0008,1110)	SQ	One item per item in the MWL Reference Study Sequence. Absent if unscheduled.	
>>Referenced SOP Class UID	(0008,1150)	UI	Same value as in of the Reference Study Sequence in the MWL	
>>Referenced SOP Instance UID	(0008,1155)	UI	Same value as in of the Reference Study Sequence in the MWL	
>Study Instance UID	(0020,000D)	UI	Same value as in MWL attribute or auto generated	
>Requested Procedure Description	(0032,1060)	LO	Same value as in MWL attribute if present or Zero Length	
>Scheduled Procedure Step Description	(0040,0007)	LO	Same value as in MWL attribute if present or Zero Length	
>Scheduled Protocol Code Sequence	(0040,0008)	SQ	Same value as in MWL attribute if present or Zero Length	
>Scheduled Procedure Step ID	(0040,0009)	SH	Same value as in MWL attribute if present or Zero Length	
>Requested Procedure ID	(0040,1001)	SH	Same value as in MWL attribute if present or Zero Length	
Performed Series Sequence	(0040,0340)	SQ		
>Retrieve AE Title	(0008,0054)	AE	Zero Length	Same
>Series Description	(0008,103E)	LO	Zero Length	Same
>Performing Physician's Name	(0008,1050)	PN	From the "Performed by" field in PDE	Same
>Operator's Name	(0008,1070)	PN	From the "Performed by" field in PDE	Same
>Referenced Image Sequence	(0008,1140)	SQ	Zero Length	One item per referenced image instance
>>Referenced SOP Class UID	(0008,1150)	UI		SOP Class UID of acquired instance
>>Referenced SOP Instance UID	(0008,1155)	UI		SOP Class UID of acquired instance
>Protocol Name	(0008,1030)	LO	"Free Form"	Same
>Series Instance UID	(0020,000E)	UI	Auto Generated	Same
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	SQ	Zero Length	One item per referenced non-image instance

Attribute Name	Tag	VR	N-CREATE	N-SET
>>Referenced SOP Class UID	(0008,1150)	UI		SOP Class UID of acquired instance
>>Referenced SOP Instance UID	(0008,1155)	UI		SOP Class UID of acquired instance

4.2.2.4 Association Acceptance Policy
The Workflow Application Entity does not accept Associations

4.2.3 Verification Application Entity specification

4.2.3.1 SOP Class
Lumify 1.8.x provides Standard Conformance to the following SOP Class:

Table 27
SOP CLASSES FOR AE VERIFICATION

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	Yes

4.2.3.2 Association Establishment Policy

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

Table 28
DICOM APPLICATION CONTEXT FOR AE VERIFICATION

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.2 Number of Associations
Lumify 1.8.x initiates one Association at a time for a Verification request.

Table 29
NUMBER OF ASSOCIATIONS INITIATED FOR AE VERIFICATION

Maximum number of simultaneous Associations	1

Table 30
NUMBER OF ASSOCIATIONS ACCEPTED FOR AE VERIFICATION

Maximum number of simultaneous Associations	1

Note: There is no enforced limit on the number of incoming associations. However, only associations from the configured Storage Commitment AE will be accepted, effectively reducing the maximum number of incoming associations to one.

4.2.3.2.3

4.2.3.2.4 Asynchronous Nature
Lumify 1.8.x does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 31
ASYNCHRONOUS NATURE AS A SCU FOR AE VERIFICATION

Maximum number of outstanding asynchronous transactions	1

4.2.3.2.5   Implementation Identifying Information
The implementation information for this Application Entity is:

Table 32
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE VERIFICATION

Implementation Class UID	1.3.46.670589.14.8100.180
Implementation Version Name	LUMIFY_1.8

4.2.3.3   Association Initiation Policy

4.2.3.3.1   Activity – Verify as SCU

4.2.3.3.1.1   Description and Sequencing of Activities

SCU: The user can verify the existence of a DICOM server on the hospitals network, through a "Test" button on the DICOM Node's Setup Dialog. When the user presses this button, Lumify 1.8.x will initiate the association.

Only one association is established for each verification attempt.
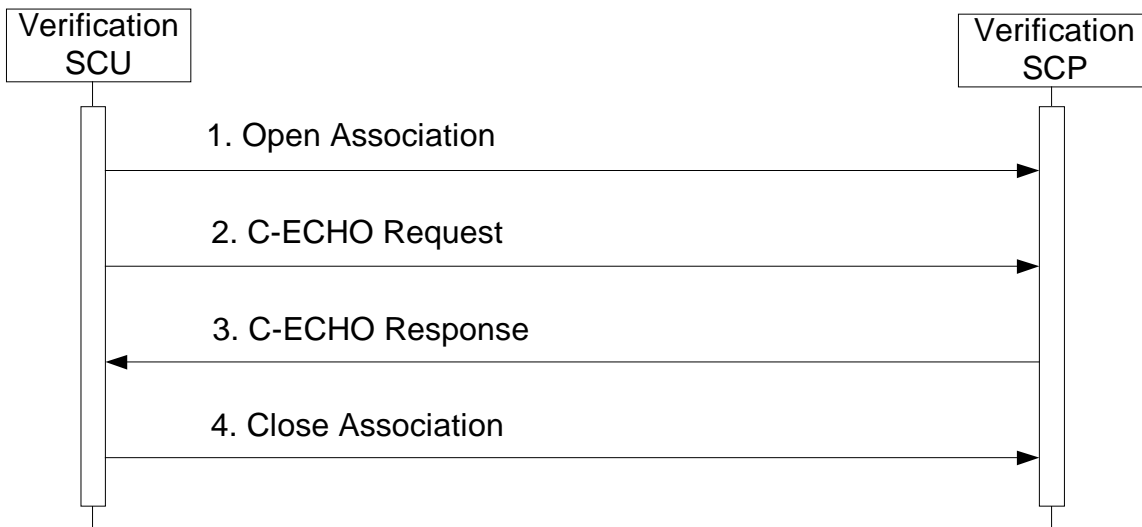
Figure 7
SEQUENCING OF ACTIVITY – ISSUE VERIFY

4.2.3.3.1.2   Proposed Presentation Contexts

Table 33
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY VERIFY AS SCU

Presentation Context Table					
Abstract Syntax		Transfer Syntax			Ext. Neg.
Name	UID	Name List	UID List	Role	
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

4.2.3.3.1.3 SOP Specific Conformance for Verification
The following table summarizes the behavior of Lumify 1.8.x when receiving status codes in a C-ECHO response. A message will appear on the user interface if Lumify 1.8.x receives any other SCP response status than "Success."

Table 34
VERIFICATION C-ECHO RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success		0000	Device Status is set to: Verified
Refused	Out of Resources	A700	Device Status is set to: Not Verified
Failed	Unable to Process	C000 – CFFF	Same as "Refused" above.
*	*	Any other status code.	Same as "Refused" above.

4.2.3.4　Association Acceptance Policy

4.2.3.4.1　Activity – Verification as SCP

4.2.3.4.1.1　Description and Sequencing of Activities

SCP: The system listens on the port configured in the Connectivity Profile for Verification requests initiated by other remote devices. The calling device AE must already be configured as the remote Storage Commitment device in the Connectivity Profile or the association is rejected.

4.2.3.4.1.2　Accepted Presentation Contexts
Table 35
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY VERIFY AS SCP

Presentation Context Table					
Abstract Syntax		Transfer Syntax			Ext. Neg.
Name	UID	Name List	UID List	Role	
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

4.2.3.4.1.3　SOP Specific Conformance for Verification
The association request will be rejected if the remote AE is not configured on Lumify 1.8.x.

4.3   PHYSICAL NETWORK INTERFACES

4.3.1   Supported Communication Stacks

4.3.1.1   TCP/IP Stack
The System provides only DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8 of the standard.

The TCP/IP Stack, as supported by the underlying Operating System, is the only protocol stack supported.

The system supports Wireless network interface that is available by the device. The system does not control or configure the network interfaces.

4.3.2   Physical Network Interface
The Lumify 1.8.x system supports one network interface at a time. The available network interfaces are determined by the Android device in use.

4.3.3   Additional Protocols
Not Applicable

4.3.4   IPv4 and IPv6 Support
IPv4 and IPv6 addresses are supported.

4.4   CONFIGURATION
Any implementation's DICOM conformance may be dependent upon configuration, which takes place at the time of installation. Issues concerning configuration are addressed in this section.

Lumify uses a concept of "Configuration Profiles" that may be used to group sets of configured devices together. Each profile may contain at least one of a Primary Storage Server, a Storage Commitment Server, a Modality Worklist Server and a Modality Performed Procedure Step server. Other settings are configurable as well, including strategies for automatic export of exam images, and automatic deletion of exams.

4.4.1   AE Title/Presentation Address Mapping
An important installation issue is the translation from AE title to presentation address. How this is to be performed is described here.

4.4.1.1   Local AE Title

Table 36
DEVICE AE TITLE CONFIGURATION

Application Entity	AE Title
Storage Storage Commitment*	\<User Specified\> \<User Specified\>
Worklist Performed Procedure Step	\<User Specified\> \<User Specified\>

- Note: For Storage Commitment N-Event-Report messages to return to the system, the Android operating system limits the range of available listening ports for Lumify to be above 1023. "104" cannot be assigned to the Lumify.

4.4.1.2   Remote AE Title/Presentation Address Mapping

Table 37
REMOTE AE TITLE CONFIGURATION

Application Entity	AE Title
Storage Storage Commitment	<User Specified> <User Specified>
Worklist Performed Procedure Step	<User Specified> <User Specified>

4.4.1.2.1 Workflow

Setup is used to set the AE Title, Port number and IP Address the remote MWL SCP. Multiple MWL SCPs may be defined, but only a single remote MWL SCP can be used at a time.

"AE Title" may be selected as the system's.

The Start Date defaults to "Today" but may be modified to be "All Dates", or a Date Range that may be 1, 7, or 30 days.

5   MEDIA STORAGE

Lumify 1.8.x does not support Media Storage.

Lumify 1.8.x does support saving of images to DICOM file formats, but does not necessarily comply with the DICOM Media Storage model in PS 3.10

6 SUPPORT OF CHARACTER SETS

Lumify 1.8.x supports the following value of Specific Character Set (0008,0005):

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

7 SECURITY

DICOM security is not implemented on Lumify 1.8.x at this time.

8   ANNEXES

8.1   CREATED IOD INSTANCES

TABLE 39 specifies the attributes of an Ultrasound Image transmitted by the Lumify 1.8.x storage application.

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
      Unless otherwise noted, values returned from worklist may be overridden by User input.
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

8.1.1   US or US Multiframe Image IOD

Table 38
IOD OF CREATED US OR US MULTIFRAME SOP INSTANCES

IE	Module	Reference	Presence of Module
Patient	Patient	TABLE 41	ALWAYS
Study	General Study	TABLE 42	ALWAYS
	Patient Study	TABLE 43	ALWAYS
Series	General Series	TABLE 45	ALWAYS
Equipment	General Equipment	TABLE 46	ALWAYS
Image	General Image	TABLE 47	ALWAYS
	Image Pixel	TABLE 48	ALWAYS
	Cine	TABLE 49	Only if Multi-frame
	Multi-frame	TABLE 50	Only if Multi-frame
	US Region Calibration	TABLE 51	ANAP*
	US Image	TABLE 52	ALWAYS
	SOP Common	TABLE 53	ALWAYS

* the US Region Calibration module is not present in US Multiframe images where a calibration change occurs, i.e. the loop contained a depth or zoom change.

8.1.2 Secondary Capture IOD

Table 39
IOD OF CREATED SECONDARY CAPTURE SOP INSTANCES

IE	Module	Reference	Presence of Module
Patient	Patient	TABLE 41	ALWAYS
Study	General Study	TABLE 42	ALWAYS
	Patient Study	TABLE 43	ALWAYS
Series	General Series	TABLE 45	ALWAYS
Equipment	SC Equipment	Table 56	ALWAYS
Image	General Image	Table 54	ALWAYS
	Image Pixel	Table 55	ALWAYS
	SC Image	N.A.	All attributes are optional and are not present
	SOP Common	Table 57	ALWAYS

8.1.3 Common Modules

Table 40
PATIENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	Same attribute of MWL or PDE input	ALWAYS	MWL/ USER/ AUTO
Patient ID	(0010,0020)	LO	From MWL, user input or system generated.	ALWAYS	MWL/ USER/ AUTO
Patient's Birth Date	(0010,0030)	DA	Same attribute of MWL or PDE input	VNAP	MWL/ USER
Patient's Sex	(0010,0040)	CS	Same attribute of MWL	ANAP	MWL/ USER
Other Patient IDs	(0010,1000)	LO	Same attribute of MWL	ANAP	MWL

Table 41
GENERAL STUDY MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	Same value as in MWL or auto generated	ALWAYS	MWL/ AUTO
Study Date	(0008,0020)	DA	Study's Start Date (0040,0244).	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Time	(0008,0030)	TM	Study's Start Time (0040,0245).	ALWAYS	AUTO
Referring Physician's Name	(0008,0090)	PN	User Input from Patient ID screen. From MWL, sent as "Last, Prefix First Middle Suffix" in the Last name field.	VNAP	MWL/ USER
Study ID	(0020,0010)	SH	MWL Requested Procedure ID (0040,1000) or Auto-generated starting at 1	ALWAYS	AUTO
Accession Number	(0008,0050)	SH	Same attribute of MWL or user PDE input.	VNAP	MWL/ USER
Study Description	(0008,1030)	LO	'Study Description' in PDE or, can be obtained from the MWL Server. The string used will be the first non-empty string from the following list: Requested Procedure description tag (0032,1060), Scheduled Procedure Step description tag (0040,0007) Scheduled Procedure Step, "Code Meaning" tag (0008,0104) Reason for the requested procedure tag (0040,1002) Reason for imaging service request tag (0040,2001)	ANAP	MWL/ USER
Physician(s) of Record	(0008,1048)	PN	Mapped from Names of Intended Recipients of Results (0040,1010) from MWL or user PDE input.	VNAP	MWL/ USER
Referenced Study Sequence	(0008,1110)	SQ	One item per item in the MWL Referenced Study Sequence.	ANAP	MWL
>Referenced SOP Class UID	(0008,1150)	UI	Same value as in of the Referenced Study Sequence in the MWL	VNAP	MWL
>Referenced SOP Instance UID	(0008,1155)	UI	Same value as in of the Referenced Study Sequence in the MWL	VNAP	MWL
Procedure Code Sequence	(0008,1032)	SQ	MWL Requested Procedure Code Sequence (0032,1064) Absent if unscheduled.	ANAP	MWL
>Code Value	(0008,0100)	SH	Same value as MWL attribute	VNAP	MWL
>Coding Scheme Designator	(0008,0102)	SH	Same value as MWL attribute	VNAP	MWL
>Coding Scheme Version	(0008,0103)	SH	Same value as MWL attribute	VNAP	MWL
>Code Meaning	(0008,0104)	LO	Same value as MWL attribute	VNAP	MWL

Table 42
PATIENT STUDY MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Admitting Diagnosis Description	(0008,1080)	LO	Same value as MWL attribute.	ANAP	MWL
Patient Size	(0010,1020)	DS	Same value as MWL attribute.	ANAP	MWL
Patient's Weight	(0010,1030)	DS	Same value as MWL attribute.	ANAP	MWL
Additional Patient's History	(0010,21B0)	LT	Same value as MWL attribute.	ANAP	MWL

Table 43
PATIENT MEDICAL MODULE OF CREATED SOP INSTANCES*

Attribute Name	Tag	VR	Value	Presence of Value	Source
Medical Alerts	(0010,2000)	LO	Same value as MWL attribute	ANAP	MWL
Pregnancy Status	(0010,21C0)	US	Same value as MWL attribute.	ANAP	MWL

*Note: These attributes extend the standard US Image and US Multiframe Image IODs

Table 44
GENERAL SERIES MODULE OF CREATED IMAGE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	"US"	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Auto generated.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	A number unique within the Study	ALWAYS	AUTO
Series Date	(0008,0021)	DA	Date of first image in series.	ALWAYS	AUTO
Performing Physician's Name	(0008,1050)	PN	MWL Scheduled Performing Physician's Name (0040,0006) or PDE input, 'Performed by'.	ANAP	MWL/ USER
Series Description	(0008,103E)	LO	User entry in the 'Study Description' field of the Patient ID screen. If the user does not enter a value, this tag is not sent.	ANAP	MWL/ USER
Operator's Name	(0008,1070)	PN	MWL Scheduled Performing Physician's Name (0040,0006) or PDE input, 'Performed by'.	ANAP	MWL/ USER
Request Attributes Sequence	(0040,0275)	SQ	This sequence will be present only for scheduled study. In case of unscheduled study, this sequence will not be present.	ANAP	MWL
>Requested Procedure Description	(0032,1060)	LO	Value from MWL.	ANAP	MWL
>Requested Procedure ID	(0040,1001)	SH	Value from MWL.	ANAP	AUTO / MWL

Attribute Name	Tag	VR	Value	Presence of Value	Source
>Scheduled Procedure Step ID	(0040,0009)	SH	Auto-generated=Study ID or value from MWL. One item.	ANAP	AUTO / MWL
>Scheduled Procedure Step Description	(0040,0007)	LO	Same value as MWL attribute.	ANAP	MWL
>Scheduled Protocol Code Sequence	(0040,0008)	SQ	Same value as MWL attribute.	ANAP	MWL
Performed Procedure Step ID	(0040,0253)	SH	Set as current date and time in the format yyyymmddhhmmss.	ANAP	AUTO
Performed Procedure Step Start Date	(0040,0244)	DA	Date on which the Performed Procedure Step started on close of Patient Data Entry Screen	ANAP	AUTO
Performed Procedure Step Start Time	(0040,0245)	TM	Time on which the Performed Procedure Step started on close of Patient Data Entry Screen	ANAP	AUTO
Performed Procedure Step Description	(0040,0254)	LO	Set with the value entered or selected in 'Study Description' field of Patient ID screen.	ANAP	USER / MWL
Performed Protocol Code Sequence	(0040,0260)	SQ	Zero length, or mapped from MWL Scheduled Protocol Code Sq (0040,0008)	ANAP	MWL

Table 45
GENERAL EQUIPMENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Philips	ALWAYS	AUTO
Station Name	(0008,1010)	SH	The AE Title of Lumify system on which the image is acquired. The user can configure the AE Title of the system through 'Setup'.	VNAP	CONFIG
Software Version(s)	(0018,1020)	LO	This is a multi-valued tag which contains the following components: SW Part number, Version number, and SW build date	ALWAYS	AUTO
Manufacturer's Model Name	(0008,1090)	LO	Lumify	ALWAYS	AUTO

8.1.4 US or Multiframe Image Modules

Table 46
GENERAL IMAGE MODULE OF CREATED US SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	Generated by device, increments from "1" in each series. Gaps in values may exist if images are deleted on the system prior to export.	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS	The system sends the tag empty	VNAP	AUTO
Content Date	(0008,0023)	DA	<yyyymmdd>	ALWAYS	AUTO
Content Time	(0008,0033)	TM	<hhmmss.ffffff>	ALWAYS	AUTO
Image Type	(0008,0008)	CS	Value is DERIVED\PRIMARY for lossy, and ORIGINAL\PRIMARY for lossless	ALWAYS	CONFIG
Acquisition Date	(0008,0022)	DT	The system uses the same value as the Content Date, tag (0008,0023).	ALWAYS	AUTO
Acquisition Time	(0008,0032)	TM	The system uses the same value as the Content time, tag (0008,0033).	ALWAYS	AUTO
Acquisition Datetime	(0008,002A)	DT	The system generates this as a combination of Acquisition Date and Acquisition Time. The format is yyyymmddhhmmss.ffffff	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	CS	"01" if image is lossy compressed, "00" if not.	ALWAYS	AUTO

Table 47
IMAGE PIXEL MODULE OF CREATED US OR US MULTIFRAME SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	3 for RGB 3 for YBR_FULL_422	ALWAYS	CONFIG
Photometric Interpretation	(0028,0004)	CS	RGB YBR_FULL_422	ALWAYS	CONFIG
Rows	(0028,0010)	US	768	ALWAYS	CONFIG
Columns	(0028,0011)	US	1024	ALWAYS	CONFIG
Bits Allocated	(0028,0100)	US	8 bits	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	Always the same numbers as Bits Allocated.	ALWAYS	AUTO
High Bit	(0028,0102)	US	The High Bit is always (Bits Allocated -1).	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	"0" pixels are Unsigned integers	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB		ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	Zero	ANAP	AUTO

Table 48
CINE MODULE OF CREATED US Multiframe SOP

Attribute Name	Tag	VR	Value	Presence of Value	Source
Recommended Display Frame Rate	(0008,2144)	IS	Used for Multiframe	ALWAYS	AUTO
Cine Rate	(0018,0040)	IS	Used for Multiframe	ALWAYS	AUTO
Effective Series Duration	(0018,0072)	DS	Used for Multiframe	ALWAYS	AUTO
Frame Time Vector	(0018,1065)	DS	An array that contains the real time increments (in msec) between frames for a Multi-frame image. Present if Frame Increment Pointer (0028,0009) points to Frame Time Vector. Is it ever NOT FTV?	ALWAYS	AUTO

Table 49
MULTI-FRAME MODULE OF CREATED US MULTIFRAME SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Frames	(0028,0008)	IS	# of frames in object	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	(0018,1065) (Frame Time Vector).	ALWAYS	AUTO

Table 50
US REGION CALIBRATION MODULE OF CREATED US IMAGE OR US MULTIFRAME IMAGE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Sequence of Ultrasound Regions	(0018,6011)	SQ	A sequence is present for each region on the system display	ANAP	AUTO
>Region Location Min x_0	(0018,6018)	UL	Top Left position of region.	ANAP	AUTO
>Region Location Min y_0	(0018,601A)	UL	Top Left position of region	ANAP	AUTO
>Region Location Max x_1	(0018,601C)	UL	Bottom Right position of region	ANAP	AUTO
>Region Location Max y_1	(0018,601E)	UL	Bottom Right position of region	ANAP	AUTO
>Physical Units X Direction	(0018,6024)	US	Enumerated Value. 2D Image = 0003H = CM MMode = 0004H = SEC	ANAP	AUTO
>Physical Units Y Direction	(0018,6026)	US	Enumerated Value. ECG Region = 0000H = None 2D Image = 0003H = CM	ANAP	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
			MMode = 0003H = CM		
>Physical Delta X	(0018,602C)	FD	The physical value per pixel increment	ANAP	AUTO
>Physical Delta Y	(0018,602E)	FD	The physical value per pixel increment	ANAP	AUTO
>Reference Pixel X0	(0018,6020)	SL	The X pixel value of baseline	ANAP	AUTO
>Reference Pixel Y0	(0018,6022)	SL	The Y pixel value of baseline	ANAP	AUTO
>Reference Pixel Physical Value X	(0018,6028)	FD	For each region, the X coordinate of the reference point for measurements within that region.	ANAP	AUTO
>Reference Pixel Physical Value Y	(0018,602A)	FD	For each region, the Y coordinate of the reference point for measurements within that region.	ANAP	AUTO
>Region Spatial Format	(0018,6012)	US	Enumerated Value. 2D (tissue or flow) = 0001H MMode (tissue or flow) = 0002H	ANAP	AUTO
>Region Data Type	(0018,6014)	US	Enumerated Value. Tissue = 0001H	ANAP	AUTO
>Region Flags	(0018,6016)	UL	Always set to 3.	ANAP	AUTO

Table 51
US IMAGE MODULE OF CREATED US IMAGE OR US MULTIFRAME IMAGE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples Per Pixel	(0028,0002)	US	See 'Image Pixel Module'	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	See 'Image Pixel Module'	ALWAYS	CONFIG
Bits Allocated	(0028,0100)	US	See 'Image Pixel Module'	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	See 'Image Pixel Module'	ALWAYS	AUTO
High Bit	(0028,0102)	US	See 'Image Pixel Module'	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	See 'Image Pixel Module'	ANAP	AUTO
Pixel Representation	(0028,0103)	US	"0" Pixels are Unsigned integers	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	(0018,1065) (Frame Time Vector).	ALWAYS	AUTO
Image Type	(0008,0008)	CS	See 'General Image Module'	ALWAYS	CONFIG
Lossy Image Compression	(0028,2110)	CS	"01" if image is lossy compressed, "00" if not.	ALWAYS	AUTO
Ultrasound Color Data Present	(0028,0014)	US	0 or 1	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Acquisition Datetime	(0008,002A)	DT	The date and time that the acquisition of data that resulted in this image started.	ALWAYS	AUTO
Transducer Data	(0018,5010)	LO	Transducer name. VM = 3, the last two fields are written as "UNUSED".	ALWAYS	AUTO
Transducer Type	(0018,6031)	LO	SECTOR_PHASED, LINEAR, CURVED LINEAR Only used for 2D images; not used for Doppler-only images (i.e. pencil probes)	ANAP	AUTO
Processing Function	(0018,5020)	LO	The factory-defined exam/preset that was active when the image was acquired even if a user-defined preset.	ALWAYS	AUTO

Table 52
SOP COMMON MODULE OF CREATED US IMAGE OR US MULTIFRAME IMAGE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.6.1 for US Image 1.2.840.10008.5.1.4.1.1.3.1 for US Multiframe Image	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Auto Generated	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 100	ALWAYS	AUTO

Table 53
GENERAL IMAGE MODULE OF CREATED SECONDARY CAPTURE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	Generated by device, increments from "1" in each series. Gaps in values may exist if images are deleted on the system prior to export.	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS	The system sends the tag empty	VNAP	AUTO
Content Date	(0008,0023)	DA	<yyyymmdd>	ALWAYS	AUTO
Content Time	(0008,0033)	TM	<hhmmss.ffffff>	ALWAYS	AUTO
Image Type	(0008,0008)	CS	Value is DERIVED\PRIMARY for lossy, and ORIGINAL\PRIMARY for lossless	ALWAYS	CONFIG
Acquisition Date	(0008,0022)	DT	The system uses the same value as the Content Date, tag (0008,0023).	ALWAYS	AUTO
Acquisition Time	(0008,0032)	TM	The system uses the same value as the Content time, tag (0008,0033).	ALWAYS	AUTO
Acquisition Datetime	(0008,002A)	DT	The system generates this as a combination of Acquisition Date and Acquisition Time. The format is yyyymmddhhmmss.ffffff	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	CS	"01" if image is lossy compressed, "00" if not.	ALWAYS	AUTO

Table 54
IMAGE PIXEL MODULE OF CREATED SECONDARY CAPTURE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	3 for RGB 3 for YBR_FULL_422	ALWAYS	CONFIG
Photometric Interpretation	(0028,0004)	CS	RGB YBR_FULL_422	ALWAYS	CONFIG
Rows	(0028,0010)	US	768	ALWAYS	CONFIG
Columns	(0028,0011)	US	1024	ALWAYS	CONFIG

Bits Allocated	(0028,0100)	US	RGB Mode:
			  2D B&W,: 8 bits
			  2D Color: 8 bits
			YBR_FULL_422 Mode:
			  2D B&W: 8 bits
			  2D Color: 8 bits
				ALWAYS	AUTO

Bits Stored	(0028,0101)	US	Always the same numbers as Bits Allocated.	ALWAYS	AUTO
High Bit	(0028,0102)	US	The High Bit is always (Bits Allocated -1).	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Pixel Representation	(0028,0103)	US	"0" pixels are Unsigned integers	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB		ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	Zero (color-by-pixel)	ANAP	AUTO

Table 55
SC EQUIPMENT MODULE OF CREATED SECONDARY CAPTURE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Conversion Type	(0008,0064)	CS	SYN = Synthetic	ALWAYS	AUTO
Modality	(0008,0060)	CS	US	ALWAYS	AUTO

Table 56
SOP COMMON MODULE OF CREATED SECONDARY CAPTURE 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 for Secondary Capture Image	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Auto Generated	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 100	ALWAYS	AUTO

8.2   USED FIELDS IN RECEIVED IOD BY APPLICATION
Not Applicable

8.3   ATTRIBUTE MAPPING
TABLE 58 summarizes the relationships between attributes received via MWL, stored in acquired images and communicated via MPPS. The format and conventions used in Table 92 are the same as the corresponding table in DICOM Part 4, Annex M.6

Table 57
ATTRIBUTE MAPPING BETWEEN MODALITY WORKLIST, IMAGE AND MPPS

Modality Worklist	Image IOD	MPPS
Patient's Name	Patient's Name	Patient's Name
Patient ID	Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex	Patient's Sex
Patient's Weight	Patient's Weight	
Referring Physician's Name	Referring Physician's Name	
----	----	Scheduled Step Attributes Sequence
Study Instance UID	Study Instance UID	> Study Instance UID
Referenced Study Sequence	Referenced Study Sequence	> Referenced Study Sequence
Accession Number	Accession Number	>Accession Number
----	Request Attributes Sequence	----
Requested Procedure ID	>Requested Procedure ID	>Requested Procedure ID
Requested Procedure Description	>Requested Procedure Description	>Requested Procedure Description
Scheduled Procedure Step ID	>Scheduled Procedure Step ID	>Scheduled Procedure Step ID
Scheduled Procedure Step Description	>Scheduled Procedure Step Description	>Scheduled Procedure Step Description
Scheduled Protocol Code Sequence	>Scheduled Protocol Code Sequence	>Scheduled Procedure Step Description
----	Performed Protocol Code Sequence	Performed Protocol Code Sequence
----	Study ID – Requested Procedure ID from MWL, else generated	Study ID – Requested Procedure ID from MWL, else generated
----	Performed Procedure Step ID	Performed Procedure Step ID
----	Performed Procedure Step Start Date	Performed Procedure Step Start Date
----	Performed Procedure Step Start Time	Performed Procedure Step Start Time
----	Performed Procedure Step Description	Performed Procedure Step Description
Requested Procedure Code Sequence	Procedure Code Sequence	Procedure Code Sequence
----	Referenced Performed Procedure Step Sequence	----
----	>Referenced SOP Class UID	SOP Class UID

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Modality Worklist	Image IOD	MPPS
----	>Referenced SOP Instance UID	SOP Instance UID

8.4   CONTROLLED TERMINOLOGY
The contents of Requested Procedure Code Sequence (0032,1064) and Scheduled Protocol Code Sequence (0040,0008) supplied in Worklist Items will be mapped to Image IOD attributes as described in TABLE 58.

8.5   EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS
Not applicable.

***** End of Document *****