IBM iConnect® Access

7.2

DICOM CONFORMANCE STATEMENT

IBM Watson Health

INDICATIONS FOR USE

The IBM iConnect Access application provides internet access to multi-modality softcopy medical images, reports, and other patient-related information to conduct diagnostic review, planning and reporting through the interactive display and manipulation of medical data. IBM iConnect Access provides healthcare professional tools to aid in interpreting medical images including:

- Displaying DICOM compliant medical images and non-DICOM content using XDS.
- Reformatting images, including creation of MPRs, MIPS, MinIPs, color/monochrome 3D volume rendered images.
- Manipulating displayed images via control of slice thickness, slice interval, obliquity, perspective, rotation, window/ level, crop, zoom, color/monochrome transformations, segmentation, sculpting, straightening the display of curved structures, and creating images perpendicular to a curvilinear path.
- Creating individually captured DICOM images that can be displayed and stored in a PACS.
- Measuring coronary calcium, which is intended for non-invasive identification and quantification of calcified atherosclerotic plaques in the coronary arteries using tomographic medical image data and clinically accepted calcium scoring algorithms.

The IBM iConnect Access application can be configured to provide either lossless or lossy compressed images for display. The medical professional user must determine the appropriate level of image data compression that is suitable for their purpose.

Lossy compressed mammographic images and digitized film screen images must not be reviewed for primary image interpretations. Mammographic images may only be interpreted using an FDA approved monitor that offers at least 5 MP resolution and meets other technical specifications reviewed and accepted by FDA.

CAUTION: U.S. federal law restricts this device to sale by, or on the order of, a physician.

NOTE: The IBM iConnect Access software complies with the MDD Council Directive 93/42/EEC of 14 June 1993.

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The symbols glossary is provided electronically at **Statements and Patches**.

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Part	Date	Revision	Description
ICA-23231	04/2020	1.0	Initial revision for IBM iConnect Access 7.2

1. Conformance Statement Overview

This document describes the DICOM v3.0 implementation supported by IBM iConnect Access. It documents conformance aspects required to interoperate with other DICOM v3.0 conformant devices.

IBM iConnect Access is a zero-client web application designed to share, visualize, and transfer medical images, reports, and other patient data from multiple data sources.

IBM iConnect Access has separate downloadable application, named the IBM iConnect PACS Gateway for receiving studies from other PACS systems and forwarding to IBM iConnect Access system. This client's DICOM conformance is documented in separate DICOM Conformance Statement (ICA-23232) and is not covered in this document.

1.1 Viewer Application/Pre-Cache Application

Table 1 lists the Supported Networking DICOM Service (SOP) Classes supported for the viewer application for loading, viewing, storing study data, and for the pre-cache service for caching study data.

Table 1 — Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Computed Radiography Image Storage 1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital Mammography Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.2	No	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Digital Intra-oral X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage 1.2.840.10008.5.1.4.1.1.3.1	No	Yes
CT Image Storage 1.2.840.10008.5.1.4.1.1.2	No	Yes
MR Image Storage 1.2.840.10008.5.1.4.1.1.4	No	Yes
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.20	No	Yes
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame True Color Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.4	No	Yes
X-Ray Angiographic Image Storage 1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage 1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Breast Tomosynthesis Image Storage 1.2.840.10008.5.1.4.1.1.13.1.3	No	Yes
Positron Emission Tomography Image Storage 1.2.840.10008.5.1.4.1.1.128	No	Yes
VL Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Video Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes
Ophthalmic Photography 8 Bit Image Storage 1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes
Ophthalmic Tomography Image Storage 1.2.840.10008.5.1.4.1.1.77.1.5.4	No	Yes
Grayscale Softcopy Presentation State Storage SOP Class 1.2.840.10008.5.1.4.1.1.11.1	Option	Yes
Key Object Selection Document Storage 1.2.840.10008.5.1.4.1.1.88.59	No	Yes
RT Image Storage 1.2.840.10008.5.1.4.1.1.481.1	No	Yes
Basic Voice Audio Waveform Storage 1.2.840.10008.5.1.4.1.1.9.4.1	No	Option
Raw Data Storage 1.2.840.10008.5.1.4.1.1.66	No	Option
Basic Text SR Storage 1.2.840.10008.5.1.4.1.1.88.11	No	Option
Encapsulated PDF Storage 1.2.840.10008.5.1.4.1.1.104.1	No	Option
Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND 1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE 1.2.840.10008.5.1.4.1.2.2.2	Yes	No

1.2 Transfer Application

Table 2 lists the Supported Networking DICOM Service (SOP) Classes supported for the transfer and download operations.

Table 2 - Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Computed Radiography Image Storage 1.2.840.10008.5.1.4.1.1.1	Yes	Yes
CT Image Storage 1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image Storage 1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
MR Image Storage 1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage 1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
MR Spectroscopy Storage 1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes
Enhanced MR Color Image Storage 1.2.840.10008.5.1.4.1.1.4.3	Yes	Yes
RT Image Storage 1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage 1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage 1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage 1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage 1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
RT Brachy Treatment Record Storage 1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
RT Treatment Summary Record Storage 1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
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
Nuclear Medicine Image Storage 1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Nuclear Medicine Image Storage (Retired) 1.2.840.10008.5.1.4.1.1.5	Yes	Yes
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Multi-frame Single Bit Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.1	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Ultrasound Image Storage (Retired) 1.2.840.10008.5.1.4.1.1.6	Yes	Yes
Ultrasound Image Storage 1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Enhanced US Volume Storage 1.2.840.10008.5.1.4.1.1.6.2	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Ultrasound Multi-frame Image Storage (Retired) 1.2.840.10008.5.1.4.1.1.3	Yes	Yes
Ultrasound Multi-frame Image Storage 1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Digital X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
VL Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
Video Endoscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	Yes
Video Microscopic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	Yes
Video Photographic Image Storage 1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	Yes
Ophthalmic Photography 8 Bit Image Storage 1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	Yes
Ophthalmic Photography 16 Bit Image Storage 1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	Yes
Stereometric Relationship Storage 1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	Yes
Ophthalmic Tomography Image Storage 1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
X-Ray Angiographic Image Storage 1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
Enhanced XA Image Storage 1.2.840.10008.5.1.4.1.1.12.1.1	Yes	Yes
X-Ray Radiofluoroscopic Image Storage 1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
Enhanced XRF Image Storage 1.2.840.10008.5.1.4.1.1.12.2.1	Yes	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired) 1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
X-Ray 3D Angiographic Image Storage 1.2.840.10008.5.1.4.1.1.13.1.1	Yes	Yes
X-Ray 3D Craniofacial Image Storage 1.2.840.10008.5.1.4.1.1.13.1.2	Yes	Yes
Breast Tomosynthesis Image Storage 1.2.840.10008.5.1.4.1.1.13.1.3	Yes	Yes
Positron Emission Tomography Image Storage 1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Enhanced PET Image Storage 1.2.840.10008.5.1.4.1.1.130	Yes	Yes
Basic Structured Display Storage 1.2.840.10008.5.1.4.1.1.131	Yes	Yes
Digital Mammography X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation 1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Digital Intra-oral X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
Basic Text SR Storage 1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Enhanced SR Storage 1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Comprehensive SR Storage 1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Procedure Log Storage 1.2.840.10008.5.1.4.1.1.88.40	Yes	Yes
Mammography CAD SR Storage 1.2.840.10008.5.1.4.1.1.88.50	Yes	Yes
Key Object Selection Document Storage 1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Chest CAD SR Storage 1.2.840.10008.5.1.4.1.1.88.65	Yes	Yes
X-Ray Radiation Dose SR Storage 1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Colon CAD SR Storage 1.2.840.10008.5.1.4.1.1.88.69	Yes	Yes
Grayscale Softcopy Presentation State Storage SOP Class 1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Color Softcopy Presentation State Storage SOP Class 1.2.840.10008.5.1.4.1.1.11.2	Yes	Yes
Pseudo-Color Softcopy Presentation State Storage SOP Class 1.2.840.10008.5.1.4.1.1.11.3	Yes	Yes
Blending Softcopy Presentation State Storage SOP Class 1.2.840.10008.5.1.4.1.1.11.4	Yes	Yes
XA/XRF Grayscale Softcopy Presentation State Storage 1.2.840.10008.5.1.4.1.1.11.5	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
12-lead ECG Waveform Storage 1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage 1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Ambulatory ECG Waveform Storage 1.2.840.10008.5.1.4.1.1.9.1.3	Yes	Yes
Hemodynamic Waveform Storage 1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Cardiac Electrophysiology Waveform Storage 1.2.840.10008.5.1.4.1.1.9.3.1	Yes	Yes
Basic Voice Audio Waveform Storage 1.2.840.10008.5.1.4.1.1.9.4.1	Yes	Yes
General Audio Waveform Storage 1.2.840.10008.5.1.4.1.1.9.4.2	Yes	Yes
Arterial Pulse Waveform Storage 1.2.840.10008.5.1.4.1.1.9.5.1	Yes	Yes
Respiratory Waveform Storage 1.2.840.10008.5.1.4.1.1.9.6.1	Yes	Yes
Raw Data Storage 1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Spatial Registration Storage 1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials Storage 1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
Deformable Spatial Registration Storage 1.2.840.10008.5.1.4.1.1.66.3	Yes	Yes
Segmentation Storage 1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Surface Segmentation Storage 1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Real World Value Mapping Storage 1.2.840.10008.5.1.4.1.1.67	Yes	Yes
Lensometry Measurements Storage 1.2.840.10008.5.1.4.1.1.78.1	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Autorefraction Measurements Storage 1.2.840.10008.5.1.4.1.1.78.2	Yes	Yes
Keratometry Measurements Storage 1.2.840.10008.5.1.4.1.1.78.3	Yes	Yes
Subjective Refraction Measurements Storage 1.2.840.10008.5.1.4.1.1.78.4	Yes	Yes
Visual Acuity Measurement 1.2.840.10008.5.1.4.1.1.78.5	Yes	Yes
Spectacle Prescription Reports Storage 1.2.840.10008.5.1.4.1.1.78.6	Yes	Yes
Macular Grid Thickness and Volume Report Storage 1.2.840.10008.5.1.4.1.1.79.1	Yes	Yes
Encapsulated PDF Storage 1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Encapsulated CDA Storage 1.2.840.10008.5.1.4.1.1.104.2	Yes	Yes
Hanging Protocol Storage 1.2.840.10008.5.1.4.38.1	Yes	Yes
Color Palette Storage 1.2.840.10008.5.1.4.39.1	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND 1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE 1.2.840.10008.5.1.4.1.2.2.2	Yes	No

2. Contents

3. Introduction

The IBM iConnect Access application (subsequently referred to simply as “the application”) is a web application that federates data from multiple data sources (including DICOM data sources) and presents the data to the user. The primary type of data presented is DICOM images and reports. The application is capable of presenting and allowing the basic manipulation of images from the web browser with only basic web browser requirements (i.e. Javascript support enabled) and no software download/install.

This document is intended for administrative staff working with the servers and will provide the reader with the knowledge of how to integrate this product within a DICOM compliant healthcare environment. It details DICOM Service Classes and Communication Protocols that are supported by this product.

If reader is unfamiliar with DICOM, it is recommended to read the DICOM Specification (referenced in section 3.7) prior to reading this conformance statement.

3.1 Revision History

Document Version	Date of Issue	Author	Description
1.0	April 13, 2020	Jack Pei	Final text

3.2 Audience

This document is written for the people that need to understand how the application will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product’s functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between the applications and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement.

The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

MergeCom3 – A DICOM library that facilitates the creation of DICOM applications.

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – A set of encoding rules that allow Application Entities to unambiguously negotiate the encoding techniques (e.g., Data Element structure, byte ordering, compression) they are able to support, thereby allowing these Application Entities to communicate. Examples: JPEG Baseline, Explicit VR Little Endian.

Unique Identifier (UID) – a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts.* The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* – which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information). The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.6 Abbreviations

AE	**Application Entity**
AET	**Application Entity Title**
DHCP	**Dynamic Host Configuration Protocol**
DICOM	**Digital Imaging and Communications in Medicine**
DNS	**Domain Name System**
DX	**Digital X-Ray**
FSC	**File-Set Creator**
HIS	**Hospital Information System**
IOD	**Information Object Definition**
IPv4	**Internet Protocol version 4**
IPv6	**Internet Protocol version 6**
ISO	**International Organization for Standards**
JPEG	**Joint Photographic Experts Group**
MPPS	**Modality Performed Procedure Step**
MSPS	**Modality Scheduled Procedure Step**
MTU	**Maximum Transmission Unit (IP)**
MWL	**Modality Worklist**
NTP	**Network Time Protocol**
O	**Optional (Key Attribute)**
OSI	**Open Systems Interconnection**
PACS	**Picture Archiving and Communication System**
PDU	**Protocol Data Unit**
R	**Required (Key Attribute)**

RIS	**Radiology Information System.**
SC	**Secondary Capture**
SCP	**Service Class Provider**
SCU	**Service Class User**
SOP	**Service-Object Pair**
SPS	**Scheduled Procedure Step**
SR	**Structured Reporting**
TCP/IP	**Transmission Control Protocol/Internet Protocol**
U	**Unique (Key Attribute)**
UL	**Upper Layer**
VR	**Value Representation**

3.7 References

NEMA PS3 2019e – Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/.

4. Networking

This section describes the networking related services of the application.

4.1 Implementation Model

4.1.1 Application Data Flow

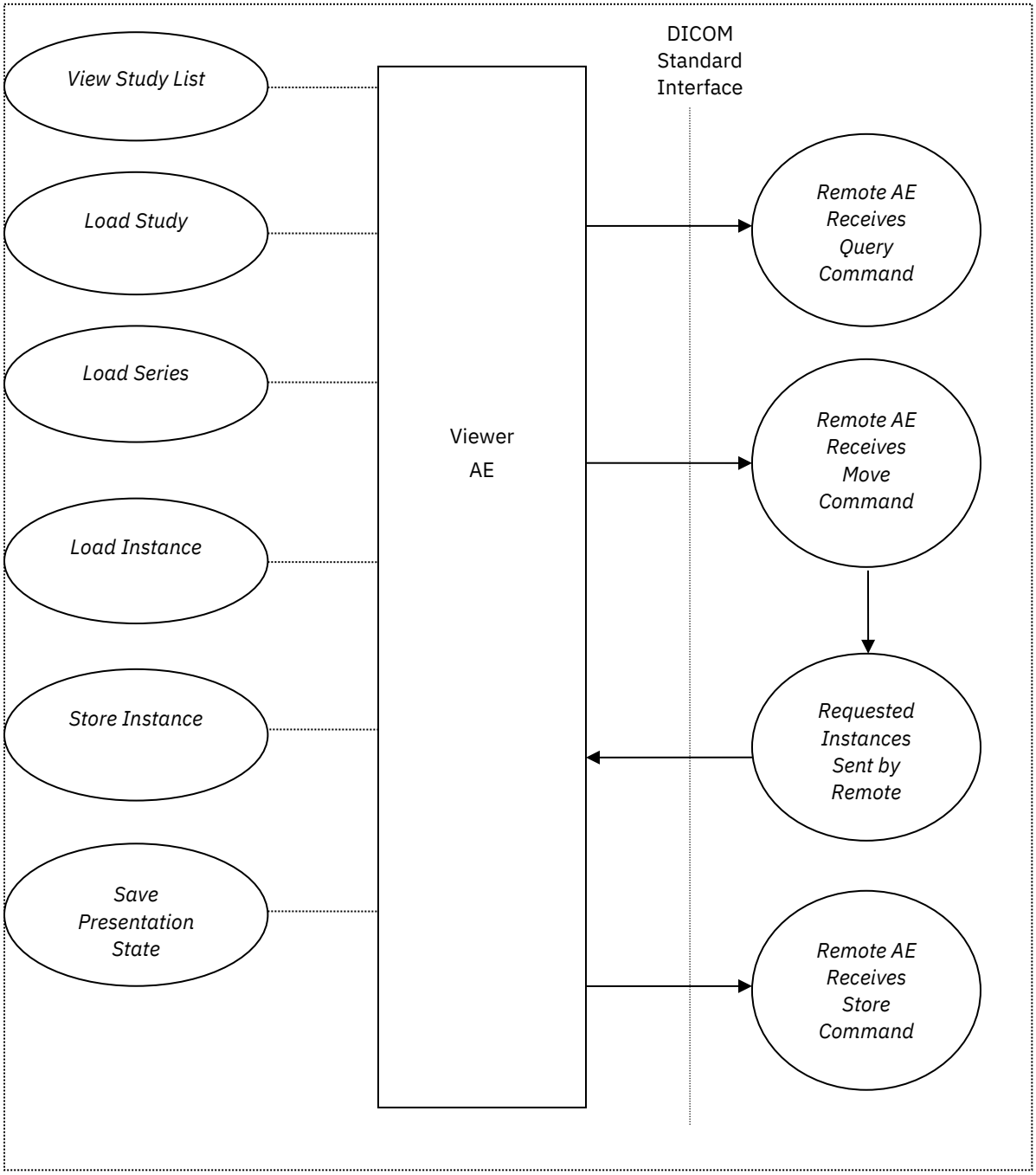

Figure 1 – Viewer Data Flow

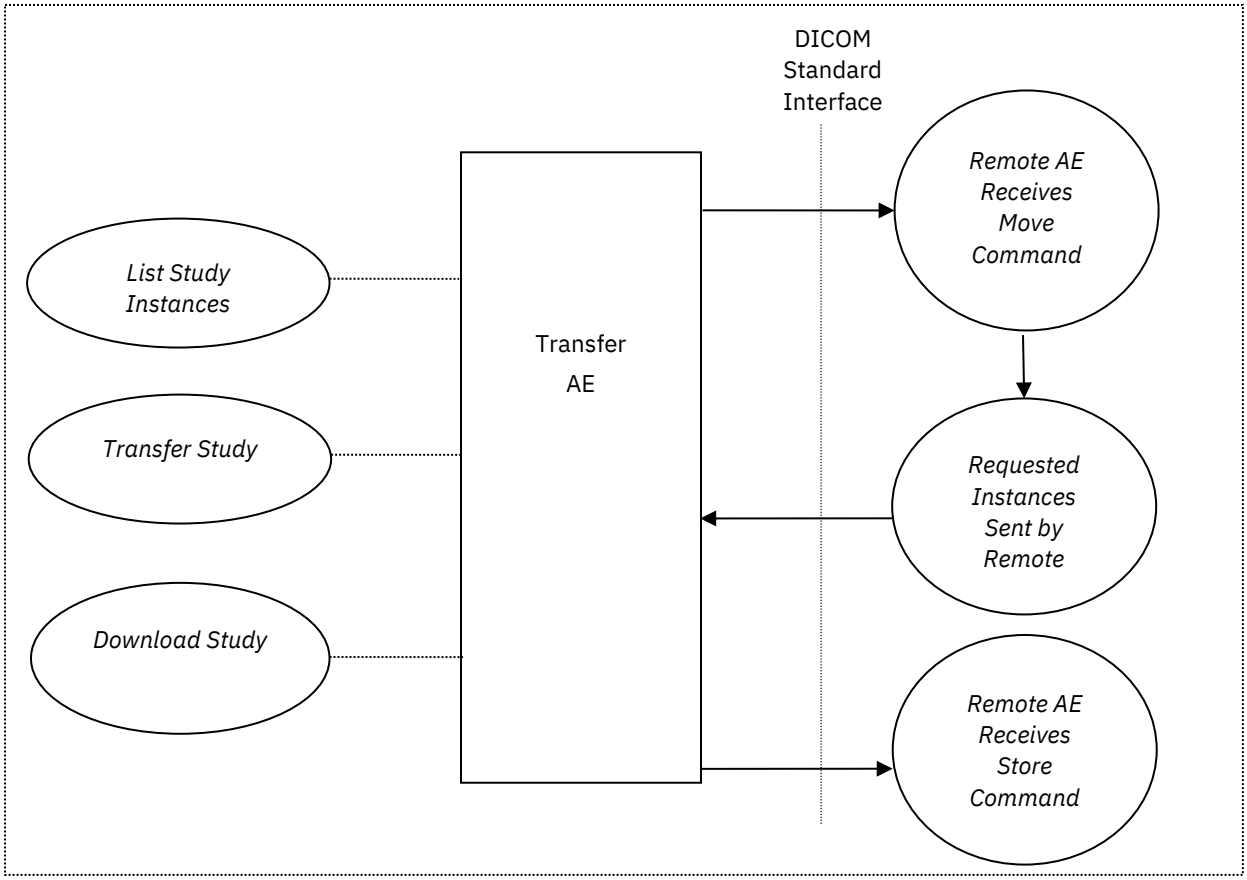

Figure 2 – Transfer/Download Data Flow

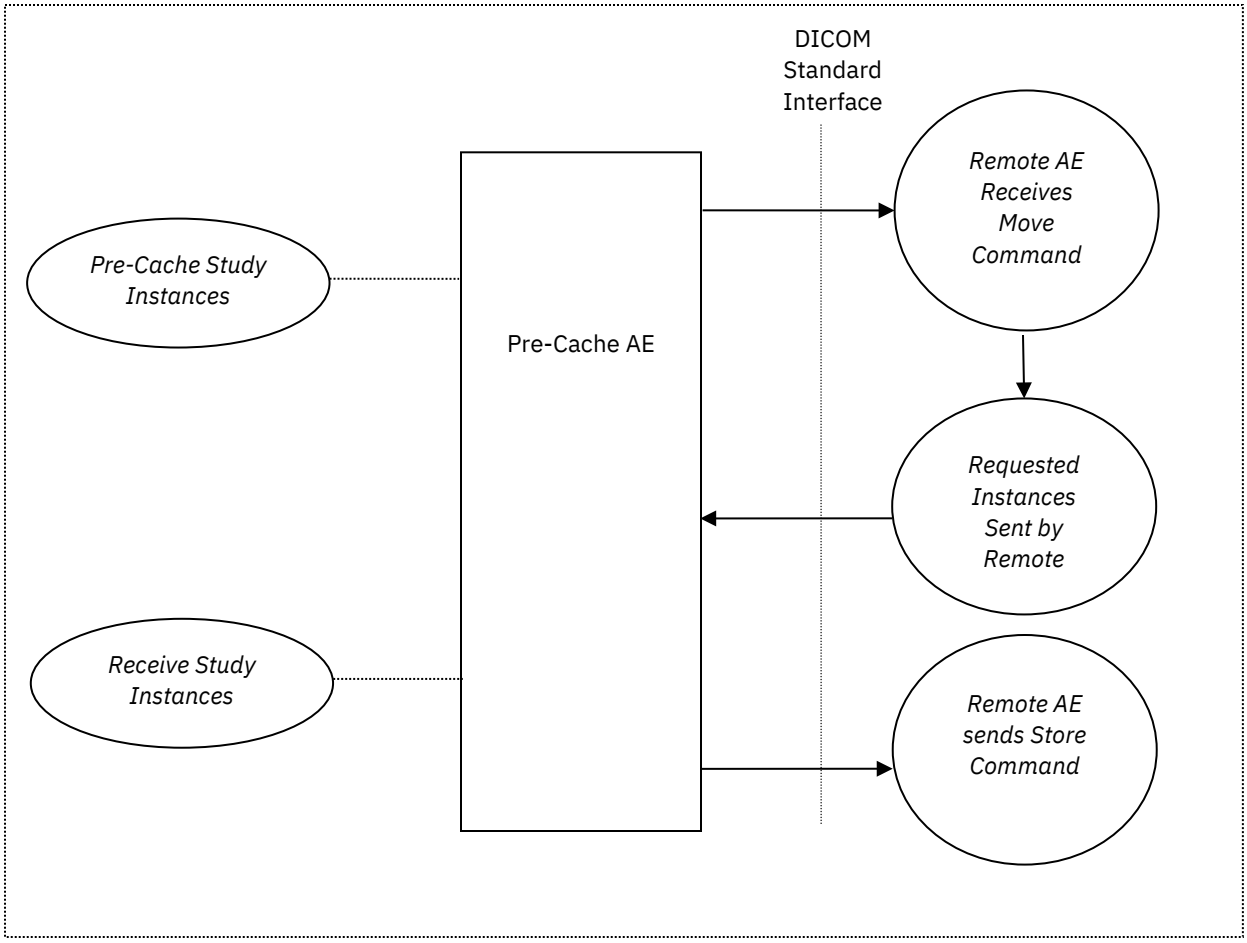

Figure 3 – Pre-Cache Data Flow

The application implements its DICOM functionality both in the ASP.NET server application and in Windows services that are part of the solution. The DICOM functionality of the application is invoked by:

- the ASP.NET web application as a result of various user actions,
- Windows services that process “jobs” created as a result of various user actions, and
- independent data requests from the download service made during a study download.

Although the AEs are the result of different implementations in different processes, they act as if they are three AEs:

- Viewer AE – All primary viewing, saving, and uploading operations, sharing a single AE title.
- Transfer AE – Retrieval and storage of data objects being transferred to another data source or downloaded to an external client, using a single AE title. This AE is optional. It is only required if the transfer or download option is configured for the system.
- Pre-Cache AE – Retrieving or receiving studies to be pre-cached ahead of viewing by users, for performance. This AE is optional.

4.1.2 Functional Definition of AE's

The application exposes three AEs to remote DICOM AEs: the Viewer AE, the Transfer AE, and the Pre-Cache AE.

4.1.2.1 Functional Definition of Viewer AE

There are various functions implemented within the Viewer AE. The application can be used in "standalone" mode, which provides a complete application UI, or it can be used in "integrated" mode, which allows a 3rd party application to embed imaging functionality within their application. Some of the Viewer AE functions are invoked only from the standalone mode and others behave differently depending on the mode. These differences are described where appropriate.

The various functions of the Viewer AE are detailed individually in the following sections specific to the real-world activities from above.

4.1.2.1.1

View Study List

When the user accesses the study list from within the application, the Viewer AE is activated to perform a query for available studies which match the user query criteria and imposed filters. An association request is sent to one or more destination AEs simultaneously and, upon successful negotiation of the association, the query request will be sent. The Viewer AE will then receive the query responses, up to a maximum. After the responses are received from all queried destination AEs, the results are consolidated and displayed to the user.

This operation only occurs from the stand-alone user interface of the application. The application also supports embedding in other 3rd party user interfaces which will not invoke the same study query operation.

Load Study

When the user requests to display a study from within the standalone application or one or more studies through a 3rd party user interface, the Viewer AE is activated. This results in multiple transactions.

4.1.2.1.2 An association request is sent to one or more destination AEs simultaneously and, upon successful negotiation of the association, a query request for the details of the study or studies requested to be loaded. The Viewer AE will then receive the query responses. After the responses are received from all queried destination AEs, the results are consolidated and the Viewer AE proceeds to the query for the first study's contents.

An association request is sent to one or more destination AEs simultaneously and, upon successful negotiation of the association, a query request to list the series for the first study is issued. The Viewer AE will then receive the query responses. After the responses are received from all queried destination AEs, the results are consolidated.

If the application is being used in standalone mode, an association request is sent to one or more destination AEs simultaneously and, upon successful negotiation of the association, a query request for studies related to the same patient is issued. The Viewer AE will then receive the query responses. After the responses are received from all queried destination AEs, the results are consolidated.

After the final contents of the study are consolidate from all of the above transactions, the study is presented to the user.

During the presentation, the system will automatically load the first one or more series, depending on the presentation selected by the user. This results in the View
4.1.2.1.3 Series real-world activity happening automatically after the Load Study activity.

Load Series

While the user is reviewing a study in both standalone and integrated modes, a series within the study can be loaded. This happens either automatically when the study is loaded, when a series thumbnail is loaded, or when the user loads a selected series into a viewer. The Viewer AE is activated to perform a query of images in the series.

An association request is sent to a destination AE and, upon successful negotiation of the association, a query request for images for the selected series is issued. The Viewer AE will then receive the query responses. After the responses are received from the destination AE, the Viewer AE proceeds to display the images in the current viewer layout.

During the presentation of the series, the system will automatically load all images that are displayed in the first page of the viewer. This results in the View Image, Report, or Audio Clip real-world activity happening automatically after the Load Series activity.

Load Instance

Any time the user requests to display an image, presentation state, key object, report, or audio clip within the application, the same operations are invoked. This can happen automatically after the Load Series activity, selection of a new series for
4.1.2.1.4 display, the application displaying a series thumbnail, or scrolling to an image that was not previously visualized. This can also happen when the user views a report or audio file.

An association request is sent to the destination AE that contains the instance and, upon successful negotiation of the association, a move request for the IOD is issued. The Viewer AE is listening for the destination AE to deliver the IOD to it using a store operation and waiting for successful completion of the move. After this, the IOD is rendered to a format suitable for delivery to the user and presented to the user.

Save Presentation State

4.1.2.1.5 The user can choose to save the presentation state of a displayed series while they are viewing and manipulating that series. When they invoke the save operation, the Viewer AE is activated to store the presentation state(s). An association request is sent to the same destination data source from which the series was loaded (although the data source can be configured to send the presentation state to a different AE than that which was used to query and retrieve data) and, upon successful negotiation of the association, the storage request will be sent. On successful completion of the storage, the presentation state series will be displayed in the thumbnail area.

This operation may or may not be available to all users.

4.1.2.2.1

4.1.2.2 Functional Definition of Transfer AE

List Study Instances

During the initial processing of transfer or download jobs, the Transfer AE is activated to acquire information about the study instances to be transferred or downloaded. This results in multiple transactions.

An association request is sent to the destination AE containing the study and, upon successful negotiation of the association, a query request for the study's series is

made. The Transfer AE will then receive the query responses. After the responses are received, the Transfer AE proceeds to query the instances of each series.

Transfer Study

4.1.2.2.2 If the application has multiple data sources and the transfer feature is enabled, the user can transfer studies between the data sources. This happens either by the Transfer AE requesting a data source to move the data directly to another data source, or by the Transfer AE retrieving the data from one data source and storing it into another data source.

In the case where a direct move is used, the Transfer AE sends an association request to the source AE that contains the study and, upon successful negotiation of the association, a move request is issued with the destination AE as the destination. The Transfer AE waits for successful completion of the move. On successful completion of the move, the transfer job will be listed as complete.

In the case where a direct move is not used, the Transfer AE sends an association request to the source AE that contains the study (assuming the source is a DICOM data source) and, upon successful negotiation of the association, a move request is issued with the destination AE as the Transfer AE. The Transfer AE is listening for the source AE to deliver the IODs to it using store operations and waiting for successful completion of the move. After this, the Transfer AE sends an association request to the destination AE and, upon successful negotiation of the association, the storage requests will be sent. On successful completion of the storage, the transfer job will be listed as complete.

4.1.2.2.3 This operation may or may not be available to all users.

Download Study

If the download feature is enabled, the user can transfer studies from the application’s data sources to an external client, possibly with an external PACS as a final destination. During processing a download job, the Transfer AE sends an association request to the source AE that contains the study and, upon successful negotiation of the association, a move request is issued with the Transfer AE as the destination AE. The Transfer AE is listening for the source AE to deliver the IODs to it using store operations and waiting for successful completion of the move. After this, the Transfer AE transmits the study to the client using non-DICOM communication and the download job will be listed as complete.

This operation may or may not be available to all users.

4.1.2.3 Functional Definition of Pre-Cache AE

Pre-Cache Study Instances

4.1.2.3.1 The Pre-Cache service can be configured with multiple data sources which it will pull studies within a configured time frame from, at a configured interval. When determining which studies to be cached, the Pre-Cache AE sends an association request to each of the configured data sources and upon successful negotiation of the association sends a query with a data range based on the configured caching retrieval range. The Pre-Cache AE then performs a study level move for each of the studies found during the initial query.

The system may also be configured so that it does not query the remote data sources and relies on them to push the data that is to be cached. In this configuration the remote data sources create an association with the Pre-Cache AE and perform moves for the instances to be cached.

Receive Study Instances

4.1.2.3.2 The Pre-Cache service can also be used to receive study instances without querying/fetching. Any external PACS can directly issue C-STORE commands and stored study instances to it.

4.1.3 Sequencing of Real World Activities

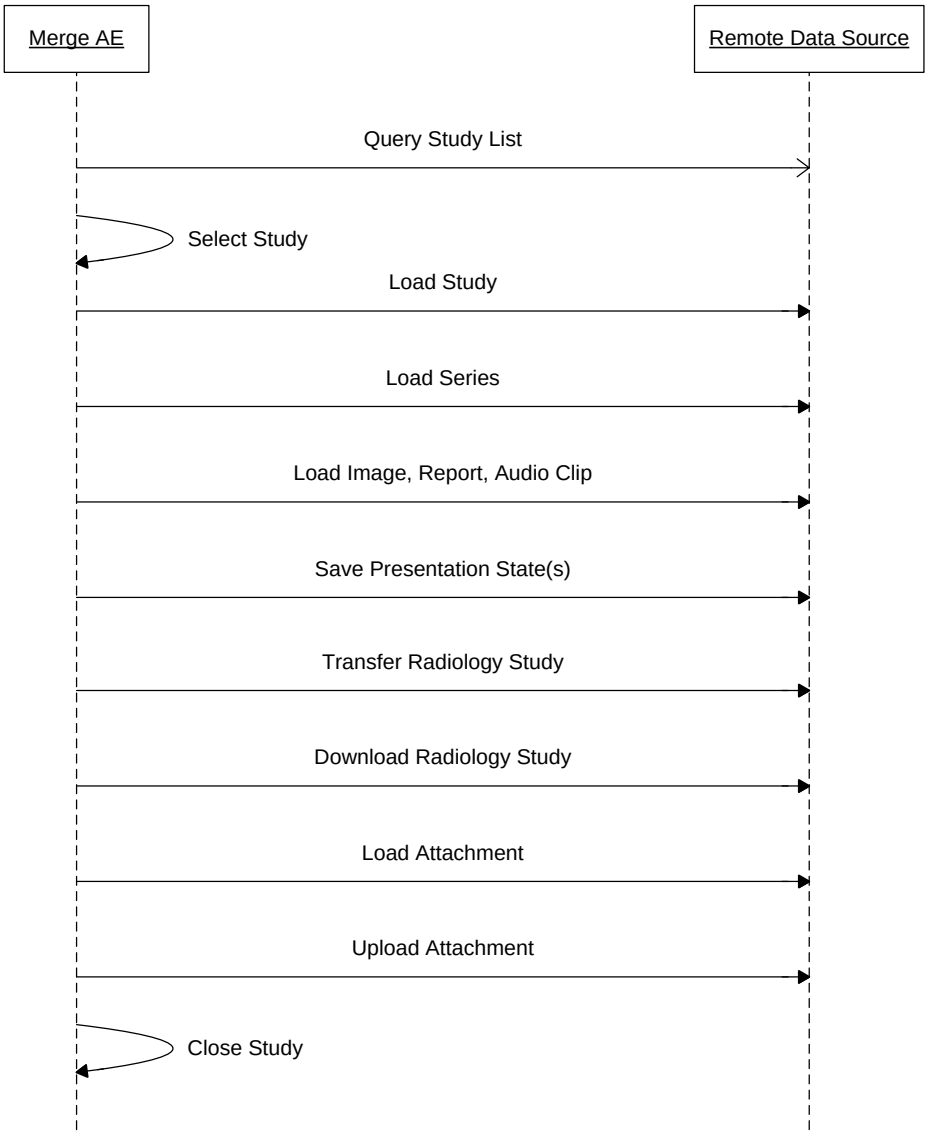

Figure 4 Real-World Activity Sequencing Constraints

Typically, the sequence of operations from the standalone application is as follows:

1. Query Study List
2. Select Study
3. Load Study
4. Load Series

5. Load Image(s), Report(s), Audio Clip(s)
6. (Optional) Save Presentation State(s)
7. (Optional) Transfer Study
8. (Optional) Download Study
9. Close Study

Steps 4, 5, 6, 7, 8, and 9 are in control of the user and can be performed in any order or repeated any number of times per study.

Steps 7 and 8 can also be initiated independently from a study list within the application, but there is no specific sequencing of operations in that case.

The typical sequence of operations from an integrated environment include only steps 3 to 10.

4.2 AE Specifications

4.2.1 Viewer Application Entity Specification

4.2.1.1 SOP Classes

The application provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	No	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	No	Yes

4.2.1.2 Association Policies

General

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

4.2.1.2.1

Application Context Name	1.2.840.10008.3.1.1.1

Number of Associations

4.2.1.2.2 The Viewer AE can initiate and accept any number of associations simultaneously, with some limitations.

If the Viewer AE is configured to reuse DICOM associations, the maximum number of active initiated associations can be configured. If it is not so configured, it will initiate as many associations as required to process outstanding requests on-demand.

The Viewer AE will only initiate one association at a time with which to save presentation states.

4.2.1.2.3 The Viewer AE will accept as many associations as required to process outstanding requests on-demand.

Asynchronous Nature

4.2.1.2.4 The Viewer AE does not support asynchronous operations and will not perform asynchronous window negotiation.

Implementation Identifying Information

The application uses the following implementation identifying information:

Implementation Class UID	2.16.840.1.113669.2013.1.2
Implementation Version Name	IBM ICA 7.1

4.2.1.3 Association Initiation Policy

This section describes the conditions under which the Viewer AE SCU will initiate an association.

Activity – View Study List

Description and Sequencing of Activities

4.2.1.3.1

4.2.1.3.1.1

When the application is used in stand-alone mode, the starting point of the user's usage is either the "Study" page or the "Patient" page, from where they may view a list of studies from which to select one to review. When the application is being integrated by another application, the user may visit a patient record page from where they may view a list of studies for a particular patient or they may request a study list page that lists studies matching some provided criteria.

When using the "Study" page, the user can set up a set of query parameters for patient, study, or even series attributes for which they want to see the list of matching studies. These query parameters supplement any filters imposed upon them by the domain administrator used to limit the information that that user may see. The Viewer AE is activated automatically when the user visits this page (is the user preference is set to automatically query) or when the user presses the "Search" button.

When using the "Patient" page, the user has selected a patient and is being presented with a list of studies for that patient. Alternatively, when a hosting application invokes the patient record, the user is also presented with a list of studies for that patient. The Viewer AE is activated automatically as a result of the user visiting the patient record or when the user refines the date range and presses the "Search" button.

In all of the above scenarios, the Viewer AE can operate (based on configuration) in one of two modes: hierarchical query, or non-negotiated relational query.

In the more common hierarchical query, the Viewer AE attempts to initiate a new Association with all remote DICOM C-FIND SCPs configured within the system, activated within the domain for which the user belongs, or which the user has selected. For each DICOM C-FIND SCP, if the association is successfully negotiated, the Viewer AE issues a C-FIND request at the Study level where the Identifier contains the study matching criteria as described above. The Viewer AE will then wait for each C-FIND response, up to a configurable maximum. When the C-FIND responses are complete or the maximum is received, the Viewer AE will remove any data which does not match the original query (in the case the DICOM data source could not apply optional query keys), combine the results from all data sources,

and, if the user applied series-level matching criteria, will proceed to a further Series level query, else it will present the combined results to the user.

If a Series level query is required, the Viewer AE attempts to initiate a new Association with all remote DICOM C-FIND SCPs sequentially for each study found in the previous query. For each DICOM C-FIND SCP, if the association is successfully negotiated, the Viewer AE issues a C-FIND request at the Series level where the Identifier contains the Study Instance UID and series -level matching criteria as described above. The Viewer AE will then wait for each C-FIND response. When the C-FIND responses for each study are received, the Viewer AE will remove any data which does not match the original query (in the case the DICOM data source could not apply optional query keys), combine the results from all data sources, and present the combined results to the user.

If the application is being integrated by another application, that application requested the study list to be displayed, and study-level query parameters were provided (i.e. Study Instance UID, Accession Number, and/or Referring Physician), an additional DICOM C-FIND request for related studies is issued before the results are combined and presented to the user.

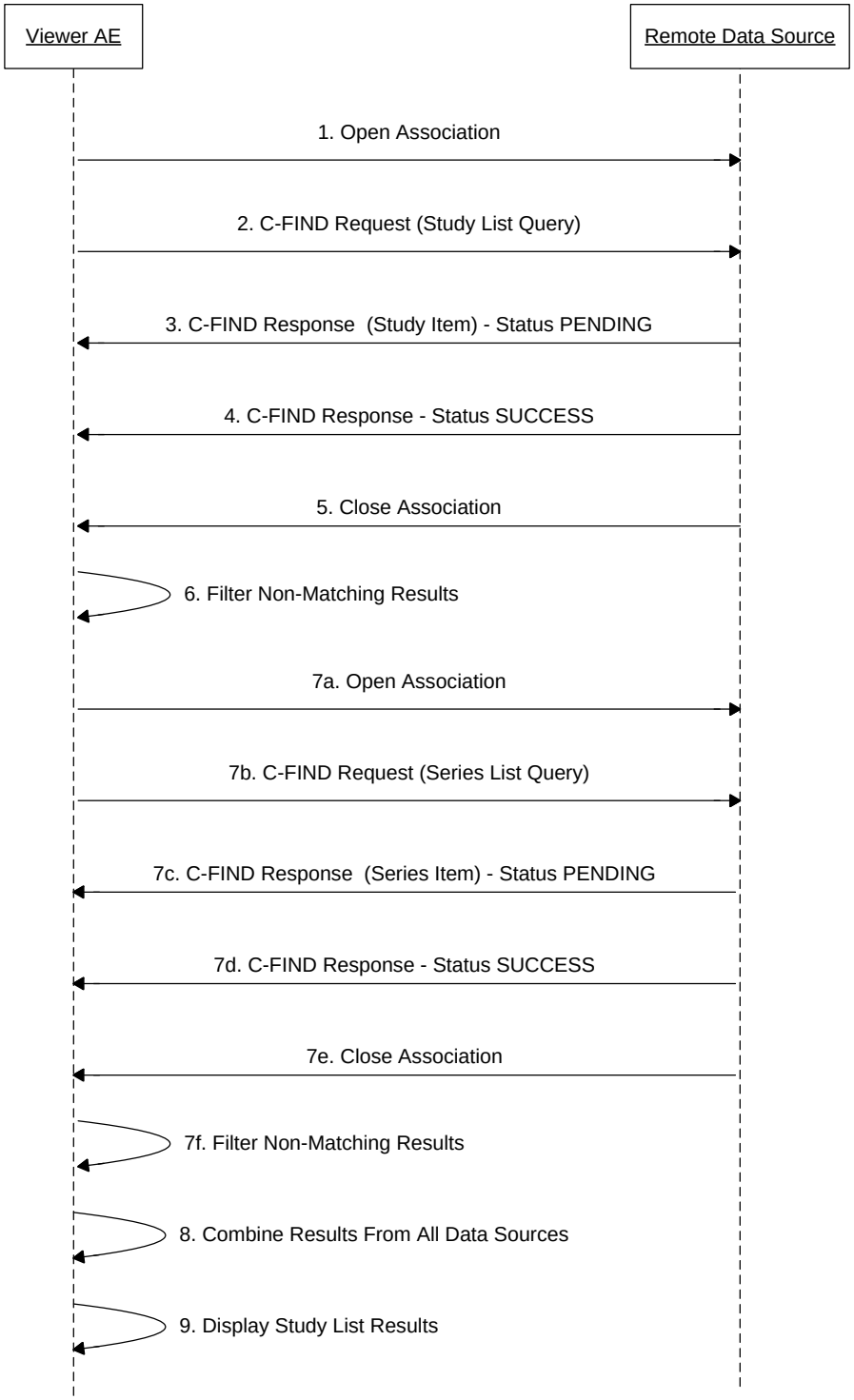

Figure 5 - View Study List Interaction – Hierarchical Query

The typical sequence of interactions between the Viewer AE and a DICOM data source when using hierarchical query as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-FIND request to the DICOM data source containing the user's study-level query attributes and domain-specific filters.
3. The DICOM data source returns one C-FIND response for each study that matches at least the required query keys and containing at least the requested return keys contained in the request.
4. The DICOM data source returns the final C-FIND response.
5. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
6. The Viewer AE checks the returned studies to confirm that all responses match the optional matching keys, else those studies are removed from the results.
7. If the user specified series-level query attributes or if they exist in their configured filters, the Viewer AE performs the following for each study found:
   a. The Viewer AE opens an association with the DICOM data source.
   b. The Viewer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID and the user's series-level query attributes and domain-specific filters.
   c. The DICOM data source returns one C-FIND response for each series that matches at least the required query keys and containing at least the requested return keys contained in the request.
   d. The DICOM data source returns the final C-FIND response.
   e. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
   f. The Viewer AE checks the returned series to confirm that all responses match the optional matching keys, else those series are removed from the results.
8. The Viewer AE combines the returned studies with results from other data sources.
9. The Viewer AE displays the combined results of the search to the user.
   In the non-negotiated relational query, the Viewer AE attempts to make a Series level query using all query criteria. The Viewer AE attempts to initiate a new Association with all remote DICOM C-FIND SCPs configured within the system, activated within the domain for which the user belongs, or which the user has selected. For each DICOM C-FIND SCP, if the association is successfully negotiated, the Viewer AE issues a C-FIND request at the Series level where the Identifier contains both the study-level and series-level matching criteria as described above. The Viewer AE will then wait for each C-FIND response, up to a configurable maximum. When the C-FIND responses are complete or the

maximum is received, the Viewer AE will remove any data which does not match the original query (in the case the DICOM data source could not apply optional query keys), combine the results from all data sources, and present the combined results to the user.

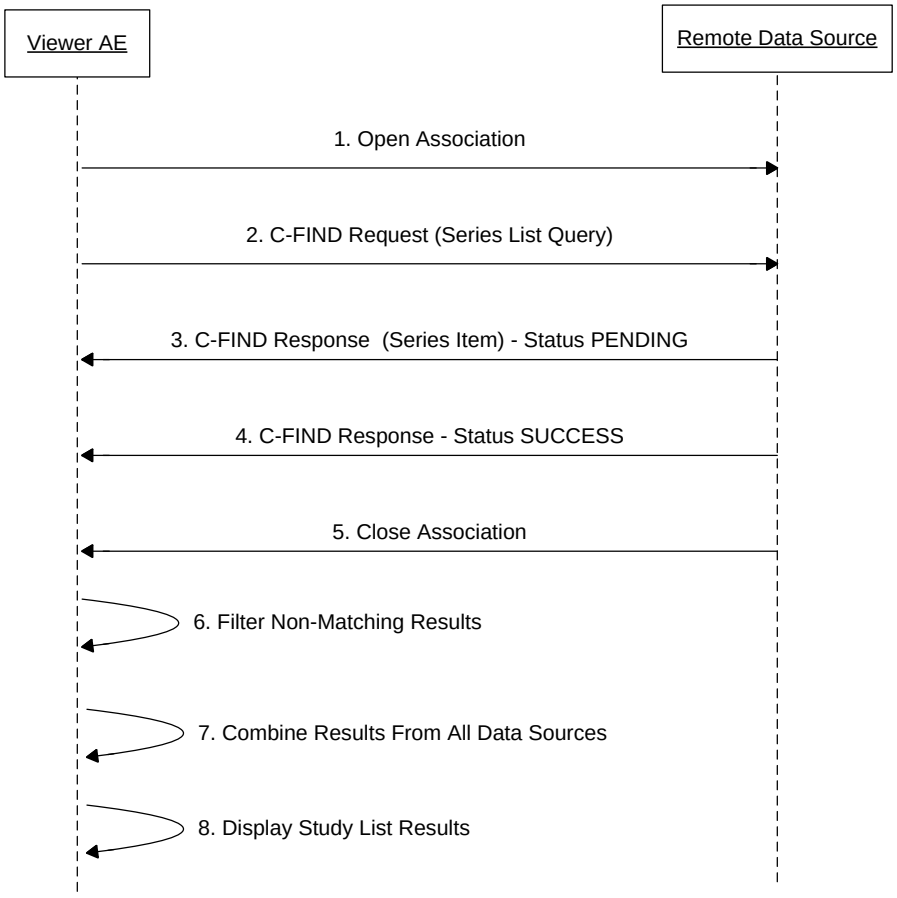

Figure 6 - View Study List Interaction – Non-Negotiated Relational Query

The typical sequence of interactions between the Viewer AE and a DICOM data source when using hierarchical query as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-FIND request to the DICOM data source containing the user's study and series level query attributes and domain-specific filters.
3. The DICOM data source returns one C-FIND response for each series that matches at least the required query keys and containing at least the requested return keys contained in the request.

4. The DICOM data source returns the final C-FIND response.
5. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
6. The Viewer AE checks the returned studies and series to confirm that all responses match the optional matching keys, else those studies are removed from the results.
7. The Viewer AE combines the returned studies with results from other data sources.
8. The Viewer AE displays the combined results of the search to the user.
   In both the hierarchical and non-negotiated relational case, while combining the results, duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not “merged”). The system will, however, keep track of which data sources study instances are found.

In both the hierarchical and non-negotiated relational case, if the application is being integrated by another application, that application requested the study list to be displayed, and study-level query parameters were provided (i.e. Study Instance UID, Accession Number, and/or Referring Physician), the following additional sequence of interactions may happen:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-FIND request to the DICOM data source containing the Patient’s Name and Patient’s Date of Birth asking for related studies for this patient.
3. The DICOM data source returns one C-FIND response for each study that matches the patient information.
4. The DICOM data source returns the final C-FIND response.
5. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).

Proposed Presentation Contexts

The Viewer AE will propose Presentation Contexts as shown in the following table.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

SOP Specific Conformance for C-FIND SOP Class

The behavior of Viewer AE when encountering status codes in a C-FIND response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to that DICOM data source is considered to have failed; the results will not be included in the response, and if other data sources succeed, the user will be informed that the results are incomplete.

C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. The results will be displayed to the user.
Refused	Out of Resources	A700	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Matches are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-FIND Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Viewer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – FIND SOP Class. The Viewer AE is also capable of using a non-negotiated relational query which can be more efficient if it is supported by the remote AE. The selection of the C-FIND behavior is configurable.

The tables below provide a description of the Viewer AE C-FIND Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are removed by the Viewer AE. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not "merged").

Hierarchical Query

C-FIND Request Identifier – Hierarchical Query – Study Level

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**R**	**Q**	**D**
Patient						
Patient Name	(0010,0010)	PN	X	X	X	X
Patient ID	(0010,0020)	LO	X	X	X	X
Issuer of Patient ID	(0010,0021)	LO	X	X	X	X
Patient's Birth Date	(0010,0030)	DA	X	X		X
Patient's Sex	(0010,0040)	CS	X	X		X
General Study						
Study Instance UID	(0020,000D)	UI		X		
Study Date	(0008,0020)	DA	X	X	X	X
Study Time	(0008,0020)	TM	X	X		X
Referring Physician's Name	(0008,0090)	PN	X	X	X	X
Study ID	(0020,0010)	SH	X	X	X	X
Accession Number	(0008,0050)	SH	X	X	X	X
Study Description	(0008,1030)	LO	X	X		X
Modalities in Study	(0008,0061)	CS	X	X	X	X
Procedure Code Sequence	(0008,1032)	SQ		X		

Module Name Attribute Name	Tag	VR	M	R	Q	D
Name of Physician(s) Reading Study	(0008,1060)	PN		X		
Admitting Diagnoses Description	(0008,1080)	LO		X		
Number of Study Related Series	(0020,1206)	IS		X		
Number of Study Related Instances	(0020,1208)	IS		X		

C-FIND Request Identifier – Hierarchical Query – Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Modality	(0008,0060)	CS	X	X	X	X
Series Instance UID	(0020,000E)	UI		X		
Series Number	(0020,0011)	IS		X		
Series Date	(0008,0021)	DA		X		
Series Time	(0008,0031)	TM		X		
Series Description	(0008,103E)	LO		X		
Body Part Examined	(0018,0015)	CS	X	X		X
Request Attributes Sequence	(0040,0275)	SQ		X		X
Number of Series Related Instances	(0020,1209)	IS		X		
General Equipment						
Institution Name	(0008,0080)	LO	X	X	X	
Performed Procedure Step						
Performed Procedure Step Start Date	(0040,0244)	DA		X		
Performed Procedure Step Start Date	(0040,0245)	TM		X		

Non-Negotiated Relational Query

C-FIND Request Identifier – Non-Negotiated Relational Query

Module Name Attribute Name	Tag	VR	M	R	Q	D
Patient						
Patient Name	(0010,0010)	PN	X	X	X	X
Patient ID	(0010,0020)	LO	X	X	X	X
Issuer of Patient ID	(0010,0021)	LO	X	X	X	X
Patient's Birth Date	(0010,0030)	DA		X		X
Patient's Sex	(0010,0040)	CS		X		X
General Study						
Study Instance UID	(0020,000D)	UI		X		
Study Date	(0008,0020)	DA	X	X	X	X
Study Time	(0008,0020)	TM	X	X		X
Referring Physician's Name	(0008,0090)	PN	X	X	X	X
Study ID	(0020,0010)	SH	X	X	X	X
Accession Number	(0008,0050)	SH	X	X	X	X
Study Description	(0008,1030)	LO	X	X		X
General Series						
Modality	(0008,0060)	CS	X	X	X	X
Series Instance UID	(0020,000E)	UI		X		
Series Description	(0008,103E)	LO		X		
Body Part Examined	(0018,0015)	CS	X	X		X
General Equipment						
Institution Name	(0008,0080)	LO	X	X	X	X

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Viewer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Viewer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Viewer AE will supply values for matching based on user input.
D:	Displayed keys. The Viewer AE will display the items to the user.

Activity – Load Study

4.2.1.3.2 **Description and Sequencing of Activities**

4.2.1.3.2.1 Whenever the user actions dictate that they want to load a study for further review, the Viewer AE is activated. At this point, a specific study or set of studies has been identified by the user and they are internally identified by their Study Instance UID(s).

In the standalone application, the user can only select one study at a time, however the application will attempt to locate additional related studies based on the patient ID and name.

Using the Study Instance UID(s), the Viewer AE issues the following requests:

1. a C-FIND request for detailed study information where the Identifier contains the Study Instance UID(s),
2. a C-FIND request for the series in the study where the Identifier contains the Study Instance UID,
3. if it is a request from the standalone application or if the integrator provided the “relatedStudies” flag, a C-FIND request for related studies where the Identifier contains the Patient ID and Patient’s Name.

For each request, the Viewer AE attempts to initiate a new Association with the remote DICOM C-FIND SCPs that has been identified to contain the studies, sends the C-FIND request, and waits for each C-FIND response. When the C-FIND responses are complete, the Viewer AE will proceed to the next request or will combine the results from all data sources, and proceed to present the study contents to the user.

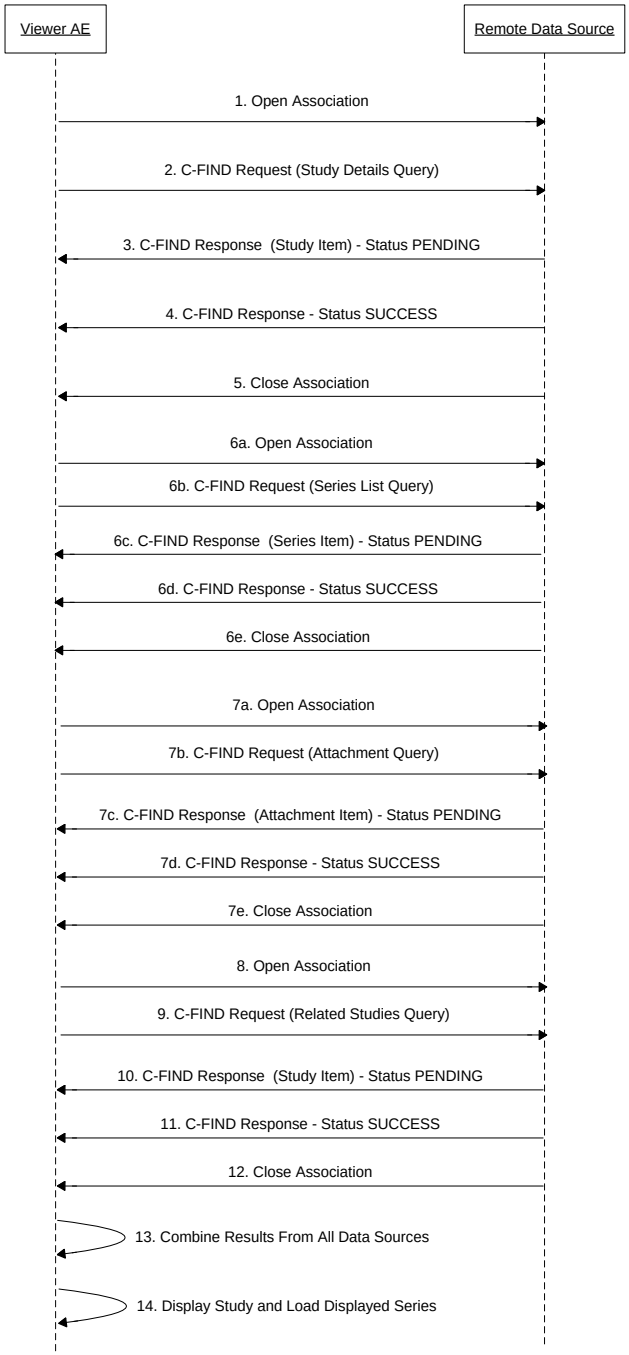

Figure 7 - Load Study Interaction

The typical sequence of interactions between the Viewer AE and a DICOM data source as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID(s) asking for additional study attributes.
3. The DICOM data source returns one C-FIND response for the study/studies that matches the Study Instance UID(s).
4. The DICOM data source returns the final C-FIND response.
5. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
6. For each study:
   a. The Viewer AE opens an association with the DICOM data source (if previously closed).
   b. The Viewer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID asking for a list of series.
   c. The DICOM data source returns one C-FIND response for each series that matches the required query key and containing at least the requested return keys contained in the request.
   d. The DICOM data source returns the final C-FIND response.
   e. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
7. For each study:
   a. The Viewer AE opens an association with the DICOM data source (if previously closed).
   b. The DICOM data source returns one C-FIND response for each series that matches the required query key and containing at least the requested return keys contained in the request.
   c. The DICOM data source returns the final C-FIND response.
   d. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
8. The Viewer AE opens an association with the DICOM data source.
9. The Viewer AE sends a C-FIND request to the DICOM data source containing the Patient ID and Patient's Name asking for related studies for this patient.
10. The DICOM data source returns one C-FIND response for each study that matches the patient information.
11. The DICOM data source returns the final C-FIND response.
12. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
13. The Viewer AE combines all of the returned information from all queries and all data sources.
14. The Viewer AE displays the study to the user and proceeds to load the automatically displayed series.

NOTE: With each of the above transactions, any query made below the study query level will cause an additional query at the study level and below, when using a hierarchical query method.

Proposed Presentation Contexts

The Viewer AE will propose Presentation Contexts as shown in the following table.

4.2.1.3.2

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

4.2.1.3.2.3

SOP Specific Conformance for C-FIND SOP Class

The behavior of Viewer AE when encountering status codes in a C-FIND response if summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to that DICOM data source is considered to have failed; the results will not be included in the response, and if other data sources succeed, study will be loaded using data from other data sources; otherwise the operation will fail, and the user will be informed about the failure.

C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. The results will be displayed to the user.
Refused	Out of Resources	A700	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Matches are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-FIND Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Viewer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – FIND SOP Class.

The tables below provide a description of the Viewer AE C-FIND Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not "merged").

Hierarchical Query

C-FIND Request Identifier – Hierarchical Query – Study Level

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**R**	**Q**	**D**
Patient						
Patient Name	(0010,0010)	PN	X	X		X
Patient ID	(0010,0020)	LO	X	X		X
Issuer of Patient ID	(0010,0021)	LO	X	X		X
Patient's Birth Date	(0010,0030)	DA		X		X
Patient's Sex	(0010,0040)	CS		X		X
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
Study Date	(0008,0020)	DA	X	X		X
Study Time	(0008,0020)	TM		X		X
Referring Physician's Name	(0008,0090)	PN	X	X		X
Study ID	(0020,0010)	SH		X		X
Accession Number	(0008,0050)	SH		X		X
Study Description	(0008,1030)	LO		X		X
Modalities in Study	(0008,0061)	CS	X	X		X
Procedure Code Sequence	(0008,1032)	SQ		X		
Name of Physician(s) Reading Study	(0008,1060)	PN		X		
Admitting Diagnoses Description	(0008,1080)	LO		X		

Module Name Attribute Name	Tag	VR	M	R	Q	D
Number of Study Related Series	(0020,1206)	IS		X		
Number of Study Related Instances	(0020,1208)	IS		X		

C-FIND Request Identifier – Hierarchical Query – Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Modality	(0008,0060)	CS	X	X		X
Series Instance UID	(0020,000E)	UI		X		
Series Number	(0020,0011)	IS		X		X
Series Date	(0008,0021)	DA		X		X
Series Time	(0008,0031)	TM		X		X
Series Description	(0008,103E)	LO	X	X		X
Body Part Examined	(0018,0015)	CS	X	X		X
Request Attributes Sequence	(0040,0275)	SQ		X		X
Number of Series Related Instances	(0020,1209)	IS		X		
General Equipment						
Institution Name	(0008,0080)	LO	X	X		X
Performed Procedure Step						
Performed Procedure Step Start Date	(0040,0244)	DA		X		
Performed Procedure Step Start Date	(0040,0245)	TM		X		

Non-Negotiated Relational Query

C-FIND Request Identifier – Non-Negotiated Relational Query – Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
Patient						
Patient Name	(0010,0010)	PN	X	X		X
Patient ID	(0010,0020)	LO	X	X		X
Issuer of Patient ID	(0010,0021)	LO	X	X		X
Patient's Birth Date	(0010,0030)	DA	X	X		X
Patient's Sex	(0010,0040)	CS	X	X		X
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
Study Date	(0008,0020)	DA	X	X		X
Study Time	(0008,0020)	TM	X	X		X
Study ID	(0020,0010)	SH	X	X		X
Accession Number	(0008,0050)	SH	X	X		X
Study Description	(0008,1030)	LO	X	X		X
General Series						
Modality	(0008,0060)	CS	X	X		X
Series Instance UID	(0020,000E)	UI		X		
Series Number	(0020,0011)	IS		X		X
Series Date	(0008,0021)	DA		X		X
Series Time	(0008,0031)	TM		X		X
Series Description	(0008,103E)	LO	X	X		
Body Part Examined	(0018,0015)	CS	X	X		X
General Equipment						
Institution Name	(0008,0080)	LO	X	X		X

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Viewer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Viewer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Viewer AE will supply values for matching based on user input.
D:	Displayed keys. The Viewer AE will display the items to the user.

Activity – Load Series

4.2.1.3.3

Description and Sequencing of Activities

4.2.1.3.3.1

Whenever the user actions dictate that they want to load a series from a loaded study, the Viewer AE is activated. At this point, a specific series has been identified by the user and is internally identified by the Study Instance UID and Series Instance UID.

If the DICOM data source where the series is stored supports instance-level queries, the system operates at an instance level, listing the instances and loading them on-demand as they are displayed (as per real-world activity Load Instance). If instance-level queries are not supported, a series-level C-MOVE is used to list and load the instances.

If the DICOM data source where the series is stored supports instance-level queries, the Viewer AE attempts to initiate a new Association with the remote DICOM C-FIND SCP that has been identified to contain the series. If the association is successfully negotiated, the Viewer AE issues a C-FIND request for instance information where the Identifier contains the Study Instance UID and Series Instance UID.

The Viewer AE waits for each C-FIND response. When the C-FIND responses are complete, the Viewer AE will evaluate the results. In the case where the instances are images, it will proceed to visualize the images in a viewer. In the case where the instances are Presentation States or Key Object Selections, the Viewer AE will

extract the referenced series and instances and initiate a further, similar query for the referenced series and instances in order to load the references images.

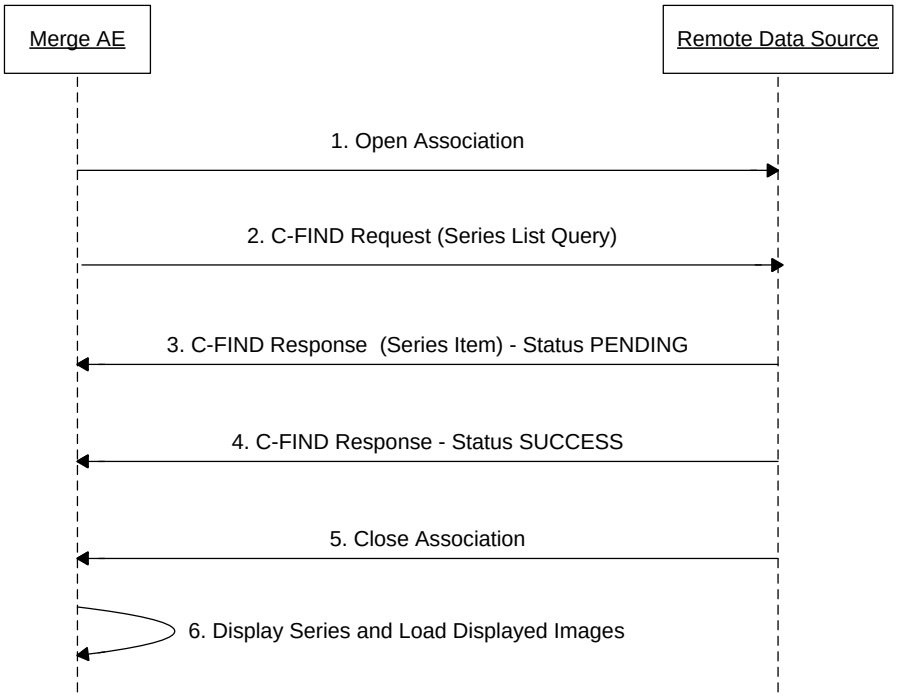

Figure 8 - Load Series Interaction – Instance Query Supported

The typical sequence of interactions between the Viewer AE and a DICOM data source as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID and Series Instance UID asking for instances from the series.
3. The DICOM data source returns one C-FIND response for each instance in the series that matches the required query key and containing at least the requested return keys contained in the request.
4. The DICOM data source returns the final C-FIND response.
5. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
6. The Viewer AE displays the series to the user in a scrollable viewer and proceeds to load the visible images.

If the DICOM data source where the series is stored does not support instance-level queries, the Viewer AE attempts to initiate a new Association with the remote DICOM C-MOVE SCP that has been identified to contain the series. If the association is successfully negotiated, the Viewer AE issues a C-MOVE request for instance information where the Identifier contains the Study Instance UID and Series Instance UID.

The Viewer AE expects that the C-MOVE will result in a C-STORE of the instances. The Viewer AE waits for the final C-MOVE response. When the final C-MOVE response occurs, the Viewer AE will parse the instances and proceed to display the images.

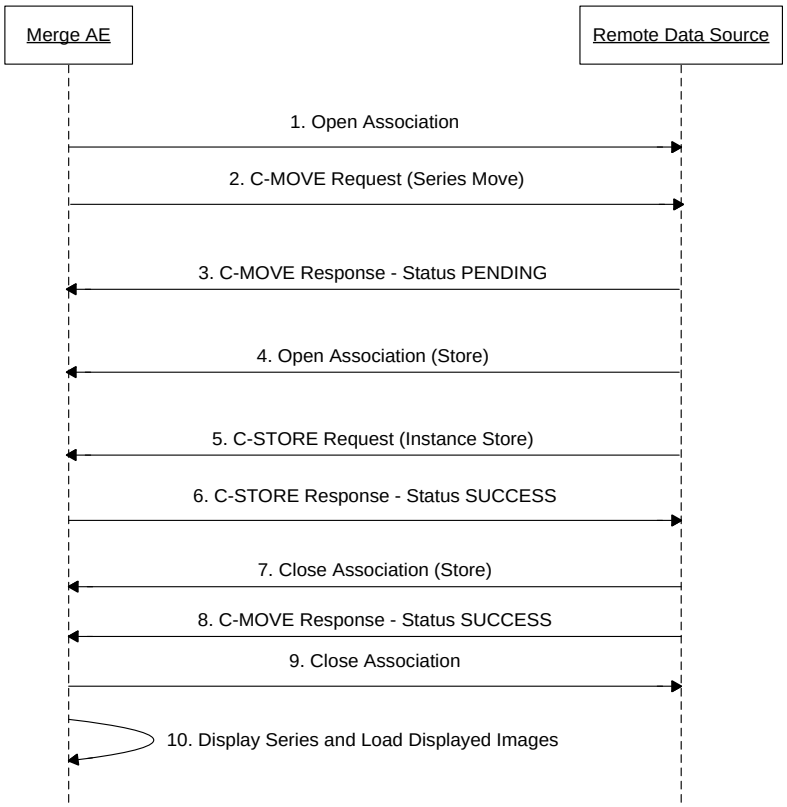

Figure 9 - Load Series Interaction – Instance Query Not Supported

The typical sequence of interactions between the Viewer AE and a DICOM data source as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-MOVE request to the DICOM data source containing the Study Instance UID and Series Instance UID asking for the series to be stored to the Viewer AE.
3. The DICOM data source sends a C-MOVE response to the Viewer AE indicating the move has pending operations.
4. The DICOM data source opens an association with the Viewer AE.
5. The DICOM data source issues C-STORE requests for the requested instances.
6. The Viewer AE receives the instances and issues C-STORE responses.
7. The DICOM data source closes the association.
8. The DICOM data source sends the C-MOVE response indicating success.
9. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
10. The Viewer AE proceeds with the display of the series.
    The order of step 3 and 7 are highly dependent on the DICOM data source and may happen out of sequence, as allowed by DICOM.

Note: With each of the above transactions, any query made below the study query level will cause an additional query at the study level and below, when using a hierarchical query method.

4.2.1.3.3.2 Proposed Presentation Contexts

The Viewer AE will propose Presentation Contexts as shown in the following table.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

SOP Specific Conformance for C-FIND SOP Class

4.2.1.3.3.3 The behavior of Viewer AE when encountering status codes in a C-FIND response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to the DICOM data source is considered to have failed; the results will not be included in the response, the operation will fail, and the user will be informed about the failure.

C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. The results will be displayed to the user.
Refused	Out of Resources	A700	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Matches are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-FIND Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Viewer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – FIND SOP Class.

The tables below provide a description of the Viewer AE C-FIND Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not "merged").

C-FIND Request Identifier –– Image Level

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**R**	**Q**	**D**
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		
General Image						
Instance Number	(0020,0013)	IS		X		
Image Pixel						
Rows	(0028,0010)	US		X		
Columns	(0028,0011)	US		X		
Bits Allocated	(0028,0100)	US		X		
Multi-Frame						
Number of Frames	(0028,0008)	IS		X		
SOP Common						
SOP Class UID	(0008,0016)	UI		X		
SOP Instance UID	(0008,0018)	UI		X		

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier

Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Viewer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Viewer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Viewer AE will supply values for matching based on user input.
D:	Displayed keys. The Viewer AE will display the items to the user.

SOP Specific Conformance for C-MOVE SOP Class

4.2.1.3.3.3 The behavior of Viewer AE when encountering status codes in a C-MOVE response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to the DICOM data source is considered to have failed; the results will not be included in the response, the operation will fail, and the user will be informed about the failure.

C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations Complete – No Failures	0000	The SCP has completed the move. The results will be displayed to the user.
Refused	Out of Resources – Unable to calculate number of matches	A701	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Out of Resources – Unable to perform sub-operations	A702	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Move Destination unknown	A801	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Sub-operations Complete – One or more Failures	B000	The SCP has completed the move. The results will be displayed to the user.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Sub-operations are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-MOVE Communication Failure Behavior

Exception	Behavior

Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Viewer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – MOVE SOP Class.

The tables below provide a description of the Viewer AE C-MOVE Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-MOVE response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not “merged”).

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**R**	**Q**	**D**
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Viewer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Viewer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Viewer AE will supply values for matching based on user input.
D:	Displayed keys. The Viewer AE will display the items to the user.

Activity – Load Instance

4.2.1.3.4 **Description and Sequencing of Activities**

4.2.1.3.4.1 Whenever the user actions dictate that they want to load an image, presentation state, key object, report, or audio clip from a loaded study, the Viewer AE is activated.

A specific instance has been identified by the user and is internally identified by the Study Instance UID, Series Instance UID, and SOP Instance UID.

If the DICOM data source does not support instance-level queries, the instances would already have been moved using a series-level C-MOVE and the DICOM interactions described in this section would not occur. The DICOM interactions described in this section only occur if the DICOM data source supports instance-level queries.

Using the Study Instance UID, Series Instance UID, and SOP Instance UID, the Viewer AE attempts to initiate a new Association with the remote DICOM C-MOVE SCP that has been identified to contain the series. If the association is successfully negotiated, the Viewer AE issues a C-MOVE request for the instance where the Identifier contains the Study Instance UID, Series Instance UID, and SOP Instance UID.

The Viewer AE expects that the C-MOVE will result in a C-STORE of the instance. The Viewer AE waits for the C-MOVE response. When the C-MOVE response occurs, the Viewer AE will read the instance and display it.

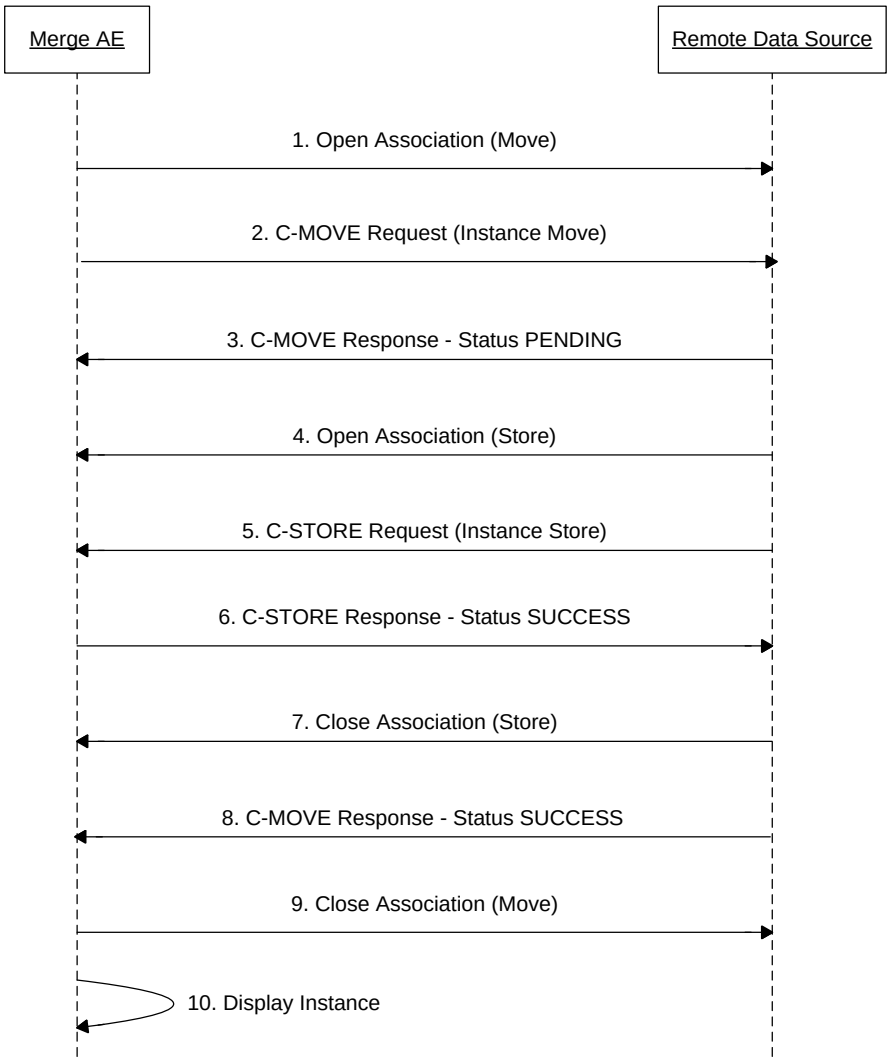

Figure 10 - Load Instance Interaction

The typical sequence of interactions for loading images between the Viewer AE and a DICOM data source as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-MOVE request to the DICOM data source containing the Study Instance UID, Series Instance UID, and SOP Instance UID asking for the instance to be stored to the Viewer AE.
3. The DICOM data source sends a C-MOVE response to the Viewer AE indicating the move has pending operations.

4. The DICOM data source opens an association with the Viewer AE.
5. The DICOM data source issues a C-STORE request for the requested instance.
6. The Viewer AE receives the instance and issues a C-STORE response.
7. The DICOM data source closes the association.
8. The DICOM data source sends the C-MOVE response indicating success.
9. The Viewer AE closes the association with the DICOM data source (optionally, depending on the configuration).
10. The Viewer AE displays the instance to the user in the appropriate viewer viewport.
    The order of step 3 and 7 are highly dependent on the DICOM data source and may happen out of sequence, as allowed by DICOM.

Proposed Presentation Contexts

The Viewer AE will propose Presentation Contexts as shown in the following table.

4.2.1.3.4.2

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

SOP Specific Conformance for C-MOVE SOP Class

The behavior of Viewer AE when encountering status codes in a C-MOVE response if summarized in the table below. If the remote AE returns a status other than "Success" or "Pending", the query to that DICOM data source is considered to have failed; the results will not be included in the response, the operation will fail, and
4.2.1.3.4.3 the user will be informed about the failure.

C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations Complete – No Failures	0000	The SCP has completed the move. The results will be displayed to the user.
Refused	Out of Resources – Unable to calculate number of matches	A701	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Out of Resources – Unable to perform sub-operations	A702	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Move Destination unknown	A801	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Sub-operations Complete – One or more Failures	B000	The SCP has completed the move. The results will be displayed to the user.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Sub-operations are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-MOVE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Viewer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – MOVE SOP Class.

The tables below provide a description of the Viewer AE C-MOVE Request Identifier and specify the attributes that are used.

C-MOVE Request Identifier – Image Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		
SOP Common						
SOP Instance UID	(0008,0018)	UI	X	X		

The above table should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Viewer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Viewer AE will supply this attribute as Return Key with zero length for Universal Matching.

Q:	Interactive Query Key. The Viewer AE will supply values for matching based on user input.
D:	Displayed keys. The Viewer AE will display the items to the user.

Activity – Save Presentation State(s)

Description and Sequencing of Activities

4.2.1.3.5 While the user is reviewing a study, they may choose to save the current presentation state of the series that they are viewing. When the user invokes the save operation, the Viewer AE is activated.

4.2.1.3.5.1 The Viewer AE attempts to initiate a new Association with the remote DICOM C-STORE SCP that has been configured for the data source that has been identified to contain the series. If the association is successfully negotiated, the Viewer AE issues a C-STORE request for each presentation state instance.

The Viewer AE expects that a C-STORE response for each C-STORE request. During the store, the Viewer AE will display a progress indicator. When all C-STORE requests are complete, the Viewer AE will indicate completion to the user and the presentation state series will appear in the thumbnail area.

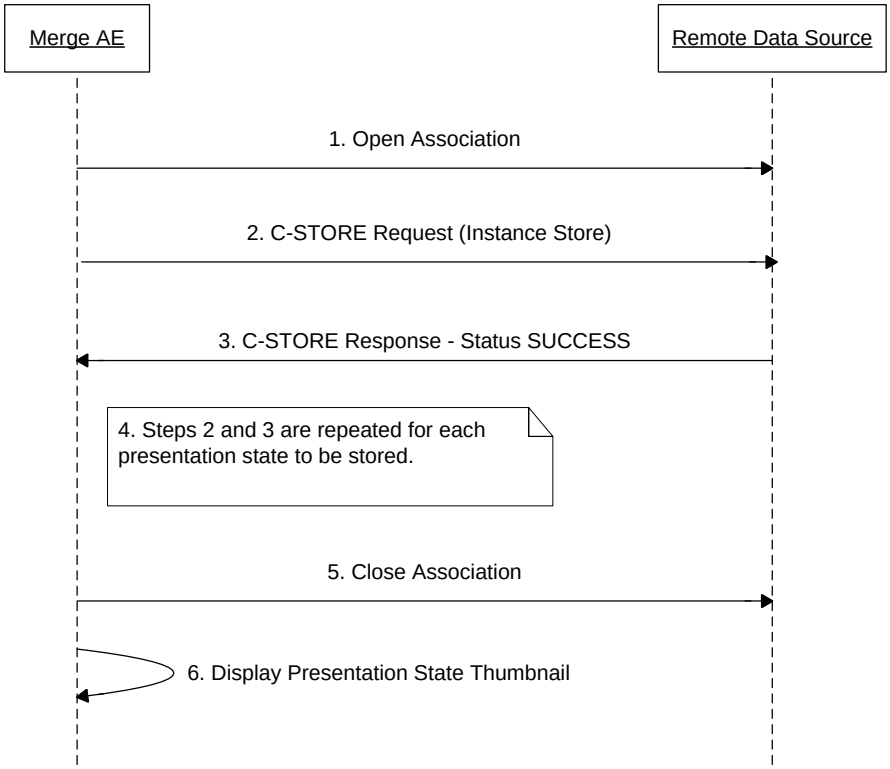

Figure 11 - Save Presentation State Interaction

The typical sequence of interactions for saving presentation states between the Viewer AE and a DICOM data source as shown above is described as follows:

1. The Viewer AE opens an association with the DICOM data source.
2. The Viewer AE sends a C-STORE request to the DICOM data source asking for the presentation state to be stored to the DICOM data source.
3. The DICOM data source stores the presentation state and sends a C-STORE response.
4. Steps 2 and 3 are repeated for each presentation state.
5. The Viewer AE closes the association with the DICOM data.
6. The Viewer AE displays the presentation state series thumbnail to the user.

Proposed Presentation Contexts

The Viewer AE will propose Presentation Contexts as shown in the following table.

4.2.1.3.5

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

SOP Specific Conformance for C-STORE SOP Class

4.2.1.3.5.3

The behavior of Viewer AE when encountering status codes in a C-STORE response is summarized in the table below. If the remote AE returns a status other than "Success" or "Pending", the store to that DICOM data source is considered to have failed; the user will be informed that the store failed.

C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the store. The user will be notified about the success.
Refused	Out of Resources	A700 – A7FF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Data Set does not match SOP Class	A900 – A9FF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Coercion of Data Elements	B000	The SCP has completed the store. The user will be notified about the success.
Warning	Elements Discarded	B006	The SCP has completed the store. The user will be notified about the success.
Warning	Data Set does not match SOP Class	B007	The SCP has completed the store. The user will be notified about the success.
Failed	Cannot understand	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

Service Status	Further Meaning	Error Code	Behavior
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-STORE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. The reason is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

When the Viewer AE creates presentation states, the user can choose to save presentation states for all images in the series, or only those with annotations (text or graphic).

The Viewer AE will generate the minimal number of presentation state IODs possible based on the DICOM standard. Different flip and rotation angles between images influence the ability to include multiple image presentation states in a single IOD.

The displayed area stored by the Viewer AE is not always the actual displayed area visible to the user, since the Viewer AE only applies scaling factors to the original displayed area (or default displayed area) provided by the original presentation state or image. This implies that if there is more area displayed due to fitting the original displayed area to a non-proportional viewport (e.g. fitting a square displayed area to a non-square viewport), the saved GSPS will not increase the displayed area values to represent the extra visible area.

4.2.1.4 Association Acceptance Policy

Activity – Store Instance

Description and sequencing of Activities

The Viewer AE listens for instances to be stored as a result of other operations performed by its users. Whenever a user action requires data to be moved to the
4.2.1.4.1 Viewer AE for viewing, the instances are stored to the Viewer AE.

4.2.1.4.1.1

The Viewer AE SCP does not support Extended Negotiation and does not perform any validation or coercion of attributes.

Data sent to the Viewer AE unsolicited (i.e. not as a result of a Viewer AE C-MOVE operation) will be ignored and is not allowed.

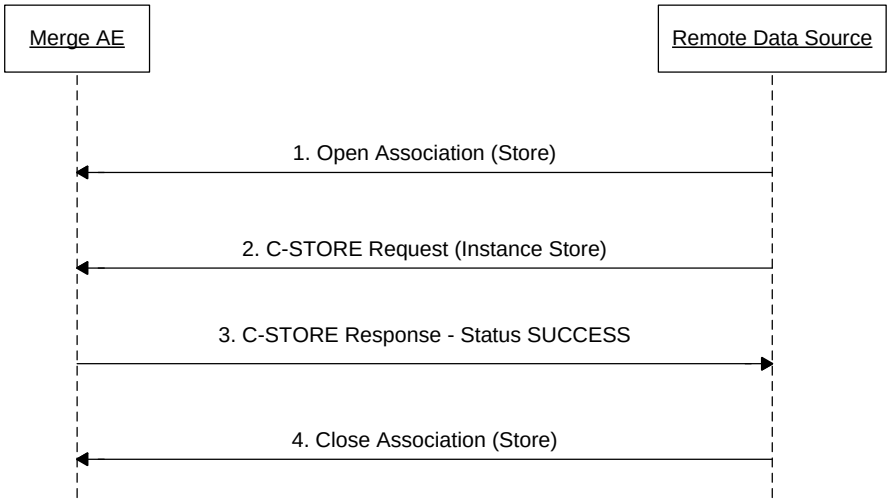

Figure 12 - Sequencing of Activity – Receive Storage Request

The typical sequence between a DICOM data source and the Viewer AE is as follows:

1. The DICOM data source opens a new association with the Viewer AE.
2. The DICOM data source sends a C-STORE request.
3. The Viewer AE stores the instance and sends a C-STORE response.
4. The DICOM data source closes the association with the Viewer AE.

The Viewer AE SCP rejects association requests if Called AE title is not one of the local AE titles configured in the system.

Accepted Presentation Contexts

The Viewer AE SCP accepts the following presentation contexts (Note, any transfer syntaxes marked with a '*' are optional, meaning they are only available when certain software options are configured. MPEG 2/4 transfer syntaxes are only available if video feature is enabled for that SOP class):

4.2.1.4.1.2

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		RLE Lossless	1.2.840.10008.1.2.5		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		RLE Lossless	1.2.840.10008.1.2.5		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
	1.2.840.10008.5.1.4.1.1.77.1.5.4	Implicit Little Endian	1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Ophthalmic Tomography Image Storage		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
	1.2.840.10008.5.1.4.1.1.11.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Grayscale Softcopy Presentation State Storage SOP Class		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90		
		JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91		
		MPEG2 MP@ML *	1.2.840.10008.1.2.4.100		
		MPEG2 MP@HL *	1.2.840.10008.1.2.4.101		
		MPEG-4 AVC/H.264 High Profile / Level 4.1 *	1.2.840.10008.1.2.4.102		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 *	1.2.840.10008.1.2.4.103		
		RLE Lossless	1.2.840.10008.1.2.5		
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

SOP Specific Conformance for SOP Class(es)

4.2.1.4.1.3 The Viewer AE can report status codes as summarized in the Table below. When Viewer AE SCP fails to store, it will close TCP/IP connection without sending C-STORE Response. Error information is logged in this case,

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Viewer AE has completed the operation successfully.

4.2.2 Transfer Application Entity Specification

4.2.2.1 SOP Classes

The application provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes
Enhanced MR Color Image Storage	1.2.840.10008.5.1.4.1.1.4.3	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Yes	Yes
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	Yes
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	Yes
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	Yes
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	Yes
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	Yes
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	Yes	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	Yes	Yes
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	Yes	Yes
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Enhanced PET Image Storage	1.2.840.10008.5.1.4.1.1.130	Yes	Yes
Basic Structured Display Storage	1.2.840.10008.5.1.4.1.1.131	Yes	Yes
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	Yes	Yes
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	Yes	Yes
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Chest CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.65	Yes	Yes
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Colon CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.69	Yes	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Color Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.2	Yes	Yes
Pseudo-Color Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.3	Yes	Yes
Blending Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.4	Yes	Yes
XA/XRF Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.5	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	Yes
General Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.2	Yes	Yes
Arterial Pulse Waveform Storage	1.2.840.10008.5.1.4.1.1.9.5.1	Yes	Yes
Respiratory Waveform Storage	1.2.840.10008.5.1.4.1.1.9.6.1	Yes	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
Deformable Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.3	Yes	Yes
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Real World Value Mapping Storage	1.2.840.10008.5.1.4.1.1.67	Yes	Yes
Lensometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.1	Yes	Yes
Autorefraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.2	Yes	Yes
Keratometry Measurements Storage	1.2.840.10008.5.1.4.1.1.78.3	Yes	Yes
Subjective Refraction Measurements Storage	1.2.840.10008.5.1.4.1.1.78.4	Yes	Yes
Visual Acuity Measurement	1.2.840.10008.5.1.4.1.1.78.5	Yes	Yes
Spectacle Prescription Reports Storage	1.2.840.10008.5.1.4.1.1.78.6	Yes	Yes
Macular Grid Thickness and Volume Report Storage	1.2.840.10008.5.1.4.1.1.79.1	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Encapsulated CDA Storage	1.2.840.10008.5.1.4.1.1.104.2	Yes	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Hanging Protocol Storage	1.2.840.10008.5.1.4.38.1	Yes	Yes
Color Palette Storage	1.2.840.10008.5.1.4.39.1	Yes	Yes

4.2.2.2 Association Policies

General

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

4.2.2.2.1

Application Context Name	1.2.840.10008.3.1.1.1

Number of Associations

4.2.2.2.2 The Transfer AE will initiate one association and accept any number of associations simultaneously.

Asynchronous Nature

4.2.2.2.3 The Transfer AE does not support asynchronous operations and will not perform asynchronous window negotiation.

4.2.2.2.4

Implementation Identifying Information

The application uses the following implementation identifying information:

Implementation Class UID	2.16.840.1.113669.2013.1.2
Implementation Version Name	IBM ICA 7.1

4.2.2.3 Association Initiation Policy

4.2.2.3.1 This section describes the conditions under which the Transfer AE SCU will initiate an association.

4.2.2.3.1.1

Activity – List Study Instances

Description and Sequencing of Activities

During transfer or download operations, the Transfer AE is activated to retrieve a list of instances that are to be transferred or downloaded. At this point, a specific study has been identified by the user and it is internally identified by its Study Instance UID.

Using the Study Instance UID, the Transfer AE issues the following requests:

1. a C-FIND request for detailed study information where the Identifier contains the Study Instance UID,
2. a C-FIND request for the series in the study where the Identifier contains the Study Instance UID,
3. if the DICOM data source supports instance level queries, C-FIND requests for the instances in each series where the Identifier contains the Study Instance UID and Series Instance UID,
4. if the DICOM data source does not support instance level queries, C-MOVE requests for each series where the Identifier contains the Study Instance UID and Series Instance UID.

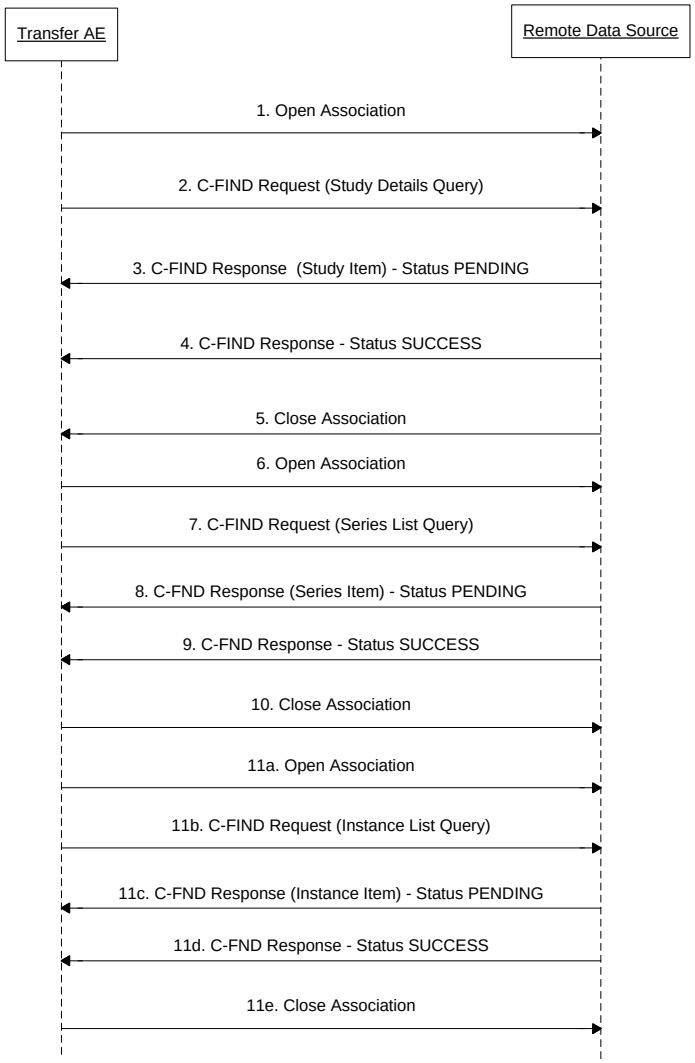

Figure 13 - List Study Instances Interaction (Instance Query Supported)

The typical sequence of interactions between the Transfer AE and a DICOM data source when instance-level queries are supported is shown above and is described as follows:

1. The Transfer AE opens an association with the DICOM data source.
2. The Transfer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID asking for additional study attributes.
3. The DICOM data source returns a C-FIND response for the study that match the Study Instance UID.
4. The DICOM data source returns the final C-FIND response.
5. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).
6. The Transfer AE opens an association with the DICOM data source (if previously closed).
7. The Transfer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID asking for a list of series.
8. The DICOM data source returns one C-FIND response for each series that matches the required query key and containing at least the requested return keys contained in the request.
9. The DICOM data source returns the final C-FIND response.
10. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).
11. For each series:
    a. The Transfer AE opens an association with the DICOM data source (if previously closed).
    b. The Transfer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID and Series Instance UID, asking for a list of series.
    c. The DICOM data source returns one C-FIND response for each series that matches the required query key and containing at least the requested return keys contained in the request.
    d. The DICOM data source returns the final C-FIND response.
    e. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).

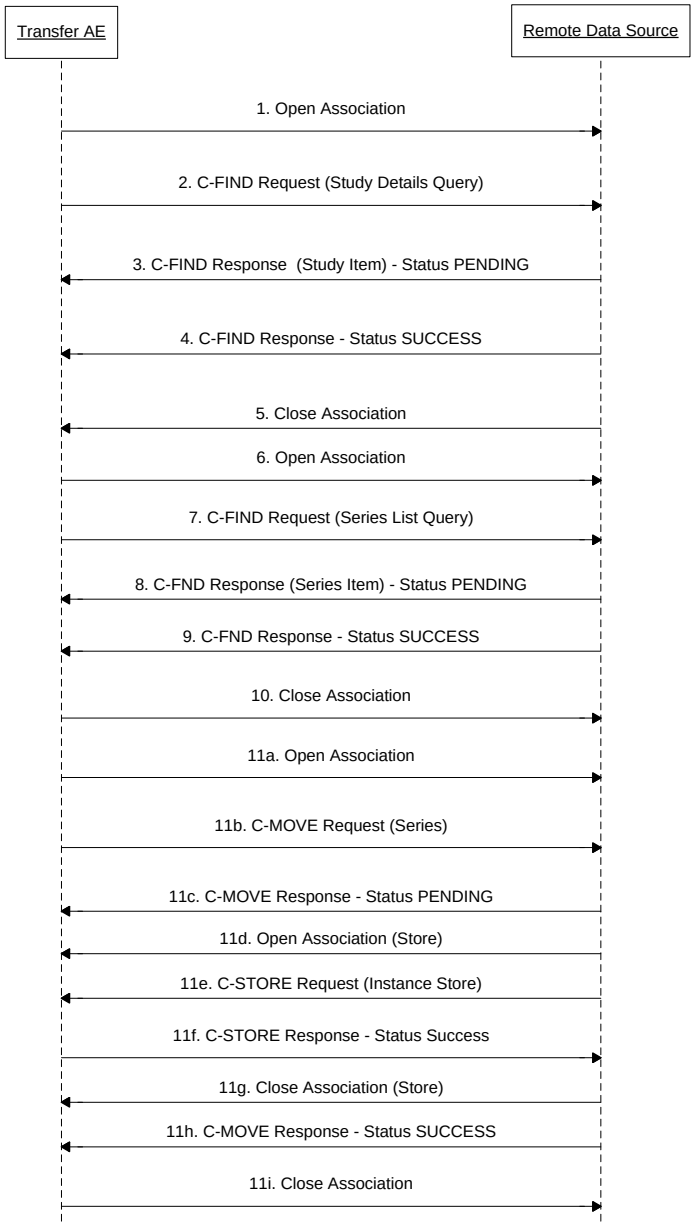

Figure 14 - List Study Instances Interaction (Instance Query Not Supported)

The typical sequence of interactions between the Transfer AE and a DICOM data source when instance-level queries are not supported is shown above and is described as follows:

1. The Transfer AE opens an association with the DICOM data source.

2. The Transfer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID asking for additional study attributes.
3. The DICOM data source returns a C-FIND response for the study that match the Study Instance UID.
4. The DICOM data source returns the final C-FIND response.
5. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).
6. The Transfer AE opens an association with the DICOM data source (if previously closed).
7. The Transfer AE sends a C-FIND request to the DICOM data source containing the Study Instance UID asking for a list of series.
8. The DICOM data source returns one C-FIND response for each series that matches the required query key and containing at least the requested return keys contained in the request.
9. The DICOM data source returns the final C-FIND response.
10. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).
11. For each series:
    a. The Transfer AE opens an association with the DICOM data source (if previously closed).
    b. The Transfer AE sends a C-MOVE request to the DICOM data source containing the Study Instance UID and Series Instance UID, asking for the series to be store to itself.
    c. The DICOM data source sends the C-MOVE response indicating the move has pending operations.
    d. The DICOM data source opens an association with the Transfer AE.
    e. The DICOM data source issues a C-STORE request for each of the requested series instances.
    f. The Transfer AE receives each of the instances and issues a C-STORE response.
    g. The DICOM data source closes the association.
    h. The DICOM data source sends the C-MOVE response indicating success.
    i. The Transfer AE closes the association.

Proposed Presentation Contexts

The Transfer AE will propose Presentation Contexts as shown in the following table.

4.2.2.3.1.2

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

4.2.2.3.1.3

SOP Specific Conformance for C-FIND SOP Class

The behavior of Transfer AE when encountering status codes in a C-FIND response if summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to that DICOM data source is considered to have failed; the results will not be included in the response, and if other data sources succeed, study will be loaded using data from other data sources; otherwise the operation will fail, and the user will be informed about the failure.

C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. The results will be displayed to the user.
Refused	Out of Resources	A700	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Matches are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-FIND Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Transfer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – FIND SOP Class.

The tables below provide a description of the Transfer AE C-FIND Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not "merged").

Hierarchical Query

C-FIND Request Identifier – Hierarchical Query – Study Level

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**R**	**Q**	**D**
Patient						
Patient Name	(0010,0010)	PN	X	X		X
Patient ID	(0010,0020)	LO	X	X		X
Issuer of Patient ID	(0010,0021)	LO	X	X		X
Patient's Birth Date	(0010,0030)	DA		X		X
Patient's Sex	(0010,0040)	CS		X		X
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
Study Date	(0008,0020)	DA	X	X		X
Study Time	(0008,0020)	TM		X		X
Referring Physician's Name	(0008,0090)	PN	X	X		X
Study ID	(0020,0010)	SH		X		X
Accession Number	(0008,0050)	SH		X		X
Study Description	(0008,1030)	LO		X		X
Modalities in Study	(0008,0061)	CS	X	X		X
Procedure Code Sequence	(0008,1032)	SQ		X		
Name of Physician(s) Reading Study	(0008,1060)	PN		X		
Admitting Diagnoses Description	(0008,1080)	LO		X		

Module Name Attribute Name	Tag	VR	M	R	Q	D
Number of Study Related Series	(0020,1206)	IS		X		
Number of Study Related Instances	(0020,1208)	IS		X		

C-FIND Request Identifier – Hierarchical Query – Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Modality	(0008,0060)	CS	X	X		X
Series Instance UID	(0020,000E)	UI		X		
Series Number	(0020,0011)	IS		X		X
Series Date	(0008,0021)	DA		X		X
Series Time	(0008,0031)	TM		X		X
Series Description	(0008,103E)	LO	X	X		X
Body Part Examined	(0018,0015)	CS	X	X		X
Request Attributes Sequence	(0040,0275)	SQ		X		X
Number of Series Related Instances	(0020,1209)	IS		X		
General Equipment						
Institution Name	(0008,0080)	LO	X	X		X
Performed Procedure Step						
Performed Procedure Step Start Date	(0040,0244)	DA		X		
Performed Procedure Step Start Date	(0040,0245)	TM		X		

Non-Negotiated Relational Query

C-FIND Request Identifier – Non-Negotiated Relational Query – Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
Patient						
Patient Name	(0010,0010)	PN	X	X		X
Patient ID	(0010,0020)	LO	X	X		X
Issuer of Patient ID	(0010,0021)	LO	X	X		X
Patient's Birth Date	(0010,0030)	DA	X	X		X
Patient's Sex	(0010,0040)	CS	X	X		X
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
Study Date	(0008,0020)	DA	X	X		X
Study Time	(0008,0020)	TM	X	X		X
Study ID	(0020,0010)	SH	X	X		X
Accession Number	(0008,0050)	SH	X	X		X
Study Description	(0008,1030)	LO	X	X		X
General Series						
Modality	(0008,0060)	CS	X	X		X
Series Instance UID	(0020,000E)	UI		X		
Series Number	(0020,0011)	IS		X		X
Series Date	(0008,0021)	DA		X		X
Series Time	(0008,0031)	TM		X		X
Series Description	(0008,103E)	LO	X	X		
Body Part Examined	(0018,0015)	CS	X	X		X
General Equipment						
Institution Name	(0008,0080)	LO	X	X		X

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Transfer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Transfer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Transfer AE will supply values for matching based on user input.
D:	Displayed keys. The Transfer AE will display the items to the user.

SOP Specific Conformance for C-MOVE SOP Class

4.2.2.3.1.4 The behavior of Transfer AE when encountering status codes in a C-MOVE response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to the DICOM data source is considered to have failed; the results will not be included in the response, the operation will fail, and the user will be informed about the failure.

C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations Complete – No Failures	0000	The SCP has completed the move. The results will be displayed to the user.
Refused	Out of Resources – Unable to calculate number of matches	A701	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Out of Resources – Unable to perform sub-operations	A702	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Move Destination unknown	A801	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

Service Status	Further Meaning	Error Code	Behavior
Warning	Sub-operations Complete – One or more Failures	B000	The SCP has completed the move. The results will be displayed to the user.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Sub-operations are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-MOVE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Transfer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – MOVE SOP Class.

The tables below provide a description of the Transfer AE C-MOVE Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-MOVE response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not “merged”).

C-MOVE Request Identifier –– Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Transfer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Transfer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Transfer AE will supply values for matching based on user input.
D:	Displayed keys. The Transfer AE will display the items to the user.

4.2.2.3.2

4.2.2.3.2.1 Activity – Transfer Study

Description and Sequencing of Activities

While reviewing a list of studies or while reviewing a particular study in detail, the user can request that selected studies be transferred to another data source within the system. This results in the creation of a transfer job for each study which is processed in the background.

When a transfer job is being processed, the actions depend on the capabilities and configuration of the source and destination data sources. If the source and destination data sources are configured such that a direct DICOM C-MOVE can be achieved, the Transfer AE will use a 3rd party DICOM C-MOVE to perform the transfer. If this is not the case, the Transfer AE will retrieve the DICOM data itself and store the DICOM to the destination.

In the case of a direct DICOM C-MOVE, the Transfer AE attempts to initiate a new association with the C-MOVE SCP that contains the study to be transferred. If the association is successfully negotiated, the Transfer AE issues a C-MOVE request at the Study level where the Identifier contains the study unique identifier. The Transfer AE will then wait for each C-MOVE response. When the C-MOVE response indicates completion, the transfer job will be considered complete and the job status will be updated within the system.

In the case of a brokered move, the Transfer AE will query the study contents to discover the instances in the study as per the real-world activity List Study Instances, move them to itself (if they were not moved as a result of the List Study Instances activity), then store them to the destination.

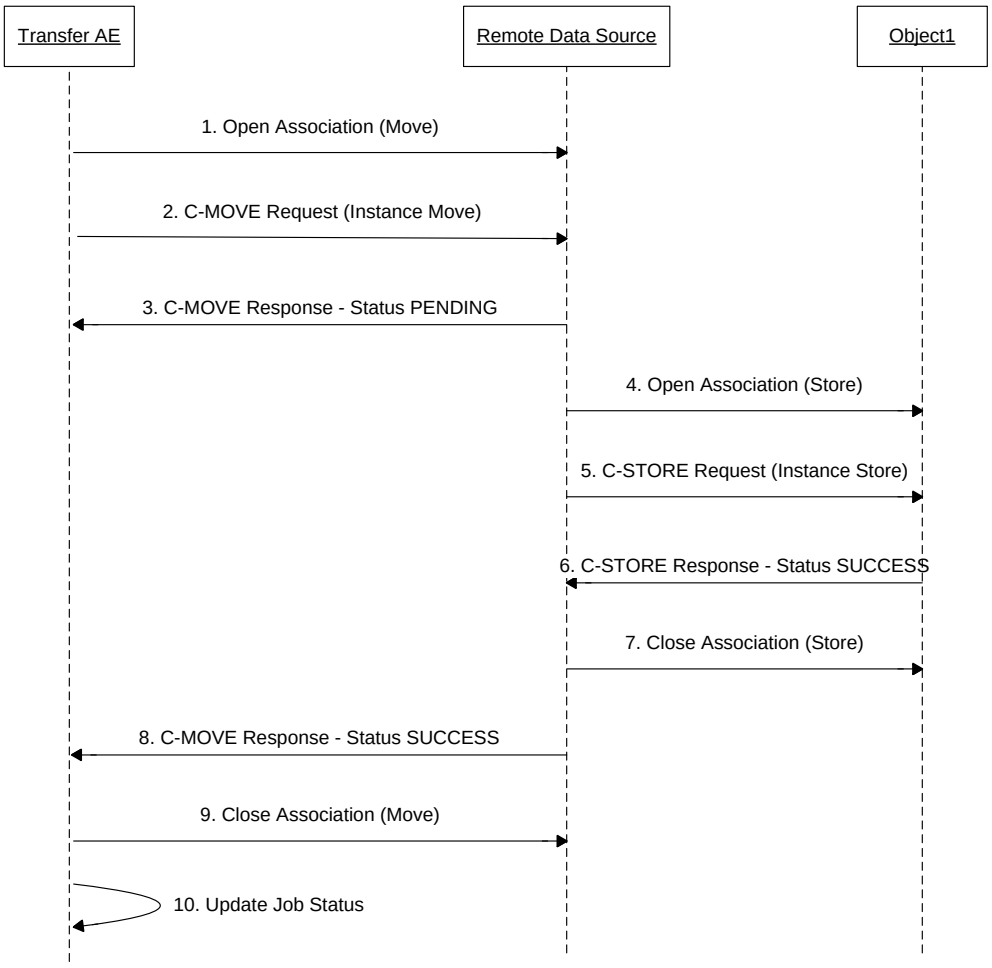

Figure 15 – 3rd Party Move Transfer Interaction

The typical sequence of interactions for a 3rd party move of a study between the Transfer AE, a DICOM data source, and a DICOM data destination as shown above is described as follows:

1. The Transfer AE opens an association with the DICOM data source.
2. The Transfer AE sends a C-MOVE request to the DICOM data source containing the Study Instance UID asking for the instance to be stored to the DICOM data destination.
3. The DICOM data source sends a C-MOVE response to the Transfer AE indicating the move has pending operations.
4. The DICOM data source opens an association with the AE of the destination.
5. The DICOM data source issues C-STORE requests for the requested instances.
6. The destination AE receives the instance and issues a C-STORE response.
7. The DICOM data source closes the association.
8. The DICOM data source sends the C-MOVE response indicating success.
9. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).
10. The Transfer AE updates the status of the transfer job.
    The order of step 3 and 7 are highly dependent on the DICOM data source and may happen out of sequence, as allowed by DICOM.

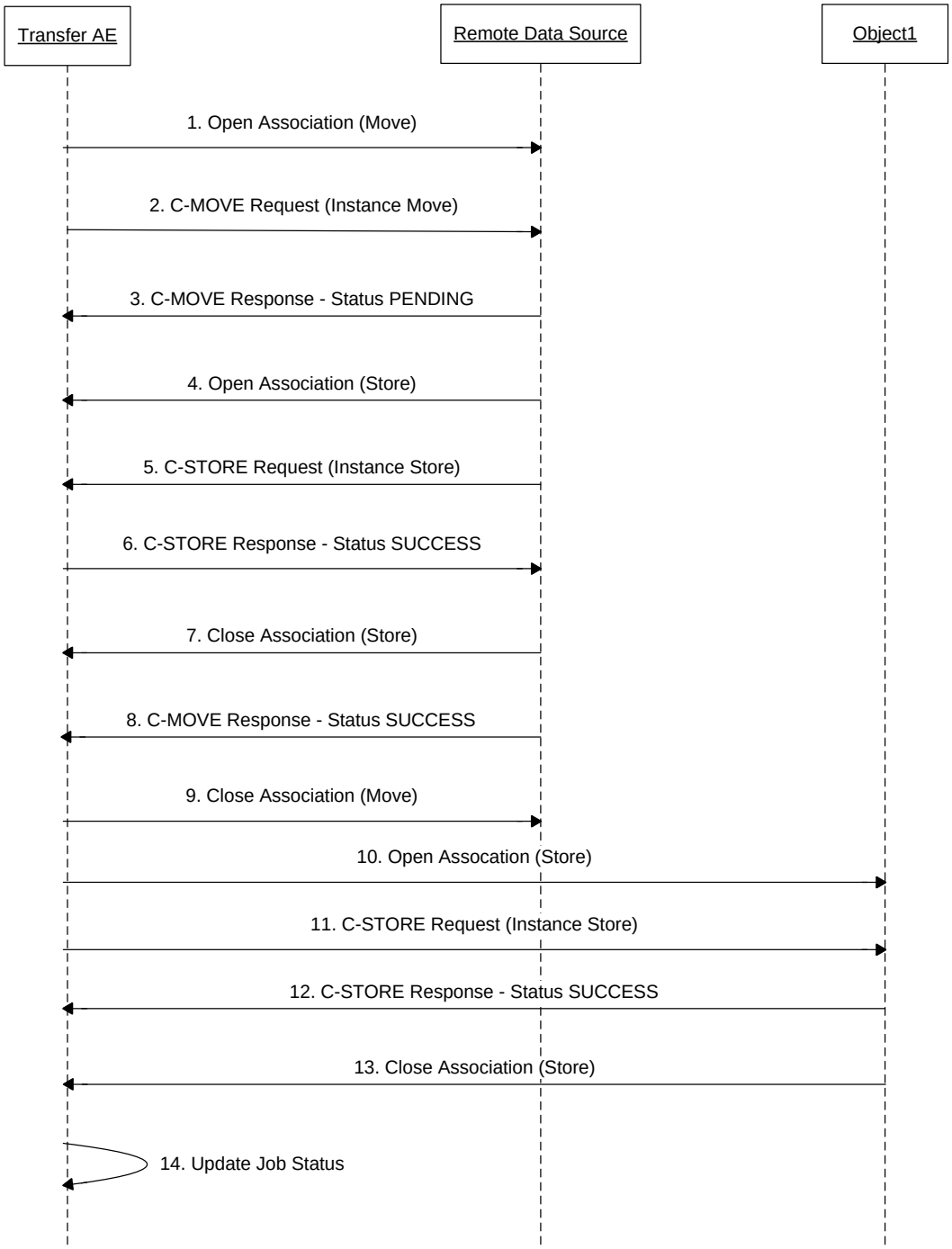

Figure 16 – Brokered Move Transfer Interaction

The typical sequence of interactions for a brokered move of a study between the Transfer AE, a DICOM data source, and a DICOM data destination as shown above is described as follows:

1. The Transfer AE opens an association with the DICOM data source.
2. The Transfer AE sends a C-MOVE request to the DICOM data source containing the Study Instance UID asking for the instance to be stored to the Transfer AE.
3. The DICOM data source sends a C-MOVE response to the Transfer AE indicating the move has pending operations.
4. The DICOM data source opens an association with the Transfer AE.
5. The DICOM data source issues a C-STORE request for the requested instance.
6. The Transfer AE receives the instance and issues a C-STORE response.
7. The DICOM data source closes the association.
8. The DICOM data source sends the C-MOVE response indicating success.
9. The Transfer AE closes the association with the DICOM data source (optionally, depending on the configuration).
10. The Transfer AE opens an association with the DICOM data destination.
11. The Transfer AE issues a C-STORE request for each instance.
12. The DICOM data destination receives the instance and issues a C-STORE response
13. The DICOM data destination closes the association.
14. The Transfer AE updates the status of the transfer job.
    The order of step 3 and 7 are highly dependent on the DICOM data source and may happen out of sequence, as allowed by DICOM.

Steps 1 through 9 are not performed in the case that the DICOM data source does not support instance-level queries. In this case the List Study Instances activity would have moved the instances to the Transfer AE using a series-level C-MOVE.

Proposed Presentation Contexts

The Transfer AE will propose Presentation Contexts as shown in the following table for the C-MOVE operations.

4.2.2.3.2

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

The Transfer AE will propose Presentation Contexts as shown in the following table for the C-STORE operations.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
The storage class name corresponding to the instance to be stored	The storage class UID corresponding to the instance to be stored	The transfer syntax as defined by the instance to be stored	The transfer syntax UID as defined by the instance to be stored	SCU	None

SOP Specific Conformance for C-MOVE SOP Class

4.2.2.3.2.3 The behavior of Transfer AE when encountering status codes in a C-MOVE response is summarized in the table below. If the remote AE returns a status other than "Success" or "Pending", the query to that DICOM data source is considered to have failed; the results will not be included in the response, the operation will fail, and the user will be informed about the failure.

C-MOVE Response Status Handling Behavior

Service Status	**Further Meaning**	**Error Code**	**Behavior**
Success	Sub-operations Complete – No Failures	0000	The SCP has completed the move. The results will be displayed to the user.
Refused	Out of Resources – Unable to calculate number of matches	A701	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Out of Resources – Unable to perform sub-operations	A702	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Move Destination unknown	A801	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Sub-operations Complete – One or more Failures	B000	The SCP has completed the move. The results will be displayed to the user.

Service Status	Further Meaning	Error Code	Behavior
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Sub-operations are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-MOVE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Transfer AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – MOVE SOP Class.

The tables below provide a description of the Transfer AE C-MOVE Request Identifier and specify the attributes that are used.

C-MOVE Request Identifier – Image Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		
SOP Common						
SOP Instance UID	(0008,0018)	UI	X	X		

The above table should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Transfer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Transfer AE will supply this attribute as Return Key with zero length for Universal Matching.
Q:	Interactive Query Key. The Transfer AE will supply values for matching based on user input.
D:	Displayed keys. The Transfer AE will display the items to the user.

4.2.2.3.2.4

SOP Specific Conformance for C-STORE SOP Class

The behavior of Transfer AE when encountering status codes in a C-STORE response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the store to that DICOM data source is considered to have failed; if the storage to all DICOM data sources fail, the user will be informed that the store failed.

C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the store. The user will be notified about the success.
Refused	Out of Resources	A700 – A7FF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Data Set does not match SOP Class	A900 – A9FF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Coercion of Data Elements	B000	The SCP has completed the store. The user will be notified about the success.
Warning	Elements Discarded	B006	The SCP has completed the store. The user will be notified about the success.
Warning	Data Set does not match SOP Class	B007	The SCP has completed the store. The user will be notified about the success.
Failed	Cannot understand	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-STORE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. The reason is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

4.2.2.3.3

4.2.2.3.3.1

Activity – Download Study

Description and Sequencing of Activities

While reviewing a list of studies or while reviewing a particular study in detail, the user can request that selected studies be downloaded to an external client. This

results in the creation of a download job per study which is processed in the background.

When a download job is being processed, the system must first query the study contents to discover the instances in the study as per the real-world activity List Study Instances via the Transfer AE.

With the list of instances, the download service attempts to transfer each instance. For each instance, the download service requests the instance which initiates an instance move. The Transfer AE then initiates a new association with the C-MOVE SCP that contains the instance. If the association is successfully negotiated, the Transfer AE issues a C-MOVE request at the series or instance level (depending on the source AE's support of instance-level queries. The Identifier of the C-MOVE contains the Study Instance UID, Series Instance UID, and, depending on the operation, the SOP Instance UID. The Transfer AE will then wait for each C-MOVE response. When the C-MOVE response indicates completion, the data will be transferred by proprietary means to the external client.

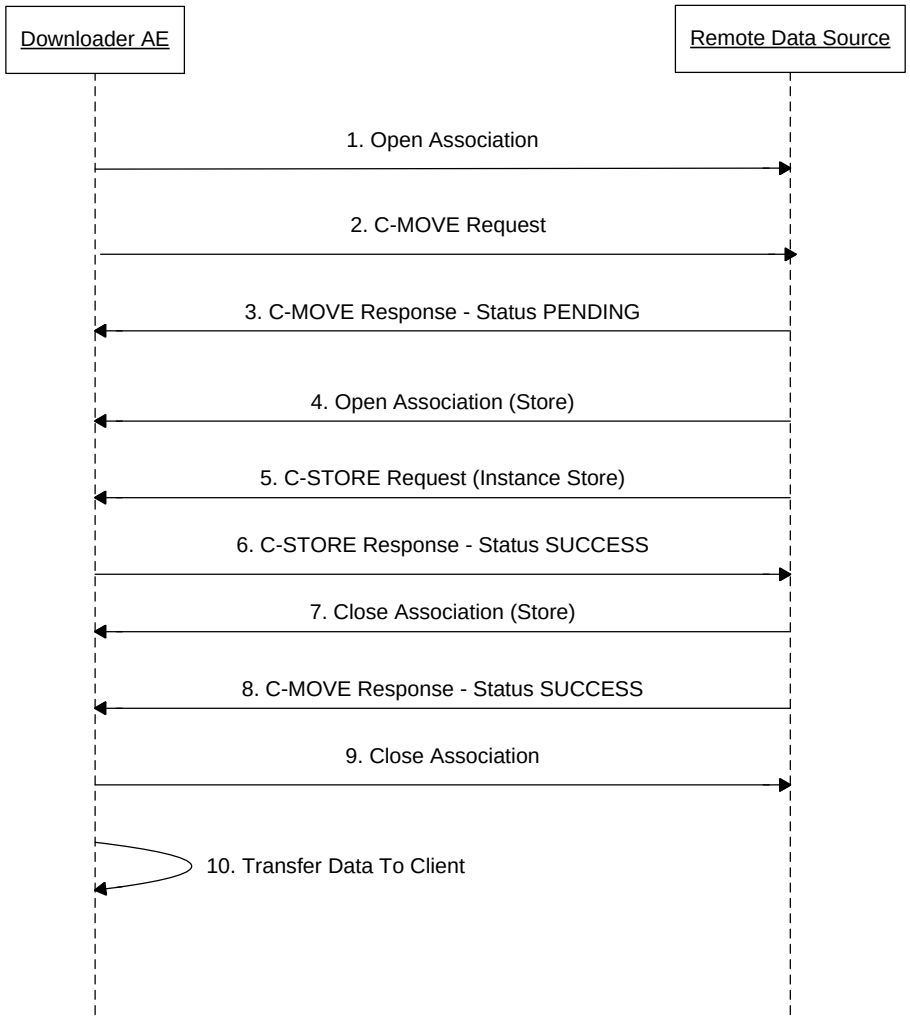

Figure 17 - Download Interaction

The typical sequence of interactions between the Transfer AE and a DICOM data source is described as follows:

1. The Transfer AE opens an association with the DICOM data source.
2. The Transfer AE sends a C-MOVE request to the DICOM data source containing the job's Study Instance UID, Series Instance UID, and, if instance-level queries are supported, SOP Instance UID.
3. The DICOM data source sends a C-MOVE response to the Transfer AE indicating the move has pending operations.
4. The DICOM data source opens an association with the Transfer AE.

5. The DICOM data source issues a C-STORE request for the requested instance or for each instance in the series.
6. The Transfer AE receives the instance and issues a C-STORE response.
7. The DICOM data source closes the association.
8. The DICOM data source sends the C-MOVE response indicating success.
9. The Transfer AE closes the association with the DICOM data source.
10. The Transfer AE transfers the data to an external client.

Proposed Presentation Contexts

The Transfer AE will propose Presentation Contexts as shown in the following table.

4.2.2.3.3

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

4.2.2.3.3.3

SOP Specific Conformance for C-MOVE SOP Class

The behavior of Transfer AE when encountering status codes in a C-MOVE response if summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to that DICOM data source is considered to have

failed; the results will not be included in the response, and if other data sources succeed, the user will be informed that the results are incomplete.

C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations Complete – No Failures	0000	The SCP has completed the move. The download job handling will proceed.
Refused	Out of Resources – Unable to calculate number of matches	A701	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Out of Resources – Unable to perform sub-operations	A702	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Move Destination unknown	A801	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Sub-operations Complete – One or more Failures	B000	The SCP has completed the move. The results will be displayed to the user.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Sub-operations are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

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

C-MOVE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The tables below provide a description of the Transfer AE C-MOVE Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-MOVE response are ignored.

C-MOVE Request Identifier – Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		

C-MOVE Request Identifier – Image Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		
General Series						
Series Instance UID	(0020,000E)	UI	X	X		
SOP Common						
SOP Instance UID	(0008,0018)	UI	X	X		

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-MOVE attributes.
Attribute Name:	Attributes supported to build a C-MOVE Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-MOVE query. A “S” will indicate that Transfer AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Transfer AE will supply this attribute as Return Key with zero length for Universal Matching.

4.2.2.4 Association Acceptance Policy

Activity – Download Study

4.2.2.4.1 **Description and sequencing of Activities**

4.2.2.4.1.1 The Transfer AE listens for instances to be stored as a result of other operations performed by its users. When a download job requires data to be moved to the Transfer AE for transfer to an external destination, the instances are stored to the Transfer AE.

The Transfer AE SCP does not support Extended Negotiation and does not perform any validation or coercion of attributes, although the data may be modified according to user input before transfer to the external client.

Data sent to the Transfer AE unsolicited (i.e. not as a result of a Transfer AE C-MOVE operation) will be ignored and is not allowed.

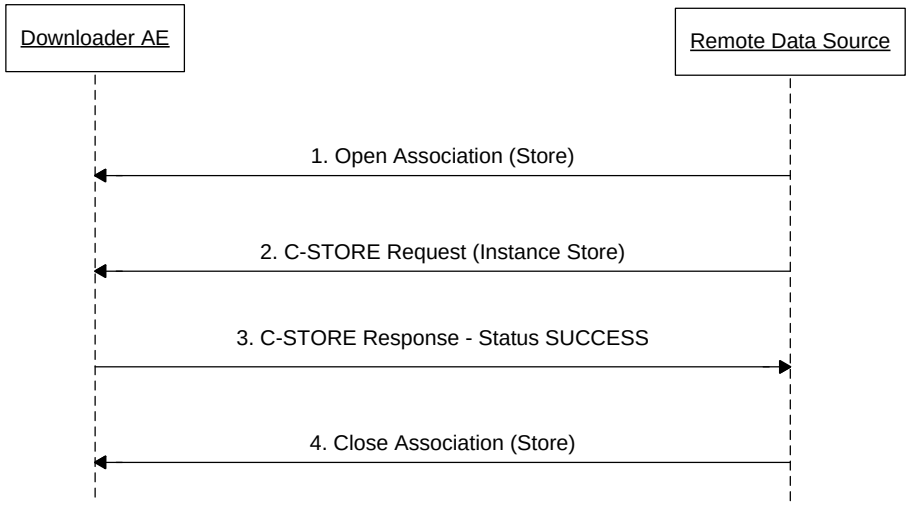

Figure 18 - Sequencing of Activity – Receive Storage Request

The typical sequence between a DICOM data source and the Transfer AE is as follows:

1. The DICOM data source opens a new association with the Transfer AE.
2. The DICOM data source sends a C-STORE request.
3. The Transfer AE stores the instance and sends a C-STORE response.
4. The DICOM data source closes the association with the Transfer AE.

The Transfer AE SCP rejects association requests if Called AE title is not one of the local AE titles configured in the system.

Accepted Presentation Contexts

The Transfer AE SCP will accept the following presentation contexts:

4.2.2.4.1

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
All Storage SOP Classes except Verification , Ultrasound Multi-frame Image Storage, and Ultrasound Multi-frame Image Storage (Retired)	All except 1.2.840.10008.1.1 , 1.2.840.10008.5.1.4.1.1.3.1, and 1.2.840.10008.5.1.4.1.1.3	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit Little Endian	1.2.840.10008.1.2	SCP	None
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50		

SOP Specific Conformance for SOP Class(es)

The Transfer AE can report status codes as summarized in the Table below. When Transfer AE SCP fails to store, it will close TCP/IP connection without sending C-STORE Response. Error information is logged in this case,

4.2.2.4.1

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The Transfer AE has completed the operation successfully.

4.2.3 Pre-Cache Application Entity Specification

4.2.3.1 SOP Classes

The application provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes

SOP Class Name	SOP Class UID	SCU	SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	No	Yes
Grayscale Softcopy Presentation State Storage SOP Class	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	No	Yes

4.2.3.2 Association Policies

General

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

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.1

Number of Associations

The Pre-Cache AE can initiate and accept any number of associations simultaneously, with some limitations.

4.2.3.2.2

The Pre-Cache AE typically only have one association open at a time - either performing C-FIND, C-MOVE, or C-STORE with one of the configured Remote Data Sources.

Asynchronous Nature

4.2.3.2.3 The Pre-Cache AE does not support asynchronous operations and will not perform asynchronous window negotiation.

Implementation Identifying Information

4.2.3.2.4

The application uses the following implementation identifying information:

Implementation Class UID	2.16.840.1.113669.2013.1.2
Implementation Version Name	IBM ICA 7.1

4.2.3.3 Association Initiation Policy

4.2.3.3.1 This section describes the conditions under which the Pre-Cache AE SCU will initiate an association.

4.2.3.3.1.1

Activity – Pre-Cache Study Instances

Description and Sequencing of Activities

When enabled, the Pre-Cache service performs caching at a configurable interval. At the configured interval the Pre-Cache AE attempts the following with each of the Remote Data Sources configured for pre-caching. First an association with the remote DICOM C-FIND SCP is attempted and if the association is successfully negotiated, the Pre-Cache AE issues a C-FIND request at the Study level with a date range determined by the configured time range configured to be pre-cached. The

Pre-Cache AE will then wait the C-FIND response, up to a configurable maximum. When the C-FIND response is complete or the maximum is received, the list of studies in the response is then used for pulling.

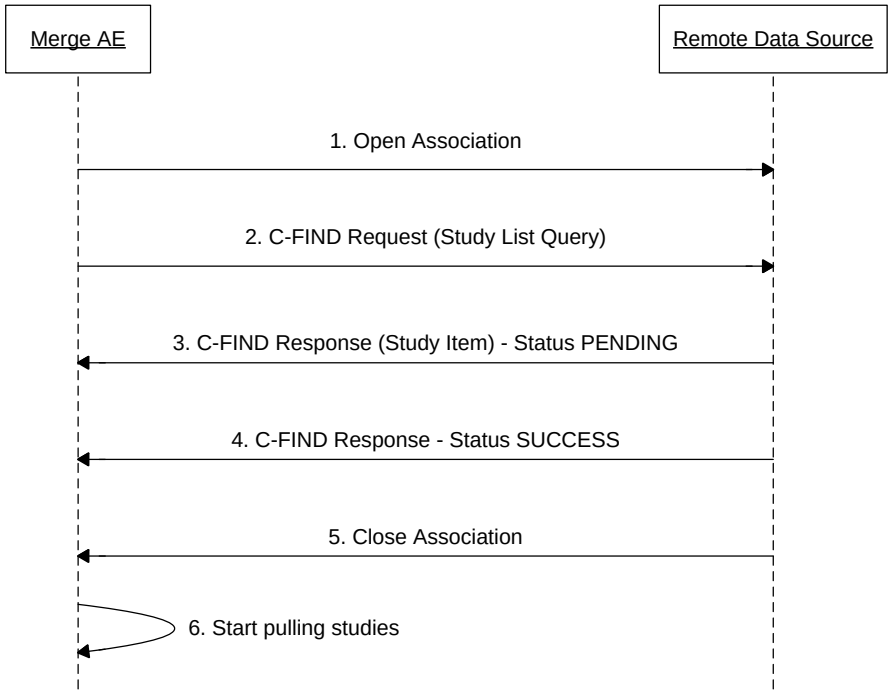

Figure 20 - Pre-Cache – Query for studies

The typical sequence of interactions between the Pre-Cache AE and a DICOM data source as shown above is described as follows:

1. The Pre-Cache AE opens an association with the DICOM data source.
2. The Pre-Cache AE sends a C-FIND request to the DICOM data source containing the study date range to be pre-cached.
3. The DICOM data source returns one C-FIND response for each study that matches the date range provided in the request.
4. The DICOM data source returns the final C-FIND response.
5. The Pre-Cache AE closes the association with the DICOM data source.
6. The Pre-Cache AE proceeds to moving studies in the results.
   For each of the studies in the C-FIND result the following is performed. The Pre-Cache AE attempts to initiate a new Association with the remote DICOM C-MOVE SCP of the Remote Data Source that was queried. If the association

is successfully negotiated, the Pre-Cache AE issues a Study level C-MOVE request for instances where the Identifier contains the Study Instance UID.

The Pre-Cache AE expects that the C-MOVE will result in a C-STORE of the instances. The Pre-Cache AE waits for the final C-MOVE response. When the final C-MOVE response occurs, the Pre-Cache AE will parse the instances and cache the Study.

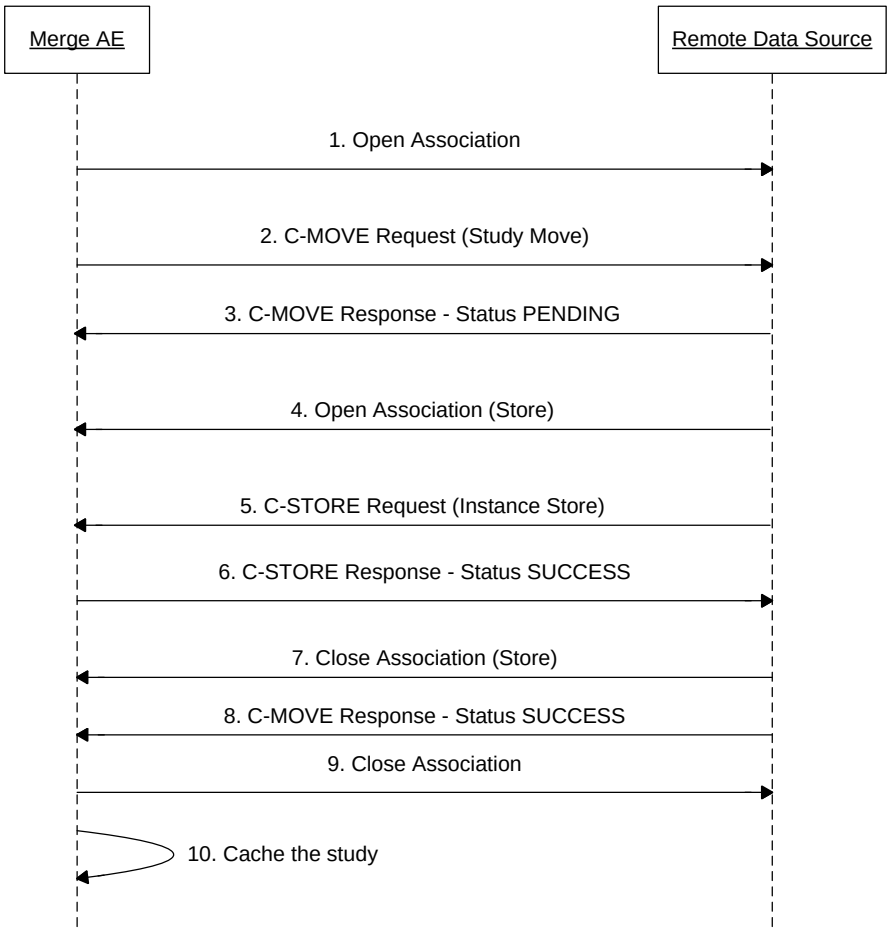

Figure 21 - Pre-Cache – Pull Studies

The typical sequence of interactions between the Pre-Cache AE and a DICOM data source as shown above is described as follows:

1. The Pre-Cache AE opens an association with the DICOM data source.
2. The Pre-Cache AE sends a C-MOVE request to the DICOM data source containing the Study Instance UID asking for the study to be stored to the Pre-Cache AE.
3. The DICOM data source sends a C-MOVE response to the Pre-Cache AE indicating the move has pending operations.
4. The DICOM data source opens an association with the Pre-Cache AE.
5. The DICOM data source issues C-STORE requests for the requested instances.
6. The Pre-Cache AE receives the instances and issues C-STORE responses.
7. The DICOM data source closes the association.
8. The DICOM data source sends the C-MOVE response indicating success.
9. The Pre-Cache AE closes the association with the DICOM data source.
10. The Pre-Cache AE proceeds to finish caching the received study.

The order of step 3 and 7 are highly dependent on the DICOM data source and may happen out of sequence, as allowed by DICOM.

There is also an alternate configuration in which the Remote Data Source will push the studies that are to be cached. In this configuration, the Remote Data Source's DICOM C-MOVE SCP initiates an Association with the Pre-Cache AE and performs a C-STORE for each of the instances to be cached.

When the Remote Data Source's DICOM C-MOVE SCP closes the Association, the Pre-Cache AE will parse the instances received and cache the Study.

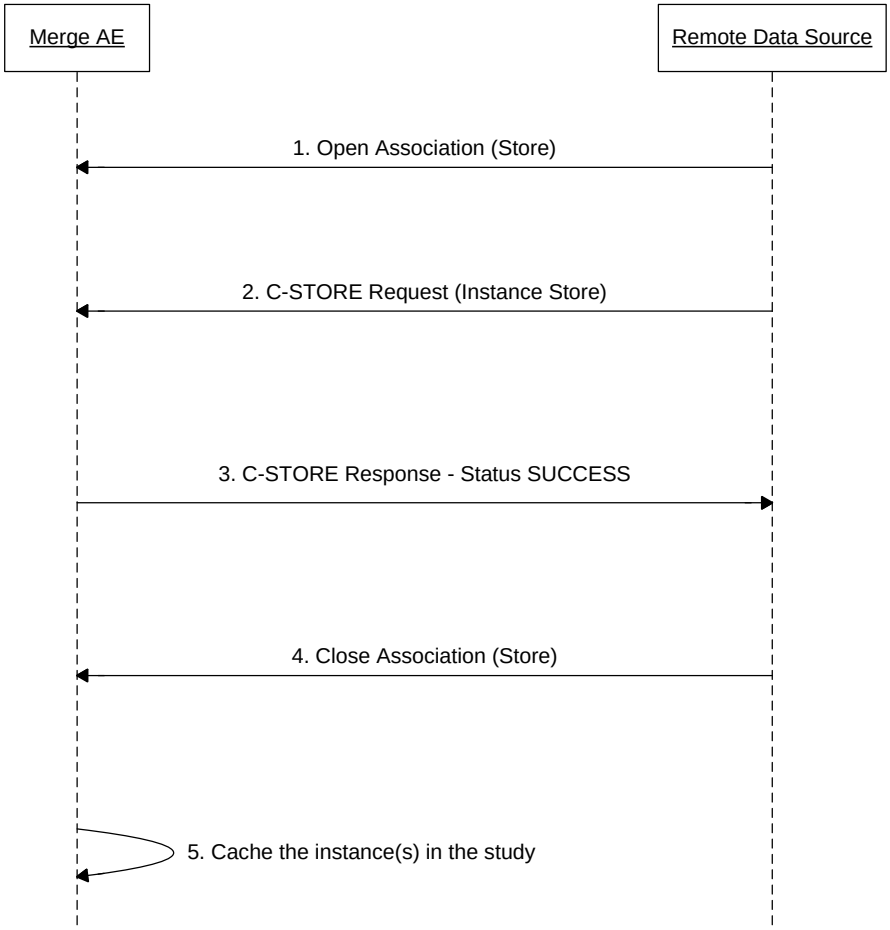

Figure 22 - Pre-Cache – Push Studies

The typical sequence of interactions between the Pre-Cache AE and a DICOM data source as shown above is described as follows:

1. The DICOM data source opens an association with the Pre-Cache AE.
2. The DICOM data source issues C-STORE requests for the requested instances.
3. The Pre-Cache AE receives the instances and issues C-STORE responses.
4. The DICOM data source closes the association.
5. The Pre-Cache AE proceeds to finish caching the received study.

Proposed Presentation Contexts

The Pre-Cache AE will propose Presentation Contexts as shown in the following table.

4.2.3.3.1

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot.**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit Little Endian	1.2.840.10008.1.2.1		

4.2.3.3.1.3

SOP Specific Conformance for C-FIND SOP Class

The behavior of Pre-Cache AE when encountering status codes in a C-FIND response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to that DICOM data source is considered to have failed; the results will not be included in the response, and if other data sources succeed, the user will be informed that the results are incomplete.

C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. The results will be displayed to the user.
Refused	Out of Resources	A700	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Matches are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

The behavior of Pre-Cache AE during communication failure is summarized in the table below:

C-FIND Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Pre-Cache AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – FIND SOP Class. The Pre-Cache AE is also capable of using a non-negotiated relational query which can be more efficient if it is supported by the remote AE. The selection of the C-FIND behavior is configurable.

The tables below provide a description of the Pre-Cache AE C-FIND Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are removed by the Pre-Cache AE. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not "merged").

Hierarchical Query

C-FIND Request Identifier – Hierarchical Query – Study Level

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**R**	**Q**	**D**
Patient						
Patient Name	(0010,0010)	PN		X		
Patient ID	(0010,0020)	LO		X		
General Study						
Study Instance UID	(0020,000D)	UI		X		
Study Date	(0008,0020)	DA	X			
Study Time	(0008,0020)	TM	X			
Study ID	(0020,0010)	SH		X		
Accession Number	(0008,0050)	SH		X		

Non-Negotiated Relational Query

C-FIND Request Identifier – Non-Negotiated Relational Query

Module Name Attribute Name	Tag	VR	M	R	Q	D
Patient						
Patient Name	(0010,0010)	PN		X		
Patient ID	(0010,0020)	LO		X		
General Study						
Study Instance UID	(0020,000D)	UI		X		
Study Date	(0008,0020)	DA	X			
Study Time	(0008,0020)	TM	X			
Study ID	(0020,0010)	SH		X		
Accession Number	(0008,0050)	SH		X		

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A “S” will indicate that Pre-Cache AE will supply an attribute value for Single Value Matching.
R:	Return keys. An “X” will indicate that Pre-Cache AE will supply this attribute as Return Key with zero length for Universal Matching.
Q: 4.2.3.3.1.4	Interactive Query Key. The Pre-Cache AE will supply values for matching based on user input.
D:	Displayed keys. The Pre-Cache AE will display the items to the user.

SOP Specific Conformance for C-MOVE SOP Class

The behavior of Pre-Cache AE when encountering status codes in a C-MOVE response is summarized in the table below. If the remote AE returns a status other than “Success” or “Pending”, the query to the DICOM data source is considered to have failed; the results will not be included in the response, the operation will fail, and the user will be informed about the failure.

C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations Complete – No Failures	0000	The SCP has completed the move. The results will be displayed to the user.
Refused	Out of Resources – Unable to calculate number of matches	A701	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Out of Resources – Unable to perform sub-operations	A702	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Refused	Move Destination unknown	A801	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Failed	Identifier does not match SOP Class	A900	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Warning	Sub-operations Complete – One or more Failures	B000	The SCP has completed the move. The results will be displayed to the user.
Failed	Unable to Process	C000 – CFFF	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Cancel	Matching terminated due to Cancel request	FE00	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Pending	Sub-operations are continuing	FF00	The SCP has provided a valid response item. The item contained in the Identifier is collected for later processing.
*	*	Any other status code.	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.

The behavior of Pre-Cache AE during communication failure is summarized in the table below:

C-MOVE Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted by closing TCP/IP connection and the operation is marked as failed. Error information is logged.
Association aborted by the SCP or network layers	The operation is marked as failed. The reason is logged.

The Pre-Cache AE conforms to the hierarchical query specifications of the Study Root Query/Retrieve Information Model – MOVE SOP Class.

The tables below provide a description of the Pre-Cache AE C-MOVE Request Identifier and specify the attributes that are used. Unexpected attributes returned in a C-MOVE response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Duplicate entries will be removed based on the unique identifier at each level of the data model, where the record that is first found during processing is used (i.e. the records are not "merged").

C-MOVE Request Identifier –– Series Level

Module Name Attribute Name	Tag	VR	M	R	Q	D
General Study						
Study Instance UID	(0020,000D)	UI	X	X		

The above tables should be read as follows:

Module Name:	The name of the associated module for supported C-FIND attributes.
Attribute Name:	Attributes supported to build a C-FIND Request Identifier
Tag:	DICOM tag for this attribute
VR:	DICOM VR for this attribute
M:	Matching keys for C-FIND query. A "S" will indicate that Pre-Cache AE will supply an attribute value for Single Value Matching.
R:	Return keys. An "X" will indicate that Pre-Cache AE will supply this attribute as Return Key with zero length for Universal Matching.

Q:	Interactive Query Key. The Pre-Cache AE will supply values for matching based on user input.
D:	Displayed keys. The Pre-Cache AE will display the items to the user.

4.2.3.4 Association Acceptance Policy

Activity – Pre-Cache Study Instances

Description and sequencing of Activities

4.2.3.4.1 The Pre-Cache AE listens for instances to be stored as a result of pulling request issued by itself, or pushing request initiated by DICOM data source directly.

4.2.3.4.1.1 Whenever it requests a study to be cached, or DICOM data source sends a study directly, the instances are stored to the Pre-Cache AE.

The Pre-Cache AE SCP does not support Extended Negotiation and does not perform any validation or coercion of attributes.

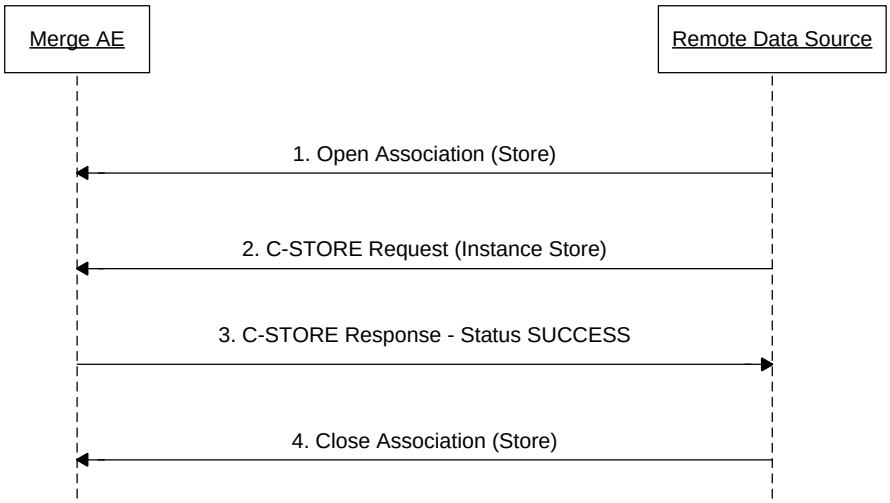

Figure 19 - Sequencing of Activity – Receive Storage Request

The typical sequence between a DICOM data source and the Pre-Cache AE is as follows:

1. The DICOM data source opens a new association with the Pre-Cache AE.
2. The DICOM data source sends a C-STORE request.

3. The Pre-Cache AE stores the instance and sends a C-STORE response.

4. The DICOM data source closes the association with the Pre-Cache AE.

The Pre-Cache AE SCP rejects association requests if Called AE title is not one of the local AE titles configured in the system.

Accepted Presentation Contexts

The Pre-Cache AE accepts the same presentation contexts as Viewer AE. Please see section 4.2.1.4.1.2.

4.2.3.4.1.2 **SOP Specific Conformance for SOP Class(es)**

The Pre-Cache AE reports the same status codes as Viewer AE. Please see section 4.2.1.4.1.3.

4.2.3.4.1.3 **Activity – Receive Study Instances**

4.2.3.4.2 **Description and sequencing of Activities**

4.2.3.4.2.1 The Pre-Cache service can also be used to receive study instances without querying/fetching. Any external PACS can directly issue C-STORE commands and stored study instances to it.

Sequencing of activities is the same as Pre-Cache Study Instances activity. Please see section 4.2.3.4.1.1.

4.2.3.4.2.2 **Accepted Presentation Contexts**

The Pre-Cache AE accepts the same presentation contexts as in Pre-Cache Study Instances activity. Please see section 4.2.3.4.1.2.

4.2.3.4.2.3 **SOP Specific Conformance for SOP Class(es)**

The Pre-Cache AE reports the same status codes as in Pre-Cache Study Instances activity. Please see section 4.2.3.4.1.3.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The application supports any network interface configured in the Windows OS.

4.3.2 Additional Protocols

The application conforms to the System Management Profiles listed in the Table below by utilizing corresponding functionality in Windows OS. All requested transactions for the listed profiles and actors are supported. Support for optional transactions are listed in the following table:

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	NTP	Find NTP Server	N/A
	DHCP Client	DHCP	N/A	N/A

The application also supports WADO as a Web Client System. Please refer to WADO section below for restrictions.

4.3.2.1 DHCP

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. Support for DHCP is configured in the Windows OS. If DHCP is not in use, TCP/IP network configuration information must be manually configured instead.

DHCP Parameter	Default Value
IP Address	None
Host Name	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	From Time Zone configured
MTU	Network Hardware Dependent
Auto-IP permission	No permission

If the DHCP server refuses to renew a lease on the assigned IP address active DICOM associations and communications may be aborted as a result.

4.3.2.2 DNS

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 in the Windows OS. If a DNS server is not in use, local mapping between hostname and IP address can be manually configured in the Windows OS.

4.3.2.3 NTP

The Windows NTP client implements the optional Find NTP Server Transaction. The NTP client will issue an NTP broadcast to identify any local NTP servers. If no local servers can be found via NTP broadcast, the NTP Servers identified by DHCP will be used as time references. Additionally, one or more NTP Servers can be configured in the Windows OS. If no NTP Servers are identified then the local clock will be used as a time reference.

4.3.2.4 WADO

WADO URI

WADO can be used in the application for instance retrieval acting as Web Client System.

These parameters are provided in the HTTP request.

4.3.2.4.1

HTTP GET Parameter	Value
Accept	*/*

These parameters are provided in the object request.

WADO Parameter	Value
requestType	WADO
studyUID	(requested object's Study Instance UID)
seriesUID	(requested object's Series Instance UID)
objectUID	(requested object's SoP Instance UID)
contentType	application/dicom

Additional parameters that are specific to any WADO implementation can also be provided as part of base URL of the WADO enabled DICOM Server HTTP end point.

For DICOM image persistent object, the application doesn't provide "transferSyntax" parameter to avoid forcing WADO enabled DICOM Server to perform transcoding. However, not all transfer syntaxes are supported by this application (please refer to 4.2.1.4.1.2 Accepted Presentation Contexts for the list of accepted transfer syntax for each SOP class). If this is a problem, the workaround is to configure transferSyntax as part of base URL of the WADO enabled DICOM Server HTTP end point.

4.3.3 IPv4 and IPv6 Support

This product supports both IPv4 and IPv6 connections.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

The Viewer AE's and Transfer AE's local AE titles can be configured using the application's Service Tool The AE titles defaults based on the name of the machine, converted to all upper-case characters as described in the following table. The local TCP/IP ports default to 4444, 4445, and 4446.

Application Entity	Default AE Title	Default TCP/IP Port
Viewer AE	Machine hostname, truncated to 16 characters and capitalized	4444
Transfer AE	Machine hostname prefixed with TRF_, truncated to 16 characters and capitalized	4445
Pre-Cache AE	Machine hostname prefixed with PF_, truncated to 16 characters and capitalized	4446

4.4.1.2 Remote AE Title/Presentation Address Mapping

The DICOM configuration used by the Viewer AE to communicate with remote DICOM data sources can be configured using the application's Service Tool. The AE title, host name or IP address, and port numbers can be configured for each remote data source.

4.4.1.2.1

Viewer AE and Transfer AE

For each remote DICOM data source, the service engineer can create and configure a "Data Source" of type "Dicom". Each remote DICOM data source is expected to provide C-FIND and C-MOVE SCP services and C-STORE SCU services at a minimum. In XDS-I-only configurations, it is possible to operate without C-FIND SCP support, however the features are greatly limited to XDS-I only operations.

The Viewer AE and Transfer AE will only accept associations where the Called AE matches one of the local AEs which are configured for the Viewer AE.

The service tool also allows the configuration of a separate AE title, host name or IP address, and port to which presentation states can be stored (in case the C-STORE SCP is a different AE).

Pre-Cache AE

The Pre-Cache AE accepts associations from any DICOM AE for pushing data in. For pulling data from, the service tool allows configuration of remote DICOM data sources used by Viewer AE to support pre-caching.

4.4.1.2.2

4.4.2 Parameters

A number of parameters related to DICOM communication can be configured using the service tool. Only the parameters directly related to the DICOM communication protocol are captured here, however there are other parameters which can affect the behavior of the application.

The following table shows those configuration parameters relevant to DICOM communication:

Parameter	Configurable (Yes/No)	Default Value
Query Type (Available options: 1) Non-Negotiated Relational – As described in previous sections, queries may be made that do not include unique keys above the query level and request attributes above the query level. This is can improve performance, but may not be supported by the remote DICOM data source. 2) Hierarchical – The default C-FIND query method.	Yes	Non-Negotiated Relational
Support List of UID Matching (Available options: 1) On – List of UID matching is supported by the remote DICOM data source as per DICOM PS3.4 C.2.2.2.2. 2) Off – List of UID matching is not supported.) NOTE: This only applies when the Query Type is configured to be Hierarchical. If the Query Type is configured to be Non-Negotiated Relational, list of UID matching will always be performed.	Yes	On

Parameter	Configurable (Yes/No)	Default Value
Support C-FIND (Available options: 1) On – The remote DICOM data source supports C-FIND as an SCP. 2) Off – The remote DICOM data source does not support C-FIND as an SCP. The Viewer AE will only make C-MOVE requests to transfer images. This can only be used in XDS-I-only configurations where the DICOM data source is a DICOM repository for an XDS-I repository.)	Yes	On
Support ModalitiesInStudy (Available options: 1) On – Modalities In Study (0008,0061) is supported by the remote DICOM data source in C-FIND responses. This makes the "Modalities" column available in the study list efficiently. 2) Off – Modalities In Study is not supported. If the "Modalities" column is required in the study list, the "Perform Series Level Query for Modality" is required to be "On".)	Yes	On
Perform Series Level Query for Modality (Available options: 1) On – The Viewer AE will make SERIES level C-FIND requests to populate the "Modalities" column in the study list. This can cause slow performance, so it should be used with care. 2) Off – The Viewer AE will not make SERIES level C-FIND requests to populate the "Modalities" column. If the "Support ModalitiesInStudy" option and this option are "Off", the "Modalities" column in the study list will have values of "Unknown".)	Yes	Off
Instance Query (Available options: 1) On – The remote DICOM data source supports instance-level C-FIND and C-MOVE as an SCP. 2) Off – The remote DICOM data source does not support C-FIND and C-MOVE as an SCP therefore only series-level C-FIND and C-MOVE operations will be issued.)	Yes	On
Allow Reusing of DICOM Associations Without Issuing A-RELEASE Command (Available options: 1) On – The Viewer AE will avoid closing associations after each operation. This can improve performance of subsequent operations to the same remote DICOM data source. 2) Off – The Viewer AE will close associations after each operation.)	Yes	Off
Maximum Number of DICOM Associations That Can Be Cached (The number of idle DICOM associations that the Viewer AE will keep open.)	Yes	5

Parameter	Configurable (Yes/No)	Default Value
Maximum Number of DICOM Associations That Can Be Open Concurrently (The number of active DICOM associations that the Viewer AE will allow before queuing requests.)	Yes	50

5. Media Interchange

The application does not support Media Storage.

6. Transformation of DICOM to CDA

The application does not support transformation of DICOM to CDA.

7. Support of Extended Character Sets

The application supports the following character sets for series loading.

1. DICOM default character set (ISO_IR 6)

2. All character sets listed by DICOM as per DICOM standard version (referenced in section 1.6)

The application supports the following character sets for series saving.

1. DICOM default character set (ISO_IR 6)

2.Unicode character set (ISO_IR 192)

As a C-FIND SCU the application sends messages using ISO_IR 6 or ISO_IR 192 and supports all character sets listed by DICOM standard version (referenced in section 1.6) while interpreting messages from the SCP.

Characters are represented as Unicode values and depend on the correct fonts installed on the client to display characters. Rendered text is dependent on the server in the same way. Font usage is controlled by the client and server environments respectively and not through IBM iConnect Access.

8. Security

The application provides support for the following secure transport connection profiles:

- The Basic TLS Secure Transport Connection Profile, and
- The AES TLS Secure Transport Connection Profile.

The support details are covered in section 5.1 – Association Level Security.

It is also the user's responsibility to use the system within a secured environment and to maintain a secured environment that includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to the system
- Firewall or router protections to ensure that the system 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))

8.1 Security Profiles

8.1.1 Secure Use Profiles

None of Secure Use Profiles are supported.

8.1.2 Secure Transport Connection Profiles

Basic TLS and AES TLS Secure Transport Connection Profiles are supported.

The service engineer can configure DICOM TLS support using the service tool. If DICOM TLS is enabled in the service tool, they can configure one or more supported ciphers, including RSA, TLSv1, TLSv1.1, TLSv1.2, SSLv2, SSLv3, AES, 3DES, DES, MD5, and SHA. From within the service tool, the certificates can be configured.

Other Secure Transport Connection Profiles are not supported.

8.1.3 Digital Signature Profiles

None of Digital Signature Profiles are supported.

8.1.4 Media Storage Security Profiles

None of Media Storage Security Profiles are supported.

8.2 Association Level Security

The C-STORE SCP of all three AEs accepts associations only when the association request contains a configured Called AE.

The C-STORE SCP of Viewer AE and Transfer AE accepts associations from all remote AEs but only data from AEs where data were requested are handles. Data that are unsolicited (i.e. not as a result of a Viewer/Transfer AE C-MOVE operation) will be ignored and is not allowed.

8.3 Application Level Security

None supported.

9. Annexes

9.1 IOD Contents

The application creates Greyscale Softcopy Presentation State SOP instances.

9.1.1 Created SOP Instances

The following tables use a number of abbreviations. The abbreviations used in the “Presence of Value” column are:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value

The abbreviations used in the “Source” column:

USER	the attribute value source is from User input
AUTO	the attribute value is generated automatically
COPY	the attribute value is copied from the loaded study
DICOM	the attribute value is defined by DICOM
CONFIG	the attribute value source is a configurable parameter

9.1.1.1 Greyscale Softcopy Presentation State SOP Instance Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Module					
Patient's Name	0010,0010	PN	Copied from loaded study (if it exists).	VNAP	COPY
Patient ID	0010,0020	LO	Copied from loaded study (if it exists).	VNAP	COPY
Patient's Birth Date	0010,0030	DA	Copied from loaded study (if it exists).	VNAP	COPY
Patient's Sex	0010,0040	CS	Copied from loaded study (if it exists).	VNAP	COPY
Patient's Age	0010,1010	AS	Copied from loaded study (if it exists).	VNAP	COPY
Patient's Weight	0010,1030	DS	Copied from loaded study (if it exists).	VNAP	COPY
Patient Study Module					
Additional Patient History	0010,21B0	LT	Copied from loaded study (if it exists).	VNAP	COPY
General Study Module					
Study Date	0008,0020	DA	Copied from loaded study (if it exists).	VNAP	COPY
Study Time	0008,0030	TM	Copied from loaded study (if it exists).	VNAP	COPY
Accession Number	0008,0050	SH	Copied from loaded study (if it exists).	VNAP	COPY
Referring Physician's Name	0008,0090	PN	Copied from loaded study (if it exists).	VNAP	COPY
Study Description	0008,1030	LO	Copied from loaded study (if it exists).	VNAP	COPY
Study Instance UID	0020,000D	UI	Copied from loaded study (if it exists).	VNAP	COPY
Study ID	0020,0010	SH	Copied from loaded study (if it exists).	VNAP	COPY

Attribute Name	Tag	VR	Value	Presence of Value	Source
General Series/Presentation Series Module					
Series Date	0008,0021	DA	Generated by application.	ALWAYS	AUTO
Series Time	0008,0031	TM	Generated by application.	ALWAYS	AUTO
Modality	0008,0060		PR	ALWAYS	AUTO
Series Instance UID	0020,000E	UI	Generated by application.	ALWAYS	AUTO
Series Number	0020,0011	IS	Generated by application.	ALWAYS	AUTO
General Equipment Module					
Manufacturer	0008,0070	LO	Cedara	ALWAYS	AUTO
Institution Name	0008,0080	LO	Copied from loaded series (if it exists).	VNAP	COPY
Presentation State Identification Module					
Instance Number	0020,0013	IS	Generated by application.	ALWAYS	AUTO
Content Label	0070,0080	CS	GSPS	ALWAYS	AUTO
Content Description	0070,0081	LO	WebAccess GSPS	ALWAYS	AUTO
Presentation Creation Date	0070,0082	DA	Generated by application.	ALWAYS	AUTO
Presentation Creation Time	0070,0083	TM	Generated by application.	ALWAYS	AUTO
Content Creator’s Name	0070,0084	PN	Name of logged in user creating the GSPS.	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Presentation State Relationship Module					
Referenced Series Sequence	0008,1115	SQ	One sequence item.	ALWAYS	AUTO
> Referenced Image Sequence	0008,1140	SQ	One or more sequence items.	ALWAYS	AUTO
>> Referenced SOP Class UID	0008,1150	UI	Copied from the referenced image.	ALWAYS	COPY
>> Referenced SOP Instance UID	0008,1155	UI	Copied from the referenced image.	ALWAYS	COPY
> Series Instance UID	0020,000E	UI	Copied from the referenced series.	ALWAYS	COPY
Displayed Area Module					
Displayed Area Selection Sequence	0070,005A	SQ	One or more sequence items depending on the referenced images.	ALWAYS	AUTO
> Referenced Image Sequence	0008,1140	SQ	One or more sequence items only if scope of displayed area is not all images in series.	ANAP	AUTO
>> Referenced SOP Class UID	0008,1150	UI	Copied from the referenced image.	ALWAYS	COPY
>> Referenced SOP Instance UID	0008,1155	UI	Copied from the referenced image.	ALWAYS	COPY
>Displayed Area Top Left Hand Corner	0070,0052	SL	Generated by application.	ALWAYS	AUTO
>Displayed Area Bottom Right Hand Corner	0070,0053	SL	Generated by application.	ALWAYS	AUTO
>Presentation Size Mode	0070,0100	CS	Generated by application.	ALWAYS	AUTO
>Presentation Pixel Spacing	0070,0101	DS	Generated by application.	ALWAYS	AUTO
>Presentation Pixel Magnification Ratio	0070,0103	FL	Generated by application.	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
Graphic Annotation Module					
Graphic Annotation Sequence	0070,0001	SQ	One or more sequence items depending on the existence of graphic annotations and the referenced images.	ANAP	AUTO
> Referenced Image Sequence	0008,1140	SQ	One or more sequence items only if scope of graphic annotations is not all images in series.	ANAP	AUTO
>> Referenced SOP Class UID	0008,1150	UI	Copied from the referenced image.	ALWAYS	COPY
>> Referenced SOP Instance UID	0008,1155	UI	Copied from the referenced image.	ALWAYS	COPY
> Graphic Layer	0070,0002	CS	Generated by application.	ALWAYS	AUTO
> Text Object Sequence	0070,0008	SQ	One or more sequence items depending on the existence of text objects.	ANAP	AUTO
>> Unformatted Text Value	0070,0006	ST	User entered text or application generated text (e.g. measurement).	ALWAYS	USER/AUTO
>> Anchor Point	0070,0014	FL	User entered position or application generated position (e.g. proximity to measurement).	ALWAYS	USER/AUTO
> Graphic Object Sequence	0070,0009	SQ	One or more sequence items depending on the existence of graphic objects.	ANAP	AUTO
>> Graphic Dimensions	0070,0020	US	User drawn graphic.	ALWAYS	USER
>> Number of Graphic Points	0070,0021	US	User drawn graphic.	ALWAYS	USER
>> Graphic Data	0070,0022	FL	User drawn graphic.	ALWAYS	USER
>> Graphic Type	0070,0023	CS	User drawn graphic.	ALWAYS	USER

Attribute Name	Tag	VR	Value	Presence of Value	Source
Spatial Transformation Module					
Image Horizontal Flip	0070,0041	CS	User controlled.	ALWAYS	USER
Image Rotation	0070,0042	US	User controlled.	ALWAYS	USER
Graphic Layer Module					
Graphic Layer Sequence	0070,0060	SQ	One or more sequence items depending on the existence of graphic annotations.	ANAP	AUTO
> Graphic Layer	0070,0002	CS	Generated by application.	ALWAYS	AUTO
> Graphic Layer Order	0070,0062	IS	Generated by application.	ALWAYS	AUTO
Modality LUT Module					
Rescale Intercept	0028,1052	DS	Generated by application.	ALWAYS	AUTO
Rescale Slope	0028,1053	DS	Generated by application.	ALWAYS	AUTO
Rescale Type	0028,1054	LO	Generated by application.	ALWAYS	AUTO
Softcopy VOI LUT Module					
Softcopy VOI LUT Sequence	0028,3110	SQ	One or more sequence items depending on the window/level values and referenced images.	ALWAYS	AUTO
> Referenced Image Sequence	0008,1140	SQ	One or more sequence items only if scope of window/level is not all images in presentation state.	ANAP	AUTO
>> Referenced SOP Class UID	0008,1150	UI	Copied from the referenced image.	ALWAYS	COPY
>> Referenced SOP Instance UID	0008,1155	UI	Copied from the referenced image.	ALWAYS	COPY
> Window Center	0028,1050	DS	User controlled.	ALWAYS	USER
> Window Width	0028,1051	DS	User controlled.	ALWAYS	USER

Attribute Name	Tag	VR	Value	Presence of Value	Source
Softcopy Presentation LUT Module					
Presentation LUT Shape	2050,0020	CS	IDENTITY or INVERSE, user controlled.	ALWAYS	USER
SOP Common Module					
SOP Class UID	0008,0016	UI	1.2.840.10008.5.1.4.1.1.11.1	ALWAYS	DICOM
SOP Instance UID	0008,0018	UI	Dynamic	ALWAYS	AUTO

9.1.2 Usage of Attributes from Received IOD's

The application is designed to visualize various imaging artifacts, including images, presentation states, key objects, reports, and audio files. To this end, various attributes from received IODs are being used as expected by DICOM. There is no special usage of such attributes that should be noted.

9.1.3 Attribute Mapping

The table below describes the default value mapping between DICOM attribute and ReferenceID that can be used in XDS FindDocumentsByReferenceId Registry Stored Query:

DICOM Attribute	XDS ReferenceID
Accession Number	urn:ihe:iti:xds:2013:accession
Study Instance UID	urn:merge:xds:2015:study
Admission ID	urn:merge:xds:2015:encounter

9.1.4 Coerced/Modified Fields

The application will perform normalization of PN fields for display by using the following algorithm:

1. Split PN field component groups;
2. Pick ideographic group (second group) if it exists and has non-empty value;
3. Otherwise pick phonetic group (third group) if it exists and has non-empty value;

4. Otherwise pick single-byte group (first group);
5. Trunk or pad the selected group to have exactly 5 components separated by caret.

In cases where the Patient Birth Date is not if proper DA format, it may be changed to “16000228”. If the date is not a valid, recognizable date according to the Microsoft .NET framework, its value may be cleared. These changes are reflected in the display, and propagated to generated data, but not the original data cannot be modified.

The download operation allows the user to modify basic patient and study information and identifiers. The outgoing data will be modified according to these values provided by the user. The original data in the data source will not be modified.

9.2 Data Dictionary of Private Attributes

The application includes various private attributes in the Greyscale Softcopy Presentation State IODs it produces. These are:

9.2.1 Greyscale Softcopy Presentation State Private Attributes

Attribute Name	Tag	VR	VM
Private Creator (Merge.MeasurementLibrary)	650B, 00xx	LO	1
Version	650B, xx00	ST	1
Instance ID	650B, xx01	UI	1
Parent ID	650B, xx02	UI	1
Object Type	650B, xx03	ST	1
Referenced Instances Sequence	650B, xx04	SQ	1
Referenced Instance ID	650B, xx05	UI	1
Graphic Annotation Constraint Sequence	650B, xx06	SQ	1
Entity Role	650B, xx0C	ST	1
Text Translation	650B, xx0D	FL	2
Private Creator (Merge_iConnect_Access)	650B, 00yy	LO	1
Calibration Category Group	650B, yy00	SQ	1

Attribute Name	Tag	VR	VM
Calibration Category	650B, yy01	LO	1
Color Split Group Sequence	650B, yy02	SQ	1
Color Split Type	650B, yy03	LO	1

9.3 Coded terminology and Templates

No coded terminology is defined or used. Within the display of Basic Text SR reports, any Code Meaning will be displayed if it is included in the IOD. No local lexicon is provided to look up alternative code meanings.

No template extensions or private templates are defined.

9.4 Grayscale Image Consistency

The application does not support the Grayscale Standard Display Function.

9.5 Standard Extended/Specialized/Private SOP Classes

The application does not claim conformance to any Extended, Specialized or Private SOP Classes.

9.6 Private Transfer Syntaxes

The application does not employ any Private Transfer Syntaxes.