

## **Trophy DICOM Patient Management System**

### **DICOM 3.0 Conformance Statement Networking and Media Interchange**

Version: 5.2  
Date: 2013-05-23  
Reference: 04XC001-I

Copyright Carestream Health, Inc., 2010

## Conformance Statement Overview

Trophy DICOM is a patient management system implementing a subset of the DICOM standard in order to achieve patient information and image data exchange with remote systems.

Trophy DICOM is an application running on Microsoft Windows 2000 Operating System and later.

The set of DICOM functionalities available thru Trophy DICOM enables to:

- Query a RIS system for patient scheduling information prior new image acquisition.
- Send newly acquired or saved images to a PACS or remote system.
- Query and retrieve a PACS system for already archived images.
- Store locally images sent by a remote system.
- Print images to a DICOM compliant imager or printer for both grayscale and color images.
- Import or export images from or to a removable media.

### Network Services:

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Transfer</b>		
CR Image Storage	Yes	Yes
DX Image Storage – For presentation	Yes	Yes
IO Image Storage – For presentation	Yes	Yes
SC Image Storage	Yes	Yes
VL Endoscopic Image Storage	Yes	Yes
VL Photographic Image Storage	Yes	Yes
CT Image Storage	Yes (1)	Yes (1)
Other types of Image Storage	Yes (2)	Yes (2)
<b>Query/Retrieve</b>		
Patient Root Q/R Information Model – FIND	Yes (3)	No
Patient Root Q/R Information Model – MOVE	Yes (3)	No
Study Root Q/R Information Model – FIND	Yes (3)	No
Study Root Q/R Information Model – MOVE	Yes (3)	No
<b>Workflow Management</b>		
Modality Worklist Information Model – FIND	Yes	No
<b>Print Management</b>		
Basic Grayscale Print Management Meta	Yes	No
Basic Color Print Management Meta	Yes	No

*Note (1): CT Image Storage SOP Class is the default data format for 3D volume datasets supported by the associated imaging application. Therefore one single 3D volume dataset is maintained internally as a set of single CT slice files. In order to ease the associated imaging application data management, each 3D volume dataset is maintained within a specific sub-directory of the patient data folder by Trophy DICOM.*

*Note (2): By design (due to the underlying DICOM libraries used) Trophy DICOM may support other Image Storage SOP Classes: nevertheless it is not guaranteed that the associated imaging application would be able to process or accept such images. Refer to section 2.2.6 for the list of SOP Classes actually supported by the Trophy DICOM Store-SCP Application Entity.*

*Note (3): Trophy DICOM provides conformance only to the Baseline C-FIND SCU and C-MOVE SCU Behavior defined by the DICOM Standard (i.e. only to the Hierarchical Search mechanism: Relational queries are not supported).*

**Media Services:**

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
<b>Compact Disk - Recordable</b>		
General Purpose CD-R	Yes	Yes
Dental Radiograph Interchange	Yes	Yes

## Table of Contents

1	INTRODUCTION	8
1.1	Revision History	8
1.2	Audience	8
1.3	Applicable Software Version	8
1.4	Trophy Root UID	9
1.5	Definitions, Terms and Abbreviations	9
1.6	References	10
2	NETWORKING	12
2.1	Implementation Model	12
2.1.1	Application Data Flow Diagram	12
2.1.2	Functional Definitions of AE's	14
2.1.2.1	Functional Definition of Worklist Application Entity	14
2.1.2.2	Functional Definition of Store-SCU Application Entity	14
2.1.2.3	Functional Definition of Print Application Entity	14
2.1.2.4	Functional Definition of Find Application Entity	14
2.1.2.5	Functional Definition of Move Application Entity	14
2.1.2.6	Functional Definition of Store-SCP Application Entity	15
2.1.3	Sequencing of Real-World Activities	15
2.2	AE Specifications	17
2.2.1	Worklist AE Specifications	17
2.2.1.1	SOP Classes	17
2.2.1.2	Association Policies	17
2.2.1.3	Association Initiation Policy	17
2.2.1.4	Association Acceptance Policy	21
2.2.2	Store-SCU AE Specifications	22
2.2.2.1	SOP Classes	22
2.2.2.2	Association Policies	22
2.2.2.3	Association Initiation Policy	23
2.2.2.4	Association Acceptance Policy	26
2.2.3	Print AE Specifications	27
2.2.3.1	SOP Classes	27
2.2.3.2	Association Policies	27
2.2.3.3	Association Initiation Policy	27
2.2.3.4	Association Acceptance Policy	37
2.2.4	Find AE Specifications	38
2.2.4.1	SOP Classes	38
2.2.4.2	Association Policies	38
2.2.4.3	Association Initiation Policy	38
2.2.4.4	Association Acceptance Policy	44
2.2.5	Move AE Specifications	45
2.2.5.1	SOP Classes	45
2.2.5.2	Association Policies	45
2.2.5.3	Association Initiation Policy	45
2.2.5.4	Association Acceptance Policy	48
2.2.6	Store-SCP AE Specifications	49
2.2.6.1	SOP Classes	49
2.2.6.2	Association Policies	49
2.2.6.3	Association Initiation Policy	50
2.2.6.4	Association Acceptance Policy	50
2.3	Network Interfaces	54
2.3.1	Physical Network Interface	54
2.3.2	Additional Protocols	54
2.4	Configuration	54
2.4.1	AE Title/Presentation Address Mapping	54
2.4.1.1	Local AE Titles	54

2.4.1.2 Remote AE Title/Presentation Address Mapping	55
2.4.2 Parameters	55
3 MEDIA INTERCHANGE	56
3.1 Implementation Model	56
3.1.1 Application Data Flow Diagram	56
3.1.2 Functional Definitions of AE's	56
3.1.2.1 Functional Definition of Media-FSR Application Entity	56
3.1.2.2 Function Definition of Media-FSC/U Application Entity	56
3.1.3 Sequencing of Real-World Activities	57
3.1.4 File Meta Information for Implementation Class and Version	57
3.2 AE Specifications	57
3.2.1 Media-FSR AE Specifications	57
3.2.1.1 File Meta Information for the Removable Media Application Entity	57
3.2.1.2 Real-World Activities	57
3.2.2 Media-FSC/U AE Specifications	59
3.2.2.1 File Meta Information for the Removable Media Application Entity	59
3.2.2.2 Real-World Activities	59
3.3 Augmented and Private Application Profiles	61
3.3.1 Augmented Application Profiles	61
3.3.1.1 General Purpose Application Profile	61
3.3.1.2 Dental Application Profile	61
3.3.2 Private Application Profiles	61
3.4 Media Configuration	61
4 SUPPORT OF CHARACTER SETS	62
5 SECURITY	63
6 ANNEXES	64
6.1 IOD Contents	64
6.1.1 Created SOP Instance(s)	64
6.1.1.1 Computed Radiography Image IOD	64
6.1.1.2 Digital X-Ray – For Presentation Image IOD	65
6.1.1.3 Digital Intra-Oral – For Presentation Image IOD	66
6.1.1.4 Secondary Capture Image IOD	67
6.1.1.5 Visible Light Endoscopic Image IOD	67
6.1.1.6 Visible Light Photographic Image IOD	68
6.1.1.7 Computed Tomography Image IOD	69
6.1.2 Usage of Attributes from received IODs	69
6.1.3 Attribute Mapping	70
6.1.4 Coerced/Modified fields	70
6.2 Data Dictionary of Private Attributes	70
6.3 Coded Terminology and Templates	70
6.3.1 Context Groups	70
6.3.2 Template Specifications	70
6.3.3 Private Code Definitions	70
6.4 Grayscale Image Consistency	70
6.5 Standard Extended/Specialized/Private SOP Classes	70
6.6 Private Transfer Syntaxes	71

## Table of Figures

Figure 1: Application Data Flow Diagram - Networking	12
Figure 2: Sequencing of Activities – Workflow Management	15
Figure 3: Sequencing of Activities – Image Processing	16
Figure 4: Sequencing of Activity - Update Worklist	18
Figure 5: Sequencing of Activity - Transfer Image	24
Figure 6: Sequencing of Activity - Print Image	30
Figure 7: Sequencing of Activity – Query Composite Instances	40
Figure 8: Sequencing of Activity – Receive Composite Instances	51
Figure 9: Application Data Flow Diagram – Media Interchange	56

## Table of Tables

Table 1: SOP Classes for Worklist AE	17
Table 2: DICOM Application Context for Worklist AE	17
Table 3: Number of Associations as an Association Initiator for Worklist AE	17
Table 4: Asynchronous Nature as an Association Initiator for Worklist AE	17
Table 5: DICOM Implementation Class and Version for Worklist AE	17
Table 6: Proposed Presentation Contexts For Activity Update Worklist	19
Table 7: Modality Worklist C-FIND Response Status Handling Behavior	19
Table 8: Modality Worklist Communication Failure Behavior	19
Table 9: Worklist Request Identifier	20
Table 10: SOP Classes for Store-SCU AE	22
Table 11: DICOM Application Context for Store-SCU AE	22
Table 12: Number of Associations as an Association Initiator for Store-SCU AE	22
Table 13: Asynchronous Nature as an Association Initiator for Store-SCU AE	22
Table 14: DICOM Implementation Class and Version for Store-SCU AE	23
Table 15: Proposed Presentation Contexts For Activity Transfer Image	24
Table 16: Storage C-STORE Response Status Handling Behavior	26
Table 17: Storage Communication Failure Behavior	26
Table 18: SOP Classes for Print AE	27
Table 19: DICOM Application Context for Print AE	27
Table 20: Number of Associations as an Association Initiator for Print AE	27
Table 21: Asynchronous Nature as an Association Initiator for Print AE	27
Table 22: DICOM Implementation Class and Version for Print AE	27
Table 23: Patient and Image Information burned into image pixels	28
Table 24: Patient and Image Information added into an image box	28
Table 25: Configurable Printing Parameters	29
Table 26: Proposed Presentation Contexts For Activity Print Image	31
Table 27: Print Communication Failure Behavior	31
Table 28: Printer SOP Class N-GET Request Attributes	32
Table 29: Printer SOP Class N-GET Responses Status Handling Behavior	32
Table 30: Printer SOP Class N-EVENT-REPORT Behavior	32
Table 31: Film Session SOP Class N-CREATE Request Attributes	33
Table 32: Film Session SOP Class N-CREATE Responses Status Handling Behavior	33
Table 33: Film Session SOP Class N-SET Request Attributes	33
Table 34: Film Session SOP Class N-SET Responses Status Handling Behavior	33
Table 35: Film Session SOP Class N-DELETE Responses Status Handling Behavior	34
Table 36: Film Box SOP Class N-CREATE Request Attributes	34
Table 37: Film Box SOP Class N-CREATE Responses Status Handling Behavior	34
Table 38: Film Box SOP Class N-SET Request Attributes	35
Table 39: Film Box SOP Class N-SET Responses Status Handling Behavior	35
Table 40: Film Box SOP Class N-ACTION Responses Status Handling Behavior	35
Table 41: Film Box SOP Class N-DELETE Responses Status Handling Behavior	35
Table 42: Image Box SOP Class N-SET Request Attributes	36
Table 43: Image Box SOP Class N-SET Responses Status Handling Behavior	37

Table 44: SOP Classes for Find AE	38
Table 45: DICOM Application Context for Find AE	38
Table 46: Number of Associations as an Association Initiator for Find AE	38
Table 47: Asynchronous Nature as an Association Initiator for Find AE	38
Table 48: DICOM Implementation Class and Version for Find AE	38
Table 49: Proposed Presentation Contexts For Activity Query Composite Instances	41
Table 50: Q&R C-FIND Response Status Handling Behavior	42
Table 51: Q&R Communication Failure Behavior	42
Table 52: Patient Root Q&R Information Model Request Identifier	42
Table 53: Study Root Q&R Information Model Request Identifier	43
Table 54: SOP Classes for Move AE	45
Table 55: DICOM Application Context for Move AE	45
Table 56: Number of Associations as an Association Initiator for Move AE	45
Table 57: Asynchronous Nature as an Association Initiator for Move AE	45
Table 58: DICOM Implementation Class and Version for Move AE	45
Table 59: Proposed Presentation Contexts For Activity Retrieve Composite Instances	47
Table 60: Q&R C-MOVE Response Status Handling Behavior	47
Table 61: Q&R Communication Failure Behavior	48
Table 62: Supported Q&R of the Move AE	48
Table 63: SOP Classes for Store-SCP AE	49
Table 64: DICOM Application Context for Store-SCP AE	49
Table 65: Number of Associations as an Association Acceptor for Store-SCP AE	49
Table 66: Asynchronous Nature as an Association Acceptor for Store-SCP AE	49
Table 67: DICOM Implementation Class and Version for Store-SCP AE	50
Table 68: Maximum PDU Size for Store-SCP AE	50
Table 69: Acceptable Presentation Contexts For Activity Receive Images	52
Table 70: AE Titles Configuration Table	54
Table 71: File Meta Information Attributes	57
Table 72: Media-FSR AE Related Application Profiles, Real-World Activities, and Roles	57
Table 73: SOP Classes and Transfer Syntaxes for Media-FSR AE	58
Table 74: Media-FSC/U AE Related Application Profiles, Real-World Activities, and Roles	59
Table 75: SOP Classes and Transfer Syntaxes for Media-FSR AE	60
Table 76: Supported Character Sets	62
Table 77: Computed Radiography Image IOD Modules	64
Table 78: Digital X-Ray Image IOD Modules	65
Table 79: Digital Intra-Oral Image IOD Modules	66
Table 80: Secondary Capture Image IOD Modules	67
Table 81: Visible Light Endoscopic Image IOD Modules	68
Table 82: Visible Light Photographic Image IOD Modules	68
Table 83: Computed Tomography Image IOD Modules	69
Table 84: Context Groups	70

# 1 INTRODUCTION

This document provides the DICOM 3.0 Conformance Statement of the Trophy DICOM application.

Trophy DICOM is a patient management system implementing a subset of the DICOM standard in order to achieve patient information and image data exchange with remote systems.

Trophy DICOM is actually a front-end application program providing the Trophy Imaging Software (namely Trophy Windows or DIS) with both patient management and DICOM capabilities.

This DICOM implementation enables the system to communicate with any DICOM 3.0 compliant systems (PACS, RIS, imagers, workstations...). This allows the exchange of patient and procedure information or images and ensures proper integration of the Trophy products into the workflow of the medical institution and the patient management environment.

Trophy DICOM implementation of the DICOM standard is based partly on the underlying DICOM compliant DicomSuite Toolkit library provided by the ETIAM Company (for all the "communication" side of the implementation), and partly on Trophy libraries (for the image creation processes).

*Note: In this document, the name 'imaging application' refers to both 'Trophy Windows (namely TW)' and 'Dental Imaging Software (namely DIS)' applications designed and developed by Trophy.*

## 1.1 Revision History

Revision	Date	Author	Description
1	2004-02-10	Xavier CARAYOL	Initial draft
2	2004-03-10	Xavier CARAYOL	First release according to DICOM Supplement 64 recommendations
2.1	2004-03-10	Xavier CARAYOL	Corrected typo and table numbering
2.2	2004-03-16	Xavier CARAYOL	Updated according to Julien BARNEOUD and Gilles MEVEL comments
3.0	2004-12-10	Xavier CARAYOL	Updated for Trophy DICOM 6.0.3 version
4.0	2006-07-10	Xavier CARAYOL	Updated for Trophy DICOM 6.0.4 version. Also updated for new DICOM PS 3 – 2006 version of the DICOM Standard.
5.0	2009-02-24	Xavier CARAYOL	Updated for Trophy DICOM 6.1.0.0 version created to support new Trophy 3D equipments (K9x00 series)
5.1	2010-02-17	Xavier CARAYOL	Updated for Trophy DICOM 6.2.0.0 version
5.2	2013-05-23	Marc LAURENTIN	Rebranding

## 1.2 Audience

It is assumed that the reader of this document is familiar with the DICOM 3.0 standard and with the terminology and concepts used in the standard.

## 1.3 Applicable Software Version

This document is related to the version 6.2.0.0 and above of Trophy DICOM, unless otherwise explicitly stated.

This Trophy DICOM version is associated with the Trophy imaging application version 6.11.0.0 and above, and shall not be used in conjunction with any other earlier version. Therefore this Trophy DICOM version is compatible with the associated 3D imaging application and associated K9000 and K9500 acquisition devices.

This Trophy DICOM version is also associated with the ETIAM DicomSuite Toolkit library version 2.52f, 2.60g and 2.80a as described in this document.



This Trophy DICOM version also provides a new background process named CSDServices for dealing with all dataset transfers in an asynchronous manner: this is particularly useful for large dataset, like 3D volume, transfers. This Trophy DICOM version is associated with CSDServices version 1.1.2.0 and above, unless otherwise stated.

## 1.4 Trophy Root UID

The Trophy DICOM root UID is: **1.2.250.1.90** (provided by the French ISO member body AFNOR).

## 1.5 Definitions, Terms and Abbreviations

The following definitions are used in this conformance statement:

Composite Instance	Any type of DICOM SOP Instances (either images or other data types).
Trophy Windows	The imaging application designed and developed by Trophy (also called Dental Imaging Software).
3D Module	The imaging application designed and developed by Trophy providing 3D display and processing functionality (also called DIS 3D Module).
CSDServices	A background process providing Trophy DICOM with asynchronous transfer capabilities.

The following symbols and abbreviations are used in this conformance statement:

ACR	American College of Radiology
ACSE	Association Control Service Element
AE	Application Entity
ANSI	American National Standards Institute
AP	Application Profile
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
CEN TC251	Comité Européen de Normalisation - Technical Committee 251 - Medical Informatics
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element-Composite
DIMSE-N	DICOM Message Service Element-Normalized
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
HISPP	Healthcare Informatics Standards Planning Panel
HL7	Health Level 7
IE	Information Entity
IEEE	Institute of Electrical and Electronics Engineers
IOD	Information Object Definition
ISO	International Standards Organization
ISP	International Standardized Profile
JIRA	Japanese Industry Radiology Apparatus
DIS	Dental Imaging Software
MSDS	Healthcare Message Standard Developers Sub-Committee
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System

PDU	Protocol Data Unit
Q&R	Query and Retrieve
RIS	Radiology Information System
RWA	Real-World Activity
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
TW	Trophy Windows
UID	Unique Identifier

The following abbreviations for presence of attribute values or modules are used in this conformance statement:

VNAP	<b>V</b> alue <b>N</b> ot <b>A</b> lways <b>P</b> resent (Attribute sent with zero length if no value is present)
ANAP	<b>A</b> tttribute <b>N</b> ot <b>A</b> lways <b>P</b> resent
MNAP	<b>M</b> odule <b>N</b> ot <b>A</b> lways <b>P</b> resent
ALWAYS	Attribute (or module) always present with a value
NEVER	Module never present
EMPTY	Attribute sent without a value
COND	Attribute (or module) presence is conditional

The following abbreviations for source of attribute values are used in this conformance statement:

USER	The attribute value source is from User input
AUTO	The attribute value is generated automatically by the program
CONFIG	The attribute value source is a configurable parameter
MWL	The attribute value source is Modality Worklist
PRT	The attribute value source is Printer

## 1.6 References

[1]. ACR/NEMA Standards Publications, PS 3 - 2009 DICOM Standard:

Part 1	Introduction and Overview
Part 2	Conformance
Part 3	Information Object Definitions
Part 4	Service Class Specifications
Part 5	Data Structures and Encoding
Part 6	Data Dictionary
Part 7	Message Exchange
Part 8	Network Communication Support for Message Exchange
<i>Part 9</i>	<i>Retired</i>
Part 10	Media Storage and File Format for Data Interchange
Part 11	Media Storage Application Profiles
Part 12	Storage Formats and Physical Media for Media Interchange
<i>Part 13</i>	<i>Retired</i>
Part 14	Grayscale Standard Display Function
Part 15	Security and System Management Profiles
Part 16	Content Mapping Resource
Part 17	Explanatory Information
Part 18	Web Access to DICOM Persistent Objects (WADO)

Copies of the DICOM 3.0 standard may be obtained by contacting:

National Electrical Manufacturers Association

1300 N. 17<sup>th</sup> Street  
Rosslyn, Virginia 22209 USA  
<http://medical.nema.org>

Current standard status may be checked also at:

<http://www.dclunie.com/dicom-status/status.html>

[2]. ETIAM DicomSuite Toolkit library DICOM Conformance Statements and User's Manuals.

[3]. Trophy DICOM Patient Management System - DICOM Configuration Manual.

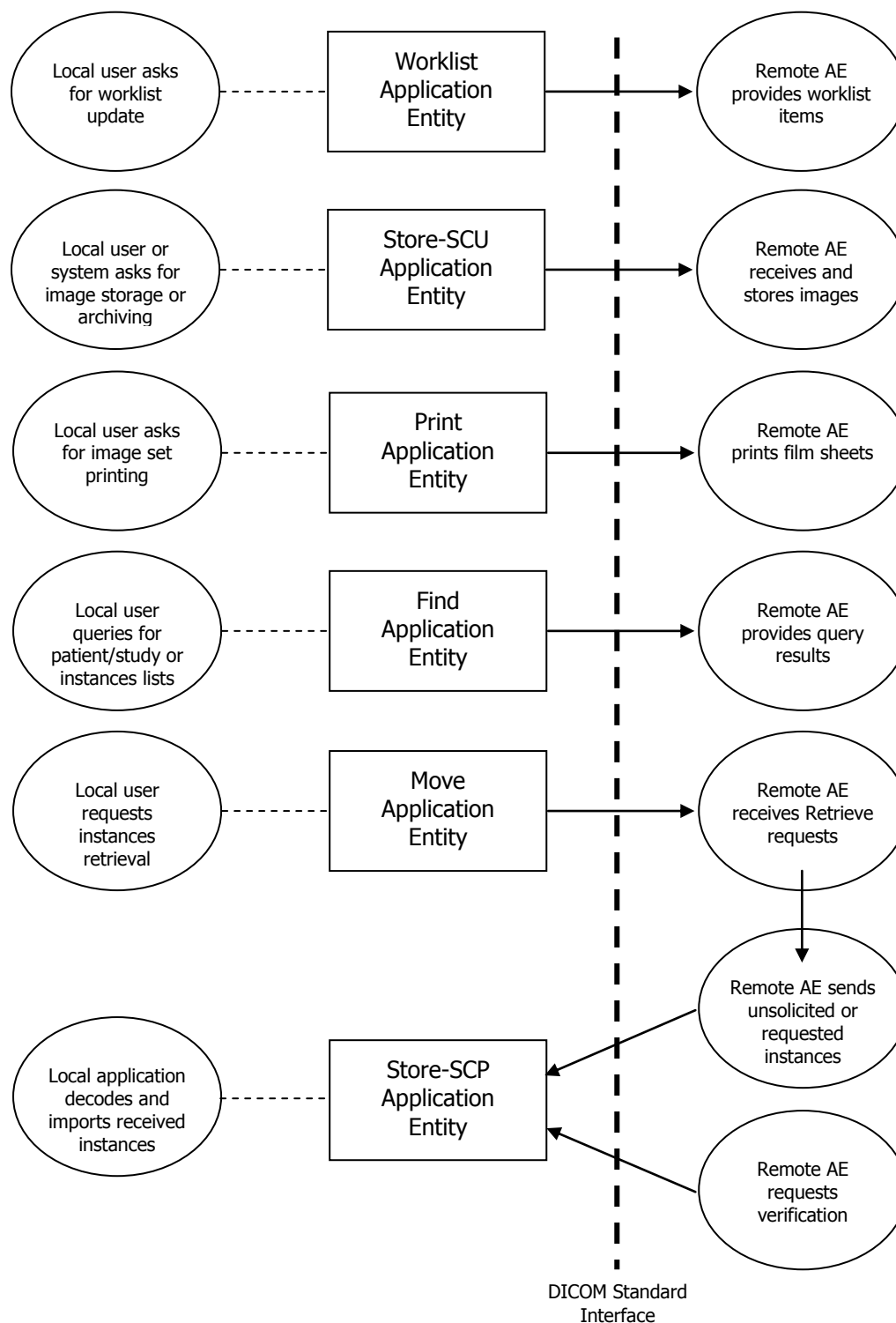
Reference: "05XC002-E Trophy DICOM DC" document

## 2 NETWORKING

### 2.1 Implementation Model

#### 2.1.1 Application Data Flow Diagram

The DICOM network services implemented by Trophy DICOM can be conceptually modeled as the following separate Application Entities:



**Figure 1: Application Data Flow Diagram - Networking**

- 1) The Worklist Application Entity receives Worklist information items from a remote AE. When the user requests a Worklist Item list update, the Worklist Application Entity queries the remote AE for Worklist Items matching the user requirements (user configurable) and returns the set of items found by the remote AE.
- 2) The Store-SCU Application Entity sends images to a remote AE. This is performed either upon user request for a specific selected image set or automatically (configurable) for each newly acquired or saved image.
- 3) The Print Application Entity prints an image set on a remote AE (printer or imager). Creating print-jobs containing film sheets composed from the images selected and organized by the user performs this.
- 4) The Find Application Entity receives patient/study or composite instance lists from a remote AE. When the user requests a patient/study list update, the Find Application Entity queries the remote AE for patients/studies matching the user requirements (user configurable) and returns the set of entries found by the remote AE. When the user requests composite instance list update for a given patient/study entry (selected in the patient/study list previously returned), the Find Application Entity queries the remote AE for all composite instances belonging to the selected patient/study entry matching the user requirements (user configurable) and returns the set of composite instances found by the remote AE.
- 5) The Move Application Entity requests composite instances to be retrieve locally from a remote AE, or transferred to a specified third-tier final destination server. When the user requests a composite instance list retrieval or transfer, the Move Application Entity sends to the remote AE the composite instance list identification parameters (either a Study Instance UID or a Series Instance UID or a SOP Instance UID) and returns the final status of the request. Processing control of the underlying associated Composite Instance Storage requests performed by the remote AE to the final destination storage AE is outside the scope of this Move Application Entity.
- 6) The Store-SCP Application Entity receives images (either unsolicited or requested by the user) from a remote AE. When a new incoming composite instance is received, it is placed in a temporary storage location before being decoded and imported into the Trophy DICOM Patient Database if available. A new patient entry is created in the database if the composite instance does not belong to an already existing patient. The Store-SCP Application Entity can also process verification requests from a remote AE.

*Note: The selection of the information model (either Patient Root or Study Root) for the Find or the Move Application Entities is configurable when defining the associated remote Find-SCP AE into Trophy DICOM.*

*Note: The "flat" model implemented by Trophy DICOM either for the Patient Root or the Study Root Information Models hides the regular levels of the related DICOM Q&R Find information models.*

*Note: The Move Application Entity does not provides the user with the ability to retrieve all composite instances belonging to a given patient at a time: Move requests are only possible starting down at the Study level in the DICOM information models.*

*Note: Trophy DICOM applications installed on different systems can share a single Store-SCP Application Entity in a centralized Trophy DICOM Patient Database network configuration. In this case, the Store-SCP Application Entity might not be installed or available on all the systems.*

*Note: The Store-SCU Application Entity is implemented thru the CSDServices background component, providing thus asynchronous transfer mechanism.*

## **2.1.2 Functional Definitions of AE's**

### **2.1.2.1 Functional Definition of Worklist Application Entity**

When the user asks for a Worklist update, a Worklist request is sent to a remote system (generally a RIS system). For this purpose, the Worklist AE establishes an Association to the remote AE and transfers the request that includes the user selected matching criteria. After receiving the Worklist Items corresponding to the request, a specific list is constructed and presented to the user for selection. This list is then cleared with the next Worklist update.

### **2.1.2.2 Functional Definition of Store-SCU Application Entity**

When the user or the system automatically asks for image storage, a store request is posted to the CSDServices component, which acts actually as the Store-SCU AE. This component then conveys that request to the remote system (generally a PACS system) asynchronously. For this purpose, the Store-SCU AE establishes an Association to the remote AE and negotiates a proper Presentation Context (i.e. transfer syntaxes per SOP Classes). If successful, an image transfer is started. The remote AE can be chosen from a preferred server set or automatically selected from a configurable distribution server list. The CSDServices maintained all the transfer request status in a transfer queue for a configurable amount of time.

### **2.1.2.3 Functional Definition of Print Application Entity**

When the user wants to print a selected image set, a print request is sent to a remote system (generally an Imager). For this purpose, the Print AE establishes an Association to the remote AE and sends film sheet requests thru print-jobs. Completion status is then presented to the user. The user can create film sheet by selecting and ordering images and choosing print layouts.

### **2.1.2.4 Functional Definition of Find Application Entity**

When the user asks for a patient or study list update (depending of the DICOM Q&R Find Information Model setup during the configuration of the remote AE), a query request is sent to a remote system (generally a PACS system). For this purpose, the Find Application Entity establishes an Association to the remote AE and transfers the request that includes the user selected matching criteria. After receiving the patient or study list corresponding to the request, a specific list is constructed and presented to the user.

For each patient or study entry found in the returned list, the user can ask for a related composite instance list update. Recursively, and transparently for the user, a set of query sub-requests is sent to the remote AE for each item found at the levels below the current level of the information model (i.e. STUDY, SERIES and IMAGE levels for Patient Root Information Model, and SERIES and IMAGE levels for Study Root Information Model). For this purpose, the Find Application Entity establishes a new Association to the remote AE for each item found, and transfers the sub-request that includes the user selected matching criteria of that level if applicable. After receiving all the associated composite instances corresponding to those sub-requests, a specific "flat" list is constructed and presented to the user.

This "flat" 2 steps design of the Trophy DICOM Q&R implementation is done in order to simplify for the user composite instance retrieval from a PACS system.

### **2.1.2.5 Functional Definition of Move Application Entity**

When the user asks for composite instance retrieval, one or more move requests are sent to a remote system (generally a PACS system). For this purpose, for each request, the Move Application Entity establishes a separate Association to the remote AE and transfers the associated request that includes the related composite instance identifying parameters, i.e. the Unique Keys used to identify an entity at the information model level of the request.

The number of move requests sent to the remote AE depends on the information model level where the requests occur. The Move Application Entity is designed to allow retrieval of all composite instances or a user defined set of composite instances belonging to a single Study or a single Series at a time. Such operation is not allowed at the Patient level.

The Move Application Entity can also be used to transfer composite instances, from remote AE to user defined third-tier final destination storage AE.

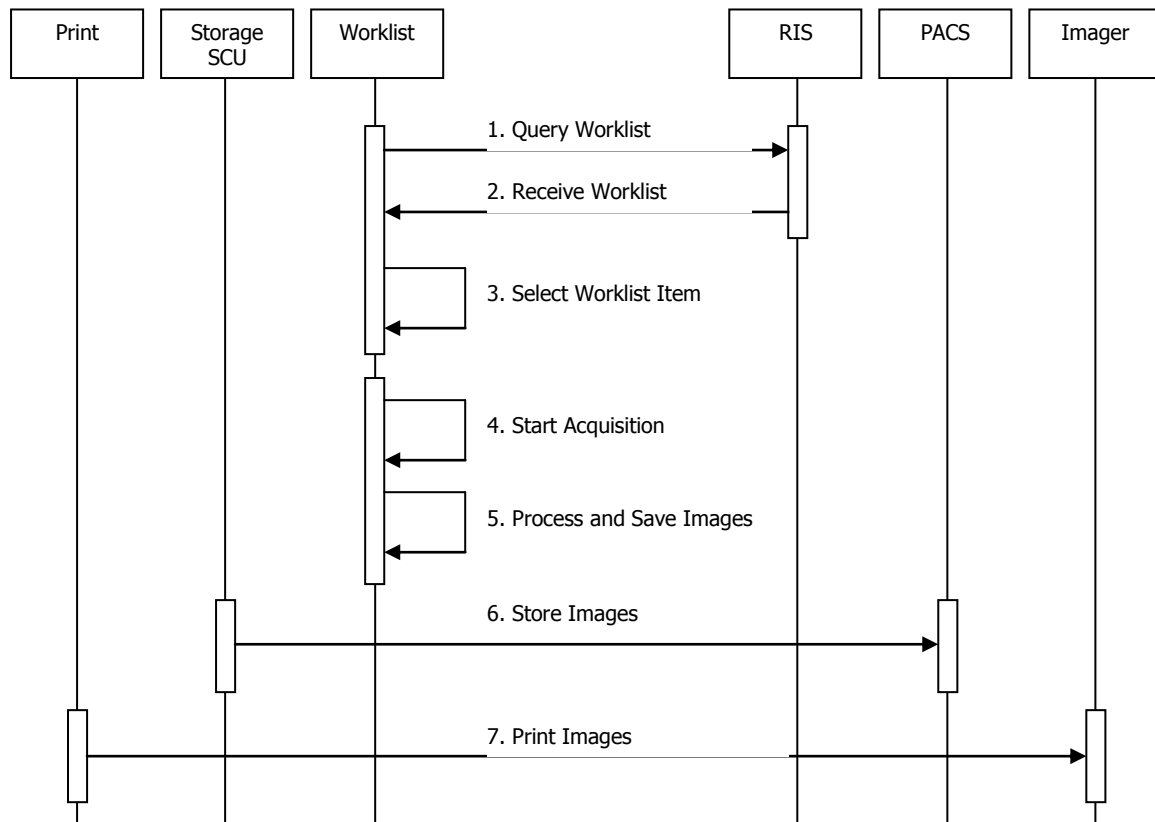
### 2.1.2.6 Functional Definition of Store-SCP Application Entity

The Store-SCP Application Entity is used to receive either requested (as a result of a user composite instance retrieval request) or unsolicited composite instances from a remote AE. For this purpose, the Store-SCP Application Entity accepts associations from the remote AE and stores any incoming composite instances in a temporary location for further processing by Trophy DICOM.

The Store-SCP Application Entity can also accept Associations from a remote AE for verification purposes.

### 2.1.3 Sequencing of Real-World Activities

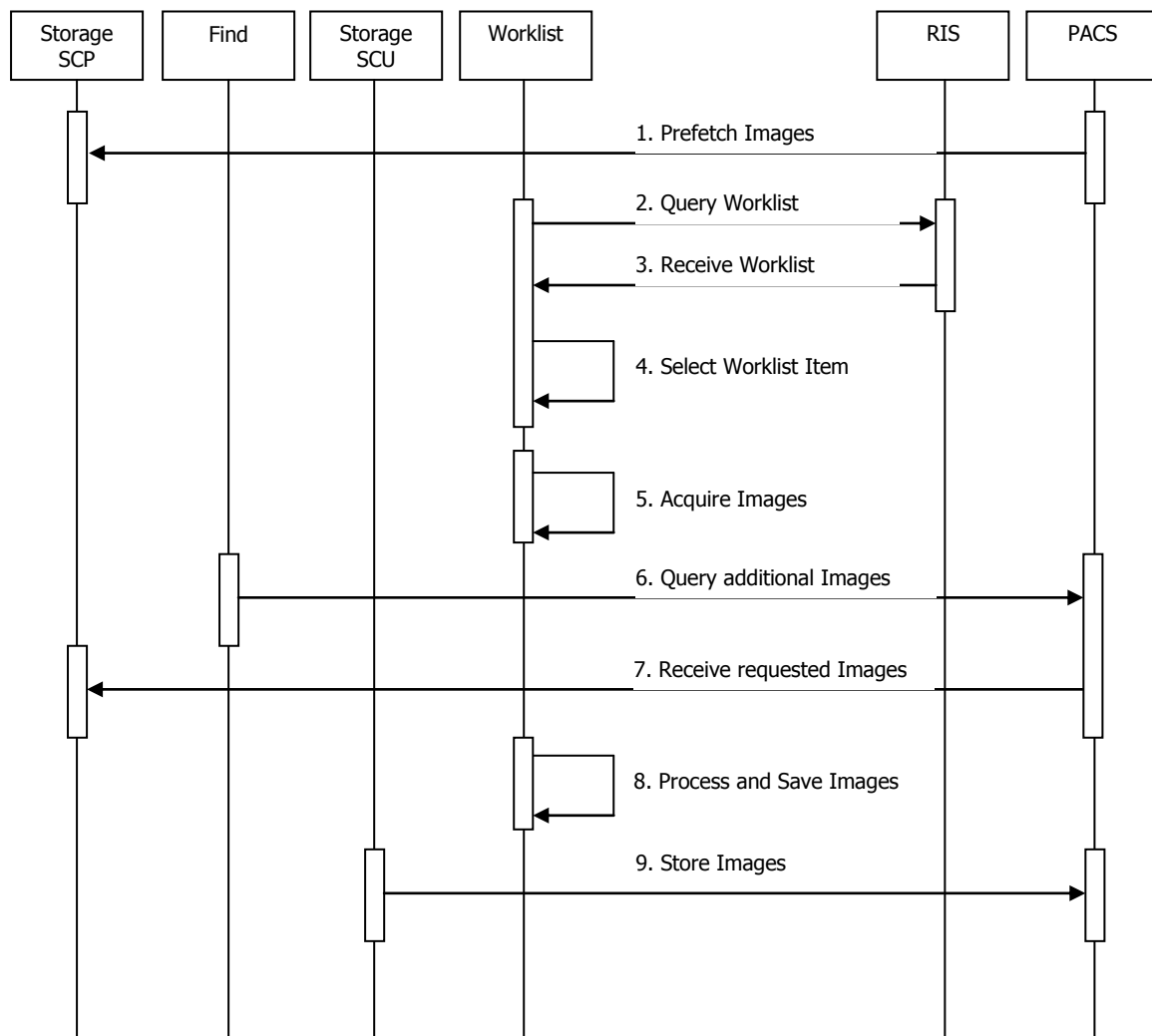
Under normal scheduled workflow conditions, the following sequencing constraints may apply:



**Figure 2: Sequencing of Activities – Workflow Management**

- 1) Query Worklist.
- 2) Receive Worklist of Modality Scheduled Procedure Steps (MSPS).
- 3) Select Worklist Item (MSPS).
- 4) Start acquisition.
- 5) Process acquired images and save images.
- 6) Store saved images (configurable).
- 7) Print images (optional step).

For older data reprocessing purposes, the following sequencing may also apply:



**Figure 3: Sequencing of Activities – Image Processing**

- 1) Pre-fetch previously acquired key images.
- 2) Query Worklist.
- 3) Receive Worklist of Modality Scheduled Procedure Steps (MSPS).
- 4) Select Worklist Item (MSPS).
- 5) Acquire new images.
- 6) Query additional previously acquired images.
- 7) Receive requested images.
- 8) Process and save images.
- 9) Store newly acquired and processed images.

Other workflow situations may obviously occur, since all AE involved in this implementation are optional and data processing may require other sequencings.



## 2.2 AE Specifications

### 2.2.1 Worklist AE Specifications

#### 2.2.1.1 SOP Classes

The Worklist AE provides Standard Conformance to the following SOP Classes:

**Table 1: SOP Classes for Worklist AE**

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

#### 2.2.1.2 Association Policies

##### 2.2.1.2.1 General

The Worklist AE always proposes the DICOM standard application context name for DICOM 3.0.

**Table 2: DICOM Application Context for Worklist AE**

<b>Application Context Name</b>	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

##### 2.2.1.2.2 Number of Associations

The Worklist AE initiates one Association at a time for each configured Worklist server. Nevertheless, multiple Worklist servers can be configured into Trophy DICOM.

**Table 3: Number of Associations as an Association Initiator for Worklist AE**

<b>Maximum number of simultaneous associations</b>	1
--	---

##### 2.2.1.2.3 Asynchronous Nature

The Worklist AE does not support negotiation of multiple outstanding transactions over a single Association, i.e. asynchronous communication.

**Table 4: Asynchronous Nature as an Association Initiator for Worklist AE**

<b>Maximum number of outstanding asynchronous transactions</b>	1
--	---

##### 2.2.1.2.4 Implementation Identifying Information

The implementation information for the Worklist AE is actually provided by the underlying Etiam DicomSuite Toolkit library implementation. At the date of this document, for the Toolkit version described in section 1.3, this information is:

**Table 5: DICOM Implementation Class and Version for Worklist AE**

<b>Implementation Class UID</b>	1.2.250.1.59.3.0.3.5.2
<b>Implementation Version Name</b>	ETIAM_DCMTK_352

#### 2.2.1.3 Association Initiation Policy

##### 2.2.1.3.1 Activity – Update Worklist

###### 2.2.1.3.1.1 Description and Sequencing of Activities

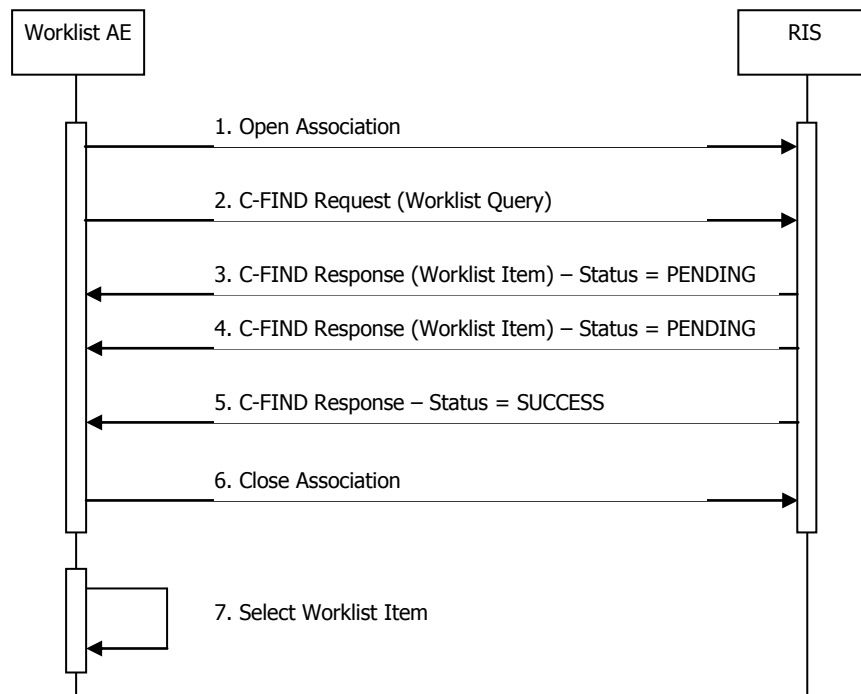
Request for Worklist update is initiated by user interaction. The user can perform a query with or without search criteria. In the later case, a dialog window, used to enter search criteria, is available

to the user in order to perform this interactive query. This dialog window offers two levels of query, either a Patient Based Query (allowing the user to search for Patient Last Name, Patient ID, Accession Number or Procedure ID) or a Broad Modality Query (allowing the user to search for Scheduled Procedure Step Start Date, Modality or Scheduled Station AE Title). Refer to section 2.2.1.3.1.3 for more information on such attribute management.

Upon initiation of the user request the Worklist AE builds an identifier for the C-FIND request, which includes the search criteria, if any, initiates an Association to the remote AE, and waits for Worklist responses. After retrieval of all the responses, the Worklist AE constructs an internal dataset of the matching Worklist items, and passes it back to Trophy DICOM. Trophy DICOM, then, displays the resulting Worklist Items to the user in a specific dialog list, which will be cleared with the next Worklist update.

The Worklist AE initiates this Association, in order to issue the C-FIND request, according to the Modality Worklist Information Model – FIND.

A possible sequence of interactions between the Worklist AE and a RIS system (i.e. a system supporting the Modality Worklist SOP Class as an SCP) is illustrated in the following diagram:



**Figure 4: Sequencing of Activity - Update Worklist**

- 1) The Worklist AE opens an Association with the RIS system.
- 2) The Worklist AE sends a C-FIND request to the RIS containing the Worklist Query attributes and search criteria.
- 3) The RIS returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
- 4) The RIS returns another C-FIND response containing the requested attributes of the second matching Worklist Item.
- 5) The RIS returns another C-FIND response with a status Success, indicating that no further matching Worklist Item exists (we assume that only 2 items match in this diagram).
- 6) The Worklist AE closes the Association with the RIS.
- 7) The user selects a Worklist Item from the list and prepares to acquire related images.

*Note: When preparing for image acquisition, Trophy DICOM tries to identify the patient associated with the selected Worklist Item in its internal patient database. Matching is performed using the Patient ID. If no patient is found, a new one is created with the information provided within the Worklist Item prior starting the actual image acquisition (see section 2.2.1.3.1.3)*

### 2.2.1.3.1.2 Proposed Presentation Contexts

The Worklist AE proposes Presentation Contexts as shown in the following table:

**Table 6: Proposed Presentation Contexts For Activity Update Worklist**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

### 2.2.1.3.1.3 SOP Specific Conformance for Modality Worklist SOP Class

The behavior of the Worklist AE when encountering status codes in a Modality Worklist C-FIND response is summarized in the table below. If the Worklist AE receives any other SCP response status than Success or Pending, the Association is closed and the Worklist Items already correctly returned are presented to the user.

**Table 7: Modality Worklist C-FIND Response Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has successfully returned all matching information. Worklist Items are available for further processing.
Pending	Matches are continuing	FF0*	The Worklist Item contained in the identifier is collected for further processing
*	*	*	The Association is aborted using A-ABORT and the Worklist is marked as globally failed. All already retrieved items are returned to the user.

The behavior of the Worklist AE during communication failure is summarized in the table below:

**Table 8: Modality Worklist Communication Failure Behavior**

Exception	Behavior
Timeout	The Association is aborted and the Worklist is marked as globally failed. No Worklist Item is returned to the user.
Association aborted by the SCP or network layers	The Worklist is marked as globally failed. No Worklist Item is returned to the user.

No CANCEL requests are ever issued by the Worklist AE.

Acquired and created images will always use the Study Instance UID specified for the Scheduled Procedure Step (MSPS) (if available).

If an acquisition is unscheduled, Trophy DICOM provides the user with the ability to manually create a Procedure Step and enter some of the parameters as described in the table below. In that case, the Study Instance UID is automatically generated.

*Note: Trophy DICOM always provides the user with the ability to manually modify some of the Procedure Step parameters as described in the table below.*

The Table below provides a description of the Worklist AE Worklist Request Identifier and specifies the attributes that are copied into the images.

Unexpected attributes returned in a C-FIND response are ignored, while requested attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made to filter out possible duplicate entries.

*Note: this table is based on the underlying Etiam DicomSuite Toolkit library implementation specifications.*

**Table 9: Worklist Request Identifier**

Module Name Attribute Name	Tag	Q	M	GUI	D	IOD
<b>Scheduled Procedure Step</b>						
Scheduled Procedure Step Sequence	(0040,0100)					
> Scheduled Station AE Title	(0040,0001)	Y	ANY	Y		
> Scheduled Procedure Step Start Date	(0040,0002)	Y	SV	Y	Y	Y
> Scheduled Procedure Step Start Time	(0040,0003)			Y		Y
> Modality	(0008,0060)	Y	ANY	Y		
> Scheduled Performing Physician's Name	(0040,0006)			Y		
> Scheduled Procedure Step Description	(0040,0007)			Y		
> Scheduled Station Name	(0040,0010)			Y		
> Scheduled Procedure Step Location	(0040,0011)			Y		
> Pre Medication	(0040,0012)					
> Scheduled Procedure Step ID	(0040,0009)			Y		
> Requested Contrast Agent	(0032,1070)					
<b>Requested Procedure</b>						
Requested Procedure ID (see note below)	(0040,1001)	Y	ANY	Y	Y	Y
Requested Procedure Description	(0032,1060)			Y	Y	Y
Study Instance UID	(0020,000D)					Y
Requested Procedure Priority	(0040,1003)			Y		
Patient Transport Arrangements	(0040,1004)			Y		
<b>Study Classification</b>						
Study Status ID	(0032,000A)			Y	Y	
<b>Imaging Service Request</b>						
Accession Number	(0008,0050)	Y	ANY	Y	Y	Y
Requesting Physician	(0032,1032)			Y		
Referring Physician's Name	(0008,0090)			Y		Y
<b>Visit Identification</b>						
Admission ID	(0038,0010)	Y	ANY	Y	Y	
<b>Visit Status</b>						
Current Patient Location	(0038,0300)			Y		
<b>Patient Identification</b>						
Patient Name	(0010,0010)	Y	ANY	Y	Y	Y

Patient ID	(0010,0020)	Y	ANY	Y	Y	Y
<b>Patient Demographic</b>						
Patient's Birth Date	(0010,0030)			Y		Y
Patient's Sex	(0010,0040)			Y		Y
Patient's Weight	(0010,1030)			Y		
<b>Patient Medical</b>						
Patient State	(0038,0500)			Y		
Medical Alerts	(0010,2000)			Y		
Contrast Allergies	(0010,2110)					
Special Needs	(0038,0050)			Y		

*Note: The attribute Requested Procedure ID (0040,1001) if present, will be passed by Trophy DICOM to the associated imaging application, and used as Study ID (0020,0010) attribute for all images acquired during the underlying exam.*

The table above should be read as follows:

**Q:** A "Y" indicates that the Worklist AE will supply this attribute as matching key, if entered by the user in the dialog user interface.

*Note: If the user provides no value, the attribute will not be part of the search criteria.*

*Note: For the Patient's Name, only the Last Name component is actually used.*

**M:** "SV" indicates that the Worklist AE may supply the attribute value for Single Value Matching. "ANY" indicates that the Worklist AE may supply the attribute for Single Value, Wildcard or Multiple Value matching, based on the user inputs (thru the GUI).

*Note: If the user provides no value, the attribute will not be part of the matching keys.*

**GUI:** A "Y" indicates that Trophy DICOM provides the ability to manually edit the attribute (for unscheduled procedure for example).

**D:** A "Y" indicates that Trophy DICOM presents the attribute in the Procedure Step list for user selection.

**IOD:** A "Y" indicates that the attribute is included into all Object Instances created during performance of the related Procedure Step.

*Note: The Worklist AE will supply all the attributes described above as Return Key with zero length for Universal Matching if not used as Matching Keys.*

#### 2.2.1.3.1.4 SOP Specific Conformance for Verification SOP Class

The Worklist AE provides Standard Conformance for the Verification SOP Class as an SCU.

*Note: The Worklist AE initiates a Verification request prior to any Update Worklist operation. In case of failure, a dialog error box is presented to the user. Verification and Update Worklist operations are performed over different Associations.*

#### 2.2.1.4 Association Acceptance Policy

The Worklist AE does not accept Associations.

## 2.2.2 Store-SCU AE Specifications

### 2.2.2.1 SOP Classes

The Store-SCU AE provides Standard Conformance to the following SOP Classes:

**Table 10: SOP Classes for Store-SCU AE**

SOP Class Name	SOP Class UID	SCU	SCP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	No
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Visible Light Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
Visible Light Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
Other types of Image Storage (1)	(As received by the Store-SCP AE)	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

*Note (1): the Store-SCU AE may provide Standard Conformance to other SOP Classes (refer to section 2.2.6 for more information) as received and imported by the associated Store-SCP AE (due to the underlying Etiam DicomSuite Toolkit capabilities); nevertheless, most of those SOP Classes may not be currently supported by the associated imaging application.*

### 2.2.2.2 Association Policies

#### 2.2.2.2.1 General

The Store-SCU AE always proposes the DICOM standard application context name for DICOM 3.0.

**Table 11: DICOM Application Context for Store-SCU AE**

<b>Application Context Name</b>	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

#### 2.2.2.2.2 Number of Associations

The Store-SCU AE initiates one Association at a time for each configured storage server. Nevertheless, multiple storage servers can be configured into Trophy DICOM.

**Table 12: Number of Associations as an Association Initiator for Store-SCU AE**

<b>Maximum number of simultaneous associations</b>	1
--	---

#### 2.2.2.2.3 Asynchronous Nature

The Store-SCU AE does not support negotiation of multiple outstanding transactions over a single Association, i.e. asynchronous communication.

**Table 13: Asynchronous Nature as an Association Initiator for Store-SCU AE**

<b>Maximum number of outstanding asynchronous transactions</b>	1
--	---

#### 2.2.2.2.4 Implementation Identifying Information

The implementation information for the Store-SCU AE is actually provided by the underlying Etiam DicomSuite Toolkit library implementation: At the date of this document, for the Toolkit version described in section 1.3, this information is:

**Table 14: DICOM Implementation Class and Version for Store-SCU AE**

<b>Implementation Class UID</b>	1.2.250.1.59.3.0.3.5.3
<b>Implementation Version Name</b>	ETIAM_DCMTK_353

### **2.2.2.3 Association Initiation Policy**

#### **2.2.2.3.1 Activity – Transfer Image**

##### *2.2.2.3.1.1 Description and Sequencing of Activities*

Request for image transfer is initiated either manually by user interaction, or automatically (configurable) each time an image or a 3D volume dataset is created (i.e. acquired or saved within the associated imaging application).

In the manual mode, the user can select one or more images or one single 3D volume dataset from the current patient image list, and request them to be sent to multiple destinations (configurable and re-selectable).

In the automatic mode, image transfer to multiple destinations (configurable) is performed immediately after image or 3D volume dataset creation.

For each selected destination, a set of requests for transfer is then passed to the Store-SCU AE (i.e. the CSDServices component), one for each image or 3D volume dataset, for later processing when available.

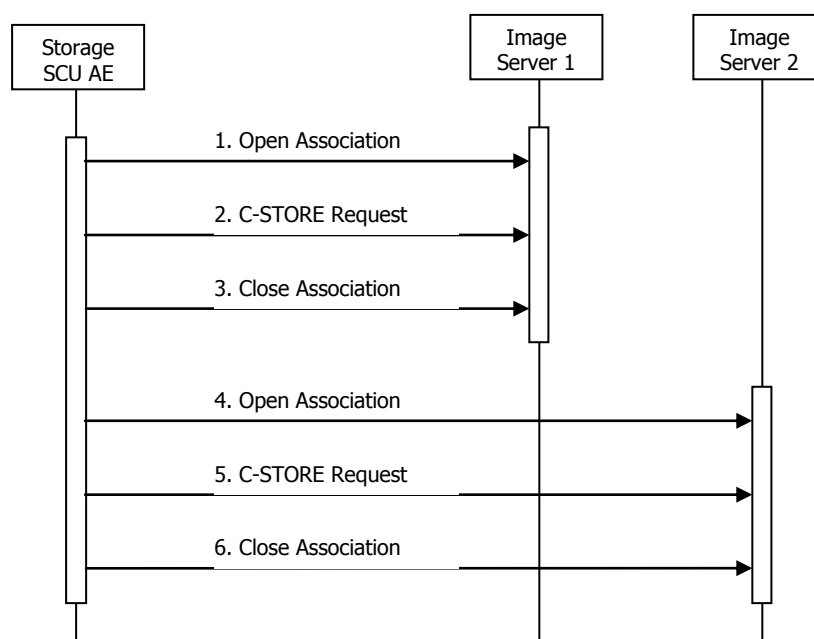
*Note: Since the associated imaging application creates, at the date of this document, CT Image SOP Class images for 3D volume slices, the request for transfer of such a dataset volume corresponds in fact to a request for transfer of several separate images representing the volume.*

When ready to process a request for transfer, the Store-SCU AE may perform a verification operation, first, based on the user configuration of that server within the application, by initiating an Association to the remote AE for Verification. If successful, the Store-SCU AE initiates then another Association to the remote AE and transfers the image or the 3D volume dataset belonging to the initial user or system transfer request. When the transfer request is related to the transfer of a 3D volume dataset (i.e. a set of separate CT slices), then the transfer is performed over the same Association. After successful completion or not of the transfer of the image or 3D volume dataset, the Store-SCU AE update accordingly the transfer status of that transfer request for later control by the user thru the CSDServices queue management dialog window. In case of failure the user may retrieve detailed status about the error in that case.

This process is repeated for each destination specified in the initial transfer requests.

*Note: At any time the user can suspend/resume/cancel any ongoing transfer request thru the CSDServices queue management dialog window. Description of the CSDServices functionality is nevertheless outside the scope of the document.*

A possible sequence of interactions between the Store-SCU AE and multiple Image Servers (i.e. a system supporting the Storage SOP Class as an SCP) is illustrated in the following diagram:



**Figure 5: Sequencing of Activity - Transfer Image**

- 1) The Store-SCU AE opens an Association with the first configured or selected Image Server system.
- 2) A created image or 3D volume dataset is transmitted to the Image Server using a C-STORE request and the Image Server replies with a C-STORE response.
- 3) The Store-SCU AE closes the Association with the Image Server.
- 4) Then the Store-SCU AE opens another Association with the second configured or selected Image Server system.
- 5) The same created image or 3D volume dataset is transmitted to the Image Server using a C-STORE request and the Image Server replies with a C-STORE response.
- 6) The Store-SCU AE closes the Association with the Image Server.

#### 2.2.2.3.1.2 Proposed Presentation Contexts

The Store-SCU AE proposes Presentation Contexts as shown in the following table:

**Table 15: Proposed Presentation Contexts For Activity Transfer Image**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Intra-oral X-Ray	1.2.840.10008.5.1.4.1.1.1.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None



Image Storage – For Presentation		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70		
Visible Light Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70		
Visible Light Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70		
Other Types of Image Storage (1)	<i>(As received by the Store-SCP AE)</i>	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		<i>(As received by the Store-SCP AE)</i>	<i>(As received by the Store-SCP AE)</i>		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

*Note (1): The Presentation Contexts listed in the table above, are actually "limited" to Image Storage SOP Classes currently supported by the Associated imaging application. Other presentation contexts may be proposed for other types of SOP Instances received from a remote AE. By default Trophy DICOM does not modify the encoding of a received SOP Instance, while importing them into the Trophy DICOM Patient Database. Therefore the Storage AE always proposed the transfer syntax used while receiving the SOP Instance in its proposed Presentation Context list (refer to section 2.2.6 for more information).*

#### 2.2.2.3.1.3 SOP Specific Conformance for all Image Storage SOP Classes

The behavior of the Store-SCU AE when encountering status codes in a C-STORE response is summarized in the table below.

**Table 16: Storage C-STORE Response Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the SOP Instance.
*	*	*	The Association is aborted using A-ABORT and the transfer status to the faulty destination is updated accordingly for the user.

The behavior of the Store-SCU AE during communication failure is summarized in the table below:

**Table 17: Storage Communication Failure Behavior**

Exception	Behavior
Timeout	The Association is aborted and the transfer status is updated.
Association aborted by the SCP or network layers	The transfer status is updated.

Failed image storage can be restarted manually any time by user interaction.

The content of the Computed Radiography, Digital X-Ray – For Presentation, Digital Intra-oral X-Ray – For Presentation, Secondary Capture, Visible Light Endoscopic, Visible Light Photographic, and Computed Tomography Image Storage SOP Instances created by the associated imaging application conforms to the associated DICOM Image IOD specifications as described in section 6.1.

The content of other types of Image Storage SOP Instances that Trophy DICOM may receive from a remote AE thru the Store-SCP AE shall conform to the associated DICOM IOD specification. Description of such content is outside the scope of this document since Trophy DICOM does not perform any data coercion or modification on received SOP Instances (refer to section 2.2.6).

#### 2.2.2.3.1.4 SOP Specific Conformance for Verification SOP Class

The Store-SCU AE provides Standard Conformance for the Verification SOP Class as an SCU.

*Note: Depending on the configuration made by the user for the remote AE a Verification may be performed before each Image Storage operation. Verification and Image Storage operations are nonetheless performed over different Associations.*

#### 2.2.2.4 Association Acceptance Policy

The Store-SCU AE does not accept Associations.

## 2.2.3 Print AE Specifications

### 2.2.3.1 SOP Classes

The Print AE provides Standard Conformance to the following SOP Classes:

**Table 18: SOP Classes for Print AE**

SOP Class Name	SOP Class UID	SCU	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

### 2.2.3.2 Association Policies

#### 2.2.3.2.1 General

The Print AE always proposes the DICOM standard application context name for DICOM 3.0.

**Table 19: DICOM Application Context for Print AE**

<b>Application Context Name</b>	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

#### 2.2.3.2.2 Number of Associations

The Print AE initiates one Association at a time for each configured hardcopy devices. Nevertheless, multiple hardcopy devices can be configured into Trophy DICOM.

**Table 20: Number of Associations as an Association Initiator for Print AE**

<b>Maximum number of simultaneous associations</b>	1
--	---

#### 2.2.3.2.3 Asynchronous Nature

The Print AE does not support negotiation of multiple outstanding transactions over a single Association, i.e. asynchronous communication.

**Table 21: Asynchronous Nature as an Association Initiator for Print AE**

<b>Maximum number of outstanding asynchronous transactions</b>	1
--	---

#### 2.2.3.2.4 Implementation Identifying Information

The implementation information for the Print AE is actually provided by the underlying Etiam DicomSuite Toolkit library implementation: At the date of this document, for the Toolkit version described in 1.3, this information is:

**Table 22: DICOM Implementation Class and Version for Print AE**

<b>Implementation Class UID</b>	1.2.250.1.59.3.0.3.5.2
<b>Implementation Version Name</b>	ETIAM_DCMTK_352

### 2.2.3.3 Association Initiation Policy

#### 2.2.3.3.1 Activity – Print Image

##### 2.2.3.3.1.1 Description and Sequencing of Activities

The user selects the images to print from the current patient image list and requests them to be sent to a specific hardcopy device. Among other things, the user can define desired film orientation, film layout and image sequence order, number of copies, whether or not she wants

patient's information to be "burned" into each image or added into a separate image box on the film and if she wants the images to be printed in Real or Pseudo True Size modes.

Addition of a separate annotation image box is only possible for film layout containing more than one image box. In this case, such annotation image box will be added in the first position of each film sheet of the film session, shifting accordingly selected images on each film sheet.

Position and font size of the text for both cases (burned into pixel or printed into a separate image box) can be configured.

For information burned directly into the image pixels:

**Table 23: Patient and Image Information burned into image pixels**

Line#	Attributes	Source
1	'Institution Name' – 'Department Name'	Preferences Dialog Window
2	['Patient ID'] – 'Last Name', 'First Name' – 'Birth Date'	Image
3	<b>Accession#:</b> 'Accession Number' – <b>Acquired:</b> 'Acquisition Date' – <b>Orientation:</b> 'Patient Orientation'	Image
4	"Image comment"	Image

For information added into a separate annotation image box:

**Table 24: Patient and Image Information added into an image box**

Line#	Attributes	Source
1	<b>Institution:</b> 'Institution Name'	Preferences Dialog Window
2	<b>Department:</b> 'Department Name'	Preferences Dialog Window
3	<b>ID:</b> 'Patient ID'	Image
4	<b>Lastname:</b> 'Last Name'	Image
5	<b>Firname:</b> 'First Name'	Image
6	<b>Birth Date:</b> 'Birth Date'	Image
7	<b>Printed:</b> 'Print Date'	System
8	<b>Magnification:</b> 'Magnification factor' (*)	Print Dialog Window

(\*) Applicable for Intra-Oral Images only, if True Size Print Mode is selected (see below).

Accession#, Acquisition Date, Patient Orientation and Image Comments, which are image based information, are not provided in this case, due to the fact that more than one image can be printed on the same film sheet from different studies.

The user can also require certain types of images to be printed in Real True Size mode, if applicable (e.g. for both IO and CR Intra Oral images): in this case it is strongly recommended to select a NxM film layout format and obviously not to select the patient and image information to be burned directly into the image pixels. Actual image size for Intra Oral images is determined using the Imager Pixel Spacing attribute information of the images.

The user can also require other types of images to be printed in Pseudo True Size mode: in this case, she may specify a desired print width for any type of non Intra Oral images (e.g. for Cephalometric or Panoramic images). Since several logical (or virtual) printers associated with the same physical hardcopy device can be configured within Trophy DICOM, this allows the user for easily defining separate Cephalometric and Panoramic print parameters.

The user can change at any time the default (configurable) hardcopy device, and for each defined device, the user can setup default-printing parameters according to the device capabilities. This type of configuration is saved internally for each configured hardcopy device.

The user has also the ability to export to a template file the current configuration parameters of a hardcopy device as setup within Trophy DICOM. This feature can be used to share hardcopy configuration between systems. A set of predefined templates is provided with the software installation for common Carestream hardcopy devices.

Thru Trophy DICOM, the user can configure the following set of parameters:

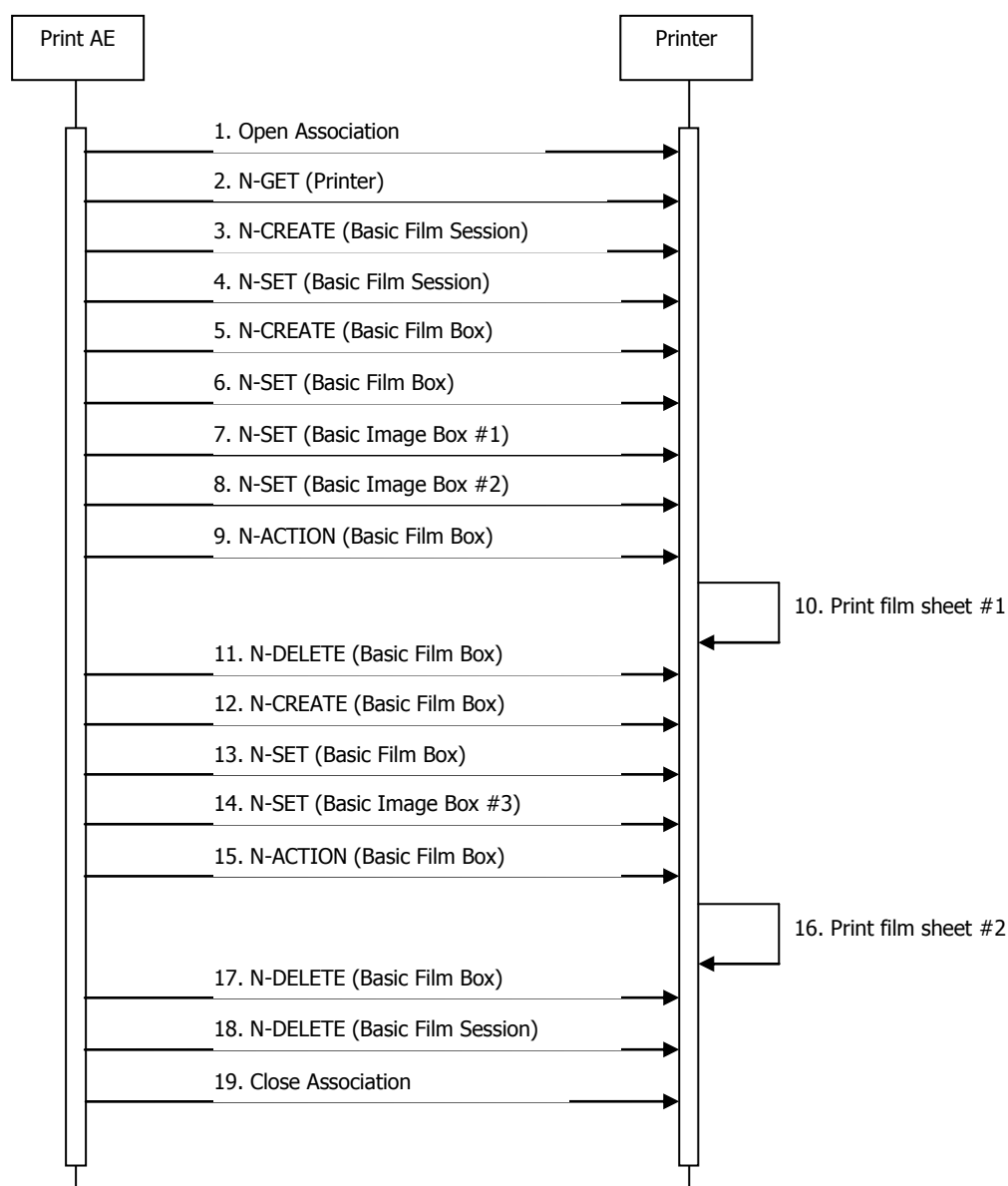
**Table 25: Configurable Printing Parameters**

Configuration Level	Parameter	Default
DICOM Server Configuration	Grayscale print support	None
	Grayscale 16 bits print support	None
	Color print support	None
Printer Configuration	Medium Type	CLEAR FILM
	Film Destination	MAGAZINE
	Film Size ID	<i>Printer Default</i>
	Magnification Type	<i>Printer Default</i>
	Smoothing Type	<i>Printer Default</i>
	Trim	NO
	Border Density	<i>Printer Default</i>
	Empty Image Density	<i>Printer Default</i>
	Configuration Information	<i>Printer Default</i>
	Min Density	<i>Printer Default</i>
	Max Density	<i>Printer Default</i>
Printing Session Setup	Film Orientation	PORTRAIT
	Number of Copies	1
	Print Priority	MEDIUM
	Image Display Format	STANDARD\1,1
	Annotation Flag	False
	Annotation Burned into Pixels	True
	Annotation Font	Arial, 24, Regular
	Annotation Alignment	Top Center
	True Size Mode	False
	Magnification Factor	1.0
	Best Print Width	200

Upon initiation of the user request, the Print AE initiates an Association to the remote AE for verification. If successful, the Print AE initiates then another Association to the remote AE in order to print the selected image set.

*Note: Trophy DICOM does not support direct printing of 3D volume dataset at the date of this document. Nevertheless a DICOM compliant print functionality may be provided by the associated 3D imaging application. Description of that functionality is outside the scope of this document.*

A possible sequence of interactions between the Print AE and the printer (i.e. a system supporting the Print Meta SOP Class as an SCP) for printing 3 images in a STANDARD\1,2 Display Format, is illustrated in the following diagram:



**Figure 6: Sequencing of Activity - Print Image**

- 1) The Print AE opens an Association with the Printer.
- 2) The current printer status is checked using an N-GET request of the Printer SOP Class.
- 3) The Print AE requests the printer to create a Film Session using an N-CREATE request of the Basic Film Session SOP Class.
- 4) The Print AE sets some printing parameters using an N-SET request of the Basic Film Session SOP Class.
- 5) The Print AE requests the printer to create a first Film Box in this Film Session using an N-CREATE request of the Basic Film Box SOP Class.
- 6) The Print AE sets some printing parameters using an N-SET request of the Basic Film Box SOP Class.
- 7) The Print AE sends to the printer the first image using an N-SET request of the Image Box SOP Class.
- 8) The Print AE sends to the printer the second image using another N-SET request of the Image Box SOP Class.
- 9) The Print AE asks the printer to print the first Film Box using an N-ACTION request of the Basic Film Box SOP Class.
- 10) The printer prints the first film sheet.

- 11) The Print AE requests the printer to delete the first Film Box using an N-DELETE request of the Basic Film Box SOP Class.
- 12) The Print AE requests the printer to create a second Film Box in this Film Session using an N-CREATE request of the Basic Film Box SOP Class.
- 13) The Print AE sets some printing parameters using an N-SET request of the Basic Film Box SOP Class
- 14) The Print AE sends to the printer the third image using an N-SET request of the Image Box SOP Class.
- 15) The Print AE asks the printer to print the second Film Box using an N-ACTION request of the Basic Film Box SOP Class.
- 16) The printer prints the second film sheet.
- 17) The Print AE requests the printer to delete the second Film Box using an N-DELETE request of the Basic Film Box SOP Class.
- 18) The Print AE requests the printer to delete the Film Session using an N-DELETE request of the Basic Film Session SOP Class.
- 19) The Print AE closes the Association.

Final completion status of the hardcopy operation is reported to the user.

#### 2.2.3.3.1.2 Proposed Presentation Contexts

The Print AE proposes Presentation Contexts as shown in the following table:

**Table 26: Proposed Presentation Contexts For Activity Print Image**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

#### 2.2.3.3.1.3 SOP Specific Conformance for all Print SOP Classes

The behavior of the Print AE during communication failure for all supported SOP Classes is summarized in the table below:

**Table 27: Print Communication Failure Behavior**

Exception	Behavior
Timeout	The Association is aborted and the final print status is updated accordingly for the user.
Association aborted by the SCP or network layers	The final print status is updated accordingly for the user.

#### 2.2.3.3.1.4 SOP Specific Conformance for the Printer SOP Class

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

- N-GET
- N-EVENT-REPORT

##### 2.2.3.3.1.4.1 Printer SOP Class Operations (N-GET)

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

**Table 28: Printer SOP Class N-GET Request Attributes**

Attribute Name	Tag	Value	Presence of Value	Source
Manufacturer	(0008,0070)	Provided by the printer	ALWAYS	PRT
Manufacturer's Model Name	(0008,1090)	Provided by the printer	ALWAYS	PRT
Device Serial Number	(0018,1000)	Provided by the printer	ALWAYS	PRT
Software Version(s)	(0018,1020)	Provided by the printer	ALWAYS	PRT
Date of Last Calibration	(0018,1200)	Provided by the printer	ALWAYS	PRT
Time of Last Calibration	(0018,1201)	Provided by the printer	ALWAYS	PRT
Printer Status	(2110,0010)	Provided by the printer	ALWAYS	PRT
Printer Status Info	(2110,0020)	Provided by the printer	ALWAYS	PRT
Printer Name	(2110,0030)	Provided by the printer	ALWAYS	PRT

The behavior of the Print AE when encountering status codes in an N-GET response is summarized in the table below.

**Table 29: Printer SOP Class N-GET Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the command successfully and returned the printer status information.
*	*	*	The status returned by the printer is ignored, and print process continues.

##### 2.2.3.3.1.4.2 Printer SOP Class Notifications (N-EVENT-REPORT)

The Print AE is capable of receiving an N-EVENT-REPORT notification at any time during an association.

The behavior of the Print AE when receiving Event Types within the N-EVENT-REPORT is summarized in the table below:

**Table 30: Printer SOP Class N-EVENT-REPORT Behavior**

Event Type Name	Event Type ID	Behavior
Normal	1	The print-job continues to be printed.
Warning	2	The print-job continues to be printed.
Failure	3	The print process is stopped, and the final print status is updated accordingly for the user.



### 2.2.3.3.1.5 SOP Specific Conformance for the Film Session SOP Class

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

- N-CREATE
- N-SET
- N-DELETE

#### 2.2.3.3.1.5.1 Film Session SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE request are listed in the table below:

**Table 31: Film Session SOP Class N-CREATE Request Attributes**

Attribute Name	Tag	Value	Presence of Value	Source
Number of Copies	(2000,0010)	1..99	ALWAYS	USER (*)

(\*) User settings are kept internally between print sessions: the source is actually USER or CONFIG.

The behavior of the Print AE when encountering status codes in an N-CREATE response is summarized in the table below.

**Table 32: Film Session SOP Class N-CREATE Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	*	*	The N-CREATE operation is considered successful.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

#### 2.2.3.3.1.5.2 Film Session SOP Class Operation (N-SET)

The attributes supplied in an N-SET request are listed in the table below:

**Table 33: Film Session SOP Class N-SET Request Attributes**

Attribute Name	Tag	Value	Presence of Value	Source
Number Of Copies	(2000,0010)	1..99	ALWAYS	USER (*)
Print Priority	(2000,0020)	LOW, MEDIUM or HIGH	ALWAYS	USER (*)
Medium Type	(2000,0030)	PAPER, CLEAR FILM or BLUE FILM	ALWAYS	USER (*)
Film Destination	(2000,0040)	MAGAZINE, PROCESSOR, or BIN_I (I = 1..10)	ALWAYS	USER (*)
Film Session Label	(2000,0050)	TROPHY	ALWAYS	AUTO

(\*) User settings are kept internally between print sessions: the source is actually USER or CONFIG.

The behavior of the Print AE when encountering status codes in an N-SET response is summarized in the table below.

**Table 34: Film Session SOP Class N-SET Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	*	*	The N-SET operation is considered successful.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

## 2.2.3.3.1.5.3 Film Session SOP Class Operations (N-DELETE)

The behavior of the Print AE when encountering status codes in an N-DELETE response is summarized in the table below.

**Table 35: Film Session SOP Class N-DELETE Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

## 2.2.3.3.1.6 SOP Specific Conformance for the Film Box SOP Class

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

- N-CREATE
- N-SET
- N-ACTION
- N-DELETE

## 2.2.3.3.1.6.1 Film Box SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE request are listed in the table below:

**Table 36: Film Box SOP Class N-CREATE Request Attributes**

Attribute Name	Tag	Value	Presence of Value	Source
Image Display Format	(2010,0010)	STANDARD\1,1 , STANDARD\1,2 or STANDARD\2,2	ALWAYS	USER (*)
Film Orientation	(2010,0040)	PORTRAIT or LANDSCAPE	ALWAYS	USER (*)
Film Size ID	(2010,0050)	8INX10IN, 85INX11IN, 10INX12IN, 10INX14IN, 11INX14IN, 11INX17IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, A4, A3	ANAP	USER (*)
Configuration Information	(2010,0150)	(According to printer conformance statement)	ANAP	USER (*)

(\*) User settings are kept internally between print sessions: the source is actually USER or CONFIG.

The behavior of the Print AE when encountering status codes in an N-CREATE response is summarized in the table below.

**Table 37: Film Box SOP Class N-CREATE Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	*	*	The N-CREATE operation is considered successful.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

## 2.2.3.3.1.6.2 Film Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET request are listed in the table below:

**Table 38: Film Box SOP Class N-SET Request Attributes**

Attribute Name	Tag	Value	Presence of Value	Source
Magnification Type	(2010,0060)	BILINEAR, CUBIC, REPLICATE or NONE	ANAP	USER (*)
Smoothing Type		(According to printer conformance statement)	ANAP	USER (*)
Border Density	(2010,0100)	BLACK, WHITE	ANAP	USER (*)
Empty Image Density	(2010,0110)	BLACK, WHITE	ANAP	USER (*)
Trim	(2010,0140)	YES or NO	ANAP	USER (*)
Min Density	(2010,0120)	(According to printer conformance statement)	ANAP	USER (*)
Max Density	(2010,0130)	(According to printer conformance statement)	ANAP	USER (*)

(\*) User settings are kept internally between print sessions: the source is actually USER or CONFIG.

The behavior of the Print AE when encountering status codes in an N-SET response is summarized in the table below.

**Table 39: Film Box SOP Class N-SET Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	*	*	The N-SET operation is considered successful.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

#### 2.2.3.3.1.6.3 Film Box SOP Class Operations (N-ACTION)

The behavior of the Print AE when encountering status codes in an N-ACTION response is summarized in the table below.

**Table 40: Film Box SOP Class N-ACTION Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. The film has been accepted for printing.
Warning	*	*	The N-ACTION operation is considered successful.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

#### 2.2.3.3.1.6.4 Film Box SOP Class Operations (N-DELETE)

The behavior of the Print AE when encountering status codes in an N-DELETE response is summarized in the table below.

**Table 41: Film Box SOP Class N-DELETE Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

#### 2.2.3.3.1.7 SOP Specific Conformance for the Image Box SOP Class

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

- N-SET

#### 2.2.3.3.1.7.1 Image Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET request are listed in the table below:

**Table 42: Image Box SOP Class N-SET Request Attributes**

Attribute Name	Tag	Value	Presence of Value	Source
Image Position	(2020,0010)	1..(NxM) (In relation with Image Display Format attribute value)	ALWAYS	AUTO
Requested Image Size	(2020,0030)	Real size of the image	COND (1)	AUTO
Basic Grayscale Image Sequence	(2020,0110)		COND (2)	AUTO
>Samples Per Pixel	(0028,0002)	1	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	MONOCHROME2	ALWAYS	AUTO
>Rows	(0028,0010)	Depends on image size	ALWAYS	AUTO
>Columns	(0028,0011)	Depends on image size	ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	1\1	ALWAYS	AUTO
>Bits Allocated	(0028,0100)	8 or 16 (*)	ALWAYS	AUTO
>Bits Stored	(0028,0101)	8 or 12 (*)	ALWAYS	AUTO
>High Bit	(0028,0102)	7 or 11 (*)	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)		ALWAYS	AUTO
Basic Color Image Sequence	(2020,0111)		COND (2)	AUTO
>Samples Per Pixel	(0028,0002)	3	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	RGB	ALWAYS	AUTO
>Planar Configuration	(0028,0006)	0	ALWAYS	AUTO
>Rows	(0028,0010)	Depends on image size	ALWAYS	AUTO
>Columns	(0028,0011)	Depends on image size	ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	1\1	ALWAYS	AUTO
>Bits Allocated	(0028,0100)	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	8	ALWAYS	AUTO
>High Bit	(0028,0102)	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)		ALWAYS	AUTO

(1) Conditional, see True Size Mode note below.

(2) Conditional, depending on the SOP Class supported (configurable), negotiated and selected.

*Note about True Size Mode: The user can decide or not to print some images in True Size mode. In the current implementation of Trophy DICOM, **True Size** mode for **Intra-Oral SOP Instances** is based on the **Imager Pixel Spacing** attribute of the image, if present. For other **non Intra-Oral Instances**, the True Size mode refers to the **desired print width** provided by the user.*

The behavior of the Print AE when encountering status codes in an N-SET response is summarized in the table below.

**Table 43: Image Box SOP Class N-SET Responses Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	*	*	The N-SET operation is considered successful.
*	*	*	The Association is aborted using A-ABORT and the final print status is updated accordingly for the user.

#### *2.2.3.3.1.8 SOP Specific Conformance for Verification SOP Class*

The Print AE provides Standard Conformance for the Verification SOP Class as an SCU.

*Note: The Print AE initiates a Verification request prior to any Print Image operation. In case of failure, a dialog error box is presented to the user. Verification and Print Image operations are performed over different Associations.*

#### **2.2.3.4 Association Acceptance Policy**

The Print AE does not accept Associations.

## 2.2.4 Find AE Specifications

### 2.2.4.1 SOP Classes

The Find AE provides Standard Conformance to the following SOP Classes:

**Table 44: SOP Classes for Find AE**

SOP Class Name	SOP Class UID	SCU	SCP
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

The Find AE provides conformance only to the Hierarchical Search method of the C-FIND SCU Baseline Behavior as defined in the DICOM Standard.

### 2.2.4.2 Association Policies

#### 2.2.4.2.1 General

The Find AE Always proposes the DICOM standard application context name for DICOM 3.0.

**Table 45: DICOM Application Context for Find AE**

<b>Application Context Name</b>	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

#### 2.2.4.2.2 Number of Associations

The Find AE initiates one Association at a time for each configured Q&R server. Nevertheless, multiple Q&R servers can be configured into Trophy DICOM.

**Table 46: Number of Associations as an Association Initiator for Find AE**

<b>Maximum number of simultaneous associations</b>	1
--	---

#### 2.2.4.2.3 Asynchronous Nature

The Find AE does not support negotiation of multiple outstanding transactions over a single Association, i.e. asynchronous communication.

**Table 47: Asynchronous Nature as an Association Initiator for Find AE**

<b>Maximum number of outstanding asynchronous transactions</b>	1
--	---

#### 2.2.4.2.4 Implementation Identifying Information

The implementation information for the Find AE is actually provided by the underlying Etiam DicomSuite Toolkit library implementation. At the date of this document, for the Toolkit version described in section 1.3, this information is:

**Table 48: DICOM Implementation Class and Version for Find AE**

<b>Implementation Class UID</b>	1.2.250.1.59.3.0.3.5.3
<b>Implementation Version Name</b>	ETIAM_DCMTK_353

### 2.2.4.3 Association Initiation Policy

#### 2.2.4.3.1 Activity – Query Composite Instances

##### 2.2.4.3.1.1 Description and Sequencing of Activities

Request for composite instance list update is initiated by user interaction. Such request is done in two steps logic. Based on the Information Model supported by the associated remote AE as specified within Trophy DICOM, the user has, in a first step, to query the remote AE for entries of the top level of the associated information model (i.e. PATIENT entries for the Patient Root Information Model, and STUDY entries for the Study Root Information Model). In a second step, selecting an entry returned by the first query, the user can then request all associated composite instances. Such subsequent queries are actually automatically performed by the Find AE recursively for all elements returned from the top selected level down to the composite instance level.

The user can perform queries with or without search criteria. In the later case, a dialog window, used to enter search criteria, is available to the user in order to perform this interactive query. This dialog window offers the ability, in one single location, to enter search criteria for parameters belonging to the different levels of the information model. Those search criteria are then automatically used for all subsequent queries performed by the Find AE. Refer to section 2.2.4.3.1.3 for more information on such attribute management.

Upon initiation of the user request, for an update of the Information Model top level entries (i.e. patients or studies), the Find AE builds an identifier for the C-FIND request, which includes the search criteria, if any, initiates an Association to the remote AE, and waits for Query responses. After retrieval of all the responses, the Find AE constructs an internal dataset of the matching entries returned, and passes it back to Trophy DICOM. Trophy DICOM, then, displays the resulting data to the user in a specific dialog list, which will be cleared the next time the user will require such update.

When the DICOM Q&R Patient Root Information Model is setup for the remote AE, the list returned by the remote AE represents the list of patients matching the user criteria as entered thru the user interface filter dialog window of the application.

At that point, the user can ask for a composite instance list update, based on criteria entered thru the user interface filter dialog window of the application, of a specific entry selected in that patient list. The Find AE performs then a recursive set of queries to the remote AE for all composite instances belonging to all series belonging to all studies of the selected patient. For each of those sub-queries, the Find AE establishes a new Association to the remote AE and transfers the request that includes the user selected matching criteria for a given level of the information model.

After retrieval of all the responses, the Find AE constructs an internal dataset of the matching composite instances returned, and passes it back to Trophy DICOM. Trophy DICOM, then, displays the resulting data to the user in a second dialog list, which will be cleared either the next time the user will require a patient list update or the next time she will require such composite instance list for another patient.

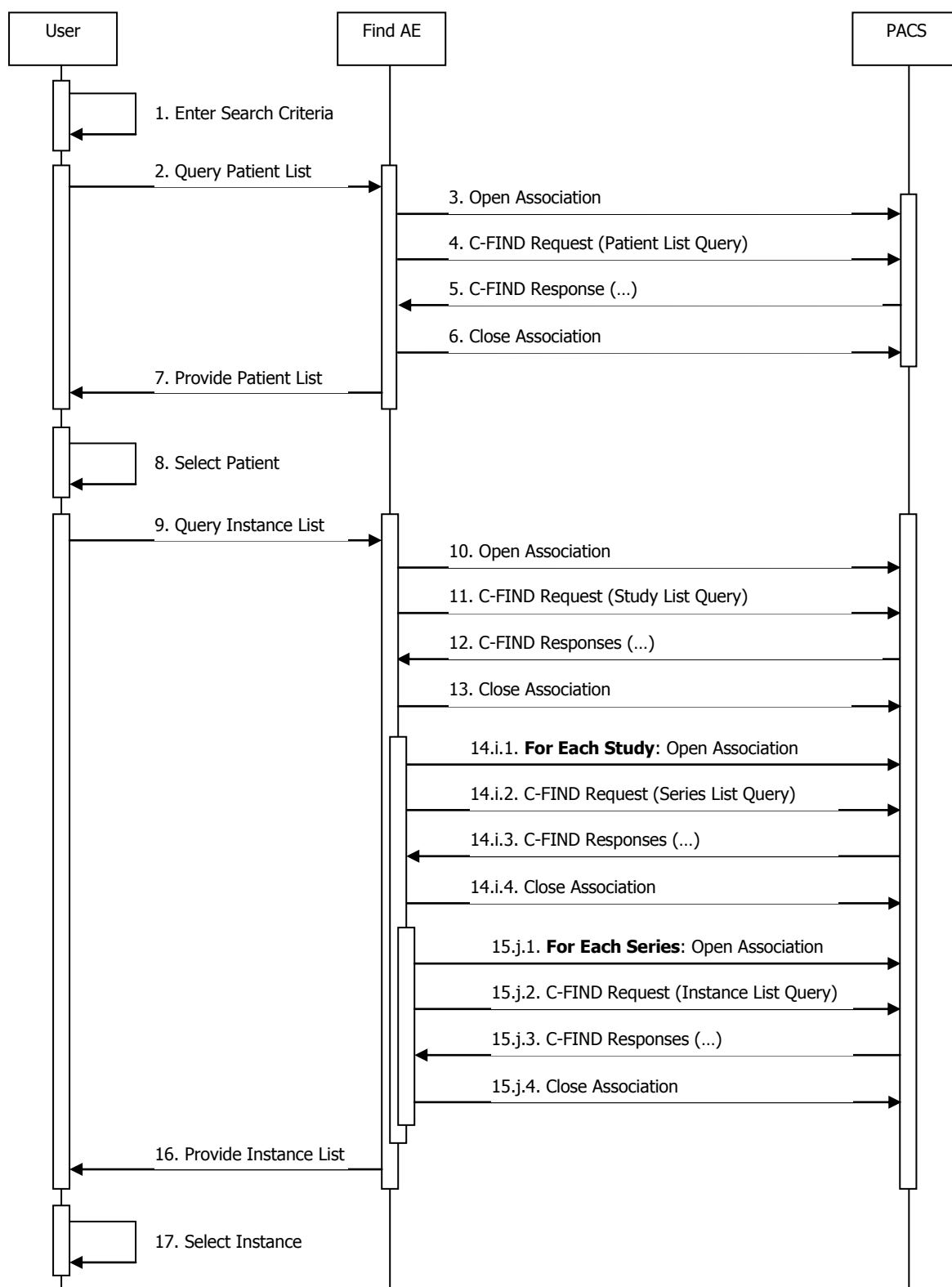
When the DICOM Q&R Study Root Information Model is setup for the remote AE, the list returned by the remote AE represents the list of studies matching the user criteria as entered thru the user interface filter dialog window of the application.

At that point, the user can ask for a composite instance list update, based on criteria entered thru the user interface filter dialog window of the application, of a specific entry selected in that study list. The Find AE performs then a recursive set of queries to the remote AE for all composite instances belonging to all series of the selected study. For each of those sub-queries, the Find AE establishes a new Association to the remote AE and transfers the request that includes the user selected matching criteria for a given level of the information model.

After retrieval of all the responses, the Find AE constructs an internal dataset of the matching composite instances returned, and passes it back to Trophy DICOM. Trophy DICOM, then, displays the resulting data to the user in a second dialog list, which will be cleared either the next time the user will require a study list update or the next time she will require such composite instance list for another study.

The Find AE initiates the required Associations, in order to issue the C-FIND requests, according to the Information Model setup while configuring the related Q&R remote AE server, i.e. either the Patient Root Q&R Information Model – FIND or the Study Root Q&R Information Model – FIND.

A possible sequence of interactions between the Find AE and a PACS system (i.e. a system supporting the Query/Retrieve SOP Class as an SCP) is illustrated in the following diagram, for the DICOM Q&R Patient Root Information Model:



**Figure 7: Sequencing of Activity – Query Composite Instances**

- 1) The user enters search criteria for all levels of the Information Model.
- 2) The user requests the Find AE to return matching patient list.



- 3) The Find AE opens an Association with the PACS system.
- 4) The Find AE sends a C-FIND request to the PACS containing the patient query attributes and search criteria.
- 5) The PACS returns C-FIND responses containing the requested attributes of all matching patient entries.
- 6) The Find AE closes the Association with the PACS.
- 7) The Find AE provides the user with the patient list returned.
- 8) The user selects a specific patient.
- 9) The user requests the Find AE to return matching instance list for the selected patient.
- 10) The Find AE opens an Association with the PACS system.
- 11) The Find AE sends a C-FIND request to the PACS containing the study query attributes and search criteria.
- 12) The PACS returns C-FIND responses containing the requested attributes of all matching study entries of the given patient.
- 13) The Find AE closes the Association with the PACS.
- 14) The Find AE performs the same type of operations to retrieve all the series belonging to each study returned by the PACS system.
- 15) The Find AE performs again the same type of operations for retrieve finally all the composite instances belonging to each series returned by the PACS system.
- 16) The Find AE provides the user with the all the instance lists returned.
- 17) The user can then select a specific set of instances for further actions.

*Note: The purpose and specific actions the user can perform on the selected instance(s) is outside the scope of the Find AE. Refer to section 2.2.5 for more information.*

#### 2.2.4.3.1.2 Proposed Presentation Contexts

The Find AE proposes Presentation Contexts as shown in the following table:

**Table 49: Proposed Presentation Contexts For Activity Query Composite Instances**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

The Find AE does not perform any extended negotiation: The Find AE provides conformance only to the Hierarchical Search method of the C-FIND SCU Baseline Behavior as defined in the DICOM Standard.

#### 2.2.4.3.1.3 SOP Specific Conformance for Q&R SOP Class

The behavior of the Find AE when encountering status codes in a Q&R C-FIND response is summarized in the table below. If the Find AE receives any other SCP response status than Success or Pending, the Association is closed and the data entries already correctly returned are presented to the user.

**Table 50: Q&R C-FIND Response Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has successfully returned all matching information. Data entries are available for further processing.
Pending	Matches are continuing	FF0*	The data entry contained in the identifier is collected for further processing
*	*	*	The Association is aborted using A-ABORT and the Query is marked as globally failed. All already retrieved entries are returned to the user.

The behavior of the Find AE during communication failure is summarized in the table below:

**Table 51: Q&R Communication Failure Behavior**

Exception	Behavior
Timeout	The Association is aborted and the Query is marked as globally failed. No data entry is returned to the user.
Association aborted by the SCP or network layers	The Query is marked as globally failed. No data entry is returned to the user.

No CANCEL requests are ever issued by the Find AE.

The tables below provide a description of the Find AE query identifiers and support for Optional Keys.

Unexpected attributes returned in a C-FIND response are ignored, while requested optional attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional keys are ignored. No attempt is made to filter out possible duplicate entries.

*Note: this table is based on the underlying Etiam DicomSuite Toolkit library implementation specifications.*

**Table 52: Patient Root Q&R Information Model Request Identifier**

Q&R Level Attribute Name	Tag	Type	Q	M	D
<b>PATIENT</b>					
Patient's Name	(0010,0010)	R	Y	ANY	Y
Patient ID	(0010,0020)	U	Y	ANY	Y
Patient's Birth Date	(0010,0030)	O			Y
Patient's Sex	(0010,0040)	O			Y
<b>STUDY</b>					
Study Date	(0008,0020)	R	Y	SV-RG	Y
Study Time	(0008,0030)	R			
Accession Number	(0008,0050)	R	Y	ANY	Y
Study ID	(0020,0010)	R	Y	ANY	Y
Study Instance UID	(0020,000D)	U			
Referring Physician's Name	(0008,0090)	O			
Study Description	(0008,1030)	O			Y
Name Of Physicians Reading the Study	(0008,1060)	O			
<b>SERIES</b>					
Modality	(0008,0060)	R	Y	ANY	Y

Series Number	(0020,0011)	R			Y
Series Instance UID	(0020,000E)	U			
Series Description	(0008,103E)	O			Y
<b>INSTANCE</b>					
Instance Number	(0020,0013)	R			Y
SOP Instance UID	(0008,0018)	U			

**Table 53: Study Root Q&R Information Model Request Identifier**

Q&R Level Attribute Name	Tag	Type	Q	M	D
<b>STUDY</b>					
Study Date	(0008,0020)	R	Y	SV-RG	Y
Study Time	(0008,0030)	R			
Accession Number	(0008,0050)	R	Y	ANY	Y
Patient's Name	(0010,0010)	R	Y	ANY	Y
Patient ID	(0010,0020)	R	Y	ANY	Y
Study ID	(0020,0010)	R	Y	ANY	Y
Study Instance UID	(0020,000D)	U			
Referring Physician's Name	(0008,0090)	O			
Study Description	(0008,1030)	O			Y
Name Of Physicians Reading the Study	(0008,1060)	O			
Patient's Birth Date	(0010,0030)	O			
Patient's Sex	(0010,0040)	O			
<b>SERIES</b>					
Modality	(0008,0060)	R	Y	ANY	Y
Series Number	(0020,0011)	R			Y
Series Instance UID	(0020,000E)	U			
Series Description	(0008,103E)	O			Y
<b>INSTANCE</b>					
Instance Number	(0020,0013)	R			Y
SOP Instance UID	(0008,0018)	U			

The tables above should be read as follows:

Q: A "Y" indicates that the Find AE will supply this attribute as matching key, if entered by the user in the dialog user interface.

*Note: For the Patient's Name, only the Last Name component is actually used.*

M: "SV-RG" indicates that the Find AE may supply the attribute value for either Single Value or Range Matching. "ANY" indicates that the Find AE may supply the attribute for Single Value, Wildcard or Multiple Value matching, based on the user inputs (thru the GUI).

D: A "Y" indicates that Trophy DICOM presents the attribute in the different lists for user selection.

*Note: The Find AE will supply all the attributes described above as Return Key with zero length for Universal Matching if not used as Matching Keys.*

#### **2.2.4.3.1.4 SOP Specific Conformance for Verification SOP Class**

The Find AE provides Standard Conformance for the Verification SOP Class as an SCU.

*Note: The Find AE initiates a Verification request prior to any main Query operations initiated by the user. In case of failure, a dialog error box is presented to the user. Verification and Query operations are performed over different Associations.*

#### **2.2.4.4 Association Acceptance Policy**

The Find AE does not accept Associations.

## 2.2.5 Move AE Specifications

### 2.2.5.1 SOP Classes

The Move AE provides Standard Conformance to the following SOP Classes:

**Table 54: SOP Classes for Move AE**

SOP Class Name	SOP Class UID	SCU	SCP
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

The Move AE provides conformance only to the Hierarchical Search method of the C-MOVE SCU Baseline Behavior as defined in the DICOM Standard.

### 2.2.5.2 Association Policies

#### 2.2.5.2.1 General

The Move AE Always proposes the DICOM standard application context name for DICOM 3.0.

**Table 55: DICOM Application Context for Move AE**

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

#### 2.2.5.2.2 Number of Associations

The Move AE initiates one Association at a time for each configured Q&R server. Nevertheless, multiple Q&R servers can be configured into Trophy DICOM.

**Table 56: Number of Associations as an Association Initiator for Move AE**

Maximum number of simultaneous associations	1
---	---

#### 2.2.5.2.3 Asynchronous Nature

The Move AE does not support negotiation of multiple outstanding transactions over a single Association, i.e. asynchronous communication.

**Table 57: Asynchronous Nature as an Association Initiator for Move AE**

Maximum number of outstanding asynchronous transactions	1
---	---

#### 2.2.5.2.4 Implementation Identifying Information

The implementation information for the Move AE is actually provided by the underlying Etiam DicomSuite Toolkit library implementation. At the date of this document, for the Toolkit version described in section 1.3, this information is:

**Table 58: DICOM Implementation Class and Version for Move AE**

Implementation Class UID	1.2.250.1.59.3.0.3.5.3
Implementation Version Name	ETIAM_DCMTK_353

### 2.2.5.3 Association Initiation Policy

#### 2.2.5.3.1 Activity – Retrieve Composite Instances

##### 2.2.5.3.1.1 Description and Sequencing of Activities

Request for composite instance retrieval is initiated by user interaction.

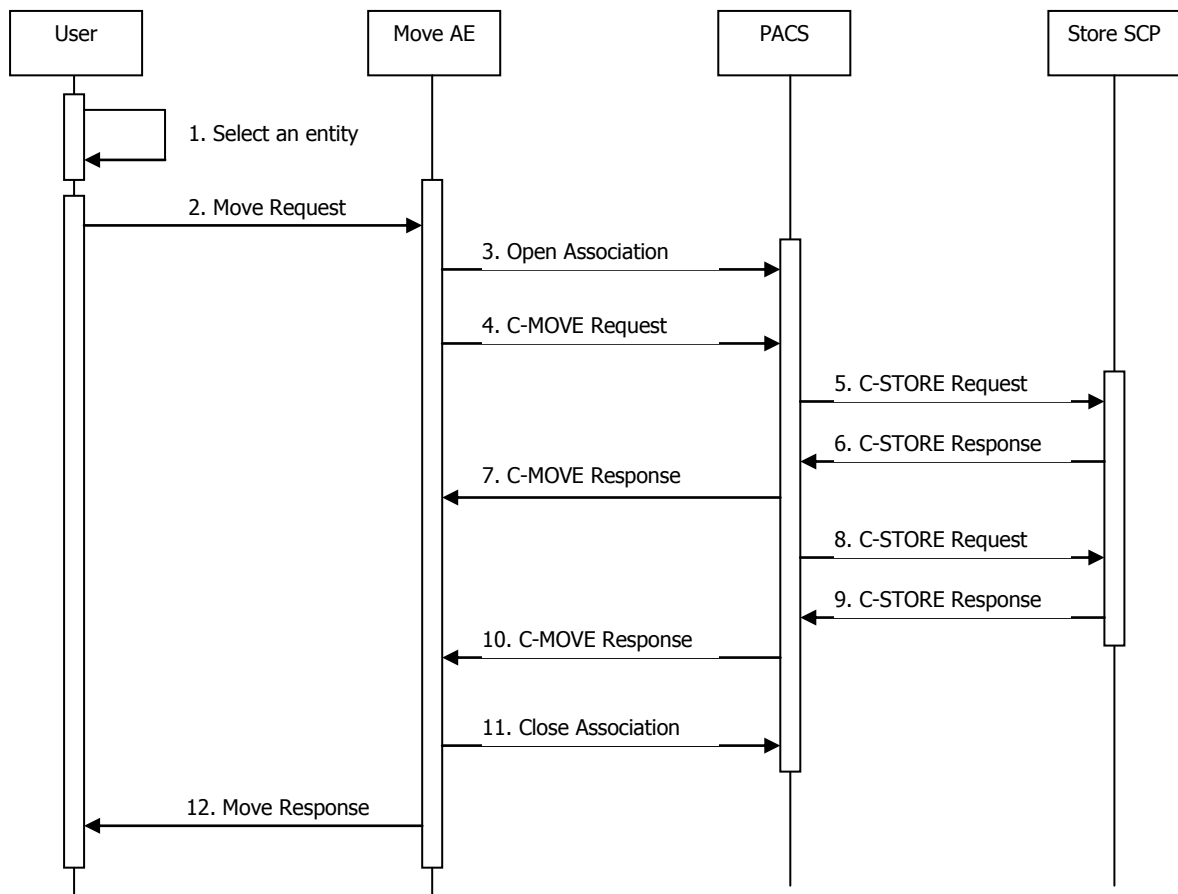
As described for the Find AE, depending on the Q&R Information Model setup for the remote AE, the Move AE allows the user to retrieve all the composite instances belonging either to a study or a series, or a list of individual composite instances belonging to a patient or a study, selected in one of the lists presented to the user.

The Move AE is also designed to let the user forward to a given third-tier final destination Storage SCP AE the selected entities.

Upon initiation of the user request, the Move AE builds an identifier for the C-MOVE request, which includes the level of retrieval, the matching entity values and the destination AE title, initiates an Association to the remote AE, and waits for the final Move response (i.e. the final status of all C-STORE sub-operations returned by the remote AE).

The Move AE initiates the required Associations, in order to issue the C-MOVE requests, according to the Information Model setup while configuring the related Q&R remote AE server, i.e. either the Patient Root Q&R Information Model – MOVE or the Study Root Q&R Information Model – MOVE.

A possible sequence of interactions between the Move AE and a PACS system (i.e. a system supporting the Query/Retrieve SOP Class as an SCP) is illustrated in the following diagram:



**Figure 9: Sequencing of Activity – Retrieve Composite Instances**

- 1) The user selects an entity to move to a specific destination storage server.
- 2) The user requests the Move AE to move the selected entity.
- 3) The Move AE opens an Association with the PACS system.
- 4) The Move AE sends a C-MOVE request to the PACS containing the associated Move identifier.
- 5) The PACS system initiates a C-STORE sub-operation to the destination Store SCP for the first matching entry found in its database.

- 6) The Store SCP returns the status of the C-STORE sub-operation to the PACS system.
- 7) The PACS system sends to the Move AE a C-MOVE response with a status of Pending.
- 8) The PACS system initiates a second C-STORE sub-operation to the destination Store SCP for the last matching entry found in its database.
- 9) The Store SCP returns the status of the C-STORE sub-operation to the PACS system.
- 10) The PACS system sends to the Move AE a C-MOVE response with a status of Success.
- 11) The Move AE closes the Association with the PACS.
- 12) The Move AE returns to the user the final status of the Move request.

*Note: when retrieving composite instances locally into the Trophy DICOM Patient Database, the destination AE title provided to the PACS system (i.e. the Q&R SCP system) refers to the Storage SCP as described in section 2.2.6.*

#### 2.2.5.3.1.2 Proposed Presentation Contexts

The Move AE proposes Presentation Contexts as shown in the following table:

**Table 59: Proposed Presentation Contexts For Activity Retrieve Composite Instances**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

The Move AE does not perform any extended negotiation: The Move AE provides conformance only to the Hierarchical Search method of the C-MOVE SCU Baseline Behavior as defined in the DICOM Standard.

#### 2.2.5.3.1.3 SOP Specific Conformance for Q&R SOP Class

The behavior of the Move AE when encountering status codes in a Q&R C-MOVE response is summarized in the table below. If the Move AE receives any other SCP response status than Success or Pending, the Association is closed and no other information than a globally failed status is returned to the user (e.g. the list of already successfully moved entities for is not provided to the user).

**Table 60: Q&R C-MOVE Response Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Moving is complete	0000	The SCP has successfully moved all required entities.
Pending	Moving are continuing	FF00	Entities are still moved by the SCP.
*	*	*	The Association is aborted using A-ABORT and the Move request is marked as globally failed. List of already moved instances is not provided to the user.

The behavior of the Move AE during communication failure is summarized in the table below:

**Table 61: Q&R Communication Failure Behavior**

Exception	Behavior
Timeout	The Association is aborted and the Move request is marked as globally failed. List of already moved instances is not provided to the user.
Association aborted by the SCP or network layers	The Move request is marked as globally failed. List of already moved instances is not provided to the user.

No CANCEL requests are ever issued by the Move AE.

The Move AE may supply Unique Key values for the following levels:

**Table 62: Supported Q&R of the Move AE**

Q&R Levels
STUDY
SERIES
INSTANCE

In order to prevent unexpected and unpredictable results, the Move AE does not support retrieval of composite instances at the PATIENT level.

The Move AE never provides a list of matching UID whatever the Q&R level being used: only Single Value Matching is issued per requests, i.e. the Move AE orders the move of only one entity per request. Therefore, the Move AE will issue separate requests for retrieving a list of individual user selected composite instances.

#### **2.2.5.4 Association Acceptance Policy**

The Move AE does not accept Associations.



## 2.2.6 Store-SCP AE Specifications

### 2.2.6.1 SOP Classes

The Store-SCP AE provides Standard Conformance to the following SOP Classes:

**Table 63: SOP Classes for Store-SCP AE**

SOP Class Name	SOP Class UID	SCU	SCP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
Digital Intra-Oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Digital Intra-Oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
Verification	1.2.840.10008.1.1	No	Yes

The Store-SCP AE may provides Standard Conformance for other Storage SOP Classes: nevertheless, it is not guaranteed that neither Trophy DICOM nor the associated imaging application will be able to handle properly such SOP Classes.

### 2.2.6.2 Association Policies

#### 2.2.6.2.1 General

The Store-SCP AE will never initiate Associations; it only accepts Association requests from remote AE. The Store-SCP will accept Associations for Verification and Storage requests.

The Store-SCP AE always accepts the DICOM standard application context name for DICOM 3.0.

**Table 64: DICOM Application Context for Store-SCP AE**

<b>Application Context Name</b>	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

#### 2.2.6.2.2 Number of Associations

The Store-SCP AE can support multiple simultaneous Associations. The Store-SCP AE accepts up to 10 Associations at a time. This maximum number is actually user configurable to offer a better system load balancing to the user.

**Table 65: Number of Associations as an Association Acceptor for Store-SCP AE**

<b>Maximum number of simultaneous associations</b>	10 (Configurable)
--	-------------------

#### 2.2.6.2.3 Asynchronous Nature

The Store-SCP AE does not support negotiation of multiple outstanding transactions over a single Association, i.e. asynchronous communication. All Associations requests shall be completed and acknowledged before a new operation is initiated.

**Table 66: Asynchronous Nature as an Association Acceptor for Store-SCP AE**

<b>Maximum number of outstanding asynchronous transactions</b>	1
--	---

#### 2.2.6.2.4 Implementation Identifying Information

The implementation information for the Store-SCP AE is actually provided by the underlying Etiam DicomSuite Toolkit library implementation. At the date of this document, for the Toolkit version described in section 1.3, this information is:

**Table 67: DICOM Implementation Class and Version for Store-SCP AE**

<b>Implementation Class UID</b>	1.2.250.1.59.3.0.3.5.2
<b>Implementation Version Name</b>	ETIAM_DCMTK_352B

#### 2.2.6.2.5 Maximum PDU Size

The Store-SCP AE supports a maximum PDU size of 64K bytes. The value is actually configurable from 4K to 64K

**Table 68: Maximum PDU Size for Store-SCP AE**

<b>Maximum PDU Size</b>	64K bytes
-------------------------	-----------

### 2.2.6.3 Association Initiation Policy

The Store-SCP does not initiate Associations.

### 2.2.6.4 Association Acceptance Policy

#### 2.2.6.4.1 Activity – Receive Composite Instances

##### 2.2.6.4.1.1 Description and Sequencing of Activities

The Store-SCP listen for incoming Association requests from remote AE.

When an Association is opened by a remote AE for composite instance transfer, the Store-SCP AE creates a new file in a configurable directory for storing temporarily the composite instance using the composite instance UID as file name. If the same composite instance is received twice before being processed by Trophy DICOM, the file is overwritten.

**Warning:** if, for some reasons, the Calling AE Title provided by the remote AE is not the same as the one configured for the Store-SCP AE, received images may be stored locally into a subdirectory of the configured import directory. The name of the provided AE Title will be used as subdirectory name.

When Trophy DICOM is ready to process a composite instance received by the Store-SCP AE (using a File System Watcher on the temporary storage directory), the file is first moved to a trashcan sub-directory before being decoded and imported into the Trophy DICOM Patient Database. This two steps process prevents Trophy DICOM from trying to process infinitely wrong or non-composite instance related files found into the temporary storage directory.

If a composite instance received file can be properly decoded, it is then moved to the associated patient data directory into the Trophy DICOM Patient Database. Patient matching is performed on the Patient ID attribute extracted from the composite instance. If no patient already exists into the Trophy DICOM Patient Database, a new one is created.

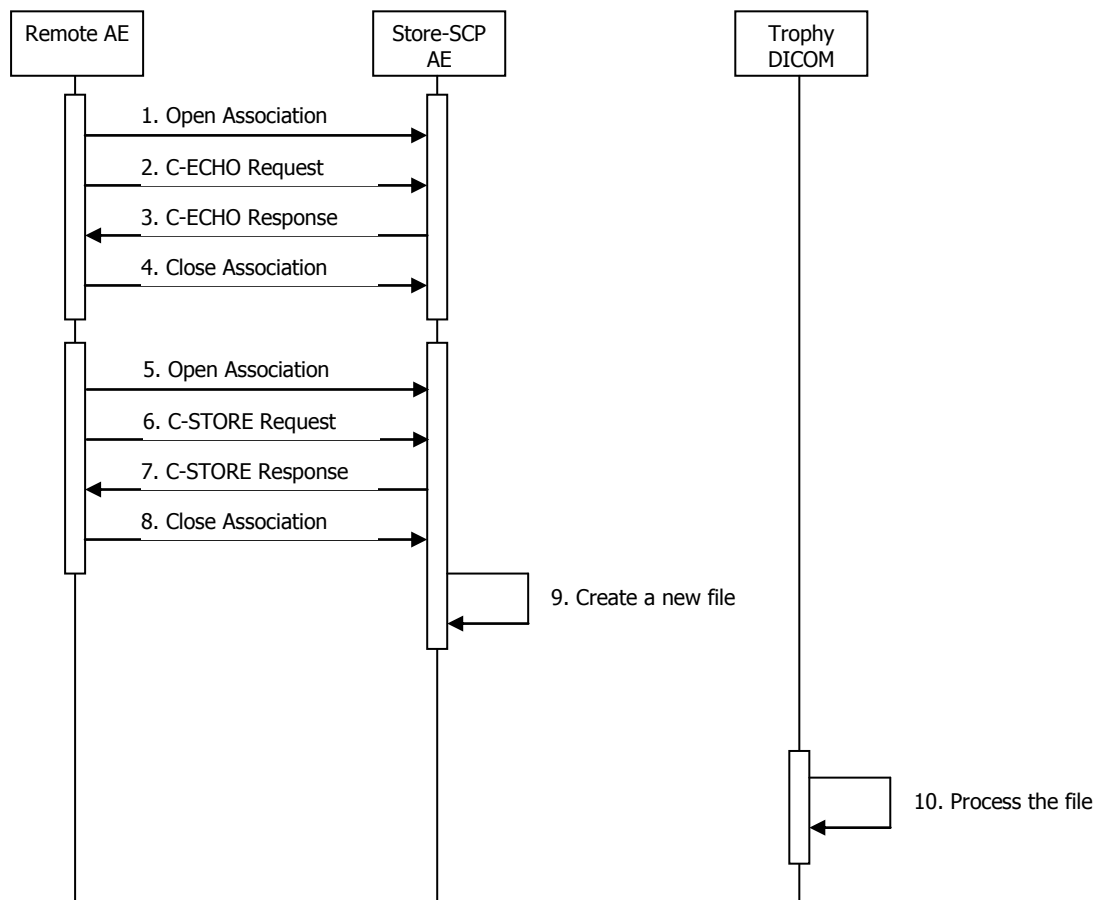
*Note: When a 3D volume dataset created originally by Trophy equipment is received, a subdirectory of the patient data directory is actually created (based on the Series Instance UID information) for storing the dataset, in order to ensure and ease that dataset management by the associated 3D imaging application.*

While moving a valid composite instance file to its final patient data directory, Trophy DICOM renames the file using a unique file name. This allows composite instance duplication into the Trophy DICOM Patient Database.

*Note: This assertion is not true for 3D volume dataset slice files. In that case, each slice file is named according to the associated Instance Number information, and replaces therefore any existing file within the final patient data subdirectory with the same file name. This is done to prevent unexpected duplication of slices for a given 3D volume dataset, and to enable overriding of any damaged data files.*

When an Association is opened by a remote AE for verification, the Store-SCP AE processes on its own the request.

A possible sequence of interactions between a remote AE and the Store-SCP AE is illustrated in the following diagram:



**Figure 8: Sequencing of Activity – Receive Composite Instances**

- 1) The Worklist AE opens an Association with the RIS system.
- 2) The Worklist AE sends a C-FIND request to the RIS containing the Worklist Query attributes and search criteria.

*Note: Trophy DICOM detects new file creation using a File System Watcher (for file creation and or modification) and a System Timer. Under normal circumstances (no file activity), the timer is armed with a timeout value of 30 seconds. When a file creation or modification is detected, the timeout value is reduced to 2 seconds. File processing actually occurs when the timeout expired, preventing Trophy DICOM from trying to access a file still being filled by the Store-SCP AE. At the end of the file-processing step, the timer is reset to its original value.*

*Note: The Store-SCP AE may be configured for receiving composite instances even if Trophy DICOM is not currently running. In such case, associated files will be processed the next time Trophy DICOM is started.*

#### 2.2.6.4.1.2 Accepted Presentation Contexts

The Store-SCP AE accepts Presentation Contexts as shown in the following table:

**Table 69: Acceptable Presentation Contexts For Activity Receive Images**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Refer to table above for Storage SOP Classes	Refer to table above for Storage SOP Classes	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51		
		JPEG Lossless, Non-Hierarchical First-Order Prediction (Process 14)	1.2.840.10008.1.2.4.70		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Due to the underlying Etiam libraries used in the DICOM implementation of Trophy DICOM, the Store-SCP AE may accept more Transfer Syntaxes for the SOP Classes listed in the table above, or even other Presentation Contexts for other Storage SOP Classes: nevertheless, it is not guaranteed that neither Trophy DICOM nor the associated imaging application will be able to handle properly such SOP Classes or Transfer Syntaxes.

##### 2.2.6.4.1.2.1 Transfer Syntax Selection Policy

The Store-SCP AE can be configured to accept or not compressed Transfer Syntaxes. If compression is accepted, the Store-SCP AE can be also configured to prefer or not compressed rather than uncompressed Transfer Syntaxes, if any is proposed.

##### 2.2.6.4.1.2.2 Extended Negotiation

No extended negotiation is performed, though Store-SCP AE:

- Is a Level 2 Storage SCP (Full – does not discard any data element)
- Does not coerce any received data elements

##### 2.2.6.4.1.3 SOP Specific Conformance for Storage SOP Classes

The Store-SCP AE provides Standard Conformance for the Storage SOP Classes listed in the table above as an SCP.

The Store-SCP AE retains the original DICOM data related to a received composite instance in a DICOM Part 10 compliant file format. The Source Application Entity Title attribute (0002,0016) is set in this file to the sending remote AE title. In additions, all Private and SOP Class Extended Elements are maintained in the DICOM format files.

#### *2.2.6.4.1.4 SOP Specific Conformance for Verification SOP Class*

The Store-SCP AE provides Standard Conformance for the Verification SOP Class as an SCP.

## 2.3 Network Interfaces

### 2.3.1 Physical Network Interface

Trophy DICOM inherits the TCP/IP stack from the Microsoft Windows Operating System upon which it executes.

### 2.3.2 Additional Protocols

DHCP protocol can be used to obtain TCP/IP network configuration information.

DNS protocol or NetBT (NetBIOS over TCP/IP for small network segment) can be used for name resolution (remote system identification by name): If available, name resolution allows using Hostname instead of TCP/IP addresses while configuring remote systems (see section 2.4)

## 2.4 Configuration

Trophy DICOM provides the ability to configure "server connections". A server connection is an entity identified by a user configurable name, corresponding to the association of the following local and remote parameters:

- 1) Local parameters:
  - Calling AE Title
- 2) Remote parameters:
  - Called AE Title
  - IP Address or Hostname
  - Port Number

For each server connection, the supported DICOM services may be specified.

More than one server connection can be defined to the same physical remote server (this features can be used for defining different profiles for hardcopy devices for example).

When several "server connections" have been defined for a given DICOM Service Class, Trophy DICOM provides the user with the capability of selecting a specific server connection on the fly during user interactions, the selected server connection becoming the default one for the next user operation.

Refer to [3] for more information on Trophy DICOM DICOM configuration.

### 2.4.1 AE Title/Presentation Address Mapping

#### 2.4.1.1 Local AE Titles

All local AE Titles (Calling AE Titles) are user configurable per server connection.

**Table 70: AE Titles Configuration Table**

Application Entity	Default AE Title	Default TCP/IP Port
Worklist	No default	Not Applicable (SCU only)
Store-SCU	No default	Not Applicable (SCU only)
Print	No default	Not Applicable (SCU only)
Find	No default	Not Applicable (SCU only)
Move	No default	Not Applicable (SCU only)
Store-SCP	No default	No default

**2.4.1.2 Remote AE Title/Presentation Address Mapping**

The Remote AE Titles (Called AE Titles), hostnames (or IP Addresses) and Port Numbers are user configurable per server connection.

For each Trophy DICOM AE, multiple remote AE SCP can be defined. The user depending on SCP availability can then choose defaults.

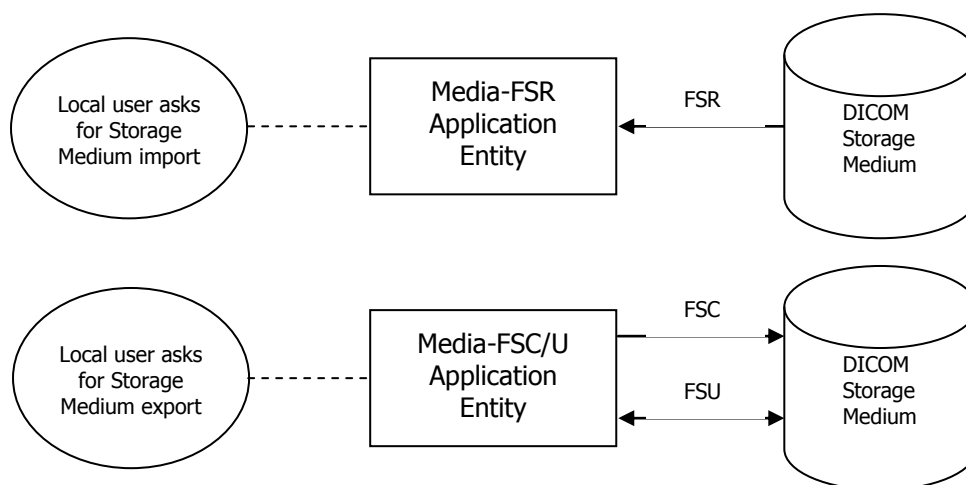
**2.4.2 Parameters**

Trophy DICOM inherits most of the parameters from the underlying ETIAM DicomSuite Toolkit library implementation. Therefore, those parameters are fixed and not configurable.

## 3 MEDIA INTERCHANGE

### 3.1 Implementation Model

#### 3.1.1 Application Data Flow Diagram



**Figure 9: Application Data Flow Diagram – Media Interchange**

- 1) The Media-FSR AE reads and decodes Storage Medium DICOM File Set (DICOMDIR) information to the user, allowing composite instance import into the Trophy DICOM Patient Database.
- 2) The Media-FSC/U AE creates or updates a Storage Medium DICOM File Set (DICOMDIR) with composite instance selected by the user into the Trophy DICOM Patient Database.

#### 3.1.2 Functional Definitions of AE's

##### 3.1.2.1 Functional Definition of Media-FSR Application Entity

The Media-FSR AE is used to import images into the Trophy DICOM Patient Database. The Media-FSR AE reads the content of the Storage Medium and the resulting data are used to present to the user the patient list found into the DICOMDIR structure. The user can then select a patient and explore the list of associated images. At that level, the user can either preview images or decides to import specific images into the Trophy DICOM Patient Database.

*Note: The set of image types Trophy DICOM can actually import into its patient database may be limited by the associated imaging application capabilities.*

*Note: Trophy DICOM does not support 3D volume dataset import at the date of this document. Nevertheless the associated 3D imaging application may provide such functionality. Description of that functionality is outside the scope of this document.*

##### 3.1.2.2 Function Definition of Media-FSC/U Application Entity

The Media-FCS/U AE is used to export images or composite instances from the Trophy DICOM Patient Database onto a Storage Medium File Set. If a DICOMDIR File Set already exists at the Storage Medium mount point, it is updated; otherwise a blank new one is created. The export process to the same Storage Medium can be performed as many time as necessary by the user: in this case, from a DICOMDIR File Set structure point of view, a new file system sub-directory of the Storage Medium mount point is created for each export sequence.



The Media-FCS/U AE provides the user with the ability to select the Application Profile to be used while creating a new DICOMDIR File Set. The Media-FCS/U AE in this case performs automatically any image conversion required by the selected Application Profile.

*Note: At the date of the document, Trophy DICOM supports now 3D volume dataset export. Nevertheless such export is performed at a volume level (as a whole), i.e. export of individual slices is impossible.*

### 3.1.3 Sequencing of Real-World Activities

The Media-FSR AE requires the user, in a first step, to insert a removable media in order to be able to select the associated Storage Medium mount point.

The Media-FSC/U AE requires the removable media to be writable. If not, the user can select a writable file system directory for Storage Medium creation or update. The process of copying the resulting Storage Medium File Set onto the removable media is outside the scope of this document.

### 3.1.4 File Meta Information for Implementation Class and Version

Not Applicable for the Media-FSR AE, the following values are assigned to the associated File Meta Information attributes by the Media-FSC/U AE:

**Table 71: File Meta Information Attributes**

Attribute	Tag	Value
File Meta Information Version	(0002,0001)	1
Implementation Class UID	(0002,0012)	1.2.250.1.59.453.252
Implementation Version Name	(0002,0013)	ACC_ETIAM_252

## 3.2 AE Specifications

### 3.2.1 Media-FSR AE Specifications

The Media-FSR AE provides Standard Conformance to the Media Storage Service Class. The Application Profiles and Roles for the Import Images activity are listed in the following table:

**Table 72: Media-FSR AE Related Application Profiles, Real-World Activities, and Roles**

Supported Application Profile	Real-World Activity	Roles
STD-GEN-CD	Import Images	FSR
STD-DEN-CD	Import Images	FSR

*Note: The import activity can actually be performed on any type of Storage Medium, as long as recognized as a directory entry into the File System by the underlying Microsoft Windows Operating System.*

#### 3.2.1.1 File Meta Information for the Removable Media Application Entity

Not Applicable (FSR only).

#### 3.2.1.2 Real-World Activities

##### 3.2.1.2.1 Activity – Import Images

When the user wants to explore the list of images present on a Storage Medium, the Media-FSR AE requests the user to select the mount point where the DICOMDIR of the Storage Medium File Set is located. This selection is based on the regular File Open dialog window provided by the underlying

Microsoft Windows Operating System. This location will be proposed by default for the next import activity.

Using the selected DicomDIR file, The Media-FSR fills an internal dataset of all the patients and associated images found onto the medium, while reading and decoding the DicomDIR file. This internal dataset is recreated each time a new DicomDIR file is selected.

The Media-FSR AE provides the internal dataset to Trophy DICOM, which updates the user interface. The data provided to the user are following two levels presentation logic: Patient and Images (Storage SOP Class instances). The user can explore and preview, directly, the set of associated images for each patient returned, and can decide or not to import specific composite instances into the Trophy DICOM Patient Database.

Patient identification and matching, when importing composites instances, is based on the Patient ID parameter decoded while reading the DicomDIR File Set structure.

### 3.2.1.2.1.1 General Purpose Application Profile

The Media-FSR AE supports the STD-GEN-CD General Purpose Application Profile.

#### 3.2.1.2.1.1.1 Options

The Media-FSR AE supports the following SOP Classes of the STD-GEN-CD Application Profile:

**Table 73: SOP Classes and Transfer Syntaxes for Media-FSR AE**

SOP Class Name	UID	Transfer Syntax Name	UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1		
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1		
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1		
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3		
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4		

The Media-FSR AE may support other Storage SOP Classes: nevertheless, it is not guaranteed that neither Trophy DICOM nor the associated imaging application will be able to handle properly such SOP Classes.

The Media-FSR AE may also support other type of Transfer Syntaxes for the supported Storage SOP Classes as described in section 3.2.2.

### 3.2.1.2.1.2 Dental Application Profile

The Media-FSR AE provides Standard Conformance for the STD-DEN-CD Dental Application Profile.

### 3.2.2 Media-FSC/U AE Specifications

The Media-FSC/U AE provides Standard Conformance to the Media Storage Service Class. The Application Profiles and Roles for the related real-world activities are listed in the following table:

**Table 74: Media-FSC/U AE Related Application Profiles, Real-World Activities, and Roles**

Supported Application Profile	Real-World Activity	Roles
STD-GEN-CD	Export Images	FSC, FSU
STD-DEN-CD	Export Images	FSC, FSU

*Note: The export activity can actually be performed on any type of Storage Medium, as long as recognized as a writable directory entry into the File System by the underlying Microsoft Windows Operating System: the physical process of moving the resulting File Set onto the destination removable media is outside the scope of this document.*

#### 3.2.2.1 File Meta Information for the Removable Media Application Entity

For composite instances received using the DICOM Storage Service Class by Trophy DICOM, the Source Application Entity Title included in the File Meta Header is the AE Title of the sending remote AE (refer to section 2.2.6). For composite instances created locally on the system, this parameter is not set (optional field).

#### 3.2.2.2 Real-World Activities

##### 3.2.2.2.1 Activity – Export Images

When the user wants to export a set of selected images or a selected volume dataset of a given patient to a Storage Medium, the Media-FSC/U AE requests the user to select the mount point (i.e. the file system directory entry) where the DICOMDIR of the Storage Medium File Set should be located. This selection is based on the regular Directory Open dialog window provided by the underlying Microsoft Windows Operating System. This location will be proposed by default for the next export activity.

At this point, the Media-FSC/U AE provides the user with the ability to select the desired Application Profile: either the Dental STD-DEN-CD Application Profile or no specific Application Profile (i.e. the General Purpose STD-GEN-CD Application Profile).

If the Dental Application Profile is selected, the Media-FSC/U AE automatically performs the necessary SOP Class conversions required by this profile if applicable: i.e. For Processing to For Presentation image type.

When the General Purpose Application Profile is selected, the Media-FSC/U AE actually does not proceed to any conversion: the selected images or volume are just copied as they are to the Storage Medium.

A new sub-directory of the selected root directory is created for each new export activity. The Media-FSC/U AE uses this sub-directory to store the DICOM Part 10 compliant image file created.

When both a mount point and an Application Profile are defined, the Media-FSC/U AE can proceed to the DICOMDIR File Set creation or update, based on a pre-existence of a DICOMDIR file in the selected root directory. This is performed by (re) creating a new DICOMDIR file obtained by scanning recursively all the (sub) directory entries of the selected root directory for DICOM Part 10 compliant files. The final status of this operation is then presented to the user.

*Note: It is the responsibility of the user to ensure that the selected images are compatible with the Dental Application Profile. The Media-FSC/U AE does not perform such control.*

*Note: When not selecting a specific Application Profile, the resulting File Set may not be strictly compatible with the General Purpose Application Profile, due to the fact that no specific conversion is performed neither at a SOP Class level nor at a Transfer Syntax used for encoding the associated file level.*

### 3.2.2.2.1.1 General Purpose Application Profile

The Media-FSC/U AE supports the STD-GEN-CD General Purpose Application Profile.

#### 3.2.2.2.1.1.1 Options

The Media-FSC/U AE supports the following SOP Classes of the STD-GEN-CD Application Profile:

**Table 75: SOP Classes and Transfer Syntaxes for Media-FSR AE**

SOP Class Name	UID	Transfer Syntax Name	UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1		
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1		
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1		
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3		
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4		

The Media-FSC/U AE may support other Storage SOP Classes, as received or imported by Trophy DICOM (refer to section 2.2.6).

The Media-FSC/U AE may also support other type of Transfer Syntaxes for the supported Storage SOP Classes, as received, imported or created by Trophy DICOM (refer to section 2.2.6).

### 3.2.2.2.1.2 Dental Application Profile

The Media-FSC/U AE provides Standard Conformance for the STD-DEN-CD Dental Application Profile. Nevertheless, the Media-FSC/U AE may extend the Standard Application Profile, as described in the following section.

### **3.3 Augmented and Private Application Profiles**

#### **3.3.1 Augmented Application Profiles**

##### ***3.3.1.1 General Purpose Application Profile***

###### **3.3.1.1.1 SOP Class Augmentations**

None.

###### **3.3.1.1.2 Directory Augmentations**

None.

###### **3.3.1.1.3 Other Augmentations**

Trophy DICOM may extend the General Purpose Application Profile by offering other Transfer Syntaxes for the supported Storage SOP Classes. See section 3.2.2.

##### ***3.3.1.2 Dental Application Profile***

###### **3.3.1.2.1 SOP Class Augmentations**

None.

###### **3.3.1.2.2 Directory Augmentations**

None.

###### **3.3.1.2.3 Other Augmentations**

Trophy DICOM extends the Dental Application Profile by adding the FSU Role to the Standard Application Profile.

#### **3.3.2 Private Application Profiles**

Trophy DICOM does not support any private application profiles for Media Interchange.

### **3.4 Media Configuration**

All the Trophy DICOM Media related AE do not require any specific configuration task for Media Interchange.

## 4 SUPPORT OF CHARACTER SETS

All the Trophy DICOM AE support the following character sets:

**Table 76: Supported Character Sets**

ISO Code	Description
ISO-IR 6	Default character set
ISO-IR 100	ISO 8859-1:1987 - 8-bit single byte coded graphic character sets – Part 1: Latin alphabet No. 1

## 5 SECURITY

Trophy DICOM does not support any specific security mechanism. It is assumed that Trophy DICOM is used in an already secured environment. Therefore Trophy DICOM relies on both the underlying Microsoft Windows Operating System security scheme and the Site security policy setup by the user.

## 6 ANNEXES

### 6.1 IOD Contents

#### 6.1.1 Created SOP Instance(s)

Trophy DICOM provides the IOD modules as described in the following sections for each SOP Instance created either by Trophy DICOM or the associated imaging application or any common application modules, into the Trophy DICOM Patient Database.

Trophy DICOM provides always Icon Image Sequence Attribute (0088,0200) with such created SOP Instances. This attribute can be used to extract a preview image of the real one.

##### 6.1.1.1 Computed Radiography Image IOD

The following table specifies the presence of modules of Computed Radiography images transferred by the Store-SCU AE.

**Table 77: Computed Radiography Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	CR Series	C.8.1.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
Equipment	General Equipment	C.7.5.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	Contrast/bolus	C.7.6.4	C - Required if contrast media was used in this image	NEVER
	Device	C.7.6.12	U	NEVER
	CR Image	C.8.1.2	M	ALWAYS
	Overlay Plane	C.9.2	U	NEVER
	Modality LUT	C.11.1	U	NEVER
	VOI LUT	C.11.2	U	CONDITION
	SOP Common	C.12.1	M	ALWAYS

##### 6.1.1.1.1 All Modules

Trophy DICOM provides Standard conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

##### 6.1.1.1.2 VOI LUT Module

VOI LUT module may include either the VOI LUT Sequence or the Window Center and Window Width Attributes, but never both.



Note: by default CR SOP Instances include the VOI LUT Sequence Attribute. Nevertheless, CR SOP Instances may also be created (by specific CR SOP Instance conversion mechanism) with presentation characteristics directly applied to the pixels.

### 6.1.1.2 Digital X-Ray – For Presentation Image IOD

The following table specifies the presence of modules of Digital X-Ray – For Presentation images transferred by the Store-SCU AE.

**Table 78: Digital X-Ray Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Specimen Identification	C.7.1.2	U	NEVER
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
	DX Series	C.8.11.1	M	ALWAYS
Frame of Reference	Frame of Reference	C.7.4.1	U	NEVER
Equipment	General Equipment	C.7.5.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	Contrast/Bolus	C.7.6.4	U	NEVER
	Display Shutter	C.7.6.11	U	NEVER
	Device	C.7.6.12	U	NEVER
	Intervention	C.7.6.13	U	NEVER
	DX Anatomy Imaged	C.8.11.2	M	ALWAYS
	DX Image	C.8.11.3	M	ALWAYS
	DX Detector	C.8.11.4	M	ALWAYS
	X-Ray Collimator	C.8.7.3	U	NEVER
	DX Positioning	C.8.11.5	U	ALWAYS
	X-Ray Tomo Acquisition	C.8.7.7	U	NEVER
	X-Ray Acquisition Dose	C.8.7.8	U	ALWAYS
	X-Ray Generation	C.8.7.9	U	ALWAYS
	X-Ray Filtration	C.8.7.10	U	NEVER
	X-Ray Grid	C.8.7.11	U	NEVER
	Overlay Plane	C.9.2	C - Required if graphic annotation is present	NEVER
	VOI LUT	C.11.2	C - Required if Presentation Intent Type (0008,0068) is FOR PRESENTATION. Shall not be present otherwise.	ALWAYS
	Image Histogram	C.11.5	U	NEVER
	Acquisition Context	C.7.6.14	M	ALWAYS
	SOP Common	C.12.1	M	ALWAYS

### 6.1.1.2.1 All Modules

Trophy DICOM provides Standard Conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

### 6.1.1.2.2 VOI LUT Module

VOI LUT module may include either the VOI LUT Sequence or the Window Center and Window Width Attributes, but never both.

### 6.1.1.3 Digital Intra-Oral – For Presentation Image IOD

The following table specifies the presence of modules of Digital Intra-Oral – For Presentation images transferred by the Store-SCU AE.

**Table 79: Digital Intra-Oral Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Specimen Identification	C.7.1.2	U	NEVER
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
	DX Series	C.8.11.1	M	ALWAYS
	Intra-Oral Series	C.8.11.8	M	ALWAYS
Frame of Reference	Frame of Reference	C.7.4.1	U	NEVER
Equipment	General Equipment	C.7.5.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	Contrast/Bolus	C.7.6.4	U	NEVER
	Display Shutter	C.7.6.11	U	NEVER
	Device	C.7.6.12	U	NEVER
	Intervention	C.7.6.13	U	NEVER
	DX Anatomy Imaged	C.8.11.2	M	ALWAYS
	DX Image	C.8.11.3	M	ALWAYS
	DX Detector	C.8.11.4	M	ALWAYS
	X-Ray Collimator	C.8.7.3	U	NEVER
	DX Positioning	C.8.11.5	U	ALWAYS
	X-Ray Tomo Acquisition	C.8.7.7	U	NEVER
	X-Ray Acquisition Dose	C.8.7.8	U	NEVER
	X-Ray Generation	C.8.7.9	U	NEVER
	X-Ray Filtration	C.8.7.10	U	NEVER
	X-Ray Grid	C.8.7.11	U	NEVER
	Intra-Oral Image	C.8.11.9	M	ALWAYS
	Overlay Plane	C.9.2	C - Required if graphic annotation is present	NEVER

	VOI LUT	C.11.2	C - Required if Presentation Intent Type (0008,0068) is FOR PRESENTATION. Shall not be present otherwise.	ALWAYS
	Image Histogram	C.11.5	U	NEVER
	Acquisition Context	C.7.6.14	M	ALWAYS
	SOP Common	C.12.1	M	ALWAYS

#### 6.1.1.3.1 All Modules

Trophy DICOM provides Standard Conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

#### 6.1.1.3.2 VOI LUT Module

VOI LUT module may include either the VOI LUT Sequence or the Window Center and Window Width Attributes, but never both.

#### 6.1.1.4 Secondary Capture Image IOD

The following table specifies the presence of modules of Secondary Capture images transferred by the Store-SCU AE.

**Table 80: Secondary Capture Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
Equipment	General Equipment	C.7.5.1	U	NEVER
	SC Equipment	C.8.6.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	SC Image	C.8.6.2	M	ALWAYS
	Overlay Plane	C.9.2	U	NEVER
	Modality LUT	C.11.1	U	NEVER
	VOI LUT	C.11.2	U	NEVER
	SOP Common	C.12.1	M	ALWAYS

#### 6.1.1.4.1 All Modules

Trophy DICOM provides Standard conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

#### 6.1.1.5 Visible Light Endoscopic Image IOD

The following table specifies the presence of modules of Visible Light Endoscopic images transferred by the Store-SCU AE.

**Table 81: Visible Light Endoscopic Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
Equipment	General Equipment	C.7.5.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	Acquisition Context	C.7.6.14	M	ALWAYS
	VL Image	C.8.12.1	M	ALWAYS
	Overlay Plane	C.9.2	U	NEVER
	SOP Common	C.12.1	M	ALWAYS

#### 6.1.1.5.1 All Modules

Trophy DICOM provides Standard Conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

#### 6.1.1.6 Visible Light Photographic Image IOD

The following table specifies the presence of modules of Visible Light Photographic images transferred by the Store-SCU AE.

**Table 82: Visible Light Photographic Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Specimen Identification	C.7.1.2	C – Required if the Imaging Subject is a Specimen	NEVER
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
Equipment	General Equipment	C.7.5.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	Acquisition Context	C.7.6.14	M	ALWAYS
	VL Image	C.8.12.1	M	ALWAYS
	Overlay Plane	C.9.2	U	NEVER
	SOP Common	C.12.1	M	ALWAYS

#### 6.1.1.6.1 All Modules

Trophy DICOM provides Standard Conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

#### 6.1.1.7 Computed Tomography Image IOD

The following table specifies the presence of modules of Computed Tomography images transferred by the Store-SCU AE.

**Table 83: Computed Tomography Image IOD Modules**

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	ALWAYS
	Clinical Trial Subject	C.7.1.3	U	NEVER
Study	General Study	C.7.2.1	M	ALWAYS
	Patient Study	C.7.2.2	U	NEVER
	Clinical Trial Study	C.7.2.3	U	NEVER
Series	General Series	C.7.3.1	M	ALWAYS
	Clinical Trial Series	C.7.3.2	U	NEVER
Frame of Reference	Frame of Reference	C.7.4.1	M	
Equipment	General Equipment	C.7.5.1	M	ALWAYS
Image	General Image	C.7.6.1	M	ALWAYS
	Image Plane	C.7.6.2	M	ALWAYS
	Image Pixel	C.7.6.3	M	ALWAYS
	Contrast/bolus	C.7.6.4	C - Required if contrast media was used in this image	NEVER
	Device	C.7.6.12	U	NEVER
	CT Image	C.8.2.1	M	ALWAYS
	Overlay Plane	C.9.2	U	NEVER
	VOI LUT	C.11.2	U	ALWAYS
	SOP Common	C.12.1	M	ALWAYS

#### 6.1.1.7.1 All Modules

Trophy DICOM provides Standard conformance for Attribute presence, according to the Attribute Types defined into the referenced modules.

#### 6.1.2 Usage of Attributes from received IODs

The main important issue when receiving or decoding IODs is the proper Patient identification. This is important in order to ensure proper image association. Trophy DICOM relies on the Patient ID attribute for this purpose. No other configurable or specific patient matching mechanism is supported.

Patient ID attribute management results in new patient creation into the Trophy DICOM Patient Database if not found.

The usage of attributes received via the Worklist AE (Modality Worklist) is described in section 2.2.1.3.1.3.

### 6.1.3 Attribute Mapping

The mapping of attributes between the different SOP Classes supported by Trophy DICOM is limited to the relationships between attributes received via Modality Worklist, and stored in acquired or saved images. This mapping is described in section 2.2.1.3.1.3.

### 6.1.4 Coerced/Modified fields

Trophy DICOM does not coerce any attributes of existing Storage SOP Instances.

Trophy DICOM might modify certain attributes received via Modality Worklist before starting the associated procedure. This process is described in section 2.2.1.3.1.3.

## 6.2 Data Dictionary of Private Attributes

Not applicable. Trophy keeps the right not to make publicly available such information.

## 6.3 Coded Terminology and Templates

Trophy DICOM Entities are not requiring any specific coding schemes except for image tooth designation.

### 6.3.1 Context Groups

The contents of the Anatomic Region Sequence (0008,2218) and the Primary Anatomic Structure Sequence (0008,2228) are filled by a tooth designation identification value selected by the user. Choice between American or European tooth numbering is user configurable.

**Table 84: Context Groups**

Context Group	Default Value Set	Configurable	Use
Anatomic Region for Intra-Oral Radiography	CID 4016	No	Tooth designation mapped from user console selection
Anatomic Region Modifier for Intra-Oral Radiography	CID 4017	No	Tooth designation mapped from user console selection
Primary Anatomic Structure for Intra-Oral Radiography (Permanent Dentition)	CID 4018	No	Tooth designation mapped from user console selection
Primary Anatomic Structure for Intra-Oral Radiography (Deciduous Dentition)	CID 4019	No	Tooth designation mapped from user console selection

### 6.3.2 Template Specifications

Not applicable.

### 6.3.3 Private Code Definitions

Not applicable.

## 6.4 Grayscale Image Consistency

Trophy DICOM does not provide any support for the DICOM Grayscale Standard Display Function.

## 6.5 Standard Extended/Specialized/Private SOP Classes

Trophy DICOM does not support any Standard Extended, Specialized or Private SOP Classes.

## **6.6 Private Transfer Syntaxes**

Trophy DICOM does not support any Private Transfer Syntaxes.