CHANGE HEALTHCARE

Change Healthcare Image Repository™

Change Healthcare Image Repository 14.0
DICOM Conformance Statement

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1 CONFORMANCE STATEMENT OVERVIEW

Change Healthcare Image Repository is a self-contained, networked computer system that archives and manages diagnostic medical data on behalf of systems that it interoperates with. As a PACS-neutral enterprise centralized imaging archive, Change Healthcare Image Repository can be used to store isolated department data or multi-facility enterprise data that has been managed by its own separate PACS system.

Change Healthcare Image Repository centralized management of enterprise image data enables and simplifies image data sharing and clinical collaborations between disparate healthcare enterprises or systems, where such sharing is legally permitted.

Change Healthcare Image Repository is designed to reduce the complexity of integrations (interfaces) across the enterprise and reduce the escalating image management related expenditures, including hardware and operating costs.

It can support multiple GSPS objects for a given study when the Presentation State information varies for each image or a group of images. The details describing how annotations in multiple GSPS objects should be applied when they are assigned to the same image (e.g. apply annotations cumulatively to the same image) or how the GSPS attributes: Presentation Label, Presentation Creation Date, and Presentation Creation Time are used for grouping multiple GSPS objects to form a presentation state is not described in this document. Change Healthcare Image Repository does not support CSPS device-independent color space capabilities. Please consult with a Change Healthcare Representative to learn more about Change Healthcare support for multiple GSPS objects and CSPS objects in the Change Healthcare Image Repository.

Change Healthcare Image Repository includes the ability to import, send, query and retrieve, and perform media import Digital Breast Tomosynthesis (DBT) images and synthesized 2D MG images. Please consult with a Change Healthcare Representative for a complete list of features that Change Healthcare Image Repository supports for DBT images.

Change Healthcare Image Repository as a centralized archive needs to handle imaging data where the patient and study identifiers can be from multiple assigning authorities. With the addition of the IHE MIMA Multiple Identity Resolution option feature, Change Healthcare Image Repository will be capable of exchanging the patient and study identifiers associated with the assigning authorities in a standard manner.

Change Healthcare Image Repository handles the synchronization of Imaging Instances based on the IHE Imaging Object Change Management (IOCM) Integration Profile. IOCM specifies how one actor communicates local changes applied on existing imaging objects to other actors that manage copies of the modified imaging objects in their own local systems. The supported changes include (1) object rejection due to quality or patient safety reasons, (2) correction of incorrect modality worklist entry selection, and (3) expiration of objects due to data retention requirements. Change Healthcare Image Repository follows the IHE IOCM approach of using DICOM KOS instances for change communication. However, certain implementation details deviate from the Profile to better fit the Change Healthcare Image Repository existing architecture and practice.

Change Healthcare Image Repository supports Query based on ID for DICOM Objects by Representational State Transfer Services (QIDO-RS) to allow web-based queries for studies, series and instances.

Change Healthcare Image Repository supports Web Access to DICOM Persistent Objects by RESTful Services (WADO-RS) to allow web-based retrieve for studies, series and instances.

The system conforms to the DICOM 3.0 standard[1] to allow the sharing of medical information with other digital imaging systems.

Table 1 provides an overview of the network services supported by Change Healthcare Image Repository.

Table 1: Network Services

DICOM SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Verification			
Verification	1.2.840.10008.1.1	Yes	Yes
Transfer			
12-lead ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
Ambulatory ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	Yes
Basic Voice Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	Yes
Cardiac Electrophysiology Waveform	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	Yes
General Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.2	Yes	Yes
Arterial Pulse Waveform	1.2.840.10008.5.1.4.1.1.9.5.1	Yes	Yes
Respiratory Waveform	1.2.840.10008.5.1.4.1.1.9.6.1	Yes	Yes
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Comprehensive Structured Report	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Mammography CAD Structured Report	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
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	Yes
Colon CAD SR Document	1.2.840.10008.5.1.4.1.1.88.69	Yes	Yes
Implantation Plan SR Document	1.2.840.10008.5.1.4.1.1.88.70	Yes	Yes
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Encapsulated CDA IOD	1.2.840.10008.5.1.4.1.1.104.2	Yes	Yes
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
CT Image	1.2.840.10008.5.1.4.1.1.2	Yes	Yes

[1] NEMA PS 3.1 - 3.20 (2014)

DICOM SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
Digital X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammography Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography Image (Processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Breast Tomosynthesis Image	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	Yes
Digital Intra-oral X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes
Digital Intra-oral X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.2	Yes	Yes
Pseudo-Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.3	Yes	Yes
Blending Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.4	Yes	Yes
XA/XRF Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.5	Yes	Yes
Hardcopy Color Image	1.2.840.10008.5.1.1.30	Yes	Yes
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	Yes	Yes
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
MR Image	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
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Nuclear Medicine Image (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	Yes
Positron Emission Tomography Image	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Enhanced PET Image	1.2.840.10008.5.1.4.1.1.130	Yes	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials	1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	Yes	Yes
Segmentation	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Surface Segmentation	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Real World Value Mapping	1.2.840.10008.5.1.4.1.1.67	Yes	Yes

DICOM SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Yes	Yes
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	Yes
RT Beams Delivery Instruction	1.2.840.10008.5.1.4.34.7	Yes	Yes
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Stand-alone Curve	1.2.840.10008.5.1.4.1.1.9	Yes	Yes
Stand-alone Modality LUT	1.2.840.10008.5.1.4.1.1.10	Yes	Yes
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Yes	Yes
Stand-alone VOI LUT	1.2.840.10008.5.1.4.1.1.11	Yes	Yes
Standalone PET Curve	1.2.840.10008.5.1.4.1.1.129	Yes	Yes
Stored Print	1.2.840.10008.5.1.1.27	Yes	Yes
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Ultrasound Image (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	Yes
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Ultrasound Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	Yes
VL Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
VL Image (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Yes	Yes
VL Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Yes	Yes
Video Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	Yes
Video Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	Yes
Video Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	Yes
Ophthalmic Photography 8 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	Yes
Ophthalmic Photography 16 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	Yes
Ophthalmic Tomography Image	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes
VL Whole Slide Microscopy Image	1.2.840.10008.5.1.4.1.1.77.1.6	Yes	Yes
Stereometric Relationship	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	Yes
X-Ray Angiographic Bi-Plane Image (retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes

DICOM SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	Yes	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	Yes	Yes
X-Ray Radiation Dose Structured Report	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Lensometry Measurements	1.2.840.10008.5.1.4.1.1.78.1	Yes	Yes
Autorefraction Measurements	1.2.840.10008.5.1.4.1.1.78.2	Yes	Yes
Keratometry Measurements	1.2.840.10008.5.1.4.1.1.78.3	Yes	Yes
Subjective Refraction Measurements	1.2.840.10008.5.1.4.1.1.78.4	Yes	Yes
Visual Acuity Measurements	1.2.840.10008.5.1.4.1.1.78.5	Yes	Yes
Spectacle Prescription Report	1.2.840.10008.5.1.4.1.1.78.6	Yes	Yes
Ophthalmic Axial Measurements	1.2.840.10008.5.1.4.1.1.78.7	Yes	Yes
Intraocular Lens Calculations	1.2.840.10008.5.1.4.1.1.78.8	Yes	Yes
Macular Grid Thickness and Volume Report	1.2.840.10008.5.1.4.1.1.79.1	Yes	Yes
Ophthalmic Visual Field Static Perimetry Measurements	1.2.840.10008.5.1.4.1.1.80.1	Yes	Yes
Basic Structured Display IOD	1.2.840.10008.5.1.4.1.1.131	Yes	Yes
Generic Implant Template	1.2.840.10008.5.1.4.43.1	Yes	Yes
Implant Assembly Template	1.2.840.10008.5.1.4.44.1	Yes	Yes
Implant Template Group	1.2.840.10008.5.1.4.45.1	Yes	Yes
Intravascular Optical Coherence Tomography Image Storage (Presentation)	1.2.840.10008.5.1.4.1.1.14.1	Yes	Yes
Intravascular Optical Coherence Tomography Image Storage (Processing)	1.2.840.10008.5.1.4.1.1.14.2	Yes	Yes
Surface Scan Mesh Storage	1.2.840.10008.5.1.4.1.1.68.1	Yes	Yes
Surface Scan Point Cloud Storage	1.2.840.10008.5.1.4.1.1.68.2	Yes	Yes
Comprehensive 3D SR	1.2.840.10008.5.1.4.1.1.88.34	Yes	Yes
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	Yes	Yes
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Yes	Yes
Query/Retrieve			
Patient Root Q/R – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Patient Root Q/R – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Study Root Q/R – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Study Root Q/R – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Patient Study Only – FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	Yes
Patient Study Only – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	Yes
Workflow Management			
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	Yes
Modality Worklist	1.2.840.10008.5.1.4.31	Yes	Yes
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	Yes

DICOM SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Verification			
Verification	1.2.840.10008.1.1	Yes	Yes
Transfer			

NOTE1: Relational Queries are not supported either as an SCU or SCP.

Table 2 provides an overview of the Media Storage Application Profiles supported by Change Healthcare Image Repository.

Table 2: Media Storage Application Profiles

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk – Recordable		
General Purpose CD-R	No	Yes
Ultrasound Image Display Single Frame	No	Yes
Ultrasound Spatial Calibration Single Frame	No	Yes
Ultrasound Combined Calibration Single Frame	No	Yes
Ultrasound Image Display Single and Multi-Frame	No	Yes
Ultrasound Spatial Calibration Single and Multi-Frame	No	Yes
Ultrasound Combined Calibration Single and Multi-Frame	No	Yes
General Purpose CD-R	No	Yes

NOTE1: Change Healthcare Image Repository can also support these Ultrasound Application Profiles for MOD media if equipped with the necessary hardware.

Table 3: QIDO-RS and WADO-RS Network Services

Network Service	User of Service (Client)	Provider of Service (Server)
Query by ID for DICOM Objects (QIDO)		
QIDO-RS – Search for Studies	No	Yes
QIDO-RS – Search for Series	No	Yes
QIDO-RS – Search for Instances	No	Yes
Web Access to DICOM Objects (WADO)		
WADO – RS – Retrieve Study	No	Yes
WADO – RS – Retrieve Series	No	Yes
WADO – RS – Retrieve Instance	No	Yes
WADO – RS – Retrieve Frames	No	Yes
WADO – RS – Retrieve BulkData	No	Yes
WADO – RS – Retrieve Metadata	No	Yes

2 Introduction

2.1 Audience

This document is the DICOM 3.0 Conformance Statement for Change Healthcare Image Repository. It is intended for hospital staff, health system integrators, and software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

2.2 Remarks

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

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.

The scope of this Conformance Statement is to facilitate communication between Change Healthcare Image Repository and other DICOM systems. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [DICOM]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different Conformance Statements is the first step towards assessing interconnectivity between Change Healthcare Image Repository and other DICOM conformant equipment.
- Test procedures should be defined to validate the desired level of connectivity.

2.3 Definitions, Terms and Abbreviations

VR	Value Representation - The value type of the DICOM attribute

3 Networking

3.1 Implementation Model

3.1.1Application Data Flow Diagram

Figure 1: Change Healthcare Image Repository 14.0 DICOM Network Data Flow Diagram

Figure 1-1 Send Instances to External System

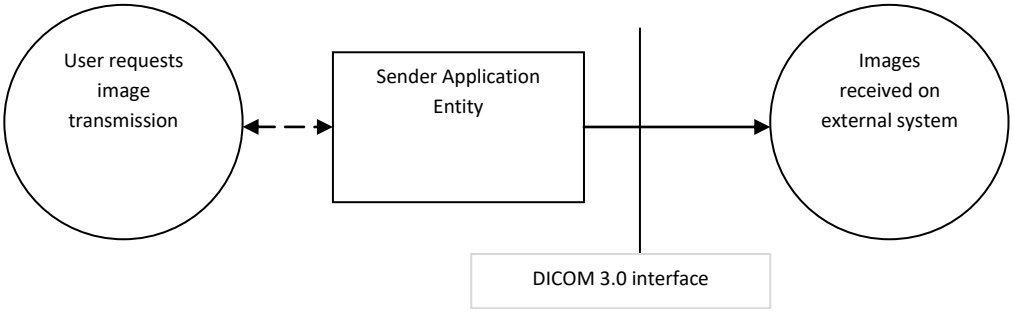


Figure 1-2 Receive Instances from External System

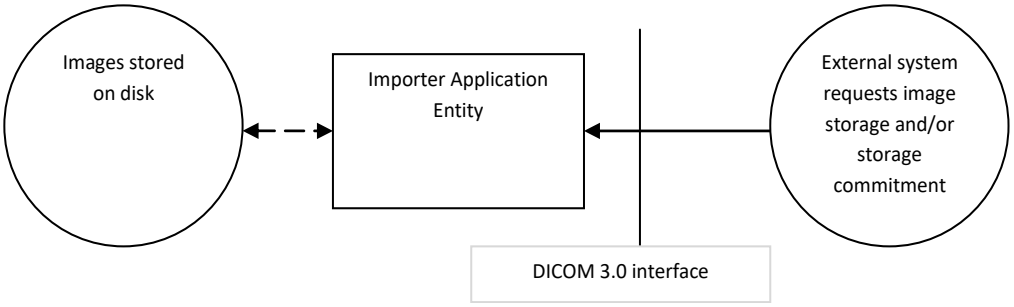


Figure 1-3 Issue Query/Retrieve Request

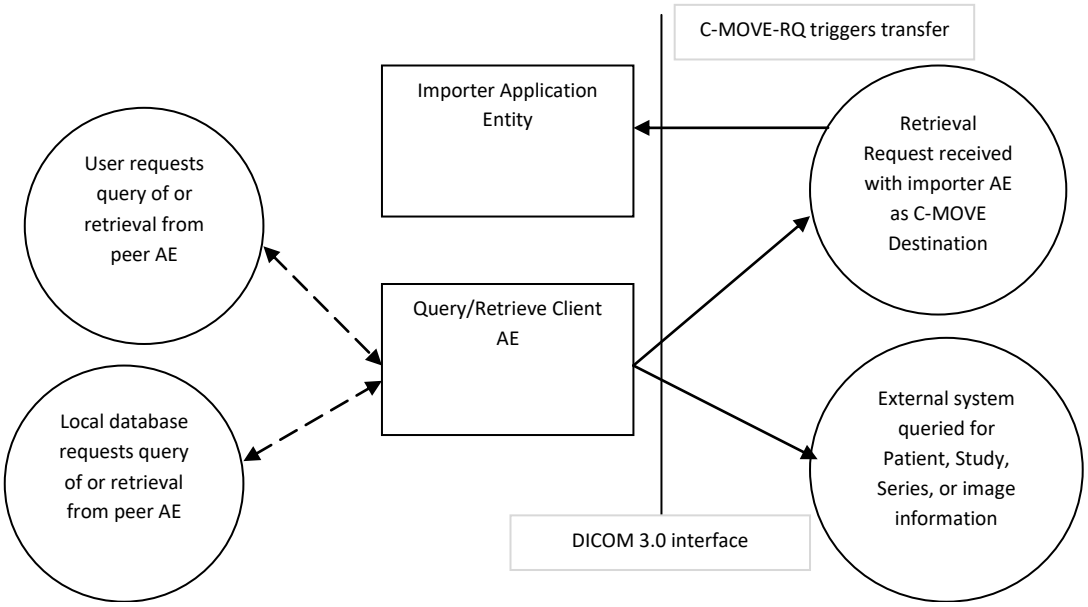


Figure 1-4 Issue Modality Worklist Request

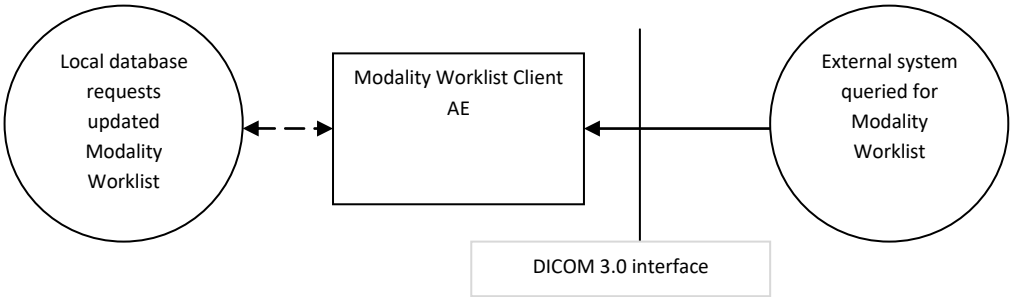


Figure 1-5 Receive Query/Retrieve and MWL requests

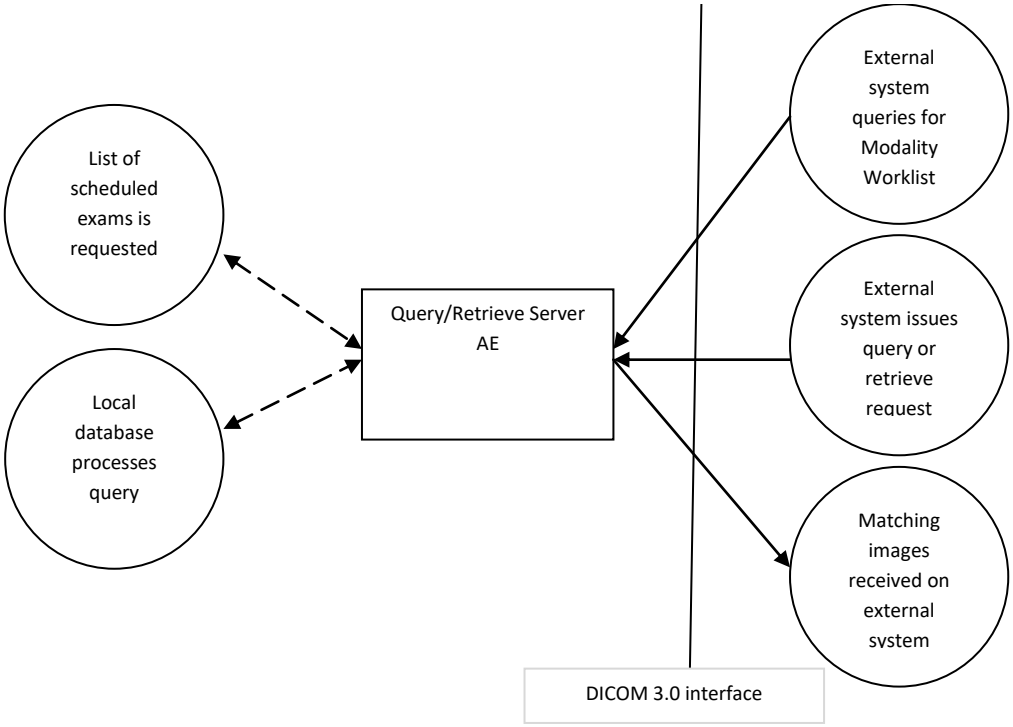


Figure 1-6 Send Notification Message

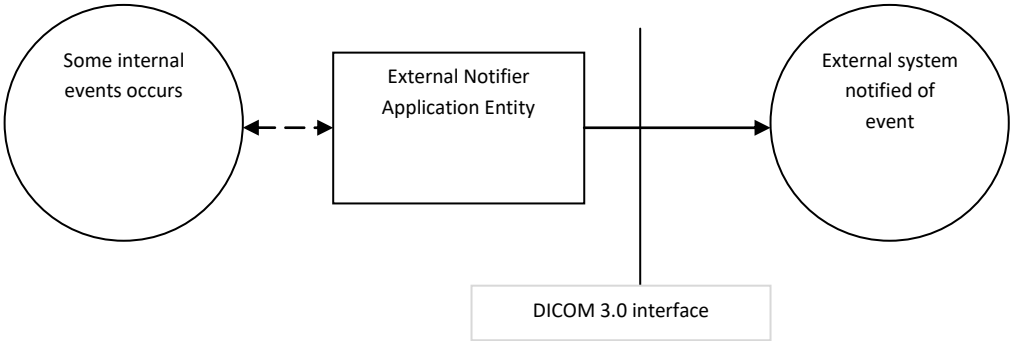


Figure 1-7 Issue Storage Commitment request and Receive Event

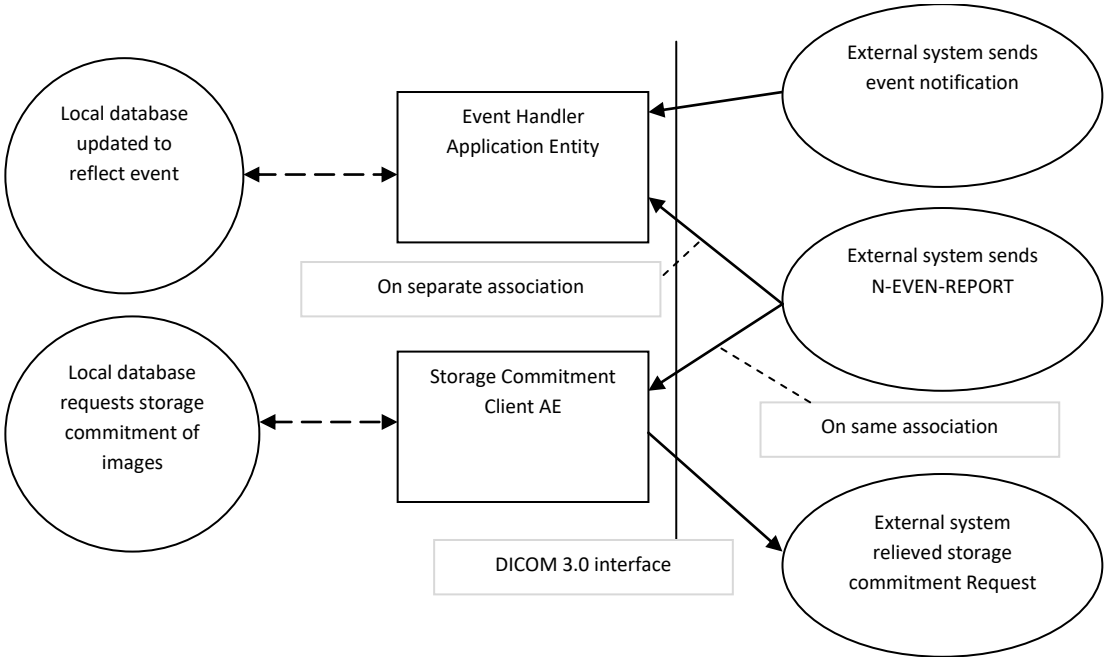


Figure 1-8 Receive QID-RS Request

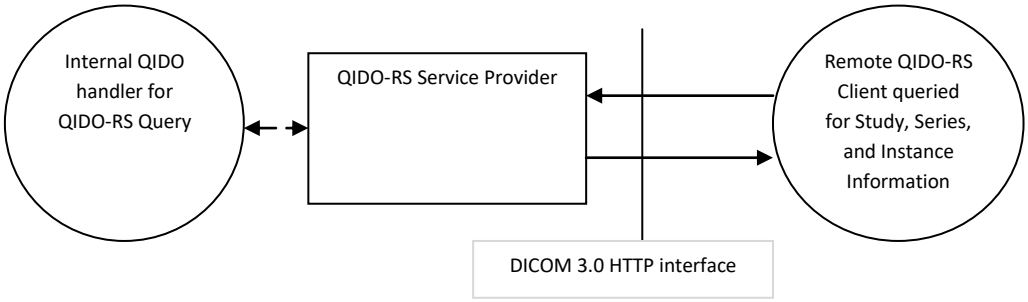
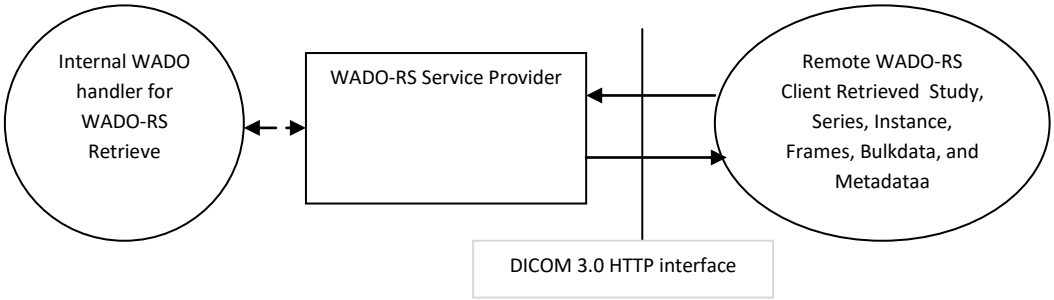


Figure 1-9 Receive WADO-RS Request



The Sender AE can send Storage Image objects as a C-STORE SCU. It receives requests from a Change Healthcare Image Repository user to transmit a list of images to a specific DICOM destination.

The Importer AE can receive Storage Image objects as a C-STORE SCP. As an SCP it can respond to external Storage Requests which are either unsolicited or a result of DICOM C-MOVE requests. It can also receive Storage Commitment Push Model N-ACTION Requests from the SCU. The Importer can send

all N-EVENT Reports over this same Association or open a new Association to the SCU and send the N-EVENT report over the new Association.

The Query/Retrieve Server AE allows external systems to query Change Healthcare Image Repository for Modality Worklist, patient, study and series demographic queries as a C-FIND SCP. Also, image retrievals will be processed by this AE as a C-MOVE SCP.

The Query/Retrieve Client AE acts as an Association Requestor for sending queries or retrieval requests to a remote AE acting as an SCP for the C-FIND query or C-MOVE retrieval SOP Classes. The Query/Retrieve Client AE can either be triggered directly through the user interface, or when the Change Healthcare Image Repository is aware that it must retrieve SOP Instances from a remote AE (i.e. The Change Healthcare Image Repository database indicates that the data was sent to the remote AE earlier, such as when the remote AE is serving as the primary archive).

The Modality Worklist Client AE acts as an Association Requestor for sending queries to a remote AE acting as an SCP for the Modality Worklist SOP Class. If the Modality Worklist Client AE is enabled, then it will automatically query a remote AE repeatedly for the latest Modality Worklist. The time period between queries is configurable.

The Event Handler AE receives notifications of events from external systems. This AE can receive Modality Performed Procedure Step requests. The External Notifier AE can forward any Modality Performed Procedure Step request received by the Event Handler AE.

The Storage Commitment Client AE implements the Storage Commitment Service Class as an SCU. When acting as an SCU, it issues a Storage Commitment Push Model N-ACTION Request to a Remote Storage Commitment SCP AE to explicitly request the remote Storage Commitment SCP AE to make the commitment for the safekeeping of the SOP Instances archived by the Sender AE.

The Removable Media AE can be used to read DICOM removable media. The user can choose to access the image files for individual studies on DICOM removable media.

The QIDO-RS Service Provider receives QIDO requests from a remote QIDO-RS Client. These requests are HTTP/1.1 GET requests. It uses the request to select matching Studies, Series or Instances. It then returns a set of matching Studies, Series or Instances or a response code indicating warning or failure back to the requesting QIDO-RS Client.

The WADO-RS Service Provider receives WADO-RS requests from a remote WADO-RS Client. These requests are HTTP/1.1 GET requests. It converts these requests into internal lookup functions to find the matching SOP Instances. It then obtains these matching SOP Instances and composes a response back to the requesting WADO-RS Client.

3.1.2Functional Definitions of Application Entities

Change Healthcare Image Repository contains, conceptually, eight local Application Entities (AE's): Sender, Importer, Query/Retrieve Server, Query/Retrieve Client, Modality Worklist Client, External Notifier, Event Handler and Storage Commitment Client AE. The AEs run as background Windows tasks.

3.1.2.1Sender AE

The Sender AE acts as an SCU and implements the Storage Service Class operation. It can transmit images that have been received from prior external DICOM transmissions.

3.1.2.2 Importer AE

The Importer AE acts as an SCP and implements the Storage Service Class operation. It can receive unsolicited image storage requests from external DICOM storage SCUs. It also acts as an SCP for the Storage Commitment Push Model SOP Class.

3.1.2.3 Query/Retrieve Server AE

The Query/Retrieve Server AE implements the Query/Retrieve Service Class as an SCP. The Query/Retrieve Server AE can handle requests from external devices to query the database for worklists, patient, study and series demographics, and image level information. It can also handle C-MOVE Requests from remote AEs for the retrieval of Composite SOP Instances. The Query/Retrieve Server AE can act as an SCU of the Storage Service to transfer the requested Composite SOP Instances.

3.1.2.4 Query/Retrieve Client AE

The Query/Retrieve Client AE implements the Query/Retrieve Service Class as an SCU. It can act as an SCU to query remote AEs for patient, study and series information. It can also request the retrieval of Composite SOP Instances from remote AEs using C-MOVE Requests. When doing so, it always specifies the Importer AE running on the same Change Healthcare Image Repository as the C-MOVE Destination AE.

3.1.2.5 Modality Worklist Client AE

The Modality Worklist Client AE implements the Modality Worklist SOP Class as an SCU. It cannot be triggered through the user interface. Instead it will repeatedly query for the latest Modality Worklist, with a configurable delay period between each query.

3.1.2.6 External Notifier AE

The External Notifier AE implements the Modality Performed Procedure Step Service Class. It can send Modality Performed Procedure Step messages whenever a configurable set of system events occurs.

3.1.2.7 Event Handler AE

The Event Handler AE implements full support of the Modality Performed Procedure Step Service Class.

3.1.2.8 Storage Commitment Client AE

The Storage Commitment Client AE implements the Storage Commitment Service Class as an SCU. When acting as an SCU, it issues a Storage Commitment Push Model N-ACTION Request to a Remote Storage Commitment SCP AE to explicitly request the remote Storage Commitment SCP AE to make the commitment for the safekeeping of the SOP Instances archived by the Sender AE. Depending on the configuration value, the Storage Commitment Client AE can receive Storage Commitment Confirmation for Composite SOP Instances from the Storage Commitment SCP AE on the same association or on a separate association. The Event Handler AE will handle Storage Commitment Confirmation if sent on a different association.

3.1.2.9 QIDO-RS Service Provider

The QIDO-RS Service Provider implements the Query based on ID for DICOM Objects (QIDO) by Representational State Transfer (REST) Services. Upon receiving a QIDO-RS HTTP/1.1 GET request for DICOM studies, series, or instances, from a Remote QIDO-RS Client, the QIDO-RS Service Provider performs the search based on the URL of the request. The search is similar to the DICOM C-FIND for the "Study Root" hierarchical Information Model for Query and Retrieve. The Study is the highest, or root level, containing study information such as patient ID and Accession Number. Below that is Series,

followed by the Instance level (Study→ Series→Instance). The response returned to the Remote QIDO-RS Client is a status code indicating the success, warning, or failure of the search along with any matching results stored in the Change Healthcare Image Repository.

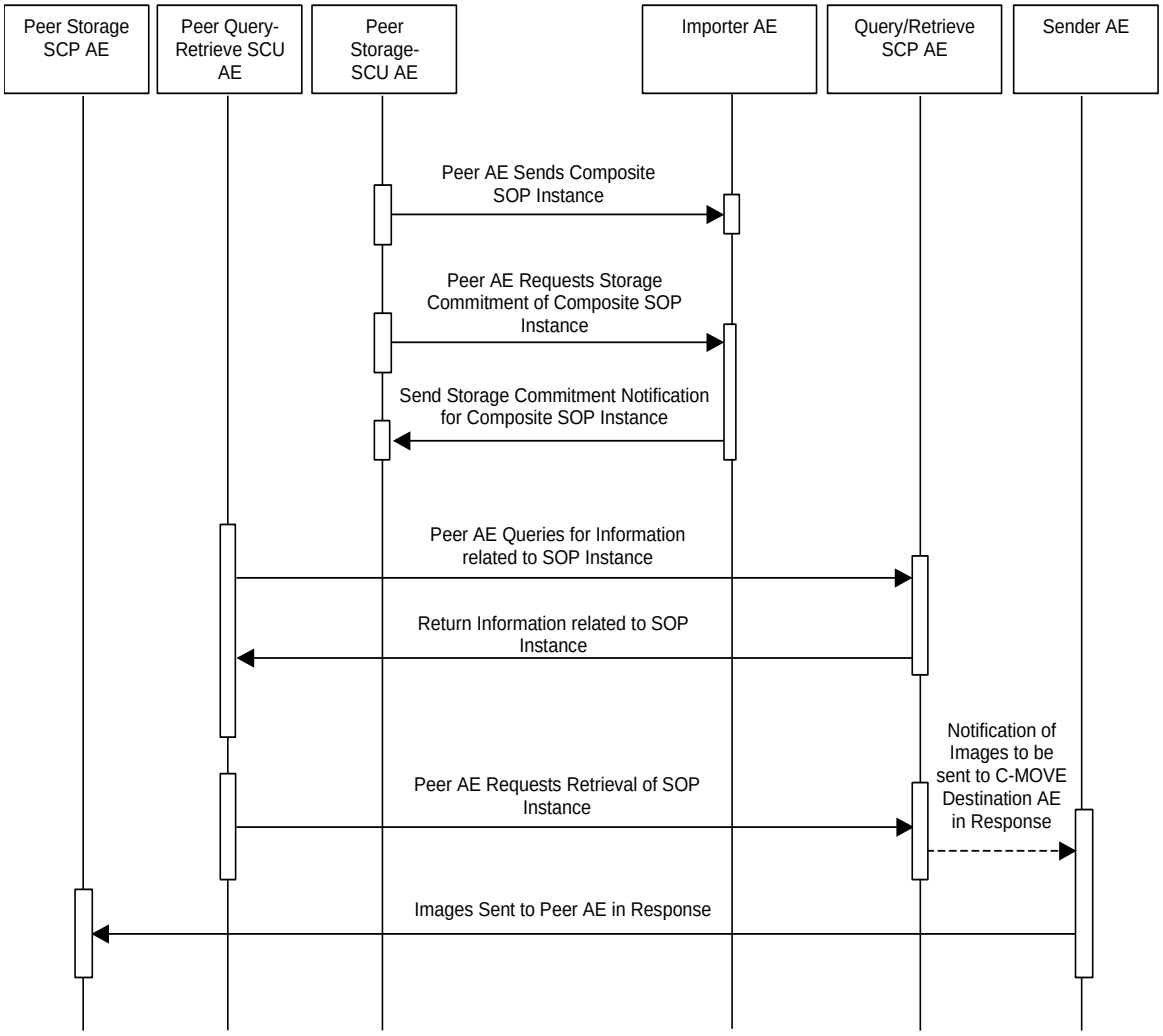
3.1.2.10 WADO-RS Service Provider

The WADO-RS Service Provider implements the Web Access to DICOM Persistent Objects by RESTful Services for access to DICOM SOP Instances that are stored in the Change Healthcare Image Repository. The DICOM WADO-RS Services defines several action types (RetrieveStudy, RetrieveSeries, RetrieveInstance, RetrieveFrames, RetrieveBulkdata, and RetrieveMetadata) that the Remote WADO-RS Client can use for accessing the SOP Instances. Upon receiving a WADO-RS HTTP/1.1 GET request for one of the action types from a Remote WADO-RS Client, the WADO-RS Service Provider retrieves the indicated SOP Instance(s) based on the URL of the request. The response returned to the Remote WADO-RS Client is a status code indicating the success, warning, or failure of the request along with resulting data retrieved.

3.1.3Sequencing of Real-World Activities

The only sequencing constraint that exists across all the Change Healthcare Image Repository Application Entities is the fact that a Composite SOP Instance must be received by the Importer AE before Storage Commitment Push Model or Query-Retrieve Requests related to this SOP Instance can be successfully handled.

Figure 2: Change Healthcare Image Repository 14.0 Sequencing Constraints



NOTE1: The only constraint is for the Composite SOP Instance to be received prior to the other events. For example, it is not necessary for the Storage Commitment Push Model Request to be received prior to receiving Query or Retrieval Requests related to the SOP Instance.

3.2 AE Specifications

3.2.1Sender AE Specification

3.2.1.1SOP Classes

The Sender AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 4: SOP Class Conformance of Sender AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Verification			
Verification	1.2.840.10008.1.1	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Transfer			
12-lead ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
Ambulatory ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Basic Voice Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Cardiac Electrophysiology Waveform	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
General Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.2	Yes	No
Arterial Pulse Waveform	1.2.840.10008.5.1.4.1.1.9.5.1	Yes	No
Respiratory Waveform	1.2.840.10008.5.1.4.1.1.9.6.1	Yes	No
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Yes	No
Comprehensive Structured Report	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Mammography CAD Structured Report	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
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	No
Colon CAD SR Document	1.2.840.10008.5.1.4.1.1.88.69	Yes	No
Implantation Plan SR Document	1.2.840.10008.5.1.4.1.1.88.70	Yes	No
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Encapsulated CDA IOD	1.2.840.10008.5.1.4.1.1.104.2	Yes	No
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	Yes	No
CT Image	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
Digital X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography Image (Processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Breast Tomosynthesis Image	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	No
Digital Intra-oral X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.2	Yes	No
Pseudo-Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.3	Yes	No
Blending Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.4	Yes	No
XA/XRF Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.5	Yes	No
Hardcopy Color Image	1.2.840.10008.5.1.1.30	Yes	No
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	Yes	No
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
MR Image	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
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	No
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Yes	No
Nuclear Medicine Image (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	No
Positron Emission Tomography Image	1.2.840.10008.5.1.4.1.1.128	Yes	No
Enhanced PET Image	1.2.840.10008.5.1.4.1.1.130	Yes	No
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	No
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Spatial Fiducials	1.2.840.10008.5.1.4.1.1.66.2	Yes	No
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	Yes	No
Segmentation	1.2.840.10008.5.1.4.1.1.66.4	Yes	No
Surface Segmentation	1.2.840.10008.5.1.4.1.1.66.5	Yes	No
Real World Value Mapping	1.2.840.10008.5.1.4.1.1.67	Yes	No
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Yes	No
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Yes	No
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	No
RT Beams Delivery Instruction	1.2.840.10008.5.1.4.34.7	Yes	No
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Yes	No
Stand-alone Curve	1.2.840.10008.5.1.4.1.1.9	Yes	No
Stand-alone Modality LUT	1.2.840.10008.5.1.4.1.1.10	Yes	No
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Yes	No
Stand-alone VOI LUT	1.2.840.10008.5.1.4.1.1.11	Yes	No
Standalone PET Curve	1.2.840.10008.5.1.4.1.1.129	Yes	No
Stored Print	1.2.840.10008.5.1.1.27	Yes	No
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Image (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	No
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Ultrasound Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
VL Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
VL Image (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Yes	No
VL Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Yes	No
Video Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	No
Video Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	No
Video Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	No
Ophthalmic Photography 8 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	No
Ophthalmic Photography 16 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	No
Ophthalmic Tomography Image	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	No
VL Whole Slide Microscopy Image	1.2.840.10008.5.1.4.1.1.77.1.6	Yes	No
Stereometric Relationship	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	No
X-Ray Angiographic Bi-Plane Image (retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	No
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	Yes	No
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	Yes	No
X-Ray Radiation Dose Structured Report	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Lensometry Measurements	1.2.840.10008.5.1.4.1.1.78.1	Yes	No
Autorefraction Measurements	1.2.840.10008.5.1.4.1.1.78.2	Yes	No
Keratometry Measurements	1.2.840.10008.5.1.4.1.1.78.3	Yes	No
Subjective Refraction Measurements	1.2.840.10008.5.1.4.1.1.78.4	Yes	No
Visual Acuity Measurements	1.2.840.10008.5.1.4.1.1.78.5	Yes	No
Spectacle Prescription Report	1.2.840.10008.5.1.4.1.1.78.6	Yes	No
Ophthalmic Axial Measurements	1.2.840.10008.5.1.4.1.1.78.7	Yes	No
Intraocular Lens Calculations	1.2.840.10008.5.1.4.1.1.78.8	Yes	No
Macular Grid Thickness and Volume Report	1.2.840.10008.5.1.4.1.1.79.1	Yes	No
Ophthalmic Visual Field Static Perimetry Measurements	1.2.840.10008.5.1.4.1.1.80.1	Yes	No
Basic Structured Display IOD	1.2.840.10008.5.1.4.1.1.131	Yes	No
Generic Implant Template	1.2.840.10008.5.1.4.43.1	Yes	No
Implant Assembly Template	1.2.840.10008.5.1.4.44.1	Yes	No
Implant Template Group	1.2.840.10008.5.1.4.45.1	Yes	No
Intravascular Optical Coherence Tomography Image Storage (Presentation)	1.2.840.10008.5.1.4.1.1.14.1	Yes	No
Intravascular Optical Coherence Tomography Image Storage (Processing)	1.2.840.10008.5.1.4.1.1.14.2	Yes	No
Surface Scan Mesh Storage	1.2.840.10008.5.1.4.1.1.68.1	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Surface Scan Point Cloud Storage	1.2.840.10008.5.1.4.1.1.68.2	Yes	No
Comprehensive 3D SR	1.2.840.10008.5.1.4.1.1.88.34	Yes	No
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	Yes	No
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Yes	No

The Sender AE will attempt to send stored DICOM images in the abstract syntax in which they were received. If a negotiated Association to a remote C-STORE SCP does not support the required abstract syntax, the Sender AE will attempt to transform the image object into an abstract syntax that is supported on that Association. The transformations that the Sender AE will attempt depend on the initial abstract syntax of the image.

To send images objects in either the single or multi-frame retired Ultrasound SOP classes across Associations not supporting these classes, the Sender AE first attempts to send the images by transforming them into the matching (single or multi-frame) Ultrasound new SOP classes. Likewise, for Associations not supporting the new Ultrasound classes, the Sender AE will transform the images into the corresponding retired class.

The Sender AE will attempt to send stored DICOM images in the Transfer Syntax in which they were received. If, however, that Transfer Syntax is not supported on an Association, the Sender AE will transform the Transfer Syntax of the image to the default DICOM Implicit VR Little Endian and send it in that syntax.

The Sender AE represents a single task on a Windows NT machine, with multiple instances of the Sender AE possible on a single host. Each Sender AE is configured to send to a single remote DICOM C-STORE SCP destination. Multiple C-STORE SCP destinations can be implemented by configuring more than one Sender AE. In this case each separate Sender AE acts independently of any others (are implemented as separate processes). In addition, multiple instances of the Sender AE can be configured to send to a single Remote AE.

3.2.1.2Association Establishment Policies

3.2.1.2.1 General

The Sender AE will initiate a new Association when the user requests the transmission of a set of images (either a complete study or series, or part thereof). Also, Change Healthcare Image Repository can be configured to automatically send (i.e. forward) any images that are sent to it (received via the Import AE). An attempt will be made to transmit all the images in the study in a single Association. The Association will be released when all the images have been sent. If the Association is broken or some other Association related error is detected, the Association will be aborted and an attempt will be made to transmit the unsent images in a new Association.

The DICOM Standard Application Context Name is always proposed:

Table 5: DICOM Application Context for Sender AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size that will be offered is configurable, and by default is 16,384 bytes.

3.2.1.2.2 Number of Associations

Each Sender AE process will only attempt to open one Association at a time to the destination it is configured to send to. By default, each instance of the Sender AE application will send to a different Remote AE, although it is possible to configure multiple Sender AE instances to send to the same Remote AE. However, as multiple destinations can be configured, each with their own Sender AE process, multiple Sender AE connections can be open at one time. Thus, there is no limit on the number of simultaneous Associations that Sender AE can attempt.

Table 6: Number of Simultaneous Associations as an SCU for Sender AE

Maximum number of simultaneous Associations	Unlimited

3.2.1.2.3 Asynchronous Nature

The Sender AE does not provide asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 7: Asynchronous Nature as an SCU for Sender AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.1.2.4 Implementation Identifying Information

Table 8: DICOM Implementation Class and Version for Sender AE

Implementation Class UID	1.2.840.113711.1
Implementation Version Name	V1.0

3.2.1.3 Association Initiation Policy

3.2.1.3.1 Activity User Requests Transmission of Images

3.2.1.3.1.1 Description and Sequencing of Activity

The Sender AE attempts to open a new Association for each set of images within a single study it attempts to transfer (i.e. images belonging to separate studies will not be sent over the same Association). This occurs when a user of Change Healthcare Image Repository requests the transmission of Images. There is no sequencing of this activity.

3.2.1.3.1.2 Proposed Presentation Contexts

Table 4. Each proposed Presentation Context contains a single Transfer Syntax. Multiple Transfer Syntaxes per abstract syntax would be proposed with multiple Presentation Contexts.

Table 9: Sender AE Proposed Transfer Syntaxes

Transfer Syntax		Role	Extended Negotiation
Name	**UID**		
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
DICOM JPEG Baseline Process 1	1.2.840.10008.1.2.4.50	SCU	None
DICOM JPEG Extended Process 2 & 4	1.2.840.10008.1.2.4.51	SCU	None
DICOM JPEG Lossless Proc 14	1.2.840.10008.1.2.4.57	SCU	None
DICOM JPEG Lossless First Order Prediction	1.2.840.10008.1.2.4.70	SCU	None

DICOM JPEG 2000 (Lossless Only)	1.2.840.10008.1.2.4.90	SCU	None
DICOM JPEG 2000	1.2.840.10008.1.2.4.91	SCU	None
DICOM RLE.	1.2.840.10008.1.2.5	SCU	None
ALI Wavelet (Private)	1.2.840.113711.1.2.100.1	SCU	None

NOTE1: The Transfer Syntaxes and supported SOP Classes the Sender AE proposes, as listed above, represent the default behavior. The Sender AE can be configured to propose a subset of these.

NOTE2: The ALI Wavelet private Transfer Syntax is implemented using the Pegasus Imaging Corporation's medical image toolkit.

3.2.1.3.1.3 SOP Specific Conformance as an Association Requestor

3.2.1.3.1.3.1 SOP Specific Conformance – Storage

In the case of a successful C-STORE response from the SCP, the Sender AE will continue to send any unsent images belonging to the same study. The Association will be properly released after all relevant images have been sent.

When an image is sent to the Change Healthcare Image Repository Importer AE, the entire set of tags received with the image will be saved in Change Healthcare Image Repository. When the object is selected for transmission from Change Healthcare Image Repository, the content of these objects will be as they were originally received unless patient demographic information and/or study-related information are altered. In such cases the latest values in the database will replace the original information in the DICOM image. Thus, the set of optional tags contained in DICOM objects going out from Change Healthcare Image Repository depends on the information that was received. For the list of patient, study, and series attributes that can be updated by the Sender AE when a SOP Instance is exported please refer to 7.1.3: Sender AE and Query/Retrieve Server AE Element Modification

The Sender AE can be configured to automatically try resending the SOP Instances if some failure occurs. In addition, the Sender AE can be configured to demote the priority of an export task if export fails a certain number of times. Refer to 0: The AE Titles, TCP/IP port-numbers, and host-names for the remote Storage Commitment SCPs must be defined in the Image Repository configuration files by Change Healthcare Services or Installation staff.

Configurable Parameters, for the default values for these settings.

The Sender AE creates files called Service Logs that can be used to monitor its status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these Service Logs.

The Sender AE will exhibit the following Behavior according to the Status Code value returned in a C-STORE Response from a destination C-STORE SCP:

Table 10: Sender AE C-STORE Response Status Handling Behavior

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

Service Status	Further Meaning	Error Code	Behavior
Refused	Out of Resources	A700 – A7FF	This is treated as a failure[2]. An error indication is output to the Service Logs.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a failure[2]. An error indication is output to the Service Logs.
Error	Cannot Understand	C000 – CFFF	This is treated as a failure[2]. An error indication is output to the Service Logs.
Warning	Coercion of Data Elements	B000	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Element Discarded	B006	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Data Set does not match SOP Class	B007	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Attribute List Error	0107	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Attribute Value Out of Range	0116	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
*		Any other status code	This is treated as a failure[2]. An error indication is output to the Service Logs.

3.2.1.3.1.3.2 Association Requestor Communication Failure Behavior

The Behavior of the Sender AE during communication failure is summarized in the following table:

Table 11: Sender AE Communication Failure Behavior

Exception	Behavior
*Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure[2]. An error indication is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure[2]. An error indication is output to the Service Logs.

[2] Sender AE can be configured to treat all failures as either permanent or transient. The default behavior is to consider all failures to be transient and to attempt to resend the SOP Instances up to 20 times.

Exception	Behavior
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure[2]. An error indication is output to the Service Logs.

3.2.1.3.2 Activity – Send Synchronization KOS Request

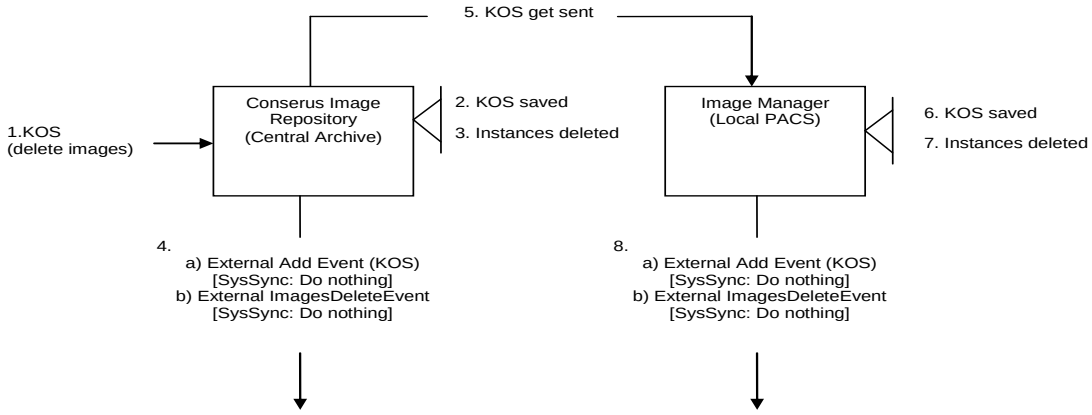
3.2.1.3.2.1 Description and Sequencing of Activity

Change Healthcare Image Repository can export IOCM KOS objects to an External Image Manager (Local PACS) as a result of an internal "Delete Image" event. Note that the exported IOCM KOS objects will always specify the DICOM Secondary Capture Image SOP Class UID in the Referenced SOP Sequence, which thus can differ from the actual SOP Class of a deleted object.

If Change Healthcare Image Repository has the Data Retention Management feature enabled then it can also broadcast IOCM KOS objects to an External Image Manager (Local PACS) as a result of an internal "Delete Study for retention" event. When a study is deleted (as a result of either Move/Merge Study or Retention Manager), the SOP Instance UIDs for DICOM objects in the study are not included in the Current Requested Procedure Evidence Sequence (0040,A375) or Content Sequence (0040,A730) of the KOS object.

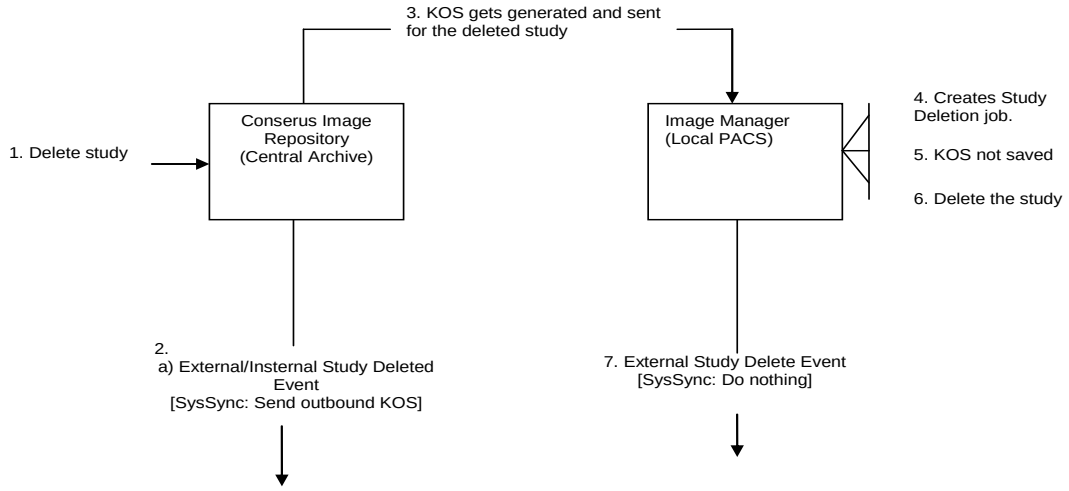
3.2.1.3.2.2 Delete Images

Deleting the images on Change Healthcare Image Repository triggers the creation of an Outbound Delete Study KOS.



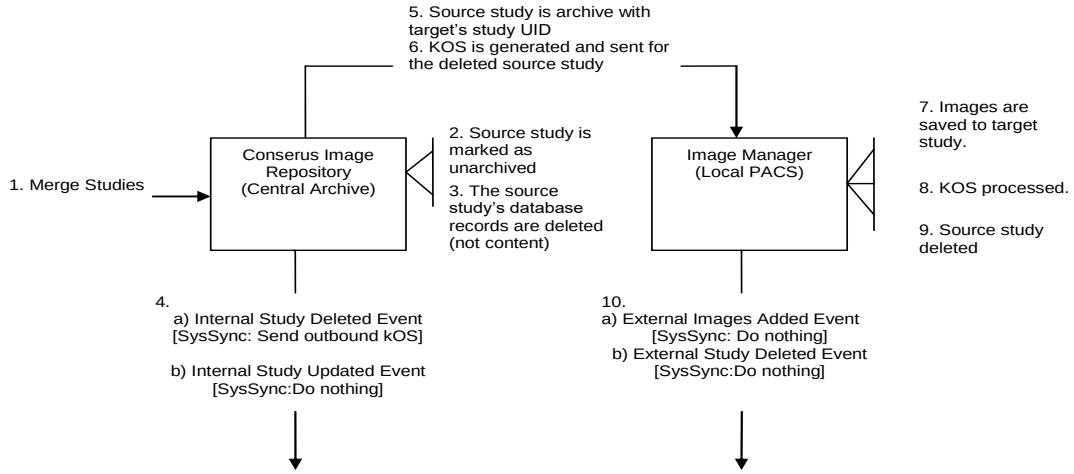
3.2.1.3.2.3 Delete Study

Deleting the study on Change Healthcare Image Repository triggers the creation of an Outbound Delete Study KOS.



3.2.1.3.2.4 Merge Studies

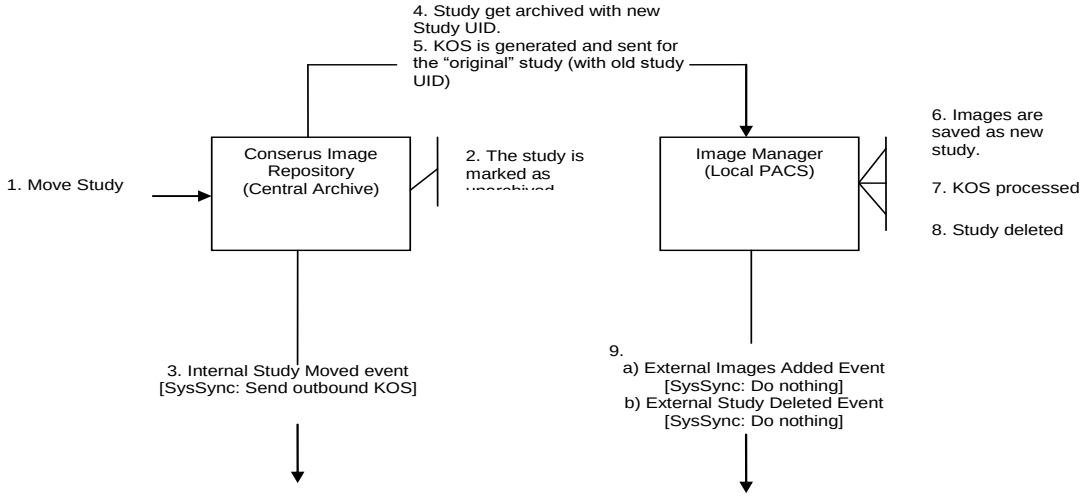
Source study will get archived to Image Manager (Local PACS) with the target study's study UID. Since the SOP Instance UIDs do not get updated, the external system may reject the archived instances because of duplicate instance UIDs in their system (e.g., copies of images from the source study still exist in their system). In such case Change Healthcare Image Repository shall keep trying until archive succeeds (or until the source study is deleted from the external system).



3.2.1.3.2.5 Move Study

After moving a study from patient A to patient B, Change Healthcare Image Repository shall:

- Generate a new study UID for the study and update the study UID in the database
- trigger re-archive
- Outbound Synchronization KOS is sent to delete the original study.



3.2.1.3.3 Proposed Presentation Contexts

The Sender AE may propose any one or more of the following Transfer Syntaxes for each of the abstract syntaxes listed in Table 12. Each proposed Presentation Context contains a single Transfer Syntax. Multiple Transfer Syntaxes per abstract syntax would be proposed with multiple Presentation Contexts.

Table 12: SOP Class Conformance of Sender AE for IOCM KOS

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	No

Table 13: Sender AE Proposed Transfer Syntaxes for IOCM KOS

Transfer Syntax		Role	Extended Negotiation
Name	UID		
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

3.2.1.3.4 SOP Specific Conformance as an Association Requestor

3.2.1.3.5 SOP Specific Conformance – KOS Storage

The status codes in a C-STORE Response returns by the Sender AE for IOCM KOS is same as described in In the case of a successful C-STORE response from the SCP, the Sender AE will continue to send any unsent images belonging to the same study. The Association will be properly released after all relevant images have been sent.

When an image is sent to the Change Healthcare Image Repository Importer AE, the entire set of tags received with the image will be saved in Change Healthcare Image Repository. When the object is

selected for transmission from Change Healthcare Image Repository, the content of these objects will be as they were originally received unless patient demographic information and/or study-related information are altered. In such cases the latest values in the database will replace the original information in the DICOM image. Thus, the set of optional tags contained in DICOM objects going out from Change Healthcare Image Repository depends on the information that was received. For the list of patient, study, and series attributes that can be updated by the Sender AE when a SOP Instance is exported please refer to 7.1.3: Sender AE and Query/Retrieve Server AE Element Modification

The Sender AE can be configured to automatically try resending the SOP Instances if some failure occurs. In addition, the Sender AE can be configured to demote the priority of an export task if export fails a certain number of times. Refer to 0: The AE Titles, TCP/IP port-numbers, and host-names for the remote Storage Commitment SCPs must be defined in the Image Repository configuration files by Change Healthcare Services or Installation staff.

Configurable Parameters, for the default values for these settings.

The Sender AE creates files called Service Logs that can be used to monitor its status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these Service Logs.

The Sender AE will exhibit the following Behavior according to the Status Code value returned in a C-STORE Response from a destination C-STORE SCP:

Table 10: Sender AE C-STORE Response Status Handling Behavior.

The Behavior of the Sender AE during communication failure is summarized as described in Table 11: Sender AE Communication Failure Behavior

3.2.1.4Association Acceptance Policy

The Sender AE does not accept Associations.

3.2.2 Importer AE Specification

3.2.2.1 SOP Classes

The Importer AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 14: SOP Class Conformance of Importer AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Verification			
Verification	1.2.840.10008.1.1	No	Yes
Transfer			
12-lead ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	No	Yes
Ambulatory ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.3	No	Yes
Basic Voice Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes
Cardiac Electrophysiology Waveform	1.2.840.10008.5.1.4.1.1.9.3.1	No	Yes
General Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.2	No	Yes
Arterial Pulse Waveform	1.2.840.10008.5.1.4.1.1.9.5.1	No	Yes

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Respiratory Waveform	1.2.840.10008.5.1.4.1.1.9.6.1	No	Yes
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Comprehensive Structured Report	1.2.840.10008.5.1.4.1.1.88.33	No	Yes
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	No	Yes
Mammography CAD Structured Report	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
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	No	Yes
Colon CAD SR Document	1.2.840.10008.5.1.4.1.1.88.69	No	Yes
Implantation Plan SR Document	1.2.840.10008.5.1.4.1.1.88.70	No	Yes
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	No	Yes
Encapsulated CDA IOD	1.2.840.10008.5.1.4.1.1.104.2	No	Yes
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	No	Yes
CT Image	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
Digital X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
Digital Mammography Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Mammography Image (Processing)	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes
Breast Tomosynthesis Image	1.2.840.10008.5.1.4.1.1.13.1.3	No	Yes
Digital Intra-oral X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Digital Intra-oral X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	No	Yes
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.2	No	Yes
Pseudo-Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.3	No	Yes
Blending Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.4	No	Yes
XA/XRF Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.5	No	Yes
Hardcopy Color Image	1.2.840.10008.5.1.1.30	No	Yes
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	No	Yes
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	No	Yes
Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
MR Image	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
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	No	Yes
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	No	Yes

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Nuclear Medicine Image (Retired)	1.2.840.10008.5.1.4.1.1.5	No	Yes
Positron Emission Tomography Image	1.2.840.10008.5.1.4.1.1.128	No	Yes
Enhanced PET Image	1.2.840.10008.5.1.4.1.1.130	No	Yes
Raw Data	1.2.840.10008.5.1.4.1.1.66	No	Yes
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Spatial Fiducials	1.2.840.10008.5.1.4.1.1.66.2	No	Yes
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	No	Yes
Segmentation	1.2.840.10008.5.1.4.1.1.66.4	No	Yes
Surface Segmentation	1.2.840.10008.5.1.4.1.1.66.5	No	Yes
Real World Value Mapping	1.2.840.10008.5.1.4.1.1.67	No	Yes
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	No	Yes
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	No	Yes
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	No	Yes
RT Image	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	No	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	No	Yes
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	No	Yes
RT Beams Delivery Instruction	1.2.840.10008.5.1.4.34.7	No	Yes
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	No	Yes
Stand-alone Curve	1.2.840.10008.5.1.4.1.1.9	No	Yes
Stand-alone Modality LUT	1.2.840.10008.5.1.4.1.1.10	No	Yes
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	No	Yes
Stand-alone VOI LUT	1.2.840.10008.5.1.4.1.1.11	No	Yes
Standalone PET Curve	1.2.840.10008.5.1.4.1.1.129	No	Yes
Stored Print	1.2.840.10008.5.1.1.27	No	Yes
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Ultrasound Image (Retired)	1.2.840.10008.5.1.4.1.1.6	No	Yes
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
Ultrasound Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.3	No	Yes
VL Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
VL Image (Retired)	1.2.840.10008.5.1.4.1.1.77.1	No	Yes
VL Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.77.2	No	Yes
Video Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Video Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2.1	No	Yes
Video Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4.1	No	Yes
Ophthalmic Photography 8 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes
Ophthalmic Photography 16 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.2	No	Yes
Ophthalmic Tomography Image	1.2.840.10008.5.1.4.1.1.77.1.5.4	No	Yes
VL Whole Slide Microscopy Image	1.2.840.10008.5.1.4.1.1.77.1.6	No	Yes
Stereometric Relationship	1.2.840.10008.5.1.4.1.1.77.1.5.3	No	Yes
X-Ray Angiographic Bi-Plane Image (retired)	1.2.840.10008.5.1.4.1.1.12.3	No	Yes
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	No	Yes
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
X-Ray Radiation Dose Structured Report	1.2.840.10008.5.1.4.1.1.88.67	No	Yes
Lensometry Measurements	1.2.840.10008.5.1.4.1.1.78.1	No	Yes
Autorefraction Measurements	1.2.840.10008.5.1.4.1.1.78.2	No	Yes
Keratometry Measurements	1.2.840.10008.5.1.4.1.1.78.3	No	Yes
Subjective Refraction Measurements	1.2.840.10008.5.1.4.1.1.78.4	No	Yes
Visual Acuity Measurements	1.2.840.10008.5.1.4.1.1.78.5	No	Yes
Spectacle Prescription Report	1.2.840.10008.5.1.4.1.1.78.6	No	Yes
Ophthalmic Axial Measurements	1.2.840.10008.5.1.4.1.1.78.7	No	Yes
Intraocular Lens Calculations	1.2.840.10008.5.1.4.1.1.78.8	No	Yes
Macular Grid Thickness and Volume Report	1.2.840.10008.5.1.4.1.1.79.1	No	Yes
Ophthalmic Visual Field Static Perimetry Measurements	1.2.840.10008.5.1.4.1.1.80.1	No	Yes
Basic Structured Display IOD	1.2.840.10008.5.1.4.1.1.131	No	Yes
Generic Implant Template	1.2.840.10008.5.1.4.43.1	No	Yes
Implant Assembly Template	1.2.840.10008.5.1.4.44.1	No	Yes
Implant Template Group	1.2.840.10008.5.1.4.45.1	No	Yes
Intravascular Optical Coherence Tomography Image Storage (Presentation)	1.2.840.10008.5.1.4.1.1.14.1	No	Yes
Intravascular Optical Coherence Tomography Image Storage (Processing)	1.2.840.10008.5.1.4.1.1.14.2	No	Yes
Surface Scan Mesh Storage	1.2.840.10008.5.1.4.1.1.68.1	No	Yes
Surface Scan Point Cloud Storage	1.2.840.10008.5.1.4.1.1.68.2	No	Yes
Comprehensive 3D SR	1.2.840.10008.5.1.4.1.1.88.34	No	Yes
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	No	Yes
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	No	Yes
Workflow Management			
Storage Commitment Push Model	1.2.840.10008.1.20.1	No	Yes

These are the default SOP Classes supported. By altering the configuration it is possible to support fewer or more SOP Classes.

The Importer AE will store the DICOM Composite SOP Instances as DICOM Part 10 compliant files using the Transfer Syntax with which they were received.

The Importer AE will fork a child process to handle each Association requested by a remote AE for the Storage of Composite SOP Instances and/or to send a Storage Commitment Push Model N-ACTION Request.

3.2.2.2 Association Establishment Policies

3.2.2.2.1 General

The Importer AE accepts Associations from external DICOM C-STORE SCUs to provide storage on the Change Healthcare Image Repository of DICOM Composite SOP Instances. The Importer AE can send a request for establishing an Association to an SCU if an SCU sends a Storage Commitment request and then drops the Association before the Storage Commitment N-EVENT-REPORT Request can be sent.

The DICOM Standard Application Context Name is always proposed:

Table 15: DICOM Application Context for Importer AE

Application Context Name	1.2.840.10008.3.1.1.1

3.2.2.2.2 Number of Associations

The Importer AE places configurable limitations on the number of simultaneous connections it will support. Once the Importer AE accepts an Association, a spawned child task will receive any images transmitted on that Association and store them on the hard drive. The default maximum number of Associations is 10 per connecting host. It is possible to restrict the number of hosts that can connect with the Importer AE so the combination of these settings can restrict the maximum number of Associations.

Table 16: Number of Simultaneous Associations as an Acceptor for Importer AE

Maximum number of simultaneous Associations	Unlimited[3]

The Importer AE can also request new Associations in order to send Storage Commitment N-EVENT-REPORT Requests. The Importer AE cannot request simultaneous Associations with the same remote AE, so the maximum number of simultaneous Associations depends upon the number of remote AEs that the Importer AE will need to open Associations with in order to send the Storage Commitment N-EVENT-REPORT Requests.

[3] Default maximum is 10 per host permitted to connect to the Importer AE.

Table 17: Number of Simultaneous Associations as a Requestor for Importer AE

Maximum number of simultaneous Associations	Unlimited

3.2.2.2.3 Asynchronous Nature

The Importer AE does not provide asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 18: Asynchronous Nature as an SCP for Importer AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.2.2.4 Implementation Identifying Information

Table 19: DICOM Implementation Class and Version for Importer AE

Implementation Class UID	1.2.840.113711.9
Implementation Version Name	V1.0

3.2.2.3Association Initiation Policies

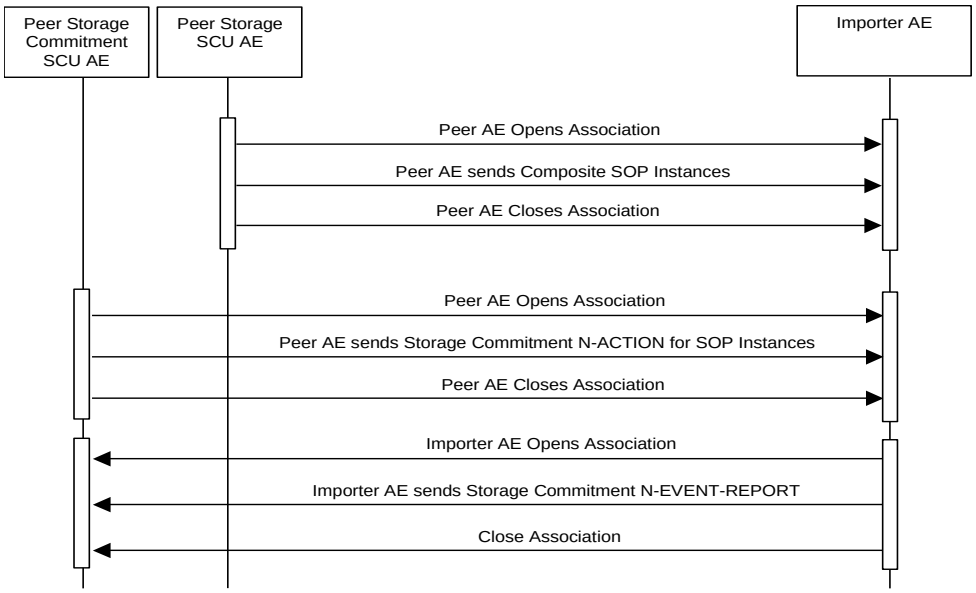
3.2.2.3.1 Activity – Require New Association for Storage Commitment

3.2.2.3.2 Description and Sequencing of Activity

The Importer AE can act as an Association Requestor in the case where the SCU issues a Storage Commitment N-ACTION and then immediately drops the Association. The Importer AE can then send a request for establishing an Association to the SCU in order to send the corresponding Storage Commitment N-EVENT-REPORT. The Importer AE can also be configured to always request a new Association to send the Storage Commitment N-EVENT-REPORT rather than trying to send it over the original Association requested by the SCU.

In order to successfully handle Storage Commitment N-ACTION Requests, the Importer AE must have already received the referenced SOP Instances. That is, the Importer AE cannot properly handle a Storage Commitment N-ACTION Request that is sent to it before the SOP Instances it references are sent to the Importer.

Figure 3: Sequencing of Activity – Require New Association for Storage Commitment



Note that the remote Storage Commitment SCU AE and Storage SCU AE could be a single AE, in which case the remote AE could send both the Composite SOP Instances and the Storage Commitment N-ACTION over the same Association. However, the Importer AE would still require that the Composite SOP Instances be sent before the Storage Commitment N-ACTION referencing them is sent.

The following sequencing constraints illustrated in The Importer AE can act as an Association Requestor in the case where the SCU issues a Storage Commitment N-ACTION and then immediately drops the Association. The Importer AE can then send a request for establishing an Association to the SCU in order to send the corresponding Storage Commitment N-EVENT-REPORT. The Importer AE can also be configured to always request a new Association to send the Storage Commitment N-EVENT-REPORT rather than trying to send it over the original Association requested by the SCU.

In order to successfully handle Storage Commitment N-ACTION Requests, the Importer AE must have already received the referenced SOP Instances. That is, the Importer AE cannot properly handle a Storage Commitment N-ACTION Request that is sent to it before the SOP Instances it references are sent to the Importer.

Figure 3 apply to the Importer AE for handling Storage Commitment Push Model Requests using a new Association:

1. Remote AE opens an Association with the Importer AE.
2. Remote AE requests Storage Commitment of Composite SOP Instance(s) (remote sends N-ACTION-RQ and Importer AE responds with N-ACTION-RSP to indicate that it received the request).
3. Remote AE closes the Association before the Importer AE can successfully send the Storage Commitment Push Model Notification (N-EVENT-REPORT-RQ).
4. Importer AE opens a new Association with the remote AE.
5. Importer AE sends Storage Commitment Push Model Notification (N-EVENT-REPORT). More than one can be sent over a single Association if multiple Notifications are outstanding.
6. Importer AE closes the Association with the remote AE.

3.2.2.3.3 Proposed Presentation Contexts

The Importer AE will propose Presentation Contexts as shown in the following table:

Table 20: Importer AE Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

3.2.2.3.4 SOP Specific Conformance as an Association Requestor

3.2.2.3.4.1 SOP Specific Conformance - Storage Commitment

Standard conformance is provided to the DICOM Storage Commitment Push Model SOP Class as an SCP.

The associated activity with the Storage Commitment Push Model Service is the communication by the Importer AE to remote AEs that it has committed to permanently store Composite SOP Instances that have been sent to it. It thus allows remote AEs to determine whether the Change Healthcare Image Repository has taken responsibility for the archiving of specific SOP Instances so that they can be flushed from the remote AE system.

By default, the Importer AE will initiate a new Association to a remote AE that sent a Storage Commitment Push Model request only if the original Association over which this was sent is no longer open. Otherwise it will send the N-EVENT-REPORT Request over the original Association requested by the SCU. However, the Importer AE can be configured to always request a new Association to send the N-EVENT-REPORT Request.

The Importer AE creates files called Service Logs that can be used to monitor its status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these Service Logs.

If the request by the Importer AE to establish an Association fails for any reason (i.e. fail to connect with remote AE's TCP/IP port, Association Request is Rejected by remote AE, etc.) then the Importer AE will not try again later to send the N-EVENT-REPORT Request. If such a failure occurs then the remote AE will have to resend the Storage Commitment Push Model N-ACTION Request.

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

Table 21: Importer AE N-EVENT-REPORT Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCU has successfully received the Storage Commitment report. Success indication message is output to the Service Logs.
Refused	Out of Resources	A700 – A7FF	This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.

Service Status	Further Meaning	Error Code	Behavior
Error	Cannot Understand	C000 – CFFF	This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.
Warning	Attribute List Error	0107	Storage Commitment report transmission is considered successful. A warning indication is output to the Service Logs.
Warning	Attribute Value Out of Range	0116	Storage Commitment report transmission is considered successful. A warning indication is output to the Service Logs.
*	*	Any other status code	This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.

3.2.2.3.4.2 Association Requestor Communication Failure Behavior

The Behavior of the Importer AE during communication failure when it is acting as an Association Requestor is summarized in the following table:

Table 22: Importer AE Communication Failure Behavior as an Association Requestor

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.
Association A-P-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.

3.2.2.4 Association Acceptance Policy

3.2.2.4.1 Activity – Receive Images and Storage Commitment Requests

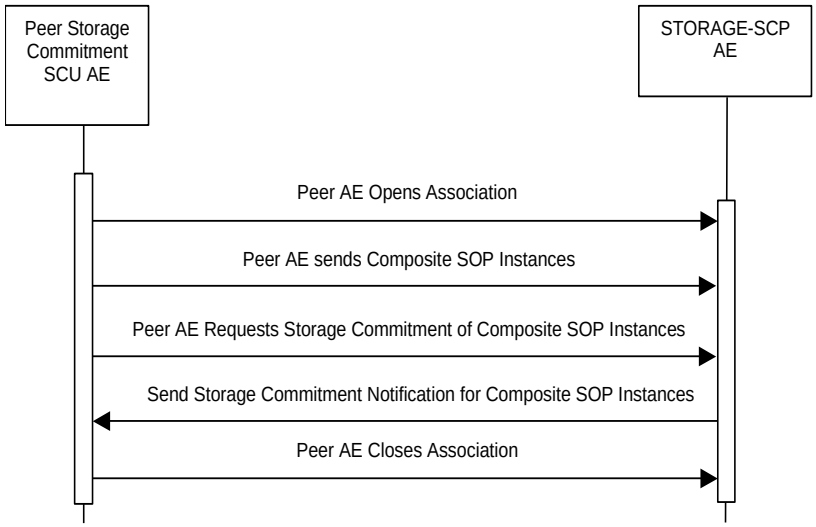
3.2.2.4.2 Description and Sequencing of Activity

The Importer AE accepts Association Requests only if they propose one or more Presentation Contexts that the Importer AE actually supports. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. The Importer AE can be configured to only accept Associations requested by certain hosts (using TCP/IP address).

The default behavior of the Importer AE is to always attempt to send a Storage Commitment Push Model Notification (N-EVENT-REPORT) over the same Association opened by the remote AE to send the request (N-ACTION). If the Importer AE receives a request to close the Association either before sending the Notification or before receiving the corresponding N-EVENT-REPORT-RSP, then it will open a new Association to send the Notification. Refer to section 3.2.2.3 for the details.

In order to successfully handle Storage Commitment N-ACTION Requests, the Importer AE must have already received the referenced SOP Instances. That is, the Importer AE cannot properly handle a Storage Commitment N-ACTION Request that is sent to it before the SOP Instances it references are sent to the Importer

Figure 4:Sequencing of Activity – Single Association for Storage and Storage Commitment



The following sequencing constraints illustrated in Figure 4 apply to the Importer AE for handling Storage Commitment Push Model Requests over the original Association:

7. .Remote AE opens an Association with the Importer AE.
8. Remote AE sends zero or more Composite SOP Instances.
9. Remote AE requests Storage Commitment of Composite SOP Instance(s) (remote sends N-ACTION-RQ and Importer AE responds with N-ACTION-RSP to indicate that it received the request).
10. STORAGE-SCP AE sends Storage Commitment Push Model Notification request (N-EVENT-REPORT-RQ) and successfully receives Notification response (N-EVENT-REPORT-RSP) from remote AE.
11. Remote AE closes the Association.

If the Importer AE receives a request to close the Association from the remote AE before sending the Notification request (N-EVENT-REPORT-RQ) or when expecting to receive a Notification response (N-EVENT-REPORT-RSP), then it will open a new Association to send (or resend) the Notification. Refer to 0 for the details.

The Importer AE has a configurable timeout value for the maximum amount of time that it will wait on an open Association for a new request from a remote AE. A remote AE can reset this timer by sending a Verification request (C-ECHO-RQ). This can act as a useful mechanism for a remote AE to maintain an active Association if the length of time between sending Storage or Storage Commitment requests is long (such as when using a single Association to send images as they are acquired during an exam).

The Importer AE may reject Association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

a) 1 – DICOM UL service-user
b) 2 – DICOM UL service-provider (ASCE related function)
c) 3 – DICOM UL service-provider (Presentation related function)

Table 23: Importer AE Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
2 – rejected-transient	c	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	a	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	b	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time. Usually this is only returned if the Importer AE has not been configured to allow the remote AE host to connect.

3.2.2.4.3 Accepted Presentation Contexts

The Importer AE will accept any Presentation Context containing:

1. An abstract syntax selected from Table 14
2. One or more Transfer Syntaxes selected from Table 24

Table 24: Importer AE Accepted Transfer Syntaxes

Transfer Syntax		Role	Extended Negotiation
Name	UID		
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
DICOM JPEG Baseline Process 1	1.2.840.10008.1.2.4.50	SCP	None
DICOM JPEG Extended Process 2 & 4	1.2.840.10008.1.2.4.51	SCP	None
DICOM JPEG Lossless Proc 14	1.2.840.10008.1.2.4.57	SCP	None
DICOM JPEG Lossless 1st Order Prediction	1.2.840.10008.1.2.4.70	SCP	None
DICOM JPEG 2000 (Lossless Only)	1.2.840.10008.1.2.4.90	SCP	None
DICOM JPEG 2000	1.2.840.10008.1.2.4.91	SCP	None
DICOM RLE	1.2.840.10008.1.2.5	SCP	None
Wavelet (Private)	1.2.840.113711.1.2.100.1	SCP	None

NOTE1: The Wavelet Transfer Syntax is implemented using the Pegasus Imaging Corporation's Medical Image Toolkit.

3.2.2.4.4 SOP Specific Conformance as an Association Acceptor

3.2.2.4.4.1 SOP Specific Conformance – Verification

The Importer AE provides standard conformance to the Verification SOP Class as an SCP.

3.2.2.4.4.2 SOP Specific Conformance – Storage

The Importer 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 Importer AE provides Level 2 DICOM conformance to the Importing SOP Class. It is configured to retain the original DICOM data in DICOM Part 10 compliant file format. In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files.

In addition to saving all Elements in files, a subset of the Elements are stored in the Change Healthcare Image Repository database to support query and retrieval requests and also allow updating of patient, study, and series information by user input, or demographic and study-related messages. Refer to Table 158: Significant Elements in Received Images in the Annex for the list of Elements that are checked and/or processed upon receiving a Composite SOP Instance.

The associated Real-World Activity with the C-STORE service is the storage of medical imaging data on a designated hard disk. The Importer AE will return a failure status if it is unable to store the Composite SOP Instances onto the hard disk. After sending the C-STORE-RSP for a failure status, Importer AE will abort the association.

When receiving a compressed image from a C-STORE SCU, the Importer AE will not decompress and recompress an image to another compression format. Also, Importer AE shall not lossy compress an image that has already been subjected to lossy compression. How Importer AE performs this lossy compression check is by inspecting the value of the DICOM element (0028,2110) Lossy image processing in the DICOM image header. A value of 01 means the Image has been subjected to lossy compression and a value of 00 means the Image has NOT been subjected to lossy compression.

Additional information regarding the support for certain image-related characteristics can be found in Table 158.

It is preferred that optimal Window Center and Width values be specified in the DICOM Image Objects if they have greater than 8 bits of image data stored per sample. If optimal Window Center and Width values cannot be provided, then it is preferred that none are included, as Change Healthcare Image Repository is capable of estimating values using histogram analysis.

The Importer AE provides support for Storage Commitment Push Model. The Importer AE expects the SCU to open an Association, send one or more images, and then send the Storage Commitment Request for those images. The Importer will then send the N-EVENT Report over this same Association. If it cannot do so, then it will open a new Association with the SCU and send the N-EVENT-REPORT over the new Association.

The Importer AE returns one of the following status codes in a C-STORE Response:

Table 25: Importer AE Returned C-STORE-RSP Status Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Importer AE has successfully received, parsed, and saved to file the received C-STORE-RQ Composite SOP Instance. Success indication message is output to the Service Logs.
Refused	Out of Resources	A700	The Importer AE does not have enough disk space to store the C-STORE-RQ Composite SOP Instance. The SOP Instance will not be saved. An error indication is output to the Service Logs.
Error	Data Set does not match SOP Class	A900	The Importer AE has determined that the C-STORE-RQ Composite SOP Instance is missing mandatory Elements specified for the SOP Class. This will only occur if the missing Elements or values prevent the Importer AE from successfully adding the Composite SOP Instance to the system database. An error indication is output to the Service Logs.
Error	Cannot Understand	C000	Indicates that the Importer AE cannot parse the C-STORE-RQ Data Set. The SOP Instance will not be saved. An error indication is output to the Service Logs.
Warning	Coercion of Data Elements	B000	Indicates that the Importer AE coerced one or more Element values of the C-STORE-RQ Composite SOP Instance. Refer Table 158 of the Annex for descriptions of those Elements that can be coerced. Note that return of this status is normally disabled as some SCUs treat it as an Error code rather than a Warning. A warning indication is output to the Service Logs.

The Importer will never delete any received images that can be successfully parsed and contain all the necessary information to add the image to the database (see the table of significant DICOM elements defined earlier). The images will always be archived to media of some sort (WORM, DLT etc.). Images are only flushed from the hard disk storage if they have been successfully archived to the media.

3.2.2.4.4.3 SOP Specific Conformance – Storage Commitment

The associated Activity with the Storage Commitment Push Model service is the communication by the Importer AE to remote AEs that it has committed to permanently store Composite SOP Instances that have been sent to it. It thus allows remote AEs to determine whether the Change Healthcare Image Repository has taken responsibility for the archiving of specific SOP Instances so that they can be flushed from the remote AE system.

The Importer AE takes the list of Composite SOP Instance UIDs specified in a Storage Commitment Push Model N-ACTION Request and checks if they are present in the Change Healthcare Image Repository database. As long as the Composite SOP Instance UIDs are present in the database, the Importer AE will consider those Composite SOP Instance UIDs to be successfully archived. The Importer AE does not require the Composite SOP Instances to actually be successfully written to archive media in order to commit to responsibility for maintaining these SOP Instances.

Once the Importer AE has checked for the existence of the specified Composite SOP Instances, it will then attempt to send the Notification request (N-EVENT-REPORT-RQ). The default behavior is to attempt to send this Notification over the same Association that was used by the remote AE to send the original N-ACTION Request. If the Association has already been released or Message transfer fails for some reason, then the Importer AE will attempt to send the N-EVENT-REPORT-RQ over a new Association. The Importer AE can be configured to always open a new Association in order to send the Notification request. Refer to 3.2.2.3.4 for SOP Specific Conformance when the Importer AE acts as an Association Requestor.

The Importer AE will not cache Storage Commitment Push Model N-ACTION Requests that specify Composite SOP Instances that have not yet been transferred to the Importer AE. If a remote AE sends a Storage Commitment Push Model N-ACTION Request before the specified Composite SOP Instances are later sent, the Importer AE will not commit to responsibility for such SOP Instances.

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

The Change Healthcare Image Repository never automatically deletes Composite SOP Instances from the archive. The absolute persistence of SOP Instances and the maximum archiving capacity for such SOP Instances is dependent on the archiving media and capacity used by the Change Healthcare Image Repository and is dependent on the actual specifications of the purchased system. It is necessary to check the actual system specifications to determine these characteristics.

The Importer AE will support Storage Commitment Push Model requests for Composite SOP Instances of any of the Storage SOP Classes that are also supported by the Importer AE as an SCP. For a complete listing refer to Table 14: SOP Class Conformance of Importer AE.

The Importer AE returns one of the following status codes in an N-ACTION Response:

Table 26: Importer AE Returned N-ACTION-RSP Status Codes

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

Refer to Standard conformance is provided to the DICOM Storage Commitment Push Model SOP Class as an SCP.

The associated activity with the Storage Commitment Push Model Service is the communication by the Importer AE to remote AEs that it has committed to permanently store Composite SOP Instances that have been sent to it. It thus allows remote AEs to determine whether the Change Healthcare Image Repository has taken responsibility for the archiving of specific SOP Instances so that they can be flushed from the remote AE system.

By default, the Importer AE will initiate a new Association to a remote AE that sent a Storage Commitment Push Model request only if the original Association over which this was sent is no longer open. Otherwise it will send the N-EVENT-REPORT Request over the original Association requested by

the SCU. However, the Importer AE can be configured to always request a new Association to send the N-EVENT-REPORT Request.

The Importer AE creates files called Service Logs that can be used to monitor its status and diagnose any problems that may arise. If any error occurs during DICOM communication then appropriate messages are always output to these Service Logs.

If the request by the Importer AE to establish an Association fails for any reason (i.e. fail to connect with remote AE's TCP/IP port, Association Request is Rejected by remote AE, etc.) then the Importer AE will not try again later to send the N-EVENT-REPORT Request. If such a failure occurs then the remote AE will have to resend the Storage Commitment Push Model N-ACTION Request.

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

Table 21: Importer AE N-EVENT-REPORT Response Status Handling Behavior, for the behavior that the Importer AE will exhibit according to the Status Code value returned in a Storage Commitment Push Model N-EVENT-REPORT Response from a destination SCU.

3.2.2.4.4.4 Association Acceptor Communication Failure Behavior

If a communication failure occurs while the Importer AE is trying to handle a Verification Service or Storage Service task or just waiting for the next Request Message on an open Association, then the Importer AE will exhibit the following behavior:

Table 27: Importer AE Communication Failure Behavior as an Association Acceptor while handling a Verification or Storage Task

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). The default timeout for waiting on an open Association to receive the next DICOM Message is 60 minutes.	The Association is aborted using a DICOM A-P-ABORT. This is treated as a failure. An error indication is output to the Service Logs. If any Composite SOP Instances have been successfully received and parsed prior to the failure, then they will still be archived rather than discarded.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). The default timeout when trying to read from or write to an open socket is 3 minutes.	The Association is aborted using a DICOM A-P-ABORT. This is treated as a failure. An error indication is output to the Service Logs. If any Composite SOP Instances have been successfully received and parsed prior to the failure, then they will still be archived rather than discarded.
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. An error indication is output to the Service Logs. If any Composite SOP Instances have been successfully received and parsed prior to the failure, then they will still be archived rather than discarded.

If a communication failure occurs while the Importer AE is trying to handle a Storage Commitment Push Model task (any point after a Storage Commitment N-ACTION-RQ has been received), then the Importer AE will exhibit the following behavior:

Table 28: Importer AE Communication Failure Behavior as an Association Acceptor while handling a Storage Commitment Push Model Task

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). The default timeout for waiting on an open Association to receive the next DICOM Message is 60 minutes.	The Association is aborted using a DICOM A-P-ABORT. This is treated as a failure. An error indication is output to the Service Logs. If a Storage Commitment N-ACTION-RQ has already been received, then the Importer AE will no longer try to process it, regardless of whether it has already sent the corresponding N-ACTION-RSP or N-EVENT-REPORT-RQ. The remote AE will have to resend the N-ACTION-RQ.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). The default timeout when trying to read from or write to an open socket is 3 minutes.	The Association is aborted using a DICOM A-P-ABORT. This is treated as a failure. An error indication is output to the Service Logs. If a Storage Commitment N-ACTION-RQ has already been received, then the Importer AE will no longer try to process it, regardless of whether it has already sent the corresponding N-ACTION-RSP or N-EVENT-REPORT-RQ. The remote AE will have to resend the N-ACTION-RQ.
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. An error indication is output to the Service Logs. If a Storage Commitment N-ACTION-RQ has already been received, then the Importer AE will no longer try to process it, regardless of whether it has already sent the corresponding N-ACTION-RSP or N-EVENT-REPORT-RQ. The remote AE will have to resend the N-ACTION-RQ.

3.2.2.4.4.5 Presentation Context Acceptance Criterion

The Importer AE will only accept a Presentation Contexts specified by a SOP Class from Table 14 and having at least one Proposed Transfer Syntax from Table 24.

More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Accepted Presentation Context.

The Importer AE can be configured to reject valid Presentation Contexts if the host for the remote AE is not listed in a local configuration file. In addition, a valid Presentation Context can be rejected if the maximum limit on the number of simultaneous processes has been reached.

The Importer AE does not check for and will accept duplicate Presentation Contexts.

3.2.2.4.4.6 Transfer Syntax Selection Policies

The default behavior of the Importer AE supports the Implicit VR Little Endian and Explicit VR Little Endian Transfer Syntaxes for all Associations. In addition, some explicit JPEG Lossy and JPEG Lossless compression Transfer Syntaxes are supported, as defined in Table 24.

The JPEG 2000 Lossy, JPEG 2000 Lossless, RLE, and Wavelet (Private) Transfer Syntaxes can also be enabled via configuration; however, these are not enabled by default. The Importer AE can be configured to accept a subset of any of these syntaxes, with the inclusion of Implicit VR Little Endian being mandatory. It can also be configured to compress images once they are received using these various compression options.

The default preferred acceptance order for Transfer Syntaxes for the Importer AE (from highest preference to lowest) is: Little Endian Explicit, Little Endian Implicit, JPEG Lossy, and JPEG Lossless (if all these contexts are proposed). This order of preference is configurable.

3.2.2.4.5 Activity – Receive Synchronization KOS Request

3.2.2.4.6 Description and Sequencing of Activity

The IHE IOCM Profile specifies the use of DICOM KOS objects to achieve synchronization between different Image Manager/Archive systems.

A KOS contains one of the Document Title codes to specify the reason for deletion:

- Rejected for Quality Reasons
- Rejected for Patient Safety Reasons
- Incorrect Modality Worklist Entry
- Data Retention Policy Expired.

Change Healthcare Image Repository adopted the following implementation:

3. Rejection of Deleted Instances

   For IOCM, the Image Manager/Archive shall "not accept subsequent occurrence of instances that have been hidden".

Table 29 summarizes the expected action of the Change Healthcare Image Repository according to the IHE IOCM Profile when receiving instances that have been previously deleted.

Table 29: Rejection of Deleted Instance

KOS Document Title/Reason	Comments
Rejection Note Stored (for Quality Reasons)	Not specified explicitly by the IHE IOCM Profile what the Image Manager / Archive should do if receiving the same previously rejected instances. For rejected instances for Image Quality Reason, Change Healthcare Image Repository does not provide the functionality of hiding. Change Healthcare Image Repository will delete the instances right away. When performing DICOM query against the Change Healthcare Image Repository , the deleted instances due to Image Quality reason will NOT be returned.
Rejection Note Stored (for Patient Safety Reasons)	The Image Manager / Archive shall not accept subsequent occurrence of instances that have been hidden. Change Healthcare Image Repository keeps track of whether a DICOM instance was deleted due to synchronization KOS and not accept the same previously rejected instance again.
Rejection Note Stored (for Incorrect Modality Worklist)	The Image Manager / Archive shall not accept subsequent occurrence of instances that have been hidden. Change Healthcare Image Repository keeps track of whether a DICOM instance was deleted due to synchronization KOS and not accept the same previously rejected instance again.
Rejection Note Stored (for Data Retention Expiry)	If the Image Manager / Archive later receives the same expired instances that have been previously hidden due to the expiry of data retention period and has not been hidden for other reasons, then it shall receive the instances as defined in one of the corresponding instance stored transactions (RAD-8, RAD-9, RAD-18, RAD-19, RAD-29, RAD-43, RAD-61). When Change Healthcare Image Repository receives the Data Retention Expiry KOS, the entire study is deleted. As a result, if the same expired instances from the deleted study are received again, Change Healthcare Image Repository will be happy to accept those instances.

4. Acceptance of Synchronization KOS

By default, Importer AE does not accept synchronization KOS from any external systems. Only KOS objects from trusted sources are allowed. If Importer AE receives a synchronization KOS from a source it does not trust, it shall fail the DICOM association and subsequent Storage Commitment requests (e.g. Importer AE returns a C-STORE-RSP failure status code C000 to the SCU).

Furthermore, if a KOS comes from a trusted source but references a study where the ownership is invalid (e.g., the KOS is from a different facility other than the referenced study facility), the KOS object will be dropped internally and not processed. The DICOM C-STORE association and storage commit requests from the sender, in this case, shall still succeed since the source is deemed valid.

If the KOS comes from a trusted source but references a study that does not yet exist in Change Healthcare Image Repository, the KOS will be saved (unless it is a study level message requesting for study deletion) since it is possible that Change Healthcare Image Repository can receive the KOS along with its referenced images in the same association.

5. Instance Availability Notification

   According to the IHE IOCM Profile, the Image Manager / Archive receives the Key Image Note with the Key Object Selection Document Title valued (113001, DCM, "Rejected for Quality Reasons"), (113037, DCM, "Rejected for Patient Safety Reasons"), (XXXXXX11, 99IHEIOCM, “Incorrect Modality Worklist Entry) or (XXXXXX22, 99IHEIOCM, “Data Retention Period Expired”), shall send one of the following availability status values for all the rejected instances according to the received KOS:

   - "UNAVAILABLE" when it is configured to hide rejected instances.
   - "ONLINE", "NEARLINE" or "OFFLINE" when regular use of rejected instances is configured, depending on the actual availability of the individual instances.
   - It shall also send one of the following availability status values for all remaining instances in the same notification:
   - "ONLINE", "NEARLINE" or "OFFLINE".

   Change Healthcare Image Repository implementation does not support sending Instance Availability Notification to the DSS/OF to confirm all the instances that remain available and those that are deleted.

   However, for Change Healthcare Image Repository, the study status will be reverted back to *scheduled* if the KOS type is Incorrect Modality Worklist and all instances in the study are deleted. Similarly, the study status shall become performed if the KOS type is Incorrect Modality Worklist and there are still images left in the study.

6. Study Level Deletion

   IHE IOCM Profile focuses on communication of changes at the Instance Level. Study Level internal change events such as Move Study, Merge Studies, and Delete Study are not explicitly supported by IOCM.

   Change Healthcare Image Repository added the capability of Study Level deletion to delete an entire study without verifying each referenced SOP instance using a private DICOM tag (3711,xx40) in the KOS. The presence of the private tag (3711,xx40) in the KOS object means the entire study shall be deleted.

   Customization work is expected for synchronization between Change Healthcare and non-Change Healthcare Image Manager / Archive. The other vendor is expected to understand how Change Healthcare Image Manager / Archive communicate its local changes, especially on our usage of the private Delete Study tag.

7. GSPS and KIN References

To avoid an overly complex design, existing references in GSPS or KIN objects will not get updated in system synchronization. The GSPS or KIN, as a result, may end up referencing instances that have been deleted.

8. Data Retention Expiry KOS

   Synchronization KOS for Data Retention reason requires special care because almost all studies to be deleted are offline. Retrieving each study from archive is not a viable option since the batch of studies to be deleted for Data Retention Expiry can be thousands of studies at one time.

   To avoid retrieval, Change Healthcare Image Repository will delete the study without verifying the referenced instances against the actual study content. Change Healthcare Image Repository will treat the IOCM KOS for retention expiry as study-level deletion. Since this behavior deviates from the IHE IOCM Profile Standard, the client must be warned of this implementation.

9. Handling Locked / Offline Case

   Importer AE cannot delete the referenced instances during import due to one of the following reasons: [1] Referenced instances cannot be deleted because the study is locked [2] Referenced instances cannot be deleted because the study is offline.

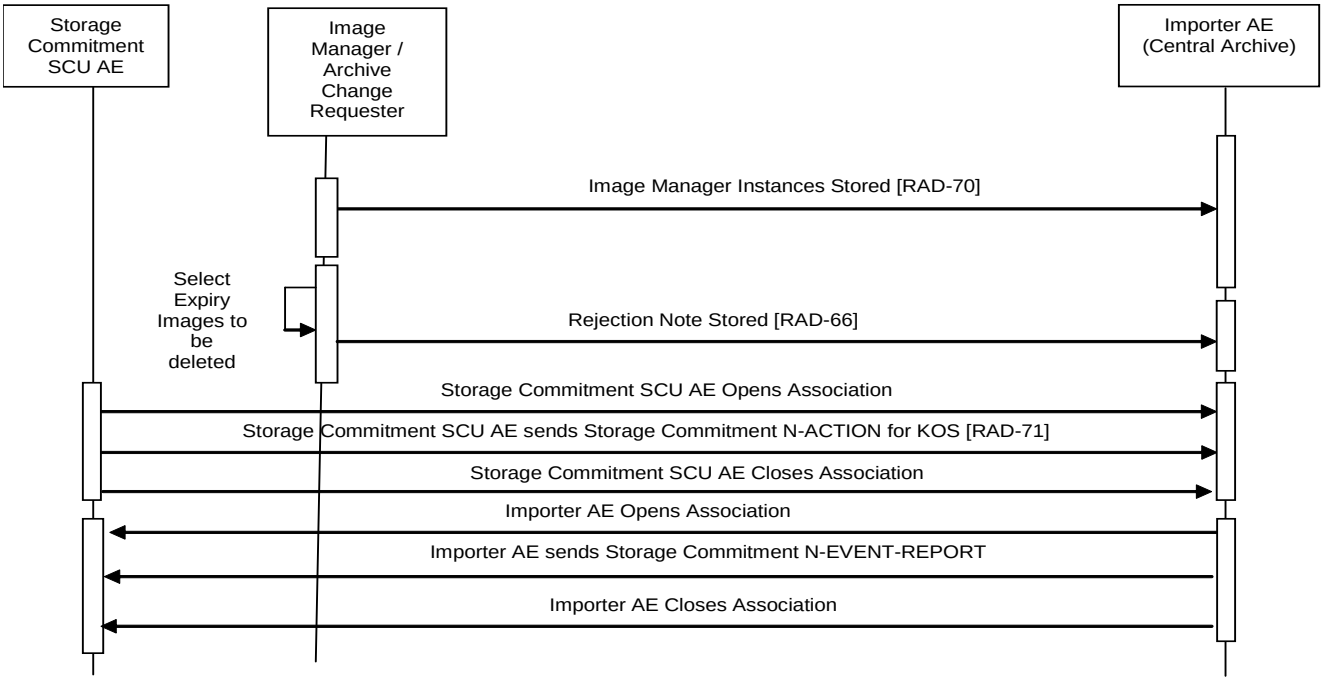
   If Importer AE cannot process the KOS during import, a TaskProcessing job will be created in the database for KOS processing at a later time. If the job fails after a configured number of retries, a System Issue will be created so the user becomes aware of the failure.

10. IOCM Storage Commitment SCP

    The IHE IOCM Profile requires the Image Manager/Archive to act as the Storage Commitment SCP for incoming KOS. Importer AE can already respond to Storage Commitment requests as a SCP. To ensure successful response to Storage Commitment requests, inbound KOS accepted by Importer AE needs to have its SOP Instance UID added to the IMAGE_UID table.

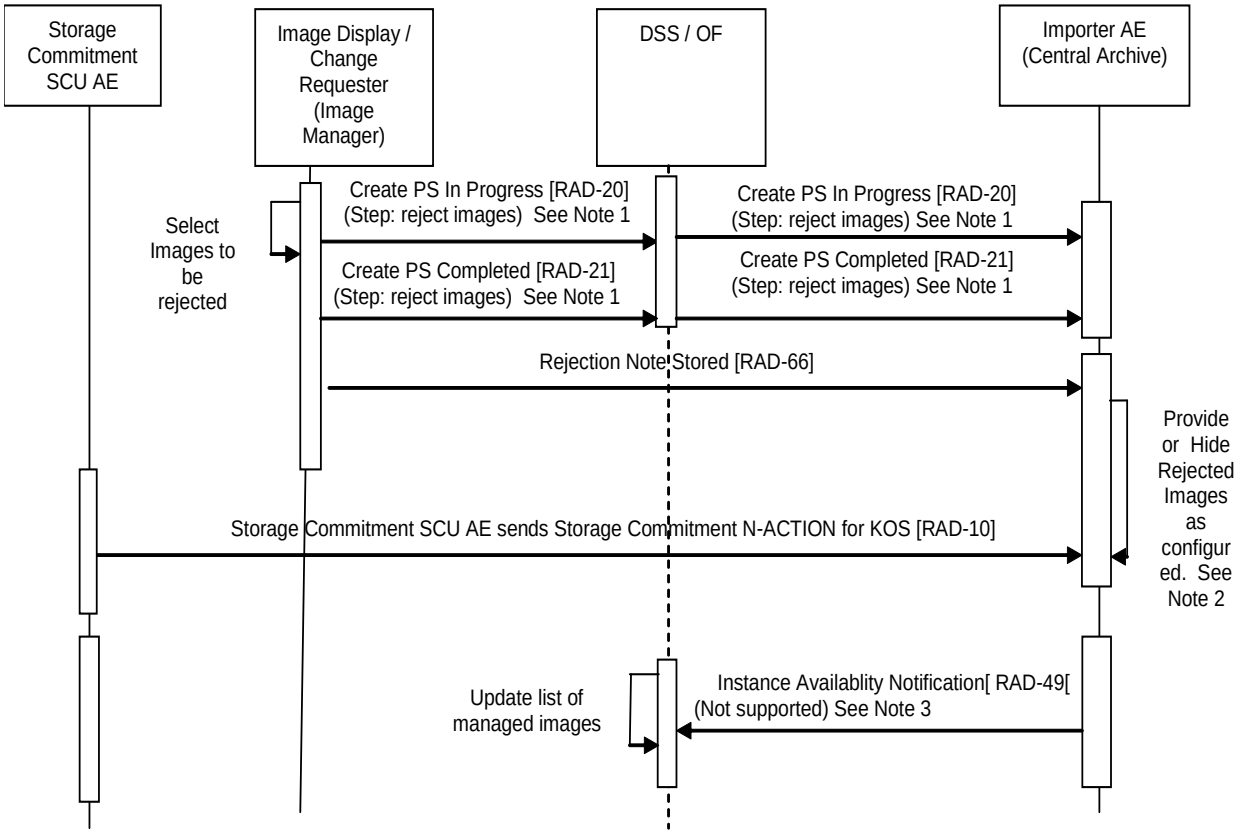
Figure 5: Sequencing of Activity – Receive Synchronization KOS

Use Case: Data Retention Expiration



NOTE1: Change Healthcare Image Repository receiving a KOS for Data Retention Expiration will delete the referenced instances and KOS.

Use Case: Image Rejection for Quality Reasons



NOTE1: The Image Manager acting as the Change Requester does not have to create an MPPS referencing the Rejection Note or an MPPS referencing the corrected images.

NOTE2: The Image Manager / Archive shall support the two behaviors for Rejection for Quality Reasons:

a) Regular use: For the Key Object Selection instance and all instances referenced therein, the Image Manager / Archive shall return SOP Instance UIDs in Query Responses and the instances in Patient, Study, Series, or Instance level retrievals.

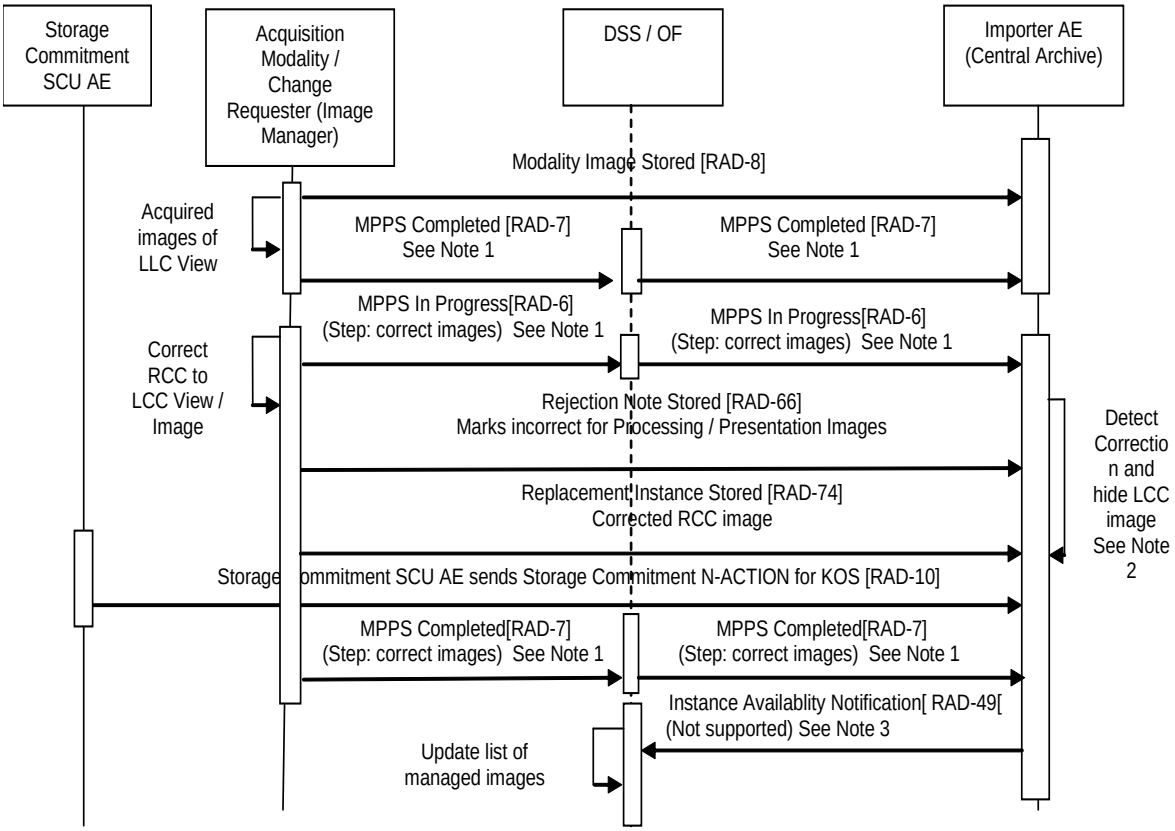
b) Hide rejected instances: For the rejected instances referenced in the Key Object Selection, the Image Manager / Archive shall neither return SOP Instance UIDs in Query Responses nor return the instances in Patient, Study, Series, or Instance level retrievals.

Change Healthcare Image Repository implementation does not hide rejected images. The rejected images are deleted by the Importer AE upon receiving a Rejection Note Stored [RAD-66]. Therefore, for the use case (a) "Regular use" above, Change Healthcare Image Repository will not return the deleted referenced instances in the Query Responses.

NOTE3: Change Healthcare Image Repository does not support sending an Instance Available Notification (RAD-49) to the DSS/OF to confirm all the instances that remain available and those that are deleted.

NOTE4: All internally generated KOS will have either "Retention Expiry" or "Patient Safety" as reasons for deletion. Change Healthcare Image Repository does not use "Quality" reason for internally generated KOS.

Use Case: Image Correction for Patient Safety Reasons



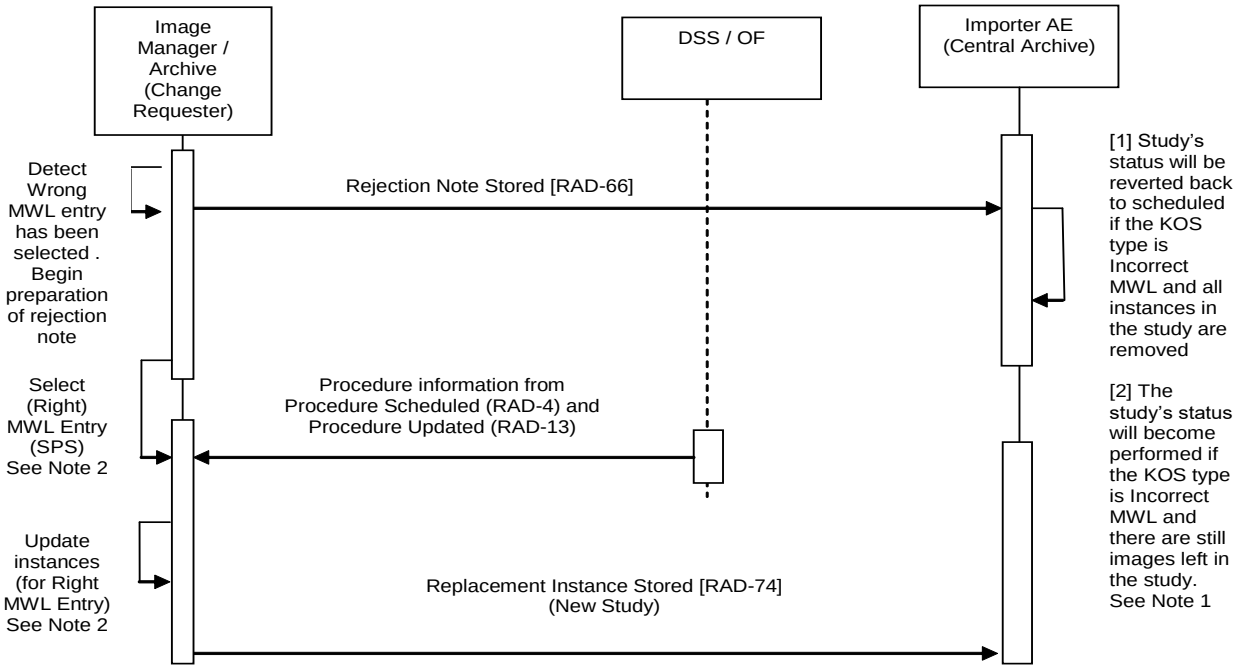
NOTE1: The Image Manager acting as the Change Requester does not have to create an MPPS referencing the Rejection Note or an MPPS referencing the corrected images.

NOTE2: Change Healthcare Image Repository implementation does not hide rejected images. The rejected images are deleted by the Importer AE upon receiving a Rejection Note Stored [RAD-66]

NOTE3: Change Healthcare Image Repository does not support sending an Instance Available Notification (RAD-49) to the DSS/OF to confirm all the instances that remain available and those that are deleted.

NOTE4: Change Healthcare Image Repository will not provide the incorrect instances referenced in this KOS in responses to an image query/ retrieve transaction (RAD-14, RAD-16) or presentation state query/retrieve transaction (RAD-15, RAD-17).

Use Case: Object Correction due to Modality Worklist Selection Error



NOTE1: This gives an alternative approach to the use of MPPS/IAN (as discussed in the IOCM standard) for resetting the study's status.

NOTE2: If an Image Manager is the Change Requester, the Image Manager uses the received procedure information from Procedure Scheduled (RAD-4) and Procedure Updated (RAD-13) to choose the correct modality worklist, updates the images and creates a new set. The Image Manager does not have to create an MPPS referencing the Rejection Note or an MPPS referencing the corrected images.

NOTE3: Change Healthcare Image Repository will not provide the incorrect instances referenced in this KOS in responses to an image query/ retrieve transaction (RAD-14, RAD-16) or presentation state query/retrieve transaction (RAD-15, RAD-17).

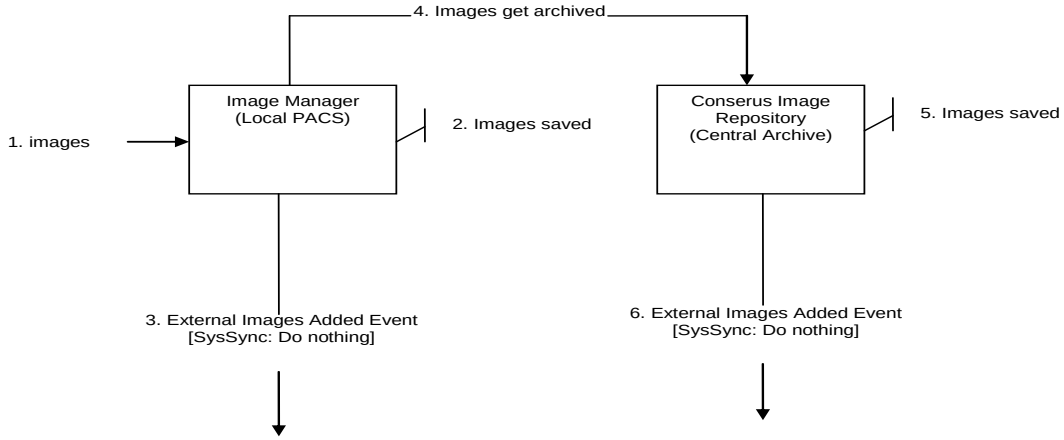
3.2.2.4.6.1 Acceptance of Synchronization Events

When the Image Manager (Local PACS) acts as the Change Requester to add or delete DICOM objects, the local changes need to be communicated to Change Healthcare Image Repository.

The following diagrams show the flow of events from the Image Manager (Local PACS) to Change Healthcare Image Repository for different local changes to DICOM objects / Studies.

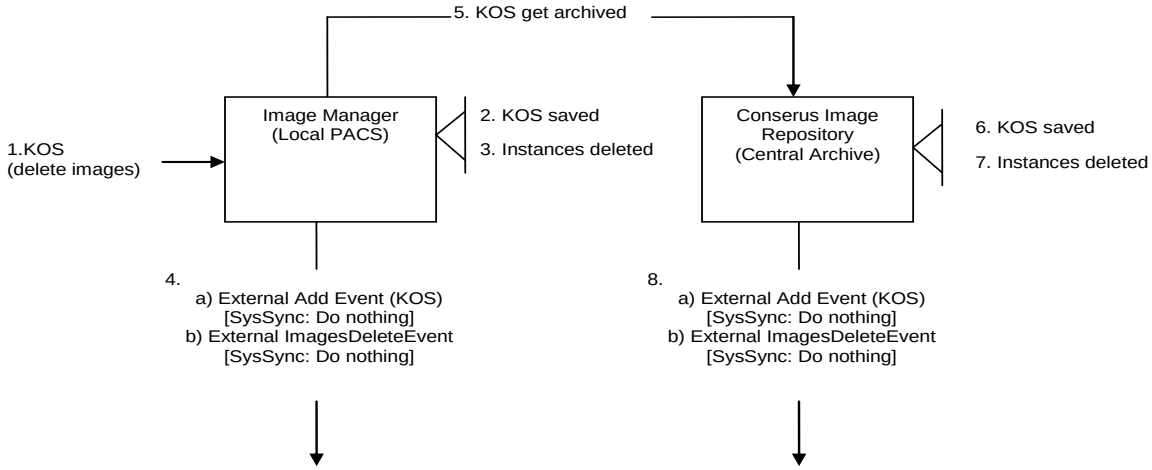
3.2.2.4.6.1.1 Add Images

New DICOM instances coming into Image Manager (Local PACS) are saved. Later they get archived to Change Healthcare Image Repository as part of the existing Migrate/Archive workflow.



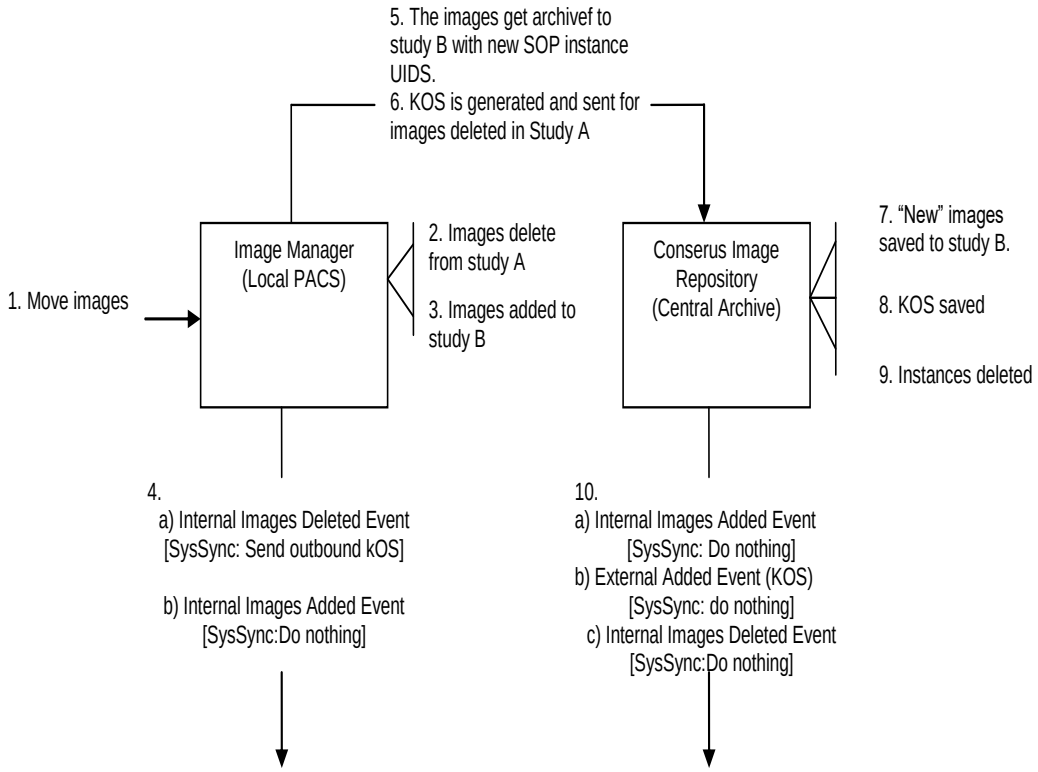
3.2.2.4.6.1.2 Delete Images

The synchronization KOS is saved in the system and the referenced items marked as deleted. Later the KOS gets archived to Change Healthcare Image Repository as part of the existing Migrate/Archive workflow. Change Healthcare Image Repository will in turn process the synchronization KOS and delete the referenced items.



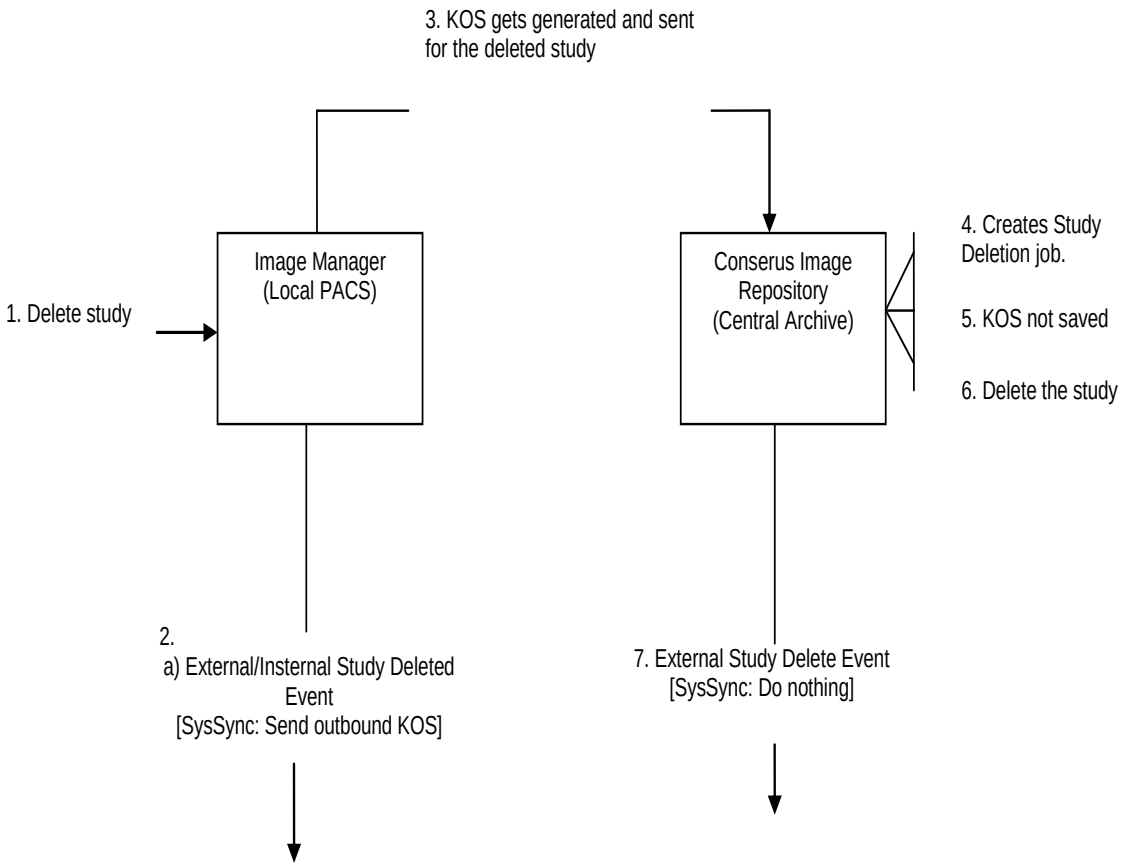
3.2.2.4.6.1.3 Move Images

Move Images is equivalent to Delete Images from the source study plus Add Images to the destination study. A moved image shall have the target study's study UID, new series UID, and new SOP instance UID.



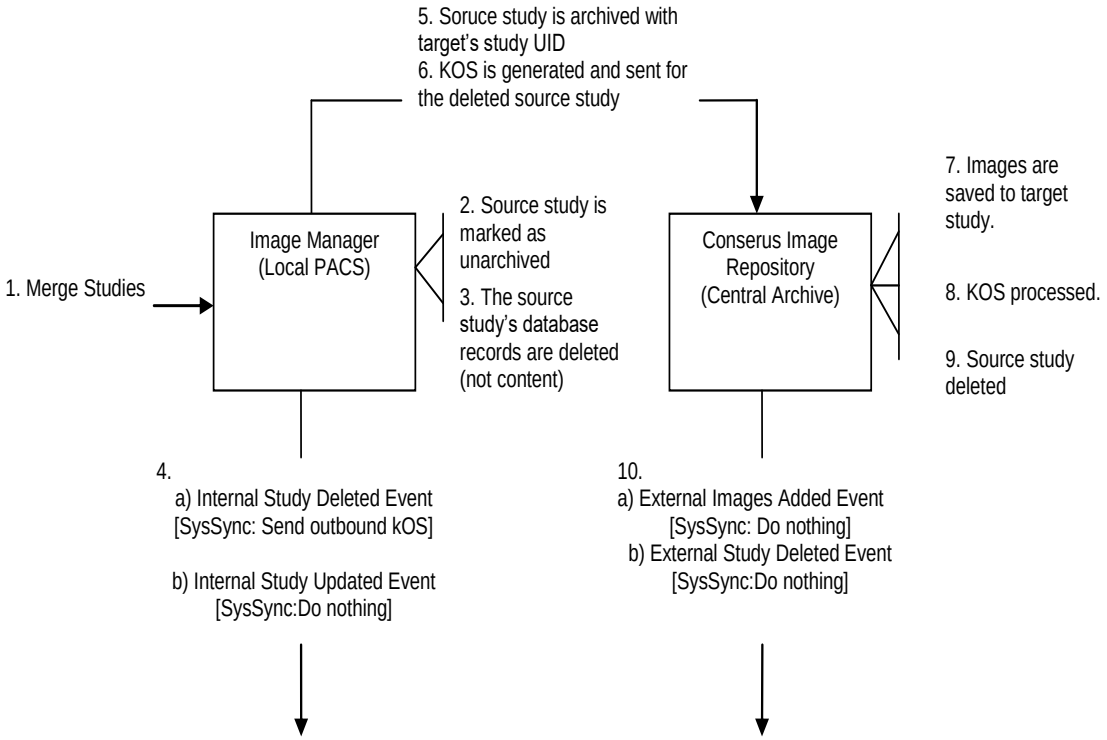
3.2.2.4.6.1.4 Delete Study

Deleting the study on the local PACS triggers the creation of an Outbound Delete Study KOS.



3.2.2.4.6.1.5 Merge Studies

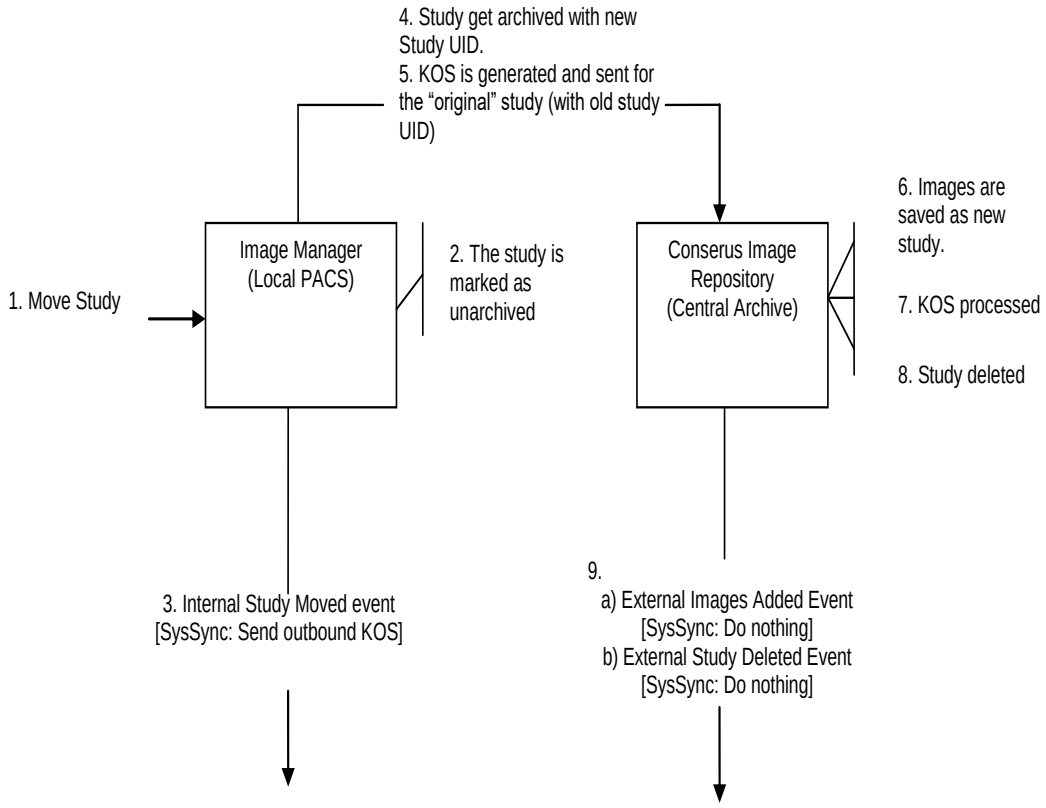
Source study will get archived to Change Healthcare Image Repository with the target study's study UID. Since the SOP Instance UIDs do not get updated, the external system may reject the archived instances because of duplicate instance UIDs in their system (e.g., copies of images from the source study still exist in their system). In such case, Image Manager (Local PACS) shall keep trying until archive succeeds (or until the source study is deleted from the external system).



3.2.2.4.6.1.6 Move Study

After moving a study from patient A to patient B, Image Manager (Local PACS) shall:

- Generate a new study UID for the study and update the study UID in the database
- trigger re-archive
- Outbound Synchronization KOS is sent to delete the original study.



3.2.2.4.7 Accepted Presentation Contexts

The Importer AE will accept Presentation Context below:

Table 30: SOP Class Conformance of Importer AE for IOCM KOS

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes

1. An abstract syntax selected from Table 30
2. One or more Transfer Syntaxes selected from Table 31

Table 31: Importer AE Accepted Transfer Syntaxes for IOCM KOS

Transfer Syntax		Role	Extended Negotiation
Name	UID		
DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None

3.2.2.4.8 SOP Specific Conformance as an Association Acceptor

3.2.2.4.8.1 SOP Specific Conformance – KOS Storage

The Importer AE provides Level 2 DICOM conformance to the Importing IOCM KOS SOP Class. It is configured to retain the original DICOM data in DICOM Part 10 compliant file format. In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files. The use of IOCM KOS is described in 0 The default behavior of the Importer AE supports the Implicit VR Little Endian and Explicit VR Little Endian Transfer Syntaxes for all Associations. In addition, some explicit JPEG Lossy and JPEG Lossless compression Transfer Syntaxes are supported, as defined in Table 24.

The JPEG 2000 Lossy, JPEG 2000 Lossless, RLE, and Wavelet (Private) Transfer Syntaxes can also be enabled via configuration; however, these are not enabled by default. The Importer AE can be configured to accept a subset of any of these syntaxes, with the inclusion of Implicit VR Little Endian being mandatory. It can also be configured to compress images once they are received using these various compression options.

The default preferred acceptance order for Transfer Syntaxes for the Importer AE (from highest preference to lowest) is: Little Endian Explicit, Little Endian Implicit, JPEG Lossy, and JPEG Lossless (if all these contexts are proposed). This order of preference is configurable.

Activity – Receive Synchronization KOS Request.

The Importer AE provides support for Storage Commitment Push Model. The Importer AE expects the SCU to open an Association, send one or more IOCM KOS, and then send the Storage Commitment Request for those objects. The Importer will then send the N-EVENT Report over this same Association. If it cannot do so, then it will open a new Association with the SCU and send the N-EVENT-REPORT over the new Association.

The status codes in a C-STORE Response returns by the Importer AE for IOCM KOS is same as described in Table 25: Importer AE Returned C-STORE-RSP Status Codes

The Importer will never delete any received KOS that can be successfully parsed and contain all the necessary information for system synchronization.

3.2.2.4.8.2 SOP Specific Conformance – KOS Storage Commitment

The associated Activity with the Storage Commitment Push Model service for IOCM KOS is the same as described in 0 The Importer will never delete any received images that can be successfully parsed and contain all the necessary information to add the image to the database (see the table of significant DICOM elements defined earlier). The images will always be archived to media of some sort (WORM, DLT etc.). Images are only flushed from the hard disk storage if they have been successfully archived to the media.

SOP Specific Conformance – Storage Commitment.

3.2.2.4.8.3 SOP Specific Conformance – Encounter-based Storage

The Importer AE accepts Associations from external encounter-based devices such as Point-of-Care Ultrasound and based on the configuration, the Importer AE assigns accession number if the incoming object does not include an accession number.

3.2.3Query/Retrieve Server AE Specification

3.2.3.1SOP Classes

The Query/Retrieve Server AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 32: SOP Class Conformance of Query/Retrieve Server AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Verification			
Verification	1.2.840.10008.1.1	No	Yes
Query/Retrieve			
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
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	No	Yes
Patient Study Only Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	No	Yes
Workflow Management			
Modality Worklist Information Model	1.2.840.10008.5.1.4.31	No	Yes
Transfer			
12-lead ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
Ambulatory ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Basic Voice Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Cardiac Electrophysiology Waveform	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
General Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.2	Yes	No
Arterial Pulse Waveform	1.2.840.10008.5.1.4.1.1.9.5.1	Yes	No
Respiratory Waveform	1.2.840.10008.5.1.4.1.1.9.6.1	Yes	No
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Yes	No
Comprehensive Structured Report	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Mammography CAD Structured Report	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
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	No
Colon CAD SR Document	1.2.840.10008.5.1.4.1.1.88.69	Yes	No
Implantation Plan SR Document	1.2.840.10008.5.1.4.1.1.88.70	Yes	No
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Encapsulated CDA IOD	1.2.840.10008.5.1.4.1.1.104.2	Yes	No
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	Yes	No
CT Image	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
Digital X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography Image (Processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Breast Tomosynthesis Image	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Digital Intra-oral X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.2	Yes	No
Pseudo-Color Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.3	Yes	No
Blending Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.4	Yes	No
XA/XRF Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.5	Yes	No
Hardcopy Color Image	1.2.840.10008.5.1.1.30	Yes	No
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	Yes	No
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
MR Image	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
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	No
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Yes	No
Nuclear Medicine Image (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	No
Positron Emission Tomography Image	1.2.840.10008.5.1.4.1.1.128	Yes	No
Enhanced PET Image	1.2.840.10008.5.1.4.1.1.130	Yes	No
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	No
Spatial Registration	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Spatial Fiducials	1.2.840.10008.5.1.4.1.1.66.2	Yes	No
Deformable Spatial Registration	1.2.840.10008.5.1.4.1.1.66.3	Yes	No
Segmentation	1.2.840.10008.5.1.4.1.1.66.4	Yes	No
Surface Segmentation	1.2.840.10008.5.1.4.1.1.66.5	Yes	No
Real World Value Mapping	1.2.840.10008.5.1.4.1.1.67	Yes	No
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Yes	No
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Yes	No
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
RT Beams Delivery Instruction	1.2.840.10008.5.1.4.34.7	Yes	No
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Yes	No
Stand-alone Curve	1.2.840.10008.5.1.4.1.1.9	Yes	No
Stand-alone Modality LUT	1.2.840.10008.5.1.4.1.1.10	Yes	No
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Yes	No
Stand-alone VOI LUT	1.2.840.10008.5.1.4.1.1.11	Yes	No
Standalone PET Curve	1.2.840.10008.5.1.4.1.1.129	Yes	No
Stored Print	1.2.840.10008.5.1.1.27	Yes	No
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Image (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	No
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Ultrasound Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No
VL Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
VL Image (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Yes	No
VL Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Yes	No
Video Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	No
Video Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	No
Video Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	No
Ophthalmic Photography 8 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	No
Ophthalmic Photography 16 Bit Image	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	No
Ophthalmic Tomography Image	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	No
VL Whole Slide Microscopy Image	1.2.840.10008.5.1.4.1.1.77.1.6	Yes	No
Stereometric Relationship	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	No
X-Ray Angiographic Bi-Plane Image (retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	No
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
X-Ray 3D Angiographic Image	1.2.840.10008.5.1.4.1.1.13.1.1	Yes	No
X-Ray 3D Craniofacial Image	1.2.840.10008.5.1.4.1.1.13.1.2	Yes	No
X-Ray Radiation Dose Structured Report	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Lensometry Measurements	1.2.840.10008.5.1.4.1.1.78.1	Yes	No
Autorefraction Measurements	1.2.840.10008.5.1.4.1.1.78.2	Yes	No
Keratometry Measurements	1.2.840.10008.5.1.4.1.1.78.3	Yes	No
Subjective Refraction Measurements	1.2.840.10008.5.1.4.1.1.78.4	Yes	No
Visual Acuity Measurements	1.2.840.10008.5.1.4.1.1.78.5	Yes	No
Spectacle Prescription Report	1.2.840.10008.5.1.4.1.1.78.6	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Ophthalmic Axial Measurements	1.2.840.10008.5.1.4.1.1.78.7	Yes	No
Intraocular Lens Calculations	1.2.840.10008.5.1.4.1.1.78.8	Yes	No
Macular Grid Thickness and Volume Report	1.2.840.10008.5.1.4.1.1.79.1	Yes	No
Ophthalmic Visual Field Static Perimetry Measurements	1.2.840.10008.5.1.4.1.1.80.1	Yes	No
Basic Structured Display IOD	1.2.840.10008.5.1.4.1.1.131	Yes	No
Generic Implant Template	1.2.840.10008.5.1.4.43.1	Yes	No
Implant Assembly Template	1.2.840.10008.5.1.4.44.1	Yes	No
Implant Template Group	1.2.840.10008.5.1.4.45.1	Yes	No
Intravascular Optical Coherence Tomography Image Storage (Presentation)	1.2.840.10008.5.1.4.1.1.14.1	Yes	No
Intravascular Optical Coherence Tomography Image Storage (Processing)	1.2.840.10008.5.1.4.1.1.14.2	Yes	No
Surface Scan Mesh Storage	1.2.840.10008.5.1.4.1.1.68.1	Yes	No
Surface Scan Point Cloud Storage	1.2.840.10008.5.1.4.1.1.68.2	Yes	No
Comprehensive 3D SR	1.2.840.10008.5.1.4.1.1.88.34	Yes	No
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	Yes	No
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Yes	No

The Query/Retrieve Server AE implements SOP Classes of the Query/Retrieve Service Class as an SCP. It also supports the Modality Worklist SOP Class as an SCP. The Query/Retrieve Server AE can handle requests from external devices to query the Change Healthcare Image Repository database for patient, study and series demographics, and Modality Worklists. It also handles requests for the retrieval of Composite SOP Instances.

The Query/Retrieve Server AE has one main task running on a Change Healthcare Image Repository. It acts as an Association Acceptor, waiting for remote AEs acting as SCUs to request an Association. When the main task receives a request to open a new Association from a remote AE, it will spawn a child task for handling messages sent by the remote AE. These child tasks will both receive the query or retrieval requests sent by the remote AE and return any necessary responses with the matching information. In addition, a child process will attempt to handle any retrieval request by opening a new Association with the specified C-MOVE Destination AE and send any matching Composite SOP Instances over this Association. Thus, each child task can also act as an Association Requestor in addition to handling Associations requested by a remote AE. After each attempt to send a Composite SOP Instance using a C-STORE Request, a C-MOVE Response is sent to the remote AE that sent the retrieval request (the C-MOVE SCU) indicating whether the transfer was successful or not.

3.2.3.2Association Establishment Policies

3.2.3.2.1 General

The Query/Retrieve Server AE will accept Associations as an SCP for the Query/Retrieve Service C-FIND, and C-MOVE SOP Classes. It will also accept Associations as an SCP for the Modality Worklist SOP Class.

The Query/Retrieve Server AE will initiate Associations to send Composite SOP Instances in response to a C-MOVE Request. It will attempt to open a new Association with the C-MOVE Destination AE specified in the C-MOVE Request.

The DICOM Standard Application Context Name is always proposed:

Table 33: DICOM Application Context for Query/Retrieve Server AE

Application Context Name	1.2.840.10008.3.1.1.1

3.2.3.2.2 Number of Associations

Each time the Query/Retrieve Server AE accepts an Association Request, a child process will be spawned to process any query or retrieval requests. The maximum number of child processes, and thus the maximum number of simultaneous Associations that can be processed, is set by configuration.

Table 34: Number of Simultaneous Associations for Query/Retrieve Server AE acting as an SCP

Maximum number of simultaneous Associations	Unlimited[4]

If a child process receives a C-MOVE Request, then a new Association will also be requested by the Query/Retrieve Server AE in order to send images to the C-MOVE Destination AE. This means that each child process can also request a new Association and thus the Query/Retrieve Server AE can have multiple simultaneous requested Associations.

Table 35: Number of Simultaneous Associations for Query/Retrieve Server AE acting as an SCU

Maximum number of simultaneous Associations	Unlimited[5]

3.2.3.2.3 Asynchronous Nature

Negotiation of multiple outstanding transactions is not supported.

Table 36: Asynchronous Nature for Query/Retrieve Server AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.3.2.4 Implementation Identifying Information

Table 37: DICOM Implementation Class and Version for Query/Retrieve Server AE

Implementation Class UID	1.2.840.113711.3
Implementation Version Name	V1.0

3.2.3.3Association Initiation Policy

3.2.3.3.1 Activity – Remote AE requests the retrieval of images

3.2.3.3.2 Description and Sequencing of Activity

When a remote AE submits a C-MOVE request to Change Healthcare Image Repository, the Query/Retrieve Server AE looks in its database to find any matches for the submitted request. If there

[5] Default maximum is 10 per host permitted to connect to the Query/Retrieve Server AE.

are Composite SOP Instances that match the C-MOVE request, then the Query/Retrieve Server AE will attempt to open an Association and transfer the requested SOP Instances. An Association Request is sent to the specified C-MOVE Destination AE and, upon successful negotiation of the required Presentation Context, the transfer is started. In all cases an attempt will be made to transmit all the indicated SOP Instances in a single Association, but this may not always be possible. The Association will be released when all the SOP Instances have been sent. If an error occurs during transmission over an open Association then the transfer is halted. The Query/Retrieve Server AE will not attempt to independently retry the image export.

The Query/Retrieve Server AE does not support the unsolicited sending of SOP Instances using the DICOM Storage Service Class. It will only send SOP Instances in response to a C-MOVE Request from a remote AE.

3.2.3.3.3 Proposed Presentation Contexts

The Query/Retrieve Server AE can propose the same Presentation Contexts as the Sender AE when it attempts to transfer Composite SOP Instances in response to a C-MOVE Request. As such, it can propose any one or more of the Transfer Syntaxes in

Table 4. Each proposed Presentation Context contains a single Transfer Syntax. Multiple Transfer Syntaxes per abstract syntax would be proposed with multiple Presentation Contexts.

Table 9: Sender AE Proposed Transfer Syntaxes for each of the abstract syntaxes listed in

Table 4: SOP Class Conformance of Sender AE (same as SOP Classes with Role of SCU listed in Table 32: SOP Class Conformance of Query/Retrieve Server AE). Each proposed Presentation Context contains a single Transfer Syntax. Multiple Transfer Syntaxes per abstract syntax would be proposed with multiple Presentation Contexts.

3.2.3.3.4 SOP Specific Conformance as an Association Requestor

3.2.3.3.4.1 SOP Specific Conformance - Storage

The Query/Retrieve Server AE will attempt to transfer all requested SOP Instances to the C-MOVE Destination AE specified in a C-MOVE Request. For each C-STORE Response received from the C-MOVE Destination AE, the Query/Retrieve Server AE will return a C-MOVE Response to the AE that sent the original C-MOVE Request. Each C-MOVE Response will indicate the appropriate Status Code based on the Status Code of the corresponding C-STORE Response. The Association will be properly released after the Query/Retrieve Server AE has attempted to transfer all requested SOP Instances. The Query/Retrieve Server AE will continue to attempt to transfer any remaining SOP Instances even if a failure Status Code is returned in a particular C-STORE Response.

When a Composite SOP Instance is selected for transmission from Change Healthcare Image Repository, the content of the object will be the same as when it was originally received unless patient demographic or study-related information is altered. In such cases, the latest values in the database will replace the original information in the SOP Instance. Thus, the set of optional tags contained in DICOM objects going out from Change Healthcare Image Repository depends on the information that was received. For the list of patient, study, and series attributes that can be updated by the Query/Retrieve Server AE when a SOP Instance is exported please refer to 7.1.3: Sender AE and Query/Retrieve Server AE Element Modification

The Query/Retrieve Server AE cannot be configured to automatically resend Composite SOP Instances when the Status Code returned in a C-STORE Response is considered to indicate a failure.

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

Table 38: Query/Retrieve Server AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the exported SOP Instance. Success indication message is output to the Service Logs.
Refused	Out of Resources	A700 – A7FF	This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend the SOP Instance. However, it will continue trying to send any remaining SOP Instances requested by the C-MOVE-RQ. An error indication is output to the Service Logs.
Error	Data Set does not match SOP Class	A900 – A9FF	This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend the SOP Instance. However, it will continue trying to send any remaining SOP Instances requested by the C-MOVE-RQ. An error indication is output to the Service Logs.
Error	Cannot Understand	C000 – CFFF	This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend the SOP Instance. However, it will continue trying to send any remaining SOP Instances requested by the C-MOVE-RQ. An error indication is output to the Service Logs.
Warning	Coercion of Data Elements	B000	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Element Discarded	B006	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Data Set does not match SOP Class	B007	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Attribute List Error	0107	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
Warning	Attribute Value Out of Range	0116	SOP Instance transmission is considered successful. A warning indication is output to the Service Logs so that there is a record of the SCP returning a Warning Status.
*	*	Any other status code	This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend the SOP Instance. However, it will continue trying to send any remaining SOP Instances requested by the C-MOVE-RQ. An error indication is output to the Service Logs.

3.2.3.3.4.2 Association Requestor Communication Failure Behavior

The Behavior of the Query/Retrieve Server AE during communication failure when acting as an Association Requestor is summarized in the following table:

Table 39: Query/Retrieve Server AE Communication Failure Behavior as an Association Requestor

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend any of the SOP Instances that were not successfully transferred. An error indication is output to the Service Logs.

Exception	Behavior
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend any of the SOP Instances that were not successfully transferred. An error indication is output to the Service Logs.
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. The Query/Retrieve Server AE does not attempt to resend any of the SOP Instances that were not successfully transferred. An error indication is output to the Service Logs.

3.2.3.4 Association Acceptance Policy

3.2.3.4.1 Activity – External system queries Change Healthcare Image Repository 14.0

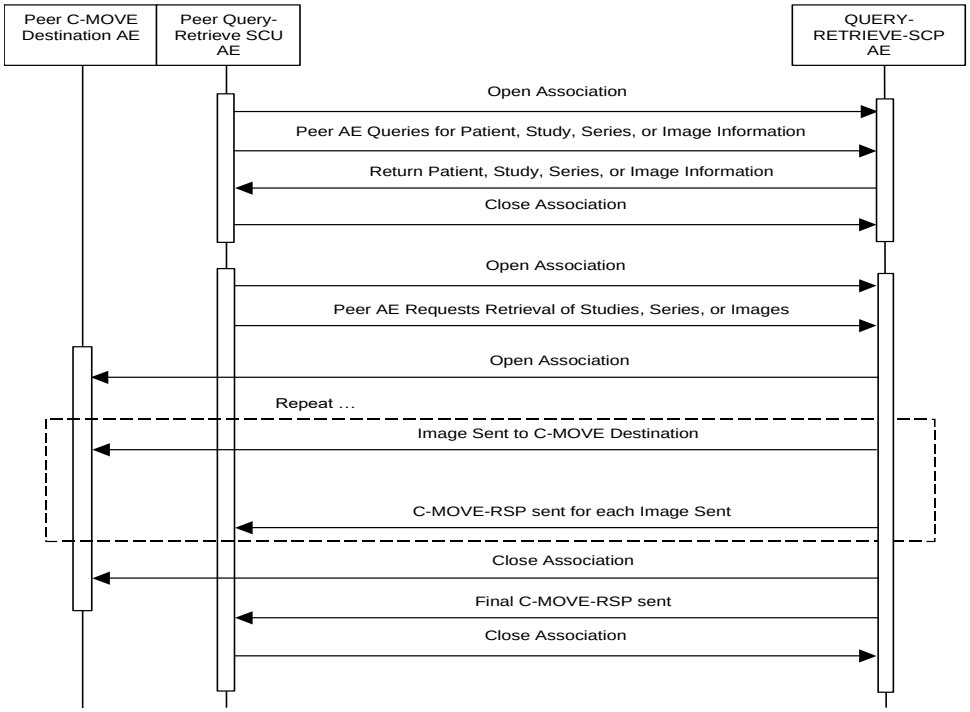
3.2.3.4.2 Description and Sequencing of Activity

The Query/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. It can be configured to only accept Associations with certain hosts (using TCP/IP address) and/or Application Entity Titles.

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

If the Query/Retrieve Server AE receives a retrieval (C-MOVE) request, then the responses will be sent over the same Association used to send the C-MOVE-Request. The Query/Retrieve Server AE will send the requested Composite SOP Instances to the C-MOVE Destination AE. After each attempt to send a SOP Instance, the Query/Retrieve Server AE sends a C-MOVE Response indicating whether the transfer was successful or not. Once the Query/Retrieve Server AE has finished attempting to transfer all the requested SOP Instances, it sends a final C-MOVE Response indicating the overall status of the attempted retrieval.

Figure 6: Sequencing of Activity – Handling Query and Retrieval Requests



The following sequencing constraints illustrated in The Query/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. It can be configured to only accept Associations with certain hosts (using TCP/IP address) and/or Application Entity Titles.

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

If the Query/Retrieve Server AE receives a retrieval (C-MOVE) request, then the responses will be sent over the same Association used to send the C-MOVE-Request. The Query/Retrieve Server AE will send the requested Composite SOP Instances to the C-MOVE Destination AE. After each attempt to send a SOP Instance, the Query/Retrieve Server AE sends a C-MOVE Response indicating whether the transfer was successful or not. Once the Query/Retrieve Server AE has finished attempting to transfer all the requested SOP Instances, it sends a final C-MOVE Response indicating the overall status of the attempted retrieval.

Figure 6 apply to the Query/Retrieve Server AE for handling queries (C-FIND-Requests):

11. Remote AE opens an Association with the Query/Retrieve Server AE.
12. Remote AE sends a C-FIND-RQ Message
13. Query/Retrieve Server AE returns a C-FIND-RSP Message to the remote AE with matching information. A C-FIND-RSP is sent for each entity matching the identifier specified in the C-FIND-RQ. A final C-FIND-RSP is sent indicating that the matching is complete.
14. Remote AE closes the Association. Note that the remote AE does not have to close the Association immediately. Further C-FIND or C-MOVE Requests can be sent over the Association before it is closed.

The following sequencing constraints illustrated in The Query/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. It can be configured to only accept Associations with certain hosts (using TCP/IP address) and/or Application Entity Titles.

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

If the Query/Retrieve Server AE receives a retrieval (C-MOVE) request, then the responses will be sent over the same Association used to send the C-MOVE-Request. The Query/Retrieve Server AE will send the requested Composite SOP Instances to the C-MOVE Destination AE. After each attempt to send a SOP Instance, the Query/Retrieve Server AE sends a C-MOVE Response indicating whether the transfer was successful or not. Once the Query/Retrieve Server AE has finished attempting to transfer all the requested SOP Instances, it sends a final C-MOVE Response indicating the overall status of the attempted retrieval.

Figure 6 apply to the Query/Retrieve Server AE for handling retrievals (C-MOVE-Requests):

15. Remote AE opens an Association with the Query/Retrieve Server AE.
16. Remote AE sends a C-MOVE-RQ Message
17. Query/Retrieve Server AE sends the Composite SOP Instances to the remote C-MOVE Destination AE as indicated in the C-MOVE-RQ.
18. After each attempt to send a SOP Instance, the Query/Retrieve Server AE returns a C-MOVE-RSP indicating this success or failure of the transfer.
19. Once the Query/Retrieve Server AE has completed all attempts to transfer the SOP Instances to the C-MOVE Destination AE, the Query/Retrieve Server AE sends a final C-MOVE-RSP indicating the overall success or failure of the retrieval.
20. Remote AE closes the Association. Note that the remote AE does not have to close the Association immediately. Further C-FIND or C-MOVE Requests can be sent over the Association before it is closed.

The Query/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, Section 9.3.4). The following abbreviations are used in the Source column:

d) 1 – DICOM UL service-user
e) 2 – DICOM UL service-provider (ASCE related function)
f) 3 – DICOM UL service-provider (Presentation related function)

Table 40: Query/Retrieve Server AE Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
2 – rejected-transient	c	2 – local-limit-exceeded	The (configurable) maximum number of simultaneous Associations for the remote AE host has been reached. An Association request with the same parameters may succeed at a later time.
1 – rejected-permanent	a	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.

Result	Source	Reason/Diag	Explanation
1 – rejected-permanent	b	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time. Usually this is only returned if the Query/Retrieve Server AE has not been configured to allow the remote AE host to connect to it. The Query/Retrieve Server AE can be configured to allow only specific host names to open Associations with it. Note that it cannot currently be configured to only allow specific calling and/or called AE Titles when forming Associations.

3.2.3.4.3 Accepted Presentation Contexts

The Query/Retrieve Server AE may accept any one or more of the following Presentation Contexts:

Table 41: Query/Retrieve Server AE Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Verification	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	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	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Patient Study Only Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Study Only Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Modality Worklist Information Model	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Modality Worklist Information Model	1.2.840.10008.5.1.4.31	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None

3.2.3.4.4 SOP Specific Conformance as an Association Acceptor

3.2.3.4.4.1 SOP Specific Conformance – Verification

Standard conformance is provided to the DICOM Verification Service Class as an SCP.

3.2.3.4.4.2 SOP Specific Conformance – Query (C-FIND)

The Query/Retrieve Server AE supports hierarchical queries and not relational queries. There are no attributes always returned by default. Only those attributes requested in the query identifier are returned. Query responses always return values from the Change Healthcare Image Repository database. Exported SOP Instances are always updated with the latest values in the database prior to export. Thus, a change in patient demographic information will be contained in both the C-FIND Responses and any Composite SOP Instances exported to a C-MOVE Destination AE. If the submitted C-FIND Request generates a large number of matches in the Change Healthcare Image Repository database, QueryServer will return a maximum of 5000 matching C-FIND Responses. This limitation of 5000 matching C-FIND Responses does not apply to instance-level C-FIND Requests. The limitation could have some consequences when the submitted C-FIND Requests are for Patient level queries and Study Root/Study Level queries that do not specify a single patient id (e.g. only specifying a patient last name: Jones). This is done by design to prevent QueryServer from using extremely large amounts of resources (CPU and memory), eventually causing the server to crash.

Change Healthcare Image Repository will return the first modality known for the study in attribute 'modalities in study (0008,0061)'.

By default, the Query/Retrieve Server AE is configured to not check for Cancel Requests sent by a remote AE. This is done to improve performance, as it does not have to spend time periodically checking if a remote AE has sent a Cancel Request over the Association. However, if it is known that a remote AE can send Cancel Requests, then the Query/Retrieve Server AE can be configured to handle them properly.

The Query/Retrieve Server AE implements support for the IHE Technical Framework version 5.5 (Year 6). All required attributes are supported at the Patient, Study, Series, Image levels.

Patient Root Information Model

All required search keys on each of the four levels (Patient, Study, Series, and Image) are supported. However, the Patient ID (0010,0020) key must be fully stated if the Patient's Name (0010,0010) is not present in the query (e.g. Change Healthcare Image Repository does not support queries for patients having the patient ID of "123*" when this is the only search criterion).

Study Root Information Model

All the required search keys on each of the three levels (Study, Series, and Image) are supported. There is, however, a caveat that applies to the Study Time (0008,0030) — it cannot be used as the only search key on the Study level. If it is used in conjunction with the other supported search keys on the Study level, it can be used in the matching criteria.

Patient/Study Only Information Model

All the required search keys on the Patient and Study levels are supported. The Patient ID (0010,0020) key must be fully stated if the Patient's Name (0010,0010) is not present in the query.

Table 42: Patient Root C-FIND SCP Supported Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient's Name (See NOTE7)	(0010,0010)	PN	S,*,U also DICOM FUZZY LOGIC if MIMA
Patient ID	(0010,0020)	LO	UNIQUE
Issuer of Patient ID (See NOTE3)	(0010,0021)	LO	S,U
Other patient IDs Sequence (See NOTE4)	(0010,1002)	SQ	NONE
> Patient ID	(0010,0020)	LO	NONE
>Issuer of Patient ID	(0010,0021)	LO	NONE
>Type of Patient ID	(0010,0022)	CS	NONE
Patient's Birth Date	(0010,0030)	DA	S,U
Patient's Birth Time	(0010,0032)	TM	S,U
Patient's Sex	(0010,0040)	CS	S,U
Medical Alerts	(0010,2000)	LO	NONE
Contrast Allergies	(0010,2110)	LO	NONE
Pregnancy Status	(0010,21C0)	US	NONE
Study Level			
Study Date	(0008,0020)	DA	S,R,U
Study Time	(0008,0030)	TM	R,U
Accession Number	(0008,0050)	SH	S,U
Issuer of Accession Number Sequence (See NOTE5)	(0008,0051)	SQ	SQ
>Local Namespace Entity ID	(0040,0031)	UT	S,U
>Universal Entity ID	(0040,0032)	UT	S,U
>Universal Entity ID Type	(0040,0033)	CS	S,U
Study ID	(0020,0010)	SH	S,U
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Referring Physician's Name	(0008,0090)	PN	S,*,U
Study Description	(0008,1030)	LO	S,*,U
Modalities in Study	(0008,0061)	CS	S,*,U
Number of Study Related Series	(0020,1206)	IS	NONE
Number of Study Related Instances	(0020,1208)	IS	NONE
Instance Availability (see NOTE2)	(0008,0056)	CS	NA
Series Level			
Modality	(0008,0060)	CS	S,U
Series Number	(0020,0011)	IS	S,U
Series Instance UID	(0020,000E)	UI	UNIQUE,L
Number of Series Related Instances	(0020,1209)	IS	NONE
Performing Physician's Name (see NOTE1)	(0008,1050)	PN	S,*,U
Operator's Name	(0008,1070)	PN	S,*,U

Series Description	(0008,103E)	LO	S,*,U
Request Attribute Sequence	(0040,0275)	SQ	SQ
>Requested Procedure ID	(0040,1001)	SH	S,*,U
>Scheduled Procedure Step ID	(0040,0009)	SH	S,*,U
Performed Procedure Step Start Date	(0040,0244)	DA	S,R,U
Performed Procedure Step Start Time	(0040,0245)	TM	S,R,U
Instance Availability (see NOTE2)	(0008,0056)	CS	NA
Institution Name (See NOTE6)	(0008,0080)	LO	NONE
Institution Code Sequence (See NOTE6)	(0008,0082)	SQ	SQ
>Code Value	(0008,0100)	SH	S,U
>Coding Scheme Designator	(0008,0102)	SH	S,U
>Coding Scheme Version	(0008,0103)	SH	S,U
>Code Meaning	(0008,0104)	LO	S,U
Image Level			
SOP Instance UID	(0008,0018)	UI	UNIQUE,L
SOP Class UID	(0008,0016)	UI	S,U,L
Content Date	(0008,0023)	DA	NONE
Content Time	(0008,0033)	TM	NONE
Retrieve AE Title (see NOTE8)	(0008,0054)	AE	N/A
Referenced Series Sequence	(0008,1115)	SQ	NONE
>Series Instance UID	(0020,000E)	UI	NONE
>Referenced Image Sequence	(0008,1140)	SQ	NONE
>>Referenced SOP Class UID	(0008,1150)	UI	NONE
>>Referenced SOP Instance UID	(0008,1155)	UI	NONE
Instance Number	(0020,0013)	IS	S,U
Rows	(0028,0010)	US	NONE
Columns	(0028,0011)	US	NONE
Bits Allocated	(0028,0100)	US	NONE
Number of Frames	(0028,0008)	IS	NONE
Observation DateTime	(0040,A032)	DT	NONE
Concept Name Code Sequence	(0040,A043)	SQ	SQ
>Code Value	(0008,0100)	SH	S,*,U
>Coding Scheme Designator	(0008,0102)	SH	S,*,U
>Coding Scheme Version	(0008,0103)	SH	NONE
>Code Meaning	(0008,0104)	LO	NONE
Verifying Observer Sequence	(0040,A073)	SQ	SQ
>Verifying Organization	(0040,A027)	LO	NONE
>Verification DateTime	(0040,A030)	DT	S,R,U
>Verifying Observer Name	(0040,A075)	PN	S,*,U

>Verifying Observer Identification Code Sequence	(0040,A088)	SQ	NONE
>>Code Value	(0008,0100)	SH	NONE
>>Coding Scheme Designator	(0008,0102)	SH	NONE
>>Coding Scheme Version	(0008,0103)	SH	NONE
>>Code Meaning	(0008,0104)	LO	NONE
Referenced Request Sequence	(0040,A370)	SQ	NONE
>Accession Number	(0008,0050)	SH	NONE
>Study Instance UID	(0020,000D)	UI	NONE
>Requested Procedure Code Sequence	(0032,1064)	SQ	NONE
>>Code Value	(0008,0100)	SH	NONE
>>Coding Scheme Designator	(0008,0102)	SH	NONE
>>Coding Scheme Version	(0008,0103)	SH	NONE
>>Code Meaning	(0008,0104)	LO	NONE
>Requested Procedure ID	(0040,1001)	SH	NONE
Completion Flag	(0040,A491)	CS	S,*,U
Verification Flag	(0040,A493)	CS	S,*,U
Content Template Sequence	(0040,A504)	SQ	NONE
>Template Identifier	(0040,DB00)	CS	NONE
Presentation Label	(0070,0080)	CS	NONE
Presentation Description	(0070,0081)	LO	NONE
Presentation Creation Date	(0070,0082)	DA	NONE
Presentation Creation Time	(0070,0083)	TM	NONE
Presentation Creator's Name	(0070,0084)	PN	NONE
Instance Availability (see NOTE2)	(0008,0056)	CS	NA

Table 43: Study Root C-FIND SCP Supported Elements

Description/Module	Tag ID	VR	Types of Matching
Study Level			
Patient's Name (See NOTE7)	(0010,0010)	PN	S,*,U also DICOM FUZZY LOGIC if MIMA
Patient ID	(0010,0020)	LO	S,U
Issuer of Patient ID (See NOTE3)	(0010,0021)	LO	S,U
Other patient IDs Sequence (See NOTE4)	(0010,1002)	SQ	NONE
> Patient ID	(0010,0020)	LO	NONE
>Issuer of Patient ID	(0010,0021)	LO	NONE
>Type of Patient ID	(0010,0022)	CS	NONE
Patient's Birth Date	(0010,0030)	DA	S,U
Patient's Birth Time	(0010,0032)	TM	S,U
Patient's Sex	(0010,0040)	CS	S,U
Medical Alerts	(0010,2000)	LO	NONE

Contrast Allergies	(0010,2110)	LO	NONE
Pregnancy Status	(0010,21C0)	US	NONE
Study Date	(0008,0020)	DA	S,R,U
Study Time	(0008,0030)	TM	R,U
Accession Number	(0008,0050)	SH	S,U
Issuer of Accession Number Sequence (See NOTE5)	(0008,0051)	SQ	SQ
>Local Namespace Entity ID	(0040,0031)	UT	S,U
>Universal Entity ID	(0040,0032)	UT	S,U
>Universal Entity ID Type	(0040,0033)	CS	S,U
Study ID	(0020,0010)	SH	S,U
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Referring Physician's Name	(0008,0090)	PN	S,*,U
Study Description	(0008,1030)	LO	S,*,U
Modalities in Study	(0008,0061)	CS	S,*,U
Number of Study Related Series	(0020,1206)	IS	NONE
Number of Study Related Instances	(0020,1208)	IS	NONE
Instance Availability (see NOTE2)	(0008,0056)	CS	NA
Series Level			
Modality	(0008,0060)	CS	S,U
Series Number	(0020,0011)	IS	S,U
Series Instance UID	(0020,000E)	UI	UNIQUE,L
Number of Series Related Instances	(0020,1209)	IS	NONE
Performing Physician's Name (see NOTE1)	(0008,1050)	PN	S,*,U
Operator's Name	(0008,1070)	PN	S,*,U
Series Description	(0008,103E)	LO	S,*,U
Request Attribute Sequence	(0040,0275)	SQ	NONE
>Requested Procedure ID	(0040,1001)	SH	S,*,U
>Scheduled Procedure Step ID	(0040,0009)	SH	S,*,U
Performed Procedure Step Start Date	(0040,0244)	DA	S,R,U
Performed Procedure Step Start Time	(0040,0245)	TM	S,R,U
Instance Availability (see NOTE2)	(0008,0056)	CS	NA
Institution Name (See NOTE6)	(0008,0080)	LO	NONE
Institution Code Sequence (See NOTE6)	(0008,0082)	SQ	SQ
>Code Value	(0008,0100)	SH	S,U
>Coding Scheme Designator	(0008,0102)	SH	S,U
>Coding Scheme Version	(0008,0103)	SH	S,U
>Code Meaning	(0008,0104)	LO	S,U
Image Level			
SOP Instance UID	(0008,0018)	UI	UNIQUE,L

SOP Class UID	(0008,0016)	UI	S,U,L
Content Date	(0008,0023)	DA	NONE
Content Time	(0008,0033)	TM	NONE
Retrieve AE Title (see NOTE8)	(0008,0054)	AE	N/A
Referenced Series Sequence	(0008,1115)	SQ	NONE
>Series Instance UID	(0020,000E)	UI	NONE
>Referenced Image Sequence	(0008,1140)	SQ	NONE
>>Referenced SOP Class UID	(0008,1150)	UI	NONE
>>Referenced SOP Instance UID	(0008,1155)	UI	NONE
Instance Number	(0020,0013)	IS	S,U
Rows	(0028,0010)	US	NONE
Columns	(0028,0011)	US	NONE
Bits Allocated	(0028,0100)	US	NONE
Number of Frames	(0028,0008)	IS	NONE
Observation DateTime	(0040,A032)	DT	NONE
Concept Name Code Sequence	(0040,A043)	SQ	SQ
>Code Value	(0008,0100)	SH	S,*,U
>Coding Scheme Designator	(0008,0102)	SH	S,*,U
>Coding Scheme Version	(0008,0103)	SH	NONE
>Code Meaning	(0008,0104)	LO	NONE
Verifying Observer Sequence	(0040,A073)	SQ	SQ
>Verifying Organization	(0040,A027)	LO	NONE
>Verification DateTime	(0040,A030)	DT	S,R,U
>Verifying Observer Name	(0040,A075)	PN	S,*,U
>Verifying Observer Identification Code Sequence	(0040,A088)	SQ	NONE
>>Code Value	(0008,0100)	SH	NONE
>>Coding Scheme Designator	(0008,0102)	SH	NONE
>>Coding Scheme Version	(0008,0103)	SH	NONE
>>Code Meaning	(0008,0104)	LO	NONE
Referenced Request Sequence	(0040,A370)	SQ	NONE
>Accession Number	(0008,0050)	SH	NONE
>Study Instance UID	(0020,000D)	UI	NONE
>Requested Procedure Code Sequence	(0032,1064)	SQ	NONE
>>Code Value	(0008,0100)	SH	NONE
>>Coding Scheme Designator	(0008,0102)	SH	NONE
>>Coding Scheme Version	(0008,0103)	SH	NONE
>>Code Meaning	(0008,0104)	LO	NONE
>Requested Procedure ID	(0040,1001)	SH	NONE
Completion Flag	(0040,A491)	CS	S,*,U

Verification Flag	(0040,A493)	CS	S,*,U
Content Template Sequence	(0040,A504)	SQ	NONE
>Template Identifier	(0040,DB00)	CS	NONE
Presentation Label	(0070,0080)	CS	NONE
Presentation Description	(0070,0081)	LO	NONE
Presentation Creation Date	(0070,0082)	DA	NONE
Presentation Creation Time	(0070,0083)	TM	NONE
Presentation Creator's Name	(0070,0084)	PN	NONE
Instance Availability (see NOTE2)	(0008,0056)	CS	NA

Table 44: Patient/Study Only Root C-FIND SCP Supported Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient's Name (See NOTE7)	(0010,0010)	PN	S,*,U also DICOM FUZZY LOGIC if MIMA
Patient ID	(0010,0020)	LO	UNIQUE
Issuer of Patient ID (See NOTE3)	(0010,0021)	LO	S,U
Other patient IDs Sequence (See NOTE4)	(0010,1002)	SQ	NONE
> Patient ID	(0010,0020)	LO	NONE
>Issuer of Patient ID	(0010,0021)	LO	NONE
>Type of Patient ID	(0010,0022)	CS	NONE
Patient's Birth Date	(0010,0030)	DA	S,U
Patient's Birth Time	(0010,0032)	TM	S,U
Patient's Sex	(0010,0040)	CS	S,U
Medical Alerts	(0010,2000)	LO	NONE
Contrast Allergies	(0010,2110)	LO	NONE
Pregnancy Status	(0010,21C0)	US	NONE
Study Level			
Study Date	(0008,0020)	DA	S,R,U
Study Time	(0008,0030)	TM	R,U
Accession Number	(0008,0050)	SH	S,U
Issuer of Accession Number Sequence (See NOTE5)	(0008,0051)	SQ	SQ
>Local Namespace Entity ID	(0040,0031)	UT	S,U
>Universal Entity ID	(0040,0032)	UT	S,U
>Universal Entity ID Type	(0040,0033)	CS	S,U
Study ID	(0020,0010)	SH	S,U
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Referring Physician's Name	(0008,0090)	PN	S,*,U
Study Description	(0008,1030)	LO	S,*,U
Modalities in Study	(0008,0061)	CS	S,*,U

Number of Study Related Series	(0020,1206)	IS	NONE
Number of Study Related Instances	(0020,1208)	IS	NONE
Performing Physician's Name (see NOTE1)	(0008,1050)	PN	S,*,U
Instance Availability (see NOTE2)	(0008,0056)	CS	NA

The types of Matching supported by the Query/Retrieve Server AE Query (C-FIND) SCP:

S - indicates Single Value Matching is supported.

R - indicates Range Matching is supported.

* - indicates Wildcard Matching is supported.

U - indicates Universal Matching is supported.

L - indicates that UID lists Matching are supported.

SQ - indicates that Sequence Matching is supported.

NONE - indicates that no matching is supported, but that values for this Element are returned if requested (i.e. universal matching).

UNIQUE - indicates that this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching is supported depending on the query level.

NA - indicates that no matching is supported, but the values for this Element will be returned whether it is requested or not.

DICOM FUZZY LOGIC - indicates DICOM Fuzzy Semantic Matching (MIMA) support so that variations in the spelling of a patient's name in different domains, phonetic matching (e.g. a query for Swain" might as well return "Swayne"), or patient name components order-insensitivity (e.g. a query for "Smith^Mary" might well return "Mary^Smith") can still be handled. However, Change Healthcare Image Repository shall only support case-insensitivity of patient name matching.

NOTE1: By default, Change Healthcare Image Repository returns Performing Physician's Name (0008,1050) at the Series Level. However, it can be configured to return it at the Study Level.

NOTE2: Change Healthcare Image Repository supports the Instance Availability attribute (0008,0056) which defines how rapidly composite object instance(s) become available for transmission from Change Healthcare Image Repository after a C-MOVE retrieval request. Change Healthcare Image Repository will return one of three possible values for this attribute:

- "ONLINE" if all the SOP Instances are immediately available because they all have a cache location.
- "NEARLINE" if all SOP Instances can be retrieved from accessible archive locations, even if some do not have a cache location.
- "OFFLINE" if some of the SOP Instances are archived, but they are not accessible from their archived location(s).

Change Healthcare Image Repository supporting the Multiple Identity Resolution option of the IHE MIMA Profile will support the query match keys as a Query SCP in the above tables. Change Healthcare Image Repository will handle Patient ID and Accession Number Assigning Authorities, and Institution Information in Queries as follows:

NOTE3: Patient ID Assigning Authority in Queries

Change Healthcare Image Repository receiving query requests will establish the Assigning Authority of an included Patient ID value from the Issuer of Patient ID (0010,0021) attribute that

is explicitly present in the received query request identifier, or if absent, from the preconfigured Assigning Authority of the Patient ID associated with the querying client.

If there is no Patient ID (0010,0020) value included in the query request then Change Healthcare Image Repository will establish the Patient ID Assigning Authority to be used for all responses from the Issuer of Patient ID (0010,0021) attribute that is explicitly present in the received query request identifier, or if absent, from the preconfigured Assigning Authority of the patient ID associated with the querying client.

The value of a returned Patient ID (0010,0020) will correspond to the Assigning Authority specified in the query, or if absent, the preconfigured Assigning Authority associated with the querying client. Change Healthcare Image Repository will use its knowledge of the cross-referencing of patient identifiers to return the appropriate Patient ID value.

For a Patient Level Query, if there is a matching patient, but there is no matching patient ID for the Assigning Authority associated with the querying client (e.g. The matching patient by Patient Name "John Doe" has a Patient Identifier for "Site A" Assigning Authority, but the Patient Identifier associated with the querying client is for "Site B" Assigning Authority), no matches will be returned for the query request. But if the query request also includes the Issuer of Patient ID (0010,0021) attribute with no value, then the existing Patient ID will be returned with the corresponding Patient ID Assigning Authority (e.g. Site A).

For a Study Level Query, if there is a matching study, but there is no Matching Patient ID for the Assigning Authority associated with the querying client (e.g. The existing Patient Identifier for the matching study is for "Site A", but the Patient Identifier associated with the querying client is for "Site B" Assigning Authority), and the Issuer of Patient ID (0010,0021) attribute is sent with no value in the query identifier, Change Healthcare Image Repository will return the existing Patient ID with the corresponding Patient ID Assigning Authority (e.g. "Site A"). If there is no Matching Patient ID for the requested Assigning Authority for the matching study and the Issuer of Patient ID (0010,0021) attribute is not included as a return key in the query, a zero length Patient ID value will be returned.

NOTE4: Other Patient IDs in Queries

Change Healthcare Image Repository can include all patient identifiers known to it in the Other Patient IDs Sequence (0010,1002) as a list of return key values.

At a minimum Change Healthcare Image Repository will include in the Other Patient IDs Sequence (0010,1002) the destination patient ID value, if it exists.

NOTE5: Accession Number Assigning Authority in Queries

Change Healthcare Image Repository receiving query requests will establish the Assigning Authority of an included Accession Number value from the Issuer of Accession Number Sequence (0008,0051) attribute that is explicitly present in the received query request identifier, or if absent, from the preconfigured Assigning Authority of the Accession Number associated with the querying client.

If there is no Accession Number (0008,0050) value included in the query request then Change Healthcare Image Repository will establish the Accession Number Assigning Authority to be used for all responses from the Accession Number Sequence (0008,0051) attribute that is explicitly present in the received query request identifier, or if absent, from the preconfigured Assigning Authority of the Accession Number associated with the querying client.

The value of a returned Accession Number shall correspond to the Assigning Authority specified in the query, or if absent, the preconfigured Assigning Authority associated with the querying client. If the Accession Number of a matching Study does not correspond to this Assigning Authority then it shall be returned zero length.

In the case where the Issuer of Accession Number Sequence (0010,0021) attribute is sent with no value in the query identifier and the existing Accession Number value (e.g. acc0001) for the

matching study is not for the Assigning Authority associated with the querying client (e.g. querying client pre-configured Accession Number Assigning Authority is for "Site B", but the Accession Number Assigning Authority of the study is for "Site A"), Change Healthcare Image Repository will return the existing Accession Number value with the corresponding Accession Number Assigning Authority (e.g. "Site A").

NOTE6: Institution in Queries

Change Healthcare Image Repository receiving query requests shall support Institution Code Sequence (0008,0082) as a Matching Key for Series, or SOP Instances acquired at a certain Institution. The Institution Name (0008,0080) attribute value shall be included in the query response if the attribute is included in the Query identifier.

NOTE7: DICOM Fuzzy Semantic Matching

Change Healthcare Image Repository supporting the Multiple Identity Resolution option shall support the DICOM Fuzzy Semantic Matching of Person Names option. However, Change Healthcare Image Repository shall only support the case-insensitivity of patient name. We do not support the true variations in the spelling of a patient's name.

NOTE8: Retrieve AE Title

The C-FIND SCP is required to support either or both the Retrieve AE Title Data Element or the Storage Media File-Set ID/Storage Media File Set UID Data Elements. An Identifier in a C-FIND response shall contain:

- Retrieve AE Title (0008,0054) which defines a list of DICOM Application Entity Title(s) that identify the location from which the composite object instance(s) may be retrieved on the network.

The Query/Retrieve Server AE returns one of the following status codes in a C-FIND Response:

Table 45: Query/Retrieve Server AE Returned C-FIND-RSP Status Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Query/Retrieve Server AE has successfully finished sending all matches in previous C-FIND-RSPs. Success indication message is output to the Service Logs.
Failed	Data Set does not match SOP Class	A900	The Query/Retrieve Server AE has determined that the C-FIND-RQ query identifier is missing mandatory Elements for the specified SOP Class and Query Level. This will only occur if the missing Elements or values prevent the Query/Retrieve Server AE from successfully querying the Change Healthcare Image Repository database. An error indication is output to the Service Logs.
Failed	Unable to Process	C001	The Query/Retrieve Server AE cannot process the C-FIND-RQ because it cannot query the Change Healthcare Image Repository database for some reason. An error indication is output to the Service Logs.
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Indicates that the Query/Retrieve Server AE received a Cancel Request from the remote AE. Note that this can only occur if the Query/Retrieve Server AE is configured to actually check for and handle Cancel Requests. A warning indication is output to the Service Logs.
Pending	Matches are continuing – Current Match is supplied	FF00	The Query/Retrieve Server AE is successfully sending a match in the C-FIND-RSP, and will continue to send further C-FIND-RSPs. Note that the Query/Retrieve Server AE does not check the C-FIND-RQ query identifier to see if there are Optional Elements that it does not support, so it never returns FF01 (Pending) - Matches are continuing but one or more Optional Keys were not supported. Success indication message is output to the Service Logs.

3.2.3.4.4.3 SOP Specific Conformance – Retrieve (C-MOVE)

The Query/Retrieve Server AE will try to establish an Association with a DICOM Application Entity named by the external C-MOVE SCU (through a C-MOVE Destination AE Title) to perform C-STORE operations on requested images. One or more of the Image Storage Presentation Contexts listed in

Table 4. Each proposed Presentation Context contains a single Transfer Syntax. Multiple Transfer Syntaxes per abstract syntax would be proposed with multiple Presentation Contexts.

Table 9 will be negotiated.

By default, the Query/Retrieve Server AE is configured to not check for Cancel Requests sent by a remote AE. This is done to improve performance as it does not have to spend time periodically checking if a remote AE has sent a Cancel Request over the Association. However, if it is known that a remote AE can send Cancel Requests, then the Query/Retrieve Server AE can be configured to handle them properly.

If the Query/Retrieve Server AE cannot handle the received C-MOVE Request, then a C-MOVE Response will be returned with the appropriate error Status Code. If the Request can be handled, then the Query/Retrieve Server AE will return a C-MOVE Response to the C-MOVE SCU after each C-STORE Response from the SCP has been received. The C-MOVE Response reports the number of remaining SOP Instances to transfer, as well as the number of SOP Instances transferred having a successful, failed, or warning status. The Association will be properly released after the Query/Retrieve Server AE has attempted to transfer all requested SOP Instances. The Query/Retrieve Server AE will continue to attempt to transfer any remaining SOP Instances even if a failure Status Code is returned in a particular C-STORE response, or the Association with the C-MOVE SCU has been lost.

MIMA specifies different behavior responding to Query SCU that can handle Issuer of Patient ID and Issuer of Accession Number attributes versus Query SCU that cannot handle those attributes where a default value for the unsupported attribute should be configurable for the Query SCU on the Query SCP.

The Query/Retrieve Server AE supporting the Multiple Identity Resolution option of the IHE MIMA Profile will meet the following requirements when handling received C-MOVE Requests:

1. If there is a preconfigured default Patient ID Assigning Authority for the C-MOVE Destination Application Entity then the Query/Retrieve Server AE will specify a Patient ID value from this Assigning Authority in the SOP Instances sent to the C-MOVE Destination Application Entity. If there is no Patient ID value defined for this preconfigured default Assigning Authority then the Patient ID value will be left blank.
2. If there is no preconfigured default Patient ID Assigning Authority for the C-MOVE Destination Application Entity then the Query/Retrieve Server AE can specify a Patient ID value from any Assigning Authority in the SOP Instances. It will assume that the C-MOVE Destination Application Entity is capable of handling the corresponding Patient ID Assigning Authority information conveyed in the SOP Instances.
3. If there is a preconfigured default Accession Number Assigning Authority for the C-MOVE Destination Application Entity then the Query/Retrieve Server AE will only specify an Accession Number value from this Assigning Authority in the SOP Instances sent to the C-MOVE Destination Application Entity. If there is no Accession Number value defined for this preconfigured default Assigning Authority then the Accession Number value shall be left blank.
4. If there is no preconfigured default Accession Number Assigning Authority for the C-MOVE Destination Application Entity then the Query/Retrieve Server AE can specify an Accession Number value from any Assigning Authority in the SOP Instances. It will be assumed that the C-

MOVE Destination Application Entity is capable of handling the corresponding Accession Number Assigning Authority information conveyed in the SOP Instances.

For a summary of the MIMA identifiers convey in the SOP Instances for export see The Sending AE sending a SOP Instance will provide DICOM attributes conveying the Assigning Authorities of the Patient ID and Accession Number. It will also convey the Institution Name (0008,0080) and Institution Code Sequence (0008,0082) so that the institution where the SOP Instance was created is identified.

If there is no patient identifier value defined for the preconfigured default Assigning Authority of the receiving Application Entity then the Patient ID value will be left blank.

If there is no preconfigured default Assigning Authority for the receiving Application Entity then the Sending AE can specify a Patient ID value from any Assigning Authority in the images.

The Change Healthcare Image Repository will support sending attributes in the images as defined in the following table:

Table 161.

The Query/Retrieve Server AE supports the following Elements depending on the Information Model used for the C-MOVE Request:

Table 46: Patient Root C-MOVE SCP Supported Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient ID	(0010,0020)	LO	UNIQUE
Study Level			
Study Instance UID	(0020,000D)	UI	UNIQUE, L
Series Level			
Series Instance UID	(0020,000E)	UI	UNIQUE
Image Level			
SOP Instance UID	(0008,0018)	UI	UNIQUE

Table 47: Study Root C-MOVE SCP Supported Elements

Description/Module	Tag ID	VR	Types of Matching
Study Level			
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Series Level			
Series Instance UID	(0020,000E)	UI	UNIQUE
Image Level			
SOP Instance UID	(0008,0018)	UI	UNIQUE

Table 48: Patient/Study Only C-MOVE SCP Supported Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient ID	(0010,0020)	LO	UNIQUE

Study Level			
Study Instance UID	(0020,000D)	UI	UNIQUE, L

The types of Matching requested by the Query/Retrieve Server AE Retrieve (C-MOVE) SCP:

L - indicates that UID lists can be sent.

UNIQUE - indicates that a single Unique Key value can be sent.

Query/Retrieve Server AE returns one of the following status codes in a Query/Retrieve C-MOVE Response:

Table 49: Query/Retrieve Server AE Returned C-MOVE-RSP Status Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations complete – No failures	0000	The Query/Retrieve Server AE has successfully finished sending all SOP Instances to the C-MOVE Destination AE and will no longer be sending any additional C-MOVE-RSPs. Success indication message is output to the Service Log.
Warning	Sub-operations complete – One or more failures	B000	The Query/Retrieve Server AE has finished trying to send all SOP Instances to the C-MOVE Destination AE and will no longer be sending any additional C-MOVE-RSPs. However, one or more of the SOP Instances were not successfully sent to the C-MOVE Destination AE. The C-MOVE Response fields indicate the number of SOP Instances transferred having a successful, failed, or warning status. A warning indication is output to the Service Log.
Refused	Move destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to Query-Retrieve Server AE. Error message is output to the Service Log.
Failed	Identifier does not match SOP Class	A900	The Query/Retrieve Server AE has determined that the C-MOVE-RQ query identifier is missing mandatory Elements for the specified C-MOVE SOP Class and Query Level. This will only occur if the missing Elements or values prevent the Query/Retrieve Server AE from successfully querying the Change Healthcare Image Repository database for matching SOP Instances. An error indication is output to the Service Log.
Failed	Unable to Process	C000	The Query/Retrieve Server AE cannot process the C-MOVE-RQ because it could not parse the C-MOVE Request identifier or cannot query the Change Healthcare Image Repository database for some reason. An error indication is output to the Service Log.
Cancel	Matching terminated due to Cancel Indication	FE00	Indicates that the Query/Retrieve Server AE received a Cancel Request from the remote AE. Note that this can only occur if the Query/Retrieve Server AE is configured to actually check for and handle Cancel Requests. A warning indication is output to the Service Log.
Pending	Matches are continuing – Current Match is supplied	FF00	The Query/Retrieve Server AE has attempted to send a SOP Instance to the C-MOVE Destination AE and further C-MOVE Responses will be sent. The C-MOVE Response fields indicates the number of remaining SOP Instances to transfer, as well as the number of SOP Instances transferred having a successful, failed, or warning status. If full tracing is enabled, then the contents of the C-MOVE Response are output to the Service Log.

3.2.3.4.5 SOP Specific Conformance – Modality Worklist

Matching on Optional Matching Keys is not supported. Type 3 Return Keys are not supported.

By default, the Query/Retrieve Server AE is configured to not check for Cancel Requests sent by a remote AE. This is done to improve performance, as it does not have to spend time periodically checking if a remote AE has sent a Cancel Request over the Association. However, if it is known that a remote AE can send Cancel Requests, then the Query/Retrieve Server AE can be configured to handle them properly.

The Query/Retrieve Server AE can be configured to respond to Encounter-based imaging devices' Modality Worklist C-FIND request by returning an on-demand study. The following attributes are returned with the on-demand study:

- Patient's Name (0010,0010)
- Patient ID (0010,0020)
- Patient's Birthdate (0010,0030)
- Patient's Sex (0010,0040)
- Study Instance UID (0020,000D)
- Scheduled Station AE Title (0040,0001)
- Scheduled Procedure Step Start Date (0040,0002)
- Scheduled Procedure Step Start Time (0040,0003)
- Modality (0008,0060)
- Scheduled Procedure Step Description (0040,0007)
- Requested Procedure Description (0032,1060)

The following table lists the Attributes that it can return in a Modality Worklist C-FIND Response. It also specifies the types of matching supported for an Attribute's value, as well as whether a default or actual value is returned for an Attribute. The default values are used only if the Modality Worklist SCP that Change Healthcare Image Repository queried for this scheduling data does not return valid values.

Table 50: Significant Worklist Attributes

Module Name Attribute Name	Tag ID	VR	Types of Matching	Returned Value	Default Value
Scheduled Procedure Step					
Scheduled Procedure Step Sequence	(0040,0100)	SQ	U	V	
> Scheduled Station AE Title	(0040,0001)	AE	NONE	D	"UNKNOWN"
> Scheduled Procedure Step Start Date	(0040,0002)	DA	R,S,*,U	V	
> Scheduled Procedure Step Start Time	(0040,0003)	TM	NONE	D	6:00 AM
> Scheduled Procedure Step End Date	(0040,0004)	DA	R,S,*,U	V	
> Modality	(0008,0060)	CS	S,*,U NONE	D	""
> Scheduled Performing Physician's Name	(0040,0006)	PN	NONE	D	""
> Scheduled Procedure Step Description	(0040,0007)	LO	NONE	D	"UNASSIGNED"
> Scheduled Station Name	(0040,0010)	SH	NONE	D	""
> Scheduled Procedure Step Location	(0040,0011)	SH	NONE	D	""
> Scheduled Procedure Step ID	(0040,0009)	SH	NONE	V	
Requested Procedure					

Requested Procedure Code Sequence (See Note 1)	(0032,1064)	SQ	U	V	
>Code Value	(0008,0100)	SH	NONE	V	
>Coding Scheme Designator	(0008,0102)	SH	NONE	D	"UNKNOWN"
>Coding Scheme Version	(0008,0103)	SH	NONE	D	"1.0"
>Code Meaning	(0008,0104)	LO	NONE	V	
Requested Procedure ID	(0040,1001)	SH	NONE	V	
Requested Procedure Description	(0032,1060)	LO	NONE	D	"UNASSIGNED"
Study Instance UID	(0020,000D)	UI	NONE	V	
Requested Procedure Priority	(0040,1003)	SH	NONE	D	""
Patient Transport Arrangements	(0040,1004)	LO	NONE	D	""
Reference Study Sequence	(0008,1110)	SQ	NONE	D	Empty Sequence
Imaging Service Request					
Accession Number	(0008,0050)	SH	S,U	V	
Referring Physician's Name	(0008,0090)	PN	NONE	D	""
Visit Identification					
Visit Admission ID	(0038,0010)	LO	NONE	D	""
Visit Status					
Current Patient Location	(0038,0300)	LO	NONE	D	""
Patient Identification					
Patient Name	(0010,0010)	PN	S,*,U	V	
Patient ID	(0010,0020)	LO	S,U	V	
Issuer of Patient ID	(0010,0021)	LO	NONE	V	
Other patient IDs Sequence	(0010,1002)	SQ	NONE	V	
> Patient ID	(0010,0020)	LO	NONE	V	
>Issuer of Patient ID	(0010,0021)	LO	NONE	V	
>Type of Patient ID	(0010,0022)	CS	NONE	V	"TEXT"
Patient Demographic					
Patient Birth Date	(0010,0030)	DA	S,*,U	V	
Patient Gender	(0010,0040)	CS	NONE	V	
Patient Weight	(0010,1030)	DS	NONE	D	""
Patient Confidentiality	(0040,3001)	LO	NONE	D	""
Referenced Patient Sequence	(0008,1120)	SQ	NONE	D	Empty Sequence
Patient Medical					
Patient State	(0038,0500)	LO	NONE	D	""
Pregnancy Status	(0010,21C0)	US	NONE	D	""
Patient Medical Alerts	(0010,2000)	LO	NONE	D	""
Patient Contrast Allergies	(0010,2110)	LO	NONE	D	""
Patient Special Needs	(0038,0050)	LO	NONE	D	""

NOTE1: The Modality Worklist query only returns the Requested Procedure Code Sequence (0032,1064) if the Change Healthcare Image Repository is configured for IHE Compliant queries.

The Types of Matching supported by the Query/Retrieve Server AE Modality Worklist SCP:

S - indicates Single Value Matching is supported.

R - indicates Range Matching is supported.

* - indicates Wildcard Matching is supported.

U - indicates Universal Matching is supported.

NONE - indicates that no matching is supported, but that values for this Element are returned if requested (i.e. universal matching).

The Returned Value supported by the Query/Retrieve Server AE Modality Worklist SCP:

V - indicates a valid value is returned.

D - indicates a default hard-coded value is returned. The default values are used only if the Modality Worklist SCP that Change Healthcare Image Repository queried for this scheduling data does not return valid values.

The Query/Retrieve Server AE returns one of the following status codes in a Modality Worklist C-FIND Response:

Table 51: Query/Retrieve Server AE Returned C-FIND-RSP Status Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Query/Retrieve Server AE has successfully finished sending all Modality Worklist matches in previous C-FIND-RSPs. Success indication message is output to the Service Logs.
Failed	Data Set does not match SOP Class	A900	The Query/Retrieve Server AE has determined that the C-FIND-RQ query identifier is missing mandatory Elements for the Modality Worklist SOP Class. This will only occur if the missing Elements or values prevent the Query/Retrieve Server AE from successfully querying the Change Healthcare Image Repository database. An error indication is output to the Service Logs.
Failed	Unable to Process	C001	The Query/Retrieve Server AE cannot process the Modality Worklist C-FIND-RQ because it cannot query the Change Healthcare Image Repository database for some reason. An error indication is output to the Service Logs.
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Indicates that the Query/Retrieve Server AE received a Cancel Request from the remote AE. Note that this can only occur if the Query/Retrieve Server AE is configured to actually check for and handle Cancel Requests. A warning indication is output to the Service Logs.
Pending	Matches are continuing – Current Match is supplied	FF00	The Query/Retrieve Server AE is successfully sending a match in the C-FIND-RSP, and will continue to send further C-FIND-RSPs. Note that the Query/Retrieve Server AE does not check the C-FIND-RQ query identifier to see if there are Optional Elements that it does not support, so it never returns FF01 (Pending) - Matches are continuing but one or more Optional Keys were not supported. Success indication message is output to the Service Logs.

3.2.3.4.5.1 Association Acceptor Communication Failure Behavior

The Behavior of the Query/Retrieve Server AE during communication failure when it is acting as an Association Acceptor is summarized in the following table:

Table 52: Query/Retrieve Server AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). The default timeout for waiting on an open Association to receive the next DICOM Message is 60 minutes.	The Association is aborted using a DICOM A-P-ABORT. This is treated as a failure. An error indication is output to the Service Logs. If Query/Retrieve Server AE is in the process of sending images to a C-MOVE Destination AE, then it will continue to do so even if the Association with the C-MOVE SCU has been lost.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). The default timeout when trying to read from or write to an open socket is 3 minutes.	The Association is aborted using a DICOM A-P-ABORT. This is treated as a failure. An error indication is output to the Service Logs. If Query/Retrieve Server AE is in the process of sending images to a C-MOVE Destination AE, then it will continue to do so even if the Association with the C-MOVE SCU has been lost.
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. An error indication is output to the Service Logs. If Query/Retrieve Server AE is in the process of sending images to a C-MOVE Destination AE, then it will continue to do so even if the Association with the C-MOVE SCU has been lost.

3.2.3.4.5.2 Presentation Context Acceptance Criteria

The Query/Retrieve Server AE will only accept the Presentation Contexts specified in Table 41: Query/Retrieve Server AE Accepted Presentation Contexts.

The Query/Retrieve Server AE can be configured to reject valid Presentation Contexts if the external DICOM host is not listed in a local configuration file. In addition, a valid Presentation Context can be rejected if the maximum limit on the number of simultaneous processes has been reached.

The Query/Retrieve Server AE does not check for, and will accept, duplicate Presentation Contexts.

3.2.3.4.5.3 Transfer Syntax Selection Policies

The Query/Retrieve Server AE supports only the Implicit VR Little Endian and Explicit VR Little Endian Transfer Syntaxes when acting in the Role of an SCP. If both of these are proposed in a single Presentation Context and the SOP Class is supported, then the default behavior is to accept the Implicit VR Little Endian Transfer Syntax.

3.2.4Query/Retrieve Client AE Specification

3.2.4.1SOP Classes

The Query/Retrieve Client AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 53: SOP Class Conformance of Query/Retrieve Client AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Query/Retrieve			
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	No
Patient Study Only Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	No

The Query/Retrieve Client AE implements the C-FIND Query and C-MOVE Retrieval SOP Classes as an SCU. It can act as a SCU to query for patient, study and series demographic information as well as retrieve all SOP Instances in a study or series. It can act in direct response to input from the user interface, or when triggered to do so by the Change Healthcare Image Repository.

The Query/Retrieve Client AE has one task running on a Change Healthcare Image Repository. It acts as an Association Requestor, requesting a new Association when the user of the system requests that a query or retrieval request be sent to a remote AE.

3.2.4.2Association Establishment Policies

3.2.4.2.1 General

The Query/Retrieve Client AE will initiate a new Association when the user requests that a remote AE be queried for certain patient, study, or series information. It will also initiate a new Association when it is triggered to retrieve all SOP Instances in a study or series from a remote AE.

The DICOM Standard Application Context Name is always proposed:

Table 54: DICOM Application Context for Query/Retrieve Client AE

Application Context Name	1.2.840.10008.3.1.1.1

3.2.4.2.2 Number of Associations

The Query/Retrieve Client AE will only open one Association at a time with a remote AE.

Table 55: Number of Simultaneous Associations for Query/Retrieve Client AE

Maximum number of simultaneous Associations	1

3.2.4.2.3 Asynchronous Nature

Negotiation of multiple outstanding transactions is not supported.

Table 56: Asynchronous Nature for Query/Retrieve Client AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.4.2.4 Implementation Identifying Information

Table 57: DICOM Implementation Class and Version for Query/Retrieve Client AE

Implementation Class UID	1.2.840.113711.10
Implementation Version Name	V1.0

3.2.4.3Association Initiation Policy

3.2.4.3.1 Activity – Users Send Query Request to Remote AE

3.2.4.3.2 Description and Sequencing of Activity

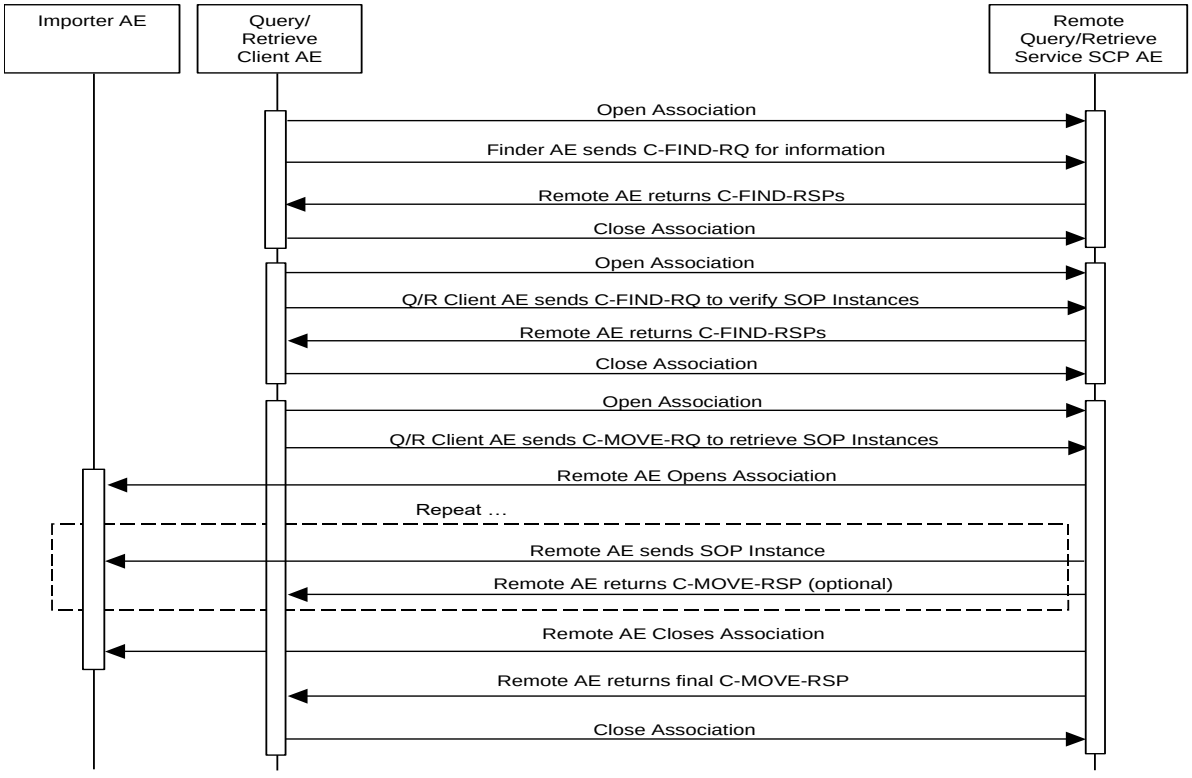
If the user of a Change Healthcare Image Repository uses the user interface to specify that a query or retrieval request be sent to a remote AE, then a single attempt will be made. If the query or retrieval request fails, for whatever reason, then no retry will be performed.

In order for the user interface to be used to request the retrieval of SOP Instances from a remote AE, the user must first query the remote AE to get the key values (Patient ID, Study UID, etc.) for the SOP Instances to be retrieved. Once the key values have been identified, then the user interface can be used to request the retrieval.

In addition to the user directly requesting the retrieval of SOP Instances, the Change Healthcare Image Repository can do this automatically. This will occur if the user wants to access a certain study and the Change Healthcare Image Repository knows that the SOP Instances for the study have to first be retrieved from a remote AE before they can be accessed. This can occur if the Change Healthcare Image Repository is configured to use a remote AE as the archive, and the SOP Instances have been flushed from the Change Healthcare Image Repository after they were sent to the remote AE.

Before the Query/Retrieve Client AE sends a C-MOVE-RQ to retrieve items, it will first verify that the remote AE really has the SOP Instances to be retrieved. This will occur regardless of whether the retrieval is being triggered directly by the user or automatically by the Change Healthcare Image Repository. In some cases this can result in a duplicate C-FIND query being sent to the remote AE, first in response to a query initiated through the user interface, and then a second query to verify that the SOP Instances can really be retrieved.

Figure 7: Sequencing of Activity – Sending Query and Retrieval Requests



3.2.4.3.3 Proposed Presentation Contexts

The Query/Retrieve Client AE may propose any one or more of the following Presentation Contexts:

Table 58: Query/Retrieve Client AE Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.4.3.4 SOP Specific Conformance as an Association Requestor

3.2.4.3.4.1 SOP Specific Conformance – Query (C-FIND)

The Query/Retrieve Client AE provides standard conformance to the supported C-FIND SOP Classes. The Query/Retrieve Client AE does not support Relational Queries.

All three query information models — Patient Root, Study Root, and Patient/Study Only Root — is supported. If more than one information model is negotiated on an Association, and it is possible to use more than one of the negotiated information models to form a query, the following information model will be used (in order of preference):

1. Study Root Information Model
2. Patient Root Information Model
3. Patient/Study Only Information Model

All queries are initiated at the highest level of the information model (the PATIENT or STUDY level depending on the SOP Class used), and then for each response received, recursively repeated at the next lower levels (the STUDY, and then SERIES, and then IMAGE levels, if using the Patient Root query information model), in order to completely elucidate the "tree" of instances available on the remote AE (from which the user may subsequently request a retrieval at any level).

The Query/Retrieve Client AE has a default setting for the maximum number of matching responses it can receive from a remote AE. If the remote AE is going to exceed this number, then the Query/Retrieve Client AE will issue a Cancel Request to the remote AE to stop it from returning further matches. By default, this maximum number is 500.

Unexpected attributes returned in a C-FIND Response (those not requested) are ignored. Requested optional return attributes that are not returned by the SCP are also ignored. Non-matching responses returned by the SCP due to unsupported (hopefully optional) matching keys are not filtered locally by the Query/Retrieve Client AE and thus will still be presented in the browser. The Query/Retrieve Client AE attempts to filter out duplicate responses, but only for responses have duplicate key values. For example, if the Query/Retrieve Client AE issues a Study Root Study Level query, and multiple matching

responses have the same Patient ID and Study UID, then the Query/Retrieve Client AE will filter these so that they are presented as a single matching response.

The Query/Retrieve Client AE can be triggered to issue a query either by user input through the user interface or by the Change Healthcare Image Repository itself. The responses to a C-FIND query are presented in the user interface only in the case where the user initiated the query.

The Query/Retrieve Client AE can include the following Elements in a C-FIND Request depending on the Query Root model and the Query level:

Table 59: Patient Root C-FIND SCU Requested Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient's Name	(0010,0010)	PN	S,*,U
Patient ID	(0010,0020)	LO	UNIQUE
Issuer of Patient ID (See NOTE1)	(0010,0021)	LO	S,U (MIMA), NONE otherwise.
Patient's Birth Date	(0010,0030)	DA	S,U
Patient's Sex	(0010,0040)	CS	S,U
Study Level			
Study Date	(0008,0020)	DA	S,R,U
Study Time	(0008,0030)	TM	R,U
Accession Number	(0008,0050)	SH	S,*,U
Issuer of Accession Number Sequence (See NOTE2)	(0008,0051)	SQ	SQ
>Local Namespace Entity ID	(0040,0031)	UT	S,U (MIMA), NONE otherwise
>Universal Entity ID	(0040,0032)	UT	S,U (MIMA), NONE otherwise
>Universal Entity ID Type	(0040,0033)	CS	S,U (MIMA), NONE otherwise
Study ID	(0020,0010)	SH	S,*,U
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Referring Physician's Name	(0008,0090)	PN	S,*,U
Study Description	(0008,1030)	LO	S,*,U
Modalities in Study	(0008,0061)	CS	S,*,U
Series Level			
Modality	(0008,0060)	CS	S,U
Series Number	(0020,0011)	IS	S,*,U
Series Instance UID	(0020,000E)	UI	UNIQUE
Request Attribute Sequence	(0040,0275)	SQ	S,*,U
> Requested Procedure ID	(0040,1001)	SH	S,*,U
> Scheduled Procedure Step ID	(0040,0009)	SH	S,*,U
Performed Procedure Step Start Date	(0040,0244)	DA	S,R,U

Performed Procedure Step Start Time	(0040,0245)	TM	R,U
Image Level			
Instance Number	(0020,0013)	IS	S,*,U
SOP Instance UID	(0008,0018)	UI	UNIQUE

Table 60: Study Root C-FIND SCU Requested Elements

Description/Module	Tag ID	VR	Types of Matching
Study Level			
Patient's Name	(0010,0010)	PN	S,*,U
Patient ID	(0010,0020)	LO	S,U
Issuer of Patient ID (See NOTE1)	(0010,0021)	LO	S,U (MIMA), NONE otherwise.
Patient's Birth Date	(0010,0030)	DA	S,U
Patient's Sex	(0010,0040)	CS	S,U
Study Date	(0008,0020)	DA	S,R,U
Study Time	(0008,0030)	TM	R,U
Accession Number	(0008,0050)	SH	S,*,U
Issuer of Accession Number Sequence (See NOTE2)	(0008,0051)	SQ	SQ
>Local Namespace Entity ID	(0040,0031)	UT	S,U (MIMA), NONE otherwise
>Universal Entity ID	(0040,0032)	UT	S,U (MIMA), NONE otherwise
>Universal Entity ID Type	(0040,0033)	CS	S,U (MIMA), NONE otherwise
Study ID	(0020,0010)	SH	S,*,U
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Referring Physician's Name	(0008,0090)	PN	S,*,U
Study Description	(0008,1030)	LO	S,*,U
Modalities in Study	(0008,0061)	CS	S,*,U
Series Level			
Modality	(0008,0060)	CS	S,U
Series Number	(0020,0011)	IS	S,*,U
Series Instance UID	(0020,000E)	UI	UNIQUE
Request Attribute Sequence	(0040,0275)	SQ	S,*,U
> Requested Procedure ID	(0040,1001)	SH	S,*,U
> Scheduled Procedure Step ID	(0040,0009)	SH	S,*,U
Performed Procedure Step Start Date	(0040,0244)	DA	S,R,U
Performed Procedure Step Start Time	(0040,0245)	TM	R,U
Image Level			
Instance Number	(0020,0013)	IS	S,*,U
SOP Instance UID	(0008,0018)	UI	UNIQUE

Table 61: Patient/Study Only C-FIND SCU Requested Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient's Name	(0010,0010)	PN	S,*,U
Patient ID	(0010,0020)	LO	UNIQUE
Issuer of Patient ID (See NOTE1)	(0010,0021)	LO	S,U (MIMA), NONE otherwise.
Patient's Birth Date	(0010,0030)	DA	S,U
Patient's Sex	(0010,0040)	CS	S,U
Study Level			
Study Date	(0008,0020)	DA	S,R,U
Study Time	(0008,0030)	TM	R,U
Accession Number	(0008,0050)	SH	S,*,U
Issuer of Accession Number Sequence (See NOTE2)	(0008,0051)	SQ	SQ
>Local Namespace Entity ID	(0040,0031)	UT	S,U (MIMA), NONE otherwise
>Universal Entity ID	(0040,0032)	UT	S,U (MIMA), NONE otherwise
>Universal Entity ID Type	(0040,0033)	CS	S,U (MIMA), NONE otherwise
Study ID	(0020,0010)	SH	S,*,U
Study Instance UID	(0020,000D)	UI	UNIQUE,L
Referring Physician's Name	(0008,0090)	PN	S,*,U
Study Description	(0008,1030)	LO	S,*,U
Modalities in Study	(0008,0061)	CS	S,*,U

The types of Matching requested by the Query/Retrieve Client AE Query (C-FIND) SCU:

S - indicates the identifier attribute can specify Single Value Matching.

R - indicates Range Matching.

* - indicates Wildcard Matching.

U - indicates Universal Matching.

L - indicates that UID lists can be sent.

NONE - indicates that no matching can be requested, but that values for this Element are requested to be returned (i.e. universal matching).

UNIQUE - indicates that this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching can be requested depending on the query level.

Change Healthcare Image Repository supports the Multiple Identity Resolution option of the IHE MIMA Profile. As such it can include the Patient ID and Accession Number Assigning Authorities as Matching Keys for DICOM Prefetch Queries. The inclusion of Patient ID and Accession Number Assigning Authorities as Matching Keys for general C-FIND queries is not supported.

NOTE1: Patient ID Assigning Authority in Queries

Change Healthcare Image Repository acting as a Query SCU for DICOM Prefetch can include a value for the Issuer of Patient ID (0010,0021) as a Matching Key in order to unambiguously identify the assigning authority for an included Patient ID value, or indicate which Patient ID assigning authority shall be used in responses if no Patient ID value is included.

NOTE2: Accession Number Assigning Authority in Queries

Change Healthcare Image Repository acting as a Query SCU for DICOM Prefetch can include values for the Issuer of Accession Number Sequence (0008,0051) as Matching Keys in order to unambiguously identify the assigning authority for an included Accession Number value, or indicate which Accession Number assigning authority shall be used in responses if no Accession Number value is included.

The Query/Retrieve Client AE will exhibit the following behavior according to the Status Code value returned in a C-FIND Response from the Remote AE acting as the SCP:

Table 62: Query/Retrieve Client AE C-FIND-RSP Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote AE has successfully finished sending all matches in previous C-FIND-RSPs. Success indication message is output to the Service Log. If a user directly initiated the query using the user interface, then resulting matching information is output to the user interface. If the Change Healthcare Image Repository initiated the query, then matching information is not output to the user interface.
Failed	Identifier does not match SOP Class	A900	This is treated as a failure. The Query/Retrieve Client AE does not attempt to resend the C-FIND-RQ. The Association is closed. An error indication is output to the Service Log. An error indication is posted to the User Interface only if the query was initiated through the user interface. Any previously returned matching information is discarded and not output to the user interface.
Failed	Unable to Process	C001	This is treated as a failure. The Query/Retrieve Client AE does not attempt to resend the C-FIND-RQ. The Association is closed. An error indication is output to the Service Log. An error indication is posted to the User Interface only if the query was initiated through the user interface. Any previously returned matching information is discarded and not output to the user interface.
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Indicates that the remote AE received a Cancel Request sent by the Query/Retrieve Client AE and will no longer return further matches. A warning indication is output to the Service Logs but not to the user interface. If a user directly initiated the query using the user interface, then resulting matching information is output to the user interface. If the Change Healthcare Image Repository initiated the query, then matching information is not output to the user interface.
Pending	Matches are continuing – However one or more Optional Keys were not supported.	FF01	Query/Retrieve Client AE continues to wait for further C-FIND-RSPs. The remote AE has successfully returned a match in the C-FIND-RSP, and will continue to send further C-FIND-RSPs. However, the remote AE does not support one or more Optional Keys in the query identifier of the C-FIND-RQ. Warning indication message is output to the Service Logs. No indication is posted to the User Interface. Matching information will not be accessed until final C-FIND-RSP is returned.

Service Status	Further Meaning	Error Code	Behavior
Pending	Matches are continuing – Current Match is supplied	FF00	Query/Retrieve Client AE continues to wait for further C-FIND-RSPs. The remote AE has successfully returned a match in the C-FIND-RSP, and will continue to send further C-FIND-RSPs. Success indication message is output to the Service Logs. No indication is posted to the User Interface. Matching information will not be accessed until final C-FIND-RSP is returned.
*	*	Any other status code	This is treated as a failure. The Query/Retrieve Client AE does not attempt to resend the C-FIND-RQ. The Association is closed. An error indication is output to the Service Logs. An error indication is posted to the User Interface only if the query was initiated through the user interface. Any previously returned matching information is discarded and not output to the user interface.

3.2.4.3.4.2 SOP Specific Conformance - Retrieval (C-MOVE)

The Query/Retrieve Client AE provides standard conformance to the supported C-MOVE SOP Classes. All three information models — Patient Root, Study Root, and Patient/Study Only Root — are supported.

Retrieval will be performed at the STUDY, SERIES or IMAGE level depending on what level of entity has been selected by the user in the user interface browser, or by the Change Healthcare Image Repository to retrieve SOP Instances that have been archived to a remote AE.

The Query/Retrieve Client AE never issues Cancel Requests while retrieving SOP Instances.

The C-MOVE Request is sent to the AE that was specified in the Retrieve AE attribute returned in the related C-FIND-RSP by the remote AE. The instances are retrieved to the Change Healthcare Image Repository's database by specifying the C-MOVE Destination AE as the AE Title of the Importer AE. This implies that the remote C-MOVE SCP must be pre-configured to determine the presentation address corresponding to the Importer AE. The Importer AE will have to be configured to either allow any host to send to it, or to allow the host of the Storage Service SCU that the C-MOVE SCP will use.

The Query/Retrieve Client AE completely ignores whatever activities are taking place in relation to the Importer AE that is receiving the retrieved SOP Instances. There is no attempt by the Query/Retrieve Client AE to confirm that SOP Instances have actually been successfully received or stored.

Whether or not completely or partially successfully retrievals are made available on the Change Healthcare Image Repository to the user is purely dependent on the success or failure of the C-STORE sub-operations, not on any explicit action by the Query/Retrieve Client AE. Whether or not the remote AE attempts to retry any failed C-STORE sub-operations is beyond the control of the Query/Retrieve Client AE.

If the Association on which the C-MOVE-RQ was issued is aborted for any reason, whether or not the C-STORE sub-operations continue is dependent on the remote AE; the Importer AE will continue to accept Associations and Storage operations regardless.

Table 63: Patient Root C-MOVE SCU Requested Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient ID	(0010,0020)	LO	UNIQUE

Study Level			
Study Instance UID	(0020,000D)	UI	UNIQUE
Series Level			
Series Instance UID	(0020,000E)	UI	UNIQUE
Image Level			
SOP Instance UID	(0008,0018)	UI	UNIQUE

Table 64: Study Root C-MOVE SCU Requested Elements

Description/Module	Tag ID	VR	Types of Matching
Study Level			
Study Instance UID	(0020,000D)	UI	UNIQUE
Series Level			
Series Instance UID	(0020,000E)	UI	UNIQUE
Image Level			
SOP Instance UID	(0008,0018)	UI	UNIQUE

Table 65: Patient/Study Only C-MOVE SCU Requested Elements

Description/Module	Tag ID	VR	Types of Matching
Patient Level			
Patient ID	(0010,0020)	LO	UNIQUE
Study Level			
Study Instance UID	(0020,000D)	UI	UNIQUE

The types of Matching requested by the Query/Retrieve Client AE Retrieve (C-MOVE) SCU:

L - indicates that UID lists can be sent.

UNIQUE - indicates that a single Unique Key value can be sent.

The Query/Retrieve Client AE will exhibit the following behavior according to the Status Code value returned in a C-MOVE Response from the Remote AE acting as the SCP:

Table 66: Query/Retrieve Client AE C-MOVE-RSP Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations complete – No failures	0000	The remote AE has successfully finished sending all SOP Instances to the C-MOVE Destination AE and will no longer be sending any additional C-MOVE-RSPs Success indication message is output to the Service Log.
Warning	Sub-operations complete – One or more failures	B000	The remote AE has finished trying to send all SOP Instances to the C-MOVE Destination AE and will no longer be sending any additional C-MOVE-RSPs. However, one or more of the SOP Instances were not successfully sent to the C-MOVE Destination AE. The C-MOVE Response fields indicate the number of SOP Instances transferred having a successful, failed, or warning status. A warning indication is output to the Service Log. Any successfully retrieved SOP Instances will be discarded.

Service Status	Further Meaning	Error Code	Behavior
Refused	Move destination unknown	A801	This is treated as a failure. The Query/Retrieve Client AE does not automatically attempt to resend the C-MOVE-RQ. The Association is closed. An error indication is output to the Service Log. Any successfully retrieved SOP Instances will be discarded.
Failed	Identifier does not match SOP Class	A900	This is treated as a failure. The Query/Retrieve Client AE does not automatically attempt to resend the C-MOVE-RQ. The Association is closed. An error indication is output to the Service Log. Any successfully retrieved SOP Instances will be discarded.
Failed	Unable to Process	C000	This is treated as a failure. The Query/Retrieve Client AE does not automatically attempt to resend the C-MOVE-RQ. The Association is closed. An error indication is output to the Service Log. Any successfully retrieved SOP Instances will not be discarded.
Cancel	Matching terminated due to Cancel Indication	FE00	This is treated as a failure because the Query/Retrieve Client AE never issues Cancel Requests for C-MOVE Requests. The Query/Retrieve Client AE does not automatically attempt to resend the C-MOVE-RQ. The Association is closed. An error indication is output to the Service Log. Any successfully retrieved SOP Instances will be discarded.
Pending	Matches are continuing – Current Match is supplied	FF00	The Query/Retrieve Client AE continues to wait for further C-MOVE-RSPs. If full tracing is enabled, then the contents of the C-MOVE Response are output to the Service Log.
*	*	Any other status code	This is treated as a failure. The Query/Retrieve Client AE does not attempt to resend the C-MOVE-RQ. The Association is closed. An error indication is output to the Service Logs. Any successfully retrieved SOP Instances will be discarded.

3.2.4.3.5 Association Requestor Communication Failure Behavior

The Behavior of the Query/Retrieve Client AE during communication failure when acting as an Association Requestor is summarized in the following table:

Table 67: Query/Retrieve Client AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. The Query/Retrieve Client AE does not automatically attempt to resend the C-FIND-RQ or C-MOVE-RQ. An error indication is output to the Service Logs. An error indication is posted to the User Interface only if the query was initiated through the user interface. If this occurs while waiting for a C-FIND-RSP, then any previously returned matching information is discarded and not output to the user interface. If this occurs while waiting for a C-MOVE-RSP, then any previously retrieved SOP Instances are not discarded.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. The Query/Retrieve Client AE does not automatically attempt to resend the C-FIND-RQ or C-MOVE-RQ. An error indication is output to the Service Logs. An error indication is posted to the User Interface only if the query was initiated through the user interface. If this occurs while waiting for a C-FIND-RSP, then any previously returned matching information is discarded and not output to the user interface. If this occurs while waiting for a C-MOVE-RSP, then any previously retrieved SOP Instances are not discarded.

Exception	Behavior
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. The Query/Retrieve Client AE does not automatically attempt to resend the C-FIND-RQ or C-MOVE-RQ. An error indication is output to the Service Logs. An error indication is posted to the User Interface only if the query was initiated through the user interface. If this occurs while waiting for a C-FIND-RSP, then any previously returned matching information is discarded and not output to the user interface. If this occurs while waiting for a C-MOVE-RSP, then any previously retrieved SOP Instances are not discarded.

3.2.4.3.6 Activity – Users Send Retrieve Request to Remote AE for A Study with IOCM KOS

3.2.4.3.7 Description and Sequencing of Activity

Change Healthcare Image Repository currently does not process synchronization KOS received as a part of study retrieval.

3.2.4.4Association Acceptance Policy

The Query/Retrieve Client AE does not accept Associations.

3.2.5Modality Worklist Client AE Specification

3.2.5.1SOP Classes

The Modality Worklist Client AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 68: SOP Class Conformance of Modality Worklist Client AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Workflow Management			
Modality Worklist Information Model	1.2.840.10008.5.1.4.31	Yes	No

The Modality Worklist Client AE implements the Modality Worklist SOP Class as an SCU. The Modality Worklist Client AE can query a remote AE for a Modality Worklist.

The Modality Worklist Client AE is a single task running on a Change Healthcare Image Repository. It acts as an Association Requestor, opening a new Association when it is triggered to query a remote AE for the latest Modality Worklist. If enabled, it will be triggered periodically by the Change Healthcare Image Repository to query a remote AE for the Modality Worklist.

3.2.5.2Association Establishment Policies

3.2.5.2.1 General

The Modality Worklist Client AE will initiate a new Association when it is triggered to query a remote AE for the Modality Worklist.

The DICOM Standard Application Context Name is always proposed:

Table 69: DICOM Application Context for Modality Worklist Client AE

Application Context Name	1.2.840.10008.3.1.1.1

3.2.5.2.2 Number of Associations

The Modality Worklist Client AE will only open one Association at a time with a remote AE to be queried.

Table 70: Number of Simultaneous Associations for Modality Worklist Client AE

Maximum number of simultaneous Associations	1

3.2.5.2.3 Asynchronous Nature

Negotiation of multiple outstanding transactions is not supported.

Table 71: Asynchronous Nature for Modality Worklist Client AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.5.2.4 Implementation Identifying Information

Table 72: DICOM Implementation Class and Version for Modality Worklist Client AE

Implementation Class UID	1.2.840.113711.12
Implementation Version Name	V1.0

3.2.5.3Association Initiation Policy

3.2.5.3.1 Activity – Update Modality Worklist

3.2.5.3.2 Description and Sequencing of Activity

The request for an updated Modality Worklist is automatically initiated at specific configurable time intervals. By default, a query to update the Modality Worklist is initiated every 15 minutes.

By default, the Modality Worklist Client AE only queries for the Scheduled Procedure Steps on the day the query is sent. However, it can be configured to also query for those Steps scheduled for future days.

Upon initiation of the request, the Modality Worklist Client AE will build an identifier for the C-FIND Request, initiate an Association to send it, and wait for the Modality Worklist C-FIND Responses. After retrieval of all C-FIND Responses, the Modality Worklist Client AE will access the local Change Healthcare Image Repository database to add or update patient demographic and study data.

To protect the system from overflow, the Modality Worklist Client AE will limit the number of processed Modality Worklist C-FIND Responses to a configurable maximum. The default maximum value is 200. Once this amount has been reached, the Modality Worklist Client AE will send a Cancel Request to the remote AE acting as the Modality Worklist SCP. The results of a Modality Worklist query are never displayed directly to a user of the Change Healthcare Image Repository as the information is only used to update the database and/or to provide this same information if the Change Healthcare Image Repository Query Server AE is configured to act as a Modality Worklist SCP.

3.2.5.3.3 Proposed Presentation Contexts

The Modality Worklist Client AE may propose the following Presentation Context:

Table 73: Modality Worklist Client AE Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Information Model	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.5.3.4 SOP Specific Conformance as an Association Requestor

3.2.5.3.4.1 SOP Specific Conformance - Modality Worklist

The following table lists the Attributes that the Modality Worklist Client AE can include in a Modality Worklist C-FIND Request identifier. It also specifies whether a matching value can be specified and the type of matching. Unexpected Attributes returned in a C-FIND Response are ignored.

Table 74: Modality Worklist Client AE Requested Elements

Module Name Attribute Name	Tag ID	VR	Types of Matching
Scheduled Procedure Step			
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	SQ	NONE
> Scheduled Station AE Title	(0040,0001)	AE	S,*,U
> Scheduled Procedure Step Start Date	(0040,0002)	DA	R,S,*,U
> Scheduled Procedure Step Start Time	(0040,0003)	TM	NONE
> Scheduled Procedure Step End Date	(0040,0004)	DA	NONE
> Modality	(0008,0060)	CS	S,*,U
> Scheduled Performing Physician's Name	(0040,0006)	PN	S,*,U
> Scheduled Procedure Step Description	(0040,0007)	LO	S,*,U
> Scheduled Station Name	(0040,0010)	SH	S,*,U
> Scheduled Procedure Step Location	(0040,0011)	SH	S,*,U
> Scheduled Procedure Step ID	(0040,0009)	SH	NONE
Requested Procedure			
Requested Procedure Code Sequence	(0032,1064)	SQ	NONE
>Code Value	(0008,0100)	SH	NONE
Requested Procedure ID	(0040,1001)	SH	NONE
Requested Procedure Description	(0032,1060)	LO	NONE
Study Instance UID	(0020,000D)	UI	NONE
Requested Procedure Priority	(0040,1003)	SH	NONE
Patient Transport Arrangements	(0040,1004)	LO	NONE
Reference Study Sequence	(0008,1110)	SQ	NONE
Imaging Service Request			
Accession Number	(0008,0050)	SH	NONE
Referring Physician's Name	(0008,0090)	PN	NONE
Visit Identification			
Visit Admission ID	(0038,0010)	LO	NONE

Visit Status			
Current Patient Location	(0038,0300)	LO	NONE
Patient Identification			
Patient Name	(0010,0010)	PN	NONE
Patient ID	(0010,0020)	LO	NONE
Patient Demographic			
Patient Birth Date	(0010,0030)	DA	NONE
Patient Gender	(0010,0040)	CS	NONE
Patient Weight	(0010,1030)	DS	NONE
Patient Confidentiality	(0040,3001)	LO	NONE
Referenced Patient Sequence	(0008,1120)	SQ	NONE
Patient Medical			
Patient State	(0038,0500)	LO	NONE
Pregnancy Status	(0010,21C0)	US	NONE
Patient Medical Alerts	(0010,2000)	LO	NONE
Patient Contrast Allergies	(0010,2110)	LO	NONE

The types of Modality Worklist Matching that can be requested by the Modality Worklist Client AE:

S - indicates the identifier attribute can specify Single Value Matching.

R - indicates Range Matching.

* - indicates Wildcard Matching.

U - indicates Universal Matching.

L - indicates that UID lists can be sent.

NONE - indicates that no matching can be requested, but that values for this Element are requested to be returned (i.e. universal matching).

The Modality Worklist Client AE will exhibit the following behavior according to the Status Code value returned in a C-FIND Response from the Remote AE acting as the SCP:

Table 75: Modality Worklist Client AE C-FIND-RSP Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote AE has successfully finished sending all matches in previous C-FIND-RSPs. Success indication message is output to the Service Log.
Failed	Data Set does not match SOP Class	A900	This is treated as a failure. The Modality Worklist Client AE does not attempt to resend the C-FIND-RQ. The Association is closed. An error indication is output to the Service Log.
Failed	Unable to Process	C001	This is treated as a failure. The Modality Worklist Client AE does not attempt to resend the C-FIND-RQ. The Association is closed. An error indication is output to the Service Log.
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Indicates that the remote AE received a Cancel Request sent by the Modality Worklist Client AE and will no longer return further matches. A warning indication is output to the Service Logs.

Service Status	Further Meaning	Error Code	Behavior
Pending	Matches are continuing – However one or more Optional Keys were not supported.	FF01	Modality Worklist Client AE continues to wait for further C-FIND-RSPs. The remote AE has successfully returned a match in the C-FIND-RSP, and will continue to send further C-FIND-RSPs. However, the remote AE does not support one or more Optional Keys in the query identifier of the C-FIND-RQ. Warning indication message is output to the Service Logs.
Pending	Matches are continuing – Current Match is supplied	FF00	Modality Worklist Client AE continues to wait for further C-FIND-RSPs. The remote AE has successfully returned a match in the C-FIND-RSP, and will continue to send further C-FIND-RSPs. Success indication message is output to the Service Logs.
*	*	Any other status code	This is treated as a failure. The Modality Worklist Client AE does not attempt to resend the C-FIND-RQ. The Association is closed. An error indication is output to the Service Logs.

3.2.5.3.4.2 Association Requestor Communication Failure Behavior

The Behavior of the Modality Worklist Client AE during communication failure when acting as an Association Requestor is summarized in the following table:

Table 76: Modality Worklist Client AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. The Modality Worklist Client AE does not automatically attempt to resend the C-FIND-RQ. An error indication is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. The Modality Worklist Client AE does not automatically attempt to resend the C-FIND-RQ. An error indication is output to the Service Logs.
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. The Modality Worklist Client AE does not automatically attempt to resend the C-FIND-RQ. An error indication is output to the Service Logs.

3.2.5.4 Association Acceptance Policy

The Modality Worklist Client AE does not accept Associations.

3.2.6 External Notifier AE Specifications

The External Notifier AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 77: SOP Class Conformance of External Notifier AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Workflow Management			
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No

The External Notifier AE will forward any Modality Performed Procedure Step Requests received by the Event Handler AE.

3.2.6.1Association Establishment Policies

3.2.6.1.1 General

The External Notifier AE can issue Notifications for any number of configurable events.

For each event that occurs, an Association to a subscribed third party device will be opened, and a Modality Performed Procedure Step SOP Instance will be sent.

Table 78: DICOM Application Context for External Notifier AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size that will be offered is configurable, and by default is 16,384 bytes

3.2.6.1.2 Number of Associations

One Association is opened for every destination configured to receive notifications.

The External Notifier AE can request one open Association to each Remote AE that it is configured to send notifications to, and keep these Associations open simultaneously.

Table 79: Number of Simultaneous Associations for External Notifier AE

Maximum number of simultaneous Associations	One per Remote AE receiving notifications

3.2.6.1.3 Asynchronous Nature

The External Notifier AE does not provide asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 80: Asynchronous Nature for External Notifier AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.6.1.4 Implementation Identifying Information

Table 81: DICOM Implementation Class and Version for External Notifier AE

Implementation Class UID	1.2.840.113711.14
Implementation Version Name	V1.0

3.2.6.2Association Initiation Policy

3.2.6.2.1 Activity – Event Occurs that Requires Notification of a Remote AE

3.2.6.2.2 Description and Sequencing of Activity

An Association is initiated with the external DICOM system when a Change Healthcare Image Repository internal event occurs. There is no sequencing of this activity.

3.2.6.2.3 Proposed Presentation Contexts

The External Notifier AE may propose the following Presentation Contexts:

Table 82: External Notifier AE Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name**	**UID**		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.6.2.4 SOP Specific Conformance as an Association Requestor

The External Notifier AE can be configured to notify Remote AE 'C' whenever a Modality Performed Procedure Step is created or set by forwarding the MPPS Messages (acting as an IHE Performed Procedure Step Manager).

Currently, the events listed in the following table are supported:

Table 83: External Notifier AE Supported Events

Event Type	Meaning
MPPSCREATE	A Modality Performed Procedure Step request has been received (N-CREATE)
MPPSSET	A Modality Performed Procedure Step has been updated (N-SET)

3.2.6.2.4.1 SOP Specific Conformance - Modality Performed Procedure Step

The External Notifier AE does not independently generate MPPS requests. It simply forwards all requests received by the Event Handler AE as-is to its configured destinations. Therefore, the attributes sent by the External Notifier AE in both the N-CREATE and N-SET messages depend solely on the originating source of the MPPS request. This behavior implements the IHE Technical Framework requirements for the Performed Procedure Step Manager Actor.

As part of the MIMA option support, the system can provide DICOM attributes conveying the Assigning Authorities of the Patient ID and Accession Number in the forwarded Performed Procedure Step N-CREATE messages, and also convey the Institution Name (0008,0080) and Institution Code Sequence (0008,0082) in the forwarded Performed Procedure Step N-CREATE messages so that the institution where the referenced SOP Instances were created is identified. If a destination system cannot handle these attributes, the system can be configured to not include this information in the forwarded message when forwarding to that destination.

The External Notifier AE will exhibit the following behavior according to the Status Code value returned in a MPPS N-CREATE Response from the Remote AE acting as the MPPS SCP:

Table 84: External Notifier AE MPPS N-CREATE-RSP Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote AE has successfully created the MPPS. Success indication message is output to the Service Log.
Warning	Attribute Value Out of Range	0116	The remote AE is considered to have created the MPPS. A warning indication is output to the Service Log.
Warning	Attribute List Error	0107	The remote AE is considered to have created the MPPS. A warning indication is output to the Service Log.
Warning	Memory allocation not supported	B600	The remote AE is considered to have created the MPPS. A warning indication is output to the Service Log.

Service Status	Further Meaning	Error Code	Behavior
*	*	Any other status code	This is treated as a failure. External Notifier AE will re-attempt to create the MPPS SOP Instance a configurable maximum number of times. An error indication is output to the Service Logs.

The External Notifier AE will exhibit the following behavior according to the Status Code value returned in a MPPS N-SET Response from the Remote AE acting as the MPPS SCP:

Table 85: External Notifier AE MPPS N-SET-RSP Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote AE has successfully set the MPPS. Success indication message is output to the Service Log.
Warning	Attribute Value Out of Range	0116	The remote AE is considered to have set the MPPS. A warning indication is output to the Service Log.
Warning	Attribute List Error	0107	The remote AE is considered to have set the MPPS. A warning indication is output to the Service Log.
Warning	Performed Procedure Step Object may no longer be updated.	A710	The remote AE is considered to have set the MPPS. A warning indication is output to the Service Log.
Warning	Memory allocation not supported	B600	The remote AE is considered to have set the MPPS. A warning indication is output to the Service Log.
*	*	Any other status code	This is treated as a failure. The MPPS-job is aborted and the Association is released. An error indication is output to the Service Logs.

3.2.6.2.4.2 Association Requestor Communication Failure Behavior

The Behavior of the External Notifier AE during communication failure is summarized in the following table:

Table 86: External Notifier AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. Notification task is re-queued so that an attempt will be made to repeat it. There are a configured maximum number of times that a notification task can be re-queued. An error indication is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. Notification task is re-queued so that an attempt will be made to repeat it. There are a configured maximum number of times that a notification task can be re-queued. An error indication is output to the Service Logs.

Exception	Behavior
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. Notification task is re-queued so that an attempt will be made to repeat it. There are a configured maximum number of times that a notification task can be re-queued. An error indication is output to the Service Logs.

3.2.6.3 Association Acceptance Policy

The External Notifier AE does not accept Associations.

3.2.7Event Handler AE

The Event Handler AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 87: SOP Class Conformance of Event Handler AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Verification			
Verification	1.2.840.10008.1.1	No	Yes
Workflow Management			
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	No	Yes

The Event Handler AE receives notifications of events from external systems. When a MPPS Request is received, it can be forwarded to the External Notifier AE so that it can be relayed to other Remote AEs. In addition, Scheduled Procedure Steps can be removed from the Modality Worklist provided by the Query/Retrieve Server AE if a received MPPS Message indicates that it is in progress.

3.2.7.1Association Establishment Policies

3.2.7.1.1 General

The Event Handler AE accepts Associations from external DICOM devices to receive event notifications.

The DICOM Standard Application Context Name is always supported:

Table 88: DICOM Application Context for Sender AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size that will be offered is configurable, and by default is 16,384 bytes

3.2.7.1.2 Number of Associations

The Event Handler AE places configurable limitations on the number of simultaneous connections it will support. Once the event Handler AE accepts an Association, a spawned child task will receive any messages transmitted on that Association. The default maximum number of Associations is 10 per connecting host. It is possible to restrict the number of hosts that can connect with the Event Handler AE so the combination of these settings can restrict the maximum number of Associations.

Table 89: Number of Simultaneous Associations as an Acceptor for Importer AE

Maximum number of simultaneous Associations	Unlimited[6]

3.2.7.1.3 Asynchronous Nature

The Event Handler AE does not provide asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 90: Asynchronous Nature as an SCP for Importer AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.7.1.4 Implementation Identifying Information

Table 91: DICOM Implementation Class and Version for Event Handler AE

Implementation Class UID	1.2.840.113711.15
Implementation Version Name	V1.0

3.2.7.2Association Initiation Policies

The Event Handler AE does not initiate Associations.

3.2.7.3Association Acceptance Policies

3.2.7.3.1 Activity – External system sends notification of an event

3.2.7.3.2 Description and Sequencing of Activity

The Event Handler AE accepts Association Requests only if they propose one or more Presentation Contexts that the Event Handler AE actually supports. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. The Event Handler AE can be configured to only accept Associations requested by certain hosts (using TCP/IP address).

If the Event Handler AE receives an MPPS SOP Class Request Message from a Remote AE, then it can forward this Request to the External Notifier AE. The External Notifier AE can then forward the Request Message to other Remote AEs acting as an SCP for the MPPS SOP Class. In addition, under certain circumstances, any Scheduled Procedure Step corresponding to the MPPS can be removed from the Modality Worklist.

The Event Handler AE has a configurable timeout value for the maximum amount of time that it will wait on an open Association for a new request from a remote AE. A remote AE can reset this timer by sending a Verification request (C-ECHO-RQ). This can act as a useful mechanism for a remote AE to maintain an active Association if the length of time between sending MPPS Requests is long (such as

[6] Default maximum is 10 per host permitted to connect to the Event Handler AE.

when using a single Association to send the initial Message to create an MPPS and then later Messages to update its status and information).

The Event Handler AE may reject Association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

a) 1 – DICOM UL service-user
b) 2 – DICOM UL service-provider (ASCE related function)
c) 3 – DICOM UL service-provider (Presentation related function)

Table 92: Event Handler AE Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
2 – rejected-transient	c	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	a	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	b	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time. Usually this is only returned if the Event Handler AE has not been configured to allow the remote AE host to connect to it. The Event Handler AE can be configured to allow only specific host names to open Associations with it. Note that it cannot currently be configured to only allow specific calling and/or called AE Titles when forming Associations.

3.2.7.3.3 Accepted Presentation Contexts

The Event Handler AE may accept any one or more of the following Presentation Contexts:

Table 93: Event Handler AE Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

3.2.7.3.4 SOP Specific Conformance as an Association Acceptor

3.2.7.3.4.1 SOP Specific Conformance – Modality Performed Procedure Step

If the Event Handler AE receives an MPPS N-CREATE or N-SET Request Message from a Remote AE, then it can forward this to the External Notifier AE. The External Notifier AE can then forward a copy of the Request Message to other Remote AEs acting as an SCP for the MPPS SOP Class. This behavior implements the IHE Technical Framework requirements for the Performed Procedure Step Manager Actor.

In addition, under certain circumstances, any Scheduled Procedure Step corresponding to the MPPS can be removed from the Modality Worklist.

The Event Handler AE can pass all Attributes and values of an MPPS N-CREATE Request to the External Notifier AE; however, it retains only the following Attribute values in the Change Healthcare Image Repository database:

Table 94: MPPS N-CREATE-RQ Attribute Values Retained by Event Handler

Attribute Name	Tag ID	VR
Performed Procedure Step ID	(0040,0253)	SH
Performed Procedure Step UID / Affected SOP Instance UID	(0000,1000)	UI
Performed Procedure Step Start Date	(0040,0244)	DA
Performed Procedure Step Start Time	(0040,0245)	TM
Performed Procedure Step Status	(0040,0252)	CS

Upon receipt of a MPPS N-CREATE "IN PROGRESS" request, the corresponding Scheduled Procedure Step entry, if it exists, will be removed from the Modality Worklist. Future Modality Worklist queries will not return the removed entry.

The Event Handler AE returns one of the following status codes in a MPPS N-CREATE Response:

Table 95: Event Handler AE MPPS N-CREATE-RSP Status Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Event Handler AE has successfully created the MPPS. Success indication message is output to the Service Log.
Failure	Processing Failure	0110	The Event Handler AE failed to properly parse or handle the MPPS N-CREATE Request. An error indication is output to the Service Logs.

The Event Handler AE can pass all Attributes and values of an MPPS N-SET Request to the External Notifier AE; however, it retains only the following Attribute values in the Change Healthcare Image Repository database:

Table 96: MPPS N-SET-RQ Attributes Updated by Event Handler

Attribute Name	Tag ID	VR
Performed Procedure Step Status	(0040,0252)	CS

Attributes may only be modified when the MPPS entry's status is "IN PROGRESS". If the status is "DISCONTINUED" or "COMPLETED", modification via an N-SET Request is not possible.

An MPPS SOP Instance will not be automatically removed from the Change Healthcare Image Repository. Removal of MPPS SOP Instances requires human intervention. Once an MPPS SOP Instance has been removed, then any subsequent N-SET Requests for the SOP Instance will be rejected and an Error Status will be returned in the corresponding N-SET Response.

The Event Handler AE returns one of the following status codes in a MPPS N-CREATE Response:

Table 97: Event Handler AE MPPS N-SET-RSP Status Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote AE has successfully set the MPPS. Success indication message is output to the Service Log.
Failure	Processing Failure	0110	The Event Handler AE failed to properly parse or handle the MPPS N-SET Request. An error indication is output to the Service Logs.

Table 98: Event Handler AE Communication Failure Behavior as an Association Acceptor

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT. This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.
Association A-P-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	This is treated as a failure. Importer AE does not attempt to resend the N-EVENT-REPORT Request. An error indication is output to the Service Logs.

3.2.7.3.4.2 Presentation Context Acceptance Criterion

The Event Handler AE will only accept the Presentation Contexts specified in Table 93.

The Event Handler AE does not check for, and will accept, duplicate Presentation Contexts.

3.2.7.3.4.3 Transfer Syntax Selection Policies

The Event Handler AE supports only the Implicit VR Little Endian Transfer Syntax.

3.2.8 Storage Commitment Client AE Specification

3.2.8.1 SOP Classes

The Storage Commitment Client AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 99: SOP Class Conformance of Storage Commitment Client AE

DICOM SOP Class Name	SOP Class UID	SCU	SCP
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

3.2.8.2 Association Establishment Policies

3.2.8.2.1 General

The Storage Commitment Client AE can send a request for establishing an Association with a Storage Commitment SCP. When the association is established, an N-ACTION Request is sent to request for Storage Commitment for previously stored Composite SOP Instances. The Storage Commitment Client AE can wait for the Storage Commitment Confirmation (N-EVENT-REPORT) from the Storage

Commitment SCP if the Commitment Confirmation is on the same association. The Event Handler AE will handle the Storage Commitment Confirmation (N-EVENT-REPORT) if the Storage Commitment Confirmation is on a separate association.

The DICOM Standard Application Context Name is always proposed:

Table 100: DICOM Application Context for Storage Commitment Client AE

Application Context Name	1.2.840.10008.3.1.1.1

3.2.8.2.2 Number of Associations

The Storage Commitment Client AE queries the database for pending Storage Commitments jobs, dispatches these jobs to Storage Commitment worker processes that perform the Storage Commitment requests, and completes them when the Storage Commitment worker processes return the responses.

It is possible to configure multiple Storage Commitment worker processes for the Storage Commitment SCU Service. But each Storage Commitment Worker process will only attempt to open one Association at a time to the destination Storage Commitment SCP it is configured to send to. There is no limit on the number Storage Commitment worker processes (simultaneous connections) that the Storage Commitment Client AE can support. However, in the real world, this number is small since the user shall only configure one Storage Commitment worker process per DICOM archive destination.

Table 101: Number of Simultaneous Associations as a Requestor for Storage Commitment Client AE

Maximum number of simultaneous Associations	No hard limit[7]

Table 102: Number of Simultaneous Associations as an Acceptor for Storage Commitment Client AE

Maximum number of simultaneous Associations	Unlimited[8]

3.2.8.2.3 Asynchronous Nature

The Storage Commitment Client AE does not provide asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

Table 103: Asynchronous Nature as an SCU for Storage Commitment Client AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

3.2.8.2.4 Implementation Identifying Information

[7] There is not hard limit to the number of simultaneous associations initiate by the Storage Commitment Client AE. However, in the real world, this number is small since the user shall only configure one Storage Commitment worker process per DICOM archive destination.

[8] Default maximum is 10 per host permitted to connect to the Event Handler AE.

Table 104: DICOM Implementation Class and Version for Storage Commitment Client AE

Implementation Class UID	1.2.840.113711.15
Implementation Version Name	V1.0

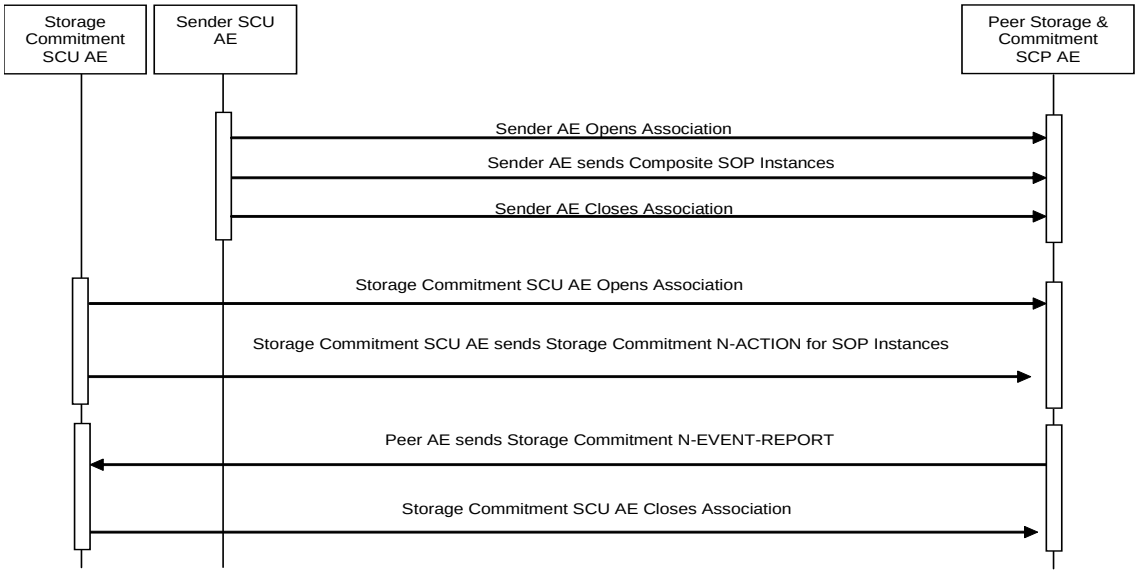
3.2.8.3Association Initiation Policies

3.2.8.3.1 Activity – Send Storage Commitment Request

3.2.8.3.2 Description and Sequencing of Activity

The Storage Commitment Client AE will attempt to initiate an association when requested to commit the Composite SOP Instances. When the association is established, an N-ACTION Request is sent to request storage commitment for previously stored Composite SOP Instances. After receiving the N-ACTION response from the Storage Commitment SCP, the Storage Commitment Client AE can wait for the corresponding Storage Commitment Confirmation (N-EVENT-REPORT) on the same association or release the association of the N-ACTION Request. If the Storage Commitment Client AE is configured to not wait for the N-EVENT-REPORT, it will release the association of the N-ACTION Request. The Storage Commitment SCP will be required to open a new association with the Storage Commitment Client AE to send over the N-EVENT-REPORT. The Event Handler AE is responsible for listening for the Storage Commitment Confirmation (N-EVENT-REPORT) on the new association on behalf of the Storage Commitment Client AE. The Storage Commitment SCP will close the association after sending over the N-EVENT-REPORT.

Figure 8: Sequencing of Activity – Send Storage Commitment Request



Note that the Storage Commitment SCU Client AE shall only send Storage Commitment N-ACTION requests for previously stored Composite SOP Instances.

The following sequencing constraints illustrated in The Storage Commitment Client AE will attempt to initiate an association when requested to commit the Composite SOP Instances. When the association is established, an N-ACTION Request is sent to request storage commitment for previously stored Composite SOP Instances. After receiving the N-ACTION response from the Storage Commitment SCP, the Storage Commitment Client AE can wait for the corresponding Storage Commitment Confirmation

(N-EVENT-REPORT) on the same association or release the association of the N-ACTION Request. If the Storage Commitment Client AE is configured to not wait for the N-EVENT-REPORT, it will release the association of the N-ACTION Request. The Storage Commitment SCP will be required to open a new association with the Storage Commitment Client AE to send over the N-EVENT-REPORT. The Event Handler AE is responsible for listening for the Storage Commitment Confirmation (N-EVENT-REPORT) on the new association on behalf of the Storage Commitment Client AE. The Storage Commitment SCP will close the association after sending over the N-EVENT-REPORT.

Figure 8 apply to the Storage Commitment Client AE for making Storage Commitment Push Model Requests and receiving N-EVENT-REPORT using a Single Association:

21. Storage Commitment Client AE opens an Association with Peer Storage Commitment SCP AE.
22. Storage Commitment Client AE requests Storage Commitment of Composite SOP Instance(s) (sends N-ACTION-RQ and Peer Storage Commitment SCP AE responds with N-ACTION-RSP to indicate that it received the request).
23. Peer Storage Commitment SCP AE sends Storage Commitment Push Model Notification (N-EVENT-REPORT).
24. Storage Commitment Client AE closes the Association.

3.2.8.3.3 Proposed Presentation Contexts

The Storage Commitment Client AE will propose Presentation Contexts as shown in the following table:

Table 105: Storage Commitment Client AE Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name**	**UID**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.8.3.4 SOP Specific Conformance as an Association Requestor

3.2.8.3.4.1 SOP Specific Conformance - Storage Commitment

Standard conformance is provided to the DICOM Storage Commitment Push Model SOP Class as an SCP.

The associated activity with the Storage Commitment Push Model Service enables the Storage Commitment Client AE to request remote AEs to make commitment to permanently store Composite SOP Instances that have been sent to them. It thus allows Change Healthcare Image Repository to safely flush the Composite SOP Instances from its local cache storage.

The Storage Commitment Client AE will send a request for establishing an Association with a remote AE. When the association is established, an N-ACTION Request is sent to request for Storage Commitment for previously stored Composite SOP Instances. The Storage Commitment Client AE can wait for the Storage Commitment Confirmation (N-EVENT-REPORT) from the remote AE if the Commitment Confirmation is on the same association. The Event Handler AE will handle the Storage Commitment Confirmation (N-EVENT-REPORT) if the Storage Commitment Confirmation is on a separate association.

The Storage Commitment Client AE creates files called Service Logs and database records that can be used to monitor its status and diagnose any problems that may arise. If any error occurs during DICOM

communication then appropriate messages are always output to the Service Logs and database Storage Commitment Job records.

If the request by the Storage Commitment Client AE to establish an Association fails for any reason (i.e. fail to connect with remote AE's TCP/IP port, Association Request is Rejected by remote AE, etc.) then the Storage Commitment Client AE will try again later to send the N-ACTION Request. The number of retries (default 3) and delay between retries (default 30 min) are configurable.

The Storage Commitment Client AE will exhibit the following Behavior according to the Status Code value returned in a Storage Commitment Push Model N-ACTION Response from a destination SCP:

Table 106: Storage Commitment Client AE N-ACTION-RSP Status Codes Handling

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Storage Commitment Client AE has successfully Requested the Storage Commitment Push Model N-ACTION Request. Continue to listen for N-EVENT-REPORT on the same association or separate association depending on configuration.
Error	Processing Failure	0110	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be parsed by the Storage Commitment SCP AE. An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Error	No Such SOP Class	0112	Indicates that the Storage Commitment Push Model N-ACTION Request cannot be processed by the Storage Commitment SCP AE because a The SCP does not accept N-ACTION Request. An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.

NOTE1: Any Error codes not 0000 is considered a failure.

The Storage Commitment Client AE will send one of the N-EVENT-REPORT Response codes to the Storage Commitment SCP after processing of the N-EVENT-REPORT Result it receives.

The Storage Commitment Client AE verifies the Transaction UID and Committed SOP Instances with the original request. If the Transaction UID and the Committed SOP Instances failed to verify then the Storage Commitment Client AE will re queue and retry the Storage Commitment Request (with a new Transaction UID). However, the Storage Commitment Client AE only returns an N-EVENT-REPORT Response status code of 0000 (Success) to indicate to that the N-EVENT-REPORT Result has been received. It will not return other status codes such as 0110 or 0119 below.

Table 107: Storage Commitment Client AE N-EVENT-REPORT Response Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCU has successfully received the Storage Commitment Report. - Verified the Transaction UID is the same Transaction UID in the N-ACTION Request. - All SOP Instances are committed - All SOP Instances in the Storage Commitment Report are verified with the Referenced SOP Instances. Success indication message is output to the Service Logs. A successful Storage Commitment database record is created.

Service Status	Further Meaning	Error Code	Behavior
Failure	Processing failure	0110	Not Used Failed to parse the N-EVENT-REPORT-RQ from the Storage Commitment SCP An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Failure	SOP Instance UID does not match	0119	Not Used Some SOP Instances in the Storage Commitment Report do not match the SOP Instances in the Reference SOP Instance.

3.2.8.3.4.2 Association Requestor Communication Failure Behavior

The Behavior of the Storage Client AE during communication failure when it is acting as an Association Requestor is summarized in the following table:

Table 108: Storage Commitment Client AE Communication Failure Behavior as an Association Requestor

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT, A-RELEASE. This is treated as a failure. Storage Commitment Client AE will attempt to resend the Storage Commitment job using the N-ACTION Request after a configurable retry delay (in minutes). An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT, A-RELEASE. This is treated as a failure. Storage Commitment Client AE will attempt to resend the Storage Commitment job using the N-ACTION Request after a configurable retry delay (in minutes). An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	The Association is aborted using a DICOM A-ABORT, A-RELEASE. This is treated as a failure. Storage Commitment Client AE will attempt to resend the Storage Commitment job using the N-ACTION Request after a configurable retry delay (in minutes). An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.

3.2.8.4Association Acceptance Policy

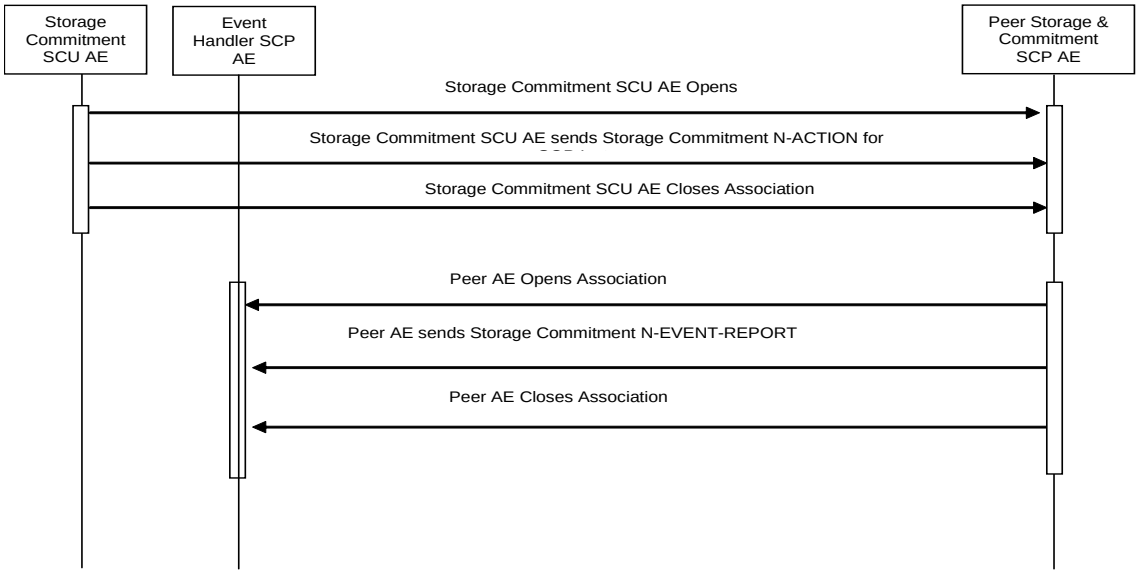
3.2.8.4.1 Activity – Receive Storage Commitment Response

3.2.8.4.1.1 Description and Sequencing of Activity

The Storage Commitment Client AE accepts association if configured to receive N-EVENT-REPORT on a separate association.

The Storage Commitment Client AE accepts Association Requests only if the Requestor proposes one or more Presentation Contexts that the Storage Commitment Client AE actually supports. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. The Storage Commitment Client AE can be configured to only accept Associations requested by certain hosts (using TCP/IP address).

Figure 9: Sequencing of Activity – Receive Storage Commitment Response in a Separate Association



The following sequencing constraints illustrated in Figure 9 apply to the Storage Commitment Client AE for handling Storage Commitment Push Model N-EVENT-REPORT over the separate Association:

1. Storage Commitment Client AE opens an Association with Peer Storage Commitment SCP AE.
2. Storage Commitment Client AE requests Storage Commitment of Composite SOP Instance(s) (sends N-ACTION-RQ and Peer Storage Commitment SCP AE responds with N-ACTION-RSP to indicate that it received the request).
3. Storage Commitment Client AE closes the Association of the N-ACTION Request.
4. Peer Storage Commitment SCP AE opens a new Association.
5. Peer Storage Commitment SCP AE sends Storage Commitment Push Model Notification (N-EVENT-REPORT).
6. Peer Storage Commit SCP AE closes the Association with the Event Handler AE.

The Storage Commitment Client AE has a configurable timeout value for the maximum amount of time that it will wait on an open Association for a new request from a remote AE. A remote AE can reset this timer by sending a Verification request (C-ECHO-RQ). This can act as a useful mechanism for a remote AE to maintain an active Association if the length of time between sending requests is long. The Storage Commitment Client AE also has a configurable wait time value to wait for the N-EVENT-REPORT from the Storage Commitment SCP before failing the Storage Commitment job and resubmitting it.

The Storage Commitment Client AE may reject Association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4 and Event Handler AE). The following abbreviations are used in the Source column:

a) 1 – DICOM UL service-user
b) 2 – DICOM UL service-provider (ASCE related function)
c) 3 – DICOM UL service-provider (Presentation related function)

Table 109: Storage Commitment Client AE Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
2 – rejected-transient	c	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	a	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	b	1 – no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time. Usually this is only returned if the Storage Commitment Client AE has not been configured to allow the remote AE host to connect.

3.2.8.4.1.2 Accepted Presentation Contexts

The Importer AE will accept any Presentation Context containing:

1. An abstract syntax selected from Table 14
2. One or more Transfer Syntaxes selected from Table 24

The Storage Commitment Client AE will accept Presentation Contexts (For N-EVENT-REPORT) as shown in the following table:

Table 110: Storage Commitment Client AE Accepted Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

3.2.8.4.1.3 SOP Specific Conformance as an Association Acceptor

3.2.8.4.1.3.1 SOP Specific Conformance – Verification

The Storage Commitment Client AE provides standard conformance to the Verification SOP Class as an SCP.

3.2.8.4.1.3.2 SOP Specific Conformance – Storage Commitment

The Storage Commitment Client AE accepts association if configured to receive N-EVENT-REPORT on a separate association.

The Storage Commitment Client AE accepts Association Requests only if the Requestor proposes one or more Presentation Contexts that the Storage Commitment Client AE actually supports. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected. The Storage Commitment Client AE can be configured to only accept Associations requested by certain hosts (using TCP/IP address).

The Storage Commitment Client AE will send one of the N-EVENT-REPORT Response codes to the Storage Commitment SCP after processing of the N-EVENT-REPORT Result it receives.

The Storage Commitment Client AE verifies the Transaction UID and Committed SOP Instances with the original request. If the Transaction UID and the Committed SOP Instances failed to verify then the Storage Commitment Client AE will re queue and retry the Storage Commitment Request (with a new

Transaction UID). However, the Storage Commitment Client AE only returns an N-EVENT-REPORT Response status code of 0000 (Success) to indicate to that the N-EVENT-REPORT Result has been received. It will not return other status codes such as 0110 or 0119 below.

Table 111: Storage Commitment Client AE N-EVENT-REPORT Response Codes

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCU has successfully received the Storage Commitment Report. - Verified the Transaction UID is the same Transaction UID in the N-ACTION Request. - All SOP Instances are committed - All SOP Instances in the Storage Commitment Report are verified with the Referenced SOP Instances. Success indication message is output to the Service Logs. A successful Storage Commitment database record is created.
Failure	Processing failure	0110	Not Used Failed to parse the N-EVENT-REPORT-RQ from the Storage Commitment SCP An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Failure	SOP Instance UID does not match	0119	Not Used Some SOP Instances in the Storage Commitment Report do not match the SOP Instances in the Reference SOP Instance.

3.2.8.4.1.3.3 Association Acceptor Communication Failure Behavior

The Behavior of the Storage Commitment Client AE during communication failure when it is acting as an Association Acceptor is summarized in the following table (See Event Handler AE):

Table 112: Storage Commitment Client AE Communication Failure Behavior as an Association Acceptor

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	The Association is aborted using a DICOM A-ABORT, A-RELEASE. This is treated as a failure. Storage Commitment Client AE will attempt to resend the Storage Commitment job using the N-ACTION Request after a configurable retry delay (in minutes). An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	The Association is aborted using a DICOM A-ABORT, A-RELEASE. This is treated as a failure. Storage Commitment Client AE will attempt to resend the Storage Commitment job using the N-ACTION Request after a configurable retry delay (in minutes). An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.
Association A-P-ABORTed by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	The Association is aborted using a DICOM A-ABORT, A-RELEASE. This is treated as a failure. Storage Commitment Client AE will attempt to resend the Storage Commitment job using the N-ACTION Request after a configurable retry delay (in minutes). An error indication is output to the Service Logs. A failure Storage Commitment Request database record is created.

3.2.9 QIDO-RS Service Provider Specification

3.2.9.1 QIDO-RS Search For Studies

Change Healthcare Image Repository supports acting as a QIDO-RS Service Provider. It allows searches for DICOM Studies based on the following specification.

3.2.9.1.1 Command

https://mckhost/DICOMRestService/qido/studies[?query]

Table 113: QIDO-RS Search For Studies Specification

Parameter	Description
Media Types	Supported "multipart/related;type=application/dicom+xml" or "application/json"
Matching Attributes	See Table 114
Return Attributes	See Table 115
Limit	Supported The maximum number of results returned in a query is the lower of: • If specified, the Limit parameter value • If the request requires a database fetch, a site configurable database fetch limit • A site configurable query results limit
Offset	Supported
Fuzzymatching	Ignored Fuzzy matching applies to names in general, so Referring Physicians Name is searched as well with Fuzzy Matching. Matching is always case-insensitive and matches against the provided name as if there was a trailing wildcard regardless of what the fuzzymatching parameter is set to (either the true or false value).
Includefield	Supported See "includefield" related entries in The types of Matching supported by the QIDO-RS Service Provider S - indicates Single Value Matching is supported. R - indicates Range Matching is supported. * - indicates Wildcard Matching is supported. U - indicates Universal Matching is supported. SQ - indicates Sequence Matching is supported. UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level.

Parameter	Description
	NOTE1: Only the first value in the Issuer of Accession Number Sequence will be used as the query key. This is the key for local namespace as opposed to universal entity ID. NOTE2: The study level query by person name (patient name or Referring Physician Name) returns wildcard matches, even without a wild card specified in the person name query. For example, a search for "Mill" would return patients whose last names begin with "Mill", such as "Miller" and "Millen". For each matching Study, the QIDO-RS provider shall return all attributes in accordance with Table 115. Table 115.

Table 114: QIDO-RS STUDY attribute matching

Key Word	Tag	Types of Matching
StudyDate	00080020	S, U, R
StudyTime	00080030	S, U, R
AccessionNumber	00080050	S,U
IssuerOfAccessionNumberSequence	00080051	SQ
ModalitiesInStudy	00080061	S,U,
ReferringPhysicianName	00080090	S,*,U
PatientName	00100010	S,*,U
PatientID	00100020	S,U
IssuerOfPatientID	00100021	S,U
StudyID	00200010	S,U
StudyInstanceUID	0020000D	UNIQUE

The types of Matching supported by the QIDO-RS Service Provider

S - indicates Single Value Matching is supported.

R - indicates Range Matching is supported.

* - indicates Wildcard Matching is supported.

U - indicates Universal Matching is supported.

SQ - indicates Sequence Matching is supported.

UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level.

NOTE1: Only the first value in the Issuer of Accession Number Sequence will be used as the query key. This is the key for local namespace as opposed to universal entity ID.

NOTE2: The study level query by person name (patient name or Referring Physician Name) returns wildcard matches, even without a wild card specified in the person name query.

For example, a search for "Mill" would return patients whose last names begin with "Mill", such as "Miller" and "Millen".

For each matching Study, the QIDO-RS provider shall return all attributes in accordance with Table 115.

Table 115: QIDO-RS STUDY attribute returned

Attribute Name	Tag
Study Date	(0008,0020)
Study Time	(0008,0030)
Accession Number	(0008,0050)
Issuer of Accession Number Sequence	(0008,0051)
Instance Availability	(0008,0056)
Modalities in Study	(0008,0061)
Referring Physician's Name	(0008,0090)
Patient Name	(0010,0010)
Patient ID	(0010,0020)
Issuer of Patient ID	(0010,0021)
Patient's Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Study ID	(0020,0010)
Study Instance UID	(0020,000D)
Number of Study Related Series	(0020,1206)
Number of Study Related Instances	(0020,1208)
Retrieve URL	(0008,1190)
All other Study Level DICOM Attributes passed as "includefield" query values that are defined in PS3.3 of the DICOM 3.0 standard[1] (Study Level Attributes are the Attributes in the General Study, Patient Study, and Clinical Trial Study Modules in PS3.3.).	
All available Study Level DICOM Attributes defined in PS3.3 of the DICOM 3.0 standard[1] if the "includefield" query key is included with a value of "all"	

NOTE1: An attribute shall be returned only if a value is available (e.g. Rows for a non-image object will not be returned since there is no value available).

NOTE2: Issuer of Accession Number and Issuer of Patient ID are returned to provide information on the study and patient context. See section 3.2.9.4.

3.2.9.2QIDO-RS Search For Series

The QIDO-RS Service AE allows searches for DICOM Series based on the following specification. This includes search by study instance UID, or series instance UID, or other study and series level search attributes.

3.2.9.2.1 Command

https://mckhost/DICOMRestService/qido/studies/<study instance uid>/series[?query]

https://mckhost/DICOMRestService/qido/series[?query]

Table 116: QIDO-RS Search For Series Specification

Parameter	Description
Media Types	Supported "multipart/related;type=application/dicom+xml" or "application/json"
Matching Attributes	See Table 114 and Table 117
Return Attributes	See Table 118
Offset	Supported
Limit	Supported The maximum number of results returned in a query is the lower of: • If specified, the Limit parameter value • If the request requires a database fetch, a site configurable database fetch limit • A site configurable query results limit
Includefield	Supported See "includefield" related entries in Table 18
Relational Queries	Supported According to DICOM C-FIND Service, relational-queries allow any combination of keys at any level in the hierarchy. Support for relational-queries removes the baseline restriction that a Unique Key shall be specified for all levels above the Query/Retrieve level in the C-FIND request. Change Healthcare Image Repository implementation does not support instance level query keys for series level queries. Only patient, study, series level keys are supported for the series level queries.

Table 117: QIDO-RS SERIES attribute matching

Key Word	Tag	Types of Matching
Modality	00080060	S, U,
SeriesNumber	00200011	S, U
SeriesInstanceUID	0020000E	UNIQUE
PerformedProcedureStepStartDate	00400244	S, U, R
PerformedProcedureStepStartTime	00400245	S, U, R
RequestAttributeSequence	00400275	SQ
>ScheduledProcedureStepID	00400009	S, U
>RequestedProcedureID	00401001	S, U

The types of Matching supported by the QIDO-RS Service Provider

S - indicates Single Value Matching is supported.

R - indicates Range Matching is supported.

* - indicates Wildcard Matching is supported.

U - indicates Universal Matching is supported.

SQ - indicates Sequence Matching is supported.

UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level.

For each matching Series, the QIDO-RS Service Provider shall return all attributes in accordance with Table 118.

Table 118: QIDO-RS SERIES attribute returned

Attribute Name	Tag
Instance Availability	(0008,0056)
Modality	(0008,0060)
Series Description	(0008,103E)
Series Number	(0020,0011)
Series Instance UID	(0020,000E)
Number of Series Related Instances	(0020,1209)
Performed Procedure Step Start Date	(0040,0244)
Performed Procedure Step Start Time	(0040,0245)
Request Attribute Sequence	(0040,0275)
>Scheduled Procedure Step ID	(0040,0009)
>Requested Procedure ID	(0040,1001)
Retrieve URL	(0040,1190)
All other Study or Series Level DICOM Attributes passed as "includefield" query values that are defined in PS3.3 of the DICOM 3.0 standard[1] (Series Level DICOM Attributes are the attributes in the General Series, Clinical Trial Series and SR Document Series Modules in PS3.3).	
All available Series Level DICOM Attributes that are defined in PS3.3 of the DICOM 3.0 standard[1] if the "includefield" query key is included with a value of "all"	
If {StudyInstanceUID} is not specified in the URL path, all Study-level attributes specified in Table 115	

NOTE1: An attribute shall be returned only if a value is available (e.g. Rows for a non-image object will not be returned since there is no value available).

3.2.9.3QIDO-RS Search For Instances

The QIDO-RS Service AE allows searches for DICOM Instances based on the following specification.

3.2.9.3.1 Command

For instance level query, the current implementation requires either study instance UID or Series instance UID to be specified in the URL or as query parameters.

For example, the following two queries are supported:

https://mckhost/DICOMRestService/qido/studies/<study instance uid>/instances?sopinstanceuid=<sop instance uid>
or

https://mckhost/DICOMRestService/qido/instances?studyinstanceuid=<studyinstanceuid>&sopinstance uid=<sop instance uid>

But the following query is not supported:

https://mckhost/DICOMRestService/qido/instances?sopinstanceuid=<sop instance uid>

For each matching Instances, the QIDO-RS provider shall return all attributes in accordance with Table 119.

Table 119: QIDO-RS Search For Instances Specification

Parameter	Restrictions
Media Types	Supported "multipart/related;type=application/dicom+xml" or "application/json"
Matching Attributes	See Table 114 and Table 117 and Table 120
Return Attributes	See The types of Matching supported by the QIDO-RS Service Provider S - indicates Single Value Matching is supported. R - indicates Range Matching is supported. * - indicates Wildcard Matching is supported. U - indicates Universal Matching is supported. SQ - indicates Sequence Matching is supported. UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level. Table 121
Offset	Supported
Limit	Supported The maximum number of results returned in a query is the lower of: • If specified, the Limit parameter value • If the request requires a database fetch, a site configurable database fetch limit • A site configurable query results limit
Includefield	Supported See "includefield" related entries in The types of Matching supported by the QIDO-RS Service Provider S - indicates Single Value Matching is supported. R - indicates Range Matching is supported. * - indicates Wildcard Matching is supported. U - indicates Universal Matching is supported. SQ - indicates Sequence Matching is supported. UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level. Table 121.
Relational Queries	Supported According to DICOM C-FIND Service, relational-queries allow any combination of keys at any level in the hierarchy. Support for relational-queries removes the baseline restriction that a Unique Key shall be specified for all levels above the Query/Retrieve level in the C-FIND request. Change Healthcare Image Repository Relational Instance level query implementation requires either study instance UID or series instance UID to be specified.

Table 120: QIDO-RS Instance attributes matching

Key Word	Tag	Types of Matching
SOPClassUID	00080016	S, U
SOPInstanceUID	00080018	UNIQUE

The types of Matching supported by the QIDO-RS Service Provider

S - indicates Single Value Matching is supported.

R - indicates Range Matching is supported.

* - indicates Wildcard Matching is supported.

U - indicates Universal Matching is supported.

SQ - indicates Sequence Matching is supported.

UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level.

Table 121: QIDO-RS INSTANCE attribute returned

Attribute Name	Tag
SOP Class UID	(0008,0016)
SOP Instance UID	(0008,0018)
Instance Availability	(0008,0056)
Rows	(0028,0010)
Columns	(0028,0011)
Bits Allocated	(0028,0100)
Number of Frames	(0028,0008)
Retrieve URL	(0040,1190)
All other Study, Series or Instance Level DICOM Attributes passed as "includefield" query values that are defined in the PS3.3 of the DICOM 3.0 standard[1].	
All available Instance Level DICOM Attributes that are defined in PS3.3 of the DICOM 3.0 standard[1] the “includefield” query key is included with a value of “all”	
If {StudyInstanceUID} is not specified in the URL path, all Study-level attributes specified in Table 115	
If {SeriesInstanceUID} is not specified in the URL path, all Series-level attributes specified in Table 118	

NOTE1: An attribute shall be returned only if a value is available (e.g. Rows for a non-image object will not be returned since there is no value available).

3.2.9.4QIDO RS Multi-Context Support

The QIDO-RS service supports specifying the context for both Patient ID and Accession Number in the URL or with the URL parameters for searches.

If both the URL and URL parameters specify context information, the URL parameters shall take precedence in setting the context for the query.

If the context for the query does not match the context of the study, the accession number returned shall be blank in the QIDO-RS response.

For the study's patient, if the patient does not have a patient ID in the context for the query, the patient ID shall be returned as blank.

For example, for the URL:

https://mckhost/DICOMRestService/qido/Context/Context1/studies?accessionNumber=acc00001&IssuerOfPatientID=Context2.

The query will be performed for a study with access number of acc00001 in context of Context 1, and if there are results found then the results will contain a patient ID issued from Context2 or no patient ID if the patient does not have a patient ID from Context2. The return will not use the patient's patient ID issued from Context1 because the QIDO-RS Service AE will return the patient ID from Context2 only, due to the query parameters specifying that patient ID should be from Context2.

3.2.9.5QIDO RS Limitations

Certain query types are not supported in the QIDO-RS implementation:

Searching for all studies, series, or instances in the system is not supported. These queries are too general and slow the system down.

In addition, searches solely with certain attributes are not supported:

Querying for only the issuer of patient ID is not supported.

Querying for only the issuer of accession number sequence is not supported.

Querying for only the modality attribute is not supported.

Querying for only the series number is not supported.

Querying for only the requested procedure ID is not supported.

Querying for only the scheduled procedure step ID is not supported.

Querying for only the performed procedure step start date is not supported.

The following shows two example queries that are not supported:

http://mckhost/DICOMRestService/qido/studies?modalitiesinstudy=us
http://mckhost/DICOMRestService/qido/series?modality=US

3.2.9.6Preference Order for Multiple Accept Headers

The QIDO-RS Service Provider supports returning data in a supported format chosen from one of the formats that the client sent in an Accept header.

The QIDO-RS Service Provider will interpret the client's priority by using the q value in the HTTPS Accept headers , and then for all formats given that have the same q value, by the order in which the client lists the formats. Note that if the format does not include a q value, this is equivalent to the client specifying a q value of 1.0. For example, if the client gives an accept header of multipart/related; type=application/dicom+xml, application/json then the response will be a multipart response with each part containing an XML file. If however the client gives application/json, multipart/related; type=application/dicom+xml then the client will get back the single part response with only JSON data contained.

3.2.9.7QIDO-RS Status Codes

The QIDO-RS Service Provider shall return HTTP status codes to indicate the status of a request.

Table 122: QIDO-RS HTTP/1.1 STATUS CODES

HTTP Status Code	Name	Description
200	OK	The query completed and all matching results are returned in the response message body.
206	Partial Content	The query completed but the number of results exceeds the query limit set by the client or the site configuration. Some of the matching results are returned to the QIDO-RS Client.
400	Bad Request	The request could not be understood by the server
403	Forbidden	Server indicates the client did not present a recognized client certificate when the server is configured to require a client certificate.
404	Not Found	QIDO-RS Client has asked for information on a result not wholly contained in the database and a retrieval of files from archive is required to complete the request. An example is a query for an attribute that doesn't exist in the database and requires loading the DICOM instance from archive to read the information from the DICOM headers. For data that was online, the results will be returned along with the status code of 404. For data that was not online, the QIDO-RS Service Provider shall initiate retrieval of the data from archive. If the QIDO-RS Client makes the same query again moments later after the data has been retrieved from archive, the data will be returned and the client should be able to get an HTTP status code of 200 for the subsequent call.
413	Request Entity Too Large	This indicates that the query was too broad and a narrower query should be requested. This is returned when the number of QIDO-RS results exceeds a site configured limit. Some of the matching results that fit in the limit are returned to the QIDO-RS Client along with the status code of 413.

3.2.9.8Connection Policies

3.2.9.8.1 General

QIDO-RS Service Provider supports TLS Client Certificates for its transport level security support. QIDO-RS Service Provider will refuse a connection over TLS from a source that is not signed by a signing certificate the service is configured to allow.

3.2.9.8.2 Security

QIDO-RS Service Provider supports TLS Client Certificates for its transport level security support.

QIDO-RS Service Provider supports site level configuration for Cross Origin Resource Sharing (CORS) which allows the resource to be requested from browsers running web applications served from servers in another domain than the one offering the DICOM RESTful services.

3.2.10 WADO-RS Service Provider Specification

3.2.10.1 Supported Transfer Syntaxes/Media Types

3.2.10.1.1 WADO-RS DICOM Object Transfer Syntaxes Support

The WADO-RS Service Provider supports the following transfer syntaxes for the application/dicom request type, which request DICOM instances:

Table 123: WADO-RS DICOM object transfer syntaxes

Transfer Syntax UID	Description	Media Type / Request Header Accept value
1.2.840.10008.1.2	DICOM Implicit VR Little Endian	application/dicom; transfer-syntax=1.2.840.10008.1.2
1.2.840.10008.1.2.1	DICOM Explicit VR Little Endian	application/dicom; transfer-syntax=1.2.840.10008.1.2.1
Unspecified	Format used is same as how Change Healthcare Image Repository system stored the instances internally. This format will incur the least load on the server as the instances will be able to be transferred without having to convert the format. For WADO-RS Clients that support the formats that the system stores, it is suggested they use this request header accept value to get the best performance.	application/dicom
1.2.840.10008.1.2.2	DICOM Explicit VR Big Endian	application/dicom; transfer-syntax=1.2.840.10008.1.2.2
1.2.840.10008.1.2.4.50	DICOM JPEG Baseline Process 1	application/dicom; transfer-syntax=1.2.840.10008.1.2.4.50
1.2.840.10008.1.2.4.51	DICOM JPEG Extended Process 2 & 4	application/dicom; transfer-syntax=1.2.840.10008.1.2.4.51
1.2.840.10008.1.2.4.57	DICOM JPEG Lossless Proc 14	application/dicom; transfer-syntax=1.2.840.10008.1.2.4.57
1.2.840.10008.1.2.4.70	DICOM JPEG Lossless First Order Prediction	application/dicom; transfer-syntax=1.2.840.10008.1.2.4.70
1.2.840.10008.1.2.4.90	DICOM JPEG 2000 (Lossless Only)	application/dicom; transfer-syntax=1.2.840.10008.1.2.4.90
1.2.840.10008.1.2.4.91	DICOM JPEG 2000	application/dicom; transfer-syntax=1.2.840.10008.1.2.4.91
1.2.840.10008.1.2.5	DICOM RLE	application/dicom; transfer-syntax=1.2.840.10008.1.2.5

3.2.10.1.2 WADO-RS Image Transfer Syntaxes Support

The WADO-RS Service Provider supports the following transfer syntaxes for the image/dicom request type, which requests the pixel data of a DICOM images.

Table 124: WADO-RS Image Transfer Syntaxes

Transfer Syntax UID	Description	Media Type / Request Header Accept value
1.2.840.10008.1.2.4.50	DICOM JPEG Baseline Process 1	image/dicom+jpeg; transfer-syntax=1.2.840.10008.1.2.4.50

Transfer Syntax UID	Description	Media Type / Request Header Accept value
1.2.840.10008.1.2.4.51	DICOM JPEG Extended Process 2 & 4	image/dicom+jpeg; transfer-syntax=1.2.840.10008.1.2.4.51
1.2.840.10008.1.2.4.57	DICOM JPEG Lossless Proc 14	image/dicom+jpeg; transfer-syntax=1.2.840.10008.1.2.4.57
1.2.840.10008.1.2.4.70	DICOM JPEG Lossless First Order Prediction	image/dicom+jpeg; transfer-syntax=1.2.840.10008.1.2.4.70
1.2.840.10008.1.2.4.70	DICOM JPEG Lossless First Order Prediction	image/dicom+jpeg
1.2.840.10008.1.2.4.90	DICOM JPEG 2000 (Lossless Only)	image/dicom+jp2; transfer-syntax=1.2.840.10008.1.2.4.90
1.2.840.10008.1.2.4.90	DICOM JPEG 2000 (Lossless Only)	image/dicom+jp2
1.2.840.10008.1.2.4.91	DICOM JPEG 2000	image/dicom+jp2; transfer-syntax=1.2.840.10008.1.2.4.91
1.2.840.10008.1.2.5	DICOM RLE	image/dicom+rle; transfer-syntax=1.2.840.10008.1.2.5
1.2.840.10008.1.2.5	DICOM RLE	image/dicom+rle

3.2.10.1.3 DICOM Little Endian Media-Type / Transfer Syntax Support

The WADO-RS Service Provider supports returning DICOM binary pixel data (contents of tag (7FE0, 0010))) in Little Endian format when clients send an Accept header with value application/octet-stream.

Table 125: DICOM Little Endian Media-Type / Transfer Syntax

Transfer Syntax UID	Description	Media Type / Request Header Accept value
n/a	Pixel data or frame data or bulk data in little endian format	application/octet-stream

3.2.10.1.4 Retrieve Metadata Media Type Support

Table 126: Retrieve Metadata Media Type Support

Media Type / Request Header Accept value	Description
multipart/related; type=application/dicom+xml or application/json	The returned metadata shall be provided in XML or JSON format.

3.2.10.2 HTTP Status Codes

The HTTP return codes from the Change Healthcare Image Repository implementation of WADO-RS are as follows:

Table 127: WADO-RS HTTP/1.1 STATUS CODES

HTTP Status Code	Name	Description
200	OK	Request completed successfully and has returned all data requested.
206	Partial Content	Request completed and has returned SOME but not ALL of the requested data.

		An example scenario where this response code would be encountered would be if a client requests a study that contains a structured report (not an image), and the only media types they specify they Accept are image types from the tables in the requirements "WADO-RS image transfer syntaxes".
403	Forbidden	Server indicates the client did not present a recognized client certificate when the server is configured to require a client certificate.
404	Not Found	Requested data is not available in online storage. For data that was not online, the WADO-RS Service Provider shall initiate retrieval of the data from archive. If the WADO-RS Client makes the same retrieval request again moments later after the data has been retrieved from archive, the data will be returned and the client should be able to get an HTTP status code of 200 for the subsequent call.
406	Not Acceptable	Accept type, Transfer Syntax or decompression method not supported.
410	Gone	Requested data is not available at all in the system.

3.2.10.3 WADO-RS Retrieve Study

The RetrieveStudy action causes retrieval of the set of DICOM instances associated with a given study unique identifier (UID) that are then used to build the response, which can be DICOM or bulk data depending on the "Accept" type in the HTTP request header, and encapsulated in a multipart MIME response.

3.2.10.3.1 Command

https://mckhost/DICOMRestService/wado/studies/{StudyInstanceUID}

3.2.10.3.2 URL Parameters

StudyInstanceUID – the study instance UID for a single study

3.2.10.3.3 WADO-RS Retrieve Study Options

The WADO-RS service shall support RetrieveStudy requests per the standard, 6.5.1.1

Table 128: Retrieve Study OptionsTable

Options	Description
Allowable request header Accept values	multipart/related;type=application/dicom Specifies that the response can be full DICOM Instances encoded in PS3.10 format. When transfer-syntax is not specified, the server can freely choose which transfer-syntax to use for each Instance (format will be same as what Change Healthcare Image Repository has stored).
	multipart/related; type=application/dicom; transfer-syntax={TransferSyntaxUID} Specifies that the response can be full DICOM Instances encoded in PS3.10 format. The allowed Transfer Syntax UID is any chosen from Table 123
	multipart/related;type=application/octet-stream Uncompressed bulk and pixel data shall be encoded in a Little Endian format using the application/octet-stream media type. See The WADO-RS Service Provider supports returning DICOM binary pixel data (contents of tag (7FE0, 0010))) in Little Endian format when clients send an Accept header with value application/octet-stream.

Options	Description
	Table 125. Specifies that the response includes instance elements with size larger than the bulk data size threshold output as bulk data in Little Endian binary format. DICOM pixel data is output in Little Endian uncompressed format.
	multipart/related; type={MediaType} Specifies that the response can be pixel data encoded using a {MediaType} chosen from Table 124.
SOP Class	SOP Classes supported in Table 14. In addition, the WADOS-RS Service Provider can be configured to exclude instances of specific SOP Classes from the retrieval results.
Size Restriction	Restricted to size supported by Change Healthcare Image Repository .

3.2.10.3.4 WADO-RS Retrieve Study Response

The WADO-RS service shall provide a response for RetrieveStudy, per standard, 6.5.1.2

3.2.10.3.4.1 Response Headers

HTTP status codes include all from The HTTP return codes from the Change Healthcare Image Repository implementation of WADO-RS are as follows:

Table 127.

The HTTP Response contains multi-level headers. The top level HTTP response headers include standard server headers plus a Content-Type of multipart/related with a boundary parameter used to separate the attached parts.

DICOM:

Content Type

multipart/related; type=application/dicom; boundary={MessageBoundary}

Bulk Data:

Content Type

multipart/related; type=application/octet-stream; boundary={MessageBoundary}

multipart/related; type={MediaType}; boundary={MessageBoundary}

Table 129: Part Response Header

Part Response Header	Value
Content-Type	The media type (from table in section 3.2.10.1.1 or 3.2.10.1.2 or 3.2.10.1.3) representing the type of data in the content
Content-Location	1) When Media Type returned is one of those in section 3.2.10.1.1. URL is the same as the associated RESTful retrieve instance call 2) When Media Type returned is one of those in section 3.2.10.1.3. URL value is for a bulk data URL for uncompressed bulk data element encoded in Little Endian binary format in each instance in each series in a specified study. 3) When Media Type returned is one of those in section 3.2.10.1.2, URL value is for a bulk data URL for compressed pixel data for each frame, in each instance in each series in a specified study.

3.2.10.3.4.2 Response Content

Table 130: Response Content

A multipart response where each part contains either
1) Instance binary data for each instance in each series in the specified study in the format specified by the part's Content-Type, when the Content-Type header is a media type chosen from the table "**WADO-RS DICOM object transfer syntaxes**"
2) Binary bulk data or uncompressed pixel data in little endian format for each instance in each series in the specified study, when the Content-Type header is application/octet-stream. See "**DICOM Little Endian Media-Type / Transfer Syntax**"
3) Pixel data for each frame in each instance in each series in the specified study in the format specified by the part's Content-Type, when the Content-Type header is a media type chosen from the table "**WADO-RS Image Transfer Syntaxes**"

NOTE1: A requested transfer syntax of 1.2.840.10008.1.2.4.50 (DICOM JPEG Baseline Process 1) only works when the stored instance is 8 bits deep.

3.2.10.3.5 Retrieve Study Example

Retrieving JPEG 2000 lossy compressed frame data or JPEG 2000 lossless compressed frame data or complete DICOM binary data for each instance in explicit VR little endian format for a study

Example URL: https://mckhost/DICOMRestService/Wado/studies/1.2.3.5

Table 131: Request Headers Sent

Accept	multipart/related; type=image/dicom+jp2; transfer-syntax=1.2.840.10008.1.2.4.91; q=0.9
Accept	multipart/related; type=image/dicom+jp2; transfer-syntax=1.2.840.10008.1.2.4.90; q=0.8
Accept	multipart/related; type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1; q=0.7

NOTE1: For WADO-RS Clients that cannot accept all DICOM formats that the system may have stored the instances internally and thus cannot use "application/dicom" as their most preferred format, the WADO-RS Client will want to explicitly specify the formats that it does support.

For the example, the multiple Accept headers has three entries, the media type of image/dicom+jp2 with transfer syntax JPEG 2000 lossy compression format and "q" [9] parameter set to 0.9, and the media type of image/dicom+jp2 with transfer syntax JPEG 2000 lossless compression format and "q" parameter set to 0.8 and the media type of application/dicom with transfer syntax explicit VR Little Endian and "q" parameter set to 0.7 means that all frames from image instances in the study will be send in JEPG 2000 lossy format, and for any instances that are not images, they will be returned as a full binary blob in explicit VR Little Endian format.

[9] The HTTP 1.1 specification defines the Accept HTTP header as a way for the client to tell the server what media types the client supports. The q parameter is used to tell the server what media types are preferred.

Since Change Healthcare Image Repository understands all three of the WADO-RS Client requested formats, it will respond to the WADO-RS Client using the client's preferred format and will send DICOM instances back to the client using the JPEG 2000 lossy format.

3.2.10.4 WADO-RS Retrieve Series

The RetrieveSeries action causes retrieval of the set of DICOM instances associated with a given study and Series unique identifier (UID) that are then used to build the response, which can be DICOM or bulk data depending on the "Accept" type in the HTTP request header, and encapsulated in a multipart MIME response.

3.2.10.4.1 Command

https://mckhost/DICOMRestService/wado/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}

3.2.10.4.2 URL Parameters

StudyInstanceUID – the study instance UID for a study

SeriesInstanceUID – the series UID for a series that belongs to the specified study

3.2.10.4.3 WADO-RS Retrieve Series Options

The WADO-RS Service Provider shall support RetrieveSeries requests per the standard, 6.5.2.1

Table 132: Retrieve Series Options

Options	Description
Allowable request header Accept values	multipart/related;type=application/dicom Specifies that the response can be full DICOM Instances encoded in PS3.10 format. When transfer-syntax is not specified, the server can freely choose which transfer-syntax to use for each Instance (format will be same as what Change Healthcare Image Repository has stored).
	multipart/related; type=application/dicom; transfer-syntax={TransferSyntaxUID} Specifies that the response can be full DICOM Instances encoded in PS3.10 format. The allowed Transfer Syntax UID is any chosen from Table 123
	multipart/related;type=application/octet-stream Uncompressed bulk and pixel data shall be encoded in a Little Endian format using the application/octet-stream media type. See The WADO-RS Service Provider supports returning DICOM binary pixel data (contents of tag (7FE0, 0010))) in Little Endian format when clients send an Accept header with value application/octet-stream. Table 125. Specifies that the response includes instance elements with size larger than the bulk data size threshold output as bulk data in Little Endian binary format. DICOM pixel data is output in Little Endian uncompressed format.
	multipart/related; type={MediaType} Specifies that the response can be pixel data encoded using a {MediaType} chosen from Table 124.
SOP Class	SOP Classes supported in Table 14 In addition, the WADOS-RS Service Provider can be configured to exclude instances of specific SOP Classes from the retrieval results.

Options	Description
Size Restriction	Restricted to size supported by Change Healthcare Image Repository .

3.2.10.4.4 WADO-RS Retrieve Series Response

The WADO-RS Service Provider shall provide a response for RetrieveSeries, per standard, 6.5.2.2.

3.2.10.4.4.1 Response Headers

HTTP status codes include all from The HTTP return codes from the Change Healthcare Image Repository implementation of WADO-RS are as follows:

Table 127.

The HTTP Response contains multi-level headers. The top level HTTP response headers include standard server headers plus a Content-Type of multipart/related with a boundary parameter used to separate the attached parts.

DICOM:

Content Type

multipart/related; type=application/dicom; boundary={MessageBoundary}

Bulk Data:

Content Type

multipart/related; type=application/octet-stream; boundary={MessageBoundary}

multipart/related; type={MediaType}; boundary={MessageBoundary}

Table 133: Part Response Header

Part Response Header	Value
Content-Type	The media type (from table in section 3.2.10.1.1 or 3.2.10.1.2 or 3.2.10.1.3) representing the type of data in the content
Content-Location	4) When Media Type returned is one of those in section 3.2.10.1.1. URL is the same as the associated RESTful retrieve instance call 5) When Media Type returned is one of those in section 3.2.10.1.3. URL value is for a bulk data URL for uncompressed bulk data element encoded in Little Endian binary format in each instance in a specified series. 4) When Media Type returned is one of those in section 3.2.10.1.2. URL value is for a bulk data URL for compressed pixel data for each frame, in each instance in a specified series.

3.2.10.4.4.2 Response Content

Table 134: Response Content

A multipart response where each part contains either
1) Instance binary data for the instance in the specified Series in the format specified by the part's Content-Type, when the Content-Type header is a media type chosen from the table in "**WADO-RS DICOM object transfer syntaxes**
2) Binary bulk data or uncompressed pixel data in little endian format for the instance in the specified series, when the Content-Type header is application/octet-stream. See "**DICOM Little Endian Media-Type / Transfer Syntax**"
3) Pixel data for each frame in each instance in a specified series, when the Content-Type header is a media type chosen from the table in "**WADO-RS Image Transfer Syntaxes**"

NOTE1: A requested transfer syntax of 1.2.840.10008.1.2.4.50 (DICOM JPEG Baseline Process 1) only works when the stored instance is 8 bits deep.

3.2.10.4.5 Retrieve Series Example

Retrieving JPEG 2000 lossless compressed frame data or complete DICOM binary data for each instance for a Series.

Example URL: https://mckhost/DICOMRestService/Wado/studies/3.4.5/series/2.3.4

Table 135: Request Headers Sent

Accept	multipart/related; type=image/dicom+jp2; transfer-syntax=1.2.840.10008.1.2.4.90
Accept	multipart/related; type=application/dicom; q=0.9

NOTE1: For the example, the multiple Accept headers has two entries, the media type of image/dicom+jp2 with transfer syntax JPEG 2000 lossless compression format and no "q" parameter (equivalent to q= 1.0), and the media type of application/dicom and "q" parameter set to 0.9 means that any image instances will have their pixel data returned with JPEG 2000 lossless compression format and all instances that do not contain pixel data will be returned as a full binary blob in the format that the Change Healthcare Image Repository has the instance stored in.

3.2.10.5 WADO-RS Retrieve Instance

The RetrieveInstance action causes retrieval of the set of DICOM instances associated with a given study, Series, and SOP Instance unique identifier (UID) that are then used to build the response, which can be DICOM or bulk data depending on the "Accept" type in the HTTP request header, and encapsulated in a multipart MIME response.

3.2.10.5.1 Command

https://mckhost/DICOMRestService/wado/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}/instances/{SOPInstanceUID}

3.2.10.5.2 URL Parameters

StudyInstanceUID – the study instance UID for a study

SeriesInstanceUID – the series UID for a series that belongs to the specified study

SOPInstanceUID – the instance UID for an instance in the specified series

3.2.10.5.3 WADO-RS Retrieve Instance Options

The WADO-RS service shall support RetrieveInstance requests per the standard, 6.5.3.1

Table 136: Retrieve Instance Options

Options	Description
Allowable request header Accept values	multipart/related;type=application/dicom Specifies that the response can be full DICOM Instances encoded in PS3.10 format. When transfer-syntax is not specified, the server can freely choose which transfer-syntax to use for each Instance (format will be same as what Change Healthcare Image Repository has stored).
	multipart/related; type=application/dicom; transfer-syntax={TransferSyntaxUID} Specifies that the response can be full DICOM Instances encoded in PS3.10 format. The allowed Transfer Syntax UID is any chosen from Table 123
	multipart/related;type=application/octet-stream Uncompressed bulk and pixel data shall be encoded in a Little Endian format using the application/octet-stream media type. See The WADO-RS Service Provider supports returning DICOM binary pixel data (contents of tag (7FE0, 0010))) in Little Endian format when clients send an Accept header with value application/octet-stream. Table 125. Specifies that the response includes instance elements with size larger than the bulk data size threshold output as bulk data in Little Endian binary format. DICOM pixel data is output in Little Endian uncompressed format.
	multipart/related; type={MediaType} Specifies that the response can be pixel data encoded using a {MediaType} chosen from Table 124.
SOP Class Restrictions	SOP Classes supported in Table 14 In addition, the WADOS-RS Service Provider can be configured to exclude instances of specific SOP Classes from the retrieval results.
Size Restriction	Restricted to size supported by Change Healthcare Image Repository .

3.2.10.5.4 WADO-RS Retrieve Instance Response

The WADO-RS Service Provider shall provide a response for RetrieveInstance, per standard, 6.5.3.2

3.2.10.5.4.1 Response Headers

HTTP status codes include all from The HTTP return codes from the Change Healthcare Image Repository implementation of WADO-RS are as follows:

Table 127.

The HTTP Response contains multi-level headers. The top level HTTP response headers include standard server headers plus a Content-Type of multipart/related with a boundary parameter used to separate the attached parts.

DICOM:

Content Type

multipart/related; type=application/dicom; boundary={MessageBoundary}

Bulk Data:

Content Type

multipart/related; type=application/octet-stream; boundary={MessageBoundary}

multipart/related; type={MediaType}; boundary={MessageBoundary}

Table 137: Part Response Header

Part Response Header	Value
Content-Type	The media type (from table in section 3.2.10.1.1 or 3.2.10.1.2 or 3.2.10.1.3) representing the type of data in the content
Content-Location	6) When Media Type returned is one of those in section 3.2.10.1.1. URL is the same as the associated RESTful retrieve instance call 7) When Media Type returned is one of those in section 3.2.10.1.3. URL value is for a bulk data URL for uncompressed bulk data element encoded in Little Endian binary format for the specified instance. 4) When Media Type returned is one of those in section 3.2.10.1.2. URL value is for a bulk data URL for compressed pixel data for each frame in the specified SOP Instance.

3.2.10.5.4.2 Response Content

Table 138: Response Content

A multipart response where each part contains either
1) Instance binary data for the instance specified in the format specified by the part's Content-Type, when the Content-Type header is a media type chosen from the table in "**WADO-RS DICOM object transfer syntaxes**
2) Binary bulk data or uncompressed pixel data in little endian format for the instance specified, when the Content-Type header is application/octet-stream. See "**DICOM Little Endian Media-Type / Transfer Syntax**"
3) Pixel data for each frame in the specified instance, when the Content-Type header is a media type chosen from the table in "**WADO-RS Image Transfer Syntaxes**"

NOTE1: A requested transfer syntax of 1.2.840.10008.1.2.4.50 (DICOM JPEG Baseline Process 1) only works when the stored instance is 8 bits deep.

3.2.10.5.5 Retrieve Instance Example

Retrieving bulk data or complete DICOM binary data in Little Endian explicit VR specified instance.

Example URL: https://mckhost/DICOMRestService/Wado/studies/3.4.6/series/2.3.5/instances/1.2.3

Table 139: Request Headers Sent

Accept	multipart/related; type=application/octet-stream; q=1.0
Accept	multipart/related; type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1;q=0.9

NOTE1: For WADO-RS Clients that cannot accept all DICOM formats that the system may have stored the instances internally and thus cannot use "application/dicom" as their most preferred format, the WADO-RS Client will want to explicitly specify the formats that it does support.

For the example, the multiple Accept headers sent has two entries, the media type of application/octet-stream and q parameter set to 1.0 and application/dicom media type with transfer syntax set to little endian VR explicit. Since both types are applicable to image and non-image types, the matching instance will be output in the preferred type of octet-stream. All the elements that are larger than the bulk data size threshold will be output in little endian format. If the instance is an image, the pixel data will be uncompressed and output in Little Endian format.

3.2.10.6 WADO-RS Retrieve Frames

The Retrieveframes action causes the retrieval of the DICOM frames associated with a given study, Series, SOP Instance unique identifier (UID) and frame numbers that are then used to build the response, which is pixel data, and encapsulated in a multipart MIME response. The clients should use

the WADO-RS Retrieve Metadata or a QIDO-RS instance level query to get the number of frames (0028,0008) before making this call to retrieve frames.

3.2.10.6.1 Command

https://mckhost/DICOMRestService/wado/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}/instances/{SOPInstanceUID}/frames/{FrameList}

3.2.10.6.2 URL Parameters

StudyInstanceUID – the study instance UID for a study

SeriesInstanceUID – the series UID for a series that belongs to the specified study

SOPInstanceUID – the instance UID for an instance in the specified series

FrameList –Number or list of numbers that are comma separated, representing the set of frames (1 based index) that indicate what frames the client would like from the requested instance.

3.2.10.6.3 WADO-RS Retrieve Frames Options

The WADO-RS service shall support RetrieveFrames requests per the standard, 6.5.4.1.

Table 140: Retrieve Frames Options

Options	Description
Allowable request header Accept values	multipart/related;type=application/octet-stream Specifies that the response can be binary DICOM pixel data for one specific frame in Little Endian uncompressed format.
	multipart/related; type={MediaType} Specifies that the response can be pixel data encoded using a {MediaType} chosen from Table 124
SOP Class Restrictions	SOP Classes supported in Table 14 In addition, the WADOS-RS Service Provider can be configured to exclude instances of specific SOP Classes from the retrieval results.
Size Restriction	Restricted to size supported by Change Healthcare Image Repository .

3.2.10.6.4 WADO-RS Retrieve Frames Response

The WADO-RS service shall provide a response for RetrieveFrames, per standard, 6.5.4.2.

3.2.10.6.4.1 Response Headers

HTTP status codes include all from .

The HTTP Response contains multi-level headers. The top level HTTP response headers include standard server headers plus a Content-Type of multipart/related with a boundary parameter used to separate the attached parts.

Pixel Data

Content Type

multipart/related; type=application/octet-stream; boundary={MessageBoundary}

multipart/related; type={MediaType}; boundary={MessageBoundary}

Table 141: Part Response Header

Part Response Header	Value
Content-Type	The media type (from table in section 3.2.10.1.2 or 3.2.10.1.3) representing the type of data in the content
Content-Location	The URL is the URL for BulkData to retrieve pixel data for the frame when the Media Type returned is one of in section 3.2.10.1.2 or 3.2.10.1.3

3.2.10.6.4.2 Response Content

Table 142: Response Content

A multipart response where each part contains either
4) Pixel data for the requested frames, when the Content-Type header is a media type chosen from the table in "**WADO-RS Image Transfer Syntaxes**"
5) Binary pixel data in little endian format for the frame specified, when the Content-Type header is application/octet-stream. See "**DICOM Little Endian Media-Type / Transfer Syntax**

NOTE1: A requested transfer syntax of 1.2.840.10008.1.2.4.50 (DICOM JPEG Baseline Process 1) only works when the stored instance is 8 bits deep.

3.2.10.6.5 Retrieve Frames Example

Retrieving JPEG baseline 1 compressed or lossy JPEG 2000 compressed middle 5 frames from 40 frame instance

Example URL:

https://mckhost/DICOMRestService/Wado/studies/4.5.6/series/3.4.5/instances/1.2.3/frames/18,19,20,21,22

Table 143: Request Headers Sent

Accept	multipart/related; type=image/dicom+jpeg; transfer-syntax=1.2.840.10008.1.2.4.50
Accept	multipart/related; type=image/dicom+jp2; transfer-syntax=1.2.840.10008.1.2.4.91; q=0.9

NOTE1: The frames/18,19,20,21,22 portion of the URL after the 4.5.6, 3.4.5, 1.2.3 parameters indicate the client wants the middle five frames from the DICOM instance of 40 frames which the client could know because of making a prior WADO Retrieve Metadata or QIDO instance level query (See The types of Matching supported by the QIDO-RS Service Provider

S - indicates Single Value Matching is supported.

R - indicates Range Matching is supported.

* - indicates Wildcard Matching is supported.

U - indicates Universal Matching is supported.

SQ - indicates Sequence Matching is supported.

UNIQUE - indicates that this is the unique key for this query level, in which case universal matching or single value matching is used depending on the query level.

Table 121).

For the example, the multiple Accept headers sent with the first having media type of image/dicom+jpeg and transfer syntax of DICOM JPEG Baseline process 1 and the second sent having media type image/dicom+jp2 and transfer syntax indicating lossy JPEG 2000 indicates the client prefers the 8 bit deep JPEG that would be directly displayable in a browser if the frames are 8 bits deep, otherwise is willing to accept JPEG 2000 lossy compression (if bit

depth is greater than 8). Since the WADO Service Provider supports both media types, the image will be converted to the most preferred type of dicom+jpeg for output. However, if the image turns out to be deeper than 8 bits, then there will be no pixel data returned in the multipart item as the conversion will fail (See 0).

3.2.10.7 WADO-RS Retrieve BulkData

The RetrieveBulkData action causes retrieval of the bulk data for a given bulk data URL that are then used to build the response, which is a single bulk data item. The WADO-RS Clients are expected to retrieve bulk data using a bulk data URL obtained from either a WADO-RS Retrieve Metadata Request or from an includefield in the QIDO-RS query response. The WADO-RS Clients are not expected to create a bulk data URL manually.

3.2.10.7.1 Command

The WADO-RS Client is expected to be getting bulk data URLs from either WADO-RS Retrieve Metadata Request or from an includefield in the QIDO-RS query response.

3.2.10.7.2 WADO-RS Retrieve BulkData Options

The WADO-RS Service Provider shall support the RetrieveBulkdata action type per the standard section 6.5.5.1.

Table 144: Retrieve BulkData Options

Options	Description
Allowable request header Accept values	multipart/related;type=application/octet-stream Specifies that the response can be binary bulk data or DICOM pixel data for one specific frame in Little Endian uncompressed format. See The WADO-RS Service Provider supports returning DICOM binary pixel data (contents of tag (7FE0, 0010))) in Little Endian format when clients send an Accept header with value application/octet-stream. Table 125
	multipart/related; type={MediaType} Specifies that the response is pixel data encoded using a {MediaType} chosen from Table 124. The WADOS-RS clients are expected to use multipart/related; type={MediaType} if they intend to retrieve pixel data in compressed format.
SOP Class	SOP Classes supported in Table 14 In addition, the WADOS-RS Service Provider can be configured to exclude instances of specific SOP Classes from the retrieval results.
Size Restriction	Restricted to size supported by Change Healthcare Image Repository .

3.2.10.7.3 WADO-RS Retrieve BulkData Response

The WADO-RS Service Provider shall provide a response to the RetrieveBulkdata request per the standard, section 6.5.5.2.

3.2.10.7.3.1 Response Headers

HTTP status codes include all from The HTTP return codes from the Change Healthcare Image Repository implementation of WADO-RS are as follows:

Table 127.

The HTTP Response contains multi-level headers. The top level HTTP response headers include standard server headers plus a Content-Type of multipart/related with a boundary parameter used to separate the attached parts.

Pixel Data

Content Type

multipart/related; type=application/octet-stream; boundary={MessageBoundary}

multipart/related; type={MediaType}; boundary={MessageBoundary}

3.2.10.7.3.2 Retrieve BulkData response

Table 145: Part Response Header

Part Response Header	Value
Content-Type	The media type (from table in section 3.2.10.1.2 or 3.2.10.1.3) representing the type of data in the content
Content-Location	8) When Media Type returned is one of those in section 3.2.10.1.3. URL value is for a bulk data URL for uncompressed bulk data element encoded in Little Endian binary format for the specified instance. 6) When Media Type returned is one of those in section 3.2.10.1.2. URL value is for a bulk data URL for compressed pixel data for each frame. In the specified SOP Instance.

3.2.10.7.3.3 Response Content

Table 146: Response Content

A multipart response where each part contains either
1) Pixel data for the specified instance if the media type is the one specified in "WADO-RS Image Transfer Syntaxes" 2) Uncompressed pixel data if an instance was requested and application/octet-stream was the requested media type. See "**DICOM Little Endian Media-Type / Transfer Syntax**" 3) Binary element value if the request was for non-pixel data and application/octet-stream was requested. See "**DICOM Little Endian Media-Type / Transfer Syntax**"

NOTE1: A requested transfer syntax of 1.2.840.10008.1.2.4.50 (DICOM JPEG Baseline Process 1) only works when the stored instance is 8 bits deep.

3.2.10.7.4 Retrieve BulkData Example

Retrieve Frame Increment Pointer (tag (0028,0009)) from a specified instance. Assume the URL is the Bulkdata URL retrieved by the WADO-RS RetrieveMetadata request.

ExampleURL:

https://mckhost/DICOMRestService/Wado/studies/4.5.6/series/3.4.5/instances/1.2.3/attribs/00280009

Table 147: Request Headers Sent

Accept	multipart/related; type=application/octet-stream

3.2.10.8 WADO-RS Retrieve Metadata

The RetrieveMetadata action causes the retrieval of the DICOM instances presented as the full study metadata with the bulk data removed that are then used to build the response, which can be XML or JSON (PS 3.19 or PS 3.18 of the DICOM Standard encoded metadata for the DICOM attributes. The full

study metadata includes all DICOM attributes under a certain size threshold which is determined by the .

3.2.10.8.1 Command

https://mckhost/DICOMRestService/wado/studies/{StudyInstanceUID}/metadata

3.2.10.8.2 URL Parameters

StudyInstanceUID – the study instance UID for a single study

3.2.10.8.3 WADO-RS Retrieve Metadata Options

The WADO-RS Service Provider supports the RetrieveMetadata action type per the standard section 6.5.6.1

Table 148: Retrieve Metadata Options

Options	Description
Allowable request header Accept values	Supported: multipart/related; type=application/dicom+xml application/json; See Table 126
Accept-Encoding	identity (the use of no transformation whatsoever)
SOP Class	SOP Classes supported in Table 14 In addition, the WADOS-RS Service Provider can be configured to exclude instances of specific SOP Classes from the retrieval results.
Size Restriction	Restricted to size supported by Change Healthcare Image Repository .

3.2.10.8.4 WADO-RS Retrieve Metadata Response

The response shall be per WADO-RS standard, sec 6.5.6.2.

3.2.10.8.4.1 Response Headers

HTTP status codes include all from Table 127.

The HTTP Response contains multi-level headers. The top level HTTP response headers include standard server headers plus a Content-Type of multipart/related with a boundary parameter used to separate the attached parts.

Pixel Data

Content Type

multipart/related; type=application/dicom+xml;

application/json;

3.2.10.8.4.2 Retrieve Metadata response

The response shall be per WADO-RS standard, sec 6.5.6.2.

Table : Part Response Header for application/dicom+xml

Part Response Header	Value
Content-Type	application/dicom+xml; charset=utf-8

NOTE1: The "application/json" accept type will not generate a multipart response, so there is no "Part Response Header" for this content type. Multiple results returned in JSON are organized as a single top-level array of JSON objects.

3.2.10.8.4.3 Response Content

Table : Response Content

A multipart response where each part contains
Metadata shall be provided in XML or JSON format

NOTE1: No matter the format the Change Healthcare Image Repository has the data stored as; all binary valued elements are returned in the little endian format.

3.2.10.8.5 Retrieve Metadata Example

Retrieving metadata from study with study UID 1.2.3.4

Example URL: https://mckhost/DICOMRestService/Wado/studies/1.2.3.4/metadata

Table : Request Headers Sent

Accept	multipart/related; type= application/dicom+xml
Accept	application/json; q = 0.8

NOTE1: For the example, the multiple Accept headers has two entries, the media type of application/dicom+xml with no “q” parameter (equivalent to 1.0) and the media type of application/json and “q” parameter set to 0.8 means that the WADO-RS Service Provider will return a multipart response with each part containing the XML document for each instance in the study. If xml format is not accepted, the WADO-RS Service Provider can return JSON array that contains all metadata for the specified Study.

Since Change Healthcare Image Repository understands both WADO-RS Client requested formats, it will respond to the WADO-RS Client using the client’s preferred format.

3.2.10.9 WADO RS Multi-Context Support

The WADO-RS Service Provider supports specifying the context for both Patient ID and Accession Number in the URL for searches.

If the context for the request does not match the context of the study, the accession number returned shall be blank in the WADO-RS response.

For the study's patient, if the patient does not have a patient ID in the context for the request, the patient ID shall be returned as blank.

Example:

https://mckhost/DICOMRestService/wado/Context/<context_code>/studies/1.22.333.4

3.2.10.10 Preference Order For Multiple Accept Headers

The WADO-RS Service Provider supports returning data in a supported format chosen from one of the formats that the client sent in an Accept header.

The format chosen by the WADO-RS Service Provider will be the first format supported that is applicable for the data to be returned from the prioritized client indicated formats.

The WADO-RS Service Provider will interpret the client's priority by using the q value in the HTTPS Accept headers , and then for all formats given that have the same q value, by the order in which the

client lists the formats. Note that if the format does not include a q value, this is equivalent to the client specifying a q value of 1.0."

3.2.10.11 WADO RS Limitations

The WADO-RS Range parameter is not supported.

Accented characters are not supported for case-insensitive searches.

For WADO-RS conversion of an image to a lower bit depth is not supported, due to loss of image fidelity.

For example, a 12-bit image may not be converted to an 8-bit image format.

On-the-fly conversion of proprietary Change Healthcare Image Repository formats to DICOM formats is not supported.

For example, conversion of annotations to GSPS and flagged image information to KIN objects is not supported.

3.2.10.12 Connection Policies

3.2.10.12.1 General

WADO-RS Service Provider supports TLS Client Certificates for its transport level security support. WADO-RS Service Provider will refuse a connection over TLS from a source that is not signed by a signing certificate the service is configured to allow.

3.2.10.12.2 Security

WADO-RS supports SSL Client Certificates for its transport level security support.

WADO-RS Service Provider supports site level configuration for Cross Origin Resource Sharing (CORS) which allows the resource to be requested from browsers running web applications served from servers in another domain than the one offering the DICOM RESTful services.

3.3 Network Interfaces

3.3.1Physical Network Interface

Change Healthcare Image Repository supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

Table 149: Supported Physical Network Interfaces

Ethernet 100baseT
Ethernet 10baseT

3.3.2Additional Protocols

Change Healthcare Image Repository conforms to the System Management Profiles listed in the Table below. All requested transactions for the listed profiles and actors are supported. Support for optional transactions is listed in the Table below:

Table 150: Supported System Management Profiles

Profile Name	Actor	Protocols Used	Optional Transactions	Security Support
Network Address Management	DHCP Client	DHCP	N/A	N/A
	DNS Client	DNS	N/A	N/A
Time Synchronization	NTP Client[10]	NTP	N/A	N/A

3.3.2.1DHCP

DHCP can be used to obtain TCP/IP network configuration information. The network parameters obtainable via DHCP are shown in the Table below. The Default Value column of the table shows the default used if the DHCP server does not provide a value. Values for network parameters set in the Service/Installation tool take precedence over values obtained from the DHCP server. Support for DHCP can be configured via the Service/Installation Tool. The Service/Installation tool can be used to configure the machine name. If DHCP is not in use, TCP/IP network configuration information can be manually configured by Change Healthcare Services or Installation staff.

Table 151: Supported DHCP Parameters

[10] Change Healthcare Image Repository uses NetTime™ 2.0 for time synchronization, which uses NTP.

DHCP Parameter	Default Value
IP Address	None
Hostname	Requested machine name
List of NTP servers	Empty list
List of DNS servers	Empty list
Routers	Empty list
Static routes	None
Domain name	None
Subnet mask	Derived from IP Address (see service manual)
Broadcast address	Derived from IP Address (see service manual)
Default router	None
Time offset	Site configurable (from Time Zone)
MTU	Network Hardware Dependent
Auto-IP permission	No permission

3.3.2.2DNS

DNS can be used for address resolution. If DHCP is not in use or the DHCP server does not return any DNS server addresses, the identity of a DNS server can be configured via the Service/Installation Tool. If a DNS server is not in use, local mapping between hostname and IP address can be manually configured by Change Healthcare Services or Installation staff.

3.4 Configuration

3.4.1AE Title/Presentation Address Mapping

3.4.1.1Local AE Titles

All Change Healthcare Image Repository Application Entities use configured AE Titles and TCP/IP Ports. These are assigned default values at the time of installation; However, these can be modified. The AE Title used by each individual application can be configured independently of the AE Title used by other applications on an individual Change Healthcare Image Repository system.

By default, all Application Entities that only act as an Association Requestor are given the same AE Title, whereas those that can act as an Association Acceptor are all given unique AE Titles. It is possible to assign all Change Healthcare Image Repository applications the same AE Title. However, this is not recommended as a single Change Healthcare Image Repository system has multiple DICOM TCP/IP listening ports and associating multiple listening ports with a single AE Title can result in connectivity problems with other systems.

Table 152: AE Title Configuration

Application Entity	Default AE Title	Default TCP/IP Port
Sender	ALI_SCU	Not Applicable
Importer	ALI_STORE_SCP	4000
Query/Retrieve Server	ALI_QUERY_SCP	5000

Query/Retrieve Client	ALI_SCU	Not Applicable
Modality Worklist Client	ALI_SCU	Not Applicable
External Notifier	ALI_SCU	Not Applicable
Event Handler	ALI_EVENT_SCP	6000
Storage Commitment Client	ALI_EVENT_SCP	6000

3.4.1.2Remote AE Title/Presentation Address Mapping

The AE Title, host names and port numbers of remote applications can be configured in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff.

3.4.1.2.1 Sender AE

The AE Titles, TCP/IP port-numbers, and host-names for the remote Storage SCPs must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff. Multiple remote Storage SCPs can be defined.

3.4.1.2.2 Importer AE

The AE Titles, TCP/IP port-numbers, host-names and capabilities for the remote Storage SCUs and Storage Commitment Push Model SCUs must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff.

The Importer AE can be configured to only accept Associations from systems having specific host-names. The Importer AE cannot presently be configured to check the Calling and Called AE Titles.

3.4.1.2.3 Query/Retrieve Server AE

The AE Titles, TCP/IP port-numbers, host-names and capabilities for the remote Query/Retrieve SCUs, Storage SCPs (C-MOVE Destination AEs), and Modality Worklist SCUs must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff. In addition, a mapping must be configured that links a possible C-MOVE Destination AE Title with a specific Presentation Address (host-name and TCP/IP port-number). Otherwise, the Query/Retrieve Server AE will not know where to send the SOP Instances in response to a C-MOVE Request.

The Query/Retrieve Server AE can be configured to only accept Associations from systems having specific host-names. The Query/Retrieve Server AE cannot presently be configured to check the Calling and Called AE Titles.

3.4.1.2.4 Query/Retrieve Client AE

The AE Titles, TCP/IP port-numbers, and host-names for the remote Query/Retrieve SCPs must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff. Multiple remote Query/Retrieve SCPs can be defined.

3.4.1.2.5 Modality Worklist Client AE

The AE Titles, TCP/IP port-numbers, and host-names for the remote Modality Worklist SCPs must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff. Only a single Modality Worklist SCP can be defined per Change Healthcare Image Repository system.

3.4.1.2.6 External Notifier AE

The AE Titles, TCP/IP port-numbers, and host-names for the Modality Performed Procedure Step SCPs, must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff. Multiple remote AEs for each supported SOP Class can be defined.

3.4.1.2.7 Event Handler AE

The AE Titles, TCP/IP port-numbers, host-names and capabilities for the remote Modality Performed Procedure Step SCUs must be defined in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff.

The Query/Retrieve Server AE can be configured to only accept Associations from systems having specific host-names. The Query/Retrieve Server AE cannot presently be configured to check the Calling and Called AE Titles.

3.4.1.2.8 Storage Commitment Client AE

The AE Titles, TCP/IP port-numbers, and host-names for the remote Storage Commitment SCPs must be defined in the Image Repository configuration files by Change Healthcare Services or Installation staff.

3.4.2Configurable Parameters

A large number of parameters related to acquisition and general operation can be specified in the Change Healthcare Image Repository configuration files by Change Healthcare Services or Installation staff. The Table below only shows those configuration parameters relevant to DICOM communication. Users of Change Healthcare Image Repository must contact Change Healthcare Services or Installation personnel if they wish to change any of these settings.

Table 153: Configuration Parameters

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
Maximum Exported PDU Size (Larger PDUs will never be sent, even if the receiver supports a larger Max PDU Receive Size. If the receiver supports a smaller Max PDU Receive Size, then the Max PDU Send Size will be reduced accordingly for the duration of the Association. Max PDU Receive Size information is exchanged during DICOM Association Negotiation in the Maximum Length Sub-Item of the A-ASSOCIATION-RQ and A-ASSOCIATE-AC)	No	232
Time-out waiting for an acceptance or rejection response to an Association Request (Application Level Timeout)	No	180s
Time-out waiting for a response to an Association release request (Application Level Timeout)	No	180s
Time-out waiting for completion of a TCP/IP connect request (Low-level timeout)	No	180s
Time-out awaiting a Response to a DIMSE Request (Low-Level Timeout)	No	180s
Time-out for waiting for data between TCP/IP-packets (Low Level Timeout)	No	180s
Sender AE Parameters		
Supported SOP Classes	Yes	SOP Classes listed in

		Table 4: SOP Class Conformance of Sender AE
Supported Transfer Syntaxes	Yes	Transfer Syntaxes listed in Table 4. Each proposed Presentation Context contains a single Transfer Syntax. Multiple Transfer Syntaxes per abstract syntax would be proposed with multiple Presentation Contexts. Table 9: Sender AE Proposed Transfer Syntaxes.
Level of tracing for Service Logs (LOW, MEDIUM, HIGH). HIGH means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	HIGH
Remote Modality Worklist SCP AE to be queried by Modality Worklist Client AE. Includes AE Title, host-name, TCP/IP port number, etc.	Yes	NONE
Time-out waiting for a response to a C-STORE-RQ	No	180s
Number of Sender AE application instances that send to a single Storage SCP Remote AE.	Yes	1
Number of times a failed send job may be retried	Yes	20
Number of times a failed send job may be retried before demoting the send job's priority	Yes	5
CompressImage Attempt to compress all images before exporting them. If set to 'YES', and neither JPEG Lossy or Wavelet compression is enabled then the images will be JPEG Lossless compressed.	Yes	NO
ConvertLosslessToLossy If both this parameter and 'CompressImage' are configured to be 'YES', then the Sender AE will attempt to JPEG Lossy compress images before exporting them using 'CompressionRatio' and 'CineCompressionRatio'.	Yes	NO
ConvertLosslessToWavelet If both this parameter and 'CompressImage' are configured to be 'YES', then the Sender AE will attempt to Wavelet compress images before exporting them using 'CompressionRatio' and 'CineCompressionRatio'. If Wavelet compression fails and 'ConvertLosslessToLossy' is 'YES', then Sender AE will attempt to JPEG Lossy compress images before exporting them.	Yes	NO
ExcludeWaveletForModalities If 'ConvertLosslessToWavelet' is YES, then the images of modalities contained in this list will not be wavelet compressed.	Yes	US, XA
The desired lossy compression ratio for single frame images	Yes	10 : 1
The desired lossy compression ratio for cine images	Yes	30 : 1
Modify or add a configurable set of DICOM Elements in a SOP Instance before it is exported. The set of Elements and the values to assign them are also configurable.	Yes	NO
Process and send any cine files to Remote AE, including decompression if necessary.	Yes	YES

Importer AE Parameters		
Supported SOP Classes	Yes	SOP Classes listed in Table 14: SOP Class Conformance of Importer AE
Supported Transfer Syntaxes	Yes	Transfer Syntaxes listed in Table 24: Importer AE Accepted Transfer Syntaxes
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). HIGH means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	HIGH
Allow any Remote AE on another system to open an Association with the Importer AE. Enable only for demonstration purposes.	Yes	NO
List of host-names that are allowed to open an Association with the Importer AE.	Yes	NONE
Time-out waiting for a response to an N-ACTION-RQ or N-EVENT-RQ	No	180s
Number of Associations that can be active per Remote AE host.	Yes	10
Time to wait on an open Association for the next command (i.e. max time to wait for first C-STORE-RQ after a new Association has been opened).	Yes	3600s
Compression type to be used on received single frame images of a specific Modality Type	Yes	JPEG Lossless (US, CT, MR, CR, NM, RF) NONE (XA)
Compression type to be used on received multi-frame images of a specific Modality Type	Yes	NONE (US)
Compression type to be used if one is not defined for the type of Modality of an image.	Yes	JPEG Lossless
The desired lossy compression ratio for single frame images	Yes	10 : 1
The desired lossy compression ratio for cine images	Yes	30 : 1
List of host-names for which the original SOP Instance UID should be kept even though the images are lossy compressed.	Yes	NONE
Allow a Warning Status Code value to be returned in C-STORE-RSP.	Yes	NO
Create new SOP Instance UIDs for SOP Instances received from the specified Remote AE host-names.	Yes	NO
Receive and parse DICOM SOP Instances in memory rather than immediately writing each received PDU to a file (increases throughput performance but uses more memory resources).	Yes	YES
List of host-names that the Importer AE should always request a new Association with when sending a Storage Commitment N-EVENT-REPORT Request.	Yes	NONE
List of modalities to create a DICOMDIR for each group of SOP Instances received over an Association.	Yes	NONE
Query/Retrieve Server AE		
Supported SOP Classes as an SCU	Yes	SOP Classes listed in Table 14: SOP Class Conformance of Importer AE
Supported Transfer Syntaxes as an SCU	Yes	Transfer Syntaxes listed in Table 24: Importer AE Accepted Transfer Syntaxes

Supported Presentation Contexts as an SCP	Yes	Presentation Contexts listed in Table 41: Query/Retrieve Server AE Accepted Presentation Contexts
Enable IHE Image Manager compliance (full support for Image Level queries and return of additional Elements).	Yes	NO
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). APP means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	HIGH
Allow any Remote AE on another system to open an Association with the Query/Retrieve Server AE. Enable only for demonstration purposes.	Yes	NO
List of host-names that are allowed to open an Association with the Query/Retrieve Server AE.	Yes	NONE
Time to wait on an open Association for the next command (i.e. max time to wait for first C-FIND-RQ after a new Association has been opened).	Yes	600s
Allow queries with no identifier Attribute values	Yes	NO
Permit Image Level queries	Yes	NO
Whether the Requestor's AE title should be matched against the C-MOVE Destination AE title. If YES, and if the AE Titles are identical, then matching images will be routed to the Requestor's host. If NO, the C-MOVE Destination AE to Host Mapping table (listed below) will be used to resolve AE titles.	Yes	YES
C-MOVE Destination AE to Host Mapping table (Provides AE Title, TCP/IP port number, and host-name for C-MOVE Destination AEs).	Yes	NONE
Number of Associations that can be active per Remote AE host.	Yes	10
List of remote C-MOVE Destination AEs for which images will be compressed before export. If compression is enabled then JPEG Lossless will be used unless some other type is enabled.	Yes	NONE
List of remote C-MOVE Destination AEs for which images will be JPEG Lossy compressed before export.	Yes	NONE
List of remote C-MOVE Destination AEs for which images will be Wavelet compressed before export.	Yes	NONE
The desired lossy compression ratio for single frame images	Yes	10 : 1
The desired lossy compression ratio for cine images	Yes	30 : 1
Check for Cancel Requests from Remote AE	Yes	NO
List of remote AE Titles to which cine files should not be sent.	Yes	NONE
Query/Retrieve Client AE		
Supported Presentation Contexts as an SCU	Yes	Presentation Contexts listed in Table 58: Query/Retrieve Client AE Proposed Presentation Contexts
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). APP means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	HIGH
Remote Query/Retrieve SCP AEs to be queried by Query/Retrieve Client AE. Includes AE Title, host-name, TCP/IP port number, etc.	Yes	NONE

Maximum number of query matches to be returned before Query/Retrieve Client AE issues a Cancel Request.	Yes	500
Modality Worklist Client AE		
Supported Presentation Contexts as an SCU	Yes	Presentation Contexts listed in Table 73: Modality Worklist Client AE Proposed Presentation Contexts
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). APP means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	APP
Remote Modality Worklist SCP AE to be queried by Modality Worklist Client AE. Includes AE Title, host-name, TCP/IP port number, etc.	Yes	NONE
Time interval between queries of Modality Worklist SCP.	Yes	900s
Maximum number of query matches to be returned before Query/Retrieve Client AE issues a Cancel Request.	Yes	200
Time interval, in seconds, to wait for the Modality Worklist SCP to return a C-FIND-RSP.	Yes	120s
External Notifier AE		
Supported Presentation Contexts as an SCU	Yes	Presentation Contexts listed in Table 82: External Notifier AE Proposed Presentation Contexts
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). APP means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	HIGH
Remote DICOM AE to be notified (AE Title, host-name, TCP/IP port number, etc.).	Yes	NONE
Number of times to retry sending a notification after a failure.	Yes	10
Time to wait before retrying a notification after a failure occurs.	Yes	60s
Event Handler AE		
Supported Presentation Contexts as an SCP	Yes	Presentation Contexts listed in Table 93: Event Handler AE Accepted Presentation Contexts
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). APP means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	Yes	HIGH
Time to wait on an open Association for the next command (i.e. max time to wait for first C-FIND-RQ after a new Association has been opened).	Yes	300s
Number of Associations that can be active per Remote AE host.	Yes	10
Allow any Remote AE on another system to open an Association with the Event Handler AE. Enable only for demonstration purposes.	Yes	NO
List of host-names that are allowed to open an Association with the Event Handler AE.	Yes	NONE
List of host-names that are allowed to send Messages to Event Handler AE to mark a Study as being Reported.	Yes	NONE
List of host-names that are allowed to send MPPS Messages to Event Handler AE.	Yes	NONE

Storage Commitment Client AE		
Supported Presentation Contexts as an SCU	NO	Presentation Contexts listed in Table 105
Supported Presentation Contexts as an SCP	YES	Presentation Contexts listed in The Importer AE will accept any Presentation Context containing: 3. An abstract syntax selected from Table 14 4. One or more Transfer Syntaxes selected from Table 24 The Storage Commitment Client AE will accept Presentation Contexts (For N-EVENT-REPORT) as shown in the following table: Table 110
Level of tracing for Service Logs (LOW, MEDIUM, HIGH, APP). APP means the least amount of tracing. LOW means the most amount of tracing, including output of all DICOM Message content to the Service Logs.	YES	HIGH
Time to wait on an open Association for the next command (i.e. max time to wait for first C-FIND-RQ after a new Association has been opened).	YES	300s
Number of Associations that can be active per Remote AE host.	YES	10
Allow any Remote AE on another system to open an Association with the Storage Commitment Client AE – Listener is Event Handler AE.	YES	NO
List of host-names that are allowed to open an Association with the Storage Commitment Client AE – Listener is Event Handler AE.	YES	NONE
Determine if the Storage Commit Client AE should wait for the N-EVENT-REPORT on the N-ACTION-RQ association (WAIT_FOR_RESULT)	YES	YES
Specifies the delay time (in second) before the agent should start processing the Storage Commitment request for a job (START_DELAY)	YES	900s
Specifies the time (in second) to wait for the N-EVENT-REPORT result (RESULT_TIMEOUT)	YES	3600s
Specifies the number of retries before expiring the job (RETRY_LIMIT)	YES	3
Specifies the delay time in minutes before a job will be re-tried (RETRY_DELAY).	YES	1800s

4 Media Interchange

4.1 Implementation Model

4.1.1Application Data Flow

Figure 10: Change Healthcare Image Repository DICOM Media Data Flow Diagram



The Removable Media AE can import DICOM files from removable media. A user of Change Healthcare Image Repository can choose to import all DICOM files for a specified study. It is not possible to choose to import only particular SOP Instance files or all the files belonging to a particular patient or series.

4.1.2Functional Definitions of AEs

4.1.2.1Removable Media AE

The user can select access to removable media present in the system's media drive. They will then be prompted to choose which studies they wish to import into the system. The system then passes control to the Removable Media AE to actually read from the DICOM removable media.

4.2 AE Specifications

4.2.1Removable Media AE Specification

The Removable Media AE provides standard Conformance to the DICOM Interchange Option of the Media Storage Service Class. Support for a particular Application Profile and role is dependent upon the type of removable media hardware with which the system is equipped. The table below lists all the Application Profiles and roles that can possibly be supported:

Table 154: Supported Application Profiles, Activities, and Roles

Application Profile	Real World Activity	FSR[11]	FSC	FSU
STD-GEN-CD	General Purpose CD-R Interchange	YES	NO	NO
STD-US-ID-SF-CDR	Ultrasound Image Display Media Interchange, CD-R.	YES	NO	NO
STD-US-SC-SF-CDR	Ultrasound Image Spatial Calibration Media Interchange, CD-R.	YES	NO	NO
STD-US-CC-SF- CDR	Ultrasound Image Combined Calibration Media Interchange, CD-R.	YES	NO	NO
STD-US-ID-MF- CDR	Ultrasound Image and Multi-frame Image Display Media Interchange, CD-R.	YES	NO	NO
STD-US-SC-MF- CDR	Ultrasound Image and Multi-frame Image Spatial Calibration Media Interchange, CD-R.	YES	NO	NO
STD-US-CC-MF- CDR	Ultrasound Image and Multi-frame Image Combined Calibration Media Interchange, CD-R.	YES	NO	NO
STD-US-ID-SF-MOD128	Ultrasound Image Display Media Interchange, 128MB MOD.	YES	NO	NO
STD-US-SC-SF-MOD128	Ultrasound Image Spatial Calibration Media Interchange, 128MB MOD.	YES	NO	NO
STD-US-CC-SF-MOD128	Ultrasound Image Combined Calibration Media Interchange, 128MB MOD.	YES	NO	NO
STD-US-ID-MF-MOD128	Ultrasound Image and Multi-frame Image Display Media Interchange, 128MB MOD.	YES	NO	NO
STD-US-SC-MF-MOD128	Ultrasound Image and Multi-frame Image Spatial Calibration Media Interchange, 128MB MOD.	YES	NO	NO
STD-US-CC-MF-MOD128	Ultrasound Image and Multi-frame Image Combined Calibration Media Interchange, 128MB MOD.	YES	NO	NO
STD-US-ID-SF-MOD230	Ultrasound Image Display Media Interchange, 230MB MOD.	YES	NO	NO
STD-US-SC-SF-MOD230	Ultrasound Image Spatial Calibration Media Interchange, 230MB MOD.	YES	NO	NO
STD-US-CC-SF-MOD230	Ultrasound Image Combined Calibration Media Interchange, 230MB MOD.	YES	NO	NO
STD-US-ID-MF-MOD230	Ultrasound Image and Multi-frame Image Display Media Interchange, 230MB MOD.	YES	NO	NO
STD-US-SC-MF-MOD230	Ultrasound Image and Multi-frame Image Spatial Calibration Media Interchange, 230MB MOD.	YES	NO	NO
STD-US-CC-MF-MOD230	Ultrasound Image and Multi-frame Image Combined Calibration Media Interchange, 230MB MOD.	YES	NO	NO
STD-US-ID-SF-MOD540	Ultrasound Image Display Media Interchange, 540MB MOD.	YES	NO	NO

[11] For the system to act as an FSR of an Application Profile it must be equipped with the necessary hardware option for reading from the specified media. This is not a standard feature of all Change Healthcare Image Repository systems.

STD-US-SC-SF-MOD540	Ultrasound Image Spatial Calibration Media Interchange, 540MB MOD.	YES	NO	NO
STD-US-CC-SF-MOD540	Ultrasound Image Combined Calibration Media Interchange, 540MB MOD.	YES	NO	NO
STD-US-ID-MF-MOD540	Ultrasound Image and Multi-frame Image Display Media Interchange, 540MB MOD.	YES	NO	NO
STD-US-SC-MF-MOD540	Ultrasound Image and Multi-frame Image Spatial Calibration Media Interchange, 540MB MOD.	YES	NO	NO
STD-US-CC-MF-MOD540	Ultrasound Image and Multi-frame Image Combined Calibration Media Interchange, 540MB MOD.	YES	NO	NO
STD-US-ID-SF-MOD640	Ultrasound Image Display Media Interchange, 640MB MOD.	YES	NO	NO
STD-US-SC-SF-MOD640	Ultrasound Image Spatial Calibration Media Interchange, 640MB MOD.	YES	NO	NO
STD-US-CC-SF-MOD640	Ultrasound Image Combined Calibration Media Interchange, 640MB MOD.	YES	NO	NO
STD-US-ID-MF-MOD640	Ultrasound Image and Multi-frame Image Display Media Interchange, 640MB MOD.	YES	NO	NO
STD-US-SC-MF-MOD640	Ultrasound Image and Multi-frame Image Spatial Calibration Media Interchange, 640MB MOD.	YES	NO	NO
STD-US-CC-MF-MOD640	Ultrasound Image and Multi-frame Image Combined Calibration Media Interchange, 640MB MOD.	YES	NO	NO

In addition to supporting these Application Profiles, the Removable Media AE can act as an FSR for the DICOM Interchange Option of the Media Storage Service Class for any of the Media Storage Standard SOP Classes listed in Table 155. The system can be configured to support any of the following media types: CD-R, 90mm MODs of 128MB, 230MB, 540MB, or 640MB capacity.

Table 155: Media Storage Standard SOP Classes Supported by the Removable Media AE

DICOM SOP Class Name	SOP Class UID	FSR	FSC
12-lead ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
Ambulatory ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Basic Voice Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Cardiac Electrophysiology Waveform	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Yes	No
Comprehensive Structured Report	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Mammography CAD Structured Report	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
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	No
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	Yes	No
CT Image	1.2.840.10008.5.1.4.1.1.2	Yes	No
Digital X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.2	Yes	No

DICOM SOP Class Name	SOP Class UID	FSR	FSC
Digital Mammography Image (Processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Digital Intra-oral X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Hardcopy Color Image	1.2.840.10008.5.1.1.30	Yes	No
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	Yes	No
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
MR Image	1.2.840.10008.5.1.4.1.1.4	Yes	No
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Yes	No
Nuclear Medicine Image (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	No
Positron Emission Tomography Image	1.2.840.10008.5.1.4.1.1.128	Yes	No
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	No
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Yes	No
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Yes	No
Stand-alone Curve	1.2.840.10008.5.1.4.1.1.9	Yes	No
Stand-alone Modality LUT	1.2.840.10008.5.1.4.1.1.10	Yes	No
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Yes	No
Stand-alone VOI LUT	1.2.840.10008.5.1.4.1.1.11	Yes	No
Standalone PET Curve	1.2.840.10008.5.1.4.1.1.129	Yes	No
Stored Print	1.2.840.10008.5.1.1.27	Yes	No
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Image (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	No
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Ultrasound Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No
VL Endoscopic Image	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No

DICOM SOP Class Name	SOP Class UID	FSR	FSC
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
VL Image (Retired)	1.2.840.10008.5.1.4.1.1.77.1	Yes	No
VL Multi-frame Image (Retired)	1.2.840.10008.5.1.4.1.1.77.2	Yes	No
X-Ray Angiographic Bi-Plane Image (retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	No
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
X-Ray Radiation Dose Structured Report	1.2.840.10008.5.1.4.1.1.88.67	Yes	No
12-lead ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
Ambulatory ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Basic Voice Audio Waveform	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Cardiac Electrophysiology Waveform	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Yes	No
Comprehensive Structured Report	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Mammography CAD Structured Report	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
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	No
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	Yes	No
CT Image	1.2.840.10008.5.1.4.1.1.2	Yes	No
Digital X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography Image (Processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Digital Intra-oral X-Ray Image (Presentation)	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image (Processing)	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Hardcopy Color Image	1.2.840.10008.5.1.1.30	Yes	No
Hardcopy Grayscale Image	1.2.840.10008.5.1.1.29	Yes	No
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
MR Image	1.2.840.10008.5.1.4.1.1.4	Yes	No
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Yes	No
Nuclear Medicine Image (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	No

DICOM SOP Class Name	SOP Class UID	FSR	FSC
Positron Emission Tomography Image	1.2.840.10008.5.1.4.1.1.128	Yes	No
Raw Data	1.2.840.10008.5.1.4.1.1.66	Yes	No
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Yes	No
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Yes	No
Stand-alone Curve	1.2.840.10008.5.1.4.1.1.9	Yes	No
Stand-alone Modality LUT	1.2.840.10008.5.1.4.1.1.10	Yes	No
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Yes	No
Stand-alone VOI LUT	1.2.840.10008.5.1.4.1.1.11	Yes	No
Standalone PET Curve	1.2.840.10008.5.1.4.1.1.129	Yes	No
Stored Print	1.2.840.10008.5.1.1.27	Yes	No

4.2.1.1File Meta Information for the Application Entity

The Source Application Entity Title included in the File Meta Header is configurable (see section 4.4).

4.2.1.2 Real-World Activities

4.2.1.2.1 Activity – User Imports Files from Removable Media

The Removable Media AE can be used as a File Set Reader (FSR): The user inserts DICOM Removable Media into the system and accesses the DICOM Part 10 format files already written to it. The user will be presented with the list of studies present on the media and can then choose to transfer one or more of these to the Change Healthcare Image Repository database. According to the DICOM Interchange Option of the Media Storage Service Class, a DICOMDIR shall be included in the DICOM removable Media. The Removable Media AE uses the information from the DICOMDIR to determine the study information for import. But if no DICOMDIR exists, the Change Healthcare Image Repository Removable Media AE will create a virtual DICOMDIR file from the DICOM files in the directory.

4.2.1.3 Options

In addition to the Media Storage Directory Storage SOP Class listed below, the Removable Media Application Entity supports all the SOP Classes listed in Table 155 and Transfer Syntaxes listed in Table 9: Sender AE Proposed Transfer Syntaxes. It can import any DICOM file having a combination of one of the SOP Classes and one of Transfer Syntaxes supported by the Sender AE.

Table 156: Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax	
Name	**UID**	**Name**	**UID**
Media Storage Directory Storage	1.2.840.10008.1.3.10	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1
All combinations of SOP Classes listed in Table 155: Media Storage Standard SOP Classes Supported by the Removable Media AE and Transfer Syntaxes listed in Table 9: Sender AE Proposed Transfer Syntaxes..			

4.3 Augmented and Private Application Profiles

The Removable Media AE does not support any augmented or private Application Profiles.

4.4 Media Configuration

All local applications use the AE Titles configured via the Service/Installation Tool. The Application Entity Titles configurable for Media Services are listed in the Table below:

Table 157: AE Title Configuration

Parameter	Configurable (Yes/No)	Default Value
Removable Media AE	No	ALI_STORE_SCP

5 Support for Extended Character Sets

Change Healthcare Image Repository supports the ISO-IR 100 Latin-1 supplementary character set and includes this value for the Specific Character Set Attribute (0008,0005).

6 SECURITY

It is assumed that Change Healthcare Image Repository is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to Change Healthcare Image Repository.
- Firewall or router protections to ensure that Change Healthcare Image Repository only has network access to approved external hosts and services.
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN))

For QIDO-RS and WADO-RS RESTful operations supported by Change Healthcare Image Repository, TLS Client Certificates can be used to secure/restrict access to private information (See QIDO-RS Security 3.2.9.8.2 and WADO-RS Security 0).

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

7 ANNEXES

7.1 IOD Contents

7.1.1Importer AE Standard Element Use

7.1.1.1 Significant Elements in Received Images

The following Elements of Composite SOP Instances received by the Importer AE are either stored to the permanent Change Healthcare Image Repository database or are of particular importance in the received images:

Table 158: Significant Elements in Received Images

Module	Attribute Name	Tag ID	Significance
Patient	Patient Name	(0010,0010)	- Importing SCP can be configured to apply a default value if there is no value specified. - Value is saved to database as separate first and last names. Only first and last names are entered in the Change Healthcare Image Repository database. - Names will be parsed correctly if they are in the format of 'lname^fname' or 'lname, fname'. If space separation is used (i.e. 'lname fname'), then the entire name will be treated as the last name. - Change Healthcare Image Repository can be configured to convert all names to uppercase only.
	Patient ID	(0010,0020)	- Importing SCP can be configured to apply a default value if there is no value specified. - The Patient ID must be unique. - Verification on incoming Patient IDs is performed. If an ID already exists but the existing name does not match, then the ID is coerced to the form '<original ID>+1'. - Value is saved to database.
	Issuer of Patient ID	(0010,0021)	For MIMA support only. Used to determine the Patient ID Context Can be configured by Source. If the issuer Of Patient ID is not available, Change Healthcare Image Repository can use AE Title in combination with the hostname to determine the patient context. This is configurable by source.
	Other Patient IDs Sequence	(0010,1002)	For MIMA Support only. Used to convey known patient identifiers for the patient. Used for Patient Matching.
	>Patient ID	(0010,0020)	
	>Issuer of Patient ID	(0010,0021)	
	Patient's Birth Date	(0010,0030)	- Importing SCP can be configured to apply a default value if there is no value specified. Value is saved to database.

	Patient's Sex	(0010,0040)	- First character must be 'M', 'm', 'F', 'f', 'O', or 'o'. If a different value or not specified then will be entered in the database as 'U', unknown. - Value is saved to database. (The value 'U' is for internal use only, and is updated to 'O' on export).
General Study	Study Date	(0008,0020)	- Importing SCP can be configured to apply a default value if there is no value specified. - Value is saved to database.
	Accession Number	(0008,0050)	- Importing SCP can be configured to apply a default value if there is no value specified. - Value is saved to database.
	Issuer of Accession Number Sequence	(0008,0051)	For MIMA Support. Used to identify the Assigning Authority that issued the Accession Number. Used to identify the Study Context in PACS. Can be configured by Source. If the issuer Of Accession Number Sequence is not available, Change Healthcare Image Repository can use AE Title in combination with the hostname to determine the Study context. This is configurable by source.
	>Local Namespace Entity ID	(0040,0031)	
	>Universal Entity ID	(0040,0032)	
	>Universal Entity ID Type	(0040,0033)	
	Referring Physician's Name	(0008,0090)	- Value is saved to database.
	Study Description	(0008,1030)	- Importer AE can be configured to use the Study Description value for the 'exam type' of the received study. If so configured and the value matches value(s) in the Change Healthcare Image Repository exam type database, then it will be saved to the database as an exam type.
	Study Instance UID	(0020,000D)	- Must be provided. - Value is saved to database.
General Series	Series Description	(0008,103E)	- Importer AE can be configured to use the Series Description value for the 'exam type' of the received study. If so configured and the value matches value(s) in the Change Healthcare Image Repository exam type database, then it will be saved to the database as an exam type.
	Modality	(0008,0060)	- Importer AE can be configured to apply a default value if there is no value specified.
	Operator's Name	(0008,1070)	- If name matches a valid User of Change Healthcare Image Repository , then it will be saved to the database as the sonographer of an ultrasound modality series.
	Institution Name	(0008,0080)	For MIMA Support Only. Used to convey the institution where the SOP Instance was created.
	Institution Code Sequence	(0008,0082)	For MIMA Support Only. Used to convey the institution where the SOP Instance was created.
	>Code Value	(0008,0100)	
	>Coding Scheme Designator	(0008,0102)	
	>Coding Scheme Version	(0008,0103)	Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously. May be present otherwise.
	>Code Meaning	(0008,0104)	

	Body Part Examined	(0018,0015)	- Importer AE can be configured to use the Body Part Examined value for the 'exam type' of the received study. If so configured and the value matches value(s) in the Change Healthcare Image Repository exam type database, then it will be saved to the database as an exam type.
General Image	Image Type	(0008,0008)	- Importer AE can be configured to use the Image Type value for the 'exam type' of the received study. If so configured and the third value, the modality specific value, matches value(s) in the Change Healthcare Image Repository exam type database, then it will be saved to the database as an exam type.
SOP Common	SOP Instance UID	(0008,0018)	- Must be provided. - Change Healthcare Image Repository can be configured to do one of two things if a received SOP Instance has the same Study Instance UID and SOP Instance UID as an existing SOP Instance. The default behavior is to not save the newly received SOP Instance. It can also be configured to save the newly received SOP Instance, but this can result in multiple SOP Instances having the same SOP Instance UID. - The system can also be configured to either preserve the original SOP Instance UID or assign a new UID if the received image data is lossy compressed prior to archival. The default behavior is to always assign a new SOP Instance UID. - In addition, Change Healthcare Image Repository can be configured to always assign a new SOP Instance UID to any SOP Instances received from a specific host. This should only be enabled if the remote host is known to make errors when assigning SOP Instances (either assigning duplicates or UIDs that are not DICOM Conformant).

7.1.2 Change Healthcare Image Repository 14.0 Added Private Elements

The Change Healthcare Image Repository may add some or all of the following Private Elements to the SOP Instances that it receives:

Table 159: Private Elements Added by Change Healthcare Image Repository

Tag ID	Attribute Name	VR	VM	Significance
(3711,00xx)	Private Creator ID	LO	1	- The Private Creator ID for this block of added Private Elements. The value is "A.L.I. Technologies, Inc.".
(3711,xx01)	Filename	LO	1	- Holds the filename of the original SOP Instance.
(3711,xx02)	Data Blob of a Visit	OB	1	- Holds the Change Healthcare Image Repository proprietary database information regarding the 'visit' for which the SOP Instance belongs.
(3711,xx03)	Revision Number	US	1	- The revision number of the extended info image.
(3711,xx04)	Unix Timestamp	UL	1	- The Unix format time-stamp of the creation of the extended info image.
(3711,xx05)	Bag ID	IS	1	- The Change Healthcare Image Repository Bag ID associated with an image.
(3711,xx0C)	Original Study UID	UI	1	- The original Study UID specified in the SOP Instance
(3711,00xx)	Private Creator ID	LO	1	- The Private Creator ID for this block of added Private Elements. The value is "A.L.I. Technologies, Inc.".
(3711,xx01)	Filename	LO	1	- Holds the filename of the original SOP Instance.
(3711,xx02)	Data Blob of a Visit	OB	1	- Holds the Change Healthcare Image Repository proprietary database information regarding the 'visit' for which the SOP Instance belongs.

(3711,xx03)	Revision Number	US	1	- The revision number of the extended info image.
(3711,xx04)	Unix Timestamp	UL	1	- The Unix format time-stamp of the creation of the extended info image.

7.1.3 Sender AE and Query/Retrieve Server AE Element Modification

Both the Sender AE and Query/Retrieve Server AE always update SOP Instances with the latest information from the Change Healthcare Image Repository database before exporting them. The following table contains a list of all Elements that can have a value modified by these AE's at the time of export using the Storage Service depending on the capabilities of the receiving remote AE:

Table 160: Significant Elements in Exported Composite SOP Instances

Module	Attribute Name	Tag ID	Significance
Patient	Patient Name	(0010,0010)	- Will be updated with value stored in database prior to export in case the Patient Name was altered after this SOP Instance was originally received.
	Patient ID	(0010,0020)	- Will be updated with value stored in database prior to export in case the Patient ID was altered after this SOP Instance was originally received.
	Patient's Birth Date	(0010,0030)	- Will be updated with value stored in database prior to export in case the Patient's Birth Date value was altered after this SOP Instance was originally received.
	Patient's Sex	(0010,0040)	- Will be updated with value stored in database prior to export in case the Patient's Sex value was altered after this SOP Instance was originally received.
General Study	Study Date	(0008,0020)	- Will be updated with value stored in database prior to export in case the Study Date value was altered after this SOP Instance was originally received.
	Accession Number	(0008,0050)	- Will be updated with value stored in database prior to export in case the Accession Number value was altered after this SOP Instance was originally received.
	Referring Physician's Name	(0008,0090)	- Will be updated with value stored in database prior to export in case the Referring Physician's Name value was altered after this SOP Instance was originally received.
	Study Description	(0008,1030)	- Will be updated with value stored in database prior to export in case the Study Description value was altered after this SOP Instance was originally received.
	Study Instance UID	(0020,000D)	- Will be updated with value stored in database prior to export in case the Study Instance UID value was altered after this SOP Instance was originally received.
General Series	Series Description	(0008,103E)	- Will be updated with value stored in database prior to export in case the Series Description value was altered after this SOP Instance was originally received.
	Modality	(0008,0060)	- Will be updated with value stored in database prior to export in case the Modality value was altered after this SOP Instance was originally received.
	Operator's Name	(0008,1070)	- Will be updated with value stored in database prior to export in case the Operator's Name value was altered after this SOP Instance was originally received.
VOI LUT	Window Center	(0028,1050)	- Default Window Center value can be configured for a specific destination AE.

	Window Width	(0028,1051)	- Default Window Width value can be configured for a specific external destination AE.
SOP Common	SOP Instance UID	(0008,0018)	- The system can also be configured to either preserve the original SOP Instance UID or assign a new UID if the received image data is lossy compressed prior to archival. The default behavior is to always assign a new SOP Instance UID. - In addition, Change Healthcare Image Repository can be configured to always assign a new SOP Instance UID to any SOP Instances received from a specific host. This should only be enabled if the remote host is known to make errors when assigning SOP Instances (either assigning duplicates or UIDs that are not DICOM Conformant).

7.1.4Sender AE MIMA Element Support

The Sending AE sending a SOP Instance will provide DICOM attributes conveying the Assigning Authorities of the Patient ID and Accession Number. It will also convey the Institution Name (0008,0080) and Institution Code Sequence (0008,0082) so that the institution where the SOP Instance was created is identified.

If there is no patient identifier value defined for the preconfigured default Assigning Authority of the receiving Application Entity then the Patient ID value will be left blank.

If there is no preconfigured default Assigning Authority for the receiving Application Entity then the Sending AE can specify a Patient ID value from any Assigning Authority in the images.

The Change Healthcare Image Repository will support sending attributes in the images as defined in the following table:

Table 161: SOP Instance Attributes for Multiple Identity Resolution

Attribute Name	Tag ID	Description
Patient's Name	(0010,0010)	This Name is referred to as the destination Patient's Name. Required if a Patient Name is known for the patient.
Patient ID	(0010,0020)	Used to identify the patient. Required if a Patient ID value is known for the Assigning Authority of the destination system. May be present otherwise. This ID is referred to as the destination Patient ID.
Issuer of Patient ID	(0010,0021)	Used to identify the Assigning Authority (system, organization, agency, or department) that issued the Patient ID. Required if Patient ID is not empty.
Other Patient IDs Sequence	(0010,1002)	Used to convey known patient identifiers for the patient. Required if a Patient ID is known for the patient.
>Patient ID	(0010,0020)	
>Issuer of Patient ID	(0010,0021)	
>Type of Patient ID	(0010,0022)	
Accession Number	(0008,0050)	Used to identify the order for the Study.
Issuer of Accession Number Sequence	(0008,0051)	Used to identify the Assigning Authority that issued the Accession Number. Required if Accession Number is not empty.

>Local Namespace Entity ID	(0040,0031)	
>Universal Entity ID	(0040,0032)	
>Universal Entity ID Type	(0040,0033)	
Institution Name	(0008,0080)	Used to convey the institution where the SOP Instance was created.
Institution Code Sequence	(0008,0082)	Used to convey the institution where the SOP Instance was created.
>Code Value	(0008,0100)	
>Coding Scheme Designator	(0008,0102)	
>Coding Scheme Version	(0008,0103)	Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously. May be present otherwise.
>Code Meaning	(0008,0104)	

7.1.5 Grayscale SoftCopy Presentation State Module Attributes

This section provides information on the Elements that are part of each module present in the GSPS SOP Instances. For each Element, the Value Description column describes the meaning of the element, whether it must be present in the GSPS instance header, and what the source of the value is.

The tables use the following abbreviations:

The abbreviations in the "Presence of Value" column are:

VNAP Value not always present (attribute is always present but may not have a value).

ANAP Attribute not always present.

ALWAYS Attribute always present and has a value.

EMPTY Attribute always present but has no value.

UNSUPPORTED Attribute not supported

The abbreviations in the "Source" column are:

ORIGINAL Value is copied from an original image.

DB Value is from the Change Healthcare Image Repository.

D indicates a default hard-coded value is set.

NA Value not applicable

NOTE1: Only support export IDENTITY value for Presentation LUT shape

Table 162: Patient Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Patient's Name	(0010,0010)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB

Patient ID	(0010,0020)	2	Copied from database.	ALWAYS	DB
Patient's Birth Date	(0010,0030)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB
Patient's Sex	(0010,0040)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB

Table 163: General Study Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Study Instance UID	(0020,000D)	1	Copied from database.	ALWAYS	DB
Study Date	(0008,0020)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB
Study Time	(0008,0030)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB
Referring Physician's Name	(0008,0090)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB
Study ID	(0020,0010)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB
Accession Number	(0008,0050)	2	Copied from database if a value is specified. Empty otherwise.	VNAP	DB
Study Description	(0008,1030)	3	Not present OR copied from database if a value is specified. Empty otherwise.	ANAP	DB

Table 164: General Series Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Modality	(0008,0060)	1	Set to “PR”	ALWAYS	D
Series Instance UID	(0020,000E)	1	Generated on SOP Instance Creation. All GSPS SOP Instances in the same study has the same Series Instance UID.	ALWAYS	AUTO
Series Number	(0020,0011)	2	Set to “1”	ALWAYS	D
Series Description	(0008,103e)	3	Copied from database if a value is specified. Empty otherwise.	ANAP	DB

Table 165: Presentation Series Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Modality	(0008,0060)	1	The Presentation Series Module specializes some Attributes of the General Series Module. Set to "PR"	ALWAYS	D

Table 166: General Equipment Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Manufacturer	(0008,0070)	2	Value specified as " Change Healthcare Canada Company"	ALWAYS	AUTO

Table 167: Presentation State Identification Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Presentation Creation Date	(0070,0082)	1	Date on which this presentation was created. Note: This date may be different from the date that the DICOM SOP Instance was created, since the presentation state information contained may have been recorded earlier. Use the last modified date of Change Healthcare Image Repository Internal/proprietary annotation or presentation files.	ALWAYS	AUTO
Presentation Creation Time	(0070,0083)	1	Time at which this presentation was created. Note: This time may be different from the time that the DICOM SOP Instance was created, since the presentation state information contained may have been recorded earlier. Use the last modified time of Change Healthcare Image Repository Internal/proprietary annotation or presentation files.	ALWAYS	AUTO
Include Content Identification Macro Table 10-12			Note: The Content Label value may be used by an application as a Defined Term in order to imply some grouping of different presentation states, i.e. it may have the same value for different presentation state instances that share some common concept.	ALWAYS	AUTO

Table 168: Content Identification Macro Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Instance Number	(0020,0013)	1	Set to "1"	ALWAYS	D
Content Label	(0070,0080)	1	A label that is used to identify this SOP Instance. Set to "CHANGE HEALTHCAREEMI GSPS"	ALWAYS	D
Content Description	(0070,0081)	2	A description of the content of the SOP Instance.	EMPTY	D
Content Creator's Name	(0070,0084)	2	Name of operator (such as a technologist or physician) creating the content of the SOP Instance.	EMPTY	D

Table 169: Presentation State Relationship Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Referenced Series Sequence	(0008,1115)	1	- Sequence of Items where each Item includes the Attributes of one Series to which the Presentation applies. - One or more Items shall be present.	ALWAYS	AUTO
>Series Instance UID	(0020,000E)	1	- Unique identifier of a Series that is part of the Study defined by the Study Instance UID (0020,000D) in the enclosing dataset.	ALWAYS	DB
>Referenced Image Sequence	(0008,1140)	1	- Sequence of Items where each Item provides reference to a selected set of Image SOP Class/SOP Instance pairs to which the Presentation applies that are part of the Study defined by Study Instance UID (0020,000D) and the Series defined by Series Instance UID (0020,000E). -The referenced SOP Class shall be the same for all Images in any Item of this Referenced Series Sequence (0008,1115). Value is saved to database. - One or more Items shall be present.	EMPTY	AUTO
>>Include Image SOP Instance Reference Macro, Table 170					

Table 170: Image SOP Instance Macro Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Include 'SOP Instance Reference Macro' Table 171					
Referenced Frame Number	(0008,1160)	1C	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.	ANAP	ORIGINAL
Referenced Segment Number	(0062,000B)	1C	Identifies the Segment Number to which the reference applies. Required if the Referenced SOP Instance is a Segmentation or Surface Segmentation and the reference does not apply to all segments and Referenced Frame Number (0008,1160) is not present.	UNSUPPORTED	NA

Table 171: SOP Instance Reference Macro Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	ALWAYS	ORIGINAL
Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	ALWAYS	ORIGINAL

Table 172: Presentation State Shutter Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Shutter Presentation Value	(0018,1622)	1C	A single grayscale unsigned value used to replace those parts of the image occluded by the shutter, when rendered on a monochrome display. The units are specified in P-Values. Required if the Display Shutter Module or Bitmap Display Shutter Module is present. Note: The requirement in this module is type 1C which overrides the type 3 in the Display Shutter Module. **- Export not supported**	UNSUPPORTED	NA
Shutter Presentation Color CIELab Value	(0018,1624)	1C	A color triplet value used to replace those parts of the image occluded by the shutter, when rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab. See C.10.7.1.1. Required if the Display Shutter Module or Bitmap Display Shutter Module is present and the SOP Class is other than Grayscale Softcopy Presentation State Storage. Note: The requirement in this module is type 1C, which overrides the type 3 in the Display Shutter and Bitmap Display Shutter Modules.	UNSUPPORTED	DB

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			- Export not supported		

NOTE1: This table contains Attributes that specialize Attributes in other Modules included in a Presentation State.

Table 173 Presentation State Mask Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Mask Subtraction Sequence	(0028,6100)	1C			Mask Subtraction Sequence
>Mask Operation	(0028,6101)	1	Type of mask operation to be performed Enumerated Values: AVG_SUB TID See C.7.6.10.1 for further explanation. Note: The requirement in this module is for Enumerated Values which override the requirements of the Mask Module. **- Export not supported**	UNSUPPORTED Required if Mask Module is present. Only a single Item shall be included in this sequence. Applicable Frame Range (0028,6102) shall not be included in the Sequence Item. See C.7.6.10 for a complete definition of the Attributes in the Items of this Sequence other than Mask Operation(0028,6101) and Applicable Frame Range (0028,6102). Notes: 1. This Sequence is replicated here in order to specify one Item, additional conditions on Mask Operation (0028,6101) and to forbid Applicable Frame Range (0028,6102). 2. The role of Applicable Frame Range (0028,6102) is replaced by	>Mask Operation

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
				Referenced Frame Number (0008,1160).	
>Contrast Frame Averaging	(0028,6112)	1C	Specified the number of contrast frames to average together before performing the mask operation. Required if Mask Frame Numbers (0028,6110) specifies more than one frame (i.e. is multi-valued). Note: The requirement in this module is conditional and overrides the optional requirements of the Mask Module. **- Export not supported**	UNSUPPORTED	>Contrast Frame Averaging
Recommended Viewing Mode	(0028,1090)	1C	Specifies the recommended viewing protocol(s). Enumerated Value: SUB = for subtraction with mask images Required if Mask Subtraction Sequence (0028,6100) is present. Note: The requirement in this module is type 1C and an Enumerated Value is specified which override the requirements of the Mask Module. **- Export not supported**	UNSUPPORTED	Recommend ed Viewing Mode

NOTE1: This table contains Attributes that specialize the use of masks in a Presentation State

Table 174: Mask Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Mask Subtraction Sequence	(0028,6100)	1	- Defines a sequence that describes mask subtraction operations for a Multiframe Image.	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			- One or more items shall be included in this sequence. **- Export not supported**		
Recommended Viewing Mode	(0028,1090)	2	- Specifies the recommended viewing protocol(s). Defined terms: SUB = for subtraction with mask images; NAT = native viewing of image as sent. Note: If an implementation does not recognize the defined term for Recommended Viewing Mode (0028,1090), reverting to native display mode is recommended. **- Export not supported**	UNSUPPORTED	NA

Table 175: Display Shutter Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Shutter Shape	(0018,1600)	1	-Shape(s) of the shutter defined for display. Enumerated Values: RECTANGULAR CIRCULAR POLYGONAL This multi-valued Attribute shall contain at most one of each Enumerated Value. When multiple values are present, and the shutter is applied to a displayed image, then all of the shapes shall be combined and applied simultaneously, that is, the least amount of image remaining shall be visible (unoccluded). See Figure C.7-4b. **- Export not supported**	UNSUPPORTED	NA
Shutter Left Vertical Edge	(0018,1602)	1C	- Required if Shutter Shape (0018,1600) is RECTANGULAR. Location of the left edge of the rectangular shutter with respect to pixels in the image given as column.	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			- Export not supported		
Shutter Right Vertical Edge	(0018,1604)	1C	- Required if Shutter Shape (0018,1600) is RECTANGULAR. Location of the right edge of the rectangular shutter with respect to pixels in the image given as column. **- Export not supported**	UNSUPPORTED	NA
Shutter Upper Horizontal Edge	(0018,1606)	1C	- Required if Shutter Shape (0018,1600) is RECTANGULAR. Location of the upper edge of the rectangular shutter with respect to pixels in the image given as row. **- Export not supported**	UNSUPPORTED	NA
Shutter Lower Horizontal Edge	(0018,1608)	1C	- Required if Shutter Shape (0018,1600) is RECTANGULAR. Location of the lower edge of the rectangular shutter with respect to pixels in the image given as row. **- Export not supported**	UNSUPPORTED	NA
Center of Circular Shutter	(0018,1610)	1C	- Required if Shutter Shape (0018,1600) is CIRCULAR. Location of the center of the circular shutter with respect to pixels in the image given as row and column. **- Export not supported**	UNSUPPORTED	NA
Radius of Circular Shutter	(0018,1612)	1C	- Required if Shutter Shape (0018,1600) is CIRCULAR. Radius of the circular shutter with respect to pixels in the image given as a number of pixels along the row direction. **- Export not supported**	UNSUPPORTED	NA
Vertices of the Polygonal Shutter	(0018,1620)	1C	- Required if Shutter Shape (0018,1600) is POLYGONAL. Multiple Values where the first set of two values are: row of the origin vertex column of the origin vertex Two or more pairs of values follow and are the row and column coordinates of the other vertices of the polygon	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			shutter. Polygon shutters are implicitly closed from the last vertex to the origin vertex and all edges shall be non-intersecting except at the vertices. **- Export not supported**		
Shutter Presentation Value	(0018,1622)	3	- A single gray unsigned value used to replace those parts of the image occluded by the shutter, when rendered on a monochrome display. The units are specified in P-Values, from a minimum of 0000H (black) up to a maximum of FFFFH (white). Note: The maximum P-Value for this Attribute may be different from the maximum P-Value from the output of the Presentation LUT, which may be less than 16 bits in depth. **- Export not supported**	UNSUPPORTED	NA
Shutter Presentation Color CIELab Value	(0018,1624)	3	- A color triplet value used to replace those parts of the image occluded by the shutter, when rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab. See C.10.7.1.1. **- Export not supported**	UNSUPPORTED	NA

Table 176: Bitmap Display Shutter Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Shutter Shape	(0018,1600)	1	Shape of the shutter defined for display. Enumerated Values are: BITMAP This Attribute shall contain one Value. **- Export not supported**	UNSUPPORTED	NA
Shutter Overlay Group	(0018,1623)	1	Specifies the Group (60xx) of an Overlay stored within the Presentation State IOD that contains the bitmap data, as defined in the Overlay Plane Module C.9.2.	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			- Export not supported		
Shutter Presentation Value	(0018,1622)	1	A single gray unsigned value used to replace those parts of the image occluded by the shutter, when rendered on a monochrome display. The units are specified in P-Values, from a minimum of 0000H (black) up to a maximum of FFFFH (white). Note: The maximum P-Value for this Attribute may be different from the maximum P-Value from the output of the Presentation LUT, which may be less than 16 bits in depth. **- Export not supported**	UNSUPPORTED	NA
Shutter Presentation Color CIELab Value	(0018,1624)	3	A color triplet value used to replace those parts of the image occluded by the shutter, when rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab. See C.10.7.1.1. **- Export not supported**	UNSUPPORTED	NA

Table 177: Overlay Plane Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Overlay Rows	(60xx,0010)	1	Number of Rows in Overlay. **- Export not supported**	UNSUPPORTED	Overlay Rows
Overlay Columns	(60xx,0011)	1	Number of Columns in Overlay. **- Export not supported**	UNSUPPORTED	Overlay Columns
Overlay Type	(60xx,0040)	1	Indicates whether this overlay represents a region of interest or other graphics. Enumerated Values: G = Graphics R = ROI. **- Export not supported**	UNSUPPORTED	Overlay Type
Overlay Origin	(60xx,0050)	1	Location of first overlay point with respect to pixels in the image, given as row\column. The upper left pixel of the image has the coordinate 1\1. Column values greater than 1 indicate the overlay plane origin is to the right of the image origin.	UNSUPPORTED	Overlay Origin

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			Row values greater than 1 indicate the overlay plane origin is below the image origin. Values less than 1 indicate the overlay plane origin is above or to the left of the image origin. Note: Values of 0\0 indicate that the overlay pixels start 1 row above and one column to the left of the image pixels.		
Overlay Bits Allocated	(60xx,0100)	1	Number of Bits Allocated in the Overlay. The value of this Attribute shall be 1. Note: Formerly the standard described embedding the overlay data in the Image Pixel Data (7FE0,0010), in which case the value of this Attribute was required to be the same as Bits Allocated (0028,0100). This usage has been retired. See PS 3.3 2004. **- Export not supported**	UNSUPPORTED	Overlay Bits Allocated
Overlay Bit Position	(60xx,0102)	1	The value of this Attribute shall be 0. Note: Formerly the standard described embedding the overlay data in the Image Pixel Data (7FE0,0010), in which case the value of this Attribute specified the bit in which the overlay was stored. This usage has been retired. See PS 3.3 2004. **- Export not supported**	UNSUPPORTED	Overlay Bit Position
Overlay Data	(60xx,3000)	1	Overlay pixel data. The order of pixels sent for each overlay is left to right, top to bottom, i.e., the upper left pixel is sent first followed by the remainder of the first row , followed by the first pixel of the 2nd row, then the remainder of the 2nd row and so on. Overlay data shall be contained in this Attribute. See C.9.2.1.1 for further explanation. **- Export not supported**	UNSUPPORTED	Overlay Data
Overlay Description	(60xx,0022)	3	User-defined comments about the overlay. **- Export not supported**	UNSUPPORTED	Overlay Description
Overlay Subtype	(60xx,0045)	3	Defined term which identifies the intended purpose of the Overlay	UNSUPPORTED	Overlay Subtype

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			Type. See C.9.2.1.3 for further explanation. **- Export not supported**		
Overlay Label	(60xx,1500)	3	A user defined text string which may be used to label or name this overlay. **- Export not supported**	UNSUPPORTED	Overlay Label
ROI Area	(60xx,1301)	3	Number of pixels in ROI area. See C.9.2.1.2 for further explanation. **- Export not supported**	UNSUPPORTED	ROI Area
ROI Mean	(60xx,1302)	3	ROI Mean. See C.9.2.1.2 for further explanation. **- Export not supported**	UNSUPPORTED	ROI Mean
ROI Standard Deviation	(60xx,1303)	3	ROI standard deviation. See C.9.2.1.2 for further explanation. **- Export not supported**	UNSUPPORTED	ROI Standard Deviation

Table 178: Overlay Activation Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Overlay Activation Layer	(60xx,1001)	2C	The layer (defined in Graphic Layer (0070,0002) of the Graphic Layer Module C.10.7) in which the Overlay described in group 60xx shall be displayed. If no layer is specified (zero length) then the overlay shall not be displayed. Required if Group 60xx is present in the referenced image(s) or the Presentation State instance containing this Module. - Export not supported	UNSUPPORTED	NA

Table 179: Display Area Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Displayed Area Selection Sequence	(0070,005A)	1	A sequence of Items each of which describes the displayed area selection for a group of images or frames. Sufficient Items shall be present to describe every image and frame listed in the Presentation State Relationship Module. One or more Items shall be included in this sequence.	ALWAYS	AUTO
>Referenced Image Sequence	(0008,1140)	1C	The subset of images and frames listed in the Presentation State Relationship Module, to which this displayed area selection applies. One or more Items shall be included in this sequence. Required if the displayed area selection in this Item does not apply to all the images and frames listed in the Presentation State Relationship Module.	ANAP	AUTO
>> Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	ALWAYS	ORIGINAL
>> Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	ALWAYS	ORIGINAL
>> Referenced Frame Number	(0008,1160)	1C	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.	ANAP	AUTO
>> Referenced Segment Number	(0062,000B)	1C	Identifies the Segment Number to which the reference applies. Required if the Referenced SOP Instance is a Segmentation or Surface Segmentation and the reference does not apply to all segments and Referenced Frame Number (0008,1160) is not present. **- Export not supported**	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
>Pixel Origin Interpretation	(0048,0301)	1C	For a referenced multi-frame image, specifies whether the Displayed Area Top Left Hand Corner (0070,0052) and Displayed Area Bottom Right Hand Corner (0070,0053) are to be interpreted relative to the individual frame pixel origins, or relative to the Total Pixel Matrix origin (see C.8.14.0.4). Required if the value of Referenced SOP Class UID (0008,1150) within Referenced Image Sequence (0008,1140) is 1.2.840.10008.5.1.4.1.1.77.1.6 (VL Whole Slide Microscopy Image). May be present otherwise. Enumerated Values: FRAME – relative to individual frame VOLUME – relative to Total Image Matrix If not present, TLHC and BRHC are defined relative to the frame pixel origins.	UNSUPPORTED	NA
>Displayed Area Top Left Hand Corner	(0070,0052)	1	The top left (after spatial transformation) pixel in the referenced image to be displayed, given as column\row. Column is the horizontal (before spatial transformation) offset (X) and row is the vertical (before spatial transformation) offset (Y) relative to the origin of the pixel data before spatial transformation, which is 1\1. See Figure C.10.4-1.	ALWAYS	AUTO
>Displayed Area Bottom Right Hand Corner	(0070,0053)	1	The bottom right (after spatial transformation) pixel in the referenced image to be displayed, given as column\row. Column is the horizontal (before spatial transformation) offset (X) and row is the vertical (before spatial transformation) offset (Y) relative to the origin of the pixel data before spatial transformation, which is 1\1. See Figure C.10.4-1.	ALWAYS	AUTO
>Presentation Size Mode	(0070,0100)	1	Manner of selection of display size. Enumerated Values: SCALE TO FIT TRUE SIZE	ALWAYS	AUTO

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			MAGNIFY		
>Presentation Pixel Spacing	(0070,0101)	1C	Physical distance between the center of each pixel in the referenced image (before spatial transformation), specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See 10.7.1.3 for further explanation of the value order. Notes: 9) This value may be different from Pixel Spacing (0028,0030) or Imager Pixel Spacing (0018,1164) specified in the referenced image, which are ignored, since some form of calibration may have been performed (for example by reference to an object of known size in the image). 10) If the row and column spacing are different, then the pixel aspect ratio of the image is not 1:1. Required if Presentation Size Mode (0070,0100) is TRUE SIZE, in which case the values will correspond to the physical distance between the center of each pixel on the display device. May be present if Presentation Size Mode (0070,0100) is SCALE TO FIT or MAGNIFY, in which case the values are used to compute the aspect ratio of the image pixels.	ANAP	AUTO

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
>Presentation Pixel Aspect Ratio	(0070,0102)	1C	Ratio of the vertical size and the horizontal size of the pixels in the referenced image, to be used to display the referenced image, specified by a pair of integer values where the first value is the vertical pixel size and the second value is the horizontal pixel size. See C.7.6.3.1.7. Required if Presentation Pixel Spacing (0070,0101) is not present. Notes: 11) This value may be different from the aspect ratio specified by Pixel Aspect Ratio (0028,0034) in the referenced image, or implied by the values of Pixel Spacing (0028,0030) or Imager Pixel Spacing (0018,1164) specified in the referenced image, which are ignored. 4) This value must be specified even if the aspect ratio is 1:1.	ANAP	AUTO
>Presentation Pixel Magnification Ratio	(0070,0103)	1C	Ratio of displayed pixels to source pixels, specified in one dimension. Required if Presentation Size Mode (0070,0100) is MAGNIFY. Notes: 12) A value of 1.0 would imply that one pixel in the referenced image would be displayed as one pixel on the display (i.e. it would not be interpolated if the aspect ratio of the image pixels is 1:1). 13) A value of 2.0 would imply that one pixel in the referenced image would be displayed as 4 pixels on the display (i.e. up-sampled by a factor	SUPPORTED	AUTO

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			of 2 in each of the row and column directions). 14) A value of 0.5 would imply that 4 pixels in the referenced image would be displayed as 1 pixel on the display (i.e. down-sampled by a factor of 2 in each of the row and column directions). 5) If the source pixels have an aspect ratio of other than 1:1, then they are assumed to have been interpolated to a display pixel aspect ratio of 1:1 prior to magnification.		

Table 180: Graphic Annotation Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Graphic Annotation Sequence	(0070,0001)	1	A sequence of Items each of which represents a group of annotations composed of graphics or text or both. One or more Items shall be included in this sequence.	Graphic Annotation Sequence	(0070,0001)
>Referenced Image Sequence	(0008,1140)	1C	The subset of images and frames listed in the Presentation State Relationship Module, to which this graphic annotation applies. One or more Items shall be included in this sequence. Required if graphic annotations in this Item do not apply to all the images and frames listed in the Presentation State Relationship Module.	>Referenced Image Sequence	(0008,1140)
>> Referenced Frame Number	(0008,1160)	1C	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.	>> Referenced Frame Number	(0008,1160)

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
>Graphic Layer	(0070,0002)	1	- The layers in which graphic and text may be Rendered **- Export not supported**	>Graphic Layer	(0070,0002)
>Text Object Sequence	(0070,0008)	1C	- Sequence that describes a text annotation. One or more Items may be present. - Either one or both of Text Object Sequence (0070,0008) or Graphic Object Sequence (0070,0009) are required.	>Text Object Sequence	(0070,0008)
>>Bounding Box Annotation Units	(0070,0003)	1C	- Units of measure for the axes of the text bounding box. **- Export not supported**	>>Bounding Box Annotation Units	(0070,0003)
>>Anchor Point Annotation Units	(0070,0004)	1C	- Units of measure for the axes of the text anchor point annotation. Enumerated Values for Anchor Point Annotation Units (0070,0004) are the same as for Bounding Box Annotation Units (0070,0003). PIXEL = Image relative position specified with sub-pixel resolution such that the origin, which is at the Top Left Hand Corner (TLHC) of the TLHC pixel is 0.0\0.0, the Bottom Right Hand Corner (BRHC) of the TLHC pixel is 1.0\1.0, and the BRHC of the BRHC pixel is Columns\Rows (see figure C.10.5-1). The values must be within the range 0\0 to Columns\Rows. DISPLAY = Fraction of Specified Displayed Area where 0.0\0.0 is the TLHC and 1.0\1.0 is the BRHC. The values must be within the range 0.0 to 1.0. MATRIX = Image relative position specified with sub-pixel resolution such that the origin, which is at the Top Left Hand Corner (TLHC) of the TLHC pixel of the Total Pixel Matrix, is 0.0\0.0, the Bottom Right Hand Corner (BRHC) of the TLHC pixel is 1.0\1.0, and the BRHC of the BRHC pixel of the Total Pixel Matrix is Total Pixel Matrix Columns\Total Pixel Matrix Rows	>>Anchor Point Annotation Units	(0070,0004)

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			(see C.8.14.0.3). The values must be within the range 0.0\0.0 to Total Pixel Matrix Columns\Total Pixel Matrix Rows. MATRIX may be used only if the value of Referenced SOP Class UID (0008,1150) within Referenced Image Sequence (0008,1140) is 1.2.840.10008.5.1.4.1.1.77.1.6 (VL Whole Slide Microscopy Image). - Required if Anchor Point (0070,0014) is present.		
>>Unformatted Text Value	(0070,0006)	1	- Text data which is unformatted and whose manner of display within the defined bounding box or relative to the specified anchor point is implementation dependent. The text value may contain spaces, as well as multiple lines separated by either LF, CR, CR LF or LF CR, but otherwise no format control characters (such as horizontal or vertical tab and form feed) shall be present, even if permitted by the Value Representation of ST. - In Change Healthcare Image Repository, Text is interpreted as ISO-IR 100	>>Unformatte d Text Value	(0070,0006)
>>Bounding Box Top Left Hand Corner	(0070,0010)	1C	- Location of the Top Left Hand Corner (TLHC) of the bounding box in which Unformatted Text Value (0070,0006) is to be displayed, in Bounding Box Annotation Units (0070,0003), given as column\row. Column is the horizontal offset and row is the vertical offset. - Required if Anchor Point (0070,0014) is not present. **- Export not supported**	>>Bounding Box Top Left Hand Corner	(0070,0010)
>>Bounding Box Bottom Right Hand Corner	(0070,0011)	1C	- Location of the Bottom Right Hand Corner (BRHC) of the bounding box in which Unformatted Text Value (0070,0006) is to be displayed, in Bounding Box Annotation Units (0070,0003), given as column\row. Column is the horizontal offset and row is the vertical offset.	>>Bounding Box Bottom Right Hand Corner	(0070,0011)

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			- Required if Anchor Point (0070,0014) is not present. **- Export not supported**		
>>Bounding Box Text Horizontal Justification	(0070,0012)	1C	- Location of the text relative to the vertical edges of the bounding box. Enumerated Values: LEFT = closest to left edge RIGHT = closest to right edge CENTER = centered - Required if Bounding Box Top Left Hand Corner (0070,0010) is present. **- Export not supported**	>>Bounding Box Text Horizontal Justification	(0070,0012)
>>Anchor Point	(0070,0014)	1C	- Location of a point in the image or Specified Displayed Area to which the Unformatted Text Value (0070,0006) is related, in Anchor Point Annotation Units (0070,0004), given as column\row. Column is the horizontal offset and row is the vertical offset. - Required if Bounding Box Top Left Hand Corner (0070,0010) and Bounding Box Bottom Right Hand Corner (0070,0011) are not present. May be present even if a bounding box is specified (i.e. Bounding Box Top Left Hand Corner (0070,0010) and Bounding Box Bottom Right Hand Corner (0070,0011) are present).	>>Anchor Point	(0070,0014)
>>Anchor Point Visibility	(0070,0015)	1C	- Flag to indicate whether or not a visible indication (such as a line or arrow) of the relationship between the text and the anchor point is to be displayed. Enumerated Values: Y = yes N = no - Required if Anchor Point (0070,0014) is present.	>>Anchor Point Visibility	(0070,0015)

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			Change Healthcare Image Repository does not interpret this tag. An arrow is always present to indicate the relationship between the text and the anchor point. **- Export not supported**		
>Graphic Object Sequence	(0070,0009)	1C	- Sequence that describes a graphic annotation. One or more Items may be present. - Either one or both of Text Object Sequence (0070,0008) or Graphic Object Sequence (0070,0009) are required.	>Graphic Object Sequence	(0070,0009)
>>Graphic Annotation Units	(0070,0005)	1C	- Units of measure for the axes of the graphic annotation. Enumerated Values for Graphic Annotation Units (0070,0005) are the same as for Bounding Box Annotation Units (0070,0003).	>>Graphic Annotation Units	(0070,0005)
>>Graphic Dimensions	(0070,0020)	1	Enumerated Value: 2 Change Healthcare Image Repository exports a default Dimensions with a value of 2. **- Export supported**	>>Graphic Dimensions	(0070,0020)
>>Number of Graphic Points	(0070,0021)	1	- Number of data points in this graphic.	>>Number of Graphic Points	(0070,0021)
>> Graphic Data	(0070,0022)	1	- Coordinates that specify this graphic annotation. Depending on Graphic Type (0070,0023)	>> Graphic Data	(0070,0022)
>>Graphic Type	(0070,0023)	1	The shape of graphic that is to be drawn. Change Healthcare Image Repository supports the following graphic types: POINT POLYLINE INTERPOLATED CIRCLE ELLIPSE	>>Graphic Type	(0070,0023)
>>Graphic Filled	(0070,0024)	1C	- Whether or not the closed graphics element is displayed as filled (in	>>Graphic Filled	(0070,0024)

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			some unspecified manner that shall be distinguishable from an outline) or as an outline. Enumerated Values: Y = yes N = no Required if Graphic Data (0070,0022) is "closed", that is Graphic Type (0070,0023) is CIRCLE or ELLIPSE, or Graphic Type (0070,0023) is POLYLINE or INTERPOLATED and the first data point is the same as the last data point. Change Healthcare Image Repository export a default value of "N" **- Export not supported**		

Table 181: Spatial Transformation Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Image Rotation	(0070,0042)	1	How far to rotate the image clockwise in degrees, before any Image Horizontal Flip (0070,0041) is applied. Enumerated Values: 0, 90,180,270 Notes: Negative values are not permitted since the Value Representation is unsigned. **- Export not supported**	UNSUPPORTED	NA
Image Horizontal Flip	(0070,0041)	1	Whether or not to flip the image horizontally after any	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			Image Rotation has been applied such that the left side of the image becomes the right side. Enumerated Values: Y = yes, N = no Note: No vertical flip is specified since the same result can be achieved by a combination of a 180 degree rotation and a horizontal flip. **- Export not supported**		

Table 182: Graphic Layer Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Graphic Layer Sequence	(0070,0060)	1	A sequence of Items each of which represents a single layer in which overlays, curves, graphics or text may be rendered. One or more Items shall be included in this sequence. An Item is required for each layer referenced from the Graphic Annotation Module or the Overlay Activation Module. **- Export not supported**	UNSUPPORTED	NA
>Graphic Layer	(0070,0002)	1	A string which identifies the layer. **- Export not supported**	UNSUPPORTED	NA
>Graphic Layer Order	(0070,0062)	1	An integer indicating the order in which it is recommended that the layer be rendered, if the display is capable of distinguishing. Lower numbered layers are to be rendered first. **- Export not supported**	UNSUPPORTED	NA
>Graphic Layer Recommended Display Grayscale Value	(0070,0066)	3	A default single gray unsigned value in which it is recommended that the layer be rendered on a monochrome display. The units are specified in P-Values from a minimum of 0000H (black) up to a maximum of FFFFH (white). Note: The maximum P-Value for this Attribute may be different from the	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			maximum P-Value from the output of the Presentation LUT, which may be less than 16 bits in depth.		
>Graphic Layer Recommended Display CIELab Value	(0070,0401)	3	A default color triplet value in which it is recommended that the layer be rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab. See C.10.7.1.1. **- Export not supported**	UNSUPPORTED	NA
>Graphic Layer Description	(0070,0068)	3	A free text description of the contents of this layer. **- Export not supported**	UNSUPPORTED	NA

Table 183: Graphic Group Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Graphic Group Sequence	(0070,0234)	1	Sequence that describes the combined graphic object. One or more Items shall be included in this sequence. - Export not supported	UNSUPPORTED	NA
>Graphic Group ID	(0070,0295)	1	A unique number identifying the Graphic Group, i.e. the combined graphic object. - Export not supported	UNSUPPORTED	NA
>Graphic Group Label	(0070,0207)	1	Name used to identify the Graphic Group, i.e. the combined graphic object. - Export not supported	UNSUPPORTED	NA
Graphic Group Description	(0070,0208)	3	Description of the group - Export not supported.	UNSUPPORTED	NA

Table 184: Modality LUT Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Modality LUT Sequence	(0028,3000)	1C	Defines a sequence of Modality LUTs. Only a single Item shall be included in this sequence. Shall not be present if Rescale Intercept (0028,1052) is present. **- Export not supported**	UNSUPPORTED	NA
>LUT Descriptor	(0028,3002)	1C	Specifies the format of the LUT Data in this Sequence. See C.11.1.1 for further explanation. Required if the Modality LUT Sequence (0028,3000) is sent. **- Export not supported**	UNSUPPORTED	NA
>LUT Explanation	(0028,3003)	3	Free form text explanation of the meaning of the LUT.	UNSUPPORTED	NA
>Modality LUT Type	(0028,3004)	1C	Specifies the output values of this Modality LUT. See C.11.1.1.2 for further explanation. Required if the Modality LUT Sequence (0028,3000) is sent. **- Export not supported**	UNSUPPORTED	NA
>LUT Data	(0028,3006)	1C	LUT Data in this Sequence. Required if the Modality LUT Sequence (0028,3000) is sent. **- Export not supported**	UNSUPPORTED	NA
Rescale Intercept	(0028,1052)	1C	The value b in relationship between stored values (SV) and the output units specified in Rescale Type (0028,1054). Output units = m*SV + b. Required if Modality LUT Sequence (0028,3000) is not present. Shall not be present otherwise. **- Export not supported**	UNSUPPORTED	NA
Rescale Slope	(0028,1053)	1C	m in the equation specified by Rescale Intercept (0028,1052). Required if Rescale Intercept is present. **- Export not supported**	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Rescale Type	(0028,1054)	1C	Specifies the output units of Rescale Slope (0028,1053) and Rescale Intercept (0028,1052). See C.11.1.1.2 for further explanation. Required if Rescale Intercept is present. **- Export not supported**	UNSUPPORTED	NA

Table 185: Softcopy VOI LUT Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Softcopy VOI LUT Sequence	(0028,3110)	1	Defines a sequence of VOI LUTs or Window Centers and Widths and to which images and frames they apply. No more than one VOI LUT Sequence containing a single Item or one pair of Window Center/Width values shall be specified for each image or frame. One or more Items shall be included in this sequence.	ANAP	AUTO
>Referenced Image Sequence	(0008,1140)	1C	The subset of images and frames listed in the Presentation State Relationship Module, to which this VOI LUT or Window Center and Width applies. One or more Items shall be included in this sequence. Required if the VOI LUT transformation in this Item does not apply to all the images and frames listed in the Presentation State Relationship Module.	ANAP	AUTO
>> Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	ALWAYS	AUTO
>> Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	ALWAYS	AUTO
>> Referenced Frame Number	(0008,1160)	1C	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.	ANAP	AUTO
>> Referenced Segment Number	(0062,000B)	1C	Identifies the Segment Number to which the reference applies. Required if the Referenced SOP Instance is a Segmentation or Surface Segmentation and the reference does not apply to all segments and	UNSUPPORTED	NA

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
			Referenced Frame Number (0008,1160) is not present. **- Export not supported**		
> VOI LUT Sequence	(0028,3010)	1C	Defines a sequence of VOI LUTs. One or more Items shall be included in this sequence. Required if Window Center (0028,1050) is not present. May be present otherwise.	ANAP	AUTO
>> LUT Descriptor	(0028,3002)	1	Specifies the format of the LUT Data in this Sequence. See C.11.2.1.1 for further explanation.	ALWAYS	AUTO
>> LUT Explanation	(0028,3003)	3	Free form text explanation of the meaning of the LUT. Export as Linear DICOM VOI LUT.	ANAP	AUTO
>> LUT Data	(0028,3006)	1	LUT Data in this Sequence.	ALWAYS	AUTO
>> Window Center	(0028,1050)	1C	Window Center for display. See C.11.2.1.2 for further explanation. Required if VOI LUT Sequence (0028,3010) is not present. May be present otherwise. Will be exported as linear VOILUT **- Export not supported**	UNSUPPORTED	NA
>> Window Width	(0028,1051)	1C	Window Width for display. See C.11.2.1.2 for further explanation. Required if Window Center (0028,1050) is sent. Will be exported as linear VOILUT **- Export not supported**	UNSUPPORTED	NA
>> Window Center & Width Explanation	(0028,1055)	3	Free form explanation of the meaning of the Window Center and Width. Multiple values correspond to multiple Window Center and Width values. **- Export not supported**	UNSUPPORTED	NA

Table 186: Softcopy Presentation LUT Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
Presentation LUT Sequence	(2050,0010)	1C	Defines a sequence of Presentation LUTs. Only a single item shall be included in this sequence. Required if Presentation LUT Shape (2050,0020) is absent. - Export not supported	UNSUPPORTED	NA
>LUT Descriptor	(0028,3002)	1	Specifies the format of the LUT Data in this Sequence. See C.11.6.1.1 for further explanation. - Export not supported	UNSUPPORTED	NA
>LUT Explanation	(0028,3003)	3	Free form text explanation of the meaning of the LUT. - Export not supported	UNSUPPORTED	NA
>LUT Data	(0028,3006)	1	LUT Data in this Sequence. - Export not supported	UNSUPPORTED	NA
Presentation LUT Shape	(2050,0020)	1C	Specifies predefined Presentation LUT transformation. Required if Presentation LUT Sequence (2050,0010) is absent. Enumerated Values: IDENTITY - no further translation necessary, input values are P-Values INVERSE - output values after inversion are P-Values See C.11.6.1.2 Export default value IDENTITY	ALWAYS	D

Table 187SOP Common Module Attributes

Attribute Name	Tag	Type	Value Description	Presence of Value	Source
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.11.1 (PR)	ALWAYS	D
SOP Instance UID	(0008,0018)	1	Generated UID. Reuse existing UID if there is one already generated for the annotation file in the study.	ALWAYS	AUTO

Table 188: Change Healthcare Private Attributes in GSPS Objects

Tag ID	Attribute Name	VR	VM	Significance
(3711,00xx)	Private Creator ID	LO	1	- The Private Creator ID for this block of added Private Elements. The value is "A.L.I. Technologies, Inc.".
(3711,xxB0)	ALI_SERIALIZED_ANNOTATIONS	OB	1	-Serialized Internal annotations in proprietary format
(3711,xxB1)	ALI_SERIALIZED_GSPS_DATE	DA	1	- Serialization Date
(3711,xxB2)	ALI_SERIALIZED_GSPS_TIME	TM	1	- Serialization Time
(3711,xxB3)	ALI_SERIALIZED_PRESENTATION	OB	1	-Serialized Internal presentation elements in proprietary format

NOTE1: Change Healthcare Radiology Solutions User created annotations (e.g. distance, ellipse etc.) and presentation elements (zoom, w/l etc.) are serialized in the above private attributes in the GSPS object. This allows the Change Healthcare applications to deserialize our own richer representation than what can be represented by DICOM standard GSPS attributes.

8 Approvers

Leonard Yan Senior Director, Engineering	Date
Paul Shum Architect Advisor	Date
Saied Rakhshandeh Product Manager	Date