

DICOM Conformance Statement

Allura FC R1.0



Issued by:

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1. DICOM Conformance Statement Overview

Allura FC Version 1.0 is an image acquisition modality. It provides the following DICOM data exchange features:

- Transfer of DICOM Images to the Image Archive or Image Displays
- Store DICOM Images sent from the Image Archive or Image Displays
- Print Images on DICOM Printers

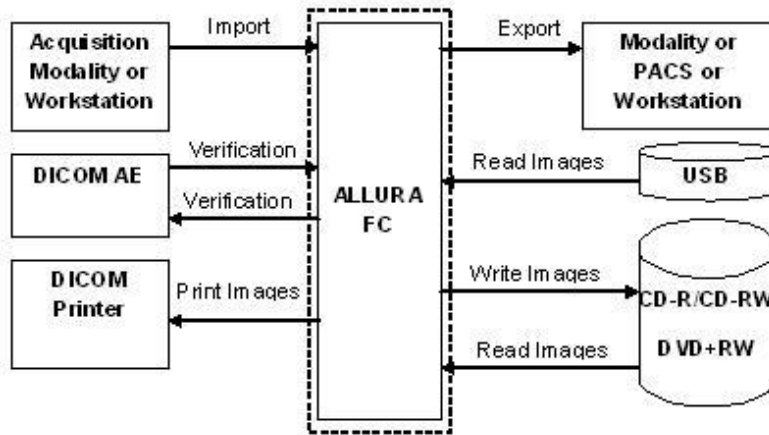


Figure 1: Allura FC System in a DICOM network overview

An overview of all the supported DICOM data exchange feature provided by Allura FC networking DICOM Service (SOP) Classes with roles (User/Provider) are organized in following categories:

- Transfer
- Store
- Print Management

An overview of all supported by Allura FC networking DICOM Service (SOP) Classes with roles (User/Provider), organized in two categories:

- Transfer (Store)
- Print Management

Table 1: Network Services

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	UID		
Other			
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Print Management			
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	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
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Yes	No
Transfer			
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	UID		
Secondary Capture Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.7	Yes	Yes

A table of Supported Media Storage Application Profiles (with roles) is provided.

Allura FC supports as medium the DVD+RW and the CD-R/CD-RW.

Image compression is supported. Finalization of the DVD will be set after the burning process has finished.

Table 2: Media Services

Media Storage Application Profile	File-set Creator (FSC)	File-set Updater (FSU)	File-set Reader (FSR)
Compact Disk-Recordable			
General Purpose CD-R Interchange	Yes	No	Yes
DVD			
General Purpose DVD Interchange with JPEG	Yes	No	Yes
USB			
General Purpose Secure USB Media Interchange with JPEG	No	No	Yes

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3. Introduction

The introduction specifies product and relevant disclaimers as well as any general information that the vendor feels is appropriate.

3.1. Revision History

The revision history provides dates and differences of the different releases.

Table 3: Revision History

Document Version	Date of Issue	Status	Description
00	25-May-2012	Approved	Approved version.
01	10-August-2012	Approved	Updated with French character set.

3.2. Audience

This Conformance Statement is intended for:

- (Potential) customers
- System integrators of medical equipment
- Marketing staff interested in system functionality
- Software designers implementing DICOM interfaces

It is assumed that the reader is familiar with the DICOM standard.

3.3. Remarks

The DICOM Conformance Statement is contained in chapter 4 through 8 and follows the contents and structuring requirements of DICOM PS 3.2.

This DICOM Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

- **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

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see [DICOM] PS 3.3 and PS 3.4.

The word Philips in this document refers to Philips Medical Systems.

The following acronyms are used in this document.

Table 4: Definitions, Terms and Abbreviations

Abbreviation/Term	Explanation
ACN	Application Context Name
ACP	Archiving, Connectivity and Print
AE	Application Entity
CD	Compact Disc
CD-R	CD-Recordable
CD-M	CD-Medical
CD-RW	Rewritable CD
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DVD+RW	Rewritable DVD
ELE	DICOM Explicit VR Little Endian
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
GUI	Graphic User Interface
IHE	Integrating the Healthcare Enterprise
ILE	DICOM Implicit VR Little Endian
IOD	Information Object Definition
ISO	International Organization for Standardization
JPEG	Joint Photographic Experts Group
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
RWA	Real-World Activity
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
USB	Universal Serial Bus
XA	X-Ray Angiographic
xxxx	Any Status Code

The following terms are used in this document.

Image Archive

A system that provides long term storage of images, presentation states, Key Image Notes and Evidence Documents [IHE].

Image Display

A system that offers browsing of patients' studies. In addition, it may support the retrieval and display of selected sets of images, Key Image Notes, and Evidence Documents [IHE].

Print Server

A system that accepts and processes DICOM print requests as a DICOM Print SCP and performs image rendering on hardcopy media. The system must support pixel rendering according to the DICOM Grayscale Standard Display Function [IHE].

Protected Health Information Protected Health Information is considered as information records, and not the flow of information between the systems [IHE].

Time Server

A system unit that knows maintains and distributes the correct time in the enterprise [IHE].

3.5. References

[DICOM] Digital Imaging and Communications in Medicine, Parts 1 - 18 (NEMA PS 3.1- PS 3.18),
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 2009) plus all the supplements and correction items that have been approved as Final Text.

4. Networking

This section contains the networking related services (vs. the media related ones).

4.1. Implementation model

The implementation model consists of three sections:

- The application data flow diagram, specifying the relationship between the Application Entities and the "external world" or Real-World Activities,
- A functional description of each Application Entity, and
- The sequencing constraints among them.

4.1.1. Application Data Flow

The implementation model consists of three sections:

- The Application data flow diagram, specifying the relationship between the Allura FC Application Entities and the "external world" or Real-World Activities
- A functional description of each Application Entity
- Sequencing constraints among the Application Entities

The Allura FC has only one Application Entities in its implementation, namely ACP AE Application Entity (ACP AE). Following figure shows the relationship between the Local and Remote Real World Activities. Networking application data flow as a functional overview of these application entities.

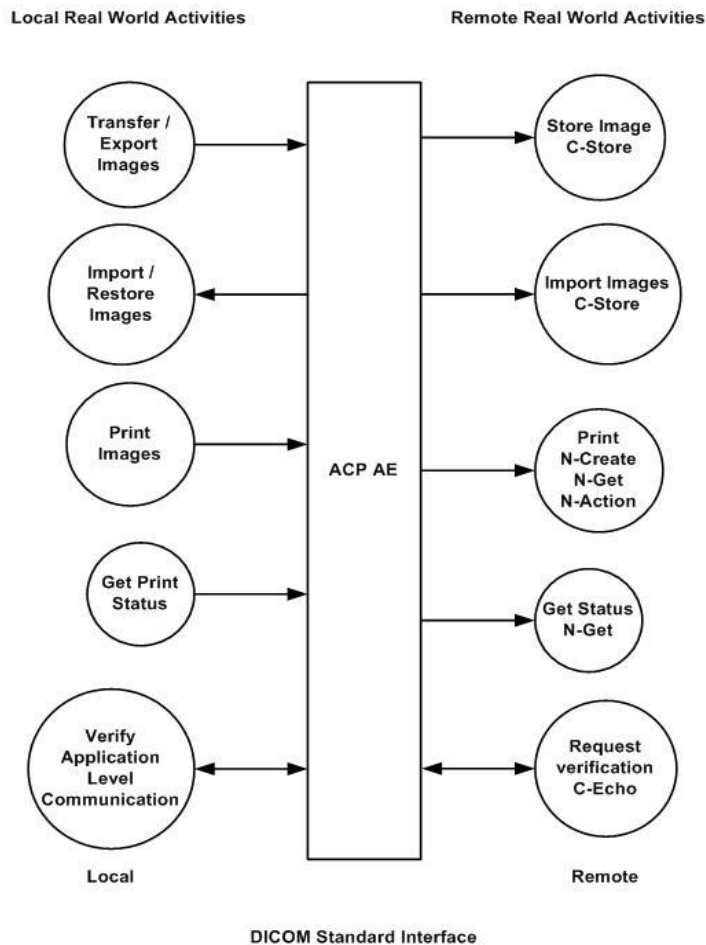


Figure 2: Application Flow Diagram

4.1.2. Functional Definition of AE's

This section contains a functional definition for each individual local Application Entity.

4.1.2.1. Functional Definition of ACP AE

Allura FC provides the DICOM Print Management Service Class support required to interface with a SCP. Therefore, the application plays the role as SCU. This involves the following functionality:

Storage Service Class

The ACP AE accepts (only from pre-configured systems) associations from systems that wish to store images using the C-STORE command (RWA Import Images). A remote SCU shall request an association with the ACP AE for Storage SOP class. After accepting the association, the ACP AE shall receive and respond to the Storage requests, and release the association when requested. The ACP AE can perform (only to pre-configured systems) the Storage service as SCU (RWA Transfer Images), triggered by the operator or by an event in the system, e.g. closing of an examination, acquisition of images). The ACP AE shall request an association with the selected remote SCP for all applicable Storage SOP classes. When the association is accepted, the ACP AE shall send the Storage requests (including data from local database), receive the Storage responses and act accordingly, and finally request for releasing the association.

Print Management Service Class

The ACP AE can perform the Print service as SCU (RWA Print Images), triggered by the operator. For each printed sheet, the ACP AE shall request an association with the selected remote SCP (i.e., a Print Server) for all applicable SOP classes of the applicable Print Management Meta SOP class. When the association is accepted, the ACP AE shall send the Print requests including data from local database (the N-GET-RQ message to get the printer status, the N-CREATE-RQ message to create the FilmSession and the FilmBox, the N-SET-RQ message to set the Image Box on the printer, finally, the N-ACTION-RQ message to give printer the command to print), receive the Print responses and act accordingly, and finally request for releasing the association. The ACP AE can perform the Print service as SCU (RWA Get Printer Status), triggered by the operator in the service mode. The ACP AE shall request an association with the selected remote SCP (Print Server) for the Printer SOP class. When the association is accepted, the ACP AE shall send the N-Get request, receive the responses from the Print Server and act accordingly, and finally request for releasing the association

Verification Service Class

The ACP AE accepts (only from pre-configured systems) associations from systems that wish to verify application level communication using the C-ECHO command (RWA Request Verification). A remote SCU shall request an association with the ACP AE for Verification SOP class. After accepting the association, the ACP AE shall receive and respond to the Verification request, and release the association when requested.

The ACP AE can perform (only to pre-configured systems) the Verification service as SCU (triggered by the operator in the service mode). The ACP AE shall request an association. When the association is accepted, the ACP AE shall send the Verification request, receive the Verification response, and request for releasing the association.

4.1.3. Sequencing of Real World Activities

The following sequence of Real World Activities (RWA) are supported by the Allura FC:

- The clinical user manually transfers images to the Image Archive and/or Image Display. As a result, the Allura FC sends the C-STORE-RQ messages containing the image information.
- The clinical user manually prints selected images. As a result, the Allura FC sends the N-GET-RQ message to get the printer status, the N-CREATE-RQ message to create the Film Session and the Film Box, the N-SET-RQ message to set the Image Box on the printer. Finally, it sends the N-ACTION-RQ message to give the DICOM printer the command to print.
- The clinical users manually do the media storage such as CD/DVD. As a result, the Allura FC creates the backup with DICOM SOP Instance for XA and SC modality
- The clinical user manually retrieves images from the media storage to the local database / application.
- The application is able to receive images for XA and SC modality, if it is configured as workstation. It receives the C-STORE-RQ messages containing the image.

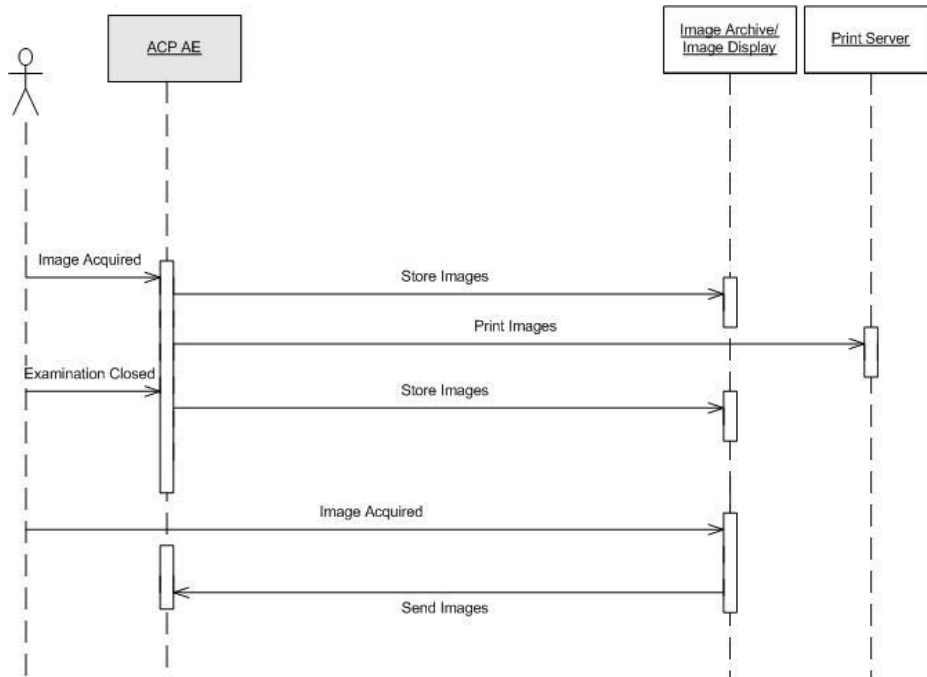


Figure 3: Allura FC Sequencing constraints

4.2. AE Specifications

This section in the DICOM Conformance Statement is a set of Application Entity specifications. There are as many of these subsections as there are different AE's in the implementation.

4.2.1. ACP AE

Detail of this specific Application Entity is specified in this section.

4.2.1.1. SOP Classes

The Standard Conformance to the SOP Classes is:

Table 5: SOP Classes for ACP AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
Secondary Capture Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	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
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Yes	No

Note that any SOP specific behavior is documented later in the DICOM Conformance Statement, in the applicable SOP class specific conformance section.

4.2.1.2. Association Policies

Each AE specification contains a description of the general association establishment and acceptance policies of the AE.

4.2.1.2.1. General

The DICOM standard application context is specified below.

Table 6: DICOM Application Context

Description	Value
Application Context Name	1.2.840.10008.3.1.1.1

The ACP AE always proposes the DICOM Application Context Name (ACN) presented below. The maximum PDU length for receiving data is 16384 Bytes. The PDU length for sending data is 16384 Bytes.

4.2.1.2.2. Number of Associations

As a result of local activities, the ACP AE (SCU) can initialize only one association. One association may be used to issue transfer images requests / print image requests / to verify application level communication

Table 7: Number of associations as an Association Initiator for this AE

Description	Value
Maximum number of simultaneous associations (initiator)	1

The maximum number of simultaneous associations supported by the ACP AE (SCP) is unlimited by default and can be configured.

Table 8: Number of associations as an Association Acceptor for this AE

Description	Value
Maximum number of simultaneous associations (acceptor)	unlimited

4.2.1.2.3. Asynchronous Nature

Not Applicable.

4.2.1.2.4. Implementation Identifying Information

The value supplied for Implementation Class UID and Implementation Version Name are as follows:

Table 9: DICOM Implementation Class and Version for ACP AE

Implementation Class UID	1.2.756.777.101536
Implementation Version Name	ALLURA_FC

4.2.1.2.5. Communication Failure Handling

The behavior of the AE during communication failure is summarized in the next table.

Table 10: Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the command is marked as failed. The reason is logged and reported to the user.

4.2.1.3. Association Initiation Policy

The ACP AE initiates associations as a result of the following events:

- Images are transferred from the Allura FC to a remote system.

- The operator prints local images.
- Images receive from a remote system to the application.
- The operator verifies application level communication.
- Operator takes Media storage.

The behavior of the ACP Application Entity is summarized in the next Table.

Table 11: Response Status Handler Behavior

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Matching is complete	The SCP has successfully returned all matching information.

The ACP Application Entity will respond to a received Association rejection as shown in the next table.

Table 12: Association Rejection response

Result	Source	Reason/Diagnosis	Behavior
1 - rejected-permanent	1 - DICOM UL service-user	1 - no-reason-given	
		2 - application-context-name-not supported	
		3 - calling-AE-title-not-recognized	
		7 - called-AE-title-not-recognized	
	2 - DICOM UL service-provider (ACSE related function)	1 - no-reason-given	
		2 - protocol-version-not-supported	
3 - DICOM UL service-provider (Presentation related function)	1 - temporary-congestion		
	2 - local-limit-exceeded		
2 - rejected-transient	1 - DICOM UL service-user	1 - no-reason-given	
		2 - application-context-name-not-supported	
		3 - calling-AE-title-not-recognized	
		7 - called-AE-title-not-recognized	
	2 - DICOM UL service-provider (ACSE related function)	1 - no-reason-given	
		2 - protocol-version-not-supported	
	3 - DICOM UL service-provider (Presentation related function)	1 - temporary-congestion	
		2 - local-limit-exceeded	

The behavior of the ACP AE on receiving an Association abort is summarized in the next table.

Table 13: Association Abort Handling

Source	Reason/Diagnosis	Behavior
0 - DICOM UL service-user (initiated abort)	0 - reason-not-specified	
2 - DICOM UL service-provider (initiated abort)	0 - reason-not-specified	
	1 - unrecognized-PDU	
	2 - unexpected-PDU	
	4 - unrecognized-PDU-parameter	
	5 - unexpected-PDU-parameter	
	6 - invalid-PDU-parameter-value	

4.2.1.3.1. (Real-World) Activity – Verification as SCU

4.2.1.3.1.1. Description and Sequencing of Activities

For each Verify Application Level Communication request, an association towards the remote system is established and a C-ECHO request is transmitted. Once the response is received, the association is closed.

The Verification SCU provides the Verification Application Level Communication for the Allura FC.

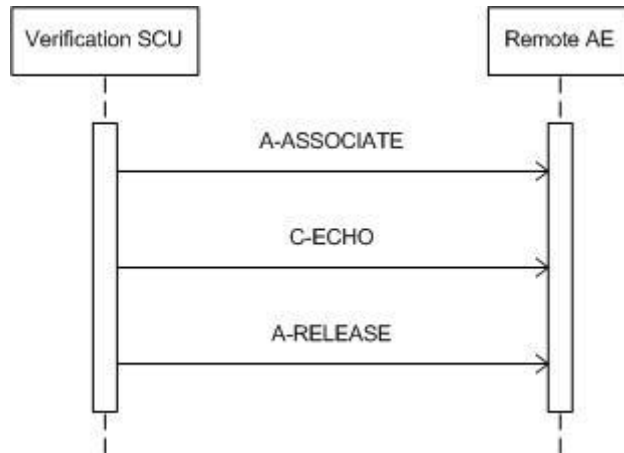


Figure 4: Sequencing of RWA Verification Application Level Communication

4.2.1.3.1.2. Proposed Presentation Contexts

Each time an association is initiated, the ACP AE proposes one presentation contexts to be used on that association. The presentation context proposed by the ACP AE for Verify Application Level Communication is as follows:

Table 14: Proposed Presentation Contexts for (Real-World) Activity – Verification as SCU

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		JPEG Lossless, Non-Hierarchical, FOP (Process 14)	1.2.840.10008.1.2.4.70		

The implementation proposes each SOP Class only ones in the abstract syntax specifying all possible transfer syntaxes for that SOP Class. Due to the fact that the SCP has to react with chosen transfer syntax, as per SOP Class used transfer syntax is forced by the SCP.

4.2.1.3.1.3. SOP Specific Conformance for Verification SOP Class

The behavior of the ACP AE for status codes in Verification response is as follows:

4.2.1.3.1.3.1. Dataset Specific Conformance for Verification C-ECHO SCU

Detail regarding the Dataset Specific response behavior will be reported in this section.

This part of the section includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs etc.

Table 15: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successfully operation	The success is reported to the operator.
Refuse / Error / Any Status code	Greater than 0000		The failure is reported to the operator.

4.2.1.3.2. (Real-World) Activity – Image Export

4.2.1.3.2.1. Description and Sequencing of Activities

The operator can select images and request them to be sent to (pre-configured) destinations. Each request is forwarded and processed as individual request to Transfer Images.

For each request to Transfer Images (i.e., transfer job), one association towards the remote system is established. Within the association, for each image, a C-STORE request is transmitted. Once the responses are received, the association is closed. A possible sequence of interactions between the ACP AE and a remote AE with only one C-STORE request is presented.

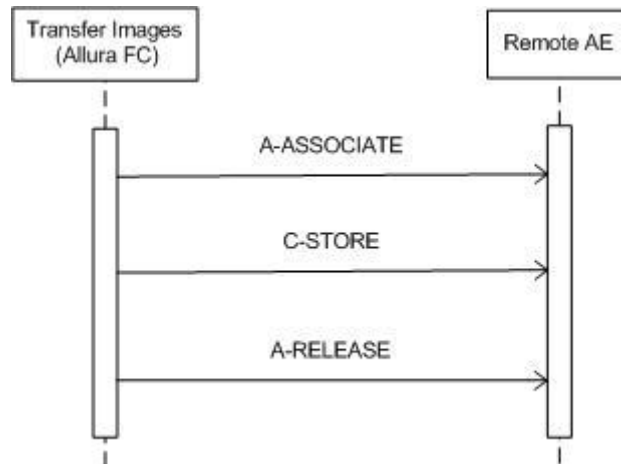


Figure 5: Sequencing of RWA Transfer Images

4.2.1.3.2.2. Proposed Presentation Contexts

Each time an association is initiated, the ACP AE proposes two presentation contexts to be used on that association. The presentation context proposed by the ACP AE for Transfer Images is as follows:

Table 16: Proposed Presentation Contexts for (Real-World) Activity – Image Export

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
		JPEG Lossless, Non-Hierarchical, FOP (Process 14)	1.2.840.10008.1.2.4.70		
Secondary Capture Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		JPEG Lossless, Non-Hierarchical, FOP (Process 14)	1.2.840.10008.1.2.4.70		

The implementation proposes each SOP Class only ones in the abstract syntax specifying all possible transfer syntaxes for that SOP Class. Due to the fact that the SCP has to react with chosen transfer syntax, as per SOP Class used transfer syntax is forced by the SCP.

4.2.1.3.2.3. SOP Specific Conformance for Storage SOP Classes

Transfer the selected images or complete procedure of a patient through C-STORE message to the SCP. If transmission of any selected image fails, because no appropriate presentation context could be negotiated, then Store SCU aborts the association. Store SCU always transmits all the elements contained in the image, independent from their type within the IOD of the corresponding SOP class.

4.2.1.3.2.3.1. Dataset Specific Conformance for C-STORE-RQ

Detail regarding the Dataset Specific response behavior will be reported in this section.

This includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

Table 17: Storage C-STORE Status Response Handling Behavior.

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful operation	The SCP has success-fully stored the SOP Instances. If all SOP Instances in a send job have status success then the job is marked as Completed. Success is logged.
Failure	xxxx	Refused: Out of Resources	The association is aborted using ABORT and the send job is marked As failed.
		Error: Data Set does not match SOP Class	The association is aborted using ABORT and the send job is marked As failed.
		Error: cannot understand	The association is aborted using ABORT and the send job is marked As failed.
Warning	xxxx	Coercion of Data Elements	The association is aborted using ABORT and the send job is marked As failed.
		Data Set does not match SOP Class	The association is aborted using ABORT and the send job is marked As failed.
		Elements Discarded	The association is aborted using ABORT and the send job is marked As failed.

4.2.1.3.3. (Real-World) Activity – Print Management As SCU

4.2.1.3.3.1. Description and Sequencing of Activities

The operator can select images and request them to be printed on a printer (out of Choice list of configured printers). Each request is forwarded and processed as individual request to Print Images.

The print job consists of data describing the images and graphics to be printed as well as the requested layout and other parameters. One print job on the Allura FC may result in a number of film sessions with the printer equal to the number of printed film sheets. Each film sheet within the print job is internally processed, converted to a STANDARD/1,1 page and then an association towards the remote Print Server is established and the page image is sent to that Print Server. Once the transmission of the film sheet is completed, the association is closed. A sequence of interactions between the ACP AE and a remote AE to print one film sheet is presented as follows:

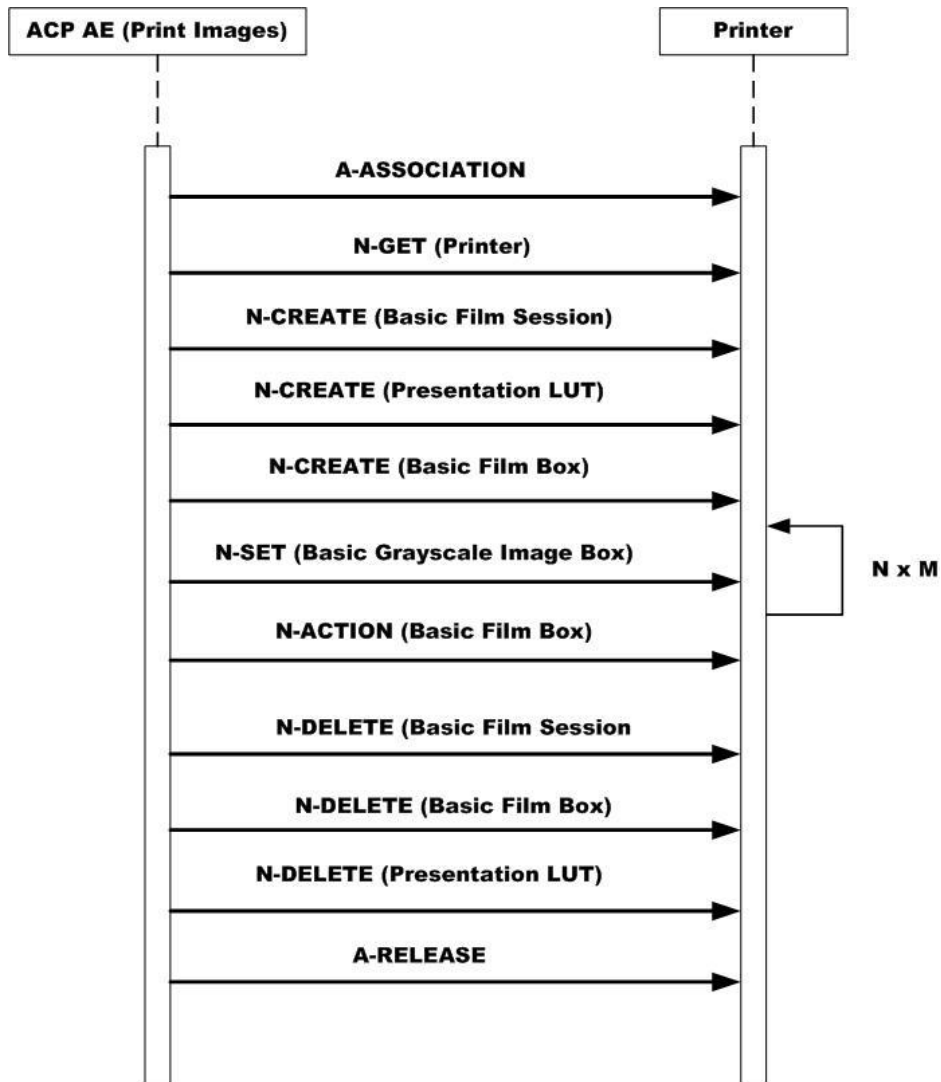


Figure 6: Sequencing of RWA Print Images

The following implementation remarks are important to achieve successful printing:

- Each film sheet is printed in a separate association.
- The number of Film Boxes per Film Session is one.
- The number of images per Film Box is one. The images to be printed on one film are rendered by the ACP AE into one logical image. This logical image is very large, depending on the pixel matrix size (pixels per line, lines per image). A rough indication is 20 Mbytes. One should take this into account when selecting the DICOM printer and the printer configuration (e.g. the amount of memory).

• The ACP AE will request for releasing the association when the print command is given (i.e. the N-ACTION Request); the association is not kept open for receiving N-EVENT-REPORTs of the Printer SOP Class.
The specific SOP Conformance statement for the Basic Grayscale Print Management Meta SOP Class is described in the Conformance Statements for each of these SOP Class components.

The Basic Grayscale Print Management Meta SOP Class consists of the following SOP Classes:

- Printer SOP Class
- Basic Film Session SOP Class
- Basic Film Box SOP Class
- Basic Grayscale Image Box SOP Class

The specific SOP Conformance statement for the Basic Grayscale Print Management Meta SOP Class is described in the Conformance Statements for each of these SOP Class components.

Table 18: Print Service Elements

Service Element of SOP Class	Description
N-GET of the Printer SOP Class	Purpose is to retrieve printer information.
N-CREATE of the Basic Film Session SOP Class	Specifies the DICOM Printer about some general presentation parameters, applicable for all films in the Film Session. Applied attributes are: Number of Copies, Print Priority, Medium Type, Film Destination
N-CREATE of the Basic Film Box SOP Class	Specifies the DICOM Printer about some general presentation parameters, applicable for all images in the Film Box. Applied attributes are: Film Orientation, Film Size ID, Magnification Type, Max. Density, Configuration Information, Trim.
N-SET of the Basic Grayscale Image Box SOP Class	Images to be printed. Applied attributes are: Polarity
N-ACTION of the Basic Film Box SOP Class	Triggers the DICOM Printer to print. This actual print action is done at film box level. No attributes are present.

Next Table specifies the supported Service Elements, which may be generated by the Printer at any time during the association.

Table 19: The Applied Seq. of Print Service Elements and its Optional Attributes

Service Element of SOP Class	note
N-EVENT-REPORT of the Printer SOP Class	The association is not kept open for receiving N-EVENT-REPORTs of the Printer SOP Class.

4.2.1.3.3.2. Proposed Presentation Contexts

Each time an association is initiated, the ACP AE proposes two presentation contexts to be used on that association. The presentation context proposed by the ACP AE for Print Images is defined in the next table:

Table 20: Proposed Presentation Contexts for (Real-World) Activity – Print Management As SCU

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9			SCU	None
>Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
>Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
>Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
>Printer SOP Class	1.2.840.10008.5.1.1.16	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

The implementation proposes the SOP Class only ones in the abstract syntax specifying all possible transfer syntaxes for that SOP Class. Due to the fact that the SCP has to react with chosen transfer syntax, as per SOP Class used transfer syntax is forced by the SCP.

4.2.1.3.3.3. SOP Specific Conformance for Basic Film Session SOP Class of the Basic Grayscale Print Management Meta SOP Class

This section and sub-section include the manufacturer SOP and Dataset specific information as well the status codes and their corresponding behavior.

4.2.1.3.3.3.1. Dataset Specific Conformance for Basic Film Session SOP Class N-CREATE-SCU

Detail regarding the Dataset Specific response behavior will be reported in this section.

Table 21: Basic Film Session Presentation Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Number of Copies	2000,0010	IS		ALWAYS	USER	between 1 & 10
Print Priority	2000,0020	CS	HIGH	ALWAYS	AUTO	-
Medium Type	2000,0030	CS	BLUE FILM, CLEAR FILM, PAPER	ALWAYS	USER	-
Film Destination	2000,0040	CS	BIN_1, BIN_2, MAGAZINE, PROCESSOR	ALWAYS	AUTO	-
Film Session Label	2000,0050	LO	Human Readable label that identifies the film session	EMPTY	AUTO	Default Value NEVER present.

The behavior of the ACP-AE for status responses in N-CREATE-SCU are summarized in next Table.

Table 22: Status Responses for N-CREATE-SCU.

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful operation	The print job continues.
Error	xxxx	Any error	The association is aborted using A-ABORT. The print job will keep resubmitting the failed sheets until the error is solved or the retry time-out is exceeded.
Failed	xxxx		The print job continues and the status is logged.
Warning	xxxx	Any Warning	The print job continues and the status is logged.

4.2.1.3.3.4. SOP Specific Conformance for Printer SOP Class of the Basic Grayscale Print Management Meta SOP Class

This section and sub-section include the manufacturer SOP and Dataset specific information as well the status codes and their corresponding behavior.

4.2.1.3.3.4.1. Dataset Specific Conformance for Printer SOP Class N-EVENT-REPORT-SCP

Following table shows the attributes for the N-EVENT-Report responses.

The behavior of the ACP-AE for status responses in N-EVENT-REPORT-RSP are summarized in next the Table.

Table 23: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful operation	The print job continues.
Error	xxxx	Any error	The association is aborted using A-ABORT. The print job will keep resubmitting the failed sheets until the error is solved or the retry time-out is exceeded.
Warning	xxxx	Any warning	The print job continues and the warning is logged.

4.2.1.3.3.4.2. Dataset Specific Conformance for Printer SOP Class N-GET-SCU

Detail regarding the Dataset Specific response behavior will be reported in this section.

Printer SOP Attribute Support:

An overview of the applied attributes in the applied Service Elements of the supported SOP Classes is presented in the next Tables. The tables use a number of abbreviations. The abbreviations used in the "Presence of ..." column are:

- ALWAYS Always Present
- NEVER Never Present

The abbreviations used in the "Source" column:

- USER the attribute value source is from User input
- AUTO the attribute value is generated automatically.

Table 24: Printer Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Manufacturer	0008,0070	LO		ALWAYS	AUTO	-
Manufacturer's Model Name	0008,1090	LO		ALWAYS	AUTO	-
Device Serial Number	0018,1000	LO		ALWAYS	AUTO	-
Software Version(s)	0018,1020	LO		ALWAYS	AUTO	-
Printer Status	2110,0010	CS	FAILURE, NORMAL	ALWAYS	AUTO	Polling is not supported.
Printer Status Info	2110,0020	CS	FILM JAM, RECEIVER FULL, SUPPLY EMPTY, SUPPLY LOW	ALWAYS	AUTO	-
Printer Name	2110,0030	LO		ALWAYS	AUTO	-

The behavior of the ACP-AE for status responses in N-GET-RQ are given in the next Table.

Table 25: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful operation	The print job continues.
Error	xxxx	Any error	The association is aborted using A-ABORT. The print job will keep resubmitting the failed sheets until the error is solved or the retry time-out is exceeded.
Warning	xxxx	Any warning	The print job continues and the warning is logged.

4.2.1.3.3.5. SOP Specific Conformance for Basic Film Box SOP Class of the Basic Grayscale Print Management Meta SOP Class

This section and sub-section include the manufacturer SOP and Dataset specific information as well the status codes and their corresponding behavior.

4.2.1.3.3.5.1. Dataset Specific Conformance for Basic Film Box SOP Class N-CREATE-SCU

Detail regarding the Dataset Specific response behavior will be reported in this section.

Table 26: Basic Film Box Presentation Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Image Display Format	2010,0010	ST	STANDARD\C,R	ALWAYS	AUTO	The applied value below indicates that one (large) image is contained in a Film Box.
Film Orientation	2010,0040	CS	LANDSCAPE, PORTRAIT	ALWAYS	AUTO	-
Film Size ID	2010,0050	CS	10INX12IN, 10INX14IN, 11INX14IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, 8INX10IN, A3, A4	ALWAYS	USER	DICOM specifies a number of Defined Terms
Magnification Type	2010,0060	CS	NONE	ALWAYS	AUTO	Normally sent out, however sometimes send out empty Because some DICOM printers are not able to handle
Smoothing Type	2010,0080	CS	NONE	ALWAYS	AUTO	-
Border Density	2010,0100	CS	150, 20, BLACK, WHITE	ALWAYS	AUTO	-
Empty Image Density	2010,0110	CS	20, BLACK, WHITE	ALWAYS	AUTO	-
Min Density	2010,0120	US	0 - 50	ALWAYS	AUTO	-
Max Density	2010,0130	US	0 - 400	ALWAYS	AUTO	Maximum density of the images on the film,
Trim	2010,0140	CS	NO	ALWAYS	AUTO	-
Configuration Information	2010,0150	ST		ALWAYS	AUTO	Contains a vendor specific Look up table (LUT)
Illumination	2010,015E	US	0 - 3000	ALWAYS	AUTO	-
Reflected Ambient Light	2010,0160	US	0 - 20	ALWAYS	AUTO	-
Requested Resolution ID	2020,0050	CS	HIGH, STANDARD	ALWAYS	AUTO	-

Table 27: Basic Film Box Relationship Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Referenced Film Session Sequence	2010,0500	SQ		ALWAYS	AUTO	Parent Film Session

>Referenced SOP Class UID	0008,1150	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO	-
>Referenced SOP Instance UID	0008,1155	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO	UID of Parent Film Session

This part of the section includes the Printer Status Response Handling.

Table 28: Printer Status Responses Handling behaviors

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Film Box Successfully created	The print job continues.
Error	xxxx	Any Error	The association is aborted using A-ABORT and the print job is marked as failed. The failure reason is logged.
Warning	xxxx	Any Warning	The print job continues and the warning is logged.

4.2.1.3.3.5.2. Dataset Specific Conformance for Basic Film Box SOP Class N-ACTION-SCU

The behavior of the ACP-AE for status responses in N-ACTION response are shown in the following Table.

Table 29: Basic film Box Status Responses

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful operation	The print job continues.
Error	xxxx	Any Error	The association is aborted using A-ABORT. The print job will keep resubmitting the failed sheets until the error is solved or the retry time-out is exceeded.
Failed	xxxx	Any Warning	The print job continues and the warning is logged.
Warning	xxxx		The print job continues and the warning is logged.

4.2.1.3.3.6. SOP Specific Conformance for Presentation LUT SOP Class

This section and sub-section include the manufacturer SOP and Dataset specific information as well the status codes and their corresponding behavior.

4.2.1.3.3.6.1. Dataset Specific Conformance for Presentation LUT SOP Class N-CREATE-SCU

Detail regarding the Dataset Specific response behavior will be reported in this section.

Table 30: Presentation LUT Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Presentation LUT Shape	2050,0020	CS	IDENTITY	ALWAYS	AUTO	-

This part of the section includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

Table 31: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	e.g. Matching is complete	e.g. The SCU has successfully returned all matching information

4.2.1.3.3.7. SOP Specific Conformance for Basic Grayscale Image Box SOP Class of the Basic Grayscale Print Management Meta SOP Class

This section and sub-section include the manufacturer SOP and Dataset specific information as well the status codes and their corresponding behavior.

4.2.1.3.3.7.1. Dataset Specific Conformance for Basic Grayscale Image Box SOP Class N-SET-SCU

Detail regarding the Dataset Specific response behavior will be reported in this section.

Table 32: Image Box Pixel Presentation Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Image Box Position	2020,0010	US	1	ALWAYS	AUTO	-
Polarity	2020,0020	CS	NORMAL	ALWAYS	AUTO	-
Basic Grayscale Image Sequence	2020,0110	SQ		ALWAYS	AUTO	-
>Samples per Pixel	0028,0002	US	1	ALWAYS	AUTO	-
>Photometric Interpretation	0028,0004	CS	MONOCHROME2	ALWAYS	AUTO	-
>Rows	0028,0010	US		ALWAYS	AUTO	Depending on the selected printer type and film size
>Columns	0028,0011	US		ALWAYS	AUTO	Depending on the selected printer type and film size
>Bits Allocated	0028,0100	US	10, 12, 14, 16, 8	ALWAYS	AUTO	-
>Bits Stored	0028,0101	US	10, 12, 14, 16, 8	ALWAYS	AUTO	-
>High Bit	0028,0102	US	11, 13, 15, 7, 9	ALWAYS	AUTO	-
>Pixel Representation	0028,0103	US	0x0000	ALWAYS	AUTO	-
>Pixel Data	7FE0,0010	O W/ OB		ALWAYS	AUTO	-

The behavior of the ACP-AE for status responses in N-SET-SCU are summarized in next Table.

Table 33: Status Responses for N-SET-SCU

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful operation	The SCP has successfully stored the SOP Instances. If all SOP Instances in a send job have status success then the job is marked as Completed. Success is logged.
Error	xxxx	Out of Resources / Data Set does not match SOP Class / Cannot Understand	The association is aborted using ABORT and the send job is marked As failed.
Refused	xxxx	Out of Resources / Data Set does not match SOP Class / Cannot Understand	The association is aborted using ABORT and the send job is marked As failed.
Warning	xxxx	Any warning	The print job continues and the warning is logged.

4.2.1.4. Association Acceptance Policy

The Application Entity may reject Association attempts as shown in the table below.

Table 34: Association Reject Reasons

Result	Source	Reason/Diagnosis	Behavior
1 - rejected permanent	1 - DICOM UL service-user	1 - no-reason-given	
		2 - application-context-name-not-supported	
		3 - calling-AE-title-not-recognized	
		7 - called-AE-title-not-recognized	
	2 - DICOM UL service provider (ACSE related function)	1 - no-reason-given	
	2 - protocol-version-not-supported		
3 - DICOM UL service provider (Presentation related function)	1 - temporary-congestion		
	2 - local-limit-exceeded		
2 - rejected-transient	1 - DICOM UL service-user	1 - no-reason-given	
		2 - application-context-name-not-supported	
		3 - calling-AE-title-not-recognized	
		7 - called-AE-title-not-recognized	
	2 - DICOM UL service provider (ACSE related function)	1 - no-reason-given	
		2 - protocol-version-not-supported	
	3 - DICOM UL service provider (Presentation related function)	1 - temporary-congestion	
		2 - local-limit-exceeded	

The behavior of the AE for sending an Association abort is summarized in next table.

Table 35: Association Abort Policies

Source	Reason/Diagnosis	Behavior
0 - DICOM UL service-user (initiated abort)	0 - reason-not-specified	
2 - DICOM UL service-provider (initiated abort)	0 - reason-not-specified	
	1 - unrecognized-PDU	
	2 - unexpected-PDU	
	4 - unrecognized-PDU parameter	
	5 - unexpected-PDU parameter	
	6 - invalid-PDU-parameter value	

4.2.1.4.1. (Real-World) Activity – Verification as SCP

4.2.1.4.1.1. Description and Sequencing of Activities

The ACP AE shall accept associations from systems that wish to verify application level communication to the Allura FC as shown in the following figure.

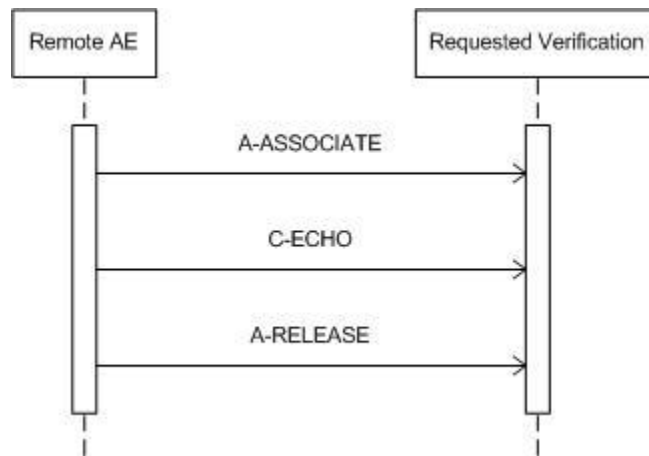


Figure 7: Sequencing of RWA Request Verification

4.2.1.4.1.2. Accepted Presentation Contexts

The presentation contexts are defined in the next table.

Table 36: Acceptable Presentation Contexts for (Real-World) Activity – Verification as SCP

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		JPEG Lossless, Non-Hierarchical, FOP (Process 14)	1.2.840.10008.1.2.4.70		

4.2.1.4.1.3. SOP Specific Conformance for Verification SOP Class

The ACP AE provides standard conformance to the DICOM Verification Service Class.

The behavior of the ACP AE for status codes in Verification response is summarized in next Table.

Table 37: Verification C-ECHO Response Status Handling Behavior

Service Status	Error Code	Further Meaning	Behavior
Not Applicable	Not Applicable	Not Applicable	Not Applicable

The behavior of the ACP AE for status codes in Verification response is summarized in the following Table.

Table 38: Verification Communication Failure Behavior

Exception	Behavior
Timeout	The association is aborted using A-ABORT. The reason is logged and reported to the user.
Association aborted	The reason is logged and failure is reported to the user.
Association rejected	The reason is logged and failure is reported to the user.

4.2.1.4.1.3.1. Dataset Specific Conformance for Verification C-ECHO SCP

Detail regarding the Dataset Specific response behavior will be reported in this section.

This part of the section includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

Table 39: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Matching is complete	The SCU has successfully returned all matching information

4.2.1.4.2. (Real-World) Activity – Image Import

4.2.1.4.2.1. Description and Sequencing of Activities

Accepts association for the following purposes:

1. To allow remote applications to store images to the Allura FC application.
2. To allow remote applications to verify application level communication with the system.

The ACP AE shall reject association requests from applications that do not address the ACP AE, i.e. applications that offer a wrong “called AE title”. The ACP AE title is defined as “DRISHTI_SCP”.

The ACP AE shall accept associations from systems that wish to store images in the Allura FC database using the C-STORE command as follows:

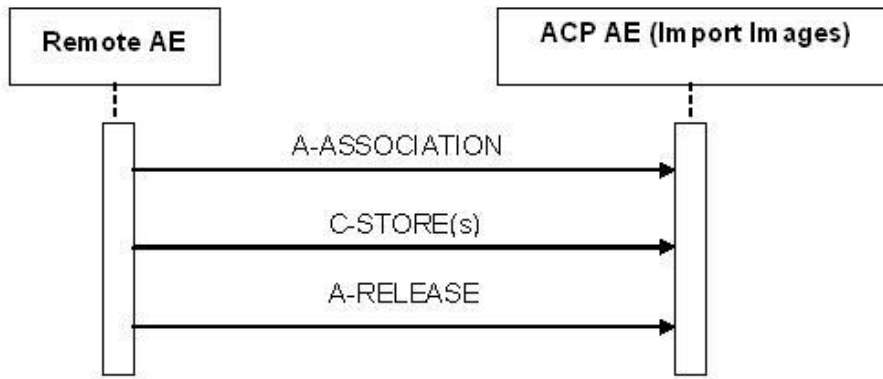


Figure 8: Sequencing of RWA Import Images

4.2.1.4.2.2. Accepted Presentation Contexts

The ACP AE accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that the ACP AE accepts multiple Proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes. There is no check for duplicate contexts and are therefore accepted.

The presentation contexts of the imported images are defined in the next table.

Table 40: Acceptable Presentation Contexts for (Real-World) Activity – Image Import

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
		JPEG Lossless, Non-Hierarchical, FOP (Process 14)	1.2.840.10008.1.2.4.70		
Secondary Capture Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		JPEG Lossless, Non-Hierarchical, FOP (Process 14)	1.2.840.10008.1.2.4.70		

4.2.1.4.2.3. SOP Specific Conformance for Storage SOP Classes

The ACP AE provides standard conformance to the error handling of image import. All error messages occur in C-STORE response. It provides level 2 (full) conformances. The behavior of the ACP AE for status codes in an C-STORE response are as follows:

4.2.1.4.2.3.1. Dataset Specific Conformance for C-STORE-RSP

Detail regarding the Dataset Specific response behavior will be reported in this section.

This includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

Table 41: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successful stored operation	The images shall be stored in the Allura FC local database. Success shall be logged.
Failure	xxxx	Refused: Out of Resources	SOP class of the image(s) does not match the negotiated abstract syntax. The ACP AE shall send a notification and abort the Association. The image(s) cannot be parsed. The ACP AE shall send a notification and abort the Association. The failure reason is logged.
		Error: Data Set does not match SOP Class	SOP class of the image(s) does not match the negotiated abstract syntax. The ACP AE shall send a notification and abort the Association. The image(s) cannot be parsed. The ACP AE shall send a notification and abort the Association. The failure reason is logged.
		Error: cannot understand	SOP class of the image(s) does not match the negotiated abstract syntax. The ACP AE shall send a notification and abort the Association. The image(s) cannot be parsed. The ACP AE shall send a notification and abort the Association. The failure reason is logged.

4.3. Network Interfaces

4.3.1. Physical Network Interfaces

The Allura FC provides DICOM V3.0 TCP/IP Network Communication. The TCP/IP stack is inherited from the .Net Framework/Windows XP operating system.

The Allura FC supports a single network interface:

Ethernet ISO.8802-3. Standard

AUI, optional twisted pair 10/100-BaseT.

4.3.2. Additional Protocols

Not applicable.

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 Titles

All local applications use the AE Titles and TCP/IP Ports configured via the Service Application. Default AE Titles are provided. The local AE title mapping and configuration is presented in the next Table:

Table 42: AE Title/Presentation Address Mapping

Application Entity	Default AE Title	Default TCP/IP Port	Calling AE Title
ACP AE	DRISHTI_SCP	1445	DRISHTI_SCP

4.4.1.2. Remote AE Title/Presentation Address Mapping

The configuration of the remote application is specified here.

All relevant remote applications that should be able to setup a DICOM association towards Allura FC and that should be able to accept a DICOM association from Allura FC must be configured during the Allura FC configuration / run time.

Both Storage and Print Server are configurable with the following parameters:

1. IP Address (Presentation Address)
2. IP Port Number
3. Called AE Title

4.4.2. Parameters

The specification of important operational parameters, their default value and range (if configurable) are specified here.

Table 43: Configuration Parameters Table

Parameter	Configurable	Default Value
General Parameter		
Time-out waiting for acceptance or rejection Response to an Association Open Request (Application Level timeout)	-	-
General DIMSE level time-out values (Verification, Storage)	-	-
Time-out for response to TCP/IP connect request. (Low-level timeout)	-	-
Time-out waiting for acceptance of a TCP/IP message over the network (Low-level timeout)	-	-
Time-out for waiting for data between TCP/IP packets. (Low-level timeout)	-	-
Any changes to default TCP/IP settings, such as configurable stack parameters.	-	-
Transfer Syntax support for DICOM Store(as an SCU), Print and Media	Yes	-
AE Specific Parameters		
Size constraint in maximum object size	-	-
Maximum PDU size the AE can receive	No	16384 Bytes
Maximum PDU size the AE can send	No	16384 Bytes
AE specific DIMSE level time-out values	Yes	30 seconds
GUI user readable string for remote AE titles	Yes	-
Storage Specific Parameters		

Parameter	Configurable	Default Value
Export Filter	-	-
Confidentiality	-	-
Export private Attributes	-	-
Print Management Specific Parameters		
Retries	-	-
Delay between retries	-	-

5. Media Interchange

5.1. Implementation model

The implementation model identifies the DICOM Application Entities for Media in specific implementation and relates the Application Entities to Real-World Activities.

5.1.1. Application Data Flow Diagram

The following figure shows the Media Interchange Application Data Flow diagram presenting all of the Application Entities present in an implementation and graphically depicting the relationship of the AE's, use of DICOM to Real-World Activities.

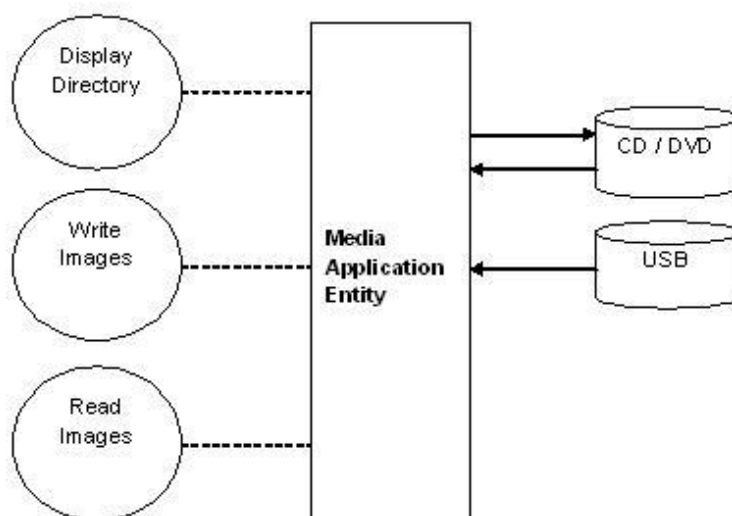


Figure 9: Media Interchange Application Data Flow Diagram

The supported DICOM Media Services are specified in Table:

Table 44: Media services.

Media Storage Application	Write Files (FSC)	Write Files (FSU)	Read Files (FSR)
General Purpose DVD Interchange	Yes	No	Yes
General Purpose CD Interchange	Yes	No	Yes

The ACP AE supports images with the DICOM photometric interpretations shown in Table:

Table 45: Photometric interpretations supported by the ACP AE.

Photometric Interpretation	Import	Export	Viewing
MONOCHROME2	Yes	Yes	Yes
MONOCHROME1	Yes	Yes	Yes

Each time an association is initiated, the ACP AE proposes one presentation contexts to be used on that association. The presentation context proposed by the ACP AE for Media Storage is as follows:

Table 46: Transfer Syntaxes of Media supported by the ACP AE

Abstract Syntax Name / UID	Transfer Syntax Name	Transfer Syntax UID	Role	Extended Negotiation
Any of the standard image storage and ILE 1.2.840.10008.1.2	ILE	1.2.840.10008.1.2	SCU	None
	ELE	1.2.840.10008.1.2.1		
	JPEG Loss Less	1.2.840.10008.1.2.4.70		

Note that the preferred supported transfer syntax is ELE.

The Create DICOMCD acts as an FSC using the interchange option while creating a DICOM CD. It writes the selected images in to a single File-set and corresponding DICOMDIR, to formatted (as specified in the Application Profile) CD-R/CD-RW.

5.1.2. Functional Definitions of AE's

The Media AE is the one and only Media Application Entity within the Allura FC System. It includes the following service class.

Media Storage Service Class:

For DVD the Media AE can perform the media storage service as SCU with capabilities for:

- RWA Display Directory (as FSR);
- RWA Read Image (as FSR);
- RWA Write Image (as FSC).

For CD the Media AE can perform the media storage service as SCU with capabilities for:

- RWA Display Directory (as FSR);
- RWA Read Image (as FSR);
- RWA Write Image (as FSC and FSU).

Using initialized media, Write Images can be initiated by selecting the requested images and clicking the media copy button.

5.1.3. Sequencing of Real World Activities

Whenever media has to be written the Media AE first tries to read the DICOMDIR. Then the Media AE will write the images of the selected Examinations and the updated DICOMDIR to the DICOM media.

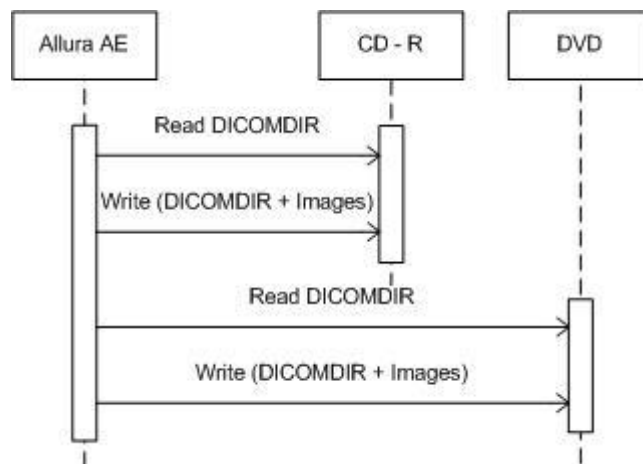


Figure 10: RWA_CD_DVD_Media_Write Image.

This shows Media creation Icon image sequence in the DICOMDIR file for each image to the corresponding patient.

Table 47: ICON IMAGE Sequence in DICOMDIR.

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples Per Pixel	0028,0002	US	1	ALWAYS	AUTO
Photometric Interpretation	0028,0004	CS	MONOCHROME2 / MONOCHROME1	ALWAYS	AUTO
Rows	0028,0010	US	128	ALWAYS	AUTO
Columns	0028,0011	US	128	ALWAYS	AUTO
Bits Allocated	0028,0100	US	8	ALWAYS	AUTO
Bits Stored	0028,0101	US	8	ALWAYS	AUTO
High Bit	0028,0102	US	7	ALWAYS	AUTO
Pixel Representation	0028,0103	US	0000H / 0	ALWAYS	AUTO

5.2. AE Specifications

This section in the DICOM Conformance Statement specifies a set of Media Application Entities.

5.2.1. Media ALLURA FC Media - Specification

The Media AE provides standard conformance to the DICOM Media Storage Service and File Format ([DICOM] PS 3.10), Media Storage Application Profiles STD-GEN-DVD-JPEG ([DICOM] PS 3.11), and Media Storage Application Profiles STD-GEN-CD ([DICOM] PS 3.11).

For one or more Application Profiles, next Table shows the Real-World Activities and the roles of each of these Real-World Activities. Notes:

- Read File-set = Display Directory, Read Image
- Create File-set = Write Image (using ELE only)
- Update File-set = Write Image (using ELE only)
- Write Image to DVD is DVD only.

Table 48: AE Media ALLURA FC related Application Profiles, RWA activities and roles

Supported Application Profile	Identifier	Real-World Activities	Roles
General Purpose CD-R Interchange	STD-GEN-CD	Create File-set	FSC
		Read File-set	FSR
General Purpose DVD Interchange with JPEG	STD-GEN-DVD-JPEG	Create File-set	FSC
		Read File-set	FSR
General Purpose Secure USB Media Interchange with JPEG	STD-GEN-SEC-USB-JPEG	Read File-set	FSR

5.2.1.1. File Meta Information for the Media ALLURA FC

The Implementation Class UID and the Implementation Version Name in the File Meta Header are as specified for networking. The Media AE has no specific File Meta Information.

The following values are assigned to the File Meta Information attributes (see also PS 3.10) that pertain to the Implementation Class UID and Implementation Version Name.

Table 49: File Meta Information for the Media ALLURA FC

Implementation Class UID	1.2.756.777.101536
Implementation Version Name	ALLURA_FC_MC

5.2.1.2. Real-World Activities

The AE specification contains a description of the Real-World Activities, which invoke the particular AE.

5.2.1.2.1. RWA - Read File-set

The Media AE supports the FSR (File Set Reader) role to interchange stored data on DICOM media. (Display Directory and Read Image).

Display Directory

When a database open action is initiated on the media then the Media AE acts as an FSR using the interchange option to read the DICOMDIR of the medium.

The Allura FC System will act as a FSR when reading the directory of the medium.

Read Images

The Allura FC System Media AE will act as a FSR when reading all images of the selected Examinations from DICOM media.

5.2.1.2.1.1. Media Storage Application Profile

This chapter refers to the related Application Profiles in the table in section 5.2.1.

5.2.1.2.1.1.1. Options

Display Directory

The mandatory DICOMDIR keys are required for the correct display of directory information. The display is structured according to the DICOM Composite Information Model: Patient, Study, Series and Image.

Read Image

The mandatory attributes of the DICOM images are required for the successful storage of the images in the Allura FC System internal image database. For conformance see section 8.

5.2.1.2.2. RWA - Create File-set

This Media Application Entity has a File-set Creator functionality which is described here.

Write Images

The Media AE acts as an FSC when writing DICOM objects onto DICOM media. The Media AE can also store private attributes. The DICOMDIR file will be extended when new images are written. In case some attributes are not present in the images but are specified Mandatory in the DICOMDIR definition in DICOM Media, a generated dummy value will be filled in.

5.2.1.2.2.1. Media Storage Application Profile

This chapter refers to the related Application Profiles in the table in section 5.2.1.

5.2.1.2.2.1.1. Options

Implementation remarks and restriction:

- When writing the DICOMDIR records the following key values are generated if no value of the corresponding attribute is supplied:
 - Patient ID;
 - Study ID;
 - Study Instance UID;
 - Series Number;
 - Series Instance UID;
 - Image Number;
 - SOP Instance UID.
- The mechanism of generating a value for Patient ID creates each time a new value based on Patient's Name for each new study written to DICOM media, even if this study belongs to a patient recorded earlier.

- The default value for the Pixel Intensity Relationship (0028,1040) is set to DISP.
- A number of attributes (e.g., Window Width and Window Centre) can be formatted as floating point numbers.

5.3. Augmented and Private Application Profiles

Not applicable

5.4. Media Configuration

Not applicable.

6. Support of Character Sets

Any support for character sets in Network and Media services is described here.

Table 50: Supported DICOM Character Sets

Character Set Description	Defined Term	ESC Sequence	ISO Registration Number	Code Element	Character Set
Latin alphabet No. 1	ISO_IR 100	-	ISO-IR 6	G0	ISO 646
		-	ISO-IR 100	G1	Supplementary set of ISO 8859
Default repertoire	-	-	ISO-IR 6	G0	ISO 646
		-	-	-	-

Besides the DICOM default character repertoire, ISO 646 Latin Alphabet (ISO_IR 6), the following character set is supported:

- ISO 8859 - Western Europe Supplementary Set 1 (ISO_IR 100).

The strings in Allura FC are represented in UNICODE. When an unsupported character set is received, the image data shall be rejected.

7. Security

7.1. Security Profiles

The Allura FC shall reject association requests from applications that do not address its ACP AE. Allura FC allows the use of a conventional (non-secure) DICOM communication.

7.1.1. Security use Profiles

Not applicable.

7.1.2. Security Transport Connection Profiles

Not Applicable.

7.1.3. Digital Signature Profiles

Not applicable.

7.1.4. Media Storage Security Profiles

Not applicable.

7.1.5. Attribute Confidentiality Profiles

The Allura FC conforms to the Basic Application Level Confidentiality Profile as a de-identifier without encryption. This functionality is targeted toward creating a special purpose, de-identified version of an already-existing Data Set. The de-identified SOP Instances are useful, for example, in creating teaching or research files, where the identity of the patient should be protected.

The Allura FC does not create instances of the Encrypted Attributes Dataset; therefore, reconstruction of the original Dataset will not be possible. Following table presents all attributes that can be de-identified by the Allura FC. Each Attribute to be protected has its value replaced by a different “replacement value” which does not allow identification of the patient. Integrity of dummy values for references (such as SOP Instance UID, etc.) if multiple SOP instances are protected is ensured within the scope of one job.

The Allura FC does not ensure that identifying information that is burned in to the image pixel data is “blackened” (removed).

Table 51: De-Identifying Attributes.

Attribute Name	Tag	Replacement Value
Specific Character Set	0008,0005	"ISO_IR 100" *
SOP Instance UID	0008,0018	Unique ID is generated
Accession Number	0008,0050	"1"
Conversion Type	0008,0064	"WSD" *
Institution Name	0008,0080	Empty value
Institution Address	0008,0081	Empty value
Referring Physician's Name	0008,0090	Empty value
Station Name	0008,1010	Empty value
Study Description	0008,1030	Empty value
Performing Physician's Name	0008,1050	Empty value
Series Description	0008,103E	Empty value
Institutional Department Name	0008,1040	Empty value
Performing Physicians' Name	0008,1050	Empty value
Name of Physician(s) Reading Study	0008,1060	Empty value

Attribute Name	Tag	Replacement Value
Operators' Name	0008,1070	Empty value
Admitting Diagnoses Description	0008,1080	Empty value
Manufacturer's Model Name	0008,1090	Empty value *
Patient's Name	0010,0010	"NO NAME"
Patient ID	0010,0020	New ID is generated
Patient's Birth Date	0010,0030	Empty value
Patient's Birth Time	0010,0032	Empty value
Patient's Sex	0010,0040	"O"
Other Patient Ids	0010,1000	Empty value
Other Patient Names	0010,1001	Empty value
Patient's Age	0010,1010	"000Y"
Patient's Size	0010,1020	"0.000000"
Patient's Weight	0010,1030	"0.000000"
Occupation	0010,2180	Empty value
Additional Patient History	0010,21B0	Empty value
Patient Comments	0010,4000	Empty value
Patient's Birth Time	0010,0032	Empty value
Patient's Address	0010,1040	Empty value
Patient's Telephone Numbers	0010,2154	Empty value
Ethnic Group	0010,2160	Empty value
Occupation	0010,2180	Empty value
Patient Comments	0010,4000	Empty value
Cine Rate	0018,0040	"0"
Slice Thickness	0018,0050	"1" *
Device Serial Number	0018,1000	Empty value
Software Version(s)	0018,1020	Empty value *
Protocol Name	0018,1030	Empty value
Frame Time	0018,1063	"83.33" *
Radiation Setting	0018,1155	"SC" *
Patient Position	0018,5100	Empty value *
Study Instance UID	0020,000D	Unique ID is generated
Series Instance UID	0020,000E	Unique ID is generated
Study ID	0020,0010	Empty value
Series Number	0020,0011	"1" *
Instance Number	0020,0013	"1" *
Laterality	0020,0060	Empty value *
Samples per Pixel	0028,0002	"1" *
Photometric Interpretation	0028,0004	"MONOCHROME2" *
Planar Configuration	0028,0006	"0" *
Pixel Aspect Ratio	0028,0034	"1\1" *
Pixel Representation	0028,0103	"0" *
Pixel Intensity Relationship	0028,1040	"LIN" *
Window Centre	0028,1050	Empty value *
Window Width	0028,1051	Empty value *

* If some value is already present then it will not be anonymized (the de-identified value is copied from the original value); else if the value is null then "replacement value" will be displayed as mentioned in the above table.

7.1.6. Network Address Management Profiles

Not applicable.

7.1.7. Time Synchronization Profiles

Not applicable.

7.1.8. Application Configuration Management Profiles

Not applicable.

7.1.9. Audit Trail Profiles

Not applicable.

7.2. Association Level Security

The Allura FC shall reject association requests from applications that do not address its ACP AE, i.e. applications that offer a wrong "called AE title". The ACP AE title of Allura FC is "DRISHTI_SCP".

7.3. Application Level Security

The Allura FC allows the use of a conventional (non-secure) DICOM communication.

8. Annexes of application "DRISHTI Application"

8.1. IOD Contents

8.1.1. Created SOP Instance

This section specifies each IOD created by this application.

The details of the applied modules are given in the tables below. The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables. The specified attributes are present and filled except for what is specified in the notes.

This section specifies each IOD created (including private IOD's). It should specify the attribute name, tag, VR, and value. The value should specify the range and source (e.g. user input, Modality Worklist, automatically generated, etc.). For content items in templates, the range and source of the concept name and concept values should be specified. Whether the value is always present or not shall be specified.

Abbreviations used in the IOD tables for the column "Presence of Module" are:

ALWAYS The module is always present
 CONDITIONAL The module is used under specified condition

Abbreviations used in the Module table for the column "Presence of Value" are:

ALWAYS The attribute is always present with a value
 EMPTY The attribute is always present without any value (attribute sent zero length)
 VNAP The attribute is always present and its Value is Not Always Present
 (attribute sent zero length if no value is present)
 ANAP The attribute is present under specified condition – if present then it will always have a value
 ANAPCV The attribute is present under specified condition – if present then its Value is Not Always Present
 (attribute sent zero length if condition applies and no value is present)
 ANAPEV The attribute is present under specified condition – if present then it will not have any value

The abbreviations used in the Module table for the column "Source" are:

AUTO The attribute value is generated automatically
 CONFIG The attribute value source is a configurable parameter
 COPY The attribute value source is another SOP instance
 FIXED The attribute value is hard-coded in the application
 IMPLICIT The attribute value source is a user-implicit setting
 USER The attribute value source is explicit user input

8.1.1.1. List of created SOP Classes

Table 52: List of created SOP Classes

SOP Class Name	SOP Class UID
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1

8.1.1.2. X-Ray Angiographic Image Storage SOP Class

Table 53: IOD of Created X-Ray Angiographic Image Storage SOP Class Instances

Information Entity	Module	Presence Of Module
Patient	Patient Module	ALWAYS
Study	General Study Module	ALWAYS
Study	Patient Study Module	ALWAYS
Series	General Series Module	ALWAYS

Equipment	General Equipment Module	ALWAYS
Image	General Image Module	ALWAYS
Image	Image Pixel Module	ALWAYS
Image	Cine Module	CONDITIONAL
Image	Multi-Frame Module	CONDITIONAL
Image	X-Ray Image Module	ALWAYS
Image	X-Ray Acquisition Module	ALWAYS
Image	XA Positioner Module	ALWAYS
Image	SOP Common Module	ALWAYS
	Extended DICOM and Private attributes	

Table 54: Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Name	0010,0010	PN		ALWAYS	USER	-
Patient ID	0010,0020	LO		ALWAYS	USER	-
Patient's Birth Date	0010,0030	DA		VNAP	USER	-
Patient's Sex	0010,0040	CS	F, M, O	VNAP	USER	-
Other Patient IDs	0010,1000	LO		ANAP	USER	-
Ethnic Group	0010,2160	SH		ANAP	USER	-
Patient Comments	0010,4000	LT		ANAP	USER	-

Table 55: General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Study Date	0008,0020	DA		ALWAYS	AUTO	<yyyymmdd>
Study Time	0008,0030	TM		ALWAYS	AUTO	<hhmmss>
Accession Number	0008,0050	SH		ALWAYS	USER	-
Referring Physician's Name	0008,0090	PN		VNAP	USER	Patients Referring Physician
Referring Physician Identification Sequence	0008,0096	SQ		VNAP	USER	
>Person Identification Code Sequence	0040,1101	SQ		VNAP	USER	
>>Code Value	0008,0100	SH		ALWAYS		
>>Coding Scheme Designator	0008,0102	SH		ALWAYS		
>>Code Meaning	0008,0104	LO		ALWAYS		
>Person's Address	0040,1102	ST		VNAP	USER	This attribute is called as "Address" in UI.
Study Description	0008,1030	LO		VNAP	USER	This attribute is called as "Study Name" in UI.
Name of Physician(s) Reading Study	0008,1060	PN		ANAPCV	USER	-
Study Instance UID	0020,000D	UI		ALWAYS	USER	-
Study ID	0020,0010	SH		VNAP	USER	-

Table 56: Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Admitting Diagnoses Description	0008,1080	LO		VNAP	USER	This attribute is called as "Diagnoses" in UI.
Patient's Age	0010,1010	AS		VNAP	USER	This attribute is called as "Age" in UI.
Patient's Size	0010,1020	DS		ANAP	USER	-
Patient's Weight	0010,1030	DS		ANAP	USER	-

Additional Patient History	0010,21B0	LT		ANAP	USER	-
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Table 57: General Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Series Date	0008,0021	DA		ALWAYS	AUTO	<yyyymmdd>
Series Time	0008,0031	TM		ALWAYS	AUTO	<hhmmss>
Modality	0008,0060	CS	XA	ALWAYS	AUTO	-
Series Description	0008,103E	LO		ALWAYS	AUTO	-
Performing Physician's Name	0008,1050	PN		VNAP	USER	This attribute is called as "Treating Physician" in UI.
Operators' Name	0008,1070	PN		ANAP	USER	-
Protocol Name	0018,1030	LO		ALWAYS	AUTO	-
Series Instance UID	0020,000E	UI		ALWAYS	AUTO	-
Series Number	0020,0011	IS		ALWAYS	AUTO	-
Laterality	0020,0060	CS		EMPTY	AUTO	-

Table 58: General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Manufacturer	0008,0070	LO	Philips	ALWAYS	AUTO	-
Institution Name	0008,0080	LO		VNAP	USER	This attribute is called as "Hospital Name" in UI.
Station Name	0008,1010	SH		ALWAYS	CONFIG	-
Manufacturer's Model Name	0008,1090	LO	Allura FC	ALWAYS	AUTO	-
Device Serial Number	0018,1000	LO		ANAP	AUTO	-
Software Version(s)	0018,1020	LO		ANAP	AUTO	-

Table 59: General Image Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Content Date	0008,0023	DA		ALWAYS	AUTO	Format: <yyyymmdd>
Content Time	0008,0033	TM		ALWAYS	AUTO	Format: <hhmmss>
Instance Number	0020,0013	IS		ALWAYS	AUTO	-
Patient Orientation	0020,0020	CS		VNAP	AUTO	-

Table 60: Image Pixel Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Rows	0028,0010	US		ALWAYS	AUTO	-
Columns	0028,0011	US		ALWAYS	AUTO	-
Pixel Data	7FE0,0010	O W/ OB		ALWAYS	AUTO	-

Table 61: Cine Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Cine Rate	0018,0040	IS		ALWAYS	AUTO	-
Frame Time	0018,1063	DS		ALWAYS	AUTO	-

Table 62: Multi-Frame Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Number of Frames	0028,0008	IS		ANAP	AUTO	-

Table 63: X-Ray Image Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Image Type	0008,0008	CS	Value 1: DERIVED, ORIGINAL, Value 2: PRIMARY, Value 3: SINGLE PLANE	ALWAYS	AUTO	-
Samples per Pixel	0028,0002	US	1	ALWAYS	AUTO	-
Photometric Interpretation	0028,0004	CS	MONOCHROME1, MONOCHROME2	ALWAYS	AUTO	-
Frame Increment Pointer	0028,0009	AT	0x00181063	ALWAYS	AUTO	-
Bits Allocated	0028,0100	US	16, 8	ALWAYS	AUTO	-
Bits Stored	0028,0101	US	10, 12, 14, 16, 8	ALWAYS	AUTO	-
High Bit	0028,0102	US	11, 13, 15, 7, 9	ALWAYS	AUTO	-
Pixel Representation	0028,0103	US	0, 0x0000	ALWAYS	AUTO	-
Pixel Intensity Relationship	0028,1040	CS	LIN	ALWAYS	AUTO	-

Table 64: X-Ray Acquisition Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
KVP	0018,0060	DS		ALWAYS	AUTO	-
Exposure Time	0018,1150	IS		ANAP	AUTO	-
X-ray Tube Current	0018,1151	IS		ANAP	AUTO	-
Exposure	0018,1152	IS		ANAP	AUTO	-
Radiation Setting	0018,1155	CS		ALWAYS	AUTO	-

Table 65: XA Positioner Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Distance Source to Detector	0018,1110	DS		ALWAYS	AUTO	-
Distance Source to Patient	0018,1111	DS		ALWAYS	AUTO	-
Positioner Primary Angle	0018,1510	DS		ALWAYS	AUTO	-
Positioner Secondary Angle	0018,1511	DS		ALWAYS	AUTO	-

Table 66: SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Specific Character Set	0008,0005	CS	ISO_IR 100	ALWAYS	AUTO	-
SOP Class UID	0008,0016	UI	1.2.840.10008.5.1.4.1.1. 12.1	ALWAYS	AUTO	Generated by device
SOP Instance UID	0008,0018	UI		ALWAYS	AUTO	Generated by device

8.1.2. Usage of Attributes from Received IOD

The following table lists the functionality supported by this Allura FC application.

Table 67: Functionalities

Functionality	Type1	Optional	Private
Display Images	X		

8.1.2.1. Usage of the Functionality Display Images

The following table lists the supported SOP Classes which can be used by this application.

Table 68: Supported SOP Classes for functionality Display Images

SOP Class name	SOP Class UID
Secondary Capture Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1

Table 69: Supported Optional attributes of functionality Display Images

Attribute Name	Tag	VR	Value	Comment
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8.1.3. Attribute Mapping

Not applicable.

8.1.4. Coerced/Modified fields

Not applicable.

8.2. Data Dictionary of Private Attributes

Table 70: Private Attributes.

Attribute Name	Tag	VR	Value	Presence of Value	Source
Acquisition Mode	0033,0033	IS	Cine / DSA / Fluoro / PFluoro/Roadmap	ALWAYS	AUTO

8.3. Coded Terminology and Templates

Not applicable.

8.3.1. Context Groups

Not applicable.

8.3.2. Template Specifications

Not applicable.

8.3.3. Private code definitions

Not applicable.

8.4. Grayscale Image consistency

The monitors and printers attached to the product can be calibrated by using the Service Application.

8.5. Standard Extended/Specialized/Private SOPs

Not applicable.

Table 71: List of created SOP Classes

SOP Class Name	SOP Class UID
X-Ray Angiographic Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.12.1

8.5.1. Standard Extended/Specialized/Private SOP Instance

8.5.1.1. X-Ray Angiographic Image Storage SOP Class

Table 72: Extended DICOM and private attributes for X-Ray Angiographic Image Storage SOP Class Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Telephone Numbers	0010,2154	SH		VNAP	USER	This attribute in UI is called as "Contact Number".

8.6. Private Transfer Syntaxes

Not applicable.