



DICOM Conformance Statement

Rialto 2.0

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Overview

Rialto is a self-contained networked information system used for receiving, archiving and displaying of diagnostic medical images. The system conforms to the DICOM 3.0 standard to allow the sharing of medical information with other digital imaging systems.

NETWORK SERVICES

DICOM SOP Class Name	User of Service (SCU)	Provider of Service (SCP)	Display
Transfer			
US Image Storage	Yes	Yes	Yes
US Multi-frame Storage	Yes	Yes	No
<i>US Multi-frame Storage (Retired)</i>	Yes	Yes	No
Computed Radiography Image Storage	Yes	Yes	Yes
Digital X-Ray Image Storage - For Presentation	Yes	Yes	Yes
Digital X-Ray Image Storage - For Processing	Yes	Yes	No
Digital Mammography X-Ray Image Storage - For Presentation	Yes	Yes	Yes
Digital Mammography X-Ray Image Storage - For Processing	Yes	Yes	No
Digital Intra-oral X-Ray Image Storage - For Presentation	Yes	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	Yes	Yes	No
CT Image Storage	Yes	Yes	Yes
Enhanced CT Image Storage	Yes	Yes	Yes
MR Image Storage	Yes	Yes	Yes
Enhanced MR Image Storage	Yes	Yes	Yes
Secondary Capture Image Storage	Yes	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	Yes	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes	Yes
VL Endoscopic Image Storage	Yes	Yes	Yes
VL Microscopic Image Storage	Yes	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	Yes	Yes	No

VL Photographic Image Storage	Yes	Yes	Yes
Positron Emission Tomography Image Storage	Yes	Yes	Yes
RT Image Storage	Yes	Yes	No
<i>Nuclear Medicine Image Storage (Retired)</i>	Yes	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Color Secondary Capture Image Storage	Yes	Yes	Yes
Grayscale Softcopy Presentation State Storage	Yes	Yes	No
Hardcopy Grayscale Image Storage SOP Class	Yes	Yes	No
Hardcopy Color Image Storage SOP Class	Yes	Yes	No
Basic Text SR	Yes	Yes	No
Enhanced SR	Yes	Yes	No
Comprehensive SR	Yes	Yes	No
Key Object Selection Document	Yes	Yes	No
Multi-frame Single Bit Secondary Capture Image Storage	Yes	Yes	No
<i>X-Ray Angiographic Bi-Plane Image Storage (Retired)</i>	Yes	Yes	No
<i>VL Image Storage (Retired)</i>	Yes	Yes	No
<i>VL Multiframe Image Storage (Retired)</i>	Yes	Yes	No
Mammography CAD SR	Yes	Yes	No
RT Dose Storage	Yes	Yes	No
RT Structure Set Storage	Yes	Yes	No
RT Beams Treatment Record Storage	Yes	Yes	No
RT Plan Storage	Yes	Yes	No
RT Brachy Treatment Record Storage	Yes	Yes	No
RT Treatment Summary Record Storage	Yes	Yes	No
12-lead ECG Waveform Storage	Yes	Yes	No
General ECG Waveform Storage	Yes	Yes	No
Ambulatory ECG Waveform Storage	Yes	Yes	No
Hemodynamic Waveform Storage	Yes	Yes	No
Cardiac Electrophysiology Waveform Storage	Yes	Yes	No

Basic Voice Audio Waveform Storage	Yes	Yes	No
Procedure Log Storage	Yes	Yes	No
Encapsulated PDF Storage	Yes	Yes	No
Query/Retrieve			
Patient Root Q/R – FIND	Yes	Yes	N/A
Patient Root Q/R - MOVE	Yes	Yes	N/A
Study Root Q/R – FIND	Yes	Yes	N/A
Study Root Q/R - MOVE	Yes	Yes	N/A
<i>Patient/Study Only Q/R – FIND (Retired)</i>	No	Yes	N/A
<i>Patient/Study Only Q/R – MOVE (Retired)</i>	No	Yes	N/A
Verification			
Verification	Yes	Yes	N/A

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1 Introduction

1.1 Revision History

Document Version	Date	Author	Description
1.0	15 September 2009	Karos Health	General

1.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader is familiar with the terminology and concepts that are used in the DICOM 3.0 standard and the appropriate IHE Profiles.

1.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with Rialto and other vendors' medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 standard. However, it is not guaranteed to ensure the desired interoperability and successful interconnectivity with existing DICOM systems.

The user should be aware of the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity between Rialto and other vendors' equipment.
- Test procedures should be defined to validate the desired level of connectivity.
- The DICOM 3.0 standard will evolve to meet the users' future requirements. Karos Health reserves the right to make changes to its products or to discontinue its delivery.

1.4 Definitions, Terms and Abbreviations

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

Abbreviations and terms are as follows:

AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
GSDf	Grayscale Standard Display Function
GUI	Graphical User Interface
HIS/RIS	Hospital Information System / Radiology Information System
HL7	Health Level 7
IHE	Integrating the Healthcare Enterprise
IHE-TF	Integrating the Healthcare Enterprise Technical Framework
IOD	Information Object Definition
ISO	International Standard Organization
PDU	DICOM Protocol Data Unit
LUT	Look-up Table

P-LUT	Presentation Look-up Table
SCP	Service Class Provider
SCU	Service Class User
SOP	DICOM Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
TLS	Transport Layer Security
UID	Unique Identifier
VR	Value Representation

1.5 References

- [DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1- 3.18, 2008
- [IHE-TF] IHE Radiology Technical Framework, HIMSS/RSNA, Vol. I – IV, Revision 8, 2007

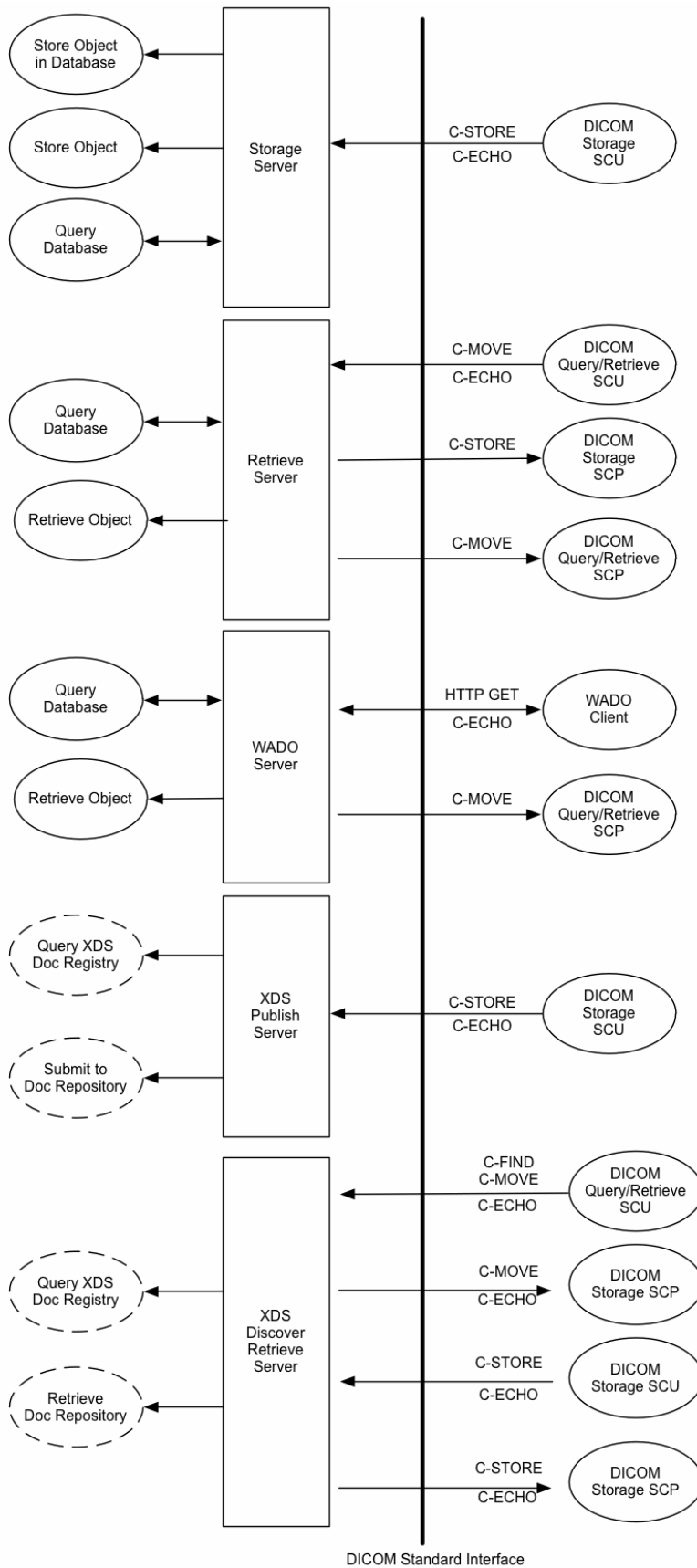
2 Networking

2.1 Implementation Model

2.1.1 Application Data Flow

Rialto is logically divided in five different DICOM Application Entities: Storage Server, Retrieve Server, WADO Server, XDS Publish Server and XDS Discover/Retrieve Server.

Application Data Flow Diagram



The Storage Server AE implements the DICOM Storage and Verification Service Classes.

The Retrieve Server AE implements the DICOM Retrieve and Verification Service Classes.

The WADO Server AE implements the WADO Service Classes.

The XDS Publish Server AE implements the DICOM Storage and Verification Service Classes.

The XDS Discover/Retrieve Server AE implements the DICOM Query/Retrieve, Storage and Verification Service Classes.

2.1.2 Functional Definitions of AEs

2.1.2.1 Functional Definition of Rialto Storage Server AE

Rialto Storage Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Storage Server AE expects it to be a DICOM application.

The Storage Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification, Storage, and Storage Commitment Service Classes.

Any objects received on such Presentation Contexts will be added to the Object Repository. The Storage Server AE stores only the Study Instance UID, Series Instance UID and SOP Instance UIDs of the objects that it receives.

2.1.2.2 Functional Definition of Rialto Retrieve Server AE

Rialto Retrieve Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Retrieve Server AE expects it to be a DICOM application.

The Retrieve Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Retrieve Service Classes.

The Retrieve Server AE responds to queries based on the records stored in its database.

The Rialto Retrieve Server AE is used to retrieve DICOM objects that were stored to the Storage Server AE. It expects that the requesting application already knows the SOP Instance UIDs of the DICOM objects that it wishes to retrieve.

If the requested object cannot be found in local storage, Rialto Retrieve Server AE will initiate a request to retrieve the object from the AE that originally stored the object.

2.1.2.3 Functional Definition of WADO Server AE

Rialto WADO Server Application Entity waits for another application to connect at the URL configured for its Application Entity Title. When another application connects, the WADO Server AE expects it to be a web application.

The WADO Server AE will accept web requests for retrieval of images..

The WADO Server AE responds to queries based on the records stored in its database.

The WADO Server AE is used to retrieve DICOM objects that were stored to the Storage Server AE. It expects that the requesting application already knows the SOP Instance UIDs of the DICOM objects that it wishes to retrieve.

If the requested object cannot be found in local storage, Rialto WADO Server AE will initiate a request to retrieve the object from the AE that originally stored the object.

2.1.2.4 Functional Definition of XDS Publish Server AE

Rialto XDS Publish Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the XDS Publish Server AE expects it to be a DICOM application.

The XDS Publish Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Storage Service Classes.

The XDS Publish Server AE will create a Key Object Selection document and publish it to an XDS Document Repository.

The XDS Publish Server AE may query the XDS Document Registry to get details about previously published Key Object Selection documents.

2.1.2.5 Functional Definition of XDS Discover/Retrieve Server AE

Rialto XDS Discover/Retrieve Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the XDS Discover/Retrieve Server AE expects it to be a DICOM application.

The XDS Discover/Retrieve Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification, Query/Retrieve and Storage Service Classes.

The XDS Discover/Retrieve Server AE will translate Query requests into queries of an XDS Document Registry and retrievals from XDS Document Repositories as required.

The XDS Discover/Retrieve Server AE will translate Retrieve requests into relational Retrieve requests of a DICOM Storage SCP.

The XDS Discover/Retrieve Server AE will forward Storage requests to a DICOM Storage SCP. Some attributes (e.g. Patient ID, Issuer of Patient ID) may be coerced during forwarding.

2.2 AE Specifications

2.2.1 Rialto Storage Server AE Specification

2.2.1.1 SOP Classes

Rialto Storage Server Application Entity provides Standard Conformance to the following SOP Classes:

SOP Classes for Rialto Storage Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	No	Yes
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	No	Yes
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 Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	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
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes

Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	No	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	No	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	No	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	No	Yes
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	No	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	No	Yes
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	No	Yes
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	No	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	No	Yes
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	No	Yes

Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	No	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	No	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	No	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	No	Yes

2.2.1.2 Association Establishment Policy

2.2.1.2.1 General

The Rialto Storage Server AE can both accept and propose Association Requests. The Rialto Storage Server AE will accept and propose Association Requests for the Verification, Storage, and Storage Commitment Push Model Services.

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

DICOM application context name for Rialto Storage Server AE

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

2.2.1.2.2 Number of Associations

Rialto Storage Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the configuration GUI.

Number of Associations accepted by Rialto Storage Server AE

Maximum number of simultaneous Associations	10 (Configurable)
---	-------------------

2.2.1.2.3 Asynchronous Nature

Rialto Storage 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 Nature as SCP for Rialto Storage Server AE

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

2.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

DICOM Implementation Class and Version for Rialto Storage Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

2.2.1.3 Association Acceptance Policy

2.2.1.3.1 Activity - Receive Images

Description and Sequencing of Activities

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

In the default configuration 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).

Association Rejection Reasons

Result	Source	Reason / Diag	Description
2 - rejected transient	provider	2 - local-limit 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 unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

Accepted Presentation Contexts

The following Transfer Syntaxes are represented by the term [Default TS List]:

[Default TS List] Transfer Syntax List for Rialto Storage Server AE

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

The following Transfer Syntaxes are represented by the term [Extended TS List]:

[Extended TS List] Transfer Syntax List for Rialto Storage Server AE

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
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 (Process 14)	1.2.840.10008.1.2.4.57
JPEG Lossless, Non- Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	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 Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Lossless	1.2.840.10008.1.2.5

Rialto Storage Server AE will accept Presentation Contexts as shown in the following table:

Accepted Presentation Contexts for Rialto Storage Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	[Default TS List]	SCP	None
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	[Extended TS List]	SCP	None
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	[Extended TS List]	SCP	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	[Extended TS List]	SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	[Extended TS List]	SCP	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	[Extended TS List]	SCP	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	[Extended TS List]	SCP	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	[Extended TS List]	SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	[Extended TS List]	SCP	None

Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	[Extended TS List]	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	[Extended TS List]	SCP	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	[Extended TS List]	SCP	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	[Extended TS List]	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	[Extended TS List]	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	[Extended TS List]	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	[Extended TS List]	SCP	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	[Extended TS List]	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	[Extended TS List]	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	[Extended TS List]	SCP	None
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	[Extended TS List]	SCP	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	[Extended TS List]	SCP	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	[Extended TS List]	SCP	None
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	[Extended TS List]	SCP	None
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	[Default TS List]	SCP	None
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	[Default TS List]	SCP	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	[Default TS List]	SCP	None
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	[Default TS List]	SCP	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	[Default TS List]	SCP	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	[Default TS List]	SCP	None
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	[Default TS List]	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	[Extended TS List]	SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	[Extended TS List]	SCP	None
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	[Extended TS List]	SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	[Extended TS List]	SCP	None

VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	[Extended TS List]	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	[Extended TS List]	SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	[Extended TS List]	SCP	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	[Extended TS List]	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	[Extended TS List]	SCP	None
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	[Extended TS List]	SCP	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	[Default TS List]	SCP	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	[Default TS List]	SCP	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	[Default TS List]	SCP	None
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	[Default TS List]	SCP	None
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	[Default TS List]	SCP	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	[Default TS List]	SCP	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	[Default TS List]	SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	[Extended TS List]	SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	[Extended TS List]	SCP	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	[Default TS List]	SCP	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	[Default TS List]	SCP	None
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	[Default TS List]	SCP	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	[Default TS List]	SCP	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	[Default TS List]	SCP	None
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	[Default TS List]	SCP	None

The preferred (default) Transfer Syntax is Explicit VR Little Endian.

SOP Specific Conformance

Specific Conformance for the Verification SOP Class

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

Rialto Storage Server C-Echo Response Status

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

Specific Conformance for the Storage SOP Classes

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

The Rialto 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 Rialto Storage Server AE always retains the original DICOM data in DICOM Part 10 compliant file format, which is stored in the local storage system. The Rialto Storage Server AE is Level 2 (Full) conformant as a Storage SCP. In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files. In addition to saving all Elements in files, the Study Instance UID, Series Instance UID and SOP Instance UID is stored in the Rialto Storage Server database to support retrieval requests.

Storage Server AE C-STORE Response

Rialto Storage Server C-STORE Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the system repository.
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response from the Rialto database or a file system operation. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.
Error	Duplicate SOP Instance UID	D000	This status is returned if the instance already exists in the database and the Rialto Storage Server AE is configured to refuse duplicate instances. The appropriate Status will be sent in the C-STORE Response. Error 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.

Rialto Storage Server Service Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The Storage Server SCP AE is waiting for the next C-STORE Request on an open	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

Association but the timer expires.	successfully received, they are maintained in the database. They are not automatically discarded because of a later failure. Error message is output to the Service Log.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The Storage Server 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, the data already received is discarded. If some Composite SOP Instances have already been successfully received over the Association, they are maintained in the database. Error message is output to the Service Log.
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, they are maintained in the database. They are not automatically discarded because of a later failure.

2.2.2 Rialto Retrieve Server AE Specification

2.2.2.1 SOP Classes

Rialto Retrieve Server Application Entity provides Standard Conformance to the following SOP Classes:

SOP Classes for Rialto Retrieve Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
<i>Patient Study Only Information Model - MOVE (Retired)</i>	<i>1.2.840.10008.5.1.4.1.2.3.2</i>	No	Yes
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	Yes	No
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	Yes	No
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 X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No

Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	No
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	No
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	No
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	No
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Yes	No
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Yes	No
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Yes	No

Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	Yes	No
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Yes	No
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	No
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	No
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	No

2.2.2.2 Association Establishment Policy

2.2.2.2.1 General

The Rialto Retrieve Server AE can both accept and propose Association Requests. The Rialto Retrieve Server AE will accept Association Requests for the Verification and Retrieve Services. It will propose Associations for Verification, Retrieve and Storage Services.

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

DICOM application context name for Rialto Retrieve Server AE

Application Context Name	1.2.840.10008.3.1.1.1
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2.2.2.2.2 Number of Associations

Rialto Retrieve Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the attribute "MaxClients" in the Application Server configuration.

Number of Associations accepted for Rialto Retrieve Server AE

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

Rialto Retrieve 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 Nature as SCP for Rialto Retrieve Server AE

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

The implementation information for this Application Entity is:

DICOM Implementation Class and Version for Rialto Retrieve Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

2.2.2.3 Association Initiation Policy

2.2.2.3.1 Activity - Send Images Requested by an External Peer AE

Description and Sequencing of Activities

The Rialto Retrieve AE will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer. The Retrieve 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, the image transfer is halted. The Query/Retrieve AE will not attempt to independently retry the image export.

Proposed Presentation Contexts

A list of Transfer Syntaxes can be configured for each AET. The default Transfer Syntaxes are the Transfer Syntax of the originally received instance plus the [Default TS List].

The following Transfer Syntaxes are represented by the term [Default TS List]:

[Default TS List] Transfer Syntax List for Rialto Retrieve Server AE

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

The following Transfer Syntaxes are represented by the term [Extended TS List]:

[Extended TS List] Transfer Syntax List for Rialto Retrieve Server AE

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
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 (Process 14)	1.2.840.10008.1.2.4.57

JPEG Lossless, Non- Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	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 Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Lossless	1.2.840.10008.1.2.5

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

Proposed Presentation Contexts by the Rialto Retrieve Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	[Default TS List]	SCU	None
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	[Extended TS List]	SCU	None
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	[Extended TS List]	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	[Extended TS List]	SCU	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	[Extended TS List]	SCU	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	[Extended TS List]	SCU	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	[Extended TS List]	SCU	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	[Extended TS List]	SCU	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	[Extended TS List]	SCU	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	[Extended TS List]	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	[Extended TS List]	SCU	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	[Extended TS List]	SCU	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	[Extended TS List]	SCU	None

Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	[Extended TS List]	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	[Extended TS List]	SCU	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	[Extended TS List]	SCU	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	[Extended TS List]	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	[Extended TS List]	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	[Extended TS List]	SCU	None
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	[Extended TS List]	SCU	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	[Extended TS List]	SCU	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	[Extended TS List]	SCU	None
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	[Extended TS List]	SCU	None
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	[Default TS List]	SCU	None
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	[Default TS List]	SCU	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	[Default TS List]	SCU	None
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	[Default TS List]	SCU	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	[Default TS List]	SCU	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	[Default TS List]	SCU	None
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	[Default TS List]	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	[Extended TS List]	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	[Extended TS List]	SCU	None
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	[Extended TS List]	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	[Extended TS List]	SCU	None
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	[Extended TS List]	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	[Extended TS List]	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	[Extended TS List]	SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	[Extended TS List]	SCU	None

VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	[Extended TS List]	SCU	None
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	[Extended TS List]	SCU	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	[Default TS List]	SCU	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	[Default TS List]	SCU	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	[Default TS List]	SCU	None
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	[Default TS List]	SCU	None
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	[Default TS List]	SCU	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	[Default TS List]	SCU	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	[Default TS List]	SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	[Extended TS List]	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	[Extended TS List]	SCU	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	[Default TS List]	SCU	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	[Default TS List]	SCU	None
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	[Default TS List]	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	[Default TS List]	SCU	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	[Default TS List]	SCU	None
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	[Default TS List]	SCU	None

SOP Specific Conformance

Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

Specific Conformance for Image, SR and KIN SOP Classes

The 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:

Rialto Retrieve Server AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote Storage SCP has successfully stored the exported SOP Instance. 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. Warning indication message is output to the Service Logs.
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.

Rialto Retrieve Server AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout).	The Association is aborted by issuing a DICOM A-ABORT. 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 A-ABORT. 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 Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs.

2.2.2.3.2 Activity - Retrieve Images Requested by an External Peer AE

Description and Sequencing of Activities

The Rialto Retrieve AE will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer but one or more of the requested objects is not found in local storage. The Retrieve AE will send an Association Request to the AE that originally stored the objects, and upon successful negotiation of the required Presentation Context a retrieve request is started. The Association will be released when all the images have been sent.

Proposed Presentation Contexts

A list of Transfer Syntaxes can be configured for each AET. The default Transfer Syntaxes are the Transfer Syntax of the originally received instance plus the [Default TS List].

The following Transfer Syntaxes are represented by the term [Default TS List]:

[Default TS List] Transfer Syntax List for Rialto Retrieve Server AE

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

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

Proposed Presentation Contexts by the Rialto Retrieve Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	[Default TS List]	SCU	None
Patient Root Q/R Information Model – Move	1.2.840.10008.5.1.4.1.2.1.2	[Default TS List]	SCU	Relational
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	[Default TS List]	SCU	Relational

SOP Specific Conformance

Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

2.2.2.4 Association Acceptance Policy

2.2.2.4.1 Activity - Handling Query and Retrieval Requests

Description and Sequencing of Activities

The Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, the Association Request itself is rejected. It can be configured to only accept Associations from certain Application Entities.

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

The 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 Composite SOP Instance.

The Retrieve 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).

Association Rejection Reasons

Result	Source	Reason / Diag	Description
2 - rejected transient	provider	2 - local-limit 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 unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

Accepted Presentation Contexts

Rialto Retrieve Server AE will accept Presentation Contexts as shown in the following table:

Accepted Presentation Contexts for Rialto Retrieve Server AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
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	SCP	Relational
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
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	SCP	Relational
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
<i>Patient/Study Only Q/R Information Model – MOVE (Retired)</i>	<i>1.2.840.10008.5.1.4.1.2.3.2 (Retired)</i>	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

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

SOP Specific Conformance

Specific Conformance for Verification SOP Class

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

Rialto Retrieve Server C-Echo Response Status

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

Specific Conformance for Retrieve SOP Classes

The Retrieve Server AE supports hierarchical and relational retrieves.

Rialto Retrieve Server C-MOVE Response Status

Service Status	Further Meaning	Error Code	Reason
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 a query of the Rialto 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 sub-operations	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	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Rialto Retrieve Server Service Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. the Retrieve Server SCP AE is waiting for the next C-FIND or C-MOVE 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.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The Retrieve Server AE is waiting for the next message PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log.
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.

2.2.3 Rialto WADO Server AE Specification

Rialto includes a WADO Server Application Entity that can be used to provide access to DICOM objects via a web based interface. The following table describes the configurable attributes of the WADO Server AE

WADO Configuration Parameters

Parameter	Configurable (Yes/No)	Default Value
Listening URL	Yes	http://localhost:8080/WADO

The following table describes the supported MIME types of the WADO Server AE.

WADO MIME TYPES

MIME Type	Description
application/dicom	The body content will be a "Part 10 File" that includes the meta-header. The returned DICOM object will be encoded using one the transfer syntaxes specified in the transfer syntax query parameter as defined below. By default, the transfer syntax shall be "Explicit VR Little Endian".
application/jpeg	The body content will be a JPEG image. The size and quality of the image will depend on the query parameters as defined below.

The following table describes the query parameters that can be passed to the WADO Server AE.

WADO Query Parameters

Query Parameters	Required (Yes/No)	Description
requestType	Yes	The value must be "WADO".
studyUID	Yes	The Study Instance UID identifying the DICOM object. The value must be present and encoded as a UID, except that it shall not be padded to even length with a NULL character.
seriesUID	Yes	The Series Instance UID identifying the DICOM object. The value must be present and encoded as a UID, except that it shall not be padded to even length with a NULL character.
objectUID	Yes	The SOP Instance UID identifying the DICOM object. The value must be

		present and encoded as a UID, except that it shall not be padded to even length with a NULL character.
contentType	No	Can be one of application/dicom or image/jpeg.
transferSyntax	No	The Transfer Syntax to be used within the DICOM object. This parameter is optional and shall not be present if the contentType is other than application/dicom.
rows	No	The maximum number of rows returned. Only valid for contentType image/jpeg.
columns	No	The maximum number of columns returned. Only valid for contentType image/jpeg.
quality	No	The quality factor for JPEG compression. Only valid for contentType image/jpeg.

2.2.3.1 Association Initiation Policy

2.2.3.1.1 Activity - Retrieve Images Requested by an External Peer AE

Description and Sequencing of Activities

The Rialto WADO AE will initiate a new Association when a valid WADO Request has been performed by an external Peer but one or more of the requested objects is not found in local storage. The WADO AE will send an Association Request to the AE that originally stored the objects, and upon successful negotiation of the required Presentation Context a retrieve request is started. The Association will be released when all the images have been sent.

Proposed Presentation Contexts

A list of Transfer Syntaxes can be configured for each AET. The default Transfer Syntaxes are the Transfer Syntax of the originally received instance plus the [Default TS List].

The following Transfer Syntaxes are represented by the term [Default TS List]:

[Default TS List] Transfer Syntax List for Rialto Retrieve Server AE

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

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

Proposed Presentation Contexts by the Rialto Retrieve Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	[Default TS List]	SCU	None
Patient Root Q/R Information Model – Move	1.2.840.10008.5.1.4.1.2.1.2	[Default TS List]	SCU	Relational
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	[Default TS List]	SCU	Relational

SOP Specific Conformance

Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

2.2.4 Rialto XDS Publish Server AE Specification

2.2.4.1 SOP Classes

Rialto XDS Publish Server Application Entity provides Standard Conformance to the following SOP Classes:

SOP Classes for Rialto XDS Publish Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	No	Yes
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	No	Yes
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 Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	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
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes

12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	No	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	No	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	No	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	No	Yes
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	No	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	No	Yes
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	No	Yes
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	No	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	No	Yes
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	No	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	No	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	No	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes

RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	No	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	No	Yes

2.2.4.2 Association Establishment Policy

2.2.4.2.1 General

The Rialto XDS Publish Server AE can accept Association Requests. The Rialto XDS Publish Server AE will accept Association Requests for the Verification and Storage Services.

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

DICOM application context name for Rialto XDS Publish Server AE

Application Context Name	1.2.840.10008.3.1.1.1
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2.2.4.2.2 Number of Associations

Rialto XDS Publish Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the configuration GUI.

Table 4. Number of Associations accepted by Rialto XDS Publish Server AE

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

Rialto XDS Publish 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 Nature as SCP for Rialto XDS Publish Server AE

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

2.2.4.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

DICOM Implementation Class and Version for Rialto XDS Publish Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

2.2.4.3 Association Acceptance Policy

2.2.4.3.1 Activity - Receive Images

Description and Sequencing of Activities

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

In the default configuration any Calling and Called AET will be accepted. If the Called AET does not correspond to the actual XDS Publish 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 XDS Publish 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).

Association Rejection Reasons

Result	Source	Reason / Diag	Description
2 - rejected transient	provider	2 - local-limit 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 unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

Accepted Presentation Contexts

The following Transfer Syntaxes are represented by the term [Default TS List]:

[Default TS List] Transfer Syntax List for Rialto XDS Publish Server AE

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

The following Transfer Syntaxes are represented by the term [Extended TS List]:

[Extended TS List] Transfer Syntax List for Rialto XDS Publish Server AE

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
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 (Process 14)	1.2.840.10008.1.2.4.57
JPEG Lossless, Non- Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	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 Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90

JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Lossless	1.2.840.10008.1.2.5

Rialto XDS Publish Server AE will accept Presentation Contexts as shown in the following table:

Accepted Presentation Contexts for Rialto XDS Publish Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	[Default TS List]	SCP	None
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	[Extended TS List]	SCP	None
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	[Extended TS List]	SCP	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	[Extended TS List]	SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	[Extended TS List]	SCP	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	[Extended TS List]	SCP	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	[Extended TS List]	SCP	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	[Extended TS List]	SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	[Extended TS List]	SCP	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	[Extended TS List]	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	[Extended TS List]	SCP	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	[Extended TS List]	SCP	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	[Extended TS List]	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	[Extended TS List]	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	[Extended TS List]	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	[Extended TS List]	SCP	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	[Extended TS List]	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	[Extended TS List]	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	[Extended TS List]	SCP	None

Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	[Extended TS List]	SCP	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	[Extended TS List]	SCP	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	[Extended TS List]	SCP	None
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	[Extended TS List]	SCP	None
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	[Default TS List]	SCP	None
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	[Default TS List]	SCP	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	[Default TS List]	SCP	None
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	[Default TS List]	SCP	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	[Default TS List]	SCP	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	[Default TS List]	SCP	None
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	[Default TS List]	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	[Extended TS List]	SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	[Extended TS List]	SCP	None
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	[Extended TS List]	SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	[Extended TS List]	SCP	None
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	[Extended TS List]	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	[Extended TS List]	SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	[Extended TS List]	SCP	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	[Extended TS List]	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	[Extended TS List]	SCP	None
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	[Extended TS List]	SCP	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	[Default TS List]	SCP	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	[Default TS List]	SCP	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	[Default TS List]	SCP	None
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	[Default TS List]	SCP	None

Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	[Default TS List]	SCP	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	[Default TS List]	SCP	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	[Default TS List]	SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	[Extended TS List]	SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	[Extended TS List]	SCP	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	[Default TS List]	SCP	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	[Default TS List]	SCP	None
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	[Default TS List]	SCP	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	[Default TS List]	SCP	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	[Default TS List]	SCP	None
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	[Default TS List]	SCP	None

The preferred (default) Transfer Syntax is Explicit VR Little Endian.

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

SOP Specific Conformance

Specific Conformance for the Verification SOP Class

Rialto XDS Publish Server provides standard conformance to the DICOM Verification Service Class as an SCP. The status code for the C-ECHO is described in the following table:

Rialto XDS Publish Server C-Echo Response Status

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

Specific Conformance for the Storage SOP Classes

The associated activity with the XDS Publish Server is the creation of Key Object Selection (KOS) documents and the publication of those documents to an XDS Document Repository. After the document has been published, the XDS Publish Server may purge the stored images.

The Rialto XDS Publish 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.

XDS Publish Server AE C-STORE Response

Rialto XDS Publish Server C-STORE Response Status

Service Status	Further Meaning	Error Code	Reason
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Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the system repository.
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response from the Rialto database or a file system operation. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.
Error	Duplicate SOP Instance UID	D000	This status is returned if the instance already exists in the database and the Rialto XDS Publish Server AE is configured to refuse duplicate instances. The appropriate Status will be sent in the C-STORE Response. Error 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.

Rialto XDS Publish Server Service Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The XDS Publish Server SCP 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, they are maintained in the database. They are not automatically discarded because of a later failure. Error message is output to the Service Log.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The XDS Publish Server 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, the data already received is discarded. If some Composite SOP Instances have already been successfully received over the Association, they are maintained in the database. Error message is output to the Service Log.
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, they are maintained in the database. They are not automatically discarded because of a later failure.

2.2.5 Rialto XDS Discover/Retrieve Server AE Specification

2.2.5.1 SOP Classes

Rialto XDS Discover/Retrieve Server Application Entity provides Standard Conformance to the following SOP Classes:

SOP Classes for Rialto XDS Discover/Retrieve Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	No	Yes
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	No	Yes
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	No	Yes
<i>Patient Study Only Information Model - FIND (Retired)</i>	<i>1.2.840.10008.5.1.4.1.2.3.1</i>	No	Yes
<i>Patient Study Only Information Model - MOVE (Retired)</i>	<i>1.2.840.10008.5.1.4.1.2.3.2</i>	No	Yes
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	Yes	Yes
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	Yes	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
Ultrasound Multi-frame Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes

Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Yes	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Yes	Yes
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	Yes	Yes
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes

RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes

2.2.5.2 Association Establishment Policy

2.2.5.2.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1
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2.2.5.2.2 Number of Associations

Rialto XDS Discover/Retrieve Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the attribute "MaxClients" in the Application Server configuration.

Number of Associations accepted for Rialto XDS Discover/Retrieve Server AE

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

Rialto XDS Discover/Retrieve 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 Nature as SCP for Rialto XDS Discover/Retrieve Server AE

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

The implementation information for this Application Entity is:

DICOM Implementation Class and Version for Rialto XDS Discover/Retrieve Server AE

Implementation Class UID	1.2.40.0.13.1.1
Implementation Version Name	dcm4che-2.0

2.2.5.3 Association Initiation Policy

2.2.5.3.1 Activity - Send Images Requested by an External Peer AE

Description and Sequencing of Activities

The Rialto XDS Discover/Retrieve AE will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer. The XDS Discover/Retrieve AE will modify and forward the C-MOVE Request to a configured destination.

The Rialto XDS Discover/Retrieve AE will initiate a new Association when a valid C-STORE Request has been performed by an external Peer. The XDS Discover/Retrieve AE will modify and forward the C-STORE Request to a configured destination.

Proposed Presentation Contexts

A list of Transfer Syntaxes can be configured for each AET. The default Transfer Syntaxes are the Transfer Syntax of the originally received instance plus the [Default TS List].

The following Transfer Syntaxes are represented by the term [Default TS List]:

[Default TS List] Transfer Syntax List for Rialto XDS Discover/Retrieve Server AE

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

The following Transfer Syntaxes are represented by the term [Extended TS List]:

[Extended TS List] Transfer Syntax List for Rialto XDS Discover/Retrieve Server AE

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
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 (Process 14)	1.2.840.10008.1.2.4.57
JPEG Lossless, Non- Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	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 Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Lossless	1.2.840.10008.1.2.5

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

Proposed Presentation Contexts by the Rialto XDS Discover/Retrieve Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	[Default TS List]	SCU	None
Hardcopy Grayscale Image Storage SOP Class	1.2.840.10008.5.1.1.29	[Extended TS List]	SCU	None
Hardcopy Color Image Storage SOP Class	1.2.840.10008.5.1.1.30	[Extended TS List]	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	[Extended TS List]	SCU	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	[Extended TS List]	SCU	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	[Extended TS List]	SCU	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	[Extended TS List]	SCU	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	[Extended TS List]	SCU	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	[Extended TS List]	SCU	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	[Extended TS List]	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	[Extended TS List]	SCU	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	[Extended TS List]	SCU	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	[Extended TS List]	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	[Extended TS List]	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	[Extended TS List]	SCU	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	[Extended TS List]	SCU	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	[Extended TS List]	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	[Extended TS List]	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	[Extended TS List]	SCU	None
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	[Extended TS List]	SCU	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	[Extended TS List]	SCU	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	[Extended TS List]	SCU	None

Multi-frame Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	[Extended TS List]	SCU	None
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	[Default TS List]	SCU	None
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	[Default TS List]	SCU	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	[Default TS List]	SCU	None
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	[Default TS List]	SCU	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	[Default TS List]	SCU	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	[Default TS List]	SCU	None
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	[Default TS List]	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	[Extended TS List]	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	[Extended TS List]	SCU	None
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	[Extended TS List]	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	[Extended TS List]	SCU	None
VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	[Extended TS List]	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	[Extended TS List]	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	[Extended TS List]	SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	[Extended TS List]	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	[Extended TS List]	SCU	None
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	[Extended TS List]	SCU	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	[Default TS List]	SCU	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	[Default TS List]	SCU	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	[Default TS List]	SCU	None
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	[Default TS List]	SCU	None
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	[Default TS List]	SCU	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	[Default TS List]	SCU	None
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	[Default TS List]	SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	[Extended TS List]	SCU	None

RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	[Extended TS List]	SCU	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	[Default TS List]	SCU	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	[Default TS List]	SCU	None
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	[Default TS List]	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	[Default TS List]	SCU	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	[Default TS List]	SCU	None
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	[Default TS List]	SCU	None
Patient Root Q/R Information Model – Move	1.2.840.10008.5.1.4.1.2.1.2	[Default TS List]	SCU	Relational
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	[Default TS List]	SCU	Relational

SOP Specific Conformance

Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

Specific Conformance Storage SOP Classes

The XDS Discover/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:

Rialto XDS Discover/Retrieve Server AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote Storage SCP has successfully stored the exported SOP Instance. 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	B007	Image transmission is considered successful.

	match SOP Class		The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Warning indication message is output to the Service Logs.
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.

Specific Conformance Storage SOP Classes

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

Rialto XDS Discover/Retrieve Server AE C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	Matching is complete. No final identifier is supplied.
Error	Processing Failure	0110	This status is returned from the forwarded C-MOVE SCP.
Error	Unable to perform sub-operations	A702	This status is returned from the forwarded C-MOVE SCP.
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	This status is returned from the forwarded C-MOVE SCP.
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	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Rialto XDS Discover/Retrieve Server AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout).	The Association is aborted by issuing a DICOM A-ABORT. 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 A-ABORT. 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 Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs.

2.2.5.4 Association Acceptance Policy

2.2.5.4.1 Activity - Handling Query and Retrieval Requests

Description and Sequencing of Activities

The XDS Discover/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, the Association Request itself is rejected. It can be configured to only accept Associations from certain Application Entities.

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

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

The XDS Discover/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 Composite SOP Instance.

The XDS Discover/Retrieve 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).

Association Rejection Reasons

Result	Source	Reason / Diag	Description
2 - rejected transient	provider	2 - local-limit 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 unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

Accepted Presentation Contexts

Rialto XDS Discover/Retrieve Server AE will accept Presentation Contexts as shown in the following table:

Accepted Presentation Contexts for Rialto XDS Discover/Retrieve Server AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Patient Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	Relational
Patient Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	Relational
Study Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	Relational
Study Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	Relational
<i>Patient/Study Only Q/R Information Model – FIND (Retired)</i>	<i>1.2.840.10008.5.1.4.1.2.3.1 (Retired)</i>	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	Relational
<i>Patient/Study Only Q/R Information Model – MOVE (Retired)</i>	<i>1.2.840.10008.5.1.4.1.2.3.2 (Retired)</i>	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	Relational

If the Called AET is not corresponding to the actual XDS Discover/Retrieve Server AET, only the Presentation Context for the Verification SOP Class will be accepted.

SOP Specific Conformance

Specific Conformance for Verification SOP Class

Rialto XDS Discover/Retrieve Server provides standard conformance to the DICOM Verification Service Class as an SCP. The status code for the C-ECHO is described in the following table:

Rialto XDS Discover/Retrieve Server C-Echo Response Status

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

Specific Conformance for Query SOP Classes

The XDS Discover/Retrieve Server AE supports hierarchical and relational queries.

The XDS Discover/Retrieve Server AE supports the subset of those attributes that may be found in the metadata stored in XDS Document Registries or in KOS documents stored in XDS Document Repositories.

Patient Root C-FIND SCP Supported Elements

SOP Common - Attribute Name	Tag	VR	Types of Matching
Specific Character Set	0008,0005	CS	NONE
Patient Level - Attribute Name	Tag	VR	Types of Matching
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Patient's Birth Date	0010,0030	DA	S,U,R
Patient's Sex	0010,0040	CS	S,U
Study Level - Attribute Name	Tag	VR	Types of Matching
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
Modalities In Study	0008,0061	CS	S,*,U
Study Description	0008,1030	LO	S,*,U
Series Level - Attribute Name	Tag	VR	Types of Matching
Series Instance UID	0020,000E	UI	S,L
Series Number	0020,0011	IS	S,*,U
Modality	0008,0060	CS	S,*,U
Image Level - Attribute Name	Tag	VR	Types of Matching
SOP Instance UID	0008,0018	UI	S,L
SOP Class UID	0008,0016	UI	S
Instance Number	0020,0013	IS	S,U

Study Root C-FIND SCP Supported Elements

SOP Common - Attribute Name	Tag	VR	Types of Matching
Specific Character Set	0008,0005	CS	NONE
Study Level - Attribute Name	Tag	VR	Types of Matching
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
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
Accession Number	0008,0050	SH	S,*,U
Modalities In Study	0008,0061	CS	S,*,U
Study Description	0008,1030	LO	S,*,U
Series Level - Attribute Name	Tag	VR	Types of Matching
Series Instance UID	0020,000E	UI	S,L
Series Number	0020,0011	IS	S,*,U
Modality	0008,0060	CS	S,*,U
Image Level - Attribute Name	Tag	VR	Types of Matching
SOP Instance UID	0008,0018	UI	S,L
SOP Class UID	0008,0016	UI	S
Image Type	0008,0008	CS	S,*,U
Instance Number	0020,0013	IS	S,U

Types of Matching:

The C-FIND SCP supports the following types of Matching: 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).

Rialto XDS Discover/Retrieve Server C-FIND Response Status

Service Status	Further Meaning	Error Code	Reason
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 a query of the Rialto database. The appropriate Status will be sent in the C-STORE 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 current 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.

Specific Conformance for Retrieve SOP Classes

Rialto XDS Discover/Retrieve Server C-MOVE Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	Matching is complete. No final identifier is supplied.
Error	Processing Failure	0110	This status is returned from the forwarded C-MOVE SCP.
Error	Unable to perform sub-operations	A702	This status is returned from the forwarded C-MOVE SCP.
Error	Move Destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to XDS Discover/Retrieve SCP AE. Error indication message is output to the Service Log.
Error	Identifier does not match SOP Class	A900	This status is returned from the forwarded C-MOVE SCP.
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	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Rialto XDS Discover/Retrieve Server Service Communication Failure Behavior

Exception	Behavior
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Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. the XDS Discover/Retrieve Server SCP AE is waiting for the next C-FIND or C-MOVE 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.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The XDS Discover/Retrieve Server AE is waiting for the next message PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log.
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.

2.3 Network Interfaces

2.3.1 Supported Communication Stacks

DICOM Upper Layer over TCP/IP is supported.

2.3.1.1 TCP/IP Stack

Rialto inherits its TCP/IP stack from the installed Java Runtime Environment.

2.3.2 Physical Network Interface

Rialto is indifferent to the physical medium over which TCP/IP executes; it inherits this from the Java Runtime Environment.

2.4 Configuration

2.4.1 AE Title/Presentation Address Mapping

2.4.1.1 Local AE Titles

The local AE Titles and TCP ports are configurable through the Rialto configuration interface (Transaction Broker).

AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
Rialto Storage Server	RIALTO_STORAGE	4104
Rialto Retrieve Server	RIALTO_RETRIEVE	4105
Rialto XDS Publish Server	RIALTO_XDS_PUB	4106
Rialto XDS Discover/Retrieve Server	RIALTO_XDS_DR	4107
Rialto WADO Server	RIALTO_WADO	8080

2.4.1.2 Remote AE Titles

Remote AE Titles, TCP/IP Addresses and ports can be configured through the Rialto configuration interface.

In the default configuration, Association Requests with any Calling AET will be accepted.

2.4.2 Configuration Parameters

The following table shows the Rialto configuration parameters relevant to DICOM communication. Refer to the Rialto Service Manual for details on general configuration capabilities.

Configuration Parameter Table

Parameter	Configurable (Yes/No)	Default Value
General		
Maximum number of simultaneous Associations	Yes	10
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	1h
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
Maximum PDU size the AE can receive	Yes	16352
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	Yes	off
Accepted TLS Ciphers	Yes	-

3 Media Interchange

Rialto does not support Media Storage.

4 Support of Extended Character Sets

Rialto supports ISO_IR 100 (ISO 8859-1 Latin 1) as an extended character set.

5 Security

5.1 Security Profiles

Rialto supports secure DICOM communication in conformance with the Basic TLS Secure Transport Connection Profile. At default configuration, the TLS option is deactivated.

5.2 Association Level Security

Rialto can be configured to accept Association Requests from only a limited list of Calling AE Titles.

In the default configuration, Association requests with any Calling AET and any Called AET will be accepted. However, if the Called AET is not corresponding to any of the actual DICOM server AETs, only acceptance of the Presentation Context for Verification SOP Class will be returned in the Association Acceptance Response (A-ASSOCIATE AC).

5.3 Application Level Security

The Rialto web based administration module can be configured to require user authentication in order to access the user interface functionalities.

6 Annexes

6.1 IOD Contents

6.1.1 Created SOP Instances

Rialto does not create SOP Instances.

6.1.2 Usage of Attributes from received IOD's

Rialto does not have any application specific dependencies on certain fields.

6.1.3 Coerced/Modified fields

The Retrieve Server, WADO Server and XDS Discover/Retrieve Server may coerce the Patient ID (0010,0010) and the Issuer of Patient ID (0010,0021) fields, mapping the Patient ID to the Issuer of Patient ID of the requesting AE.