Lumify DICOM Conformance Statement

Lumify 1.2.x

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PHILIPS

1   CONFORMANCE STATEMENT OVERVIEW

The Philips Lumify 1.2.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
Workflow Management		
Modality Worklist	Yes	No

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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 1.2.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 (in case of media).

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
CD-R	Compact Disk Recordable
DICOM	Digital Imaging and Communications in Medicine
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
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 (currently 2015) 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

Local AEs   Remote AEs

Send Images → Storage AE → Remote AE Receives Images

Worklist Update → Workflow AE ← Remote AE Provides Worklist Items
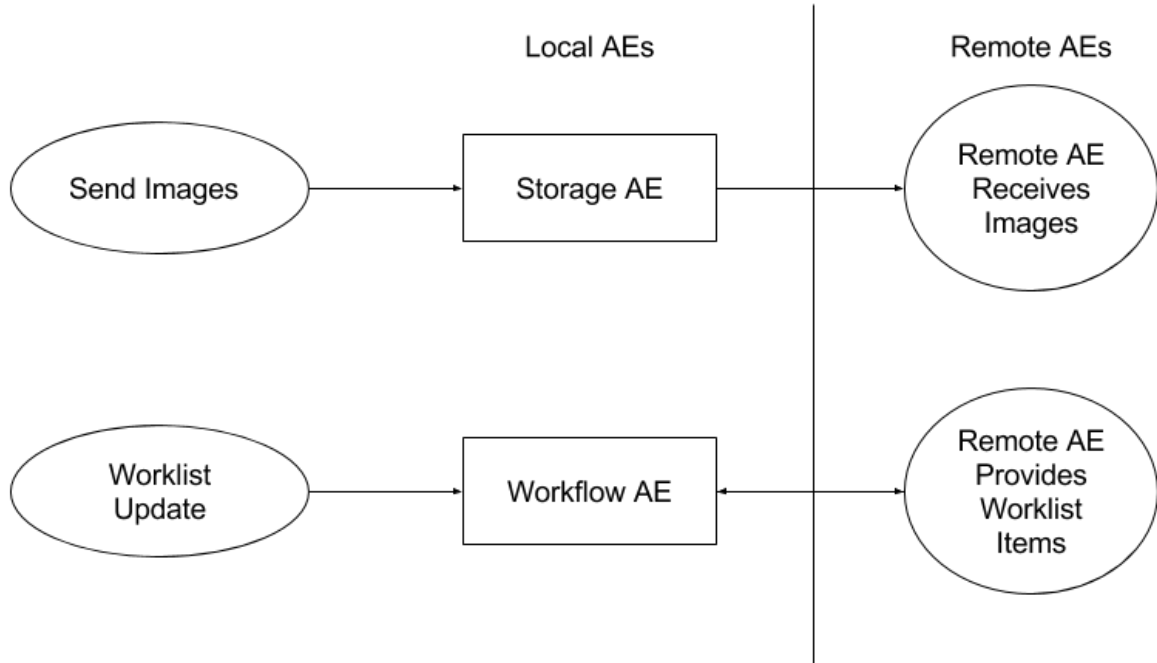
Figure 1
APPLICATION DATA FLOW DIAGRAM

— 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 or exporting of images depends on user configuration, either "Batch" when End Exam is pressed, or Manual.

— The **Workflow Application Entity** receives Worklist information remote AEs. It is associated with the local real-world activities "Refresh." When the "Refresh" is performed, the Workflow Application Entity queries a remote AE for worklist items that provides the set of worklist items matching the query request.

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 Job Manager (CNTL-J). 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-sends 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*

"Refresh" 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.

Settings that may be customized are:

- o   Start Date (All Dates, Today or Date Range)
- 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, 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 Worklist.

4.1.3   Sequencing of Real-World Activities
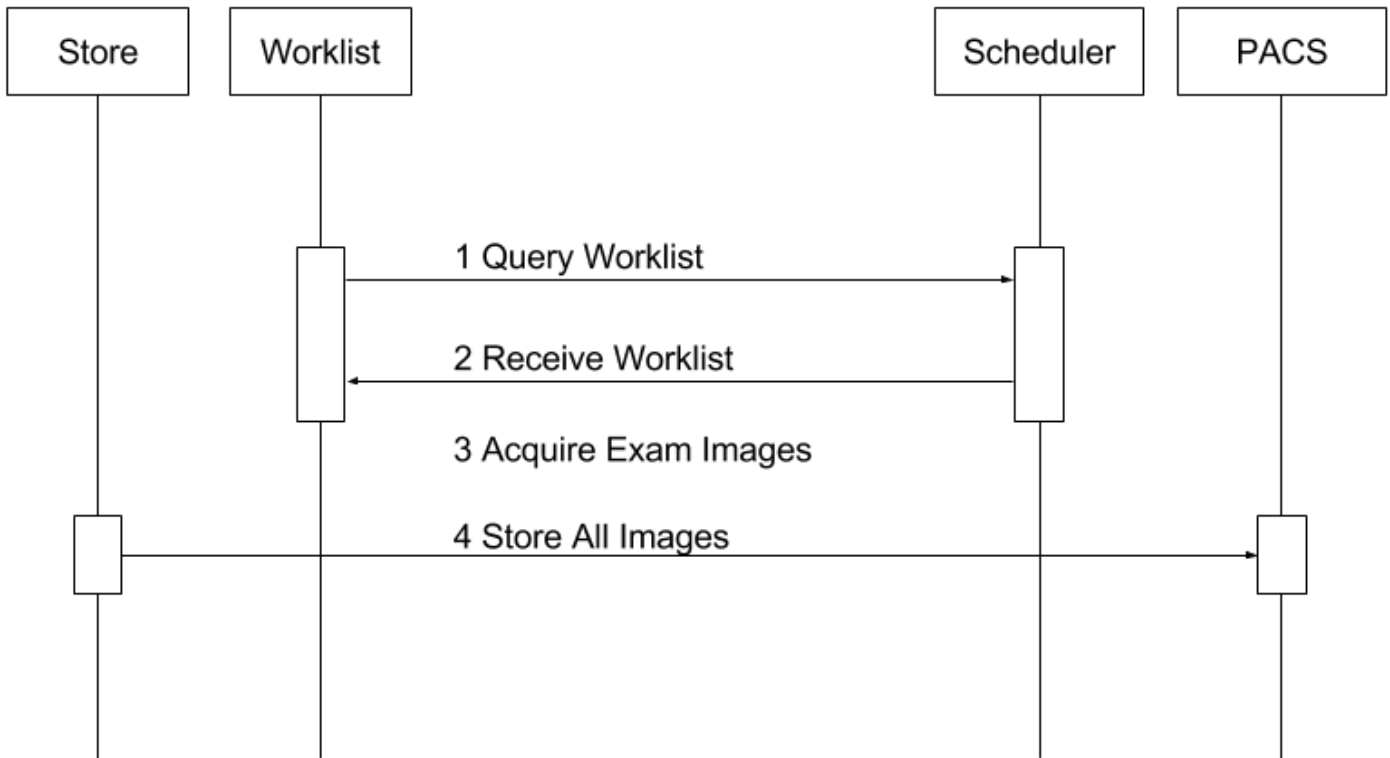
Figure 2
Sequencing Constraints

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

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

The PDU size is configurable with a minimum size of 100 and a maximum size of 16,000. The default PDU size is 16,000.

4.2.1.2.2 Number of Associations

Lumify 1.2.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 1.2.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	1.3.46.670589.14.8100.100
Implementation Version Name	LUMIFY_1.2

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.
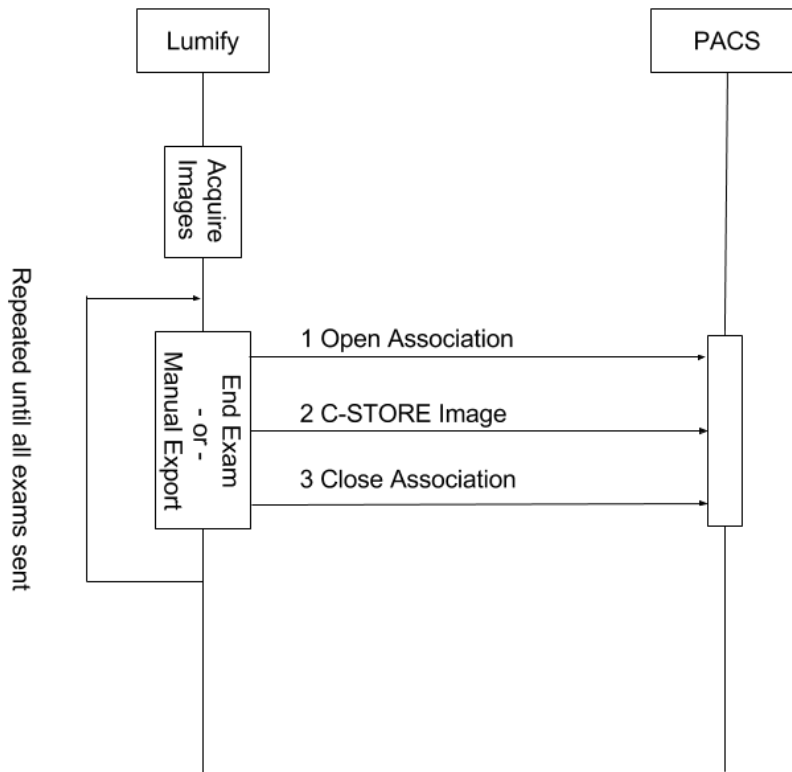

Figure 3
SEQUENCING OF ACTIVITY – SEND IMAGES

Lumify 1.2.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

4.2.1.3.1.3   *SOP Specific Conformance for Image SOP Classes*
All SOP Classes supported by the Storage AE exhibit the same behavior, except where stated, and are described together in this section.

Table 10 describes C-Store response behavior.

The following Default Settings and Ranges may be used where applicable in Table 10:

Setting	Default
Connect Timeout	30 sec
Read Timeout	300 sec
Retry Interval	300 sec
Maximum Retries	3

Establishing the Association with Default settings

Table 7
STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR

Condition (After C-Store)	Status Codes (C-Store-RSP)	Response
Could not establish the association within 30-second time window (Connect Timeout) due to NO RESPONSE from the Storage Server	Not Applicable	The association attempt is aborted, and after 5-minutes a new association is attempted. Lumify 1.2.x will make three attempts to open an association with the configured Storage SCP before aborting the storage request and placing the job in an error state. The user can then manually restart the job at some later date. The 5-minute timeout and the number of retries are configurable by the user from the DICOM Setup screens. The 5-minute timeout is mapped to the 'Retry Interval' input control on the DICOM Setup screen and the number of retries is mapped to 'Maximum Retries' on the DICOM Setup screen.
Refused	A7xx	If the Storage SCP server refuses the association, then the association attempt is aborted. Lumify 1.2.x will wait 5-minutes and then reattempt the association. Lumify 1.2.x will make three attempts to establish the association before aborting the storage request and placing the job in an error state. The user can then manually restart the job at some later date. The failure is logged to the DICOM log file as an error. As an example, the association would be refused if the storage server employs a high security mechanism whereby it only accepts association

Condition (After C-Store)	Status Codes (C-Store- RSP)	Response
		requests from DICOM Servers that it knows about and the Lumify 1.2.x 's AE Title was not in the PACS database. See the timeout and retry settings above.

During Image Transfer

Table 8

Service Status	Error Code	Behavior
After association has been accepted, there is no response to a request within 5-minute time window (Read Timeout).	Not Applicable	If the association is lost during active image transfer to the Storage SCP server, Lumify 1.2.x will initiate a new association after 5 minutes, and attempt to store all the images. If during transfer, the association is again lost, Lumify 1.2.x will wait another 5 minutes and try again. Lumify 1.2.x will make three attempts to send all the images before aborting the storage request and placing the job in an error state. The user can then manually restart the job at some later date. See the timeout and retry settings above.
Error	A9xx, Cxxx, 0122, Other	Lumify 1.2.x will treat all errors as failure of Storage request (also called as Job). A failed job is automatically retried after 5 minutes. If the job fails even after three attempts, Lumify 1.2.x will abort this request and place the job in an Error state. The user can then manually restart the job at some later date.
Warning	D000, B000, B006, B007	If the Storage SCP issues a warning on a particular image (perhaps it had to use coercion), Lumify 1.2.x logs the warning to the DICOM log file as an informational event and continues on as if the image was successfully stored to the PACS (see row below).
Success	0000	When an image is successfully stored to the Storage SCP (PACS), Lumify 1.2.x will keep a record of the successful storage. If all the images in the job are successfully stored, Lumify 1.2.x will notify the user (through an icon on the list of studies), and the job will be removed from the job manager.

The behavior of Storage AE during communication failure is summarized in Table 8.

Table 9
STORAGE COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	Same as Service Status timeouts in Table 8 above.
Association aborted by the SCP or network layers	Same as Service Status in Table 8 above.

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

4.2.2 Workflow Application Entity Specification

4.2.2.1 *SOP Classes*
Lumify 1.2.x provides Standard Conformance to the following SOP Classes:

Table 10
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

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 11
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 1.2.x initiates one Association at a time for a Worklist request.

Table 12
NUMBER OF ASSOCIATIONS INITIATED FOR AE WORKFLOW

Maximum number of simultaneous Associations	1

4.2.2.2.3 Asynchronous Nature
Lumify 1.2.x does not support asynchronous communication.

Table 13
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 14
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE WORKFLOW

Implementation Class UID	1.3.46.670589.14.8100.100
Implementation Version Name	LUMIFY_1.2

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.
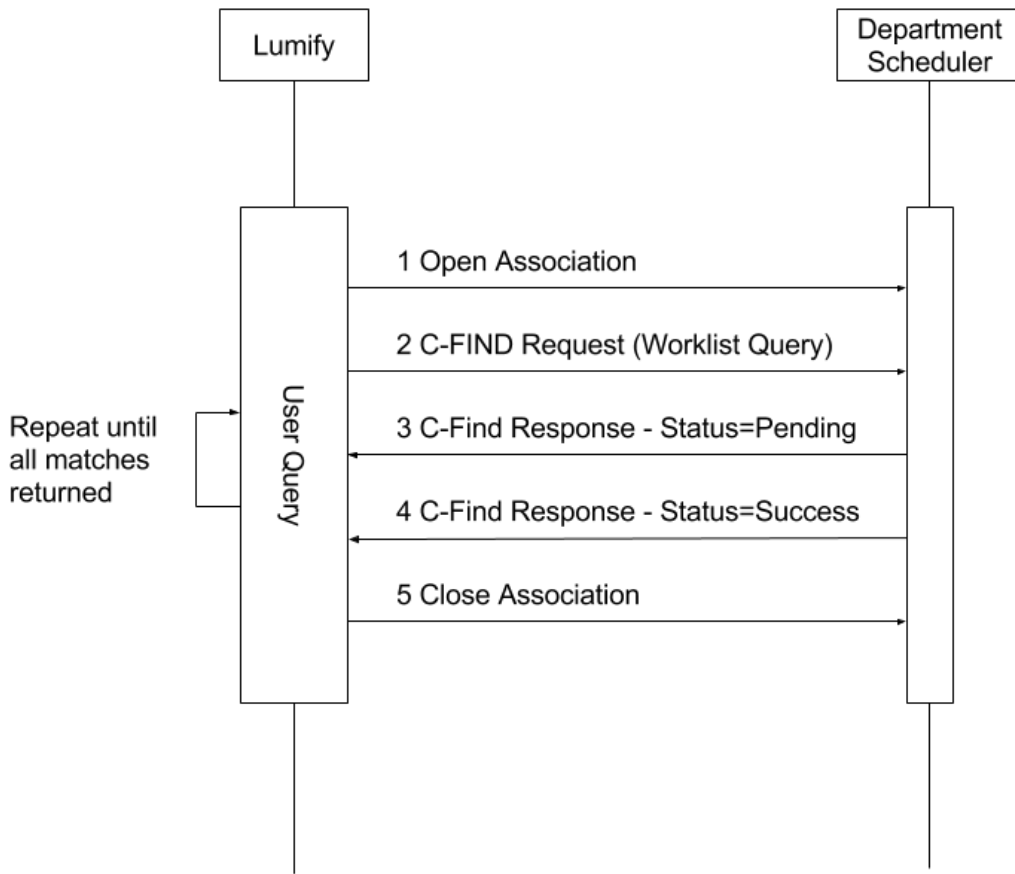
Figure 4
SEQUENCING OF ACTIVITY – WORKLIST UPDATE

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

4.2.2.3.1.2   Proposed Presentation Contexts
Lumify 1.2.x will propose Presentation Contexts as shown in the following table:

Table 15
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	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 1.2.x will use Explicit VR Little Endian Transfer Syntax.

4.2.2.3.1.3 SOP Specific Conformance for Modality Worklist

Table 24 summarizes the behavior of Lumify 1.2.x when encountering status codes in a MWL C-FIND response.

A message "query failed" will appear on the user interface if Lumify 1.2.x receives any other SCP response status than "Success" or "Pending."

Table 16
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 17 summarizes the behavior of Lumify 1.2.x during communication failure.

Table 17
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 18 describes the Lumify 1.2.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 18
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	x	x
> Scheduled Procedure Step Start Date	(0040,0002)	DA	S, R	x	x	x
> Scheduled Procedure Step Start Time	(0040,0003)	TM		x	x	x
> Modality	(0008,0060)	CS	S	x		x
> Scheduled Performing Physician's Name[1]	(0040,0006)	PN		x		x
> Scheduled Procedure Step Description[2]	(0040,0007)	LO		x	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	x
Reason for the Requested Procedure[4]	(0040,1002)	LO		x	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		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	x	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	x
Patient Demographic						
Patient's Birth Date	(0010,0030)	DA		x	x	x
Patient's Sex	(0010,0040)	CS		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
Referenced Patient Sequence	(0008,1120)	SQ		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 1.2.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 1.2.x supplies an attribute value for Single Value Matching, "R" indicates a Range Value and "*" is for Wildcard matching. See section 4.2.2.3.1.2 for setup location.
R:	Return keys. An "x" indicates that Lumify 1.2.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.

4.2.3   Verification Application Entity specification

4.2.3.1   *SOP Class*

Lumify 1.2.x provides Standard Conformance to the following SOP Class:

Table 19
SOP CLASSES FOR AE VERIFICATION

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

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 20
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 1.2.x initiates one Association at a time for a Verification request.

Table 21
NUMBER OF ASSOCIATIONS INITIATED FOR AE VERIFICATION

Maximum number of simultaneous Associations	1

4.2.3.2.3   Asynchronous Nature

Lumify 1.2.x does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 22
ASYNCHRONOUS NATURE AS A SCU FOR AE VERIFICATION

Maximum number of outstanding asynchronous transactions	1

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

Table 23
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE VERIFICATION

Implementation Class UID	1.3.46.670589.14.8100.100
Implementation Version Name	LUMIFY_1.2

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 1.2.x will initiate the association.

Only one association is established for each verification attempt.
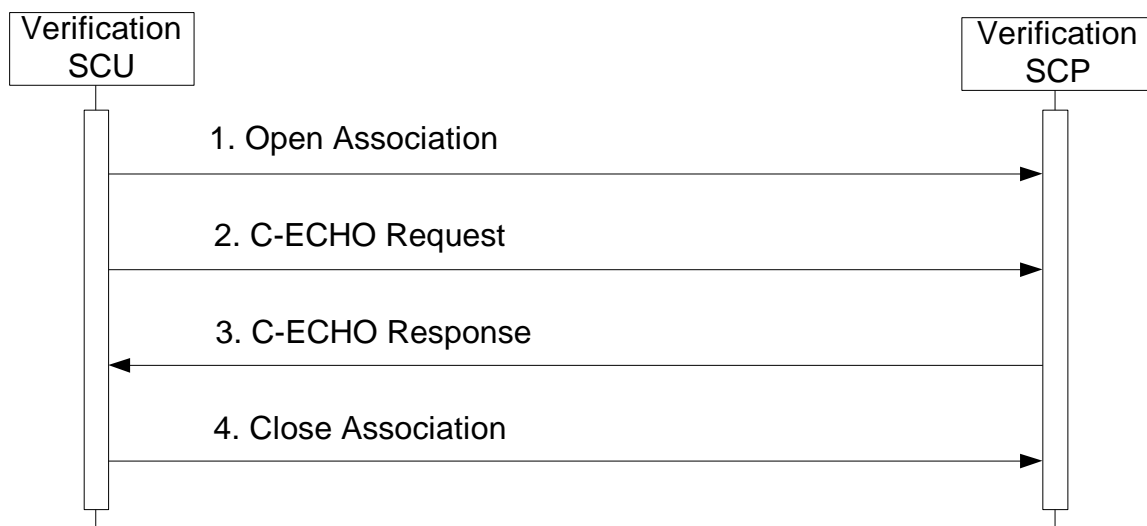
Figure 5
SEQUENCING OF ACTIVITY – ISSUE VERIFY

4.2.3.3.1.2   *Proposed Presentation Contexts*

Table 24
Proposed Presentation Contexts for Activity Verify As Scu

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5	SCU	None

4.2.3.3.1.3   SOP Specific Conformance for Verification
No SOP Specific behavior

4.2.3.4   Association Acceptance Policy

4.2.3.4.1   Verification
Table 51.8 summarizes the behavior of Lumify 1.2.x when receiving status codes in a C-ECHO response.

A message will appear on the user interface if Lumify 1.2.x receives any other SCP response status than "Success."

Table 25
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.

4.3   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 1.2.xsystem supports one network interface at a time. The following physical network interfaces are available:

Table 26
SUPPORTED PHYSICAL NETWORK INTERFACE

1) 802.11 b/g Wireless

4.3.3   Additional Protocols

Not Applicable

4.3.4   IPv4 and IPv6 Support

Only IPv4 is 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.

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 27
Device AE Title Configuration

Application Entity	AE Title
Storage	<User Specified>
Worklist	<User Specified>

4.4.1.2   *Remote AE Title/Presentation Address Mapping*

Table 28
Remote AE Title Configuration

Application Entity	AE Title
Storage	<User Specified>
Worklist	<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.

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5   MEDIA STORAGE

Lumify 1.2.x does not support Media Storage

6 SUPPORT OF CHARACTER SETS

Table 29
Supported Character Sets

Character Set Description	Defined Term	ESC Sequence	ISO Registration Number	Code Element	Character Set
Unicode as UTF-8	ISO_IR 192	-	ISO-IR 192	N/A	ISO 10646-1, 10646-2, and their associated supplements and extensions
		-	ISO-IR 6	G0	ISO 646

7 SECURITY

DICOM security is not implemented on Lumify 1.2.x at this time.

8   ANNEXES

8.1   CREATED IOD INSTANCES

Table 30 specifies the attributes of an Ultrasound Image transmitted by the Lumify 1.2.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 30
IOD of created US or US Multiframe SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 72	ALWAYS
Study	General Study	Table 73	ALWAYS
	Patient Study	Table 74	ALWAYS
Series	General Series	Table 75	ALWAYS
Equipment	General Equipment	Table 76	ALWAYS
Image	General Image	Table 77	ALWAYS
	Image Pixel	Table 78	ALWAYS
	Cine	Table 79	Only if Multi-frame
	Multi-frame	Table 80	Only if Multi-frame
	US Region Calibration	Table 81	ANAP*
	US Image	Table 82	ALWAYS
	SOP Common	Table 84	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   Common Modules

Table 31
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
Other Patient IDs	(0010,1000)	LO	Same attribute of MWL	ANAP	MWL

Table 32
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
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

Attribute Name	Tag	VR	Value	Presence of Value	Source
>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
>Requested Procedure Description	(0032,1060)	LO	Same value as MWL attribute	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 33
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 34
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 35
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

Attribute Name	Tag	VR	Value	Presence of Value	Source
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 ID	(0040,1001)	SH	Value from MWL.	ANAP	AUTO / MWL
>Requested Procedure Description	0032,1060	LO	Value from MWL.	ANAP	MWL
>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 yyyymmdd.hhmmss.	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 36
GENERAL EQUIPMENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Philips Medical Systems	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
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

8.1.3 US or Multiframe Image Modules

Table 37
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 38
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	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
Pixel Representation	(0028,0103)	US	"0" pixels are Unsigned integers	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OW / OB		ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Planar Configuration	(0028,0006)	US	RGB Images: Zero (color-by-pixel) YBR: Images: Always zero (color-by-pixel)	ANAP	AUTO

Table 39
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.	ALWAYS	AUTO

Table 40
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 41
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 / Doppler = 0004H = SEC	ANAP	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
>Physical Units Y Direction	(0018,6026)	US	Enumerated Value. ECG Region = 0000H = None 2D Image = 0003H = CM MMode = 0003H = CM Doppler = 0007H = CM / SEC	ANAP	AUTO
>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 Spectral (CW or PW Doppler) = 0003H ECG (waveform) = 0004H	ANAP	AUTO
>Region Data Type	(0018,6014)	US	Enumerated Value. Tissue = 0001H PW Spectral Doppler = 0003H CW Spectral Doppler = 0004H ECG (waveform) = 000AH	ANAP	AUTO
>Region Flags	(0018,6016)	UL	Always set to 3.	ANAP	AUTO

Table 42
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

Attribute Name	Tag	VR	Value	Presence of Value	Source
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
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 43
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 192	ALWAYS	AUTO

8.2 USED FIELDS IN RECEIVED IOD BY APPLICATION

Not Applicable

8.3 ATTRIBUTE MAPPING

Table 44 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 44
ATTRIBUTE MAPPING BETWEEN MODALITY WORKLIST, IMAGE AND MPPS

Modality Worklist	Image IOD
Patient's Name	Patient's Name
Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex
Patient's Weight	Patient's Weight
Referring Physician's Name	Referring Physician's Name
----	----
Study Instance UID	Study Instance UID
Referenced Study Sequence	Referenced Study Sequence
Accession Number	Accession Number
----	Request Attributes Sequence
Requested Procedure ID	>Requested Procedure ID
Requested Procedure Description	>Requested Procedure Description
Scheduled Procedure Step ID	>Scheduled Procedure Step ID
Scheduled Procedure Step Description	>Scheduled Procedure Step Description
Scheduled Protocol Code Sequence	>Scheduled Protocol Code Sequence
Requested Procedure Code Sequence	Procedure Code Sequence

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 44.

8.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

Not applicable.

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

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