

DICOM Conformance Statement

Product details:

Product type:

Data Analysis Software

Image Management Software

Product Name:

Image-Arena™ 4.3

Manufacturer:

TomTec Imaging Systems GmbH

Edisonstrasse 6

85716 Unterschleissheim

Used standards:

ACR-NEMA Digital Imaging and Communications in Medicine, DICOM V3.0

We declare under sole responsibility that the product listed above is in compliance with DICOM 3.0



Unterschleissheim, 26.04.2010

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CTO

1 Conformance Statement Overview

The software package Image-Arena supports medical staff in their daily activity. It serves for organizing, visualizing, processing, measuring, storing and transferring image and non-image data that was previously acquired during medical examinations.

Image-Arena supports several DICOM Service Classes (using the DICOM Toolkit DCMTK) to provide the following functionalities.

- Receives from different modalities DICOM data in order to be stored in the database, viewed, analyzed or transferred to a PACS system.
- Implements a GUI to visualize the contents of a DICOMDIR and imports study data selected by the user.
- Finds and retrieves DICOM data from a PACS.
- Allows modalities to find and retrieve data stored in the database.
- Transfers DICOM data to a PACS in order to be stored and requests storage commitment for the files stored.

Table 1-1 contains an overview of the main network services supported by Image-Arena. Table 1-2 lists the supported media services.

Networking SOP Class	Service Class User	Service Class Provider
Transfer		
Verification	Yes	Yes
Storage Commitment Push Model	Yes	No
Storage SOP Classes	Yes	Yes
Workflow		
FIND SOP Classes	Yes	Yes
MOVE SOP Classes	Yes	Yes

Table 1-1. Network Services

Media Storage Application Profile	Write Files (FSC, FSU)	Read Files (FSR)
DicomDir	Yes	Yes

Table 1-2. Media Services

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3 Introduction

This document describes the conformance of the Image-Arena 4.3 product to the ACR-NEMA DICOM standard and satisfies the DICOM requirement for a vendor conformance specification. It is intended to provide the reader with the knowledge of how to integrate this product within a DICOM compliant hospital network.

3.1 Intended Audience

The reader of this document is involved with design of medical software or medical system integration. We assume that the reader is familiar with the DICOM 3.0 standard terminology and concepts. Experience and familiarity with DICOM conformance statements in general is helpful but not necessarily required.

3.2 Remarks

This conformance statement is intended to facilitate the communication with other imaging equipments. However, it does not guarantee by itself the inter-operation of the connection. The integration of any device into a system of interconnected devices goes beyond the scope of the DICOM 3.0 standard and this conformance statement when interoperability is desired. A comparison of two complementary conformance statements is only one step towards determining whether two applications are interoperable; aside from this comparison other steps are inevitable. It is the user's responsibility to analyse the applications requirements and to develop a solution that integrates the Image-Arena 4.3 equipment with other vendors' systems. It is also the user's task to validate the complete range of communication possibilities between the Image-Arena 4.3 equipment and the devices to be connected to.

The Image-Arena 4.3 product will follow the evolution of the DICOM 3.0 standard. This evolution may require changes to devices that have implemented DICOM 3.0. To guarantee future interoperability, the user should ensure that any provider connecting with Image-Arena 4.3 devices will follow future evolution of the DICOM standard.



3.3 Acronyms, Abbreviations

The following acronyms and abbreviations are used in this document:

ACR	American College of Radiology
AE	Application Entity
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
GUI	Graphic User Interface
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
ISO	International Standards Organization
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
PIR	Patient Information Reconciliation
SCU	Service Class User
SCP	Service Class Provider
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
VM	Value Multiplicity
VR	Value Representation

3.4 References

[DICOM] This document is written with respect to the ACR-NEMA Digital Imaging and Communications in Medicine (DICOM) version number 3.0.

[IHE] IHE Cardiology Technical Framework Year 2: 2005-2006, Volume I Integration Profiles, Revision 2.0, Trial Implementation Version, Publication Date: June 27, 2005

4 Networking

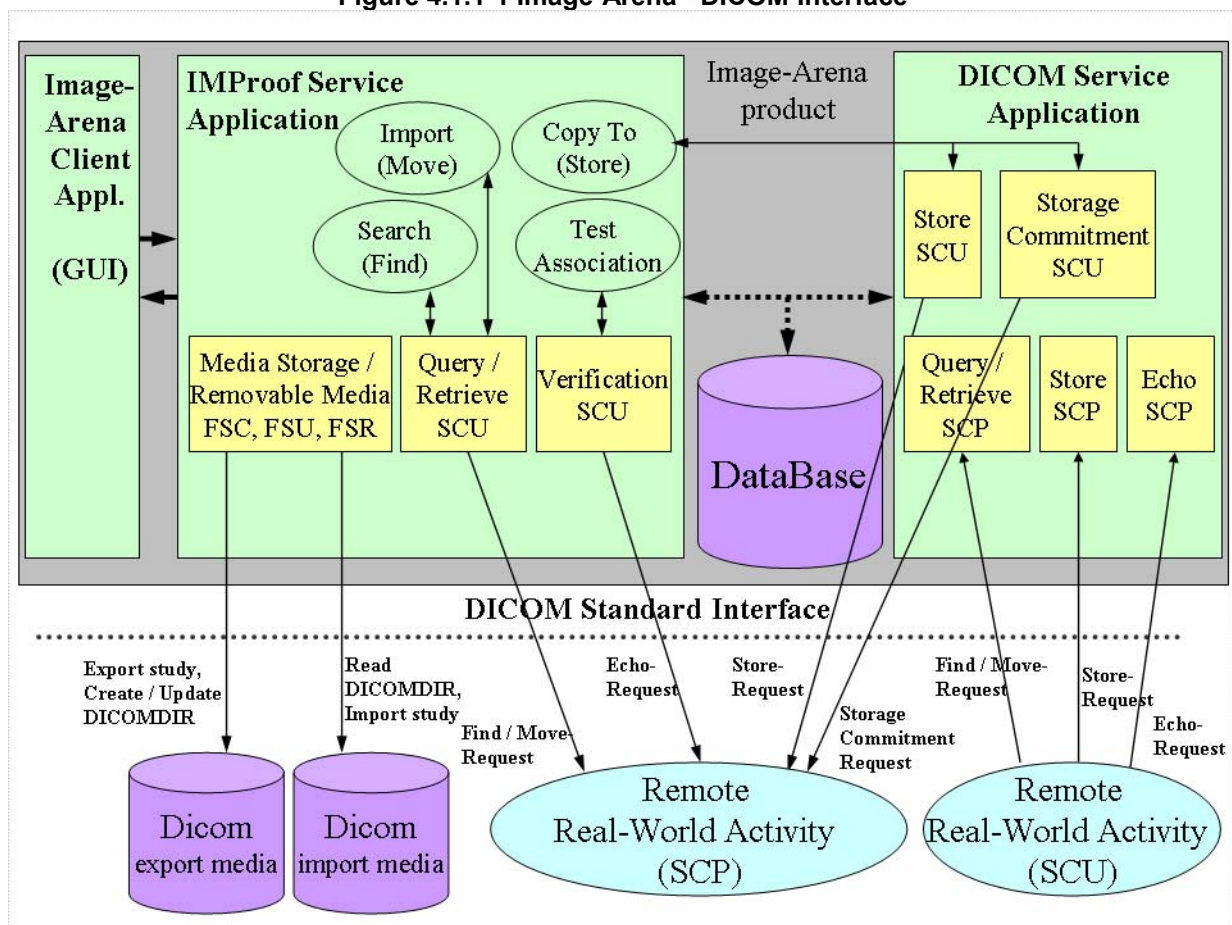
4.1 Implementation model

The Image-Arena product serves for acquiring, processing, storing and communicating medical image data. It is composed of four applications with different functionalities: The Image-Arena client for user interaction, the ImProof Service and the DICOM Service with real DICOM functionality, and the Server Manager to configure the Image-Arena product. In this document, we only describe the two components ImProofService and DicomService. The Image-Arena product will be referred further on in this document as “Image-Arena product”.

4.1.1 Application Data Flow Diagram

The ImProof Service application and Dicom Service application work on the same database. Figure 4.1.1-1 shows the DICOM interface of the Image-Arena product.

Figure 4.1.1-1 Image-Arena - DICOM Interface



4.1.2 Functional Definition of AE's

The ImProof Service application implements DICOM SCU functionalities for verification and query/retrieve. It also implements DICOM Media Storage. The Dicom Service application has SCU and SCP functionalities for storage, SCU functionality for storage commitment and allows verification as SCP. Conceptually the network services may be modelled as separate AEs, though in fact all the AEs share a single configurable AETitle.

The following table summarises the DICOM Services supported by Image-Arena:

DICOM (DIMSE) Service	SCU	SCP
Verification (C-ECHO)	Yes	Yes
Storage (C-STORE)	Yes	Yes
Storage Commitment (N-ACTION, N-EVENT-REPORT)	Yes	No
Query (C-FIND)	Yes	Yes
Retrieve (C-MOVE)	Yes	Yes

Table 4.1.2 DICOM services supported by Image-Arena.

4.1.2.1 Verification SCU and SCP

The ImProof Service application supports the C-ECHO DIMSE-C service as SCU. The **Echo SCU** is able to initiate an association with Presentation Contexts for the Verification SOP Class and sends echo requests.

The DICOM Service application supports the C-ECHO DIMSE-C service as SCP. The **Echo SCP** waits in background for connections, will accept associations with Presentation Contexts for the Verification SOP Class and will respond successfully to echo requests.

4.1.2.2 Storage SCU and SCP

The DICOM Service application implements the C-STORE DIMSE-C service as SCU and SCP.

The **Storage SCU** functionality can transmit DICOM conform files to remote devices that have STORE SCP functionality and have been configured in the system. It initiates associations with Presentation Contexts for Storage SOP Classes. It attempts to store more than one file on an association. Storage SCU is activated through the user interface where the user can select a study and send it to a DICOM Storage SCP host. It can also be activated automatically while archiving all studies at the end of the day. The third possibility to activate Storage SCU is that Query-Retrieve SCP sends the required instances to the remote AE.

The **Storage SCP** functionality waits for incoming connections and will accept associations with Presentation Contexts for Storage SOP Classes. When receiving an incoming DICOM dataset, it extracts the Patient, Study, Series, Image and Structured Report information from the received data and stores them to its database. No patient reconciliation happens automatically: in case a discrepancy occurs between patient/study data already existing in the database and patient/study data of the received file, a new patient/study will be created for the received data. The merge of the two studies can be made later by the user.

4.1.2.3 Storage Commitment SCU and SCP

As a **Storage Commitment SCU** the DICOM Service application can send N-ACTION Requests and can accept incoming N-EVENT-REPORT Requests.

The Storage Commitment SCU functionality requests an association with Presentation Contexts for the Storage Commitment Push Model SOP Class and issues an N-ACTION Request for all files that have been successfully stored and are marked for commitment. It is the Storage SCP functionality of the DicomService Application that receives the Storage Commitment Responses. The Storage Commitment SCU is activated automatically after the DICOM data have been stored.

4.1.2.4 Query and Retrieve SCU

The ImProof Service application supports the C-FIND DIMSE-C service as SCU. It is able to issue DICOM queries (C-FIND Requests) and interprets the responses coming from the foreign SCP. The **Find SCU** is activated through the user interface when the user selects an AE to query, sets the configurable query parameters and initiates a query.

The ImProof Service application implements the C-MOVE DIMSE-C service as SCU. It is able to issue C-MOVE requests and interprets the move responses. It uses the DicomService's Storage functionality to receive the required DICOM files and to store them into DB. The **Move SCU** is activated through the user interface when the user selects some DICOM data from the Find SCU answer list and initiates the retrieval of these data.

4.1.2.5 Query and Retrieve SCP

The Dicom Service application supports the C-FIND and C-MOVE DIMSE-C services as SCP.

The **Find SCP** is able to accept DICOM queries (C-FIND Requests) for Patient, Study, Series and Image data, interpret them and responds with data objects with values corresponding to the contents of the Image-Arena database.

The **Move SCP** functionality handles retrieval requests by issuing a command to the Storage SCU to send the requested instances to the Move Destination AE (specified in the C-Move Request).

4.1.3 Sequencing of Real-World Activities

The SCP activities are performed asynchronously and therefore sequencing is not applicable for them.

Most of the SCU activities are sequentially initiated through the user interface (Echo SCU, Find SCU, Move SCU) and a new activity can only be initiated after the current one has completed. The SCU, Storage Commitment SCU activities are performed asynchronously in the background, here no sequencing is applicable except that a Storage Commitment request will only be issued for a DICOM file that have successfully been stored.

4.2 AE Specifications

The Image-Arena product AE-Title is configurable from the Server Manager application. All of the DICOM Services listed above in Table 4.1.2 use the same AE-Title.

4.2.1 SOP Classes

4.2.1.1 Verification as SCU and SCP

Image-Arena provides Standard Conformance to the following DICOM V3.0 Verification SOP Classes as an SCU and SCP.

SOP Class	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	yes	yes

Table 4.2.1-1 Verification SOP class.

4.2.1.2 Storage as SCU and SCP

Image-Arena provides Standard Conformance to the following DICOM V3.0 Storage SOP Classes as an SCU and SCP. Part of this list has to be specified in the Image-Arena ini file in order to configure which SOP Classes are supported.

SOP Class	SOP Class UID
<i>BasicTextSR</i>	1.2.840.10008.5.1.4.1.1.88.11
<i>ComprehensiveSR</i>	1.2.840.10008.5.1.4.1.1.88.33
<i>DRAFT_SRAudioStorage</i>	1.2.840.10008.5.1.4.1.1.88.2
<i>DRAFT_SRDetailStorage</i>	1.2.840.10008.5.1.4.1.1.88.3
<i>DRAFT_SRTTextStorage</i>	1.2.840.10008.5.1.4.1.1.88.1
<i>EnhancedSR</i>	1.2.840.10008.5.1.4.1.1.88.22
<i>RawDataStorage</i>	1.2.840.10008.5.1.4.1.1.66
<i>NuclearMedicineImageStorage</i>	1.2.840.10008.5.1.4.1.1.20
<i>RETIRED_UltrasoundImageStorage</i>	1.2.840.10008.5.1.4.1.1.6
<i>RETIRED_UltrasoundMultiframeImageStorage</i>	1.2.840.10008.5.1.4.1.1.3
<i>SecondaryCaptureImageStorage</i>	1.2.840.10008.5.1.4.1.1.7
<i>UltrasoundImageStorage</i>	1.2.840.10008.5.1.4.1.1.6.1
<i>UltrasoundMultiframeImageStorage</i>	1.2.840.10008.5.1.4.1.1.3.1
<i>XRayAngiographicImageStorage</i>	1.2.840.10008.5.1.4.1.1.12.1
<i>MultiframeSingleBitSecondaryCaptureImageStorage</i>	1.2.840.10008.5.1.4.1.1.7.1
<i>MultiframeGrayscaleByteSecondaryCaptureImageStorage</i>	1.2.840.10008.5.1.4.1.1.7.2
<i>MultiframeGrayscaleWordSecondaryCaptureImageStorage</i>	1.2.840.10008.5.1.4.1.1.7.3
<i>MultiframeTrueColorSecondaryCaptureImageStorage</i>	1.2.840.10008.5.1.4.1.1.7.4
<i>EncapsulatedPDFStorage</i>	1.2.840.10008.5.1.4.1.1.104.1

Table 4.2.1-2 Storage SOP Classes.

4.2.1.3 Storage Commitment as SCU

Image-Arena provides Standard Conformance to the following DICOM V3.0 Storage Commitment SOP Classes as an SCU:

SOP Class	SOP Class UID	SCU	SCP
StorageCommitmentPushModelSOPClass	1.2.840.10008.1.20.1	yes	no

Table 4.2.1-3 Storage Commitment SOP Classes.

4.2.1.4 Query/Retrieve as SCU and SCP

Image-Arena provides Standard Conformance to the following DICOM V3.0 Query/Retrieve SOP Classes as an SCU and SCP:

SOP Class	SOP Class UID	SCU	SCP
Patient Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.1.1	no	yes
Patient Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.1.2	no	yes
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1	yes	yes
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2	yes	yes
Patient/Study Only Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.3.1	no	yes
Patient/Study Only Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.3.2	no	yes

Table 4.2.1-4 Query/Retrieve SOP Classes.

4.2.1.5 Supported Transfer Syntaxes

Image-Arena supports as SCU and as SCP all the above listed verification, storage and query/retrieve SOP Classes with the following transfer syntaxes, if not otherwise specified later in this document.

Transfer Syntax Name	Transfer Syntax UID
LittleEndianImplicitTransferSyntax (Uncompressed, default)	1.2.840.10008.1.2
BigEndianExplicitTransferSyntax (Uncompressed)	1.2.840.10008.1.2.2
LittleEndianExplicitTransferSyntax (Uncompressed)	1.2.840.10008.1.2.1
RLELossless	1.2.840.10008.1.2.5
JPEGProcess14SV1TransferSyntax	1.2.840.10008.1.2.4.70
JPEGProcess1TransferSyntax	1.2.840.10008.1.2.4.50
JPEGProcess2_4TransferSyntax	1.2.840.10008.1.2.4.51

Table 4.2.1-5 Supported Transfer Syntaxes.

4.2.2 Association Policies

4.2.2.1 General

Image-Arena will attempt to establish an association whenever it is invoked with valid parameters (including a known destination and valid DICOM format files, containing valid group 0002 header, abstract syntax and transfer syntax).

Image-Arena limits the maximum PDU size to 16KB.

4.2.2.2 Number of Associations

There is no inherent limit to the number of associations other than limits imposed by the computer's operating system.

4.2.2.3 Asynchronous Nature

Image-Arena allows a single outstanding operation at a time on any association. However, multiple associations can exist and operate simultaneously.

4.2.2.4 Implementation Identifying Information

Image-Arena has the following implementation identifying parameters:

- Implementation Class UID: **1.2.276.0.7230010.3.0.3.5.4**
- Implementation Version Name: **OFFIS_DCMTK_354**
- All DICOM UIDs generated by Image-Arena begin with the registration number: **1.2.276.0.48**

4.2.3 Association Initiation Policy

Image-Arena can initiate associations only to the AETitles registered by the Image-Arena application.

An association will be initiated in the following cases:

- Image-Arena sends a verification request to a remote DICOM host.
- Image-Arena sends a store request to a remote DICOM host.
- Image-Arena sends a storage commitment request to a remote DICOM host.
- Image-Arena sends a query request to a remote DICOM host.
- Image-Arena sends a move request to a remote DICOM host.
- Image-Arena stores one or more DICOM files to a remote DICOM host (this happens at incoming move requests).

If Image-Arena initiates an association for storing files, it offers the original transfer syntax of a DICOM file followed by the three uncompressed transfer syntaxes. It supports decoding but does not support encoding of DICOM files. **Image-Arena sends more than one file on an association, if the files have the same original transfer syntax.**

At associations for verification, storage commitment, query or move requests, Image-Arena offers the uncompressed transfer syntaxes.

4.2.3.1 General transfer syntax selection policy at association initiation

The order in which transfer syntaxes are offered on association initiation depends on the local machine byte order, on the configuration parameters and on the original transfer syntax of the file to be stored (in case of Store SCU).

The configuration possibilities are:

- SupportJPEG = true/false → support JPEG compression
- SupportRLE=true/false → switch RLE compressed transfer syntaxes on/off
- SupportBigEndian=true/false → switch big endian byte order transfer syntaxes on/off
- PreferExplicit=true/false → explicit transfer syntaxes will be preferred to implicit ones.

By default, the explicit transfer syntax with the machine byte order is offered first, followed by the explicit transfer syntax with the inverse byte order and at last the implicit little endian transfer syntax is offered.

When storing a compressed file, the original (compressed) transfer syntax of the file will be offered first, followed by the three uncompressed transfer syntaxes.

4.2.3.2 Activity: Image-Arena sends a verification request to an AE (Verification SCU)

- **Associated Real World Activity – Verification SCU**

Image-Arena issues **Verification** requests in order to check if an SCP has the ability to receive DICOM requests. This can happen automatically before issuing a store or query request or it can happen on user interaction: clicking the TomTecServerManager->DICOM Modalities tab ->Send Echo button issues a C-ECHO request to the selected modality.

- **Presentation Context – Verification SCU**

Image-Arena will use any of the following Presentation Contexts for Verification SCU.

SOP Class	Transfer Syntax	Role	Extended Negotiation
All Table 4.2.1-1	Uncompressed transfer syntaxes from Table 4.2.1-5	SCU	None

Table 4.2.3-1 Presentation contexts for Verification SCU.

- **SOP Specific Conformance – Verification SCU**

Image-Arena provides standard conformance to the DICOM **Verification** Service Class as an SCU.

4.2.3.3 Activity: Image-Arena stores one or more DICOM files to an AE (Storage SCU)

- **Associated Real World Activity - Storage SCU**

Image-Arena transmits DICOM files that have either been created by our application or imported from a DICOMDIR or received via DICOM network services. The transmission of the files is invoked by user interaction: by selecting the study and choosing the *Copy to DICOMHOST* option in the study selection dialog. All DICOM files (except non-DICOM files like images and reports) of this study are stored to the selected DICOM host.

Image-Arena can be configured to send an echo-request before each store request.

For each stored file, the storage status and possible failure reasons will be logged to the Image-Arena logfiles. It is configurable whether (and how many times) a failed storage will be retried at a later time.

Image-Arena does not open a distinct association for each DICOM file to be sent. It reorganizes the list of files to be sent according to their original transfer syntaxes. For each group (files with the same transfer syntax) a new association will be initiated. Generally, more than one file will be sent on the same association.

- **Proposed Presentation Contexts - Storage SCU**

Image-Arena can negotiate for the presentation contexts listed in Table 4.2.3-2.

SOP Class	Transfer Syntax	Role	Extended Negotiation
Part of Table 4.2.1-2 (the list of SOP classes configured in the inifile)	Part of Table 4.2.1-5	SCU	None

Table 4.2.3-2 Presentation contexts for Storage SCU.

In an association request, Image-Arena negotiates for all supported SOP Classes with four (in case of compressed files) or three (in case of uncompressed files) transfer syntaxes. See also section 4.2.3.1: General transfer syntax selection policy at association initiation.

- **SOP Specific Conformance - Storage SCU**

- Image-Arena conforms to the DICOM Storage Service Class as an SCU.
- Presentation Context Acceptance Criterion: not applicable since Storage SCU does not accept associations.
- Transfer Syntax Selection Policy: Image-Arena prefers the original transfer syntax of the file to be transmitted. In case this transfer syntax is not accepted by the SCP, (especially by compressed files,) Image-Arena will decompress the files in order to convert them to the desired transfer syntax.
- Response Status: Storage SCU will behave as described in the Table below in response to status returned in the C-STORE response.

Service status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources	A7xx	Retry storage later
Error	Data Set does not match SOP Class	A9xx	Retry storage later
	Cannot understand	Cxxx	Retry storage later
Warning	Coercion of Data Elements	B000	Ignored
	Data Set does not match SOP Class	B007	Ignored
	Elements discarded	B006	Ignored
Success		0000	Ignored

Table 4.2.3-3 Response Status for Storage SCU.

4.2.3.4 Activity: Image-Arena requests storage commitment for one or more DICOM files (Storage Commitment SCU)

- **Associated Real World Activity - Storage Commitment SCU**

Image-Arena periodically looks for DICOM files that have been successfully stored and are waiting for storage commitment. This happens automatically, without user interaction. Commitment of all files (that are to be committed to the same SCP) is requested on the same association in one N-ACTION request. Image-Arena is not prepared to receive a commitment response on the same association. It listens to N-EVENT-REPORT responses off-line, on a different association. See Activity 4.2.4.4: Image-Arena accepts storage commitment response (for one or more DICOM files).

For each file to be committed, the commitment status and possible failure reasons will be logged to the Image-Arena logfiles. In case of a successful commitment the committed files will later be deleted, only a reference to the Retrieve AETitle will be kept in the Image-Arena database. In case of a failed commitment Image-Arena considers that the storage of the file failed as well, therefore the whole storage + commitment sequence will be executed again at a later time.

- **Proposed Presentation Contexts - Storage Commitment SCU**

Image-Arena can negotiate for the presentation contexts listed in Table 4.2.3.3.

SOP Class	Transfer Syntax	Role	Extended Negotiation
StorageCommitmentPushModelSOPClass (Table 4.2.1-3)	Uncompressed transfer syntaxes from Table 4.2.1-5	SCU	None

Table 4.2.3-4 Presentation contexts for Storage Commitment SCU.

- **SOP Specific Conformance - Storage Commitment SCU**

- Image-Arena conforms to the DICOM Storage Commitment Push Model Service Class as an SCU.

Storage Commitment SCU uses a newly generated unique TransactionUID for each N-ACTION request. There are no limitations regarding the lifetime of the TransactionUID.

Storage Commitment SCU does not support the optional Storage Media File-Set ID & UID Attributes in the N-ACTION request.

- Presentation Context Acceptance Criterion: here not applicable, see Activity 4.2.4.4 (SCP Part of Storage Commitment SCU).
- Transfer Syntax Selection Policy: Storage Commitment SCU offers the uncompressed transfer syntaxes. See the Transfer syntax selection policy at association initiation (section 4.2.3.1) for their order of appearance.
- Response Status: here not applicable, see Activity 4.2.4.4 (SCP Part of Storage Commitment SCU).

4.2.3.5 Activity: Image-Arena requests a list of studies from an SCP (Find SCU)

- **Associated Real World Activity - Find SCU**

Image-Arena can send find requests to an SCP. Find requests are invoked by user interaction:

Go to the Query/Retrieve tab, select the desired DICOM SCP host in the “Import from” drop-down list, set the query filters and press Search.

A single attempt will be made to query the remote AE. If the query fails, for whatever reason, no retry will be performed automatically. The user can re-launch the query if he wants to.

- **Proposed Presentation Contexts - Find SCU**

Image-Arena can negotiate for the following presentation contexts for Find SCU:

SOP Class	Transfer Syntax	Role	Extended Negotiation
All Table 4.2.1-4 SCU Find	Uncompressed transfer syntaxes from Table 4.2.1-5	SCU	None

Table 4.2.3-5 Presentation contexts for find.

- **SOP Specific Conformance - Find SCU**

- SOP classes of the Query/Retrieve Service Class are implemented via the DIMSE C-FIND and C-MOVE services as defined in Part 7 of the DICOM standard. Image-Arena conforms to the DICOM Query/Retrieve Service Class as an SCU for the supported SOP Classes.

A C-ECHO request is sent before each C-FIND to ensure that the SCP host is available. If no response to the echo request is received, the find request will not be sent.

Image-Arena usually issues query requests on Study level. The used Information Model can be configured in the inifile: Patient/Study Only or Study Root Information Models are supported.

Queried fields at study level are:

- Patient ID (single value and wildcard matching)
- Patient Name (single value and wildcard matching)
- Patient Birth Date (universal matching, range matching)
- Study Date (universal matching, range matching)
- Study Description (single value and wildcard matching)
- Modalities In Study (single value matching)

After this query at Study level has been successfully executed, according to the hierarchical query model further queries are executed from Image-Arena internally on series and image level. These queries are triggered by the results of the study level query and require no further user interaction. In this way Image-Arena obtains the list of all SOP Instances and SOP Class UIDs that are necessary for retrieving DICOM objects of a study. See the next activity.

The user is given the possibility to CANCEL the current C-FIND request.

Non-matching responses returned by the SCP due to unsupported matching keys are not filtered locally by the Find SCU. No attempt is made to filter out multiple responses.

- Presentation Context Acceptance Criterion: not applicable since Find SCU does not accept associations.
- Transfer Syntax Selection Policy: Find SCU offers the uncompressed transfer syntaxes. See also section 4.2.3.1: General transfer syntax selection policy at association initiation for their order of appearance.
- Response Status: Find SCU will behave as described in the Table below in response to status returned in the C-FIND response.

Service status	Further Meaning	Status Codes	Find SCU Behavior
Success	Matching is complete – no final identifier is supplied	0000	Current query is terminated, remaining queries continue
Refused	Out of Resources	A700	Current query is terminated, remaining queries continue

Error	Data Set does not match SOP Class	A900	Current query is terminated, remaining queries continue
	Unable to process	Cxxx	Current query is terminated, remaining queries continue
Cancel	Matching terminated due to Cancel request	FE00	Query is terminated.
Pending	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	Answer data are used to populate browser and trigger recursive lower level queries
	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier.	FF01	Answer data are used to populate browser and trigger recursive lower level queries

Table 4.2.3-6 Response Status for Find SCU.

4.2.3.6 Activity: Image-Arena retrieves DICOM objects of a study from an SCP (Move SCU)

- **Associated Real World Activity - Move SCU**

Image-Arena initiates retrieve requests to an SCP. Move requests are invoked by user interaction: after a find request has been executed, one or more studies can be selected from the resulting study list. The Import button executes C-MOVE requests for the selected studies.

For a selected study to be retrieved, a single attempt will be made to retrieve it from the selected remote AE. If retrieve fails, no automatic retry will be performed. The user can retry later.

- **Proposed Presentation Contexts - Move SCU**

Image-Arena can negotiate for the following presentation contexts for Move.

SOP Class	Transfer Syntax	Role	Extended Negotiation
All Table 4.2.1-4 SCU Move	Uncompressed transfer syntaxes from Table 4.2.1-5	SCU	None

Table 4.2.3-7 Presentation contexts for Move.

- **SOP Specific Conformance - Move SCU**

- **SOP Specific Conformance:** SOP classes of the Query/Retrieve Service Class are implemented via the DIMSE C-FIND and C-MOVE services as defined in Part 7 of the DICOM standard. Image-Arena conforms to the DICOM Query/Retrieve Service Class as an SCU for the supported SOP Classes.

Image-Arena will try to establish an association with the move destination specified in the C-MOVE request. One or more of the Presentation Contexts listed in the above table may be negotiated in this association.

Image-Arena usually issues move requests on Study level with Study Root Information Model.

Usual Move request fields at study/series/image level are:

- StudyInstanceUID (unique key at study level)
- SeriesInstanceUID (unique key at series level)
- SOPInstanceUID (unique key at image level)
- SOPClassUID (unique key at image level)

The user is given the possibility to CANCEL the current C-MOVE request.

Move SCU only requests the retrieval of DICOM instances, it is the Store SCP who receives the requested files and updates the Image-Arena database with these file information.

- **Presentation Context Acceptance Criterion:** not applicable here, since Move SCU does not accept associations. For the case of receiving the requested files, see activity 4.2.4.3 of Store SCP.
- **Transfer Syntax Selection Policy:** Move SCU offers the uncompressed transfer syntaxes. See also section 4.2.3.1: General transfer syntax selection policy at association initiation for their order of appearance.
- **Response Status:** Move SCU will behave as described in the Table below in response to status returned in the C-MOVE response. On success, the retrieved study will be automatically opened for review, otherwise a message box will indicate the failure status.

Service status	Further Meaning	Status Codes	Move SCU Behavior
Refused/ Error	Refused: Out of Resources – Unable to calculate number of matches	A701	Retrieval is terminated
	Refused: Out of Resources – Unable to perform sub-operations	A702	Retrieval is terminated
	Refused: Move Destination unknown	A801	Retrieval is terminated
	Data Set does not match SOP Class	A900	Retrieval is terminated
	Unable to process	Cxxx	Retrieval is terminated
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Retrieval is terminated
Warning	Suboperations Complete –One or more Failures	B000	Retrieval is terminated
Success	Sub-operations Complete – No Failures	0000	Retrieval is terminated
Pending	Sub-operations are continuing	FF00	Retrieval continues

Table 4.2.3-7 Response Status for Move SCU.

- **Sub-operation dependent behavior:** It is not only the C-MOVE response status that determines the real success or failure of a C-MOVE operation: it obviously depends on the success of the C-STORE sub-operations that occur on a separate association. However, as these sub-operation activities take place outside the control of the Move SCU, (between the remote Move SCP AE and the local Store SCP that receives the instances,) Move SCU ignores these activities. There is no attempt by Move SCU to confirm that instances have

actually been successfully received and locally stored. Whether or not the remote AE attempts to retry any failed C-STORE sub-operations is beyond the control of the Move SCU. Should the association of the C-MOVE request be aborted for any reason, it is up to the remote AE to decide whether it stops performing the sub-operations or continues sending the remaining instances.

4.2.4 Association Acceptance Policy

The AE title of Image-Arena can be configured using the GUI interface from the Server Manager (described in the Server Manager manual).

Image-Arena accepts associations to allow remote DICOM hosts to:

- Send verification requests to Image-Arena.
- Store images and structured reports to Image-Arena.
- Send N-EVENT-REPORT answers to a storage commitment request.

Image-Arena places no limitations on who may connect to it, nor on the number of simultaneous connects it will support. When Image-Arena accepts an association, it will receive any DICOM C-ECHO, C-STORE requests coming on that association that conform to the negotiated terms.

4.2.4.1 General transfer syntax selection policy at association acceptance

On receiving an association, the order of preferred transfer syntaxes depends on the local machine byte order and on the configuration parameters of the Image-Arena SCP AE.

The configuration possibilities are:

- SupportJPEG = true/false → switch JPEG compressed transfer syntaxes on/off
- SupportRLE=true/false→ switch RLE compressed transfer syntaxes on/off
- SupportBigEndian=true/false→ switch big endian byte order transfer syntaxes on/off
- PreferExplicit=true/false→ explicit transfer syntaxes will be preferred to implicit ones.

Image-Arena always prefers compressed transfer syntaxes (if not otherwise configured), followed by the uncompressed ones in the following order.

If not otherwise configured, the explicit transfer syntax with the machine byte order is preferred,, followed by the explicit transfer syntax with the inverse byte order and the implicit little endian transfer syntax.

4.2.4.2 Activity: Image-Arena receives verification request (Verification SCP)

- **Associated Real World Activity - Verification SCP**

Image-Arena will respond to all correctly formulated **Verification** requests to the requesting SCU, independent on whether Image-Arena “knows” this SCU or not.



- **Presentation Context Table – Verification SCP**

Image-Arena will accept any of the following Presentation Contexts for Verification:

SOP Class	Transfer Syntax	Role	Extended Negotiation
All Table 4.2.1-1	Uncompressed transfer syntaxes from Table 4.2.1-5	SCP	None

Table 4.2.4-1 Presentation contexts for Verification.

- **SOP Specific Conformance - Verification SCP**

Image-Arena provides standard conformance to the DICOM **Verification** Service Class as an SCP. Image-Arena always returns the status code “Success”:

Service Status	Further Meaning	Protocol Codes	Description
Success	Success	0000	Operation performed properly.

Table 4.2.4-2 Verification status codes.

4.2.4.3 Activity: Image-Arena receives storage request (Storage SCP)

- **Associated Real World Activity – Storage SCP**

Image-Arena will store all DICOM files that are sent to it from an SCU. It extracts patient, study and series information from the stored files and writes this information into its database.

- **Presentation Context Table – Storage SCP**

Image-Arena will accept any of the following Presentation Contexts for Storage.

SOP Class	Transfer Syntax	Role	Extended Negotiation
All from Table 4.2.1-1	Table 4.2.1-5	SCP	None

Table 4.2.4-3 Presentation contexts for storage.

- **SOP Specific Conformance – Storage SCP**

- **SOP Specific Conformance:** Image-Arena provides standard conformance to the DICOM Storage Service Class as an SCP. No elements are discarded or coerced by Image-Arena. In case of a successful C-STORE operation, the DICOM file will be written to the database.

Image-Arena implements no DICOM Storage Commitment SCP. This means that Image-Arena may delete the stored files at a later time.

Image-Arena can display only DICOM files of Image and Structured Report types, but all the stored files of a study can be retrieved later if they were not already deleted.

4.2.4.3.1 Patient Identification and Reconciliation

The criteria for comparing two patients are configurable at installation or service time. Here are the possible options. Two patients are considered to be identical if the following fields have equal values:

1. PatientID
2. PatientID + FamilyName + GivenName
3. PatientId + FamilyName + GivenName + DateOfBirth
4. PatientId + FamilyName + GivenName + DateOfBirth + Sex

Option 1 applies by default.

Studies, series and instances will be uniquely identified by their UIDs.

No coercion of fields and no patient reconciliation happen automatically: in case a discrepancy occurs between patient/study data already existing in the database and patient/study data of the received file, a new patient/study will be created for the received data. The merge of the two studies can be made later by the user.

Note: Each DICOM SCU needs a licence for Image-Arena to be able to perform a C-STORE request. Without licence the association between SCU and SCP will be aborted by Storage SCP. The licence administration is out of the scope of the DICOM standard and therefore will not be handled in this document. Please refer to the Image-Arena manual for more information about licensing.

- **Presentation Context Acceptance Criterion**

Image-Arena will accept any number of Storage Presentation Contexts per association request. Any Abstract Syntax may be specified more than once in an association request, if the Transfer Syntaxes differ between the Presentation Contexts.

- **Transfer Syntax Selection Policies**

Image-Arena supports all transfer syntaxes listed in Table 4.2.1-5. Extended negotiation is not supported. Image-Arena does not perform image conversion.

See also section 4.2.4.1: General transfer syntax selection policy at association acceptance.

- **Response Status:** Storage SCP returns one of the following status codes:

Service Status	Further Meaning	Protocol Codes	Description
Success	Success	0000	Operation performed properly.
Error	Refused: Out of Resources	A700	Indicates that there was not enough storage space to store the image.
	Data set does not match SOP Class	A900	Indicates that the Data Set does not encode an instance of the SOP Class specified.
	Cannot understand	C005	Indicates that the Data Set cannot be parsed into elements.
	Failed	C000	The operation was not successful.

Warning	Coercion of Data Elements	B000	Newer sent
	Data Set does not match SOP Class	B007	Newer sent
	Elements Discarded	B006	Newer sent

Table 4.2.4-4 C-STORE status codes.

4.2.4.4 Activity: Image-Arena receives N-EVENT-REPORTs in response to a storage commitment request (SCP Part of Storage Commitment SCU)

- **Associated Real World Activity – SCP Part of Storage Commitment SCU**

Image-Arena will receive and process N-EVENT-REPORT requests that are sent to it from a Storage Commitment SCP. It extracts the list of committed and the list of failed SOP Instance UIDs and compares this information with the list of UIDs of DICOM instances waiting for commitment.

It is the responsibility of the **SCP Part of Storage Commitment SCU** to decide whether an instance has been successfully committed or it has to be re-scheduled for store. No automatic retry of a failed storage commitment will be made. In this case the whole storage + storage commitment process will be repeated.

- **Presentation Context Table – SCP Part of Storage Commitment SCU**

Image-Arena will accept any of the following Presentation Contexts for Storage Commitment Response.

SOP Class	Transfer Syntax	Role	Extended Negotiation
StorageCommitmentPushModelSOPClass (Table 4.2.1-3)	Uncompressed Transfer Syntaxes from Table 4.2.1-5	SCU	None

Table 4.2.4-5 Presentation contexts for SCP Part of Storage Commitment SCU.

- **SOP Specific Conformance – SCP Part of Storage Commitment SCU**

- **SOP Specific Conformance:** Image-Arena provides standard conformance to the DICOM Storage Commitment Push Model Service Class as an SCU.

At receiving an N-EVENT-REPORT notification, Image-Arena extracts the TransactionUID, RetrieveAETitle, EventTypeID fields and the list of committed and failed SOP Instance UIDs. The committed SOP instances will later be deleted from the system while the instances with failed commitment will later be re-scheduled for storage (both storage and commitment will be repeated).

- **Presentation Context Acceptance Criterion**

The SCP Part of Storage Commitment SCU will accept any Presentation Context with uncompressed transfer syntax for N-EVENT-REPORT notification. Although it is the one who accepts the association, Part of Storage Commitment SCU will take the SCU role at association negotiation.

- **Transfer Syntax Selection Policies**

The SCP Part of Storage Commitment SCU will accept any uncompressed transfer syntax listed in Table 4.2.1-5. See also section 4.2.4.1: General transfer syntax selection policy at association acceptance.

- **Response Status:** SCP Part of Storage Commitment SCU always sends an N-EVENT-REPORT Response with the status code success.

4.2.4.5 Activity: Image-Arena receives find request (Find SCP)

- **Associated Real World Activity - Find SCP**

Image-Arena will respond to all correctly formulated **C-FIND** requests to the requesting SCU.

Note: Each DICOM SCU needs a licence for Image-Arena to be able to perform a C-FIND request. Without licence the association between SCU and SCP will be aborted by Find SCP. The licence administration is out of the scope of the DICOM standard and therefore will not be handled in this document. Please refer to the Image-Arena manual for more information about licensing.

- **Presentation Context Table – Find SCP**

Image-Arena will accept any of the following Presentation Contexts for Find:

SOP Class	Transfer Syntax	Role	Extended Negotiation
All Table 4.2.1-4 SCP Find	Uncompressed transfer syntaxes from Table 4.2.1-5	SCP	None

Table 4.2.4-6 Accepted presentation contexts for Find SCP.

- **SOP Specific Conformance - Find SCP**

- SOP classes of the Query/Retrieve Service Class are implemented via the DIMSE C-FIND and C-MOVE services as defined in Part 7 of the DICOM standard. Image-Arena conforms to the DICOM Query/Retrieve Service Class as an SCP for the supported SOP Classes.

Find SCP supports hierarchical queries relational queries are not supported.

Find SCP does not support extended negotiation of combined date-time matching and/or fuzzy semantic matching of person names.

Find SCP supports case-insensitive matching for the following PN VR attributes: Patient’s Name, Operator’s Name, Referring Physician’s Name.

Find SCP does not support Cancel requests to interrupt an ongoing FIND operation.

There are no attributes that are always returned by default. Find SCP returns only the requested identifiers in the query attribute. Queried fields that do not exist in database will be returned with empty value. The database query will always be performed at the time of the Find-Request, that is, always the current state will be reflected.

- Patient Root Information Model: all required search keys on each of the four levels (Patient, Study, Series, Image) are supported.
- Study Root Information Model: All the required search keys on each of the three levels (Study, Series, and Image) are supported.
- Patient/Study Only Information Model: All the required search keys on the Patient and Study levels are supported.
- On a specific level, all tags of the current level and levels above are allowed as search key. For example, patient attributes are allowed at any level; series attributes are allowed at series and image

levels, while image attributes are only allowed at image level. It is always possible to leave attributes of the current level empty while specifying some attributes at higher levels.

In addition to the required search keys, some optional keys are also supported. See the following tables for details. Used notations:

- Attribute Name: Attributes supported to be returned in C-FIND Responses.
- Tag: DICOM Tag for this attribute.
- VR: DICOM VR for this attribute.
- Types of Matching: The types of Matching supported by the C-FIND SCP. "S" indicates Single Value Matching, "R" means indicate Range Matching, "*" means wildcard matching, "U" will indicate universal matching, and "L" will indicate that UID lists are supported for matching. "NONE" means that no matching is supported, but that values for this Element in the database can be returned.

Level Name / Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
Patient Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Patient's Birth Date	0010,0030	DA	S,U
Patient's Sex	0010,0040	CS	S,*,U
Study Level			
Study Date	0008,0020	DA	S, U
Study Time	0008,0030	TM	U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,U
Study Instance UID	0020,000D	UI	S,*,U
Referring Physician's Name	0008,0090	PN	S,*, U
Study Description	0008,1030	LO	S,*,U
Patient's Age	0010,1010	AS	NONE
Patient's Size	0010,1020	DS	NONE
Patient's Weight	0010,1030	DS	NONE
Admitting Diagnoses Description	0008,1080	LO	NONE
Series Level			
Modality	0008,0060	CS	S,*,U
Series Number	0020,0011	IS	S,U
Series Instance UID	0020,000E	UI	S,*,U
Operator's Name	0008,1070	PN	S,*,U
Series Date	0008,0021	DA	S,U
Series Time	0008,0031	TM	S,U
Series Description	0018,1030	LO	NONE
Protocol Name	0018,103E	LO	NONE
Performing Physician's Name	0008,1050	PN	NONE
Image Level			
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U
Image Date	0008,0023	DA	NONE

Table 4.2.4-7 Find SCP – PATIENT ROOT: Supported matching attributes.

Level Name / Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
Study Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Patient's Birth Date	0010,0030	DA	S,U
Patient's Sex	0010,0040	CS	S,*,U
Other Patient IDs	0010,1000	LO	NONE
Other Patient Names	0010,1001	PN	NONE
Study Date	0008,0020	DA	S, U
Study Time	0008,0030	TM	U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,U
Study Instance UID	0020,000D	UI	S,*,U
Referring Physician's Name	0008,0090	PN	S,*, U
Study Description	0008,1030	LO	S,*,U
Patient's Age	0010,1010	AS	NONE
Patient's Size	0010,1020	DS	NONE
Patient's Weight	0010,1030	DS	NONE
Admitting Diagnoses Description	0008,1080	LO	NONE
Series Level			
Modality	0008,0060	CS	S,*,U
Series Number	0020,0011	IS	S,U
Series Instance UID	0020,000E	UI	S,*,U
Operator's Name	0008,1070	PN	S,*,U
Series Date	0008,0021	DA	S,U
Series Time	0008,0031	TM	S,U
Series Description	0018,1030	LO	NONE
Protocol Name	0018,103E	LO	NONE
Performing Physician's Name	0008,1050	PN	NONE
Image Level			
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U
Image Date	0008,0023	DA	NONE

Table 4.2.4-8 Find SCP – STUDY ROOT: Supported matching attributes.



Level Name / Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
Patient Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Patient's Birth Date	0010,0030	DA	S,U
Patient's Sex	0010,0040	CS	S,*,U
Other Patient IDs	0010,1000	LO	NONE
Other Patient Names	0010,1001	PN	NONE
Study Level			
Study Date	0008,0020	DA	S, U
Study Time	0008,0030	TM	U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,U
Study Instance UID	0020,000D	UI	S,*,U
Referring Physician's Name	0008,0090	PN	S,*, U
Study Description	0008,1030	LO	S,*,U
Patient's Age	0010,1010	AS	NONE
Patient's Size	0010,1020	DS	NONE
Patient's Weight	0010,1030	DS	NONE
Admitting Diagnoses Description	0008,1080	LO	NONE

Table 4.2.4-9 Find SCP – PATIENT STUDY ONLY: Supported matching attributes.

Note that List of UID matching and Range matching are not supported.

- **Presentation Context Acceptance Criterion**

Find SCP will accept any Presentation Context with uncompressed transfer syntax for C-FIND Requests resulting from table 4.2.4.6.

- **Transfer Syntax Selection Policies**

See also section 4.2.4.1: General transfer syntax selection policy at association acceptance.

- **Response status:** Find SCP returns one of the status codes in the following table.

Service status	Further Meaning	Status Codes	Description
Success	Matching is complete – no final identifier is supplied	0000	Operation performed properly.
Refused	Out of Resources	A700	Cannot process request (e.g. out of memory or disk space). Error message is output to the log file.
Error	Identifier does not match SOP Class	A900	The C-FIND identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class.

			E.q. query level is missing or does not match to the information model. Error message is output to the log file.
	SOP Class not supported	A800	Find Information model not supported Error message is output to the log file.
	Unable to process	Cxxx	Unknown error occurred, cannot continue. Error message is output to the log file.
Cancel	Matching terminated due to Cancel request	FE00	Never sent.
Pending	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	Operation is continuing, everything OK.
	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier.	FF01	Never sent.

Table 4.2.4-10 Possible status codes returned by Find SCP.

4.2.4.6 Activity: Image-Arena receives move request (Move SCP)

- **Associated Real World Activity - Move SCP**

Image-Arena will respond to all correctly formulated **C-MOVE** requests to the requesting SCU.

Note: Each DICOM SCU needs a licence for Image-Arena to be able to perform a C-MOVE request. Without licence the association between SCU and SCP will be aborted. The licence administration is out of the scope of the DICOM standard and therefore will not be handled in this document. Please refer to the Image-Arena manual for more information about licensing.

- **Presentation Context Table – Move SCP**

Image-Arena will accept any of the following Presentation Contexts for Move:

SOP Class	Transfer Syntax	Role	Extended Negotiation
All Table 4.2.1-4 SCP Move	Uncompressed transfer syntaxes from Table 4.2.1-5	SCP	None

Table 4.2.4-11 Accepted presentation contexts for Move SCP.

- **SOP Specific Conformance - Move SCP**

- SOP classes of the Query/Retrieve Service Class are implemented via the DIMSE C-FIND and C-MOVE services as defined in Part 7 of the DICOM standard. Image-Arena conforms to the DICOM Query/Retrieve Service Class as an SCP for the supported SOP Classes.

Move SCP cannot support lists of UIDs in the C-MOVE Request at the Study, Series, and Image Levels.

For each matching SOPInstanceUID found in the database, a C-STORE request will be issued to the move destination.

Move SCP will return a PENDING response to the C-MOVE SCU every time the STORE SCU AE has attempted to send an image. This response reports the number of remaining SOP Instances to transfer, and the number transferred having a successful, failed, or warning status. The final response will have the status SUCCESS if all matches found in the dataset have been successfully stored. A final response with status FAILURE / ERROR / WARNING will always contain the list of failed SOP Instance UIDs (0008,0058).

- **Presentation Context Acceptance Criterion**

Move SCP will accept any Presentation Context with uncompressed transfer syntax for C-MOVE Requests resulting from table 4.2.4.11.

- **Transfer Syntax Selection Policies**

See also section 4.2.4.1: General transfer syntax selection policy at association acceptance.

- **Response status:** Move SCP returns one of the status codes in the following table.

Service status	Further Meaning	Status Codes	Description
Success	Sub-operations complete – No Failures	0000	Operation performed properly. All the Composite SOP Instances have been successfully sent to the C-MOVE Destination AE.
Refused	Out of Resources – Unable to calculate number of matches	A701	Number of matches cannot be determined due to system failure. Returned if the server's database is not functioning so the search for matches to the C-MOVE Request cannot be found. Error message is output to the log file.
	Out of Resources – Unable to perform sub-operations	A702	C-STORE sub-operations cannot be performed due to failure to access SOP Instances in archive, or failure of a C-STORE Request. Error message is output to the log file.
	Move destination unknown	A801	The Destination Application Entity named

			in the C-MOVE Request is unknown to Query-Retrieve SCP AE. Error message is output to the log file.
Error	Identifier does not match SOP Class	A900	The C-MOVE identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class or retrieval level. E.g. retrieval level is missing or does not match to the information model. Error message is output to the log file.
Cancel	Matching terminated due to Cancel request	FE00	Never sent.
Pending	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Table 4.2.4-12 Possible status codes returned by Move SCP.

4.3 Network Interfaces

4.3.1 Supported Communication Stacks

DICOM Upper Layer over TCP/IP is supported.

Image-Arena inherits the TCP/IP stack from the computer system upon which it executes.

At identifying a DICOM AE Title, the resolution of machine name to IP Address depends on the underlying name server.

4.3.2 Physical Network Interface

Image-Arena is indifferent to the physical medium over which TCP/IP executes.

Image-Arena provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.3.3 Additional Protocols

When host names rather than IP addresses are used in the configuration properties to specify presentation addresses for remote AEs, the application is dependent on the name resolution mechanism of the underlying operating system.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

Mapping from Application Entity Titles to Presentation Addresses can be configured within the Image-Arena application and is stored in the database.

4.4.2 Parameters

Table 4.4.2 contains the configurable parameters of the AEs. Image-Arena uses the dcmk DICOM toolkit of OFFIS. Some low-level parameters, like PDU size and connection time-out are not configurable within Image-Arena, the default values used in dcmk are taken.

Parameter	Configurable	Default Value
Parameters configurable for all AEs		
Host name, AETitle, IPAddress, Port number	yes	none
Support of JPEG transfer syntax in association negotiations	yes	true
Support of RLE transfer syntax in association negotiations	yes	true
Support of Big Endian transfer syntax in association negotiations	yes	true
Prefer explicit transfer syntax in association negotiations	yes	true
List of supported SOP Classes	yes	none
Networking roles of this AE	yes	none
Maximum PDU size the AE can send/receive	no	16 kB
Additional parameters configurable for the Image-Arena SCP host		
Time out for an echo request (in ms)	yes	1000
Maximum number of simultaneous associations for store	yes	1
Minimum amount of free disk space (in MB)	yes	500
Abort echo request after a failed ping	Yes	true
Supported Modalities for Query/Retrieve	Yes	US, SC, SR, CT

Table 4.4.2 Configurable Parameters Table

5 Media Interchange

5.1 Implementation Model

5.1.1 Application Data Flow Diagram

Conceptually, the media storage service which is implemented in the Image-Arena may be modelled as follows:

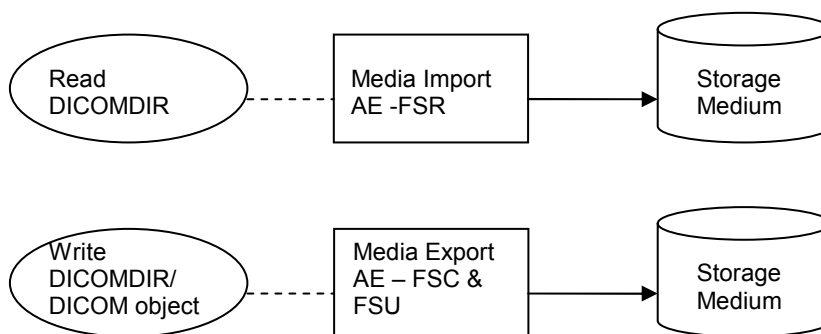


Figure 5-1. Application Data Flow Diagram

The Image-Arena product is capable of importing/exporting studies to/from DICOM media. A DICOM conformant data format layer is created when a non-conformant media is specified as DICOM Media export location.

5.1.2 Functional Definition of AEs

5.1.2.1 Media Import – FSR

The **Media Import** application entity reads a user-selected PS 3.10 compliant DICOM file (generally a DICOMDIR) from the local file system or from PS 3.12 compliant DICOM media.

5.1.2.2 Media Export – FSC and FSU

The **Media Export** application entity is able to create a new DICOMDIR or update an existing one. Furthermore, DICOM image or structured report instances can also be stored to media on user interaction.

5.1.3 Sequencing of Real-World Activities

A DICOMDIR is created at first study export. The existing DICOMDIR is updated at exporting further studies.

5.1.4 File Meta Information for Implementation Class and Version

The implementation information to be written to the File Meta Header of each file created by Image-Arena is the following.

DICOM Tag	Value
File Meta Information Version	0 1
Implementation Class UID	1.2.276.0.7230010.3.0.3.5.4
Implementation Version Name	OFFIS_DCMTK_354

Table 5.1-1 File Meta Information for Media Storage.

5.2 AE Specifications

5.2.1 Media Import

The Media Import application entity provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The application profiles and roles are as follows.

Application Profiles Supported	Real-World Activity	Role	SC Option
STD-GEN-CD	Load directory	FSR	Interchange
STD-GEN-DVD-RAM	Load directory	FSR	Interchange
File-Set under the STD-US class of Application Profiles	Load directory	FSR	Interchange

Table 5.2-1 Supported Application Profiles for AE Media Import.

5.2.1.1 File Meta Information for the Application Entity

Not applicable, since Media Import is not an FSC or FSU.

5.2.1.2 Real-World Activities

5.2.1.2.1 Activity: Read DICOMDIR from DICOM Media

Studies can be imported from DICOM Media import locations on user interaction: switch to the Import tab and enter a valid DICOM Media. The list of studies contained in the DICOMDIR is read and displayed. The user can then select one or more studies to be imported into the Image-Arena database.

- Media Storage Application Profiles: The Media Import application entity supports the STD-US class of Application Profiles (PS.3.11).
- Presentation Contexts:

The DICOM Media Import functionality of Image-Arena operates with the following SOP classes.

SOP Class	SOP Class UID
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Media Storage Directory Storage SOP Class	1.2.840.10008.1.3.10
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Table 5.2-2 Media Import: Supported SOP classes.

The DICOM Media Import functionality of Image-Arena supports the following presentation contexts in the different media storage roles.

Abstract Syntax Name and UID	Transfer Syntax Name and UID	Media Storage Role
Media Storage Directory Storage (DICOMDIR) 1.2.840.10008.1.3.10	LittleEndianExplicitTransferSyntax 1.2.840.10008.1.2.1	FSR

Table 5.2-3 Media Import: Supported Presentation Contexts.

5.2.2 Media Export

The Media Export AE implements the Interchange Option of the DICOM Media Storage functionality. It does not support the Directory Information Module. It can play the following roles at handling with file sets: File Set Creator (FSC) role, File Set Updater (FSU) role.

The Media Export functionality provides Standard Conformance to the DICOM Media Storage Service (PS.3.10). It generates a File-Set under the STD-US class of Application Profiles (PS.3.11). It provides standard conformance to the SOP Classes presented in Table 5.2-6 according to the DICOM V3.0 Standard (PS.3.3).

The application profiles and roles are the following.

Application Profiles Supported	Real-World Activity	Role	SC Option
STD-GEN-CD	Create/update directory	FSC, FSU	Interchange
STD-GEN-DVD-RAM	Create/update directory	FSC, FSU	Interchange
File-Set under the STD-US class of Application Profiles	Create/update directory	FSC, FSU	Interchange

Table 5.2-4 Supported Application Profiles for AE Media Export.

5.2.2.1 File Meta Information for the Application Entity

See Table 5.1-1: File Meta Information for Media Export AE

5.2.2.2 Real-World Activities

5.2.2.2.1 Activity: Export Study or some Study Components to DICOM Media

Studies can be exported by selecting the study and choosing the *Copy to DICOM and XML Format* option in the study selection dialog. If a study contains images and reports in non-DICOM format, only the DICOM images are added to the DICOMDIR. The *XML Format* file (IMProof2.xml) contains all files related to the study and is located in the same folder as the DICOMDIR.

There is a possibility to export standalone clips or images in DICOM format without exporting the whole study (right click on the image and choose *Export item to -> DICOM*). In this case only the US single frame or multi-frame image is created, without updating the DICOMDIR.

- Media Storage Application Profiles: The Media Export application entity supports the STD-US class of Application Profiles (PS.3.11).
- Presentation Contexts:

The DICOM Media Export functionality operates with the following SOP classes.

SOP Class	SOP Class UID
Media Storage Directory Storage SOP Class	1.2.840.10008.1.3.10
Comprehensive Structured Reports	1.2.840.10008.5.1.4.1.1.88.33
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1

Table 5.2-5 Media Export: Supported SOP classes.

The DICOM Media Export functionality supports the following presentation contexts in the different Media Export roles.

Abstract Syntax Name and UID	Transfer Syntax Name and UID	Media Export Role
Media Export Directory Storage (DICOMDIR) 1.2.840.10008.1.3.10	LittleEndianExplicitTransferSyntax 1.2.840.10008.1.2.1	FSC, FSU
Comprehensive Structured Reports 1.2.840.10008.5.1.4.1.1.88.33	LittleEndianExplicitTransferSyntax 1.2.840.10008.1.2.1	FSC, FSU
Ultrasound Multiframe Image Storage 1.2.840.10008.5.1.4.1.1.3.1	Original transfersyntax of the multiframe image (JPEG, RLE or uncompressed)	FSC, FSU
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6.1	Original transfersyntax of the image (JPEG, RLE or uncompressed)	FSC, FSU

Table 5.2-6 Media Export: Supported Presentation Contexts.

6 Support for Extended Character Sets

6.1 Overview

Image-Arena supports a couple of extended character sets defined in the DICOM 3.0 standard, including single-byte and multi-byte character sets as well as code extension techniques using ISO 2022 escapes.

Support extends to correctly decoding and displaying the correct symbol for all names and strings found in the DICOMDIR, in storage instances from media and received over the network, and in the local database.

No specific support for sorting of strings other than in the default character set is provided in the browsers.

6.2 Character Sets

In addition to the default character repertoire, the Defined Terms for Specific Character Sets in Table 6.2-1 are supported. Image-Arena uses the Qt Development Toolkit to decode and visualize extended character sets.

Character Set Description	Defined Term	Qt Codec Used
Latin alphabet No. 1	ISO_IR 100	ISO-8859-1
Latin alphabet No. 2	ISO_IR 101	ISO-8859-2
Latin alphabet No. 3	ISO_IR 109	ISO-8859-3
Latin alphabet No. 4	ISO_IR 110	ISO-8859-4
Latin alphabet No. 5	ISO_IR 148	ISO-8859-9
ASCII	ISO_IR 6	UTF-8
UTF-8	ISO_IR 192	UTF-8
Cyrillic	ISO_IR 144	ISO-8859-5
Arabic	ISO_IR 127	ISO-8859-6
Greek	ISO_IR 126	ISO-8859-7
Hebrew	ISO_IR 138	ISO-8859-8
Chinese	GB18030	GB180-30
Default repertoire	ISO 2022 IR 6	ISO 2022-JP
Japanese	ISO 2022 IR 13	ISO 2022-JP
Japanese	ISO 2022 IR 87	ISO 2022-JP
Japanese	ISO 2022 IR 149	ISO 2022-JP
Japanese	ISO 2022 IR 159	ISO 2022-JP

Table 6.2-1: Supported Specific Character Set Defined Terms

6.3 Character Set Configuration

Whether or not characters are displayed correctly depends on the presence of font support in the underlying operating system. Typically, it may be necessary for the user to add some Unicode fonts to their system configuration in order to correctly display characters that would not typically be used in the default locale.

7 Security

Image-Arena does not support any specific security measures.

Application level security: not supported.

Association level security: any Calling AE Titles and/or IP addresses may open an Association for Verification. Only AE Titles that own a license and are known to Image-Arena will be allowed to open an association for storage, query and retrieval purposes.

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instances

During DICOM Media Export Image-Arena creates DICOMDIR instances. The structure of a DICOMDIR object underlies the Basic Directory IOD.

8.1.2 Usage of attributes from received IOD's

The local database, remote query and directory browsers use the conventional identification attributes to distinguish patients, studies, series and instances. In particular, it can be configured which fields should have equal values for two patients to be treated as the same in the browser and in the local database. See section **4.2.4.3.1: Patient Identification and Reconciliation** for more details.

If two patients have the same values for all identification fields they will be treated as the same in the browser and the local database. If only part of these coincide, they will be treated as two separate patients and the user has the possibility to perform patient reconciliation and merge the two patients.

8.1.3 Attribute Mapping

Attribute mapping does not take place.

8.1.4 Coerced / Modified Fields

Image-Arena does not modify any fields, no coercion is performed.

8.2 Data Dictionary of Private Attributes

Image-Arena does not use any private attributes.

8.3 Coded Terminology and Templates

Image-Arena does not use any codes or controlled terminology.

8.4 Grayscale Image Consistency

Image-Arena does not make use of the DICOM Grayscale Standard Display Function.

8.5 Standard Extended / Specialized / Private SOP Classes

Not applicable.

8.6 Private Transfer Syntaxes

Image-Arena does not use any private transfer syntaxes.

8.7 Private Context Mapping Resources

Image-Arena does not use any private context mapping resources.

9 Document History

29. Sep. 2006	Ronny Schleicher	Updated with the Store SCU functionality.
14. Mar. 2007	Ronny Schleicher	Updated with the extendet SCU Architecture.
04. July 2007	Ronny Schleicher	Document format updated
26.09.2007	Hkrack	Update of Image-Arena communication graphic
15. Apr 08	Judit Verestóy	Reviewed, re-structured and updated for Image-Arena 4.0 with the Storage Commitment SCU, Query/Retrieve SCP functionalities.
16. Feb 09	Stefan Frohnappel	Relabeled on Image-Arena 4.1 (no functional changes)
20. Okt 09	Stefan Frohnappel	Relabeled on Image-Arena 4.2 (no functional changes) Reduced SOP Classes on supported one
26. Apr 10	Stefan Frohnappel	Relabeled on Image-Arena 4.3 (no functional changes)