

*t2Store*TM

Serveur de stockage, d'archivage et de diffusion de dossiers radiologiques

DICOM Conformance Statement

Release 2.1

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1. Overview

T2Store is a server application with a Web Interface for system configuration and monitoring.

T2Store is an implementation of an IHE (Integrating the Healthcare Enterprise) compliant Image Manager / Image Archive.

T2Store supports the following IHE Integration Profiles:

- Access to Radiology Information
- Patient Information Reconciliation
- Scheduled Workflow
- Consistent Presentation Images
- Key Image Note

This includes the capabilities :

- to store and retrieve various DICOM Objects (Images, GSPS, KO, SR,...)
- to process HL7 notification messages from the Order Filler, about Procedure Scheduling, Procedure Updates and Patient Information Updates
- to process DICOM Modality Performed Procedure Step (MPPS) messages from modalities and forward them to the Order Filler.

T2Store supports the following DICOM network services :

SOP Classes	Services
US Image Storage	SCP/SCU
US Multi-frame Storage	SCP/SCU
Computed Radiography Image Storage	SCP/SCU
Digital X-Ray Image Storage – For Presentation	SCP/SCU
Digital X-Ray Image Storage – For Processing	SCP/SCU
Digital Mammography X-Ray Image Storage – For Presentation	SCP/SCU
Digital Mammography X-Ray Image Storage – For Processing	SCP/SCU
Digital Intra-oral X-Ray Image Storage – For Presentation	SCP/SCU
Digital Intra-oral X-Ray Image Storage – For Processing	SCP/SCU
CT Image Storage	SCP/SCU
MR Image Storage	SCP/SCU
Enhanced MR Image Storage	SCP/SCU
Secondary Capture Image Storage	SCP/SCU
X-Ray Angiographic Image Storage	SCP/SCU
X-Ray Radiofluoroscopic Image Storage	SCP/SCU
Nuclear Medicine Image Storage	SCP/SCU
VL Endoscopic Image Storage	SCP/SCU
VL Microscopic Image Storage	SCP/SCU
VL Slide-Coordinates Microscopic Image Storage	SCP/SCU
VL Photographic Image Storage	SCP/SCU
Positron Emission Tomography Image Storage	SCP/SCU
RT Image Storage	SCP/SCU
Raw Data Storage	SCP/SCU
Multi-frame Grayscale Byte Secondary Capture Image Storage	SCP/SCU
Multi-frame Grayscale Word Secondary Capture Image Storage	SCP/SCU
Multi-frame Color Secondary Capture Image Storage	SCP/SCU
Grayscale Softcopy Presentation State Storage	SCP/SCU

SOP Classes	Services
Hardcopy Grayscale Image Storage SOP Class	SCP/SCU
Hardcopy Color Image Storage SOP Class	SCP/SCU
Basic Text SR	SCP/SCU
Enhanced SR	SCP/SCU
Comprehensive SR	SCP/SCU
Key Object Selection Document	SCP/SCU
Storage Commitment Push Model	SCP
Modality Worklist – FIND	SCP/SCU
Modality Performed Procedure Step	SCP/SCU
Instance Availability Notification	SCU
Basic Study Content Notification	SCU
Patient Root Q/R – FIND	SCP
Study Root Q/R – MOVE	SCP
Study Root Q/R – FIND	SCP
Study Root Q/R – MOVE	SCP
Patient/Study Only Q/R – FIND	SCP
Patient/Study Only Q/R – MOVE	SCP
Verification	SCP

2. Introduction

2.1 Revision History

Revision Number	Date	Reason for Change	Author
1.0	January 1, 2005	Initial Version	E. Roecker
2.0	September 1, 2007	New services : - MPPS - Storage Commitment - Worklist - IAN / SCN	E. Roecker
2.1	October 1, 2007	Revisited	S.C. Tan

2.2 Purpose and Intended Audience

This document is intended for hospital staff, health system integrators. It's assumed that the reader has a working understanding of DICOM standard and the IHE Technical Framework.

DICOM does not guarantee interoperability.

The Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

The scope of this Conformance Statement is to facilitate communication between T2Store and other vendor's medical equipment.

The responsibility for analyzing the applications requirements and developing a solution that integrates the T2Store with other vendors' systems is the user's responsibility and should not be underestimated.

The comparison of different conformance statements is the first step towards assessing interconnectivity.

2.3 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

AE : DICOM Application Entity

AET : Application Entity Title

DICOM : Digital Imaging and Communications in Medicine

DIMSE : DICOM Message Service Element

GSDF : Grayscale Standard Display Function

HIS/RIS : Hospital Information System / Radiology Information System

IHE : Integrating the Healthcare Enterprise

IHE-TF : Integrating the Healthcare Enterprise Technical Framework

IAN : Instance Availability Notification

IOD : Information Object Definition

ISO : International Standard Organisation

PDU : DICOM Protocol Data Unit

LUT : Look-up Table

MPPS : Modality Performed Procedure Step

MWL : Modality Worklist

P-LUT : Persentation Look-up Table

Q/R : Query Retrieve

SCP : Service Class Provider

SCU : Service Class User

SCN : Study Content Notification

SOP : DICOM Service-Oject Pair

TCP/IP : Transmission Control Protocol/Internet Protocol

TLS : Transport Layer Security

UID : Unique Identifier

VR : Value Representation

2.4 References

DICOM

Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1 – 3.16, 2001

IHE-TF

Integrating the Healthcare Enterprise Technical Framework, HIMSS/RSNA, Revision 7.0, 2006

3. Networking

3.1 Implementation Model

3.1.1 Application Data Flow Diagrams

T2Store is divided in 4 different DICOM Application Entities :

Storage/Query/Retrieve Server

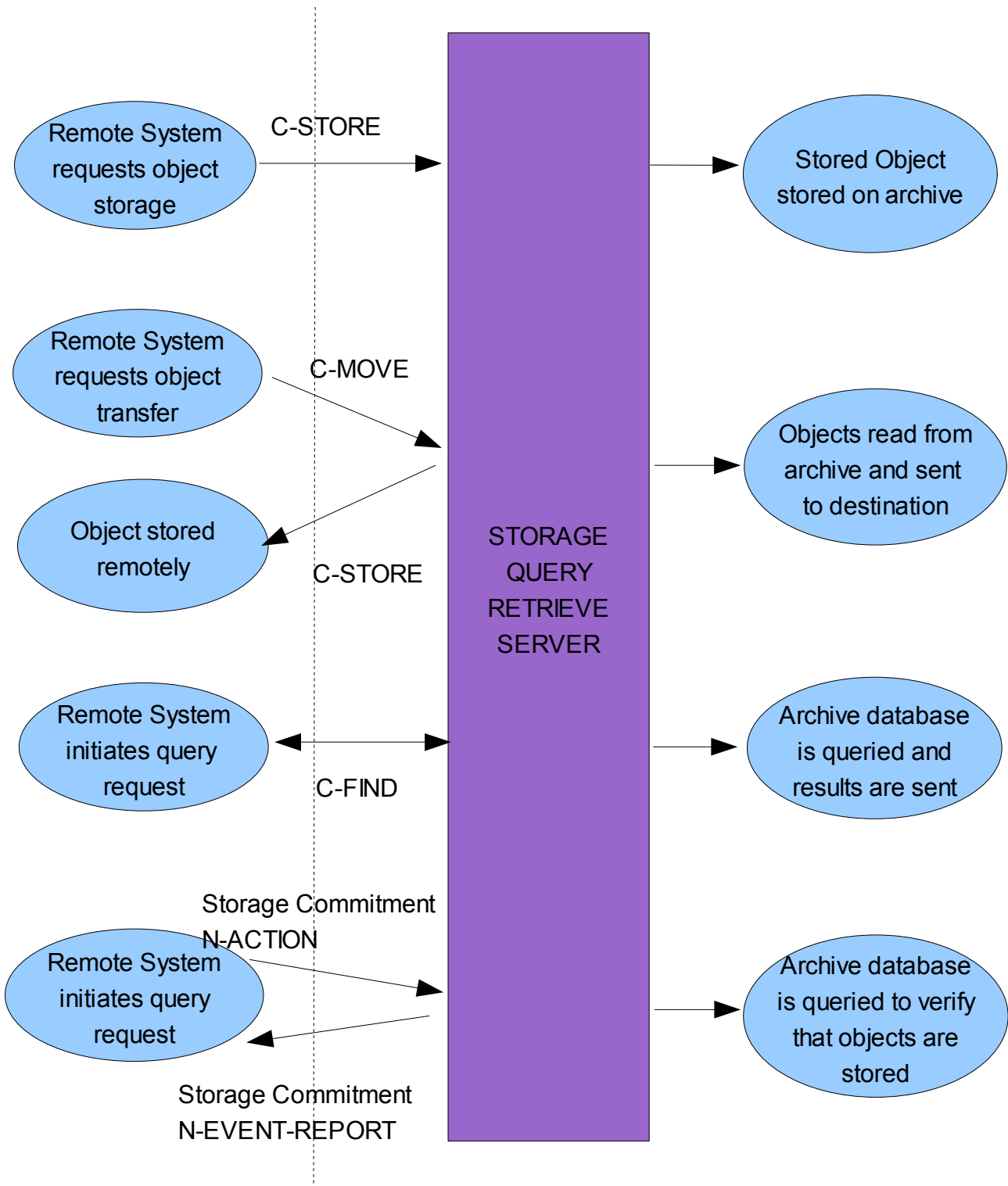
Worklist Manager

MPPS Manager

IAN/SCN Service

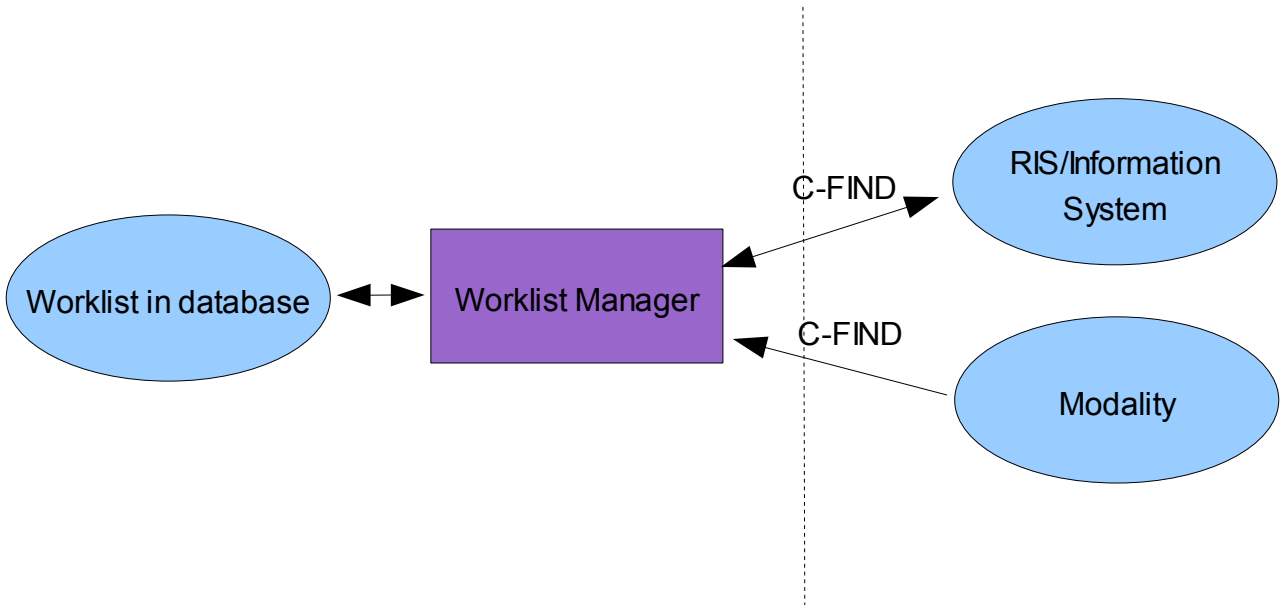
3.1.1.1 Storage/Query/Retrieve Server

The Storage/Query/Retrieve Server implements the DICOM Storage Service Class, the Verification Service Class, the DICOM Storage Commitment Service, Query/Retrieve Services as SCU/SCP



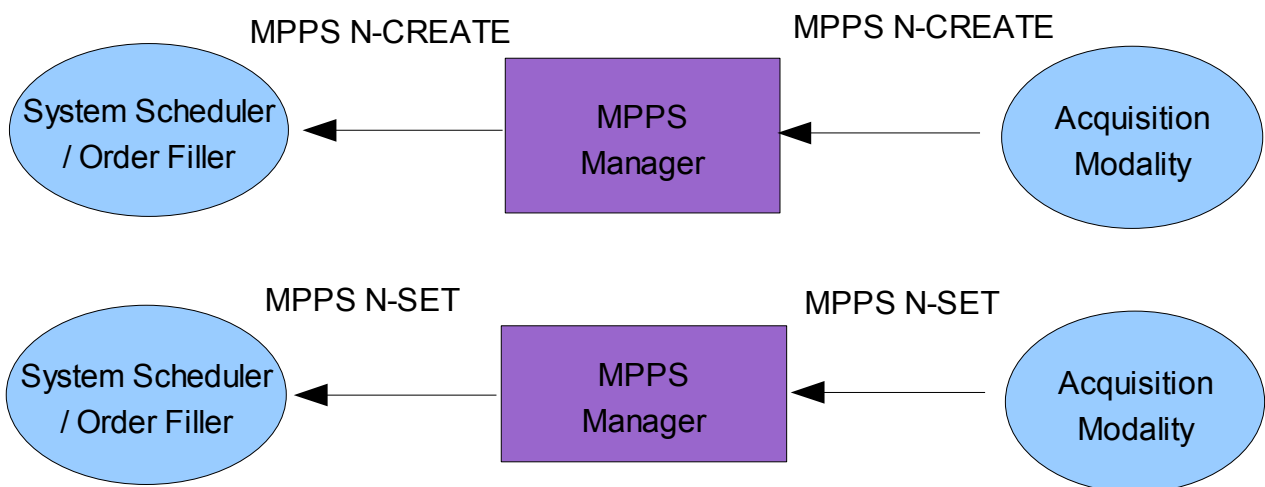
3.1.1.2 Worklist Manager

The Worklist Manager implement the DICOM Basic Worklist Management Service Class as SCU/SCP.



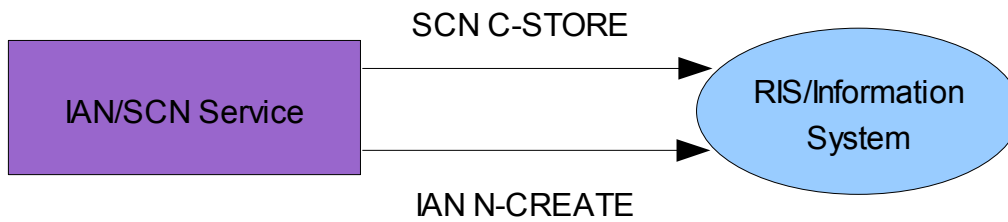
3.1.1.3 MPPS Manager

The MPPS manager AE implements the DICOM Modality Performed Procedure Step Service as SCU/SCP.



3.1.1.4 IAN/SCN Service

The IAN/SCN service implements the DICOM Instance Availability Notification and the Basic Study Content Notification as SCU



3.1.2 Functional Definition of AEs

3.1.2.1 Functional Definition of Storage/Query/Retrieve Server AE

The storage server AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Storage/Query/Retrieve SCP AE expects it to be a DICOM application.

The Storage/Query/Retrieve SCP AE will accept Associations with Presentation Contexts for SOP Classes of the Verification, Storage, Storage Commitment, Query/Retrieve Service Classes

DICOM Instances received in a Storage Request are filed on local file system. A subset of attributes from received Instances is also stored in records local database.

Once received a Retrieve (Move) request, Query/Retrieve AE will initiate a new association and send the requested instances to the Move Destination AE.

3.1.2.2 Functional Definition of Modality Worklist Manager AE

The modality Worklist Manager has worklist scu (MWL SCU) and worklist scp (MWL SCP).

The MWL SCP waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Modality Worklist Server AE expects it to be a DICOM application.

The MWL SCP will accept Associations with Presentation Contexts for SOP Classes of the Verification and Modality Worklist Service Classes.

When a Modality Worklist Find request is received, MWL AE will query the local database for a list of Scheduled Procedure Steps matching the query and will return a pending C-Find response for each match.

Before patient and order information can be included in response to MWL query, MWL items must be created by MPPS.

The MWL SCU will establish an association automatically to verify an incoming patient every n seconds for prefetching (send old exams automatically to modality workstation).

3.1.2.3 Functional Definition of MPPS Manager AE

The MPPS Manager Application Entity waits for another application to connect at the presentation address configured for its AET. When another application connects, the MPPS Manager expects it to be a DICOM application.

The MPPS Manager AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Modality Performed Procedure Step Service Classes.

The MPPS Manager stores the received MPPS instances in the local database and can be configured to forward them to a remote MPPS SCP.

3.1.2.4 Functional Definition of IAN/SCN AE

The IAN/SCN AE notifies a configurable list of remote DICOM peer application, about new instances received by the Storage Server AE, triggered by the release of the association to the Storage Server AE.

It will initiate a new association to the remote AE which shall be notified, offering a Presentation Context for the Instance Availability Notification SOP Class or for the Basic Study Content Notification SOP Class or for both – dependant of its configuration and perform the notification for each study received by the Storage Server AE in the released association, using the accepted service.

3.1.3 Sequencing of Real-Word Activities

The only constraint is for the Composite SOP Instance to be received prior to the other events. All the other events (even MPPS Send) are not constrained and can happen at any time.

3.2 AE Specifications

3.2.1 Storage/Query/Retrieve Server AE Specification

3.2.1.1 SOP Classes

Storage/Query/Retrieve Server AE provides Standard Conformance to the following SOP Classes :

SOP Class Name	SOP Class UID	Services
Verification SOP Class	1.2.840.10008.1.1	SCP
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	SCU
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	SCP
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	SCP
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	SCP
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	SCP
Patient/Study Only Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	SCP
Patient/Study Only Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	SCP
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	SCP/SCU
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	SCP/SCU
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCP/SCU
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	SCP/SCU
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	SCP/SCU
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	SCP/SCU
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	SCP/SCU
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	SCP/SCU
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	SCP/SCU
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCP/SCU
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	SCP/SCU
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCP/SCU

SOP Class Name	SOP Class UID	Services
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	SCP/SCU
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	SCP/SCU
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	SCP/SCU
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	SCP/SCU
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	SCP/SCU
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	SCP/SCU
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	SCP/SCU
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	SCP/SCU
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	SCP/SCU
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	SCP/SCU
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	SCP/SCU
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	SCP/SCU
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	SCP/SCU
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	SCP/SCU
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	SCP/SCU
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	SCP/SCU
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	SCP/SCU
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	SCP/SCU
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	SCP/SCU
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	SCP/SCU
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	SCP/SCU

3.2.1.1 Association Establishment Policy

3.2.1.1.1 General

The Storage/Query/Retrieve Server AE can both accept and propose Association Requests. The Storage Server AE will accept Association Requests for the Verification, Storage, and Storage

Commitment Push Model Services. It will propose Associations only for the Storage Commitment Push Model Service.

The DICOM standard application context name for DICOM 3.0 is always accepted and proposed.

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

3.2.1.1.2 Number of Associations

Storage/Query/Retrieve Server can support multiple simultaneous Associations requested by peer Aes.

The number of simultaneous Associations is unlimited

Maximum number of simultaneous Associations	Unlimited (Not configurable)
---	------------------------------

3.2.1.1.3 Asynchronous Nature

Storage/Query/Retrieve Serve does not support aynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous). Asynchronous mode of operation is not supported.

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)
---	----------------------

3.2.1.1.4 Implementation Identifying Information

The implementation information for this Application Entity is :

Implementation Class UID	1.2.276.0.7230010.3.0.3.5.3
Implementation Version Name	OFFIS_DCMTK_353

3.2.1.2 Association Initiation Policy

3.2.1.2.1 Real-World Activity – Send Storage Commitment Notification

3.2.1.2.1.1 Description and Sequencing of Activities

An association Request is sent to the peer AE that sent the Storage Commitment Push Model request and upon successful negotiation of the required Presentation Context the outstanding N-EVENT-REPORT is sent.

3.2.1.2.1.1.1 Proposed Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
Storage Commitment Push Model	Implicit VR Little Endian Explicit VR Little Endian	SCP	None

3.2.1.2.1.1.1.1 SOP Specific Conformance

3.2.1.2.1.1.1.1.1 Storage Commitment SOP Class

The associated Activity with the Storage Commitment Push Model service is the communication by the Storage/Query/Retrieve AE to peer Aes that is has committed to permanently store Composite SOP Instances that have been sent to it.

It thus allows peers Aes to determine whether the server has taken responsibility for the archiving of specific SOP Instances so that they can be flushed from the peer AE System.

3.2.1.2.2 Real-World Activity - Send Images Requested by an External Peer AE

3.2.1.2.2.1 Description and Sequencing of Activities

The T2Store will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer.

The Query/Retrieve Server AE will send the Association Request to the specific C-MOVE destination, and upon successful negotiation of the required Presentation Context the image transfer is started.

In all cases an attempt will be made to transmit all the indicated images in a single Association but this may not always be possible.

The Association will be released when all the images have been sent.

If an error occurs during transmission over an open Association then the image transfer is halted.

The Query/Retrieve Server AE will not attempt to independently retry the image export.

3.2.1.2.2.1.1 Proposed Presentation Contexts

Query/Retrieve Server will propose Presentation Contexts as shown in the following table:

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
Hardcopy Grayscale Image Storage SOP Class 1.2.840.10008.5.1.1.29	Transfer Syntaxes for Image Storage Service	SCU	None
Hardcopy Color Image Storage SOP Class 1.2.840.10008.5.1.1.30	Transfer Syntaxes for Image Storage Service	SCU	None
Computed Radiography Image Storage 1.2.840.10008.5.1.4.1.1.1	Transfer Syntaxes for Image Storage Service	SCU	None
Digital X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Mammography X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.2	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Mammography X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Intra-oral X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.3	Transfer Syntaxes for Image Storage Services	SCU	None
Digital Intra-oral X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.3.1	Transfer Syntaxes for Image Storage Services	SCU	None
CT Image Storage 1.2.840.10008.5.1.4.1.1.2	Transfer Syntaxes for Image Storage Services	SCU	None
Ultrasound Multi-frame Image Storage 1.2.840.10008.5.1.4.1.1.3.1	Transfer Syntaxes for Image Storage Services	SCU	None
MR Image Storage 1.2.840.10008.5.1.4.1.1.4	Transfer Syntaxes for Image Storage Services	SCU	None
Enhanced MR Image Storage	Transfer Syntaxes for	SCU	None

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
1.2.840.10008.5.1.4.1.1.4.1	Image Storage Services		
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6.1	Transfer Syntaxes for Image Storage Services	SCU	None
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	Transfer Syntaxes for Image Storage Services	SCU	None
X-Ray Angiographic Image Storage 1.2.840.10008.5.1.4.1.1.12.1	Transfer Syntaxes for Image Storage Services	SCU	None
X-Ray Radiofluoroscopic Image Storage 1.2.840.10008.5.1.4.1.1.12.2	Transfer Syntaxes for Image Storage Services	SCU	None
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.20	Transfer Syntaxes for Image Storage Services	SCU	None
Raw Data Storage 1.2.840.10008.5.1.4.1.1.66	Transfer Syntaxes for Image Storage Services	SCU	None
VL Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1	Transfer Syntaxes for Image Storage Services	SCU	None
VL Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.2	Transfer Syntaxes for Image Storage Services	SCU	None
VL Slide-Coordinates Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.3	Transfer Syntaxes for Image Storage Services	SCU	None
VL Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4	Transfer Syntaxes for Image Storage Services	SCU	None

Accepted Transfer Syntaxes for Non-Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

Accepted Transfer Syntaxes for Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline	1.2.840.10008.1.2.4.50
JPEG Extended	1.2.840.10008.1.2.4.51

Name	UID
JPEG Lossless, Non-Hierarchical	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG-LS Lossy (Near-Lossless) Image	1.2.840.10008.1.2.4.81
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91

3.2.1.2.2.1.1.1 SOP Specific Conformance

3.2.1.2.2.1.1.1.1 Image, SR, KIN and SPS SOP Classes

When a SOP Instance is selected for export from T2Store Query/Retrieve Server, its contents will be exported as it was originally received unless some of the Patient demographic and Study information Elements were altered.

The Patient demographic and Study information can be entered or altered by several means: manually (through the web interface), or from HL7 messaging.

The replacement behavior depends on which specific DICOM and HL7 services are supported. Also, this behavior is configurable.

Values can be altered without changing the SOP Instance UID unless otherwise noted.

The Query/Retrieve Server AE will exhibit the following behavior according to the Status Code value returned in a C-STORE Response from a destination C-STORE SCP:

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote Storage SCP has successfully stored the exported SOPInstance. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Refused	Out of Resources	A700- A7FF	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.

Error	Cannot Understand	C000-CFFF	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Data Set does not match SOP class	B007	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Elements Discarded	B006	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Attribute List Error	0107	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Attribute Value Out of Range	0116	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
*	*	Any other status code	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.

Exception	Behavior
Timeout expiry for an expected DICOM Message	The Association is aborted by issuing a DICOM

Exception	Behavior
Request (DIMSE level timeout).	AABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM AABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The TCP/IP Socket is closed. Error indication message is output to the Service Logs.

3.2.1.2 Association Acceptance Policy

3.2.1.2.1 Real-World Activity – Receive Images and Storage Commitment Requests

3.2.1.2.1.1 Description and Sequencing of Activities

A remote peer DICOM Application Entity, acting as an Storage SCU, establishes an association with T2Store Storage Server that accepts these Associations for the purpose of receiving supported SOP Class Instances and Storage Commitment requests.

Any Calling and Called AET will be accepted.

If the called AET does not correspond to the actual Storage Server AET, only a Presentation Context for the Verification SOP Class will be accepted and the SCU can only verify the DICOM Association, but cannot invoke any other related DICOM service.

The Storage Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason / Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4).

Result	Source	Reason	Description
1 - rejected permanent	user	2 - application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.

3.2.1.2.1.2 Accepted Presentation Contexts

Accepted Presentation Contexts for Storage Server AE

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
Verification SOP Class 1.2.840.10008.1.1	Implicit VR Little Endian 1.2.840.10008.1.2	SCP	None
Storage Commitment Push Model 1.2.840.10008.1.20.1	Transfer Syntaxes for Non Image Storage Services	SCP	None
Hardcopy Grayscale Image Storage SOP Class 1.2.840.10008.5.1.1.29	Transfer Syntaxes for Image Storage Service	SCP	None
Hardcopy Color Image Storage SOP Class 1.2.840.10008.5.1.1.30	Transfer Syntaxes for Image Storage Service	SCP	None
Computed Radiography Image Storage 1.2.840.10008.5.1.4.1.1.1	Transfer Syntaxes for Image Storage Service	SCP	None
Digital X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.1	Transfer Syntaxes for Image Storage Services	SCP	None
Digital X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.1.1	Transfer Syntaxes for Image Storage Services	SCP	None
Digital Mammography X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.2	Transfer Syntaxes for Image Storage Services	SCP	None
Digital Mammography X-Ray Image Storage - For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	Transfer Syntaxes for Image Storage Services	SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation 1.2.840.10008.5.1.4.1.1.1.3	Transfer Syntaxes for Image Storage Services	SCP	None
Digital Intra-oral X-Ray Image Storage- For Processing	Transfer Syntaxes for	SCP	None

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
1.2.840.10008.5.1.4.1.1.1.3.1	Image Storage Services		
CT Image Storage 1.2.840.10008.5.1.4.1.1.2	Transfer Syntaxes for Image Storage Services	SCP	None
Ultrasound Multi-frame Image Storage 1.2.840.10008.5.1.4.1.1.3.1	Transfer Syntaxes for Image Storage Services	SCP	None
MR Image Storage 1.2.840.10008.5.1.4.1.1.4	Transfer Syntaxes for Image Storage Services	SCP	None
Enhanced MR Image Storage 1.2.840.10008.5.1.4.1.1.4.1	Transfer Syntaxes for Image Storage Services	SCP	None
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6.1	Transfer Syntaxes for Image Storage Services	SCP	None
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	Transfer Syntaxes for Image Storage Services	SCP	None
X-Ray Angiographic Image Storage 1.2.840.10008.5.1.4.1.1.12.1	Transfer Syntaxes for Image Storage Services	SCP	None
X-Ray Radiofluoroscopic Image Storage 1.2.840.10008.5.1.4.1.1.12.2	Transfer Syntaxes for Image Storage Services	SCP	None
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.20	Transfer Syntaxes for Image Storage Services	SCP	None
Raw Data Storage 1.2.840.10008.5.1.4.1.1.66	Transfer Syntaxes for Image Storage Services	SCP	None
VL Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1	Transfer Syntaxes for Image Storage Services	SCP	None
VL Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.2	Transfer Syntaxes for Image Storage Services	SCP	None
VL Slide-Coordinates Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.3	Transfer Syntaxes for Image Storage Services	SCP	None
VL Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4	Transfer Syntaxes for Image Storage Services	SCP	None

Accepted Transfer Syntaxes for Non-Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

Accepted Transfer Syntaxes for Image Storage Services

Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline	1.2.840.10008.1.2.4.50
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG Lossless, Non-Hierarchical	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG-LS Lossy (Near-Lossless) Image	1.2.840.10008.1.2.4.81
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91

3.2.1.2.1.3 SOP Specific Conformance

3.2.1.2.1.3.1 Specific Conformance for Verification SOP Class

T2Store Storage Server provides standard conformance to the DICOM Verification Service Class as a SCP. The status code for the C-ECHO is described in the following table:

C-Echo Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The C-ECHO request is accepted

3.2.1.2.1.3.2 Storage SOP Classes

The associated Activity with the Storage service is the storage of medical DICOM data received over the network on a designated storage repository. The T2Store Storage Server AE will return a failure status if it is unable to store the received instance(s).

The T2Store Storage Server AE does not have any dependencies on the number of Associations used to send images to it.

Images belonging to more than one Study or Series can be sent over a single or multiple Associations. Images belonging to a single Study or Series can also be sent over different Associations.

There is no limit on either the number of SOP Instances or the maximum amount of total SOP Instance data that can be transferred over a single Association.

The T2Store Storage Server AE is configured to retain the original DICOM data in DICOM Part 10 compliant file format.

In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files.

In addition to saving all Elements in files, a subset of the Elements are stored in the T2Store Query/Retrieve

Server database to support query and retrieval requests and also allow updating of Patient, Study, and Series information by user input, or demographic and Study related messages.

If the received instance is a duplicate of a previously received instance, the old file and database information

will be overwritten with the new one.

The average throughput performance has been determined to be between 4 and 10 Mega Bytes per second on a 100 Megabit Ethernet network. Actual performance will depend greatly on the performance of the CSTORE SCU, the number of simultaneous active Associations, and the underlying network performance.

3.2.1.2.1.3.2.1 C-STORE Response

Storage Server C-STORE Response Status

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the system repository.

Service Status	Further Meaning	Error Code	Behavior
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response from the internal database or a filesystem operation. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.
Warning	Coercion of Data Elements	B000	This status is returned if one or more Attribute values were coerced/modified on reception. Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response. Warning indication message is output to the Service Log.
Warning	Data Set does not match SOP class	B007	This status is returned if the C-STORE Request specifies Attributes that are not specific as part of the Storage SOP class. Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response. Warning indication message is output to the Service Log.

3.2.1.2.1.3.2.2 Storage Service Communication Failure Reasons

Storage Server Service Communication Failure Reasons

Exception	Reason
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The STORAGESCP AE is waiting for the next C-STORE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received then they are maintained in the database. They are not automatically discarded because of a later failure.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). I.e. The STORAGE-SCP AE is waiting for the next C-STORE Data Set PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If a C-STORE Data Set has not been fully received then the data already received is discarded. If some Composite SOP Instances have already been successfully received over the Association then they are maintained in the database.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received then they are maintained in the database. They are not automatically discarded because of a later failure.

3.2.1.2.1.3.3 Storage Commitment SOP Class

The associated Activity with the Storage Commitment Push Model service is the communication by the T2Store Storage Server AE to peer AEs that it has committed to permanently store Composite SOP Instances that have been sent to it.

It thus allows peer AEs to determine whether the T2Store Query/Retrieve Server has taken responsibility for the archiving of specific SOP Instances so that they can be flushed from the peer

AE system.

The T2Store Storage Server AE takes the list of Composite SOP Instance UIDs specified in a Storage Commitment Push Model N-ACTION Request and checks if they are present in the local database and in the local filesystem.

As long as the Composite SOP Instance UIDs are present in the database, the T2Store Storage Server AE will consider those Composite SOP Instance UIDs to be successfully archived. The T2Store Storage Server AE does not require the Composite SOP Instances to actually be successfully written to archive media in order to commit to responsibility for maintaining these SOP Instances.

Once the T2Store Storage Server AE has checked for the existence of the specified Composite SOP Instances, it will then attempt to send the Notification request (N-EVENT-REPORT-RQ). The T2Store Storage Server AE will request a new Association with the peer AE that made the original N-ACTION Request.

If a peer AE sends a Storage Commitment Push Model N-ACTION Request before the specified Composite SOP Instances are later sent over the same Association, the T2Store Storage Server AE will not commit to responsibility for such SOP Instances.

The T2Store Storage Server AE does not support the optional Storage Media File-Set ID & UID attributes in the N-ACTION.

The T2Store Storage Server AE will support Storage Commitment Push Model requests for SOP Instances of any of the Storage SOP Classes that are also supported by the T2Store Storage Server AE:

Supported Referenced SOP Classes In Storage Commitment Push Model N-ACTION Requests

Supported Referenced SOP Classes
Hardcopy Grayscale Image Storage SOP Class
Hardcopy Color Image Storage SOP Class
Computed Radiography Image Storage
Digital X-Ray Image Storage - For Presentation
Digital X-Ray Image Storage - For Processing
Digital Mammography X-Ray Image Storage - For Presentation
Digital Mammography X-Ray Image Storage - For Processing

Supported Referenced SOP Classes
Digital Intra-oral X-Ray Image Storage - For Presentation
Digital Intra-oral X-Ray Image Storage - For Processing
CT Image Storage
Ultrasound Multi-frame Image Storage
MR Image Storage
Enhanced MR Image Storage
Ultrasound Image Storage
Secondary Capture Image Storage
X-Ray Angiographic Image Storage
X-Ray Radiofluoroscopic Image Storage
Nuclear Medicine Image Storage
VL Endoscopic Image Storage
VL Microscopic Image Storage
VL Slide-Coordinates Microscopic Image Storage
VL Photographic Image Storage
Positron Emission Tomography Image Storage
RT Image Storage
Grayscale Softcopy Presentation State Storage SOP Class
Basic Text SR
Enhanced SR
Comprehensive SR
Key Object Selection Document

The T2Store Storage Server AE will return the following Status Code values in N-ACTION Responses:

Storage Server N-ACTION Response Status

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully received the Storage Commitment Push Model N-ACTION Request and can process the commitment request for the indicated SOP Instances.
Error	Processing Failure	0110	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be parsed or fully processed due to a database or system failure.
Error	Missing Attribute	0120	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be processed because a required attribute is missing from the NACTION Request Data Set.
Error	Missing Attribute Value	0121	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be processed because a Type 1 attribute in the N-ACTION Request Data Set does not specify a value.

The T2Store Storage Server AE will exhibit the following Behavior according to the Status Code value returned in an N-EVENT-REPORT Response from a destination Storage Commitment Push Model SCU:

Storage Server N-EVENT Report Response Status Handling Behaviour

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCU has successfully received the Storage Commitment Push Model N-EVENT-REPORT Request. Success indication message is output to the Service Logs.
Warning	Attribute List Error	0107	Transmission of Storage Commitment Push Model N-EVENTREPORT

Service Status	Further Meaning	Error Code	Behavior
			Request is considered successful. Warning indication message is output to the Service Logs.
*	*	Any Other Code	This is treated as a permanent Failure. Error indication message is output to the Service Logs.

The next table report the T2Store Storage Server behaviour in case of communication failure:

Storage Server AE Storage Commitment Push Model Communication Failure Behaviour

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The STORAGESCP AE is waiting for the next N-ACTION Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM AABORT. If some Composite SOP Instances have been successfully received over the same Association via the Storage Service then they are maintained in the database. They are not automatically discarded because of a later Storage Commitment messaging failure. Any previously received Storage Commitment Push Model N-ACTION Requests will still be fully processed. Error indication message is output to the Service Logs. No message is posted to the User Interface.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM A-ABORT. If some Composite SOP Instances have been successfully received over the same Association via the Storage Service then they are maintained in the database. They are not automatically discarded because of a later Storage Commitment messaging failure. Any previously received Storage Commitment Push Model NACTION Requests will still be fully processed. Error indication message is output to the Service Logs. No message is posted to the User Interface.
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level	The TCP/IP socket is closed. If some Composite SOP Instances have been successfully received over the same Association via the Storage Service then they are

Exception	Behavior
TCP/IP socket closure).	maintained in the database. They are not automatically discarded because of a later Storage Commitment messaging failure. Any previously received Storage Commitment Push Model NACTION Requests will still be fully processed. Error indication message is output to the Service Logs. No message is posted to the User Interface.

3.2.1.2.2 Real-World Activity – Handling Query and Retrieval Requests

3.2.1.2.2.1 Description and Sequencing of Activities

The Query/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected.

If Query/Retrieve Server AE receives a query (C-FIND) request then the response(s) will be sent over the same Association used to send the C-FIND-Request.

If Query/Retrieve Server AE receives a retrieval (C-MOVE) request then the responses will be sent over the same Association used to send the C-MOVE-Request.

The Query/Retrieve Server AE will send the requested SOP Instances to the C-MOVE Destination over a newly created Association and report in the C-MOVE-Response any success or failure status of each attempt to send a CompositeSOP Instance.

Association Rejection Reasons

Result	Source	Reason	Description
1 – rejected permanent	user	2 – application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.

3.2.1.2.2.2 Accepted Presentation Contexts

Accepted Presentation Contexts for Query/Retrieve Server AE

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
Patient Root Q/R Information Model – FIND	Implicit VR Little Endian	SCP	Relational

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
1.2.840.10008.5.1.4.1.2.1.1	1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1		retrieve
Patient Root Q/R Information Model – MOVE 1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP	Relational retrieve
Study Root Q/R Information Model – FIND 1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP	Relational retrieve
Study Root Q/R Information Model – MOVE 1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP	Relational retrieve
Patient/Study Only Q/R Information Model – FIND 1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP	Relational retrieve
Patient/Study Only Q/R Information Model – MOVE 1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP	Relational retrieve

3.2.1.2.2.3 SOP Specific Conformance

3.2.1.2.2.3.1 Query SOP Classes

The Query/Retrieve Server AE supports hierarchical and relational queries.

There are no attributes always returned by default.

Only those attributes requested in the query identifier are returned.

Query responses always return values from the Query/Retrieve Server database.

Exported SOP Instances are always updated with the latest values kept in the database prior to export.

Thus, a change in Patient demographic information will be contained in both the C-FIND Responses and any Composite SOP Instances exported to a C-MOVE Destination AE.

Patient Root Information Model: All required search keys on each of the four levels (Patient, Study, Series, and Image) are supported.

However, the Patient ID (0010,0020) key must have at least a partial value if the Patient's Name (0010,0010) is not present in a Patient Level query.

Study Root Information Model: All the required search keys on each of the three levels (Study, Series, and Image) are supported. If no partial values are specified for Study attributes then either the Patient ID (0010,0020) key or the Patient's Name (0010,0010) must have at least a partial value specified.

Patient/Study Only Information Model: All the required search keys on the Patient and Study levels are supported.

The Patient ID (0010,0020) key must be at least partially stated if the Patient's Name (0010,0010) is not present in a Patient Level query.

Patient Root C-FIND SCP Supported Elements

Attribute Name	Tag	VR	Types of Matching
<i>SOP Common</i>			
Specific Character Set	0008,0005	CS	NONE
<i>Patient Level</i>			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Issuer of Patient ID	0010,0021	LO	NONE
Patient's Birth Date	0010,0030	DA	S,U,R
Patient's Sex	0010,0040	CS	S,*,U
<i>Study Level</i>			
Study Instance UID	0020,000D	UI	S,L
Study ID	0020,0010	SH	S,*,U
Study Date	0008,0020	DA	S,U,R
Study Time	0008,0030	TM	S,U,R
Accession Number	0008,0050	SH	S,*,U
Referring Physician's Name	0008,0090	PN	S,*,U

Attribute Name	Tag	VR	Types of Matching
Modalities In Study	0008,0061	CS	S,*,U
<i>Series Level</i>			
Series Instance UID	0020,000E	UI	S,L
Series Number	0020,0011	IS	S,*,U
Modality	0008,0060	CS	S,*,U
Performed Procedure Step Start Date	0040,0244	DA	S,U,R
Performed Procedure Step Start Time	0040,0245	TM	S,U,R
<i>Image Level</i>			
SOP Instance UID	0008,0018	UI	S,L
SOP Class UID	0008,0016	UI	S,L
Instance Number	0020,0013	IS	S,*,U
Completion Flag	0040,0A91	CS	S,*,U
Verification Flag	0040,0A93	CS	S,*,U

Study Root C-FIND SCP Supported Elements

Attribute Name	Tag	VR	Types of Matching
<i>SOP Common</i>			
Specific Character Set	0008,0005	CS	NONE
<i>Study Level</i>			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Issuer of Patient ID	0010,0021	LO	NONE
Patient's Birth Date	0010,0030	DA	S,U,R
Patient's Sex	0010,0040	CS	S,*,U
Study Instance UID	0020,000D	UI	S,L
Study ID	0020,0010	SH	S,*,U
Study Date	0008,0020	DA	S,U,R
Study Time	0008,0030	TM	S,U,R

Attribute Name	Tag	VR	Types of Matching
Accession Number	0008,0050	SH	S,*U
Referring Physician's Name	0008,0090	PN	S,*U
Modalities In Study	0008,0061	CS	S,*U
<i>Series Level</i>			
Series Instance UID	0020,000E	UI	S,L
Series Number	0020,0011	IS	S,*U
Modality	0008,0060	CS	S,*U
Performed Procedure Step Start Date	0040,0244	DA	S,U,R
Performed Procedure Step Start Time	0040,0245	TM	S,U,R
<i>Image Level</i>			
SOP Instance UID	0008,0018	UI	S,L
SOP Class UID	0008,0016	UI	S,L
Instance Number	0020,0013	IS	S,*U
Completion Flag	0040,0A91	CS	S,*U
Verification Flag	0040,0A93	CS	S,*U

Types of Matching:

The types of Matching supported by the C-FIND SCP. An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, an "*" indicates wildcard matching, a 'U' indicates Universal Matching, and an 'L' indicates that UID lists are supported for matching. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned (i.e. universal matching).

Query/Retrieve Server C-FIND Response Status

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response on an query of the internal database. The appropriate Status will be sent in the C-FIND Response. Error indication message is output to the Service Log.
Cancel	Matching terminated due to Cancel Request	FE00	The C-FIND SCU sent a Cancel Request. This has been acknowledged and the search for matches has been halted. Cancel indication message is output to the Service Log.
Pending	Matches are continuing and curent match is supplied	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. Pending indication message is output to the Service Log.

3.2.1.2.2.3.2 Retrieve SOP Classes

Exported SOP Instances are always updated with the latest values kept in the database prior to export.

Query/Retrieve Server C-MOVE Response Status

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure

Service Status	Further Meaning	Error Code	Behavior
			response on an query of the internal database. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Error	Unable to perform suboperations	A702	C-STORE sub-operations cannot be performed due to failure of an Association Request or a C-STORE Request. Error indication message is output to the Service Log.
Error	Move Destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to Query/Retrieve SCP AE. Error indication message is output to the Service Log.
Error	Identifier does not match SOP Class	A900	The C-MOVE identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class or retrieval level. Error indication message is output to the Service Log.
Error	Unable to process	Cxxx	The Move Destination AET is missing in the C-MOVE Request. Error indication message is output to the Service Log.
Pending	Matches are continuing and curent match is supplied	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. Pending indication message is output to the Service Log.

Query/Retrieve Server Service Communication Failure Behavior

Exception	Behavior
<p>Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. the Query/Retrieve Server SCP AE is waiting for the next C-FIND or CMOVE Request on an open Association but the timer expires.</p>	<p>The Association is aborted by issuing a DICOM AABORT. Error message is output to the Service Log.</p>
<p>Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The Query/ Retrieve Server AE is waiting for the next message PDU but the timer expires.</p>	<p>The Association is aborted by issuing a DICOM AABORT. Error message is output to the Service Log.</p>
<p>Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)</p>	<p>Error message is output to the Service Log.</p>

3.2.2 Modality Worklist Manager AE Specification

3.2.2.1 SOP Classes

Modality Worklist Server Application Entity provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	Role
Verification SOP Class	1.2.840.10008.1.1	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	SCU/SCP

3.2.2.2 Association Establishment Policy

3.2.2.2.1 General

Modality Worklist Server AE can both accept and propose Association Requests.

The Modality Worklist AE will accept Association Requests for the Verification and Worklist Services.

It will propose Associations for Verification and Storage Services.

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

DICOM application context name for Modality Worklist Server AE

Application Context Name	1.2.840.10008.3.1.1.1
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3.2.2.2.2 Number of Associations

Modality Worklist Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured.

Number of Associations accepted for Modality Worklist Server AE

Maximum number of simultaneous Associations	10 (Configurable)
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3.2.2.2.3 Asynchronous Nature

Modality Worklist Server does not support asynchronous communication.

Multiple outstanding transactions are not supported.

It allows up to one invoked and one performed operation on an Association (it is synchronous). Asynchronous mode of operation is not supported.

Asynchronous Nature as SCP for Modality Worklist Server AE

Maximum number of outstanding asynchronous	1 (Not Configurable)
--	----------------------

3.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

DICOM Implementation Class and Version for Modality Worklist Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-1.1

3.2.2.3 Association Initiation Policy
3.2.2.3.1 Real-World Activity – Get Worklist
3.2.2.3.1.1 Description and Sequencing of Activities

Use for « prefetching ».

T2Store can query a remote worklist AE for patient and study information.

T2Store will establish an association automatically to verify an incoming patient every n seconds. And it will send automatically all old exams from this incoming patient to modalities workstation with store scu.

3.2.2.3.1.2 Proposed Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
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

3.2.2.4.1.3 SOP Specific Conformance

T2Store provides Standard conformance to the DICOM Basic Worklist Management Service Class

as an SCU.

3.2.2.4 Association Acceptance Policy

3.2.2.4.1 Real-World Activity - External Peer AE requests MWL query

3.2.2.4.1.1 Description and Sequencing of Activities

The Modality Worklist Server AE accepts Associations only if they have valid Presentation Contexts.

If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected.

It can be configured to only accept Associations from certain Application Entities.

When Modality Worklist SCUs query the Modality Worklist Server AE the queries run against the MWL items in the local database.

The Modality Worklist Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason / Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4).

Result	Source	Reason	Description
2 – rejected transient	provider	2 – locallimit exceeded	The (configurable) maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
1 – rejected permanent	user	2 – application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.
1 – rejected permanent	user	3 – calling AE title not recognized	The Association request contained an

Result	Source	Reason	Description
			unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

3.2.2.4.1.2 Accepted Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Ext. Neg.
Verification SOP Class 1.2.840.10008.1.1	Implicit VR Little Endian 1.2.840.10008.1.2	SCP	None
Modality Worklist Information Model – FIND 1.2.840.10008.5.1.4.31	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP	None

If the Called AET is not corresponding to the actual Modality Worklist Server AET, only the Presentation Context for the Verification SOP Class will be accepted.

3.2.2.4.1.3 SOP Specific Conformance

3.2.2.4.1.3.1 Verification SOP Class

T2Store Storage Server provides standard conformance to the DICOM Verification Service Class as a SCP. The status code for the C-ECHO is described in the following table:

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The C-ECHO request is accepted

3.2.2.4.1.3.2 Modality Worklist SOP Class

Return attributes depend on the information provided by the connected HIS/RIS. There are no attributes always returned by default. Only those attributes requested in the query identifier are returned. Query responses always return values from the Modality Worklist Server database.

Modality Worklist C-FIND SCP Supported Elements

Attribute Name	Tag	VR	Types of Matching
Specific Character Set	0008,0005	CS	NONE
Scheduled station AE title	0040,0001	AE	S
Scheduled Procedure Step Start Date	0040,0002	DA	S,R
Scheduled Procedure Step Start Time	0040,0003	TM	S,R
Scheduled Performing Physician's Name	0040,0006	PN	S,*
Modality	0008,0060	CS	S
Accession Number	0008,0050	SH	S
Patient's Name	0010,0010	PN	S,*
Patient's ID	0010,0020	LO	S

Types of Matching:

The types of Matching supported by the C-FIND SCP. An "S" indicates the identifier attribute uses Single

Value Matching, an "R" indicates Range Matching, an "*" indicates wildcard matching, a "U" indicates Universal

Matching. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned.

3.2.2.4.1.3.2.1 AE C-Store Response

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	Success indication message is output to the Service Log.

Service Status	Further Meaning	Error Code	Behavior
Error	Processing Failure	0110	This is treated as a permanent Failure. The appropriate Status will be sent in the C-FIND Response. Error indication message is output to the Service Log.
Canceled	Matching terminated due to cancel request	FE00	This status is returned if a Cancel Request is received from the SCU during the processing of a Modality Worklist request. A cancel indication message is output to the Service Log.
Pending	Matching is continuing	FF00	This status is returned with each matching response. A pending indication message is output to the Service Log.

3.2.2.4.1.3.2.2 Communication Failure Reasons

Exception	Behavior
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log.

3.2.3 MPPS Manager Application Entity Specification

3.2.3.1 SOP Classes

T2Store MPPS Manager AE provides Standard Conformance to the following SOP Classes:

SOP Classes for MPPS Manager AE

SOP Class Name	SOP Class UID	Role
Verification SOP Class	1.2.840.10008.1.1	SCP
General Purpose Performed Procedure Step	1.2.840.10008.5.1.4.32.3	SCP/SCU

3.2.3.1.1 Association Establishment Policy

3.2.3.1.1.1 General

MPPS Manager AE can both accept and propose Association Requests.

The MPPS Manager AE will accept Association Requests for the Verification and MPPS Services.

It will propose Associations for MPPS Services.

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

DICOM application context name for MPPS Manager AE

Application Context Name	1.2.840.10008.3.1.1.1
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3.2.3.1.1.2 Number of Associations

MPPS Manager can support multiple simultaneous Associations requested by peer AEs.

Default is 10. This value can be configured .

Number of Associations accepted for dcm4che/archive Modality Worklist Server AE

Maximum number of simultaneous Associations	10 (Configurable)
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3.2.3.1.1.3 Asynchronous Nature

MPPS Manager does not support asynchronous communication.

Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous).

Asynchronous mode of operation is not supported.

Asynchronous Nature as SCP for MPPS Manager AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)
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3.2.3.1.1.4 Implementation Identifying Information

The implementation information for this Application Entity is:

DICOM Implementation Class and Version for MPPS Manager AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-1.1

3.2.3.1.2 Association Initiation Policy

The MPPS Manager AE does not initiate Associations.

3.2.3.1.3 Association Acceptance Policy

3.2.3.1.3.1 Real-World Activity – Send Performed Procedure Status

3.2.3.1.3.1.1 Description and Sequencing of Activities

The Performed Procedure Step Manager supports forwarding messages to two different destinations. It starts issuing messages to the configured destinations immediately after it accepts the corresponding messages from the acquisition modality.

- An acquisition modality informs the Performed Procedure Step Manager that a particular Performed Procedure Step has started through the MPPS-N-CREATE service.
- An acquisition modality informs the Performed Procedure Step Manager that a particular Performed Procedure Step is completed through the MPPS-N-SET service.

The Real World activity associated with the MPPS-N-CREATE and MPPS-N-SET commands is triggered by the acquisition modality. MPPS Manager will forward the MPPS information to the Order Filler/System Scheduler and optionally to the report manager.

3.2.3.1.3.1.2 Accepted Presentation Contexts

Abstract Syntax	Transfer Syntax	Role	Ext.Neg.
Verification SOP Class 1.2.840.10008.1.1	Implicit VR Little Endian 1.2.840.10008.1.2	SCP	None
General Purpose Performed Procedure Step 1.2.840.10008.5.1.4.32.3	DICOM Implicit VR Little Endian 1.2.840.10008.1.2 DICOM Explicit VR Little Endian 1.2.840.10008.1.2.1	SCP/ SCU	None

3.2.3.1.3.1.3 SOP Specific Conformance

3.2.3.1.3.1.3.1 Verification SOP Class

MPPS Manager provides standard conformance to the DICOM Verification Service Class as a SCP.

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The C-ECHO request is accepted

3.2.3.1.3.1.3.2 MPPS SOP Classes

MPPS Manager receives MPPS-N-CREATE and MPPS-N-SET and acts as SCU to send them to the Order Filler/System Scheduler.

If MPPS Manager returns one of the following status codes, it means that the service request has been unsuccessful.

Service Status	Further Meaning	Status Codes	Reason
Refused	General refusal status	A700	
Warning	General warning status	B000	
Failure	General failure status	C000	

3.3 Physical Network Interfaces

3.3.1 Supported Communication Stacks

DICOM Upper Layer over TCP/IP is supported.

3.3.1.1 TCP/IP Stack

T2Store inherits their TCP/IP stack from the kernel and Java Runtime Environment.

3.3.2 Physical Network Interface

T2Store is indifferent to the physical medium over which TCP/IP executes.

3.4 Configuration

3.4.1 AE Title / Presentation Address Mapping

3.4.1.1 Local AE Titles

The local AE Titles and TCP ports are configurable through web interface.

Application Entity	Default AE Title	Default TCP/IP Port
Storage/Query/Retrieve Server	T2STORE	104
Modality Worklist Server	T2STOREWL	2350
MPPS Manager	T2STOREMPPS	2351

3.4.1.2 Remote AE Titles

Remote AE Titles, TCP/IP Addresses and ports can be configured through web interface. In the default configuration, Association Requests with any Calling AET will be accepted.

3.4.2 Parameters

The following table shows the T2Store configuration parameters relevant to DICOM communication.

Parameter	Configurable	Default Value
Time-out waiting for A-ASSOCIATE RQ on open TCP/IP connection (ARTIM timeout)	Yes	5s
Time-out waiting on an open association for the next message (DIMSE timeout)	Yes	no timeout
Time-out waiting for acceptance or rejection Response to an Association Open Request. (Application Level timeout)	No	no timeout
Time-out waiting on an open association for the next message after sending A-RELEASE RSP or A-ABORT RQ (Closing timeout)	Yes	500ms

Parameter	Configurable	Default Value
Maximum PDU size the AE can send	No	65535
Pack Command and Data PDVs in one PDU	Yes	false
Support for the Basic TLS Secure Transport Connection Profile	No	Off

4. Media Interchange

T2Store does not support Media Storage.