DICOM CONFORMANCE STATEMENT

FOR

DP10/DP20/DP30 SERIES

DIGITAL ULTRASONIC

DIAGNOSTIC IMAGING SYSTEM

mindray 迈瑞

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1 Conformance Statement Overview

This document describes the conformance to the DICOM 3.0(NEMA PS 3.1-3.18(2009), Digital Imaging and Communication in Medicine (DICOM) Set) by all the ultrasound systems such as DP-10/DP-10T/DP-11/DP-15/DP-18/DP-10Vet, DP-20/DP-20T/DP-21/DP-25/DP-28/DP-20Vet, DP-30/DP-30T/DP-30Vet. We specify ultrasound system generally refer to the products above in this document. The ultrasound system implements the necessary DICOM services to download worklists from an information system, save acquired Ultrasound (US) images to a network storage device and/or removable media, print to a networked hardcopy device. Table 1 provides an overview of the supported network services, Table 2 lists the supported Media Storage Application Profiles.

Table 1
NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer（Storage）		
Verification	Yes	No
Ultrasound Image Storage	Yes	No
Ultrasound Multi-frame Image Storage	Yes	No
Secondary Capture Image Storage	Yes	No
Workflow Management		
Modality Worklist Information Model – Find	Yes	No
Storage Commitment Push Model	Yes	No
Print Management		
Basic Color Print Management	Yes	No
Basic Grayscale Print Management	Yes	No

Table 2
MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC / FSU)	Read Files (FSR)
Compact Disk - Recordable		
STD-US-SC-SF&MF-CDR	Yes / Yes[1]	Yes

Media Storage Application Profile	Write Files (FSC / FSU)	Read Files (FSR)
DVD		
STD-US-SC-SF&MF-DVD STD-US-SC-SF&MF-DVD-RAM	Yes / Yes[1]	Yes
USB Devices		
STD-GEN-USB-JPEG for Ultrasound images, compressed and uncompressed	Yes / Yes[1]	Yes

Note: 1 Only acts as a FSU for media that may be written to multiple times.

2 Table of Contents

3 Introduction

3.1 Review History

DOCUMENT VERSION	DATE OF ISSUE	DESCRIPTION
1.0	01/ 10/ 2013	Creation of the document

3.2 Audience

This document is intended for potential customers, system integrators of medical equipment, marketing staff interested in system functionality and software designers implementing DICOM interfaces. It is assumed that the readers of this document are familiar with the DICOM Standard and with the terminology and concept which are used in the Standard. If readers are unfamiliar with DICOM terminology they should read the DICOM Standard, prior to reading this DICOM Conformance Statement document.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between Mindray Products and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

— The comparison of different Conformance Statements is the first step towards assessing interconnectivity and interoperability between Mindray medical equipment and other DICOM conformant equipments.

— Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

— The DICOM standard will evolve to meet the user's growing requirements. Mindray is actively involved in the development of the DICOM standard. Therefore, Mindray reserves the right to make changes to its products or to discontinue its delivery.

— The Ultrasound System follows the IHE SWF, PDI, ED Profiles.

3.4 Terms and Definitions

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

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

- **Application Entity (AE)** – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

- **Application Entity Title** – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network. The Called AE Title defines the intended receiver of an Association. Nevertheless, the Calling AE Title defines the requestor of an Association.

- **Association** – a network communication channel set up between *Application Entities*.

- **Association Establishment** - an Association Establishment is the first phase of communication between two DICOM Application Entities. The AEs use the Association Establishment to negotiate how data will be encoded and the type of data to be exchanged.

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

- **DICOM File Format** - the DICOM File Format provides a means to encapsulate in a File the Data Set representing a SOP Instance related to a DICOM Information Object.

- **DICOM Message Service Element (DIMSE)** – a DIMSE defines the services and protocols utilized by an Application Entity to exchange messages.

- **File** - a File is an ordered string of zero or more bytes, where the first byte is at the beginning of the file and the last byte is at the end of the File. Files are identified by an unique File ID and may by written, read, or deleted.

- **File Meta Information** - the File Meta Information includes identifying information on the encapsulated Data Set. It is a mandatory header at the beginning of every DICOM File.

- **Information Object Definition (IOD)** - the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes*

may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: Print Job IOD.

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

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

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

- **Physical Media** - a piece of material with recording capabilities for streams of bits. Characteristics of a Physical Media include form factor, mechanical characteristics, recording properties and rules for recording and organizing bit streams in accessible structures.

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

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

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

- **Service Class Provider (SCP)** – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

- **Service Class User (SCU)** – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU).

- **Service/Object Pair (SOP) Class** – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

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

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

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

- **Unique Identifier (UID)** – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

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

3.5 Acronyms, Abbreviations, and Symbols

The following acronyms and abbreviations are used in this document.

ACR	American College of Radiology
AE	Application Entity
CDR	Compact Disk Recordable
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element-Composite
FSC	File-Set Creator
FSR	File-Set Reader
FSU	File-Set Updater
HIS	Hospital Information System
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
ISO	International Standard Organization
JPEG	Joint Photographic Experts Group
MODALITY	Ultrasound System
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
R	Required (Key Attribute)
RIS	Radiology Information System

SCP   Service Class Provider

SCU   Service Class User

SOP   Service Object Pair

SR   Structured Reporting

TCP/IP Transmission Control Protocol/Internet Protocol

U   Unique (Key Attribute)

UL   Upper Layer

VR   Value Representation

US   Ultrasound

UID   Unique Identifier

3.6 References

DICOM Quick Guide & FAQ, Revision 1.0 Final Text, Mindray Co. Ltd

Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18(2009), available free at http://medical.nema.org/

IHE Technical Framework, available free at http://www.ihe.net/

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow
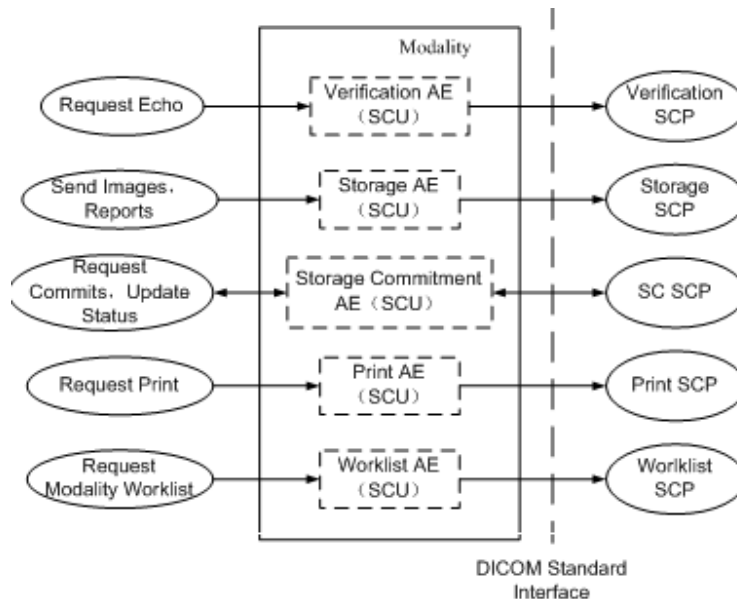
Figure 1
Implementation Model

This application entity provides a user interface, internal database and network listener that spawns additional threads as necessary to handle incoming connections.

Conceptually the network services may be modeled as the following AEs, however, in fact all the AEs share a single (configurable) AE Title:

- Verification AE (as SCU)
- Storage AE (as SCU)
- Storage Commitment AE（as SCU）
- Print AE (as SCU)
- Worklist AE (as SCU)

4.1.2 Functional Definitions of AE's

4.1.2.1 Verification AE

The ultrasound system supports the Verification service as a SCU.

As a SCU, verification is activated when the verify button is selected on the dicom service configuration page where the verification results will also be showed to the user.

4.1.2.2 Storage AE

As a SCU, the Storage AE originates associations for the transfer of DICOM Ultrasound single frame images, multi-frame images, secondary capture images to remote AE (selected from a pre-configured list)..

The system supports automatic and manual storage.

The operations for automatic storage service are described below:

- Operation 1

Step 1: Enable "Sending/printing after End Exam" in the user preset.

Step 2: End Exam, the ended exam (maybe include images) would automatically send to the default storage service SCPs which have been set as default in the DICOM service preset dialog.

The operations for manual storage service are described below:

- Operation 1

Step 1: Select exams in the iStation Dialog.

Step 2: Press "Send Exam" and select DICOM Storage service.

Step 3: Send the selected exams (maybe include images) to the DICOM Storage service SCPs.

- Operation 2

Step 1: Select thumbnail in the iStation Dialog.

Step 2: Press "Send to" button and select DICOM Storage service SCPs.

Step 3: Send the image to the DICOM Storage service SCPs.

- Operation 3

Step 1: Open the review dialog and select the images.

Step 2: Press the "Send To" button to choose the storage SCPs.

Step 3: Send the image to the DICOM Storage service SCPs.

In the event that the ultrasound system is taken off the network as a portable system or when a network failure occurs during a background store, the Storage SCU maintains a queue of failed C-STORE requests. If pre-configured on Preset UI, the failed C-Store requests will be automatically retried specified times. If no pre-configuration, the user can also retry the failed requests manually.

4.1.2.3 Storage Commitment AE

The Storage Commitment AE originates associations to ensure the reliable storage of DICOM composite information objects on remote DICOM device after sending DICOM Storage Service to the device.

The Storage Commitment service will be executed automatically in the circumstance as below:

- The Storage Commitment Service is set to associate with the Storage Service in DICOM storage service preset dialog and the associated Storage Service is executed.
- Exam is the unit to send.
- The status of the exam is "End". It would not be executed when an "Active", "Paused" or "Cancelled" exam is selected.

4.1.2.4 Print AE

As a SCU, the Print AE originates associations for the print of DICOM Ultrasound single frame images and secondary capture images to remote AE (selected from a pre-configured list).

The system is capable of grayscale (B/W) and color print supporting with automatic and manual print functions.

The operations for automatic print service are described below:

- Operation 1

Step 1: Enable "Send/printing after End Exam" in the user preset.

Step 2: End Exam, the single frame images and secondary capture images of ended exam would automatically send to the default print service SCPs which have been set as default in the DICOM service preset dialog. .

The operations for manual print service are described below:

- Operation 1

Step 1: Select exams in the iStation Dialog.

Step 2: Press "Send Exam" and select DICOM print service SCPs.

Step 3: Send the single frame images and secondary capture images of the selected exams to the DICOM print service SCPs.

- Operation 2

Step 1: Select thumbnail in the iStation Dialog.

Step 2: Press "Send to" button and select DICOM print service SCPs.

Step 3: Send the image to the DICOM print service SCPs.

- Operation 3

Step 1: Open the review dialog and select the images.

Step 2: Press the "Send To" button to choose the print SCPs.

Step 3: Send the image to the DICOM print service SCPs.

4.1.2.5   Worklist AE

The Worklist AE is activated through the Worklist UI when the user selects a remote AE to query (from a pre-configured list).The system supports automatic and manual query depending on its configuration on Preset UI. The system supports fuzzy query using "?" and "*".

- If set one and only one remote AE to be default status. The system can initiate a query with default rules when show the Worklist UI. The Worklist Server is the default server. The Modality Type is US, the Exam Date is today, and the Scheduled Station AE Title is blank.
- Alternatively if the default status is no, the user can specify query rules on Worklist UI. Such as Patient ID, Patient Name, Accession Number, Requested Procedure ID, Worklist Server, Exam Date, Modality Type and Scheduled Station AE Title.

If no matches are found, a dialogue will be presented to the user to indicate so. The possible reasons for this failure are listed to help trouble shooting.

If more than one matching patients found, user can discover lists number on the UI. The user can also change query rules for another query, or for further filter in local database to locate the patients quickly. And the lists can be sorted in ascending or descending order.

4.1.3 Sequence of Real World Activities

All SCU activities are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed.

4.2 AE Specifications

4.2.1 Modality AE

4.2.1.1   SOP Classes

The ultrasound system provides Standard Conformance to the following SOP Class:

Table 3

SOP Class for Modality AE

SOP Class Name	*SOP Class UID*	*SCU*	*SCP*
Verification SOP Class	*1.2.840.10008.1.1*	*Yes*	*No*
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*
Storage Commitment Push Model	*1.2.840.10008.1.20.1*	*Yes*	*No*
Basic Grayscale Print Management Meta	*1.2.840.10008.5.1.1.9*	*Yes*	*No*
Basic Color Print Management Meta SOP Class	*1.2.840.10008.5.1.1.18*	*Yes*	*No*
Basic Film Session SOP Class	*1.2.840.10008.5.1.1.1*	*Yes*	*No*
Basic Film Box SOP Class	*1.2.840.10008.5.1.1.2*	*Yes*	*No*
Basic Grayscale Image Box SOP Class	*1.2.840.10008.5.1.1.4*	*Yes*	*No*
Printer SOP Class	*1.2.840.10008.5.1.1.16*	*Yes*	*No*
Print Job SOP Class	*1.2.840.10008.5.1.1.14*	*Yes*	*No*
Modality Worklist Information Model – Find	*1.2.840.10008.5.1.4.31*	*Yes*	*No*

4.2.1.2   Association Establishment Policies

4.2.1.2.1 General

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

Table 4

DICOM Application Context for Modality AE

Application Context Name	*1.2.840.10008.3.1.1.1*

The PDU size is configurable with a minimum size of 16,384 and a maximum size of 65,536. The default PDU size is 32,768.

4.2.1.2.2 Number of Associations

The system initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Since Storage and Print tasks are executed within a same thread, when they are selected simultaneously, only one job will be active at a time, the other(s) remain pending until the active job is successful or failed.

Table 5

Number of Associations as an Association Initiator

Maximum number of simultaneous associations	*1*

Table 6

Number of Associations as an Association Acceptor

Maximum number of simultaneous associations	*1*

4.2.1.2.3 Asynchronous Nature

The ultrasound system will only allow a single outstanding operation on an association.

4.2.1.2.4 Implementation Identifying Information

Table 7

DICOM Implementation Class and Version for Modality AE

Implementation Class UID	*1.2.156.112536.1.2308.0.1.0.1*
Implementation Version Name	*MINDRAY_V1.0*

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Request Echo

4.2.1.3.1.1 Description and Sequencing of Activities

The user can verify the communication of a DICOM server on the hospitals network, by clicking [Verify] button in the DICOM Service screen. When the user presses this button, the ultrasound system will initiate the association.
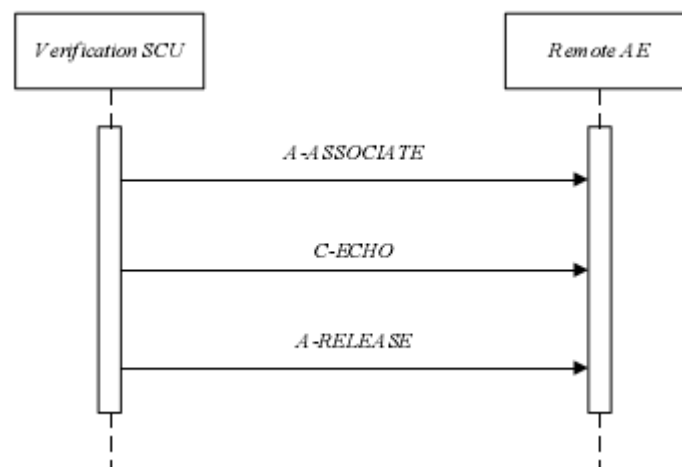
Figure 2
Sequencing of Activity – Send Echo Request

4.2.1.3.1.2 Proposed Presentation Contexts

The Verification AE (as SCU) supports the following Presentation Contexts for Verification.

Table 8

Presentation Contexts for Verification

PROPOSED PRESENTATION CONTEXTS					
Abstract Syntax		*Transfer Syntax*		*Role*	*Ext. Neg.*
Name	*UID*	*Name*	*UID*		
Verification	*1.2.840.100 08.1.1*	*Implicit VR Little Endian*	*1.2.840.10008.1.2*	*SCU*	*None*
		Explicit VR Little Endian	*1.2.840.10008.1.2.1*	*SCU*	*None*
		Explicit VR Big Endian	*1.2.840.10008.1.2.2*	*SCU*	*None*

4.2.1.3.1.33SOP Specific Conformance

It summarizes the behavior of Ultrasound System when receiving status codes in a C-ECHO response.

Table 9

Verification C-Echo Response Status Handling Behavior

Service Status	*Further Meaning*	*Error Code*	*Behavior (as SCU)*
Success	*Success*	*0000*	*Device Status is set to: Verify Successful*
Refused	*Out of Resources*	*A7XX*	*Device Status is set to: Verify Failed*
Failed	*Unable to process*	*CXXX*	*Device Status is set to: Verify Failed*
*	***	*Any other status code*	*Device Status is set to: Verify Failed*

4.2.1.3.2 Activity – Store images

4.2.1.3.2.1 Description and Sequencing of Activities
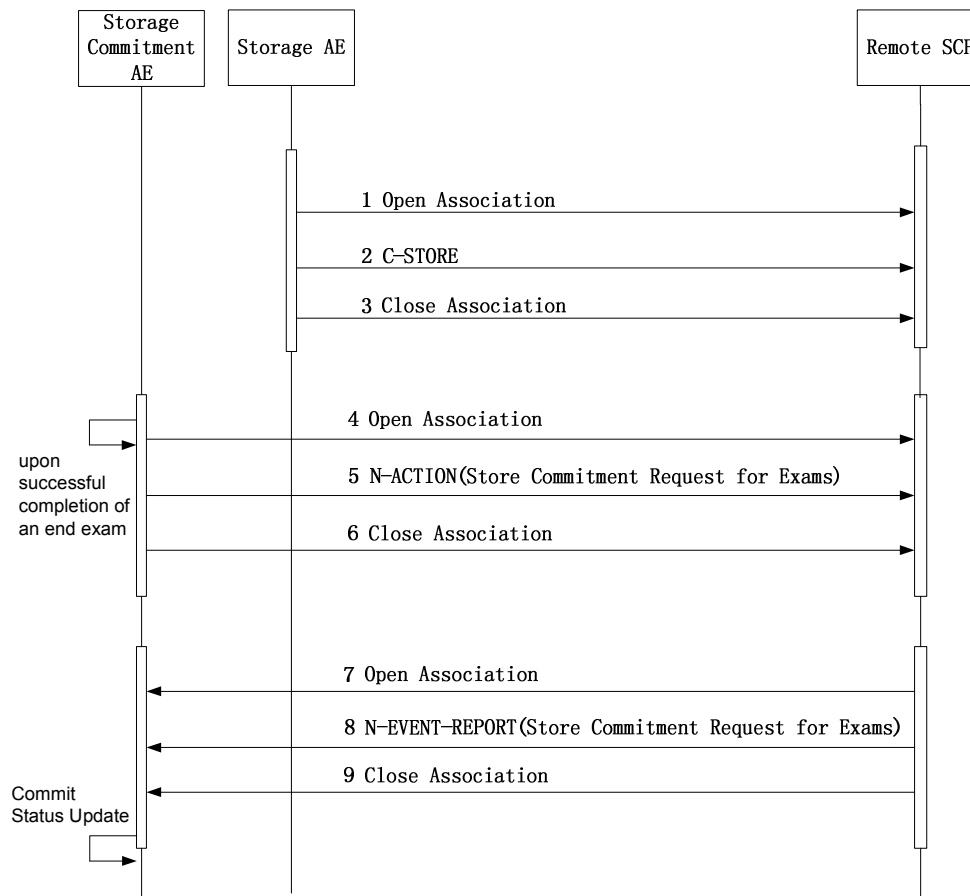
Figure 3

Sequencing of Activity – Send Storage Request

For each exam, images selected from the user interface will be transfered to the selected remote AE. When the storage fails, not only the failed task will automatically retry specific times if configured on Preset UI, but also user can restart the failed task by pressing "Retry" Button on the ultrasound task management dialog. Besides that, in the event that the ultrasound system is taken off the network or when a network failure occurs during a background store, the Storage SCU maintains a queue of failed C-STORE requests. Once the network is restored, the system will retry automaticlly.

4.2.1.3.2.2 Proposed Presentation Contexts

If Storage AE is offered a choice of Transfer Syntaxes in the accepted Presentation Contexts, it will apply the first encountered to use for the C-STORE operation. As to Compress Transfer Syntaxes, it will apply the user configured one.

Table 10

Proposed Presentation Contexts for Storage

PROPOSED PRESENTATION CONTEXTS					
Abstract Syntax		*Transfer Syntax*		*Role*	*Ext. Neg.*
Name	*UID*	*Name*	*UID*		
US Image Storage	1.2.840.100 08.5.1.4.1.1 .6.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG Lossy, Baseline Sequential with Huffman Coding (Process 1)	1.2.840.10008.1.2.4. 50	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4. 70	SCU	None
		RLE Lossless	1.2.840.10008.1.2.5	SCU	None
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4. 90	SCU	None
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4. 91	SCU	None
US Multiframe Image Storage	1.2.840.100 08.5.1.4.1.1 .3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG Lossy, Baseline Sequential with Huffman Coding (Process 1)	1.2.840.10008.1.2.4. 50	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4. 70	SCU	None
		RLE Lossless	1.2.840.10008.1.2.5	SCU	None
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4. 90	SCU	None

		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG Lossy, Baseline Sequential with Huffman Coding (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70	SCU	None
		RLE Lossless	1.2.840.10008.1.2.5	SCU	None
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	SCU	None
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91	SCU	None

4.2.1.3.2.3 SOP Specific Conformance

Storage AE provides Standard Conformance to the Storage Service Class.

Storage AE will behave as described in the Table below in response to the status returned in the C-STORE response command message.

Table 11
Storage C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Image transmission is successful, The status code is logged and the task success is reported to the user via task management.
Refused	Out of Resources	A7xx	The association is aborted using A-ABORT and the send task is marked as failed. The reason is logged and, If user selects the failed task, the reasons for this failure will be showed via task management.
Error	Data Set does not match SOP Class	A9xx	The association is aborted using A-ABORT and the send task is marked as failed. The reason is logged and, If user selects the failed task, the reasons for this failure will be showed via task management.

Error	Cannot Understand	Cxxx	The association is aborted using A-ABORT and the send job is marked as failed. The reason is logged and, If user selects the failed task, the reasons for this failure will be showed via task management.
Failure	Any other failure	xxxx	The association is aborted using A-ABORT and the send job is marked as failed. The reason is logged and, If user selects the failed task, the reasons for this failure will be showed via task management.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful but the status meaning is logged.
	Data Set does not match SOP Class	B007	Image transmission is considered successful but the status meaning is logged.
	Elements Discarded	B006	Image transmission is considered successful but the status meaning is logged.
	Any other status code.	xxxx	The Association is aborted using A-ABORT and the send job is marked as failed. The status code is logged and the job failure is reported to the user via task management.

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

Table 12

Storage Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the send job is marked as failed. The reason is logged and the job failure is reported to the user via task management.
Association aborted by the SCP or network layers	The send job is marked as failed. The reason is logged and the job failure is reported to the user via task management.

The following table provides the list of attributes requested in the Storage.

Table 13

Storage IOD Attribute

ATTRIBUTE	VR	TYPE	ATTRIBUTE NAME	VALUE(S) AND COMMENTS
Module: Patient Module (M)				
(0010,0010)	PN	2	Patient's Name	MWL/USER
(0010,0020)	LO	2	Patient ID	MWL/USER
(0010,0030)	DA	2	Patient's Birth Date	MWL/USER, default is set to zero length
(0010,0040)	CS	2	Patient's Sex	MWL/USER, default is set to zero length

(0010,1000)	LO	3	Other Patient IDs	MWL
(0010,2160)	SH	3	Ethnic Group	MWL
(0010,4000)	LT	3	Patient Comments	MWL/USER
Module: General Study Module (M)				
(0008,0020)	DA	2	Study Date	AUTO
(0008,0030)	TM	2	Study Time	AUTO
(0008,0050)	SH	2	Accession Number	MWL/USER, default is set to zero length
(0008,0090)	PN	2	Referring Physician's Name	MWL/USER, default is set to zero length
(0008,1030)	LO	3	Study Description	MWL/USER, default is set to zero length
(0008,1032)	SQ	3	Procedure Code Sequence	MWL
(0020,000D)	UI	1	Study Instance UID	MWL/AUTO
(0020,0010)	SH	2	Study ID	AUTO
Module: Patient Study Module (U)				
(0008,1080)	LO	3	Admitting Diagnoses Description	MWL
(0010,1010)	AS	3	Patient's Age	MWL/USER, default is set to zero length. If the user set Patient Birth Date, it will be calculated automatically.
(0010,1020)	DS	3	Patient's Size	MWL/USER, default is set to zero length
(0010,1030)	DS	3	Patient's Weight	MWL/USER, default is set to zero length
(0010,21B0)	LT	3	Additional Patient History	MWL
Module: General Series Module (M)				
(0008,0021)	DA	3	Series Date	AUTO
(0008,0031)	TM	3	Series Time	AUTO
(0008,0060)	CS	1	Modality	"US"
(0008,103E)	LO	3	Series Description	MWL
(0008,1050)	PN	3	Performing Physician's Name	MWL/USER, default is set to zero length
(0008,1070)	PN	3	Operators' Name	MWL/USER, default is set to zero length
(0018,1030)	LO	3	Protocol Name	AUTO – set to ExamType
(0018,5100)	CS	2C	Patient Position	Set to zero length
(0020,000E)	UI	1	Series Instance UID	AUTO

(0020,0011)	IS	2	Series Number	AUTO
(0020,0060)	CS	2C	Laterality	Set to zero length
Module: General Equipment Module (O)				
(0008,0070)	LO	2	Manufacturer	MINDRAY
(0008,0080)	LO	3	Institution Name	CONFIG
(0008,1010)	SH	3	Station Name	CONFIG
(0008,1040)	LO	3	Institutional Department Name	CONFIG
(0008,1090)	LO	3	Manufacturer's Model Name	CONFIG
(0018,1000)	LO	3	Device Serial Number	The Ethernet card Mac Address
(0018,1020)	LO	3	Software Version(s)	AUTO
Module: General Image Module (M)				
(0008,0023)	DA	2C	Content Date	AUTO
(0008,0033)	TM	2C	Content Time	AUTO
(0008,2111)	ST	3	Derivation Description	CONFIG, default is set to zero length
(0020,0013)	IS	2	Instance Number	AUTO
(0020,0020)	CS	2C	Patient Orientation	Set to zero length
(0020,4000)	LT	3	Image Comments	Set to zero length
(0028,0301)	CS	3	Burned In Annotation	YES
Module: US Image Module (M)				
(0008,0008)	CS	2	Image Type	ORIGINAL/PRIMARY
(0018,5010)	LO	3	Transducer Data	USER
(0018,5020)	LO	3	Processing Function	USER
(0028,0002)	US	1	Samples per Pixel	1 or 3
(0028,0004)	CS	1	Photometric Interpretation	RGB, for color images; MONOCHROME2, if the image is grayscale; YBR_FULL_422, if the image is sent using JPEG. RGB, if the image is sent using JPEG Lossless. YBR_FULL,if the image is sent using

				RLE Lossless.
				YBR_ICT,if the image is sent using JPEG 2000 Image Compression.
				YBR_RCT,if the image is sent using JPEG 2000 Image Compression (Lossless Only)
(0028,0006)	*US*	*1C*	*Planar Configuration*	*1, if the image is sent using RLE Lossless 0，otherwise.*
(0028,0009)	*AT*	*1C*	*Frame Increment Pointer*	*Frame Time*
(0028,0014)	*US*	*3*	*Ultrasound Color Data Present*	*0 or 1*
(0028,0100)	*US*	*1*	*Bits Allocated*	*0x0008*
(0028,0101)	*US*	*1*	*Bits Stored*	*0x0008*
(0028,0102)	*US*	*1*	*High Bit*	*0x0007*
(0028,0103)	*US*	*1*	*Pixel Representation*	*0x0000*
(0028,2110)	*CS*	*1C*	*Lossy Image Compression*	*Not used if image is uncompressed; support JPEG baseline, JPEG Lossless,RLE Lossless,JPEG 2000 Image Compression,JPEG 2000 Image Compression (Lossless Only) process1 and set it to "01"*
Module: Image Pixel Module (M)				
(0028,0010)	*US*	*1*	*Rows*	*CONFIG*
(0028,0011)	*US*	*1*	*Columns*	*CONFIG*
(0028,0034)	*IS*	*1c*	*Pixel Aspect Ratio*	*Set to zero length*
(7FE0,0010)	*OW*	*1*	*Pixel Data*	
Module: SOP Common Module (M)				
(0008,0005)	*CS*	*1C*	*Specific Character Set*	*AUTO*
(0008,0012)	*DA*	*3*	*Instance Creation Date*	*AUTO*
(0008,0013)	*TM*	*3*	*Instance Creation Time*	*AUTO*
(0008,0016)	*UI*	*1C*	*SOP Class UID*	*AUTO*
(0008,0018)	*UI*	*1C*	*SOP Instance UID*	*AUTO*

Module: US Region Calibration Module (U)				
(0018,6011)	*SQ*	*1*	*Sequence of Ultrasound Regions*	
>(0018,6012)	*US*	*1*	*Region Spatial Format*	*Set by the system*
>(0018,6014)	*US*	*1*	*Region Data Type*	*Set by the system*
>(0018,6016)	*UL*	*1*	*Region Flags*	*Set by the system*
>(0018,6018)	*UL*	*1*	*Region Location Min X0*	*Set by the system*
>(0018,601A)	*UL*	*1*	*Region Location Min Y0*	*Set by the system*
>(0018,601C)	*UL*	*1*	*Region Location Max X1*	*Set by the system*
>(0018,601E)	*UL*	*1*	*Region Location Max Y1*	*Set by the system*
>(0018,6024)	*US*	*1*	*Physical Units X Direction*	*Set by the system*
>(0018,6026)	*US*	*1*	*Physical Units Y Direction*	*Set by the system*
>(0018,602C)	*FD*	*1*	*Physical Delta X*	*Set by the system*
>(0018,602E)	*FD*	*1*	*Physical Delta Y*	*Set by the system*
Module: Cine Module (M) Used for US Multi-Frame Images Only				
(0008,2142)	*IS*	*3*	*Start Trim*	*Set by the system*
(0008,2143)	*IS*	*3*	*Stop Trim*	*Set by the system*
(0008,2144)	*IS*	*3*	*Recommended Display Frame Rate*	*Set by the system*
(0018,0040)	*IS*	*3*	*Cine Rate*	*CONFIG*
(0018,0072)	*DS*	*3*	*Effective Duration*	*Set by the system*
(0018,1063)	*DS*	*1C*	*Frame Time*	*Set by the system*
(0018,1065)	*DS*	*1C*	*Frame Time Vector*	*Set by the system*
(0018,1066)	*DS*	*3*	*Frame Delay*	*Set by the system*
(0018,1242)	*IS*	*3*	*Actual Frame Duration*	*Set by the system*
(0018,1244)	*US*	*3*	*Preferred Playback Sequencing*	*Set by the system*

Module: Multi-Frame Module (M)				
Used for US Multi-Frame Images Only				
(0028,0008)	IS	1	Number of Frames	AUTO
(0028,0009)	AT	1	Frame Increment Pointer	0018 1063 = Frame Time
Module: SC Equipment Module (M)				
Used for Second Capture Images Only				
(0008,0060)	CS	3	Modality	US
(0008,0064)	CS	1	Conversion Type	WSD
(0018,1010)	LO	3	Secondary Capture Device ID	CONFIG
(0018,1016)	LO	3	Secondary Capture Device Manufacturer	MINDRAY
(0018,1018)	LO	3	Secondary Capture Device Manufacturer's Model Name	CONFIG
(0018,1019)	LO	3	Secondary Capture Device Software Version(s)	AUTO
Module: SC Image Module (M)				
Used for Second Capture Images Only				
(0018,1012)	DA	3	Date of Secondary Capture	AUTO
(0018,1014)	TM	3	Time of Secondary Capture	AUTO

Conventions used for the Value(s) and Comments section are:

MWL – the attribute value source is from Modality WORKLIST

USER – the attribute value source is from User's input

AUTO – automatically generated by the MODALITY system

CONFIG - the attribute value source is a configurable parameter

4.2.1.3.3 Activity – Film Images

4.2.1.3.3.1 Description and Sequencing of Activities

A user composes images onto film sheets and requests them to be sent to a specific hardcopy device. The user can select the desired film format and number of copies. Each print-job is forwarded to the job queue and processed individually.

The system is invoked by the user on "Send to" UI if the print remote AE is pre-configured.

Status of the print-job is reported through task management UI. If pre-configured on Preset UI, the failed print task will be automatically retried specified times. If no pre-configuration, the user can also retry manually. Only one task will be active at a time for each separate hardcopy device. The same as Storage, the system could retry automaticlly the failed task caused by network failure，when the network is restored.
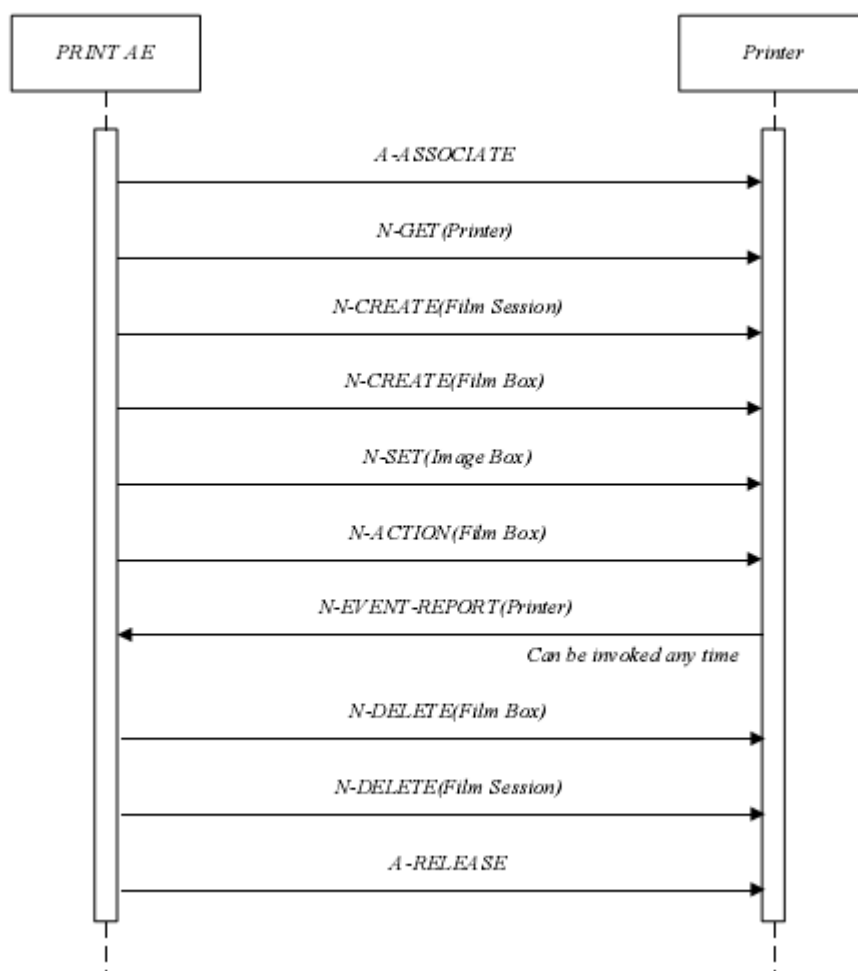
Figure 4

Sequencing of Activity – Film Images

A typical sequence of DIMSE messages sent over an association between Print AE and a Printer is illustrated in Figure 4:

1.　Print AE opens an association with the Printer.

2.　N-GET on the Printer SOP Class is used to obtain current printer status information.

3.　N-CREATE on the Film Session SOP Class creates a Film Session.

4.　N-CREATE on the Film Box SOP Class creates a Film Box linked to the Film Session. A single Image Box will be created as the result of this operation (Print AE default uses the format STANDARD\1.1, but user can change it on Preset UI).

5.　N-SET on the Image Box SOP Class transfers the contents of the film sheet to the printer.

6.　N-ACTION on the Film Box SOP Class instructs the printer to print the Film Box.

7. The Printer prints the requested number of film sheets.

8. The Printer asynchronously reports its status via N-EVENT-REPORT notification (Printer SOP Class).　The Printer can send this message at any time. Print AE does not require the N-EVENT-REPORT to be sent. Print AE is capable of receiving an N-EVENT-REPORT notification at any time during an association.

9. N-DELETE on the Film Box SOP Class deletes the complete Film box SOP Instance hierarchically.

10. N-DELETE on the Film Session SOP Class deletes the complete Film Session SOP Instance hierarchically.

11. Print AE closes the association with the Printer.

4.2.1.3.3.2 Proposed Presentation Contexts

Print AE is capable of proposing the Presentation Contexts shown in the Table below:

Table 14

Proposed Presentation Contexts for Activity Film Images

Presentation Context Table					
Abstract Syntax		*Transfer Syntax*			
Name	*UID*	*Name List*	*UID List*	*Role*	*Ext. Neg.*
Basic Grayscale Print Management Meta	*1.2.840.10008.5.1.1.9*	*Implicit VR Little Endian*	*1.2.840.10008.1.2*	*SCU*	*None*
		Explicit VR Little Endian	*1.2.840.10008.1.2.1*	*SCU*	*None*
		Explicit VR Big Endian	*1.2.840.10008.1.2.2*	*SCU*	*None*
Basic Grayscale Print Management Meta	*1.2.840.10008.5.1.1.9*	*Implicit VR Little Endian*	*1.2.840.10008.1.2*	*SCU*	*None*
		Explicit VR Little Endian	*1.2.840.10008.1.2.1*	*SCU*	*None*
		Explicit VR Big Endian	*1.2.840.10008.1.2.2*	*SCU*	*None*

4.2.1.3.3.3 Common SOP Specific Conformance for all Print SOP Classes

Table 15

Print AE Communication Failure Behavior

Exception	*Behavior*
Timeout	*The association is aborted using A-ABORT and the print-job is marked as failed.*
Association aborted by the SCP or network	*The print-job is marked as failed. The reason is*

layers	*logged and the job failure is reported to the user.*

The general behavior of Print AE during communication failure is summarized in the Table below. This behavior is common for all SOP Classes supported by Print AE.

Recommended abbreviations to be used for the tables are:

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

ANAP   Attribute Not Always Present

ALWAYS   Always Present with a value

EMPTY   Attribute is sent without a value

Recommended abbreviations to be used for the source of the data values in the tables are:

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

PRINTER the attribute value is provided by printer

4.2.1.3.3.4 SOP Specific Conformance for the Printer SOP Class

Print AE supports the following DIMSE operations and notifications for the Printer SOP Class:

— N-GET

— N-EVENT-REPORT

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.1.3.3.4.1   Printer SOP Class Operations (N-GET)

Print AE uses the Printer SOP Class N-GET operation to obtain information about the current printer status. The attributes excepted via N-GET are listed in the Table below:

Table 16
Printer SOP Class N-GET Request Attribute Identifier List

Attribute Name	Tag
Printer Status	*(2110,0010)*
Printer Status Info	*(2110,0020)*
Printer Name	*(2110,0030)*
Manufacturer	*(0008,0070)*
Manufacturer Model Name	*(0008,1090)*
Device Serial Number	*(0018,1000)*
Software Version(s)	*(0018,1020)*
Date of Last Calibration	*(0018,1200)*
Time of Last Calibration	*(0018,1201)*

The behavior of Print AE when encountering status codes in a N-GET response is summarized in the Table below:

Table 17

Printer SOP Class N-GET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The request to get printer status information was success.
Warning	any warning	xxxx	The print-job continues to be printed.
Failure	any failure	xxxx	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.

4.2.1.3.3.4.2   Printer SOP Class Notifications (N-EVENT-REPORT)

Table 18

Printer SOP Class N-Event-Report Behavior

Event Type Name	Event Type ID	Behavior
Normal	1	The print-job continues to be printed.
Warning	2	The print-job continues to be printed. The contents of Printer Status Info (2110, 0020) is logged and reported to the user via the job-control application.
Failure	3	The print-job is marked as failed. The contents of Printer Status Info (2110, 0020) is logged and reported to the user via the job-control application.
*	*	An invalid Event Type ID will cause a status code of 0113H to be returned in a N-EVENT-REPORT response.

Print AE is capable of receiving an N-EVENT-REPORT request at any time during an association. The behavior of Print AE when receiving Event Types within the N-EVENT-REPORT is summarized in the Table 18.

The reasons for returning specific status codes in a N-EVENT-REPORT response are summarized in the Table below:

Table 19

Printer SOP Class N-EVENT-REPORT Response Status Reasons

Service Status	Further Meaning	Error Code	Reasons
Success	Success	0000	The notification event has been successfully received.
Failure	No Such Event Type	0113H	An invalid Event Type ID was supplied in the N-EVENT-REPORT request.
Failure	Processing Failure	0110H	An internal error occurred during processing of the N-EVENT-REPORT. A short description of the error will

			be returned in Error Comment (0000, 0902).

4.2.1.3.3.5 SOP Specific Conformance for the Film Session SOP Class

Print AE supports the following DIMSE operations for the Film Session SOP Class:

— N-CREATE

— N-DELETE

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.1.3.3.5.1 Film Session SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 20
Film Session SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Copies	*(2000,0010)*	*IS*	*[1, 100]*	*ALWAYS*	*CONFIG*
Print Priority	*(2000,0020)*	*CS*	*LOW, MED,HIGH*	*ALWAYS*	*CONFIG*
Medium Type	*(2000,0030)*	*CS*	*BLUE FILM, CLEAR FILM, PAPER*	*ALWAYS*	*CONFIG*
Film Destination	*(2000,0040)*	*CS*	*MAGAZINE，PROCESSOR*	*ALWAYS*	*CONFIG*

The behavior of Print AE when encountering status codes in a N-CREATE response is summarized in the Table below:

Table 21
Film Session SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	*Success*	*0000*	*The SCP has completed the operation successfully.*
Warning	*Memory allocation not supported*	*B60x*	*The N-CREATE operation is considered successful.*
Warning	*any warning*	*xxxx*	*The N-CREATE operation is considered successful.*
Failure	*any failure*	*C60x*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*

4.2.1.3.3.5.2 Film Session SOP Class Operations (N-DELETE)

The behavior of Print AE when encountering status codes in a N-DELETE response is

summarized in the Table below:

Table 22
Printer SOP Class N-DELETE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	*Success*	*0000*	*The SCP has completed the operation successfully.*
Warning	*Any warning*	*xxxx*	*The N-DELETE operation is considered successful.*
Failure	*Any failure*	*xxxx*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*

4.2.1.3.3.6 SOP Specific Conformance for the Film Box SOP Class

Print AE supports the following DIMSE operations for the Film Box SOP Class:

— N-CREATE

— N-ACTION

— N-DELETE

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.1.3.3.6.1　Film Box SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 23
Film Box SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	*(2010,0010)*	*CS*	*PORTRAIT:* *STANDARD\1,1* *STANDARD\1,2* *STANDARD\1,3* *STANDARD\2,1* *STANDARD\2,2* *STANDARD\2,3* *STANDARD\2,4* *STANDARD\3,3* *STANDARD\3,4* *STANDARD\3,5* *STANDARD\3,6*	*ALWAYS*	*CONFIG*

		STANDARD\4,4		
		STANDARD\4,5		
		STANDARD\4,6		
		STANDARD\4,7		
		STANDARD\4,8		
		STANDARD\5,5		
		STANDARD\5,6		
		STANDARD\5,7		
		STANDARD\5,8		
		STANDARD\6,6		
		STANDARD\6,7		
		STANDARD\6,8		
		STANDARD\6,9		
		STANDARD\6,10		
		STANDARD\7,7		
		STANDARD\7,8		
		STANDARD\7,9		
		STANDARD\7,10		
		STANDARD\8,8		
		STANDARD\8,9		
		STANDARD\8,10		
		LANDSCAPE:		
		STANDARD\1,1		
		STANDARD\2,1		
		STANDARD\3,1		
		STANDARD\1,2		
		STANDARD\2,2		
		STANDARD\3,2		
		STANDARD\4,2		
		STANDARD\3,3		
		STANDARD\4,3		
		STANDARD\5,3		
		STANDARD\6,3		
		STANDARD\4,4		
		STANDARD\5,4		
		STANDARD\6,4		

			STANDARD\7,4		
			STANDARD\8,4		
			STANDARD\5,5		
			STANDARD\6,5		
			STANDARD\7,5		
			STANDARD\8,5		
			STANDARD\6,6		
			STANDARD\7,6		
			STANDARD\8,6		
			STANDARD\9,6		
			STANDARD\10,6		
			STANDARD\7,7		
			STANDARD\8,7		
			STANDARD\9,7		
			STANDARD\10,7		
			STANDARD\8,8		
			STANDARD\9,8		
			STANDARD\10,8		
Referenced Film Session Sequence	(2010,0500)	SQ			
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	From created Film Session SOP Instance	ALWAYS	AUTO
Film Orientation	(2010,0040)	CS	PORTRAIT or LANDSCAPE	ALWAYS	CONFIG
Film Size ID	(2010,0050)	CS	8INX10IN 8_5INX11IN 10INX12IN 10INX14IN 11INX14IN 11INX17IN 14INX14IN 14INX17IN	ALWAYS	CONFIG

			24CMX24CM 24CMX30CM A4 A3		
Magnification Type	*(2010,0060)*	*CS*	*REPLICATE, BILINEAR, CUBIC or NONE*	*ALWAYS*	*CONFIG*
Max Density	*(2010,0130)*	*US*	*0~65535*	*ANAP*	*CONFIG*
Min Density	*(2010,0120)*	*US*	*0~65535*	*ANAP*	*CONFIG*
Trim	*(2010,0140)*	*CS*	*YES or No*	*ALWAYS*	*CONFIG*
Configuration Information	*(2010,0150)*	*ST*	*User defined text*	*ANAP*	*USER*

The behavior of Print AE when encountering status codes in a N-CREATE response is summarized in the Table below:

Table 24
Film Box SOP Class N-CREATE Response Status Handling Behavior

Service Status	*Further Meaning*	*Error Code*	*Behavior*
Success	*Success*	*0000*	*The SCP has completed the operation successfully.*
Warning	*Requested Min Density or Max Density outside of printer's operating range*	*B605H*	*The N-CREATE operation is considered successful.*
Warning	*Any other warning*	*xxxx*	*The N-CREATE operation is considered successful.*
Failure	*Any failure*	*xxxx*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*

4.2.1.3.3.6.2   Film Box SOP Class Operations (N-ACTION)

An N-ACTION Request is issued to instruct the Print SCP to print the contents of the Film Box. The Action Reply argument in an N-ACTION response is not evaluated.

The behavior of Print AE when encountering status codes in a N-ACTION response is summarized in the Table below:

Table 25
Film Box SOP Class N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. The film has been accepted for printing.
Warning	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	B603H	The N-ACTION operation is considered successful.
Warning	Image size is larger than Image Box size. The image has been demagnified.	B604H	The N-ACTION operation is considered successful.
Warning	Image size is larger than Image Box size. The image has been cropped to fit.	B609H	The N-ACTION operation is considered successful.
Warning	Image size or Combined Print Image Size is larger than Image Box size. The image or combined Print Image has been decimated to fit.	B60AH	The N-ACTION operation is considered successful.
Warning	Any other warning	xxxx	The N-ACTION operation is considered successful.
Failure	Unable to create Print Job SOP Instance; print queue is full.	C602	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Image size is larger than Image Box size.	C603	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Combined Print Image Size is larger than Image Box size.	C613	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.
Failure	Any other failure	xxxx	The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to

			the user.

4.2.1.3.3.6.3　Film Session SOP Class Operations (N-DELETE)

The behavior of Print AE when encountering status codes in a N-DELETE response is summarized in the Table below:

Table 26
Printer SOP Class N-DELETE Response Status Handling Behavior

Service Status	*Further Meaning*	*Error Code*	*Behavior*
Success	*Success*	*0000*	*The SCP has completed the operation successfully.*
Warning	*Any warning*	*xxxx*	*The N-DELETE operation is considered successful.*
Failure	*Any other failure*	*xxxx*	*The Association is aborted using A-ABORT and the print-job is marked as failed.　The status meaning is logged and reported to the user.*

4.2.1.3.3.7　SOP Specific Conformance for the Image Box SOP Class

Print AE supports the following DIMSE operations for the Image Box SOP Class:

— N-SET

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.1.3.3.7.1　Image Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET Request are listed in the Table below:

Table 27
Image Box SOP Class N-SET Request Attributes

Attribute Name	*Tag*	*VR*	*Value*	*Presence of Value*	*Source*
Image Position	*(2020,0010)*	*US*	*[1, num_image1]*	*ALWAYS*	*AUTO*
Basic Grayscale Image Sequence	*(2020,0111)*	*SQ*		*If the service is configured as MONOCHROME2*	
>Samples Per Pixel	*(0028,0002)*	*US*	*1*	*ALWAYS*	*AUTO*
>Photometric Interpretation	*(0028,0004)*	*CS*	*MONOCHROME2*	*ALWAYS*	*CONFIG*
>Rows	*(0028,0010)*	*US*	*Depends on film size*	*ALWAYS*	*AUTO*
>Columns	*(0028,0011)*	*US*	*Depends on film size*	*ALWAYS*	*AUTO*
>Pixel Aspect Ratio	*(0028,0034)*	*IS*	*Set to zero length*	*VNAP*	*AUTO*
>Bits Allocated	*(0028,0100)*	*US*	*8*	*ALWAYS*	*AUTO*

>Bits Stored	*(0028,0101)*	*US*	*8*	*ALWAYS*	*AUTO*
>High Bit	*(0028,0102)*	*US*	*7*	*ALWAYS*	*AUTO*
>Pixel Representation	*(0028,0103)*	*US*	*0*	*ALWAYS*	*AUTO*
>Pixel Data	*(7FE0,0010)*	*OB*	*Pixels of rendered film sheet*	*ALWAYS*	*AUTO*
Basic Color Image Sequence	*(2020,0111)*	*SQ*		*If the service is configured as RGB*	
>Samples Per Pixel	*(0028,0002)*	*US*	*3*	*ALWAYS*	*AUTO*
>Photometric Interpretation	*(0028,0004)*	*CS*	*RGB*	*ALWAYS*	*CONFIG*
>Planar Configuration	*(0028,0006)*	*US*	*1*	*ANAP*	*AUTO*
>Rows	*(0028,0010)*	*US*	*Depends on film size*	*ALWAYS*	*AUTO*
>Columns	*(0028,0011)*	*US*	*Depends on film size*	*ALWAYS*	*AUTO*
>Pixel Aspect Ratio	*(0028,0034)*	*IS*	*Set to zero length*	*VNAP*	*AUTO*
>Bits Allocated	*(0028,0100)*	*US*	*8*	*ALWAYS*	*AUTO*
>Bits Stored	*(0028,0101)*	*US*	*8*	*ALWAYS*	*AUTO*
>High Bit	*(0028,0102)*	*US*	*7*	*ALWAYS*	*AUTO*
>Pixel Representation	*(0028,0103)*	*US*	*0*	*ALWAYS*	*AUTO*
>Pixel Data	*(7FE0,0010)*	*OB*	*Pixels of rendered film sheet*	*ALWAYS*	*AUTO*

Note：1 If the attribute of Image Display Format is (STANDARD\m, n), num_image is m*n.

The behavior of Print AE when encountering status codes in a N-SET response is summarized in the Table below:

Table 28
Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	*Further Meaning*	*Error Code*	*Behavior*
Success	*Success*	*0000*	Image print is successful, The status code is logged and the task success is reported to the user via task management.

Warning	*Image size is larger than Image Box size. The image has been demagnified.*	*B604H*	*The N-SET operation is considered successful.*
Warning	*Requested Min Density or Max Density outside of printer's operating range.*	*B605H*	*The N-SET operation is considered successful.*
Warning	*Image size is larger than Image Box size. The image has been cropped to fit.*	*B609H*	*The N-SET operation is considered successful.*
Warning	*Image size or Combined Print Image Size is larger than Image Box size. The image or combined Print Image has been decimated to fit.*	*B60AH*	*The N-SET operation is considered successful.*
Warning	*Any other warning*	*xxxx*	*The N-SET operation is considered successful.*
Failure	*Image size is larger than Image Box size.*	*C603*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*
Failure	*Insufficient memory in printer to store the image.*	*C605*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*
Failure	*Combined Print Image Size is larger than Image Box size.*	*C613*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*
Failure	*Any other failure*	*xxxx*	*The Association is aborted using A-ABORT and the print-job is marked as failed. The status meaning is logged and reported to the user.*

4.2.1.3.4 Activity – Send Find Request

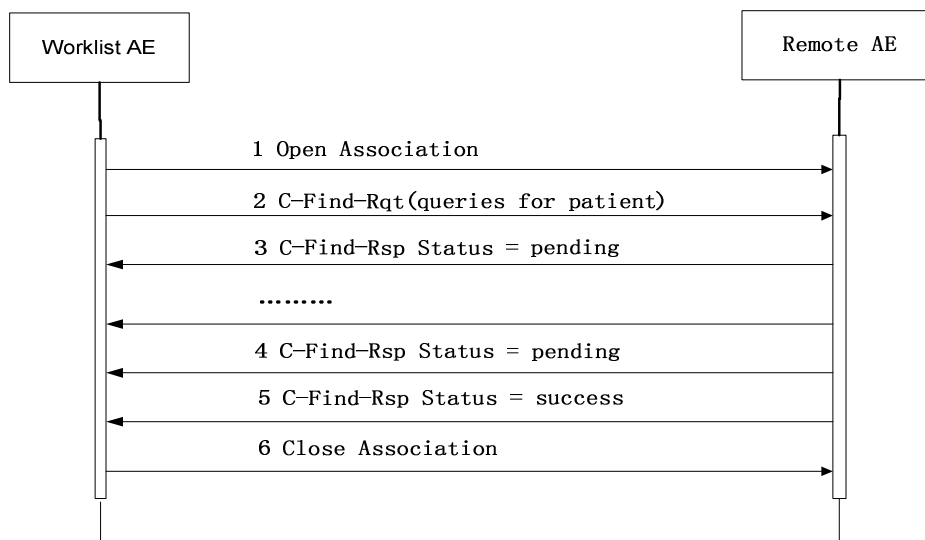### 4.2.1.3.4.1 Description and Sequencing of Activities

Figure 5

Sequencing of Activity – Send FIND Request

A possible sequence of interactions between the Worklist AE and a remote AE (e.g. a system such as a RIS or HIS; or a PACS) is illustrated in the Figure below:

1. *The Worklist AE opens an association with the remote AE*
2. *The Worklist AE sends a C-FIND request to the remote AE containing the Query attributes.*
3. *The remote AE generates a C-FIND response for the first match.*
4. *The remote AE generates another C-FIND response for each match.*
5. *When the process of matching is complete a C-FIND response is sent with a status of Success*
6. *The C-Find AE closes the association with the remote AE.*

4.2.1.3.4.2 Proposed Presentation Contexts

Table 29

Proposed Presentation Contexts for Worklist AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Information Model – Find	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

Worklist AE will propose Presentation Contexts for the SOP Classes listed above. For

these SOP Class, Worklist AE will propose multiple Presentation Contexts, one for each of the supported Transfer Syntaxes.

If Worklist AE is offered a choice of Transfer Syntaxes in the accepted Presentation Contexts, it will apply the first encountered to use for the C-FIND operation.

4.2.1.3.4.3 SOP Specific Conformance

Table 30
C_FIND Response Status Handling Behavior

Service Status	*Further Meaning*	*Error Code*	*Behavior (as SCU)*
Refused	*Out of resources*	*A700*	*The association is aborted using A-ABORT and a notify message is displayed: Some errors happen when query worklist server.*
Failed	*Identifier Does Not Match SOP Class*	*A900*	
Failed	*Unable to process*	*Cxxx*	
Cancel	*Matching terminated due to Cancel request*	*FE00*	*/*
Success	*Matching is complete - No final Identifier is supplied.*	*0000*	*Patient lists show on the UI*
Pending	*Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.*	*FF00*	*/*
Pending	*Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.*	*FF01*	*/*
*	*The Association is aborted using A-ABORT and the query is marked as failed. The status meaning is logged and reported to the user if an interactive query. Any additional error information in the Response will be logged.*	*Any other status code.*	*The association is aborted using A-ABORT and a notify message is displayed: Some errors happen when query worklist server.*

Worklist AE provides Standard Conformance to the Storage Service Class.

Worklist AE will behave as described in the *Table 30* in response to the status returned in the C-FIND response command message.

The behavior of Ultrasound System during communication failure is summarized in the Table below.

Table 31

Communication Failure Behavior for worklist ae

Exception	*Behavior*
Timeout	*The Association is aborted using A-ABORT and the query marked as failed. The reason is logged and reported to the user if an interactive query.*
Association aborted by the SCP or network layers	*The query is marked as failed. The reason is logged and reported to the user if an interactive query.*

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

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

Table 32

Worklist Request Identifier

ATTRIBUTE	*VR*	*ATTRIBUTE NAME*	*MATCHING KEYS*	*RETURN KEYS*
Module: Patient Identification Module (M)				
(0010,0010)	*PN*	*Patient's Name*	*configurable*	*X (DI)*
(0010,0020)	*LO*	*Patient ID*	*configurable*	*X(DI)*
(0010,1000)	*LO*	*Other Patient IDs*		*X (DI)*
Module: Patient Demographic Module (M)				
(0010,0030)	*DA*	*Patient's Birth Date*		*X(DI)*
(0010,0032)	*TM*	*Patient's Birth Time*		*X(DI)*
(0010,0040)	*CS*	*Patient's Sex*		*X(DI)*
(0010,1020)	*DS*	*Patient's Size*		*X (DI)*
(0010,1030)	*DS*	*Patient's Weight*		*X (DI)*
(0010,2160)	*SH*	*Ethnic Group*		*X (DI)*
(0010,4000)	*LT*	*Patient Comments*		*X (DI)*
(0040,3001)	*LO*	*Confidentiality constraint on patient data Description*		*X (DI)*

Module: Patient Medical Module (M)				
(0010,2000)	LO	Medical Alerts		X (DI)
(0010,2110)	LO	Contrast Allergies		X (DI)
(0010,21B0)	US	Additional Patient's History		X (DI)
(0010,21C0)	US	Pregnancy Status		X (DI)
(0010,21D0)	DA	Last Menstrual Date		X (DI)
(0038, 0050)	LO	Special Needs		X (DI)
(0038, 0500)	LO	Patient State		X (DI)
Module: Visit Relationship Module (M)				
(0008,1120)	SQ	Referenced Patient Sequence		X (DI)
Module: Visit Identification Module (M)				
(0038,0010)	LO	Admission ID		X (DI)
Module: Visit Status Module (M)				
(0038,0300)	LO	Current Patient Location		X (DI)
Module: Visit Admission Module (M)				
(0008,1080)	LO	Admitting Diagnosis Description		X (DI)
Module: Scheduled Procedure Step Module (M)				
(0040,0100)	SQ	Scheduled Procedure Step Sequence		X (DI)
>(0008,0060)	CS	Modality	Configurable and the default set to last used value	
>(0032,1070)	LO	Requested Contrast Agent		X (DI)
>(0040,0001)	AE	Scheduled Station AE Title	configurable and the default set to your AE title	X (DI)
>(0040,0002)	DA	Scheduled Procedure Step Start Date	configurable and the default set to today's date	X(DI)
>(0040,0003)	TM	Scheduled Procedure Step Start		X (DI)

		Time		
>(0040,0004)	*DA*	*Scheduled Procedure Step End Date*		*X (DI)*
>(0040,0005)	*TM*	*Scheduled Procedure Step End Time*		*X (DI)*
>(0040,0006)	*PN*	*Scheduled Performing Physician's Name*		*X (DI)*
>(0040,0007)	*LO*	*Scheduled Procedure Step Description*		*X(DI)*
>(0040,0008)	*SQ*	*Scheduled Protocol Code Sequence*		*X (DI)*
> >(0008,0100)	*SH*	*Code Value*		*X (DI)*
> >(0008,0102)	*SH*	*Coding Scheme Designator*		*X (DI)*
> >(0008,0103)	*SH*	*Coding Scheme Version*		*X (DI)*
> >(0008,0104)	*LO*	*Code Meaning*		*X (DI)*
>(0040,0009)	*SH*	*Scheduled Procedure Step ID*		*X (DI)*
>(0040,0010)	*SH*	*Scheduled Station Name*		*X (DI)*
>(0040,0011)	*SH*	*Scheduled Procedure Step Location*		*X (DI)*
>(0040,0012)	*LO*	*Pre-Medication*		*X (DI)*
> (0040,0020)	*CS*	*Scheduled Procedure Step Status*		*X (DI)*
> (0040,0400)	*LT*	*Comments on the Scheduled Procedure Step*		*X (DI)*
Module: Requested Procedure Module (M)				
(0008,1110)	*SQ*	*Referenced Study Sequence*		*X (DI)*

> (0008,1150)	*UI*	*Referenced SOP Class UID*		*X (DI)*
> (0008,1155)	*UI*	*Referenced SOP Instance UID*		*X (DI)*
(0020,000D)	*UI*	*Study Instance UID*		*X (DI)*
(0032,1060)	*LO*	*Requested Procedure Description*		*X (DI)*
(0032,1064)	*SQ*	*Requested Procedure Code Sequence*		*X (DI)*
> (0008,0100)	*SH*	*Code Value*		*X (DI)*
> (0008,0102)	*SH*	*Coding Scheme Designator*		*X (DI)*
>(0008,0103)	*SH*	*Coding Scheme Version*		*X (DI)*
>(0008,0104)	*LO*	*Code Meaning*		*X (DI)*
(0040,1001)	*SH*	*Requested Procedure ID*	*configurable*	*X (DI)*
(0040,1003)	*SH*	*Requested Procedure Priority*		*X (DI)*
(0040,1004)	*LO*	*Patient Transport Arrangements*		*X (DI)*
(0040,1400)	*LT*	*Requested Procedure Comments*		*X (DI)*
Module: Imaging Service Request Module (M)				
(0008,0050)	*SH*	*Accession Number*	*configurable*	*X (DI)*
(0008,0090)	*PN*	*Referring Physician's Name*		*X (DI)*
(0032,1032)	*PN*	*Requesting Physician*		*X (DI)*
(0032,1033)	*LO*	*Requesting Service*		*X (DI)*
(0040,2400)	*LT*	*Imaging Service Request Comments*		*X (DI)*
Module: SOP Common Module (M)				

(0008,0005)	CS	Specific Character Set		X (DI)
Module: Additional Attributes Module (M)				
(0008,0032)	TM	Acquisition Time		X (DI)

The convention used for Matching Keys is:

> X - Return keys. An " X " indicates that MODALITY supplies this attribute as a Return Key with zero length for Universal Matching.

> DI – Display to the user.

4.2.1.4　Association Acceptance Policy

4.2.1.4.1 Activity – Receive Storage Commitment

4.2.1.4.1.1 Description and Sequencing of Activities

A possible sequence of interactions between the Storage Commitment AE and a remote AE is illustrated in the Figure 3.

4.2.1.4.1.2 Accepted Presentation Contexts

The Storage Commitment AE will accept Presentation Contexts as shown in the Table below.

Table 33

Acceptable Presentation Contexts for

Activity Receive Storage Commitment Response

Presentation Context Table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Ext. Neg.*
Name	*UID*	*Name List*	*UID List*		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

The Storage Commitment AE will only accept the SCU role within a Presentation Context for the Storage Commitment Push Model SOP Class.

4.2.1.4.1.3 SOP Specific Conformance

4.2.1.4.1.3.1　Storage Commitment Operations (N-ACTION)

The Storage Commitment AE will issue a storage commitment request after the successful transfer of an end exam storage task .

The behavior of Storage Commitment AE when receiving N-Action response status codes

is summarized in the Table below:

Table 34

Storage Commitment N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	*Success*	*0000*	*The request for storage comment is considered successfully sent. The ultrasound system waits for the N-EVENT-REPORT in background.*
*	***	*Any other status code.*	*The request for storage comment is failed.*

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

Table 35

Storage Commitment Communication Failure Behavior

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

4.2.1.4.1.3.2   Storage Commitment Tags (N-ACTION)

The Storage Commitment AE will request storage commitment using the following tags.

NOTE: Storage Commitment may only be automatically requested upon successful completion of an end exam storage task.

Table 36

Storage Commitment N-Action-Request Message Contents

Action Type Name	Event Type ID	Attribute	Tag
N-ACTION-RQ (M)	*1*	*Requested SOP Class UID*	*(0000,0003)*
		Requested SOP Instance UID	*(0000,1001)*
Module: Additional Attributes Module (O)	*3*	*Instance Creation Date*	*(0008,0012)*
		Instance Creation Time	*(0008,0013)*
Request Storage Commitment	*1*	*Transaction UID*	*(0008,1195)*
		Referenced SOP Sequence	*(0008,1199)*
		>Referenced SOP Class UID	*(0008,1150)*
		>Referenced SOP Instance UID	*(0008,1155)*

4.2.1.4.1.3.3   Storage Commitment Notifications (N-EVENT-REPORT)

The reasons for returning specific status codes in a N-EVENT-REPORT response are

summarized in the Table below.

The Error Code represent service status should be sent with one of the values as below.

Table 37

Storage Commitment N-EVENT-REPORT Response Status Reasons

Service Status	Further Meaning	Error Code
Success	N-EVENT-REPORT message operate success.	0000
Failed	N-EVENT-REPORT message operate failed.	0110

4.2.1.4.1.3.4   Storage Commitment Tags (N-EVENT- REPORT)

Tags supported for receiving an N-Event-Report message are listed as below.

Table 38

Storage Commitment N-Event-Report Message Contents

EVENT TYPE NAME	EVENT TYPE ID	ATTRIBUTE	TAG	REQUIREMENT TYPE SCP
Storage Commitment Request Successful	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
Storage Commitment Request Complete – Failures Exist	2	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
		Failed SOP Sequence	(0008,1198)	1
		>Referenced SOP Class UID	(0008,1150)	1
		>Referenced SOP Instance UID	(0008,1155)	1
		>Failure Reason	(0008,1197)	1

4.3 Network Interface

4.3.1 Supported Communications Stacks

Modality DICOM AEs provide DICOM 3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.3.2 TCP/IP Stack

Modality DICOM AEs inherit their TCP/IP stack from the Linux System upon which they execute.

4.3.3 Physical Network Interface

Modality supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

Table 39
Supported Physical Network Interfaces

ETHERNET 1000BASET
Ethernet 100baseT
Ethernet 10baseT

4.3.4 Additional Protocols

Modality does not support additional protocols.

4.4 Configuration

The Configuration Utility allows the service engineer to set and maintain configuration parameters of local and remote DICOM application entities.

4.4.1 AE Title/Presentation Address Mapping

This mapping (including IP and port numbers) is defined during the system Network Configuration procedure.

4.4.2 Configurable Parameters

Localhost DICOM Service Property(Including SCU and SCP):
- AE Title
- Port
- PDU

Server Setting:
- Device
- IP address

Storage:

- Device, Service name, AE Title and Port.

- Timeout.

- Maximum retries. (default value is 3)

- Interval Time (In this version, this parameter is not usable.)

- Compression Mode, Compression Ratio.

- Color Mode (Color, Mixed, or Gray).

- Allow Multiframe(Enable or not)

- Max Framerate(options(25, 30, 35, full), or other inputed valid value)

- Default Service Status (Y/N)

Print:

- Device, Service name, AE Title and Port .

- Timeout.

- Maximum retries. (default value is 3)

- Interval Time (In this version, this parameter is not usable.)

- Media Type: PAPER, CLEAR FILM, or BLUE FILM

- Film Size:

    8INX10IN

    8_5INX11IN

    10INX12IN

    10INX14IN

    11INX14IN

    11INX17IN

    14INX14IN

    14INX17IN

    24CMX24CM

    24CMX30CM

    A4

    A3

- Copies:1-100

- Max Density: 0-65535

- Min Density:0-65535

- Settings: RGB or MONOCHROME2

- Display Format:

    ✧ PORTRAIT:

        STANDARD\1,1

        STANDARD\1,2

STANDARD\1,3

STANDARD\2,1

STANDARD\2,2

STANDARD\2,3

STANDARD\2,4

STANDARD\3,3

STANDARD\3,4

STANDARD\3,5

STANDARD\3,6

STANDARD\4,4

STANDARD\4,5

STANDARD\4,6

STANDARD\4,7

STANDARD\4,8

STANDARD\5,5

STANDARD\5,6

STANDARD\5,7

STANDARD\5,8

STANDARD\6,6

STANDARD\6,7

STANDARD\6,8

STANDARD\6,9

STANDARD\6,10

STANDARD\7,7

STANDARD\7,8

STANDARD\7,9

STANDARD\7,10

STANDARD\8,8

STANDARD\8,9

STANDARD\8,10

✧ LANDSCAPE:

STANDARD\1,1

STANDARD\1,1

STANDARD\2,1

STANDARD\3,1

STANDARD\1,2

STANDARD\2,2

STANDARD\3,2

STANDARD\4,2

STANDARD\3,3

STANDARD\4,3

STANDARD\5,3

STANDARD\6,3

STANDARD\4,4

STANDARD\5,4

STANDARD\6,4

STANDARD\7,4

STANDARD\8,4

STANDARD\5,5

STANDARD\6,5

STANDARD\7,5

STANDARD\8, 5

STANDARD\6,6

STANDARD\7,6

STANDARD\8,6

STANDARD\9,6

STANDARD\10,6

STANDARD\7,7

STANDARD\8,7

STANDARD\9,7

STANDARD\10,7

STANDARD\8,8

STANDARD\9,8

STANDARD\10,8

- Destination: MAGAZINE or PROCESSOR

- Film Orientation: LANDSCAPE or PORTRAIT

- Priority: HIGH, MED, or LOW

- Configuration Info

- Magnification Type: NONE, CUBIC, REPLICATE, or BILINEAR

- Trim: Yes/Not

- Default Status (Y/N)

WORKLIST:

- Device, Service name, AE Title and Port .

- Timeout.

- Maximum retries, Interval Time (In this version, these two parameters are not usable.)

- Default Status (Y/N)

Storage Commitment:

- Device, Service name, AE Title and Port.

- Timeout.

- Maximum retries, Interval Time (In this version, these two parameters are not usable.)

- Associated Storage Service

- Default Status (Not available)

5 Media Storage

5.1 Implementation Model
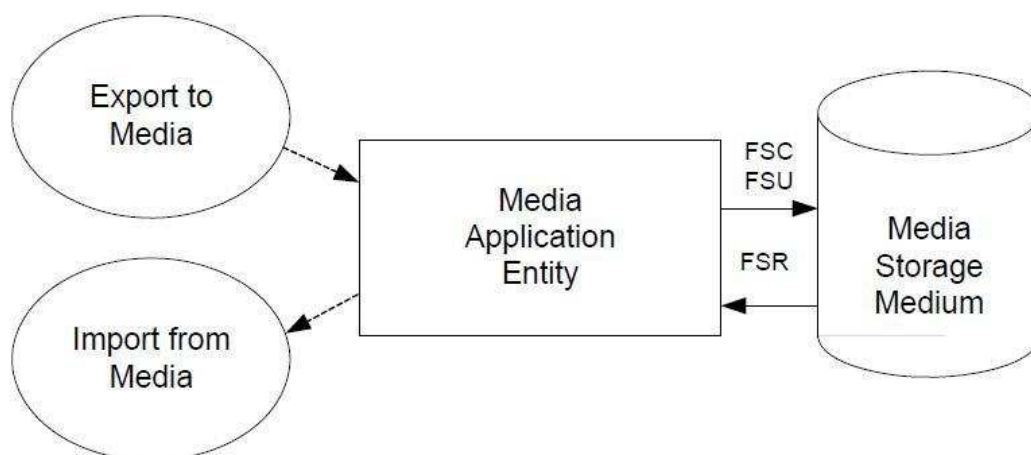
5.1.1 Application Data Flow

Figure 6
Application Data Flow Diagram for Media Storage

— The Media Application Entity exports Images to a removable storage medium. It is associated with the local real-world activity "Backup" using the configured export selection parameters for selected patients' data(images) .

5.1.2 Functional Definition of AE's

5.1.2.1 Functional Definition of Media Application Entity

Using"Export" will pass the currently selected patients' exams or individually selected images to the Media Application Entity. The contents of each export job will be written to the selected media destination. The size of the selected media is used to determine and display the number of media required for the export. When a device is filled to capacity, the system will prompt the user for addition media and continue.

5.1.3 Sequencing of Real-World Activities

At least one image must exist and be selected before the Media Application Entity can be invoked. The operator can insert new media at any time. The Media Application Entity will wait indefinitely for media to be inserted before starting to write to the device.

5.1.4 File Meta Information Options

The implementation information written to the File Meta Header in each file is:

Table 40
DICOM Implementation Class and Version for Media Storage

Implementation Class UID	1.2.156.112536.1.2308.0.1.0.1
Implementation Version Name	*MINDRAY_V1.0*

5.2 AE Specifications

5.2.1 Media Application Entity Specification

The Media Application Entity provides standard conformance to the Media Storage Service Class.   The Application Profiles and roles are listed below: The available physical media is CD-R, CD-RW, DVD-R, DVD-RW, DVD+R, DVD+RW, DVD-RAM, and USB devices.

Table 41
Application Profiles, Activities and Roles

Application Profiles Supported	*Real World Activity*	*Role*
STD-GEN-USB-JPEG	*Export Exam*	*FSC/FSU[1]*
STD-US-SC-SF&MF-CDR	*Read Exam*	*FSR*
STD-US-SC-SF&MF-DVD	*Import Exam*	*FSR*
STD-US-SC-SF&MF-DVD-RAM		

Note: 1 functionality requires DVD+RW, DVD-RW, or USB

5.2.1.1   File Meta Information for the Application Entity

The File Meta Header does not include the Source Application Entity Title.

5.2.1.2   Real-World Activities

5.2.1.2.1 Activity-FSC-Export exams

When system user exports exams，images to a media upon which no DICOM data resides, it creates a DICOM file set and writes this DICOM File Set to this media.

The Media Application Entity acts as an FSC using the interchange option when requested to export SOP Instances from the local database to media upon which no DICOM data resides.

5.2.1.2.2 Activity-FSR-Import exams

When system user presents the directory of the media, presses "Restore" button and the selected exams are transferred from the media to the system for review. Objects transferred to the system retain their original SOP Instance UIDs.

The Media Application Entity acts as an FSR using the interchange option when requested to import SOP Instances from media to the local database.

5.2.1.2.3 Activity-FSU-Export exams

The system user selects exams from the system's directory for transfer to media that already contains data. The DICOMDIR is updated allowing access to original and new data.

The Media Application Entity acts as an FSU using the interchange option when requested to export SOP Instances from the local database to media upon which DICOM data already resides.

5.2.1.2.3.1 Media Storage Application Profiles

See Table   for supported Application Profiles.

5.2.1.2.3.1.1   Options

The Media Application Entity supports the SOP Classes and Transfer Syntaxes listed in the Table below:

Table 42
IODs, SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
DICOM Media Storage Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1

5.3 Media Storage Application Profile

See Table 41 for supported Application Profiles.

5.3.1 DICOMDIR Attributes

The DICOMDIR file will contain the following attributes.

Table 43

Common Directory Information Module Attributes

ATTRIBUTE	VR	TYPE	ATTRIBUTE NAME	VALUE(S) AND COMMENTS
(0004,1130)	CS	2	File-set ID	AUTO
(0004,1200)	UL	1	Offset of the First Directory Record of the Root Directory Entity	AUTO
(0004,1202)	UL	1	Offset of the Last Directory Record of the Root Directory Entity	AUTO
(0004,1212)	US	1	File-set Consistency Flag	0xFFFF
(0004,1220)	SQ	2	Directory Record Sequence	
>(0004,1400)	UL	1	Offset of the Next Directory Record	AUTO
>(0004,1410)	US	1	Record In-use Flag	0xFFFF
>(0004,1420)	UL	1	Offset of Referenced Lower-Level Directory Entity	AUTO
>(0004,1142)	CS	2	Specific Character Set of File-set Descriptor File	AUTO

Table 44

Patient Directory Record

ATTRIBUTE	VR	TYPE	ATTRIBUTE NAME	VALUE(S) AND COMMENTS
(0004,1430)	CS	1	Directory Record Type	PATIENT
(0010,0020)	LO	1	Patient ID	MWL/USER
(0010,0010)	PN	2	Patient's Name	MWL/USER
(0010,0030)	DA		Patient's Birth Date	MWL/USER
(0010,0040)	CS		Patient's Sex	MWL/USER

Table 45

Study Directory Record

ATTRIBUTE	VR	TYPE	ATTRIBUTE NAME	VALUE(S) AND COMMENTS
(0004,1430)	CS	1	Directory Record Type	STUDY

(0008,0020)	DA	1	Study Date	AUTO
(0008,0030)	TM	1	Study Time	AUTO
(0020,0010)	SH	1	Study ID	AUTO
(0020,000D)	UI	1C	Study Instance UID	AUTO
(0008,0050)	SH	2	Accession Number	MWL/USER
(0008,1030)	LO	2	Study Description	If it is a scheduled exam, the value is mapped from Scheduled Procedure Step Description; If not, USER
(0008,0090)	PN		Referring Physician's Name	MWL/USER

Table 46

Series Directory Record

ATTRIBUTE	VR	TYPE	ATTRIBUTE NAME	VALUE(S) AND COMMENTS
(0004,1430)	CS	1	Directory Record Type	SERIES
(0008,0060)	CS	1	Modality	US
(0020,000E)	UI	1	Series Instance UID	AUTO
(0020,0011)	IS	1	Series Number	AUTO
(0008,0021)	DA	3	Series Date	AUTO
(0008,0031)	TM	3	Series Time	AUTO
(0008,103e)	LO		Series Description	If it is a scheduled exam, the value is mapped from Scheduled Procedure Step Description; If not, same as the value of Study Description
(0008,1050)	PN		Performing Physician's Name	MWL/USER

Table 47

Image Directory Record

ATTRIBUTE	VR	TYPE	ATTRIBUTE NAME	VALUE(S) AND COMMENTS
(0004,1430)	CS	1	Directory Record Type	IMAGE
(0004,1500)	CS	1C	Referenced File ID	AUTO

(0004,1510)	UI	1C	Referenced SOP Class UID in File	AUTO
(0004,1511)	UI	1C	Referenced SOP Instance UID in File	AUTO
(0004,1512)	UI	1C	Referenced Transfer Syntax UID in File	AUTO
(0020,0013)	IS	1	Instance Number	AUTO
(0028,0008)	IS	3	Number of Frames	AUTO(Only used for mutil-frame image)

5.4 Augmented and Private Application Profiles

No augmented/private profile is supported.

5.5 Media Configuration

None.

6 SUPPORT OF CHARACTER SETS

In addition to the default character repertoire, the Defined Terms for Specific Character Set in Table 48 are supported:

Table 48
Supported Specific Character Set Defined Terms

Character Set Description	Defined Term	System Language
ISO 8859-1	ISO_IR 100	English, French, German, Italian, Portuguese, Spanish, Finnish, Danish, Icelandic, Norwegian, Swedish
ISO 8859-5	ISO_IR 144	Russian
ISO-8859-2	ISO_IR 101	Polish, Czech
ISO-8859-9	ISO_IR 148	Turkish
Chinese	GB18030	Chinese

If the system language is configured for one of above languages, the corresponding Character Set will be used automatically. Whether or not characters are displayed correctly depends on the operating system. For example, if the system is configured for Turkish, the characters of Turkish could display correctly.

7 SECURITY

7.1 Security Profiles

None supported.

7.2 Association level security

None supported.

Any Calling AE Titles and/or IP addresses may open an Association.

7.3 Application level security

None supported.

8 ANNEXES

8.1 IOD contents

8.1.1 Created SOP Instances

None.

8.1.2 Usage of attributes from received IOD's

No SOP Class specific fields are required.

The local database makes use of the conventional identification attributes to distinguish patients, studies, series and instances. In particular, if two patients have the same value for Patient ID, Patient's Name and Patient's Sex, they will be treated as the same in the browser and the local database.

8.1.3 Attribute Mapping

Not applicable.

8.1.4 Coerced/Modified fields

No coercion is performed.

8.2 Data Dictionary of private attributes

No private attributes are defined.

8.3 Coded terminology and templates

The value for Code Meaning will be displayed for all code sequences. No local lexicon is provided to look up alternative code meanings.

8.4 Grayscale Image Consistency

Modality does not support the Grayscale Standard Display Function.

8.5 Standard extended/specialized/private sop Classes

None.

8.6 Private Transfer Syntaxes

None.