Merge Unity PACS™

DICOM NETWORK INTERFACES CONFORMANCE STATEMENT

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INDICATIONS FOR USE: Merge Unity PACS

Merge Unity PACS is a medical image and information management system that allows viewing, selection, processing, printing, telecommunications, and media interchange of medical images from a variety of diagnostic imaging systems. Merge Unity PACS interfaces to various storage and printing devices using DICOM or similar interface standards.

Merge Unity PACS displays, stores, prints, and telecommunicates images from a number of medical modalities, including but not limited to MRI, CT, US, PET, DXA (bone densitometry), nuclear imaging, computed radiography, digital radiography, digitized films, digital photographs, mammographic images, and processed data from FDA-cleared third party image processing systems, including FDA-cleared systems for computer-aided detection and advanced image processing (e.g. 3-D processed images such as those produced by Voxar Corp.).

Lossy compressed mammographic images must not be used for primary diagnostic interpretation unless approved for use in digital mammography. Display monitors used for primary diagnostic interpretation of mammographic images must be approved for use in digital mammography.

INDICATIONS FOR USE: Z3D

Z3D is intended to provide reading physicians, referring physicians, and other appropriate healthcare professionals tools to aid in interpreting medical images, including:

• Displaying DICOM compliant medical image volumes, such as CT, MRI, and PET.
• 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 series of DICOM images and individually captured 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.

CAUTION: Federal law restricts this device to sale by or on the order of a physician.
CAUTION: Unity PACS and Merge Z3D are not intended for diagnostic use on mobile device such as a phone or tablet.

The symbols glossary is provided electronically at http://www.merge.com/Support/Resources.aspx.

CANADIAN DEVICE IDENTIFIER:

Device Name	Device Identifier
UNITY RIS/PACS	C-DRSW-00001
Merge Z3D	MERGE Z3D

Manufacturer's Address
Merge Healthcare Incorporated
900 Walnut Ridge Drive
Hartland, WI 53029

DOCUMENT VERSION LOG:

Part	Date	Revision	Description
UPAX-4466	July 23, 2010	1	Initial release.
	May 12, 2017	2	Migrated to Merge template and edited copyright page.

Contents

1 Introduction

1.1 Purpose

This document is a DICOM Conformance Statement for network DICOM interfaces of the Unity PACS. The contents of a DICOM Conformance statement are specified in the ACR/NEMA DICOM Standard Part 2: Conformance.

1.2 Scope

This document describes the DICOM conformance of all network and other non-media Unity DICOM interfaces. A separate document, "DICOM Media Storage Conformance Statement" describes the conformance details of Unity media DICOM interfaces.

1.3 Related Documentation

The following are related documents:

Document number	Title
UPAX-4467	DICOM Media Storage: Conformance Statement for Unity

1.4 Glossary

The following acronyms and abbreviations are used in this document.
- ACR   American College of Radiology
- AE   Application Entity
- DICOM   Digital Imaging and Communications in Medicine
- DIMSE   DICOM Message Service Element
- DIMSE-C   DICOM Message Service Element-Composite
- PACS   Picture Archival and Communications System
- IOD   Information Object Definition
- NEMA   National Electrical Manufacturers Association
- PDU   Protocol Data Unit
- SCP   Service Class Provider
- SCU   Service Class User
- SOP   Service Object Pair
- TCP/IP   Transmission Control Protocol/Internet Protocol
- UID   Unique Identifier

1.5 Overview of Unity PACS and DICOM functionality

Unity PACS provides extensive DICOM functionality, with the goal not only to support interchange and display of DICOM images, but also to provide the tools to make DICOM images more usable to technologists and radiologist than the inherent data would otherwise allow. DICOM is a native image format in the Unity.

> **NOTE:** Unity uses the term "exam" to be roughly synonymous to DICOM's use of the term "study".

Unity receives DICOM images either by waiting for a Storage service class provider (SCP) to "push" images to it or by "pulling" images from Query/Retrieve service class user (SCU). There is an explicit process, called "import", that makes the received study available for Quality Assurance or for reading by a radiologist. Import is invoked either manually or by a configurable automatic trigger mechanism. The Import process also performs additional image organization processing that enhances the usability of the study.

Unity can also acquire images from many imaging devices that don't support DICOM. Those images are stored as DICOM standard SOP instances.

Unity PACS can also act as a Storage SCU, allowing users to send images to another DICOM Application Entity.   From the user's point-of-view, the destination (Storage SCP) is just another destination among the list of configured destinations to which images (and other composite instances) can be sent. If the destination requires it, conversion from compressed or uncompressed Explicit VR format to uncompressed Implicit VR format is performed automatically.

Unity provides Modality Worklist support. Worklist items can be entered directly into the Unity PACS or received via HL7. An installation can choose to have a single or multiple Modality Worklist Servers. Modality Worklist Servers typically operate in connected mode; all connected mode Worklist Servers query the same list of current worklist items. To permit mobile operation and to allow operation in case of network failure, Modality Worklist Servers can also operate in disconnected mode. A disconnected mode Server presents only worklist items which it is aware of: those that were downloaded while the AE was connected or which are entered directly on the station while disconnected.

All Service Class Providers also support Verification Service as an SCP. All Application Entities support DICOM Upper Layer Services over TCP/IP protocol.

Unity provides Query and Retrieve SCP support that allows DICOM compliant equipment to find (query) and retrieve patient, study series and other DICOM composite information objects from the Unity PACS. Unity provides all three Query/Retrieve models, Patient Root, Study Root and Patient Study Only root for Online studies and Patient Study Only root for Nearline and Offline studies.

In addition, Unity provides support for third-party DICOM archive. Unity PACS operates as a Storage SCU to send DICOM objects to an archive, as a Study Root Query/Retrieve SCU to query the archive, verifying that objects were stored and are available, and to request moves to initiate restores, and as a Storage SCP to receive the restored objects.

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2 Implementation Model

DICOM Gateway ("DIGATE")

The Unity DICOM Gateway is a component of the Unity PACS. The DICOM Gateway provides support for Storage Service as a Service Class Provider, allowing other DICOM Application Entities to send images to it.

DICOM Guardian Archive

The Unity DICOM Guardian is an optional component of the Unity PACS. The DICOM Storage SCP provides support for Storage Service as a Service Class Provider. It supports the dual role as a primary archive for Unity PACS.

DICOM Guardian Query/Retrieve

DICOM Guardian supports a Query/Retrieve SCU to a DICOM Archive.

Modality Worklist Server

Unity provides the Modality Worklist Server as an optional component that provides support for Basic Worklist Management Service Class as a Service Class Provider for the Modality Worklist SOP Class.

The Modality Worklist Server is implemented as a component of the Unity DICOM Gateway, but the Worklist SCP support and Storage SCP support are logically distinct. An instance of the DICOM Gateway application can provide either or both, and there is no expectation that a modality will use the same DICOM Gateway application instance for Worklist Service support and Storage Service support.

Catapult

The Unity Catapult is a separate application that runs as an integrated component of the Unity PACS. The Catapult acts as a user interface to create DICOM images from non-DICOM image-creating equipment and external documents (Bitmaps, JPEGs, TWAIN devices). The acquired images are stored as DICOM Secondary Capture Images.

Storage

The core application or "Universal Manager" provides DICOM Storage SCU capabilities.

The Universal Manager provides two Storage SCU Software Mechanisms: DICOM Copy and DICOM Send. DICOM Copy is direct storage of an exam by the Universal Manager. DICOM Send builds up a queue of requests that is processed by a separate mechanism (Messenger).

DICOM Copy capabilities include:
- Verification
- Image decompression
- VR Implicit conversion

DICOM Send (via Messenger) capabilities include:
- Image compression
- Image decompression
- VR Implicit conversion

DICOM Control Panel ("DIQUERY")

The DICOM Control Panel acts as a Query/Retrieve service class user, allowing the user to examine the studies available on another DICOM Application Entity, and to instruct the queried Application Entity to send images to a designated recipient DICOM application entity (most typically, the DICOM Gateway).

The DICOM Control Panel supports Verification as an SCU.

The DICOM Control Panel also supports Storage as an SCU, but this has been largely superceded by Universal Manager module's Storage SCU support.

Print Formatter

Unity PACS provides extensive complete DICOM Print SCU support for rendering images to a DICOM Print SCP.

The user may control the series to be printed, image quality, layout, orientation, annotations and size characteristics of the printed image. The supported page formats are entirely configurable within the system.

The DICOM Print SCU runs within the Print Format application on the Unity DICOM Print Workstation.

DICOM Print SCU capabilities can be invoked by sending a print job to a DICOM Printer from the "Universal Manager" application.   DICOM Printing is controlled by printer specific settings for each validated DICOM printer.

DICOM Print SCU supports DICOM Upper Layer Services over TCP/IP protocol.

Query/Retrieve Server

Unity provides the Query/Retrieve SCP Server as an optional component that provides support for Query/Retrieve Service Class as a Service Class Provider for the Query/Retrieve SOP Class.

The Query/Retrieve Server is implemented as a component of the Unity DICOM Gateway, but is logically distinct from the Worklist SCP support and Storage SCP support. An instance of the DICOM Gateway application can provide one or all of the above, and there is no expectation that a modality will use the same DICOM Gateway application instance for Query/Retrieve Service support and Worklist Service support and Storage Service support.

2.1 Application Data Flow Diagram

Figure 1 - Application Data Flow Diagram
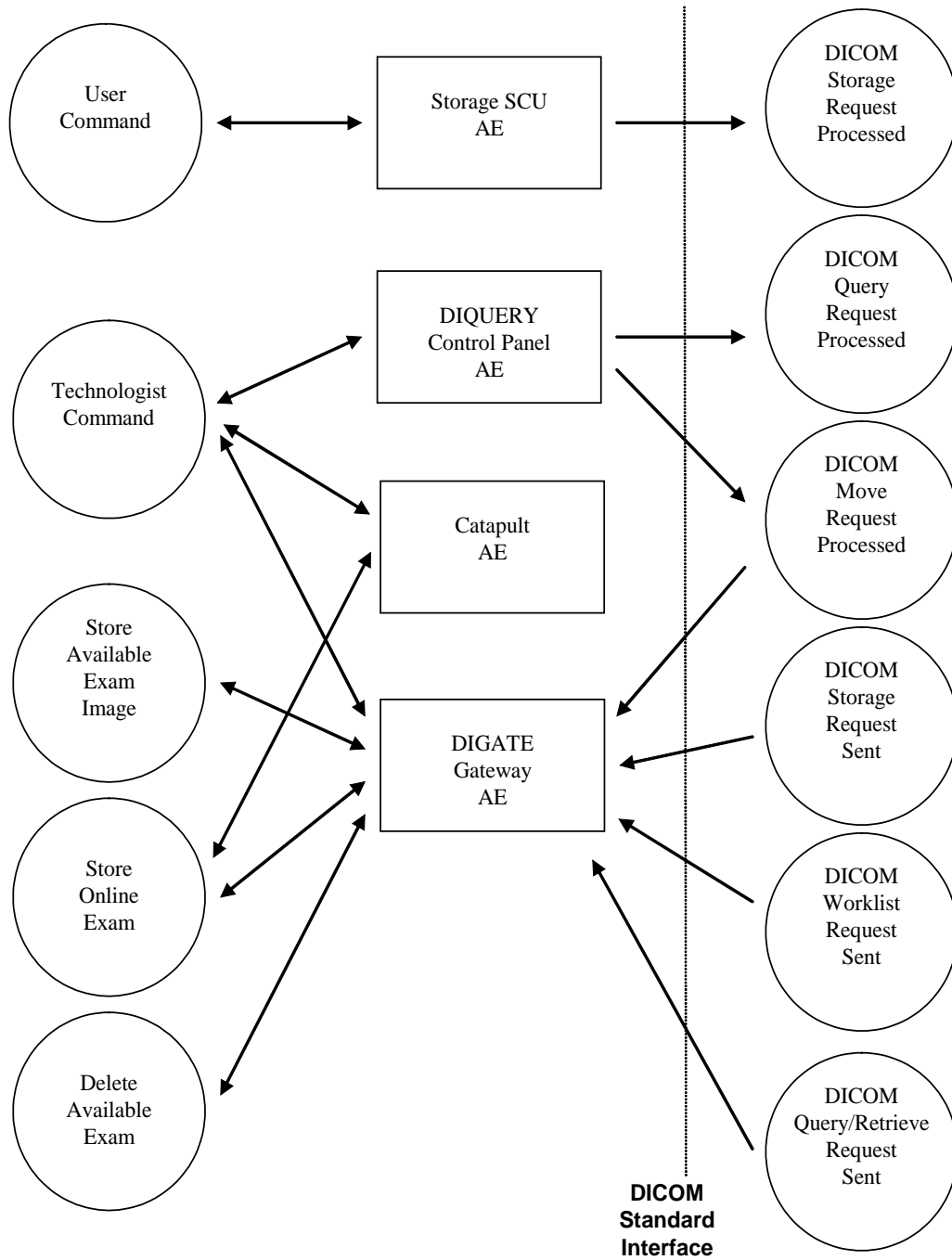
The next diagram is specific to the Guardian AE (storage and Query/Retrieve)

Figure 2 - Guardian Application Entity Data Flow Diagram
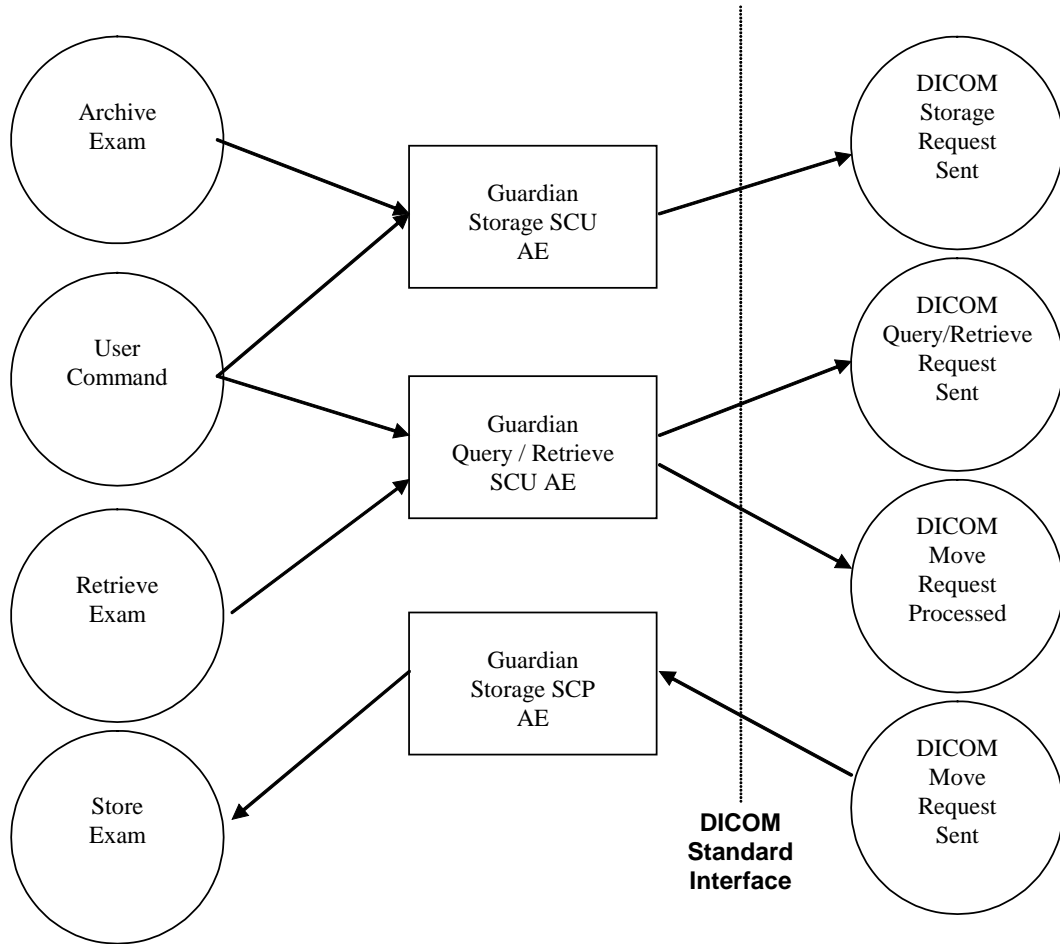
2.2 Functional Definitions of AEs

DICOM Gateway ("DIGATE") Application Entity

The DICOM Gateway AE is available to act as a verification, storage or modality performed procedure step SCP. Its AE Title and the port listened to are configurable. The receipt of a C-STORE-RQ from a remote AE will, if the IOD is acceptable, cause the received image to be stored in a study.

The DICOM Gateway AE responds to a C-ECHO-RQ with a C-ECHO-RSP.

The DICOM Gateway AE accepts and processes N-CREATE and N-SET messages as described in 3.1.3.3 Real World Activity - Modality Performed Procedure Step SCP, below.

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Typically, some real-world event causes a DICOM Storage SCU application entity to initiate an association with the DICOM Gateway and to send images to it. As the Gateway receives storage requests from an external Application Entity, the received images are logically grouped by Study UID.

DICOM Guardian Storage Application Entity

The DICOM Guardian Archive SCU is available to act as a verification or storage SCU. Its AE Title is configurable. When invoked (either at user command or setup to do so automatically), it will issue C-ECHO-RQ or C-STORE-RQ, as appropriate.

DICOM Guardian Query/Retrieve Application Entity

The DICOM Guardian acts as a verification and query/retrieve SCU, and as a verification SCP. The AE Title is configurable. It will initiate a C-ECHO-RQ, a C-FIND-RQ or a C-MOVE-RQ upon user request. It does not issue C-GET-RQs.

A separate component acts as a Storage SCP, acting as the destination for C-MOVE-RQs. Its AE Title and port are configurable.

Modality Worklist Server Application Entity

The Modality Worklist Server AE is available to act as a verification or basic worklist SCP. Its AE Title and the port listened to are configurable, but may not be the same as the DICOM Gateway AE (if both are enabled). The receipt of a C-FIND-RQ from a remote AE will result in a search of the system's worklist, and the response of as many C-FIND-RSPs as appropriate.

The Modality Worklist Server AE responds to a C-ECHO-RQ with a C-ECHO-RSP.

Catapult

In response to user commands, the Catapult creates SOP instances from scanner images. It does not interact with remote DICOM AEs. However, because it can create DICOM SOP instances that can then participate in network or media interfaces, its behavior is documented in this conformance statement.

Storage SCU Application Entity

The Storage SCU AE provides two, similar Storage SCU Software Mechanisms: DICOM Copy, in which Storage SCU is done directly from the application workstation, and DICOM Send, in which a Storage SCU request is queued to be performed by the Messenger workstation . DICOM Copy is available to act as a verification or storage SCU. DICOM Send is available as a storage SCU. Both AE Titles are configurable. When invoked (either at user command or setup to do so automatically), a C-ECHO-RQ or C-STORE-RQ is issued, as appropriate.

DICOM Control Panel ("DIQUERY") Application Entity

The Control Panel AE acts as a verification and query/retrieve SCU, and as a verification SCP. The AE Title is configurable. It will initiate a C-ECHO-RQ, a C-FIND-RQ or a C-MOVE-RQ upon user request. It does not issue C-GET-RQs.

The receipt of a C-ECHO-RSP in response to a C-ECHO-RQ causes the Control Panel to display that the test was "successful". The contents of C-FIND-RSPs received in response to a C-FIND-RQ are displayed in a "grid". Selections from that grid provide the criteria for a C-MOVE-RQ. The status code from a C-MOVE-RSP received in response to a C-MOVE-RQ is used to indicate to the user whether the move was successful.

> **NOTE:** By the design of DICOM architecture, the Control Panel is not informed of (and hence cannot display) the results of the C-STORE sub-operations initiated by the Query/Retrieve SCP.

Print Formatter Application Entity

The DICOM Print SCU is available to act as a verification or DICOM Print SCU. Its AE Title is configurable. Each Print Formatter instance communicates with a single DICOM Print SCP.

Query/Retrieve Server Application Entity

The DICOM Query/Retrieve SCU acts as a verification SCP.

The Query/Retrieve Server waits for association requests, and will negotiate the Query/Retrieve Service as an SCP. There are two distinct Application Entities, each with configurable AE Titles and distinct ports. One AE will query the centralized "Online" exam table, the other will query the the union of the centralized "Online" and "Archived" exam tables.

The receipt of a C-FIND-RQ from a remote AE will result in a search of the system's online and/or archived tables, and the response of as many C-FIND-RSPs as appropriate.

The Query/Retrieve Server AE responds to a C-ECHO-RQ with a C-ECHO-RSP, a C-FIND-RQ with C-FIND-RSPs and a C-MOVE-RQ with a C-MOVE-RSP. C-GET is not supported.

2.3 Sequencing of Real World Activities

The "import" and "revert" operations control whether received images are considered part of the same Unity exam as other images with the same Study Instance UID. If images are to be added to a Unity exam which has already been imported, that exam must be reverted before the additional images are sent. Conversely, if images with the same Study Instance UID are to be placed into a different Unity study than already-received images with the same Study Instance UID, then the already-received images must be imported before the additional images are sent.

3 AE Specifications

3.1 DIGATE AE Specification - SCP

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCP.

Table 1 - DIGATE AE Verification SOP Class

SOP Class	SOP Class UID
Verification	1.2.840.10008.1.1

This Application Entity provides Level 2 (Full) Standard Conformance to the following DICOM V3.0 Storage SOP Classes as an SCP.

Table 2 - DIGATE AE Storage SOP Classes

SOP Class	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3

SOP Class	SOP Class UID
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Mammography CAD Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.50
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128

NOTE: The DICOM Gateway DIGATE AE can be configured to accept Presentation Contexts for Storage SOP Classes for which it does not claim Full Standard Conformance, as indicated by Table 8 - DIGATE Non-Image Storage SCU AE Transfer Syntaxes.   This capability is employed when it is determined that, in specific situations, the level of support provided is sufficient for the SOP Class, or to allow Unity to provide media exchange, archive, and/or Storage SCU services for SOP Classes for which it does not claim Full Standard Conformance.

NOTE: Consult with Technical Support for the availability of support of additional Image Storage SOP classes which are not yet listed in Table 2.

This Application Entity provides Standard Conformance to the Modality Performed Procedure Step SOP Class as SCP.

Table 3 - DIGATE AE Modality Performed Procedure Step SOP Class

SOP Class	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

This AE does not operate as an SCU of any SOP class.

3.1.1 Association Establishment Policies

3.1.1.1 General

There are no inherent limitations for maximum PDU size. Default maximum PDU size is configurable, and defaults to 100 KB.

3.1.1.2 Number of Associations

DIGATE can be configured to support multiple concurrent associations. The practical upper limit is constrained by resources and by performance requirements. In most cases, the number of concurrent associations is configured to be at most two.

3.1.1.3 Asynchronous Nature

The DIGATE AE allows a single outstanding operation on any association. Therefore, DIGATE does not support asynchronous operations window negotiation.

3.1.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: **2.16.840.1.113786.0.11**

This AE will respond with the following Implementation Version Name:
- Implementation Version Name: **DRSYS_V11**

The numeric portion of the implementation version name may change as new versions are released.

3.1.2 Association Initiation Policy by Real-World Activity

This AE does not initiate associations.

3.1.3 Association Acceptance Policy

The DIGATE AE accepts association as a Verification SCP, as a Storage SCP and as a Modality Performed Procedure Step SCP. It may be configured to accept associations on any single designated port, the default is 104. It does not verify that the called AE Title is the same as its own configured AE title. There are no provisions to restrict the AEs that it will accept associations from.

3.1.3.1 Real World Activity - Verification

3.1.3.1.1 Associated Real World Activity - Verification

The DIGATE AE will respond to Verification requests to provide an SCU with the ability to determine if the AE is receiving DICOM requests.

3.1.3.1.2 Presentation Context Table - Verification

The DIGATE AE supports the transfer syntaxes listed in Table 4. The DIGATE AE will accept any of the Presentation Contexts listed in Table 5 for Verification.

Table 4 - DIGATE AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 5 - DIGATE AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 4	SCP	None

3.1.3.1.3 SOP Specific Conformance - Verification

The DIGATE AE provides standard conformance to the DICOM Verification Service Class. It returns one of the following status codes.

Table 6 - DIGATE AE Verification status codes

Service Status	Further Meaning	Protocol Codes	Related Fields	Description
Error	Failed	C000		The operation was not successful.
Success	Success	0000		Operation performed properly.

3.1.3.1.4 Presentation Context Acceptance Criterion - Verification

The DIGATE AE will always accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in Table 4.

3.1.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a Verification command, only the default DICOM transfer syntax is supported.

3.1.3.2 Real World Activity - Storage

3.1.3.2.1 Associated Real World Activity - Storage

The DIGATE AE will create or identify an available exam that corresponds to an image sent to it from a Storage SCU, and will store that image as a component of the available exam.

3.1.3.2.2 Presentation Context Table – Storage

The DIGATE AE supports the following transfer syntaxes listed in Table 7. The DIGATE AE will accept any of the Presentation Contexts listed in Table 9 - DIGATE AE Storage Presentation Contexts.

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Table 7 - DIGATE AE Storage Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
Lossy JPEG 8 Bit JPEG Baseline (Process 1) Compression	1.2.840.10008.1.2.4.50
Lossy JPEG 12 Bit JPEG Baseline (Process 4) Compression	1.2.840.10008.1.2.4.51
Lossless, non-hierarchical, JPEG coding process 14 Compression	1.2.840.10008.1.2.4.57
Lossless, non-hierarchical, first-order prediction, JPEG coding process 14 (selection value 1) Compression	1.2.840.10008.1.2.4.70
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Run Length Encoding (Lossless)	1.2.840.10008.1.2.5

Table 8 - DIGATE Non-Image Storage SCU AE Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1

Table 9 - DIGATE AE Storage Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	all from Table 7	SCP	See Table 10
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	all from Table 7	SCP	See Table 10
Digital X-Ray Image Storage	1.2.840.10008.5.1.4.1.1.1.1.1	all from Table 7	SCP	See Table 10
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	all from Table 7	SCP	See Table 10
Digital Mammography Image Storage	1.2.840.10008.5.1.4.1.1.1.2.1	all from Table 7	SCP	See Table 10
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	all from Table 7	SCP	See Table 10
Digital Intra-oral X-Ray Image Storage	1.2.840.10008.5.1.4.1.1.1.3.1	all from Table 7	SCP	See Table 10
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	all from Table 7	SCP	See Table 10
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	all from Table 7	SCP	See Table 10
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	all from Table 7	SCP	See Table 10

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Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	all from Table 7	SCP	See Table 10
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	all from Table 7	SCP	See Table 10
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	all from Table 7	SCP	See Table 10
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	all from Table 7	SCP	See Table 10
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	all from Table 7	SCP	See Table 10
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	all from Table 7	SCP	See Table 10
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	all from Table 7	SCP	See Table 10
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	all from Table 7	SCP	See Table 10
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	all from Table 8	SCP	See Table 10
X-Ray Angiographic Storage	1.2.840.10008.5.1.4.1.1.12.1	all from Table 7	SCP	See Table 10
X-Ray Radiofluoroscopic Storage	1.2.840.10008.5.1.4.1.1.12.2	all from Table 7	SCP	See Table 10
X-Ray Angiographic BiPlane Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	all from Table 7	SCP	See Table 10
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20	all from Table 7	SCP	See Table 10
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	all from Table 8	SCP	See Table 10
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	all from Table 7	SCP	See Table 10
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	all from Table 7	SCP	See Table 10
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	all from Table 7	SCP	See Table 10
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	all from Table 7	SCP	See Table 10
Mammography CAD Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.50	all from Table 8	SCP	See Table 10
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	all from Table 7	SCP	See Table 10

> **NOTE:** This list includes SOP Classes for which the DIGATE AE does not claim Full Standard Conformance, as described in the Note in 3.1 DIGATE AE Specification - SCP.

> **NOTE:** Consult with Technical Support for the availability of support for additional Image Storage SOP classes which are not yet listed in Table 9.

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> **NOTE:** Storage Extended Negotiation will be supported. The DIGATE AE will respond with the information in Table 10 - DIGATE AE Storage Extended Negotiation:
>
> **NOTE:** The following SOP Classes are supported for the DIGATE Storage SCU AE as a component of the DICOM Guardian but are not supported for other storage SCP uses.
> - Raw Data Storage   1.2.840.10008.5.1.4.1.1.66
> - Basic Voice Audio Waveform Storage   1.2.840.10008.5.1.4.1.1.9.4.1

Table 10 - DIGATE AE Storage Extended Negotiation

Field Name	Value	Description of Field
Level of Support	2	level 2 (FULL) SCP

3.1.3.2.3 SOP Specific Conformance - Storage (all)

The DICOM Gateway requires that Patient ID (0010,0020) not be empty. This is a restriction over standard DICOM. Any image with an empty attribute value for Patient ID (0010,0020) will be responded to with status B007 - "Warning - Data Set does not match SOP Class".

The DICOM Gateway requires that Patient ID (0010,0020) attribute value be identical for all images in a study. If images are received with identical SOP Class Instance UIDs (0008,0018) but differing Patient IDs (0010,0020), the DICOM Gateway will treat them as members of two different studies. This is a necessitated by Unity image consistency check, a safety feature.

The DICOM Gateway requires that Study Date (0008,0020) not be empty. This is a restriction over standard DICOM. Any image with an empty attribute value for Study Date (0008,0020) will have that attribute coerced, either to the current date or to the already-established Study Date for the study.

The DICOM Gateway requires that Study Date (0008,0020) attribute value be identical for all images in a study. If images are received with identical SOP Class Instance UIDs (0008,0018) but differing Study Dates (0008,0020), the DICOM Gateway will coerce the Study Dates to the same value (that of the first such image received).

The element Derivation Description (0008,2111) may be coerced if the DICOM Gateway determines that additional information needs to satisfy the Unity PACS image identification tests. In this case, the existing contents (if any) will be prefixed with a line that begins "DRS:", and, if the attribute was not previously empty, ends with a new line character.

If any attribute is coerced, and if that attribute is within the scope of a Group Length (xxxx,0000), then that Group Length attribute is removed from the SOP Instance.

The DIGATE AE expands the definition of standard DICOM status codes to represent error conditions specific to the DICOM Gateway but related to the standard meaning of the code. In response to a C-STORE request, the DIGATE AE returns one of the following status codes.

Table 11 - DIGATE AE C-STORE Status Codes

Service Status	Further Meaning	Protocol Codes	Related Fields	Description
Refused	Out of resources	A700		Indicates that there was not enough storage space to store the image, or some other database or resource error prevented the image or study information from being stored.
	SOP Class not supported	A800		Indicates one or more of the following: The SOP Class of the Image in the C-STORE operation did not match the Abstract Syntax negotiated for the Presentation Context. The SOP Class UID was not recognized. The SOP Class represents a non-image IOD.
Error	Data set does not match SOP Class	A900		Indicates that the Data Set does not encode an instance of the SOP Class specified. The SOP Instance UID (0008,0018), Patient ID (0010,0020), Study Instance UID (0020,000D) and/or Series Instance UID (0020,000E) was not found in the received image.
	Failed	C000		The operation was not successful.
	Cannot understand	C005		Indicates that the Data Set cannot be parsed into elements by the DICOM Gateway.
Warning	Data set does not match SOP Class	B007		Indicates one or more of the following: The Data Set does not match the SOP Class Attributes that are required to be consistent across a study differ. The modality is not uniform across the study. The image was stored anyway.
Success	Success	0000		Operation performed properly.

3.1.3.2.4 Presentation Context Acceptance Criterion - Storage

The DIGATE AE will accept any number of Storage Presentation Contexts per association request. Any one Abstract Syntax may be specified more than once in an association request, if the Transfer Syntaxes differ between the Presentation Contexts.

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3.1.3.3 Real World Activity - Modality Performed Procedure Step SCP

Figure 3 - MPPS Application Data Flow
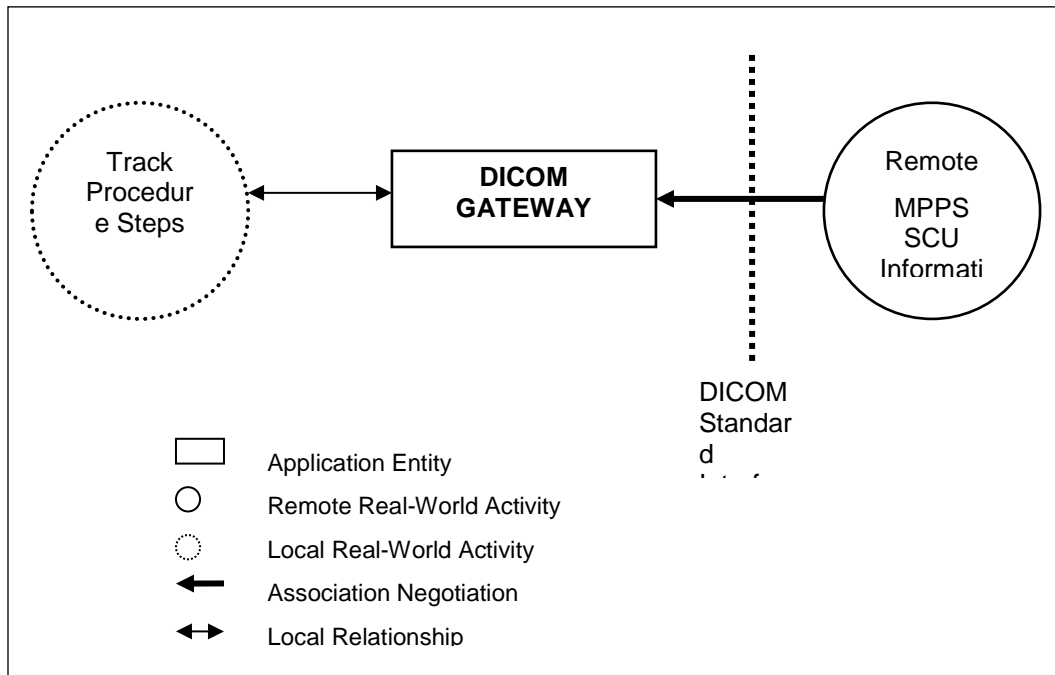
3.1.3.3.1 Associated Real World Activity -   MPPS SCP

Unity MPPS SCP accepts Modality Performed Step requests and tracks the progress of Modality Performed Procedure steps in a study. To prevent premature reading, studies are not automatically made available to the radiologist worklist until

a) Performed Procedure Steps of that study are COMPLETED or DISCONTINUED, and

b) all performed series image and non-image SOP instances have been received (C-STORE), and

c) an optional, configurable delay timer, to wait for the possible receipt of an additional, unanticipated procedure step, has expired.

A manual attempt to make an incomplete study available to the radiologist worklist will receive an appropriate warning message, but will be allowed.

SOP Instances in DISCONTINUED procedure steps remain part of the study.

3.1.3.3.2 Sequencing of Real World Activities

The following is the message and data flow for each modality performed procedure step in a study. This sequence may overlap for multiple steps in a study.

1. At the start of a procedure step, the modality sends an MPPS message (N-CREATE) instructing DICOM Gateway to begin tracking a new procedure step, and saying that this step is "IN PROGRESS".

2. If the step is suspended, reactivated, or cancelled, the modality sends a message (N-SET) updating the step's status to "SUSPENDED", "IN PROGRESS" or "DISCONTINUED", respectively.

3. When the step is finished,, the modality sends an MPPS update message setting the step's status to "COMPLETED", and listing the DICOM images and other objects created in the procedure step.

   Once a step's status is "COMPLETED" or "DISCONTINUED", there cannot be any further update messages for that step. Discontinued steps remain part of the study.

4. The "COMPLETED" status, along with the list of DICOM objects, can arrive before, during or after the objects themselves are sent.

Figure 4 - Standard MPPS Data Flow
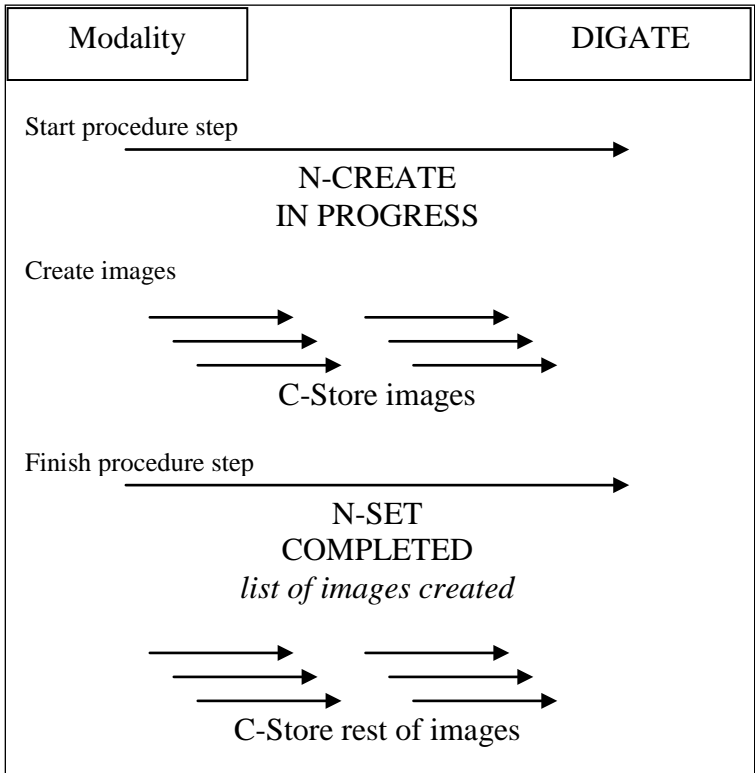
3.1.3.3.3 Accepted Presentation Contexts

Unity MPPS SCP accepts the presentation contexts listed in Table 12.

Table 12 – MPPS Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian – 1.2.840.10008.1.2.1	SCP	None

3.1.3.3.4 SOP Specific Conformance – N-CREATE

Unity MPPS SCP handles N-CREATE message and responds with the following status values:

Table 13 - N-CREATE Response Status Values

Service Status	Further Meaning	Error Code	Reason
SUCCESS	Success	0x0000	Operation performed properly.
Refused	Out of resources	A700	System unable to process the message, or failed to generate a SOP Instance UID.
Error	Data Set does not match SOP Class	A900	Error in parsing header-missing mandatory tags.

3.1.3.3.4.1   Generating SOP Instance UID If Not Present In N-CREATE

Unity MPPS SCP will generate a SOP Instance UID for any individual step if it is not included in N-CREATE message for that step. The SCU must save this value which is sent back in response and use it accordingly for all of the following operations.

3.1.3.3.5 SOP Specific Conformance – N-SET

Unity MPPS will accept N-SET message and respond with the following status values:

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Table 14 - N-SET Response Status Values

Service Status	Further Meaning	Error Code	Reason
SUCCESS	Success	0000	Operation performed properly.
Refused	Out of resources	A700	System unable to process the message.
Error	Data Set does not match SOP Class	A900	Error in parsing header-missing mandatory tags.

3.1.3.4 Real World Activity – Storage Commitment Push Model

3.1.3.4.1 Associated Real World Activity – Storage Commitment Push Model

Processing and acknowledgement of N-ACTION: The DIGATE AE will accept a N-ACTION Push Model Storage Commitment Request, store the transaction contents and send an N-ACTION response on the same association. If the Transaction ID is the same as a current outstanding Storage Commitment Request, it is considered a duplicate transmission of the same request.

List of known DICOM Hosts: The SCU's AE Title must be among the configured, known DICOM hosts for the DIGATE AE, otherwise the DIGATE AE will respond with an N-ACTION rejection, and the transaction will not be stored.

Commitment timeframe: All referenced SOP instances in a transaction must have been received via Storage Service within a configurable window (by default, 1 day before or after) surrounding the receipt of the Storage Commitment Request. Any SOP Instances which do not arrive within that window may be given a failure status of 0112H - No Such Object Instance, even if the instance was successfully stored prior to that window.

Final commitment status: The definition of final storage commitment status is configurable, at customer discretion. The choice will affect the timing of the N-EVENT-REPORT and the storage characteristics.

Final commitment timeframe: A configurable response time period (by default, 24 hours) will limit how long a Storage Commitment transaction can wait for final commitment status. Any SOP Instance which has not been assigned a final commitment status by the end of this period will be arbitrarily assigned the failure status 0110H – Processing Failure. This will ensure that an N-EVENT-REPORT is guaranteed to be available within a fixed amount of time, but this cannot guarantee that the Storage Commitment SCU will receive an N-EVENT-REPORT within a fixed time because other reasons may delay it, e.g. network connectivity failure or either the SCU or SCP not running.

> **NOTE:** If the final commitment status becomes available between the response time period expiring and actual sending of the N-EVENT-REPORT, the SOP Instance will be identified with the correct status.

Event reporting: Once all SOP Instances in a pending Storage Commitment transaction have received a final commitment status or once the response time period has passed, the

DIGATE AE will attempt to open an association to the AE that sent the N-ACTION request and send the N-EVENT-REPORT.

Event report retry: If the SCU is unavailable, the DIGATE AE will retry periodically (configurable, 5 minutes by default), for a configurable time period (24 hours, by default). Once that time period has expired, the transaction will be considered stale, and deleted, even though the SCU has not received an N-EVENT-REPORT.

Commitment transaction purge: When the DIGATE AE receives a successful acknowledgement of the N-EVENT-REPORT from the SCU, the transaction is deleted. If the DIGATE AE receives a response status of 0115H – Invalid Argument Value, it is assumed the SCU no longer recognizes the Transaction UID, and the transaction is deleted.

3.1.3.4.2   Presentation Context Table – Storage Commitment Push Model

The DIGATE AE supports accepts the transfer syntaxes listed in Table 15 - DIGATE AE Storage Commitment Transfer Syntaxes.   When initiating an association as a Storage Commitment SCP, the DIGATE AE will only propose Implicit VR Little Endian for Storage Commitment.

Table 15 - DIGATE AE Storage Commitment Transfer Syntaxes

Transfer Syntax	UID	Propose/Accept
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2	Propose/Accept
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1	Accept

Table 16 - DIGATE AE Storage Commitment Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Storage Commitment Push Model	1.2.840.10008.1.20.1	all from Table 15	SCP	See Table 10

> **NOTE:** Storage Extended Negotiation will be supported. The DIGATE AE will respond with the information in Table 10 - DIGATE AE Storage Extended Negotiation

3.1.3.4.3   SOP Specific Conformance – Storage Commitment Push Model

1..1.1.2.1   Retention

The trigger event for a SOP Instances' final commitment status is configurable, based on user requirements. Options include:
- Storage of object in PACS file storage.
- Study marked as tentatively complete. (Receipt of additional SOP Instances is allowed in a tentatively complete study.)
- Successful storage of the SOP Instance in the long term archive.

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The Unity PACS does not automatically delete SOP Instances until they have been safely stored in the long-term archive.

> **NOTE:** The capacity of the PACS to store unarchived SOP Instances depends on the capacity of the equipment.

A properly authorized user may delete a SOP Instance, a study, or the links to a study in the long-term archive. Such a user request takes priority over any Storage Commitment for the affected SOP Instances.

If the Storage SCP receives a SOP Instance with the same SOP Instance UID as a previously received SOP Instance, the Storage SCP has the right to replace the previously received SOP Instance with the newly received one.

> **NOTE:** The circumstances under which the prior SOP Instance will be replaced by one with an identical SOP Instance UID is both configurable and may depend on the point in the workflow that it occurs and whether the SOP Instances are considered "locked".

3.1.3.4.3.1 Access to SOP Instances

Unity Query/Retrieve SCP, defined elsewhere in this conformance statement, can provide access to SOP Instances in online storage and in the long term archive. All Query/Retrieve SCPs for a data source access the same pool of studies. The optional Retrieve AE Title (0008,0054) is not provided. Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0008,0140) are not used from the N-ACTION or provided in the N-EVENT-REPORT.

3.2 Modality Worklist Server AE Specification - SCP

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCP.

Table 17 - Modality Worklist Server AE Verification SOP Class

SOP Class	SOP Class UID
Verification	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 Basic Worklist Management SOP Classes as an SCP.

Table 18 - Modality Worklist Server AE Basic Worklist Management SOP Class

SOP Class	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

3.2.1 Association Establishment Policies

3.2.1.1 General

There are no inherent limitations for maximum PDU size. Default maximum PDU size is configurable, and defaults to 100 KB.

3.2.1.2 Number of Associations

The number of concurrent Worklist associations is configurable. There is no inherent limit, other than those imposed by resources and responsiveness requirements.

> **NOTE:** The count of Worklist associations is independent from the count of Storage associations; each can be configured with a different maximum number.

3.2.1.3 Asynchronous Nature

The Modality Worklist Server AE allows a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

The Modality Worklist Server AE implements C-FIND-CANCEL within the processing of a C-FIND request to the degree of support provide by the underlying DICOM toolkit.

3.2.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: `2.16.840.1.113786.0.11`

This AE will respond with the following Implementation Version Name:
- Implementation Version Name: `DRSYS_V11`

The numeric portion of the implementation version name may change as new versions are released.

3.2.2 Association Initiation Policy by Real-World Activity

The Modality Worklist Server AE does not initiate associations.

3.2.3 Association Acceptance Policy

The Modality Worklist Server AE accepts association as a Verification SCP and as a Worklist SCP. It may be configured to accept associations on any single designated port, the default is 5000. It does not verify that the called AE Title is the same as configured AE title.

> **NOTE:** The port on which the Modality Worklist Server AE waits for associations must be different from the port on which the Storage Service AE listens for associations.

Each application instance of the Worklist AE has a configured list of allowed Worklist SCU AEs. The Worklist SCP AE will reject an association request from an AE that is not on the list.

3.2.3.1 Real World Activity - Verification

3.2.3.1.1 Associated Real World Activity - Verification

The Modality Worklist Server AE will respond to Verification requests to provide an SCU with the ability to determine if the Worklist AE is receiving DICOM requests.

3.2.3.1.2 Presentation Context Table - Verification

The Modality Worklist Server AE supports the transfer syntaxes listed in Table 19. The Modality Worklist Server AE will accept any of the Presentation Contexts listed in Table 20 for Verification.

Table 19 - Modality Worklist Server AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 20 - Modality Worklist Server AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 19	SCP	None

3.2.3.1.3 SOP Specific Conformance - Verification

The Modality Worklist Server AE provides standard conformance to the DICOM Verification Service Class. It returns one of the following status codes.

Table 21 - Modality Worklist Server AE Verification status codes

Service Status	Further Meaning	Protocol Codes	Related Fields	Description
Error	Failed	C000		The operation was not successful.
Success	Success	0000		Operation performed properly.

3.2.3.1.4 Presentation Context Acceptance Criterion - Verification

The Modality Worklist Server AE will accept a Presentation Context for the Verification SOP Class with the default DICOM transfer syntax listed in Table 19 if the Requesting AE Title appears in the configurable list of AE Titles from which the Modality Worklist Server AE will accept an association request.

3.2.3.1.5 Transfer Syntax Selection Policies - Verification

Since no DICOM data object is associated with a Verification command, only the default DICOM transfer syntax is supported.

3.2.3.2 Real World Activity – Basic Worklist Management

3.2.3.2.1 Presentation Context Table - Basic Worklist Management

The Modality Worklist Server AE supports the following transfer syntaxes listed in Table 22 - Modality Worklist Server AE Basic Worklist Management Transfer Syntaxes. The Modality Worklist Server AE will accept any of the Presentation Contexts listed in Table 23 - Modality Worklist Server AE Basic Worklist Management Presentation Contexts.

Table 22 - Modality Worklist Server AE Basic Worklist Management Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian	1.2.840.10008.1.2

Table 23 - Modality Worklist Server AE Basic Worklist Management Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	all from Table 22	SCP	None

3.2.3.2.2 SOP Specific Conformance – Modality Worklist Information Model – FIND

The Modality Worklist Server AE provides standard conformance to the DICOM Basic Worklist Management Service Class. The Basic Worklist Manage Service AE returns one of the following status codes:

Table 24 - Modality Worklist Server AE C-FIND status codes

Service Status	Further Meaning	Protocol Codes	Related Fields	Description
Error	Unable to process - Invalid attribute value	C001	(0000,0901) (0000,0902)	Indicates that C-FIND request could not be performed because an illegal value was encountered in a Matching Key. The Offending Element Tag (0000,0901) identified the element. One or more of the following conditions exist:. Invalid DA format in Patient's Birth Date (0010,0030). Invalid DA format in >Scheduled Procedure Step Start Date (0040,0002) Invalid TM format in >Scheduled Procedure Step Start Time (0040,0003)

Service Status	Further Meaning	Protocol Codes	Related Fields	Description
	Unable to process - Failed during processing	C002	(0000,0902)	Indicates that the C-FIND request could not be performed because of an error encountered during query processing.
	Cancel	FE00		Matching terminated due to Cancel request
Success	Success	0000		Matching is complete - No final Identifier is supplied.
Pending	Pending	FF00	Identifier	Matches are continuing - Current Match is supplied.

Supported Matching and Return Key elements are listed in Table 26.

> **NOTE:** All attributes listed in Table 26 are Return Key attributes, except for those which the Remarks say "Not a return key." The names of unsupported attributes appear in italics, the Return Key is marked "No", and the Return Key Type is in parenthesis.
>
> **NOTE:** The abbreviations used in the Matching Key column of Table 26 are listed in Table 25 - Match Key Type Abbreviations.
>
> **NOTE:** In addition to the Matching Key types listed, all supported Return Keys also support Universal Matching.

Table 25 - Match Key Type Abbreviations

Matching Key Types	
SV	Single Valued matching
UI	List of UID matching
WC	Wild Card matching
SQ	Sequence Matching
DR	Date Range matching
(empty)	Return key only

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Table 26 - Attribute Support for the Modality Worklist Information Model

Description / Module	Tag	Matching Key	Return Key	Remarks
SOP Common				
Specific Character Set	(0008,0005)	See Note "Specific Character Set"	No (1C) (unless forced – see Note)	Not supported as a return key: No expanded or replacement character sets are used. See Note "MWL Force Character Set".
Scheduled Procedure Step				
Scheduled Procedure Step Sequence	(0040,0100)	SQ	1	
>Scheduled Station AE Title	(0040,0001)	SV	1	Taken from Scanner value. If that's empty, then Modality.
>Scheduled Procedure Step Start Date	(0040,0002)	SV, DR	1	
>Scheduled Procedure Step Start Time	(0040,0003)	SV, DR	1	
>Modality	(0008,0060)	SV	1	
>Scheduled Performing Physician's Name	(0040,0006)	SV, WC	2	Value not available in worklist: - any match other than Universal Matching and equivalent Wild Card match will return no worklist entries - return value will always be zero length.
>Scheduled Procedure Step Description	(0040,0007)	SV, WC	1C	
>Scheduled Station Name	(0040,0010)	SV, WC	2	Scanner
>Scheduled Procedure Step Location	(0040,0011)	SV, WC	2	Scanner
>Pre-Medication	(0040,0012)		2C	See Note "MWL Force Return Key".
>Scheduled Procedure Step ID	(0040,0009)	SV, WC	1	
>Requested Contrast Agent	(0032,1070)		2C	See Note "MWL Force Return Key".
Requested Procedure				
Requested Procedure ID	(0040,1001)	SV, WC	1	

Description / Module	Tag	Matching Key	Return Key	Remarks
Requested Procedure Comments	(0040,1400)		3	
Requested Procedure Description	(0032,1060)	SV, WC	1C	
Requested Procedure Code Sequence	(0032,1064)	SQ	1C	
>Code Value	(0008,0100)	SV, WC	1C	
>Coding Scheme Designator	(0008,0102)		1C	"99DRSYS"+site-specific number
>Code Meaning	(0008,0104)	SV, WC	3	
Study Instance UID	(0020,000D)	UI	1	
Referenced Study Sequence	(0008,1110)		2	Returned as zero length, with no contained items.
Requested Procedure Priority	(0040,1003)	SV, WC	2	
Patient Transport Arrangements	(0040,1004)		2	Returned as zero length
Names of Intended recipients of results.	(0040,1010)		3	Ordering physician only
Imaging Service Request				
Accession Number	(0008,0050)	SV, WC	2	
Requesting Physician	(0032,1032)	SV, WC	2	
Referring Physician's Name	(0008,0090)	SV, WC	2	
Placer Issuer and Number	(0040,2016)	SV, WC	3	Placer Number only
Filler Issuer and Number	(0040,2017)	SV, WC	3	Filler Number only
Visit Identification				
Admission ID	(0038,0010)	SV, WC	2	Visit Number
Visit Status				
Current Patient Location	(0038,0300)		2	Returned as zero length
Visit Relationship				
Referenced Patient Sequence	(0008,1120)		2	Returned as zero length, with no contained items.
Patient Identification				
Patient's Name	(0010,0010)	SV, WC	1	
Patient ID	(0010,0020)	SV	1	

Description / Module	Tag	Matching Key	Return Key	Remarks
Patient Demographic				
Patients Birth Date	(0010,0030)	SV, DR	2	
Patient's Sex	(0010,0040)	SV, WC	2	
Patient Comment	(0010,4000)		3	
Patient's Weight	(0010,1030)		2	Returned as zero length
Confidentiality constraint on patient data	(0040,3001)		2	Returned as zero length
Patient Medical				
Patient State	(0038,0500)		2	Returned as zero length
Pregnancy Status	(0010,21C0)		2	Returned as zero length
Medical Alerts	(0010,2000)		2	Patient Allergies
Contrast Allergies	(0010,2110)		2	Patient Allergies
Special Needs	(0038,0050)		2	Returned as zero length

NOTE: All Person Name matches are case-insensitive. This applies to Matching Keys with VR=PN:
- Patient's Name (0010,0010)
- Requesting Physician (0032,1032)
- Referring Physician's Name (0008,0090)

NOTE: In wild card Person Name matches, each name component is matched separately:
- Omitted components are considered Universal Matches
- Wild cards do not cross component boundaries

Examples:

"^HARRY"	would match but not	"SMITH^**HARRY**" "TOM^DICK^HARRY"
"S*H*"	would match but not	"**S**MIT**H**^JOHN^S" "SAMSON^HARRY"
"S*^H*"	would match but not	"**S**OUTH^**H**ARRY" "SOUTH^LOUIS^H"

NOTE: In cases where only the first character of the middle name is known, only the first character of the middle name component of a Person Name matching key needs to match, additional characters in that component of the matching key are ignored.

NOTE: If both Scheduled Procedure Step Start Date (0040,0002) and Scheduled Procedure Step Start Time (0040,0003) are both specified for Range Matching

with compatible ranges, the corresponding date and times are considered endpoints of the range, rather than independent matching keys.

NOTE: For maximum usefulness, the Basic Worklist Manage Service AE supports both Requested Procedure Description (0032,1060) and Requested Procedure Code Sequence (0032,1064). If both Return Keys are specified, then Requested Procedure Description (0032,1060) and Requested Procedure Code Sequence (0032,1064) >Code Meaning (0008,0104) return identical values.

NOTE: The current implementation of Unity' modality worklist records scheduled procedures without further identifying the component scheduled procedure steps. To accommodate DICOM Modality Worklist, each procedure is considered to consist of a single procedure step.

If both Return Keys are specified, then the following return identical values:
- Requested Procedure Code Sequence (0032,1064) >Code Meaning (0008,0104) and
- Scheduled Procedure Step Sequence (0040,0100) >Scheduled Procedure Step Description (0040,0007)

Also:
- Requested Procedure ID (0040,1001) and
- Scheduled Procedure Step Sequence (0040,0100) >Scheduled Procedure Step ID (0040,0009)

The Basic Worklist Manage Service AE does not support priority processing or define priority levels.

NOTE: **Specific Character Set** - Modality Worklist responses use the ISO_IR 6 character set, and will not use expanded or replacement character sets. For such cases, DICOM prohibits including Specific Character Set (0008,0005) in a Modality Worklist Response Identifier. (See PS 3.4-2003 Table K.6-1 and C.4.1.1.3.2.)

To accommodate MWL SCUs that require the single value matching of certain requested character in this attribute, the Unity Modality Worklist Server SCP will perform single value matching on and return any of he following supersets of ISO_IR 6:
- ISO_IR 100
- ISO_IR 101

No additional configuration is required, and this behavior cannot be suppressed; it applies only to single value matching.

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> **NOTE: MWL Force Character Set** - As noted above, Modality Worklist responses use the ISO_IR 6 character set, and will not use expanded or replacement character sets. For such cases, DICOM prohibits including Specific Character Set (0008,0005) in a Modality Worklist Response Identifier. (See PS 3.4-2003 Table K.6-1 and C.4.1.1.3.2.)

To accommodate MWL SCUs that require the value ISO_IR 100 in this attribute, the Unity Modality Worklist Server SCP can be configured to respond to a Specific Character Set (0008,0005) matching or return key with that value (unless it is a specifically recognized single value match , as described above.). (ISO_IR 100 is a superset of ISO_IR 6.)

By default, this override is turned off. Unity support personnel can enable it when needed.

> **NOTE: MWL Force Return Key** - DICOM requires that a conditional attribute (Type 1C or 2C) must not be included if the condition is not met.. (See PS 3.5 7.4.2 and 7.4.4.)

To accommodate MWL SCUs that require the presence of these attributes even when the condition is not met, the Unity Modality Worklist Server SCP can be configured to unconditionally include Type 2C attributes. If this override is enabled and the condition is not met, these conditional attributes will be returned with zero length if they are matching or return keys in the MWL query. The attributes that can be forced to appear are:

- Pre-Medication (0040,0012)
- Requested Contrast Agent (0032,1070)

By default, this override is turned off.

3.3 Catapult Specification

3.3.1 Association Establishment Policies

The Catapult does not accept associations from remote DICOM AEs.

3.3.2 Association Initiation Policies

The Catapult does not initiate associations from remote DICOM AEs.

3.3.3 Real World Activity - Create Image

The Catapult creates standard Secondary Capture SOP instances in response to user command.

3.3.3.1 SOP Specific Conformance - Secondary Capture

Table 27 lists attributes that may be created as part of a Secondary Capture by the Catapult system to produce DICOM-compliant images from scanning or adding images from Documents (Bitmaps, etc…).

Table 27 - Catapult SC Created Attributes

Tag	Attribute Name
(0002,0002)	Media SOP Class UID
(0002,0003)	Media SOP Instance UID
(0008,0008)	Image Type
(0008,0016)	SOP Class UID
(0008,0018)	SOP Instance UID
(0008,0020)	Study Date
(0008,0023)	Image Date
(0008,0030)	Study Time
(0008,0033)	Image Time
(0008,0060)	Modality
(0008,0064)	Conversion Type
(0008,0070)	Manufacturer
(0008,0080)	Hospital Name
(0008,0081)	Institution Address
(0008,0090)	Referring Physician
(0008,1000)	Device Serial Number
(0008,1010)	Station Name
(0008,1020)	Software Version
(0008,1030)	Study Description
(0008,103E)	Series Description
(0008,1040)	Institutional Department Name
(0008,1050)	Spatial Resolution
(0008,1080)	Admitting Diagnosis Description
(0008,1090)	Manufacturer Model Name
(0008,1200)	Date of Last Calibration
(0008,1201)	Time of Last Calibration
(0010,0010)	Patient Name
(0010,0020)	Patient ID

Tag	Attribute Name
(0010,0030)	Patient Date of Birth
(0010,0040)	Patient Sex
(0010,1010)	Patient Age
(0010,4000)	Patient Comments
(0018,0022)	Scan Options
(0018,0023)	MR Acquisition Type
(0018,1000)	Manufacturer Serial Number
(0018,1010)	Secondary Capture Device ID
(0018,1012)	Date of Secondary Capture
(0018,1014)	Time of Secondary Capture
(0018,1016)	Secondary Capture Device Manufacturer
(0018,1018)	Secondary Capture Device Manufacturer's Model Name
(0018,1019)	Secondary Capture Software Version
(0020,000D)	Study Instance UID
(0020,000E)	Series Instance UID
(0020,0010)	Study ID
(0020,0011)	Series Number
(0020,0012)	Acquisition Number
(0020,0013)	Image Number
(0028,0120)	Pixel Padding
Private Tags may also be coerced as described in Table 86 - Private Tags	

3.4 DICOM Guardian Query/Retrieve SCU AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCU.

This Application Entity provides Standard Conformance to the following DICOM V3.0 **Query/Retrieve** SOP Classes as an SCU.

Table 28 - DICOM Guardian AE Query/Retrieve SOP Classes

SOP Class	SOP Class UID
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2

This AE does not operate as an SCU of any SOP class.

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3.4.1 Association Establishment Policies

3.4.1.1 General

The DICOM Guardian Q/R AE contains no limitations for maximum PDU size and the PDU size is configurable.

3.4.1.2 Number of Associations

The DICOM Guardian Q/R AE initiates one association at a time.

3.4.1.3 Asynchronous Nature

The DICOM Guardian Q/R AE requests a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

3.4.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: `2.16.840.1.113786.0.11`

This AE will respond with the following Implementation Version Name:
- Implementation Version Name: `DRSYS_V11`

The numeric portion of the implementation version name may change as new versions are released.

3.4.2 Association Initiation Policy by Real-World Activity

The DICOM Guardian Q/R AE will initiate an association in response to user request.

3.4.2.1 Real World Activity - Verification

3.4.2.1.1 Associated Real World Activity - Verification

When the operator asks to test an AE, DICOM Guardian will attempt to initiate an association for Verification Service in order to perform a C-ECHO-RQ.

3.4.2.1.2 Proposed Presentation Context Table - Verification

The DICOM Guardian AE supports the transfer syntaxes listed in Table 29. For a Verification request, the DICOM Guardian AE will propose the Presentation Contexts listed in Table 30 - DICOM Guardian AE Verification Presentation Contexts.

Table 29 - DICOM Guardian AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 30 - DICOM Guardian AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 29	SCU	None

3.4.2.1.3 SOP Specific Conformance - Verification

The DICOM Guardian provides standard conformance to the DICOM Verification Service Class.

3.4.2.2 Real World Activity – Find/Move

3.4.2.2.1 Associated Real World Activity – Find/Move

When the operator asks to look up studies on an AE, DICOM Guardian will attempt to initiate an association for Query Service in order to perform a C-FIND-RQ.

3.4.2.2.2 Proposed Presentation Context Table – Find/Move

DICOM Guardian supports the transfer syntaxes listed in Table 31. For a QUERY request, DICOM Guardian will propose the Presentation Contexts listed in Table 32.

Table 31 - DICOM Guardian AE Query Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 32 - DICOM Guardian AE Query SOP Classes

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1	all from Table 31	SCU	See
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2	all from Table 31	SCU	See

3.4.2.2.3 SOP Specific Conformance – Find/Move

Currently only Study UID attribute is supported for both Find and Move. DICOM Guardian Matching Keys require an exact match of the Study UID. No wildcard matching is supported.

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Table 33 - Attribute Support for the Find DICOM Guardian AE C-Find Q/R Information Model

Description	Tag	Matching Key	Return Key	Remarks
Study UID	(0020,000D)		Required	Exact Match Required

3.5 DICOM Guardian Storage SCU AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCU.

Table 34 - Storage SCU AE Verification SOP Class

SOP Class	SOP Class UID
Verification	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 Storage SOP Classes as an SCU.

Table 35 - Archive SCU AE Storage SOP Classes

SOP Class	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3

SOP Class	SOP Class UID
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
X-Ray Angiographic Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Angiographic BiPlane Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Mammography CAD Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.50
Key Object Selection	1.2.840.10008.5.1.4.1.1.88.59
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128

> **NOTE:** This list includes SOP Classes for which the DIGATE AE does not claim Full Standard Conformance as a Storage SCP, as described in the Note in 3.1 DIGATE AE Specification - SCP.

This AE does not operate as an SCP of any SOP class.

3.5.1 Association Establishment Policies

3.5.1.1 General

There are no inherent limitations for maximum PDU size. Maximum PDU size is configurable, and defaults to 100 KB.

3.5.1.2 Number of Associations

Each application instance of the Storage SCU AE will initiate at most a single association at a time.

> **NOTE:** However, there may be multiple application instances of the Storage SCU in a single Unity PACS installation.

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3.5.1.3 Asynchronous Nature

The Storage SCU AE allows a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

3.5.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: **2.16.840.1.113786.0.11**

3.5.2 Association Initiation Policy by Real-World Activity

In response to a user request to perform an "Echo Test" of a DICOM AE, the Storage AE will initiate an association as a Verification SCU. Upon completion of the test (i.e. a C-ECHO response is received or a configured "timeout" interval elapses) the Storage AE terminates the association.

In preparation for sending an exam to the SCP, DICOM Raw Data Objects, DICOM Key Objects and DICOM Presentation States may be generated and the appropriate SOP Classes negotiated (refer to Table 35). This is done to represent the current state of the exam as accurately as possible prior to storage.

3.5.2.1 Real World Activity - Verification

3.5.2.1.1 Associated Real World Activity - Verification

When the operator asks to test an AE, this AE will attempt to initiate an association for Verification Service in order to perform a C-ECHO-RQ.

3.5.2.1.2 Proposed Presentation Context Table - Verification

The Storage SCU AE supports the transfer syntaxes listed in Table 36 - Storage SCU AE Verification Transfer Syntaxes. For a Verification request, the Storage SCU AE will propose the Presentation Contexts listed in Table 37 - Storage SCU AE Verification Presentation Contexts.

Table 36 - Storage SCU AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 37 - Storage SCU AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 36	SCU	None

3.5.2.1.3 SOP Specific Conformance - Verification

The Storage SCU AE provides standard conformance to the DICOM Verification Service Class.

3.5.2.2 Real World Activity - Store

3.5.2.2.1 Associated Real World Activity - Store

When processing a request to transmit all of the images of an exam, the Storage SCU AE will attempt to initiate an association for Storage Service in order to perform a C-STORE-RQ.

3.5.2.2.2 Proposed Presentation Context Table – Store

There are two separate tables of SCU transfer syntaxes; one for Images and one for non-images. They are seen below in Table 38 - Image Storage SCU AE Storage Transfer Syntaxes and Table 39 - Non-Image Storage SCU AE Storage Transfer Syntaxes

Table 38 - Image Storage SCU AE Storage Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
Lossy JPEG 8 Bit JPEG Baseline (Process 1) Compression	1.2.840.10008.1.2.4.50
Lossy JPEG 12 Bit JPEG Baseline (Process 4) Compression	1.2.840.10008.1.2.4.51
Lossless, non-hierarchical, JPEG coding process 14 Compression	1.2.840.10008.1.2.4.57
Lossless, non-hierarchical, first-order prediction, JPEG coding process 14 (selection value 1) Compression	1.2.840.10008.1.2.4.70
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Run Length Encoding (Lossless)	1.2.840.10008.1.2.5

Table 39 - Non-Image Storage SCU AE Storage Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1

Table 40 – Guardian Storage SCU AE Storage Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	All from Table 38	SCP	See Table 41
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	All from Table 38	SCP	See Table 41
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	All from Table 38	SCP	See Table 41
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	All from Table 38	SCP	See Table 41
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	All from Table 38	SCP	See Table 41
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	All from Table 38	SCP	See Table 41
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	All from Table 38	SCP	See Table 41
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	All from Table 38	SCP	See Table 41
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	All from Table 38	SCP	See Table 41
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	All from Table 38	SCP	See Table 41
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	All from Table 38	SCP	See Table 41
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	All from Table 38	SCP	See Table 41
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	All from Table 38	SCP	See Table 41
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	All from Table 38	SCP	See Table 41
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	All from Table 38	SCP	See Table 41
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	All from Table 38	SCP	See Table 41

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Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	All from Table 38	SCP	See Table 41
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	All from Table 38	SCP	See Table 41
X-Ray Angiographic Storage	1.2.840.10008.5.1.4.1.1.12.1	All from Table 38	SCP	See Table 41
X-Ray Radiofluoroscopic Storage	1.2.840.10008.5.1.4.1.1.12.2	All from Table 38	SCP	See Table 41
X-Ray Angiographic BiPlane Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	All from Table 38	SCP	See Table 41
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	All from Table 39	SCP	See Table 41
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	All from Table 39	SCP	See Table 41
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20	All from Table 38	SCP	See Table 41
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	All from Table 39	SCP	See Table 41
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	All from Table 38	SCP	See Table 41
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	All from Table 38	SCP	See Table 41
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	All from Table 38	SCP	See Table 41
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	All from Table 38	SCP	See Table 41
Mammography CAD Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.50	All from Table 39	SCP	See Table 41
Key Object Selection	1.2.840.10008.5.1.4.1.1.88.59	All from Table 39	SCP	See Table 41
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	All from Table 38	SCP	See Table 41

> **NOTE:** This list includes SOP Classes for which the DIGATE AE does not claim Full Standard Conformance as a Storage SCP, as described in the Note in 3.1 DIGATE AE Specification - SCP.
>
> **NOTE:** Storage Extended Negotiation will be supported. The Storage SCU AE will respond with the following information:

Table 41 - Storage SCU AE Storage Extended Negotiation

Field Name	Value	Description of Field
Level of Support	2	level 2 (FULL) SCP

3.5.2.2.3 SOP Specific Conformance - Storage (all)

This AE can coerce values upon send. Only the transmitted SOP Instance is affected, the instance stored in the Unity PACS is not affected.

Transfer Syntax

Images may be transmitted as compressed, not compressed, or as-is (neither forcing compression nor decompression.) The type and degree of compression is selected from a configurable, modality-specific list, thus allowing site policy to control whether, what type and how much compression is acceptable for each modality.

The compression request is subject to the Presentation Contexts accepted during Association negotiation. The Storage SCU AE will ignore a request to compress an image if the Storage SCP does not accept the implied Presentation Context.

Furthermore, if the image is already a compressed image or is VR Explicit and the Storage SCP does not accept the image's Transfer Syntax, then the Storage SCU AE will send the image in Implicit VR Little Endian Uncompressed format.

These changes can result in the coercion of a number of attributes. The bulk of the coerced tags are listed in Appendix A - List of Potentially Coerced DICOM Tags, but the following image-related tags are also coerced for a transmitted exam. Note that in the case of Lossy Compression the tags are coerced at the time of compression and not just when an exam is transmitted.

Attribute Name	Tag	Comment
Image Type	(0008,0008)	If an image is compressed, then the Value 1 is coerced to DERIVED.
SOP Instance UID	(0008,0018)	A SOP Instance UID is generated and coerced
Derivation Description	(0008,2111)	If an image is compressed, Derivation Description is coerced to include compression history information. The existing contents (if any) will be prefixed with a line that begins "DRS:", and, if the attribute was not previously empty, ends with a new line character.
Source Image Sequence	(0008,2112)	Describes the image that was the source for this compressed image.
Derivation Code Sequence	(0008,9215)	For lossy compression only, describes how this image was derived.

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Attribute Name	Tag	Comment
Samples per Pixel	(0028,0002)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, Samples per Pixel is coerced from 1 to 3.
Photometric Interpretation	(0028,0004)	If a color image is compressed, then the Photometic Interpretation is coerced as follows: JPEG YBR_FULL_422 JPEG 2000 lossy YBR_ICT JPEG 2000 lossless YBR_RCT JPEG lossless RGB
Planar Configuration	(0028,0006)	If a color image is compressed, Planar Configuration is coerced to 0 (color-by-pixel).
Bits Allocated	(0028,0100)	If an image is compressed, Bits Allocated is coerced to reflect the compression technique.
Bits Stored	(0028,0101)	If an image is compressed, Bits Stored is coerced to reflect the compression technique.
High Bit	(0028,0102)	If an image is compressed, High Bit is coerced to reflect the compression technique.
Pixel Representation	(0028,0103)	If an image is compressed using JPEG, Pixel Representation is coerced to 0 (unsigned).
Rescale Intercept	(0028,1052)	If an image is compressed with JPEG, it is necessary to scale the pixel domain to match that expected by the compression technique. In this case, Rescale Intercept and Rescale Slope are coerced to preserve the logical range of the output of the Modality LUT Module step in the DICOM pixel processing pathway. Hence, the parameters of the VOI LUT Module do not need to be adjusted as a result of compression.
Rescale Slope	(0028,1053)	See Rescale Intercept, above.
Smallest Pixel Value in Series	(0028,0108)	If an image is compressed, Smallest Pixel Value in Series is coerced to the correct value if it can be computed, or dropped if it cannot.
Largest Pixel Value in Series	(0028,0109)	If an image is compressed, Largest Pixel Value in Series is coerced to the correct value if it can be computed, or dropped if it cannot.
Pixel Padding	(0028,0120)	If an image is compressed with lossy compression, this tag is dropped if present
Red Palette Color Lookup Table Descriptor	(0028,1101)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Green Palette Color Lookup Table Descriptor	(0028,1102)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Red Palette Color Lookup Table Data	(0028,1201)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Green Palette Color Lookup Table Data	(0028,1202)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.

Attribute Name	Tag	Comment
Blue Palette Color Lookup Table Data	(0028,1203)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Lossy Image Compression	(0028,2110)	If an image is compressed with lossy compression, this tag is added or coerced to 01 (Image has been subjected to lossy compression)
Lossy Image Compression Ratio	(0028,2112)	If an image is compressed with lossy compression, this tag is added if needed. If the tag exists, the lossy compression ratio is appended to the end. May be multivalued.
Lossy Image Compression Method	(0028,2114)	Applies only when lossy compression is applied. A list of lossy compressions applied. May be multivalued, where new lossy compressions are appended ISO_10918_1 = JPEG Lossy Compression ISO_15444_1 = JPEG 2000 Irreversible Compression
Modality LUT Sequence	(0028,3000)	If an image with a Modality LUT Sequence is compressed, the LUT is applied to the pixel data prior to compression, and the Modality LUT Sequence is removed from the compressed image.

The following table represents a list of tags that are coerced when a lossy compression algorithm is applied to the images upon transfer. For lossy compression, these tags are coerced in addition the tags in the previous table.

In this table, data contained within double quotes in the Comment section refer the actual value that is coerced for the corresponding tag attribute.

For each sequence, the sequence is created if none existed previously. If there was an existing sequence then a new item is appended to the end of the existing items.

Attribute Name	Tag	Comment
Source Image Sequence	(0008,2112)	For lossy compression, describes the image that was the source for this compressed image.
>Referenced SOP Class UID	(0008,1150)	SOP Class UID of the source image
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the source image
>Purpose of Reference Code Sequence	(0040,A170)	
>>Code Value	(0008,0100)	"121320"
>>Coding Scheme Designator	(0008,0102)	"DCM"
>>Code Meaning	(0008,0104)	"Uncompressed predecessor"
>>Context Identifier	(0008,010F)	"7202"
>>Mapping Resource	(0008,0105)	"DCMR"
>>Context Group Version	(0008,0106)	"20020904"

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Attribute Name	Tag	Comment
>>Context Group Extension Flag	(0008,010B)	"N"
Derivation Code Sequence	(0008,9215)	For lossy compression only, describes how this image was derived.
>Code Value	(0008,0100)	"113040"
>Coding Scheme Designator	(0008,0102)	"DCM"
>Code Meaning	(0008,0104)	"Lossy Compression"
>Context Identifier	(0008,010F)	"7203"
>Mapping Resource	(0008,0105)	"DCMR"
>Context Group Version	(0008,0106)	"20020904"
>Context Group Extension Flag	(0008,010B)	"N"

Display Parameters

Unity PACS allows users to override the VOI LUT Module parameters stored in an image, and to view an image in one or more user-specified VOI LUT Module settings. Properly authorized users can store these settings, so that when the images are printed or displayed in the future, they initially appear with the user-specified VOI LUT Module parameters.

If any overridden VOI LUT Module parameters are in the form of Window Center (0028,1050) and Window Width (0028,1051) values, then the Storage SCU AE will coerce Window Center (0028,1050), Window Width (0028,1051) and Window Center & Width Explanation (0028,1055) to contain the user-specified values. The VM of these attributes reflects the number of such user settings. By the nature of the Unity PACS, there will be an Explanation for each Window Center/Width combination, and logically related Window Center/Width values among various images will have identical Explanations.

The list of coerced window/level tags is found in Table 81 in Appendix A - List of Potentially Coerced DICOM Tags.

UID Data

When necessary to unsure globally uniqueness, exams exported by Unity are updated with new UIDs. This ensures strict DICOM compliance and provides for greater exam usability. Refer to Table 78 in Appendix A - List of Potentially Coerced DICOM Tags for the full list of potentially coerced DICOM tags. Exported Exams are always given a new Study Instance UID and new SOP Instance UIDS. The Series Instance UIDs are coerced as necessary and the Referenced SOP Instance UIDs are updated to the correct values based on the coerced UIDs.

Also, a history of the UID sequences in stored in a Private Tag (see subsequent paragraphs). This provides greater flexibility and history tracking capabilities for Unity exams.

Demographic Data

The transmitted exam is updated with the most current patient demographic data. This is done as a safety issue, so that corrections to patient identification are propagated to the Storage SCP. Refer to Table 79 in Appendix A - List of Potentially Coerced DICOM Tags for the specific tags that may be coerced.

Study Data

Information about the study is coerced to match the information stored on the PACS for the study. This information is usually more detailed than that originally provided by the modality, and may reflect corrections made to the study information after the SOP Instances were originally acquired, or information not available at that time Table 83 in Appendix A - List of Potentially Coerced DICOM Tags contains the complete list of potentially coerced study-related DICOM tags.

Equipment/Institute Data

Any updates to Equipment or Institute related information will be reflected by coercing the appropriate DICOM Tags. For example, an image acquired as a Secondary Capture will require some or all of these tags to be coerced.

The complete list of Equipment/Institute related tags is found in Table 82 in Appendix A - List of Potentially Coerced DICOM Tags.

Series Level Data

Occasionally, series level tags will need to be coerced. For example, if the Series Instance UIDs were coerced or if the images in a series were acquired as Secondary Capture, then some or all of the series level tags will be coerced.

The complete list of Equipment/Institute related tags is found in Table 83 in Appendix A - List of Potentially Coerced DICOM Tags.

Image Information Related Tags

Exams exported by a Unity PACS may require image information tags to be coerced. These tags are in addition the tags listed in the preceding table.

The complete list of Private Tags is found in Table 85 in Appendix A - List of Potentially Coerced DICOM Tags.

Private Tags

All Exams exported by a Unity PACS will have Private Tags coerced. This allows Unity to provide and maintain vital Exam information (including UID history tracking), while still be fully DICOM compliant.

The complete list of Private Tags is found in Table 86 in Appendix A - List of Potentially Coerced DICOM Tags.

3.5.3 Association Acceptance Policy

This AE does not accept associations.

3.6 Storage SCU AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCU. This is a separate software component from the Guardian Storage SCU AE.

Table 42 - Storage SCU AE Verification SOP Class

SOP Class	SOP Class UID
Verification	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 Storage SOP Classes as an SCU.

Table 43 - Storage SCU AE Storage SOP Classes

SOP Class	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
X-Ray Angiographic Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Angiographic BiPlane Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3

SOP Class	SOP Class UID
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Mammography CAD Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.50
Key Object Selection	1.2.840.10008.5.1.4.1.1.88.59
Positron Emission Tomography Storage	1.2.840.10008.5.1.4.1.1.128

> **NOTE:** This list includes SOP Classes for which the DIGATE AE does not claim Full Standard Conformance as a Storage SCP, as described in the Note in 3.1 DIGATE AE Specification - SCP.

> **NOTE:** Consult with Technical Support for the availability of support for additional Image Storage SOP classes which are not yet listed in the above table.

This AE does not operate as an SCP of any SOP class.

3.6.1 Association Establishment Policies

3.6.1.1 General

There are no inherent limitations for maximum PDU size. Maximum PDU size is configurable, and defaults to 100 KB.

3.6.1.2 Number of Associations

Each application instance of the Storage SCU AE will initiate at most a single association at a time.

> **NOTE:** However, there may be multiple application instances of the Storage SCU in a single Unity PACS installation.

3.6.1.3 Asynchronous Nature

The Storage SCU AE allows a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

3.6.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: `2.16.840.1.113786.0.11`

3.6.2 Association Initiation Policy by Real-World Activity

In response to a user request to perform an "Echo Test" of a DICOM AE, the Storage AE will initiate an association as a Verification SCU. Upon completion of the test (i.e. a C-ECHO response is received or a configured "timeout" interval elapses) the Storage AE terminates the association.

The user interface can be configured to offer either or both of a "Copy" or "Send" function. For either, the user selects one or more studies to be transferred, the destination to send them to, and can optionally select which series of the study are to be sent. If the "Copy" function is used, then the storage request is passed directly to an instance of the Storage SCU AE. If the "Send" function is used, then the request is placed on a queue. The Messenger application incorporates an instance of the Storage SCU AE. An instance of the Messenger application, which may be elsewhere in the network, retrieves the request from the queue and passes it to its Storage SCU AE.

To process the request, the Storage SCU AE will initiate an association as a Storage SCU. The Storage AE will attempt to send all of the selected images of an exam on a single association, and then closes the association.

3.6.2.1 Real World Activity - Verification

3.6.2.1.1 Associated Real World Activity - Verification

When the operator asks to test an AE, this AE will attempt to initiate an association for Verification Service in order to perform a C-ECHO-RQ.

3.6.2.1.2 Proposed Presentation Context Table - Verification

The Storage SCU AE supports the transfer syntaxes listed in Table 44 - Storage SCU AE Verification Transfer Syntaxes. For a Verification request, the DIQUERY AE will propose the Presentation Contexts listed in Table 45 - Storage SCU AE Verification Presentation Contexts.

Table 44 - Storage SCU AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 45 - Storage SCU AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 44	SCU	None

3.6.2.1.3 SOP Specific Conformance - Verification

The DIQUERY AE provides standard conformance to the DICOM Verification Service Class. Refer to that Section for further details.

3.6.2.2 Real World Activity - Store

3.6.2.2.1 Associated Real World Activity - Store

When processing a request to transmit some or all of the images of an exam, the Storage SCU AE will attempt to initiate an association for Storage Service in order to perform a C-STORE-RQ.

3.6.2.2.2 Proposed Presentation Context Table – Store

Table 46 - Storage SCU AE Storage Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
Lossy JPEG 8 Bit JPEG Baseline (Process 1) Compression	1.2.840.10008.1.2.4.50
Lossy JPEG 12 Bit JPEG Baseline (Process 4) Compression	1.2.840.10008.1.2.4.51
Lossless, non-hierarchical, JPEG coding process 14 Compression	1.2.840.10008.1.2.4.57
Lossless, non-hierarchical, first-order prediction, JPEG coding process 14 (selection value 1) Compression	1.2.840.10008.1.2.4.70
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90
JPEG 2000 Lossy Image Compression	1.2.840.10008.1.2.4.91
RLE Run Length Encoding (Lossless)	1.2.840.10008.1.2.5

Table 47 - Non-Image Storage SCU AE Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2
Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1

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Table 48 - Storage SCU AE Storage Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	all from Table 46	SCP	See Table 49
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	all from Table 46	SCP	See Table 49
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	all from Table 46	SCP	See Table 49
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	all from Table 46	SCP	See Table 49
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	all from Table 46	SCP	See Table 49
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	all from Table 46	SCP	See Table 49
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	all from Table 46	SCP	See Table 49
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	all from Table 46	SCP	See Table 49
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	all from Table 46	SCP	See Table 49
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	all from Table 46	SCP	See Table 49
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	all from Table 46	SCP	See Table 49
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	all from Table 46	SCP	See Table 49
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	all from Table 46	SCP	See Table 49
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	all from Table 46	SCP	See Table 49
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	all from Table 46	SCP	See Table 49
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	all from Table 46	SCP	See Table 49
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	all from Table 46	SCP	See Table 49
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	all from Table 46	SCP	See Table 49
X-Ray Angiographic Storage	1.2.840.10008.5.1.4.1.1.12.1	all from Table 46	SCP	See Table 49
X-Ray Radiofluoroscopic Storage	1.2.840.10008.5.1.4.1.1.12.2	all from Table 46	SCP	See Table 49
X-Ray Angiographic BiPlane Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	all from Table 46	SCP	See Table 49
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	all from Table 47	SCP	See Table 49

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Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	all from Table 47	SCP	See Table 49
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20	all from Table 46	SCP	See Table 49
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	all from Table 47	SCP	See Table 49
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	all from Table 46	SCP	See Table 49
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	all from Table 46	SCP	See Table 49
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	all from Table 46	SCP	See Table 49
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	all from Table 46	SCP	See Table 49
Mammography CAD Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.50	all from Table 47	SCP	See Table 49
Key Object Selection	1.2.840.10008.5.1.4.1.1.88.59	all from Table 47	SCP	See Table 49
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	all from Table 46	SCP	See Table 49

> **NOTE:** This list includes SOP Classes for which the DIGATE AE does not claim Full Standard Conformance as a Storage SCP, as described in the Note in 3.1 DIGATE AE Specification - SCP.

> **NOTE:** Storage Extended Negotiation will be supported. The Storage SCU AE will respond with the following information:

Table 49 - Storage SCU AE Storage Extended Negotiation

Field Name	Value	Description of Field
Level of Support	2	level 2 (FULL) SCP

3.6.2.2.3 SOP Specific Conformance - Storage (all)

This AE can coerce values upon transmission of a study. Only the transmitted SOP Instance is affected, the instance stored in the Unity PACS is not affected.

Transfer Syntax

In a "Send" request, the user may request that images be send compressed, not compressed, or as-is (neither forcing compression nor decompression.) The type and degree of compression is selected from a configurable, modality-specific list, thus allowing site policy to control whether, what type and how much compression is acceptable for each modality.

The user-selected compression is a request, subject to the Presentation Contexts accepted during Association negotiation. The Storage SCU AE will ignore a request to compress an image if the Storage SCP does not accept the implied Presentation Context.

Furthermore, if the image is already a compressed image or is VR Explicit and the Storage SCP does not accept the image's Transfer Syntax, then the Storage SCU AE will send the image in Implicit VR Little Endian Uncompressed format. (The instance of the image stored in the PACS is unaffected.)

These changes can result in the coercion of a number of attributes. The bulk of the coerced tags are listed in Appendix A - List of Potentially Coerced DICOM Tags, but the following image-related tags are also coerced for a transmitted exam.

Attribute Name	Tag	Comment
Image Type	(0008,0008)	If an image is compressed, then the Value 1 is coerced to DERIVED.
Derivation Description	(0008,2111)	If an image is compressed, Derivation Description is coerced to include compression history information. The existing contents (if any) will be prefixed with a line that begins "DRS:", and, if the attribute was not previously empty, ends with a new line character.
Source Image Sequence	(0008,2112)	Describes the image that was the source for this compressed image.
Derivation Code Sequence	(0008,9215)	For lossy compression only, describes how this image was derived.
Samples per Pixel	(0028,0002)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, Samples per Pixel is coerced from 1 to 3.
Photometric Interpretation	(0028,0004)	If a color image is compressed, then the Photometric Interpretation is coerced as follows: JPEG YBR_FULL_422 JPEG 2000 lossy YBR_ICT JPEG 2000 lossless YBR_RCT JPEG Lossless RGB
Planar Configuration	(0028,0006)	If a color image is compressed, Planar Configuration is coerced to 0 (color-by-pixel).
Bits Allocated	(0028,0100)	If an image is compressed, Bits Allocated is coerced to reflect the compression technique.
Bits Stored	(0028,0101)	If an image is compressed, Bits Stored is coerced to reflect the compression technique.
High Bit	(0028,0102)	If an image is compressed, High Bit is coerced to reflect the compression technique.
Pixel Representation	(0028,0103)	If an image is compressed using JPEG, Pixel Representation is coerced to 0 (unsigned).
Rescale Intercept	(0028,1052)	If an image is compressed with JPEG, it is necessary to scale the pixel domain to match that expected by the compression technique. Iin this case, Rescale Intercept and Rescale Slope are coerced to preserve the logical range of the output of the Modality LUT Module step in the DICOM pixel processing pathway. Hence, the parameters of the VOI LUT Module do not need to be adjusted as a result of compression.

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Attribute Name	Tag	Comment
Rescale Slope	(0028,1053)	See Rescale Intercept, above.
Smallest Pixel Value in Series	(0028,0108)	If an image is compressed, Smallest Pixel Value in Series is coerced to the correct value if it can be computed, or dropped if it cannot.
Largest Pixel Value in Series	(0028,0109)	If an image is compressed, Largest Pixel Value in Series is coerced to the correct value if it can be computed, or dropped if it cannot.
Pixel Padding	(0028,0120)	If an image is compressed with lossy compression, this tag is dropped if present
Red Palette Color Lookup Table Descriptor	(0028,1101)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Green Palette Color Lookup Table Descriptor	(0028,1102)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Red Palette Color Lookup Table Data	(0028,1201)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Green Palette Color Lookup Table Data	(0028,1202)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Blue Palette Color Lookup Table Data	(0028,1203)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Lossy Image Compression	(0028,2110)	If an image is compressed with lossy compression, this tag is added or coerced to 01 (Image has been subjected to lossy compression)
Lossy Image Compression Ratio	(0028,2112)	If an image is compressed with lossy compression, this tag is added if needed. If the tag exists, the lossy compression ratio is appended to the end. May be multivalued.
Lossy Image Compression Method	(0028,2114)	Applies only when lossy compression is applied. A list of lossy compressions applied. May be multivalued, where new lossy compressions are appended ISO_10918_1 = JPEG Lossy Compression ISO_15444_1 = JPEG 2000 Irreversible Compression
Modality LUT Sequence	(0028,3000)	If an image with a Modality LUT Sequence is compressed, the LUT is applied to the pixel data prior to compression, and the Modality LUT Sequence is removed from the compressed image.

The following table represents a list of tags that are coerced when a lossy compression algorithm is applied to the images upon transfer. For lossy compression, these tags are coerced in addition the tags in the previous table.

In this table, data contained within double quotes in the Comment section refer the actual value that is coerced for the corresponding tag attribute.

Attribute Name	Tag	Comment
Source Image Sequence	(0008,2112)	For lossy compression, describes the image that was the source for this compressed image.
>Referenced SOP Class UID	(0008,1150)	SOP Class UID of the source image
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the source image
>Purpose of Reference Code Sequence	(0040,A170)	
>>Code Value	(0008,0100)	"121320"
>>Coding Scheme Designator	(0008,0102)	"DCM"
>>Code Meaning	(0008,0104)	"Uncompressed predecessor"
>>Context Identifier	(0008,010F)	"7202"
>>Mapping Resource	(0008,0105)	"DCMR"
>>Context Group Version	(0008,0106)	"20020904"
>>Context Group Extension Flag	(0008,010B)	"N"
Derivation Code Sequence	(0008,9215)	For lossy compression only, describes how this image was derived.
>Code Value	(0008,0100)	"113040"
>Coding Scheme Designator	(0008,0102)	"DCM"
>Code Meaning	(0008,0104)	"Lossy Compression"
>Context Identifier	(0008,010F)	"7203"
>Mapping Resource	(0008,0105)	"DCMR"
>Context Group Version	(0008,0106)	"20020904"
>Context Group Extension Flag	(0008,010B)	"N"

Display Parameters

Unity PACS allows users to override the VOI LUT Module parameters stored in an image, and to view an image in one or more user-specified VOI LUT Module settings. Properly authorized users can store these settings, so that when the images are printed or displayed in the future, they initially appear with the user-specified VOI LUT Module parameters.

If any overridden VOI LUT Module parameters are in the form of Window Center (0028,1050) and Window Width (0028,1051) values, then the Storage SCU AE will coerce Window Center (0028,1050), Window Width (0028,1051) and Window Center & Width Explanation (0028,1055) to contain the user-specified values. The VM of these attributes reflects the number of such user settings. By the nature of the Unity PACS, there will be an Explanation for each Window Center/Width combination, and logically related Window Center/Width values among various images will have identical Explanations.

The list of coerced window/level tags is found in Table 81 in Appendix A - List of Potentially Coerced DICOM Tags.

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UID Data

All Exams exported by Unity are updated with new (globally unique) UIDs. This ensures strict DICOM compliance and provides for greater exam usability.   Refer to Table 78 in Appendix A - List of Potentially Coerced DICOM Tags for the full list of potentially coerced DICOM tags. Exported Exams are always given a new Study Instance UID and new SOP Instance UIDS. The Series Instance UIDs are coerced as necessary and the Referenced SOP Instance UIDs are updated to the correct values based on the coerced UIDs.

Also, a history of the UID sequences in stored in a Private Tag (see subsequent paragraphs). This provides greater flexibility and history tracking capabilities for Unity exams.

Demographic Data

The transmitted exam is updated with the most current patient demographic data. This is done as a safety issue, so that corrections to patient identification are propagated to the Storage SCP. Refer to Table 79 in Appendix A - List of Potentially Coerced DICOM Tags for the specific tags that may be coerced.

Study Data

Information about the study is coerced to match the information stored on the PACS for the study. This information is usually more detailed than that originally provided by the modality, and may reflect corrections made to the study information after the SOP Instances were originally acquired, or information not available at that time. Table 80 in Appendix A - List of Potentially Coerced DICOM Tags contains the complete list of potentially coerced study-related DICOM tags.

Equipment/Institute Data

Any updates to Equipment or Institute related information will be reflected by coercing the appropriate DICOM Tags. For example, an image acquired as a Secondary Capture will require some or all of these tags to be coerced.

The complete list of Equipment/Institute related tags is found in Table 82 in Appendix A - List of Potentially Coerced DICOM Tags.

Series Level Data

Occasionally, series level tags will need to be coerced. For example, if the Series Instance UIDs were coerced or if the images in a series were acquired as Secondary Capture, then some or all of the series level tags will be coerced.

The complete list of Equipment/Institute related tags is found in Table 83 in Appendix A - List of Potentially Coerced DICOM Tags.

Secondary Capture Level Data

Occasionally, Secondary Capture DICOM tags will be coerced. This is especially true in images acquired by Unity via scanning, adding images to exams from bitmaps, pictures, etc. All of these circumstances result in Secondary Capture images.

The complete list of Equipment/Institute related tags is found in Table 84 in Appendix A - List of Potentially Coerced DICOM Tags.

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Image Information Related Tags

Exams exported by a Unity PACS may require image information tags to be coerced. These tags are in addition the tags listed in the preceding table.

The complete list of Private Tags is found in Table 85 in Appendix A - List of Potentially Coerced DICOM Tags.

Private Tags

All Exams exported by a Unity PACS will have Private Tags coerced. This allows Unity to provide and maintain vital Exam information (including UID history tracking), while still be fully DICOM compliant.

The complete list of Private Tags is found in Table 86 in Appendix A - List of Potentially Coerced DICOM Tags.

3.6.3 Association Acceptance Policy

This AE does not accept associations.

3.7 DIQUERY AE Specification - SCU

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCU.

Table 50 - DIQUERY AE Verification SOP Class

SOP Class	SOP Class UID
Verification	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 **Query/Retrieve** SOP Classes as an SCU.

Table 51 - DIQUERY AE Query/Retrieve SOP Classes

Patient Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.3.2

This AE does not operate as an SCP of any SOP class.

3.7.1 Association Establishment Policies

3.7.1.1 General

The DIQUERY AE contains no limitations for maximum PDU size. DIQUERY maintains a table of AEs it can attempt to negotiate an association with, the PDU size for each AE is configured into that table.

3.7.1.2 Number of Associations

The DIQUERY AE initiates one association at a time.

3.7.1.3 Asynchronous Nature

The DIQUERY AE requests a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

3.7.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: `2.16.840.1.113786.0.11`

This AE will respond with the following Implementation Version Name:
- Implementation Version Name: `DRSYS_V11`

The numeric portion of the implementation version name may change as new versions are released.

3.7.2 Association Initiation Policy by Real-World Activity

The DIQUERY AE will initiate an association in response to user request.

3.7.2.1 Real World Activity - Verification

3.7.2.1.1 Associated Real World Activity - Verification

When the operator asks to test an AE, DIQUERY will attempt to initiate an association for Verification Service in order to perform a C-ECHO-RQ.

3.7.2.1.2 Proposed Presentation Context Table - Verification

The DIQUERY AE supports the transfer syntaxes listed in Table 52. For a Verification request, the DIQUERY AE will propose the Presentation Contexts listed in Table 53 - DIQUERY AE Verification Presentation Contexts.

Table 52 - DIQUERY AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 53 - DIQUERY AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 52	SCU	None

3.7.2.1.3 SOP Specific Conformance - Verification

The DIQUERY AE provides standard conformance to the DICOM Verification Service Class.

3.7.2.2 Real World Activity - Find

3.7.2.2.1 Associated Real World Activity - Find

When the operator asks to look up studies on an AE, DIQUERY will attempt to initiate an association for Query Service in order to perform a C-FIND-RQ.

3.7.2.2.2 Proposed Presentation Context Table - Find

DIQUERY supports the transfer syntaxes listed in Table 54. For a **QUERY** request, DIQUERY will propose the Presentation Contexts listed in Table 55.

Table 54 - DIQUERY AE Query Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 55 - DIQUERY AE Query SOP Classes

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Patient Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.1.1	all from Table 54	SCU	See Table 56
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1	all from Table 54	SCU	See Table 56
Patient Study Only Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.3.1	all from Table 54	SCU	See Table 56

> **NOTE:** Find Extended Negotiation will be supported. The DIQUERY AE will negotiate with the following information:

Table 56 - DIQUERY AE Find Extended Negotiation

Field Name	Value	Description of Field
Relational-queries	1	relational queries supported

3.7.2.2.3 SOP Specific Conformance – Find

All DIQUERY Matching Keys support both Universal and Wild Card matching. If the user enters a value for a matching key, DIQUERY uses implicit prefix Wild Card matching: the value is suffixed with "*". If no value is entered for a matching key, universal matching is used.

Table 57 - Attribute Support for the Find DIQUERY AE C-Find Q/R Information Model

Description	Tag	Matching Key	Return Key	Remarks
Study ID	(0020,0010)		Optional	
Patient ID	(0010,0020)	Universal, Wild Card	Optional	
Patient's Name	(0010,0010)	Universal, Wild Card	Optional	
Study Description	(0008,1030)		Optional	
Modality	(0008,0060)	Universal, Wild Card	Optional	
Study Date	(0008,0020)		Optional	
Patient Birth Date	(0010, 0030)		Optional	
Patient Sex	(0010, 0040)		Optional	
Patient Age	(0010, 1010)		Optional	
Study UID	(0020,000D)		Required	

3.7.2.3 Real World Activity - Move

3.7.2.3.1 Associated Real World Activity - Move

When the operator asks to transfer a study from an AE (marked "Acceptor" on the DIQUERY screen) to a "Destination" AE, DIQUERY will attempt to initiate an association with the "Acceptor" AE for Query Service in order to perform a C-MOVE-RQ

3.7.2.3.2 Proposed Presentation Context Table - Move

The DIQUERY AE supports the transfer syntaxes listed in Table 58. For a MOVE request, DIQUERY will propose the Presentation Contexts listed in Table 59

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Table 58 - DIQUERY AE Move Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 59 - DIQUERY AE Move SOP Classes

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Patient Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.1.2	all from Table 58	SCU	See Note
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2	all from Table 58	SCU	See Note
Patient/Study Only Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.3.2	all from Table 58	SCU	See Note

> **NOTE:** Move Extended Negotiation will be supported. The DIQUERY AE will negotiate with the following information:

Table 60 - DIQUERY AE Move Extended Negotiation

Field Name	Value	Description of Field
Relational-retrieval	1	relational retrieval supported

3.7.2.3.3 SOP Specific Conformance – Move

The Identifier in a DIQUERY C-MOVE request always provides SOP Instance UID (0008,0018) as the sole method for specifying the SOP Instance that the SCP is to send to the Move Destination.

3.8 Print Formatter DICOM Print SCU AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 Verification SOP Class as an SCU.

Table 61 - Print SCU AE Verification SOP Class

SOP Class	SOP Class UID
Verification	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 Print SOP Classes as an SCU.

Table 62 - Print SCU AE Print SOP Classes

SOP Class	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9

This AE does not operate as an SCP of any SOP class.

3.8.1 Association Establishment Policies

3.8.1.1 General

There are no inherent limitations for maximum PDU size. Maximum PDU size is configurable, and defaults to 100 KB.

3.8.1.2 Number of Associations

Each application instance of the Print SCU AE will initiate at most a single association at a time.

> **NOTE:** However, there may be multiple application instances of the Print SCU in a single Unity PACS installation.

3.8.1.3 Asynchronous Nature

The Print SCU AE allows a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

3.8.1.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: **2.16.840.1.113786.0.11**

3.8.2 Association Initiation Policy by Real-World Activity

In response to a user request to perform an "Echo Test" of a DICOM AE, the Print AE will initiate an association as a Verification SCU. Upon completion of the test (i.e. a C-ECHO response is received or a configured "timeout" interval elapses) the Print AE terminates the association.

The user interface presents the user with the list of target printers that have been configured. The user selects one or more studies to be printed, the destination printer, and the selected printing options.. The print request and the associated printing options is placed on a queue. The Print Formatter application incorporates an instance of the Print SCU AE. An instance of the Print Formatter application, which may be elsewhere in the network, retrieves the request from the queue and passes it to its Print SCU AE.

To process the request, the Print SCU AE will initiate an association as a Print SCU. The association is negotiated either once per page or once per job based on configuration

parameters. The Print AE will attempt to send all of the selected images of an exam that are appropriate to the association (per page or per job), and then closes the association.

3.8.2.1 Real World Activity - Verification

3.8.2.1.1 Associated Real World Activity - Verification

When the operator asks to test an AE, this AE will attempt to initiate an association for Verification Service in order to perform a C-ECHO-RQ.

3.8.2.1.2 Proposed Presentation Context Table - Verification

The Print SCU AE supports the transfer syntaxes listed in Table 63 - Print SCU AE Verification Transfer Syntaxes. For a Verification request, the Print Formatter AE will propose the Presentation Contexts listed in Table 64 - Print SCU AE Verification Presentation Contexts.

Table 63 - Print SCU AE Verification Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 64 - Print SCU AE Verification Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Verification	1.2.840.10008.1.1	all from Table 63	SCU	None

3.8.2.1.3 SOP Specific Conformance - Verification

The Print Formatter AE provides standard conformance to the DICOM Verification Service Class.

3.8.2.2 Real World Activity - Print

3.8.2.2.1 Associated Real World Activity - Print

When processing a request to print some or all of the images of an exam, the Print SCU AE will attempt to initiate an association for Print Service in order to perform printing.

3.8.2.2.2 Proposed Presentation Context Table - Print

The list of presentation contexts that the Print SCU AE can propose is defined in Table 65 - Print SCU AE Print Transfer Syntaxes and Table 66 - Print SCU AE Print Presentation Contexts.

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Table 65 - Print SCU AE Print Transfer Syntaxes

Transfer Syntax	UID
Implicit VR Little Endian Uncompressed	1.2.840.10008.1.2

Table 66 - Print SCU AE Print Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	all from Table 65	SCU	None

3.8.2.2.3 SOP Specific Conformance – N-Get

This request is used to obtain any printer specific information for logging purposes.

3.8.2.2.4 SOP Specific Conformance – N-Create Film Session

The application may be configured to create a single page per Film Session or multiple pages per film session. A Film Session UID is provided by the SCU.

The following tags may be part of the creation request. Configurable tags are optional for the SCU, but may be provided from the configuration if required by the SCP.

Configurable settings may only be performed by authorized personnel.

If an error is returned by the SCP the print job is deleted and the association is closed. The printer status is checked after each image is sent. If the printer does not have normal status, the SCU will wait until the printer returns to normal status before continuing.

Description	Tag	Value	Remarks
Copies	(2000,0010)	Established by User	Automatic
Priority	(2000,0020)	Established by User	Automatic
Film Session Label	(2000,0050)	Print Job Title is used	Automatic
Medium Type	(2000,0030)	Configurable	Optional
Film Destination	(2000,0040)	Configurable	Optional

3.8.2.2.5 SOP Specific Conformance – N-Create Film Box

A Film Box UID is provided by the SCU.

The following tags may be part of the creation request. Configurable tags are optional for the SCU, but may be provided from the configuration if required by the SCP.

Configurable settings may only be performed by authorized personnel.

If an error is returned by the SCP the print job is deleted and the association is closed. The printer status is checked after each image is sent. If the printer does not have normal status, the SCU will wait until the printer returns to normal status before continuing.

Description	Tag	Value	Remarks
Image Display Format	(2010,0010)	Established by User	Automatic
Film Orientation	(2010,0030)	Established by User	Automatic
Film Size ID	(2010,0050)	Configurable	Optional
Medium Type	(2000,0030)	Configurable	Optional
Magnification Type	(2010,0060)	Configurable	Optional
Max Density	(2010,0130)	Configurable	Optional
Min Density	(2010,0120)	Configurable	Optional
Smoothing Type	(2010,0080)	Configurable	Optional
Border Density	(2010,0100)	Configurable	Optional
Trim	(2010,0140)	Configurable	Optional
Empty Image Density	(2010,0110)	Configurable	Optional
Req Decimate Crop	(2020,0040)	Configurable	Optional
Req Resolution ID	(2020,0050)	Configurable	Optional

3.8.2.2.6 SOP Specific Conformance – N-Set Image Box

The following tags may be part of the set request. Configurable tags are optional for the SCU, but may be provided from the configuration if required by the SCP.

True-size (Requested Image Size) is supported in one of two ways. If it is supported by the SCP, then the dimensions of the image are sent to the SCP in the DICOM proscribed way. If it is not supported, then the application sends and image of the appropriate page size to the SCP so that the desired size is achieved.

Configurable settings may only be performed by authorized personnel.

If an error is returned by the SCP the print job is deleted and the association is closed. The printer status is checked after each image is sent. If the printer does not have normal status, the SCU will wait until the printer returns to normal status before continuing.

Description	Tag	Value	Remarks
Image Position	(2020,0010)	Based on Page Format and Orientation	Automatic
Requested Image Size	(2020,0030)	Based on configuration settings AND image size	Based on configuration
Configuration Info	(2010,0130)	Established based on configuration AND exam Modality	Automatic
Magnification Type	(2010,0060)	Configurable	Optional
Smoothing Type	(2010,0080)	Configurable	Optional
Polarity	(2020,0020)	Configurable	Optional

3.8.2.2.7 SOP Specific Conformance – N-Action

After successful construction of a print job, a print request is issued.

3.8.2.2.8 SOP Specific Conformance – N-Delete

A print job is deleted using this command when an error occurs.

3.8.3 Association Acceptance Policy

This AE does not accept associations.

3.9 Query/Retrieve AE Specification – SCP

3.9.1 Query/Retrieve SCP Data Flow

Figure 5 - Query/Retrieve SCP Data Flow Diagram
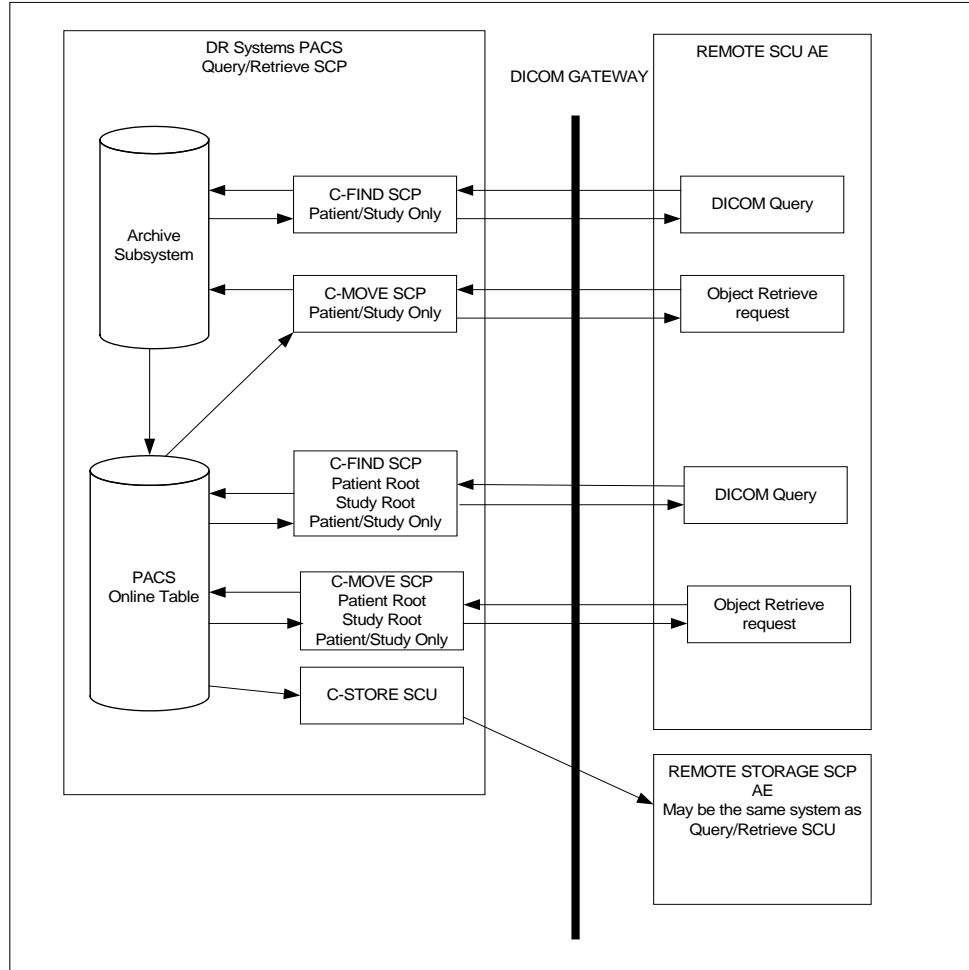
3.9.2 Functional Definition of Query/Retrieve Application Entity

Unity Query/Retrieve AE supports the following functionality:

- Respond to queries about patients, studies, series and composite object instances stored in the Unity PACS.
- Move composite object instances to destination Application Entities.

3.9.3 Sequencing of Real World Activities for the Query/Retrieve AE

1. Query
   a. Search for patients, studies, series, or composite object instances
   b. Send Query Responses to the Query/Retrieve SCU

2. Retrieve
   a. Select composite object instances to move
   b. Move composite object instances (Send Images)

Unity Query/Retrieve Application Entity provides Standard Conformance to the following DICOM V3.0 Query/Retrieve models:

Table 67 - Query/Retrieve Server AE C-FIND SOP Classes

SOP Class	SOP Class UID
Patient Root C-FIND	1.2.840.10008.514.1.2.1.1
Study Root C-FIND	1.2.840.10008.514.1.2.2.1
Patient/Study Only C-FIND	1.2.840.10008.5.1.4.1.2.3.1

Table 68 - Query/Retrieve AE C-MOVE SOP Classes

SOP Class	SOP Class UID
Patient Root C-MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root C-MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only C-MOVE	1.2.840.10008.5.1.4.1.2.3.2

3.9.4 Association establishment policy

3.9.4.1 General

There are no inherent limitations for maximum PDU size. Default maximum PDU size is configurable, and defaults to 100 KB.

3.9.4.2 Number of Associations

The number of concurrent Query/Retrieve associations is configurable. There is no inherent limit, other than those imposed by resources and responsiveness requirements.

> **NOTE:** The count of Query/Retrieve associations is independent from the count of Storage associations and Worklist associations each can be configured with a different maximum number.

3.9.4.3 Asynchronous Nature

The Query/Retrieve Server AE allows a single outstanding operation on any association. Therefore, it does not support asynchronous operations window negotiation.

The Query/Retrieve Server AE implements C-FIND-CANCEL within the processing of a C-FIND request to the degree of support provide by the underlying DICOM toolkit.

3.9.4.4 Implementation Identifying Information

This AE provides the following Implementation Class UID:
- Implementation Class UID: `2.16.840.1.113786.0.11`

This AE will respond with the following Implementation Version Name:
- Implementation Version Name: `DRSYS_V11`

The numeric portion of the implementation version name may change as new versions are released.

3.9.5 Association Initiation Policy by Real-World Activity

The Query/Retrieve Server AE initiates associations to the C-Move destination.

3.9.6 Association Acceptance Policy

The Query/Retrieve Server AE accepts association as a Query/Retrieve SCP.   Unity Query/Retrieve supports two Query/Retrieve SCP AEs. AE1 supports only the Online tables of the Unity PACS database and supports all three Query/Retrieve models, Patient Root, Study Root and Patient/Study Only. AE2 will support both the Online and Archive tables for the Unity PACS database but will support only the Patient/Study Only model.   The Query/Retrieve Server AEs may be configured to accept associations on any single designated port, the default for AE1 is 5010, the default for AE2 is 5015. The Query/Retrieve Server AE does not verify that the called AE Title is the same as configured AE title.

> **NOTE:** The port on which the Query/Retrieve Server AE waits for associations must be different from the ports on which the Storage Service AE listens for associations and from the port on which the Modality Worklist Service AE listens for associations.

Each application instance of the Query/Retrieve AE has a configured list of allowed Query/Retrieve SCU AEs. The Query/Retrieve SCP AE will reject an association request from an AE that is not on the list.
- The Query/Retrieve Server will support simple hierarchical queries.
- The Query/Retrieve Server does not support relational queries.
- SOP Class Extended Negotiation is not supported
- SCU/SCP Role Selection Negotiation is not supported.
- The Asynchronous Operations Window negotiation is not supported.
- The 'priority' attribute in C-FIND, C-MOVE, and C-STORE are NOT supported.

- Query/Retrieve will not be available for in-progress exams.

The DICOM specification allows a Storage SCP to modify the values of certain attributes, i.e. Patient ID, Study Instance UID, and Series Instance UID.   The DICOM specification further notes that other Attributes may be modified/corrected by an SCP of a Storage SOP Class. Unity Query/Retrieve SCP will match C-FINDs to corrected attributes in the Unity PACS database. Any attributes that need to be coerced will only be added to the requested image files during the DICOM send operation. The following is a list of tags that Unity currently corrects during DICOM send:

- Patient Name   (0010,0010)
- Patient ID   (0010,0020)
- Patient Birth date   (0010,0030)
- Patient Sex   (0010,0040)
- Study date   (0008,0020)
- Study description   (0008,1030)
- Referring Physician   (0008,0090)
- Reading Radiologist   (0008,1060)

In addition Unity will selectively coerce the following:

- Study Instance UID   (0020,000D)

Unity DICOM Query/Retrieve SCP will support the Instance Availability tag (0008:0056) in C-FIND responses. This tag uses the notion of 'ONLINE', 'NEARLINE', and 'OFFLINE'.

- 'ONLINE" means the instances are immediately available (this applies to the online table only).
- 'NEARLINE' means the instances need to be retrieved from relatively slow but available media such as CD Jukeboxes, Centera/NAS type devices, DICOM Archives.
- 'OFFLINE' means that instances need to be retrieved by manual intervention.
- A C-MOVE request from an SCU for an offline instance will return status success even though no objects are sent. The study will be queued for manual restore and it will be up to the requestor to check later to see if the exam is online.

3.9.6.1 Real World Activity – Query/Retrieve C-FIND Service element behavior

3.9.6.1.1 Presentation Context Table – Query/Retrieve C-FIND

The table below lists the Presentation Contexts that are accepted by the Query AE

Table 69 - Query/Retrieve Server AE C-FIND Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
Query/Retrieve Patient Root - C-FIND	1.2.840.10008.514.1.2.1.1	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None
Query/Retrieve Study Root – C-FIND	1.2.840.10008.514.1.2.2.1	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None
Query/Retrieve Patient/Study Only – C-FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None

3.9.6.1.2 SOP Specific Conformance – Query/Retrieve Information Model – FIND

The Query/Retrieve Server AE provides standard conformance to the DICOM Basic Query/Retrieve Service Class. The Basic Query/Retrieve C-FIND Service AE returns one of the following status codes:

Table 70 - C-FIND Response Status Values

Response	Further Meaning	Protocol Codes	Related Fields	Description
Refused	Out of resources	A700	(0000,0900) (0000,0902)	
Cancel	Matching terminated due to Cancel Request	FE00	NONE	
Error	Data set does not match SOP Class	A900		Indicates that the Data Set does not encode an instance of the SOP Class specified. The SOP Instance UID (0008,0018), Patient ID (0010,0020), Study Instance UID (0020,000D) and/or Series Instance UID (0020,000E) was not found in the received image.
Failed	Failed	C000		The operation was not successful.
Failed	Failed	C001		Unity SCP can not process the request at this time.

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Response	Further Meaning	Protocol Codes	Related Fields	Description
Failed	Cannot understand	C005		Indicates that the Data Set cannot be parsed into elements by the DICOM Gateway.
Pending	Matches are continuing	FF00		Current Match is supplied and any Optional keys supported in the same manner as Required Keys.
Pending	Matches are continuing	FF01		Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier.
Success	Success	0000		Operation performed properly.

Unity Query/Retrieve Server will support matching and return on all Unique and Required key attributes per DICOM part 4 Annex C.

Attribute matching in the Unity Query/Retrieve AE will support the following types of matching following the rules in the DICOM specification PS3.4-2003 C.2.2.2 – C.2.2.6 with the exception of range matching discussed in the note below:

- Single value matching
- List of UID matching
- Universal matching
- Wild Card Matching
- Range Matching
- Sequence Matching

> **NOTE:** The range matching for Date and Time will be using the method specified in the Modality Worklist specification where Date and Time form the endpoints of a range as opposed to the definition in Query/Retrieve where each attribute is matched separately. For example, if the date range is July 5 to July 7 and the time range is 10am to 6pm then the search range is July 5, 10am until July 7, 6pm.

The following tables, Table 71 to Table 75, show the Unique, Required and Optional attributes that the Unity Query/Retrieve server supports. An 'X' in the FIND column indicates that the attribute is supported for matching. An 'X' in the RET column indicates that the attribute is supported for return value.

The maximum number of available result sets is configurable and may be limited based on performance.

Table 71 - Patient level attributes for the Patient Root Query/Retrieve Information Model

Description	Tag	Type	FIND	RET
Patient's Name	(0010,0010)	R	X	X
Patient ID	(0010,0020)	**U**	X	X
Patient's Birth Date	(0010,0030)	O	X	X
Patient's Sex	(0010,0040)	O	X	X
Patient Comments	(0010,4000)	O		X
Number of Patient Related Studies	(0020,1200)	O		X

Table 72 - Study level attributes for the Patient Root Query/Retrieve Information Model

Description	Tag	Type	FIND	RET
Study Date	(0008,0020)	R	X	X
Study Time	(0008,0030)	R	X	X
Accession Number	(0008,0050)	R	X	X
Study ID	(0020,0010)	R	X	X
Study Instance UID	(0020,000D)	**U**	X	X
Modalities in Study	(0008,0061)	O	X	X
Referring Physician's Name	(0008,0090)	O	X	X
Study Description	(0008,1030)	O	X	X
>Code Value	(0008,0100)	O	X	X
>Coding Scheme Designator	(0008,0102)	O		X
>Code Meaning	(0008,0104)	O	X	X
Name of Physician(s) Reading Study	(0008,1060)	O	X	X
Admitting Diagnoses Description	(0008,1080)	O		X
Patient's Age	(0010,1010)	O	X	X
Patient's Weight	(0010,1030)	O		X
Requesting Physician	(0032,1032)	O	X	X
Placer Issuer and number	(0040,2016)	O		X
Filler Issuer and number	(0040,2017)	O		X
Admission ID	(0038,0010)	O		X

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Table 73 - Study Level Attributes for the Study Root Query/Retrieve Information model

Description	Tag	Type	FIND	RET
Study Date	(0008,0020)	R	X	X
Study Time	(0008,0030)	R	X	X
Accession Number	(0008,0050)	R	X	X
Patient's Name	(0010,0010)	R	X	X
Patient ID	(0010,0020)	R	X	X
Study ID	(0020,0010)	R	X	X
Study Instance UID	(0020,000D)	**U**	X	X
Modalities in Study	(0008,0061)	O	X	X
Referring Physician's Name	(0008,0090)	O	X	X
Study Description	(0008,1030)	O	X	X
Procedure Code Sequence	(0008,1032)	O		
>Code Value	(0008,0100)	O		X
>Coding Scheme Designator	(0008,0102)	O		X
>Code Meaning	(0008,0104)	O		
Name of Physician(s) Reading Study	(0008,1060)	O	X	X
Admitting Diagnoses Description	(0008,1080)	O		
Patient's Birth Date	(0010,0030)	O	X	X
Patient's Sex	(0010,0040)	O	X	X
Patient's Age	(0010,1010)	O	X	X
Number of Patient Related Studies	(0020,1200)	O		X
Requesting Physician	(0032,1032)	O	X	X
Placer Issuer and number	(0040,2016)	O		X
Filler Issuer and number	(0040,2017)	O		X
Admission ID	(0038,0010)	O		X

Table 74 - Series Level Attributes for Both the Patient Root and Study Root Query/Retrieve Information Model

Description	Tag	Type	FIND	RET
Modality	(0008,0060)	R	X	X
Series Number	(0020,0011)	R	X	X
Series Instance UID	(0020,000E)	**U**	X	X
Number of Series Related Instances	(0020,1209)	O		

Table 75 - Composite Object Instance Level Attribute For Both The Patient Root and the Study Root Query/Retrieve Information Model

Description	Tag	Type	FIND	RET
Instance Number	(0020,0013)	R	X	X
SOP Instance UID	(0008,0018)	**U**	**X**	**X**
SOP Class UID	(0008,0016)	O	X	X
Rows	(0028,0010)	O		
Columns	(0028,0011)	O		
Bits Allocated	(0028,0100)	O		
Number of Frames	(0028,0008)	O		

The Attributes for the <u>Patient</u> Level of the Patient/Study Only Query/Retrieve Information Model:

These are the same as the Attributes for the <u>Patient</u> Level of the Patient Root Query/Retrieve Information Model.

The Attributes for the <u>Study</u> Level of the Patient/Study Only Query/Retrieve Information Model:

These are the same as the Attributes for the <u>Study</u> Level of the Patient Root Query/Retrieve Information Model.

3.9.6.2 Real World Activity – Query/Retrieve C-Move Service element behavior

3.9.6.2.1 C-MOVE Service Element Behavior

- Query/Retrieve AE1 searches the Unity online table for the requested patients, studies, series or images of the entities specified by the Unique Key values.
- Query/Retrieve AE2 searches the union of the online and archived tables for the requested patients or studies specified by the Unique Key values.
- During the move operation the Query/Retrieve AE will return C-MOVE responses to the requester with a status equal to pending. The response will contain the number of remaining, completed, failed and warning sub-operations for the study being moved.
- If no matches are found both Query/Retrieve AEs will return status equal to success. The value will be zero for the number of completed, failed, and warning sub-operations.

3.9.6.2.2 Presentation Context Table – Query/Retrieve C-MOVE

The table below lists the Presentation Contexts that are accepted by the Retrieve AE

Table 76 - Query/Retrieve Server AE C-MOVE Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	**SOP Class UID**			
Query/Retrieve Patient Root - C-MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None
Query/Retrieve Study Root – C-MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None
Query/Retrieve Patient/Study Only – C-MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian - 1.2.840.10008.1.2	SCP	None

3.9.6.2.3 SOP Specific Conformance – Query/Retrieve Information Model – MOVE

The Query/Retrieve Server AE provides standard conformance to the DICOM Basic Query/Retrieve Service Class. The Basic Query/Retrieve C-MOVE Service AE returns one of the following status codes:

Table 77 - C-MOVE Response Status Values

	Further Meaning	Protocol Codes	Related Fields	Description
Refused	Out of resources	A701	(0000,0902)	Unable to calculate number of matches
		A702	(0000,1020)(0000,1021)(0000,1022)(0000,1023)	Unable to perform sub-operations, or unable to perform storage of images to move destination
		A801	(0000,0902)	Move destination unknown
Cancel	Matching terminated due to Cancel Request	FE00	(0000,1020)(0000,1021)(0000,1022)(0000,1024)	Sub-operations complete – One or more failures
Failed	Data set does not match SOP Class	A900	(0000,0901)(0000,0902)	Indicates that the Data Set does not encode an instance of the SOP Class specified. The SOP Instance UID (0008,0018), Patient ID (0010,0020), Study Instance UID (0020,000D) and/or Series Instance UID (0020,000E) was not found in the received image.
	Failed	C000		The operation was not successful.
	Unable to process			Unity SCP is unable to process C-MOVE requests at this time.
Pending	Sub operations are continuing	FF00	(0000,1020)(0000,1021)(0000,1022)(0000,1023)	Current Storage sub-operation is continuing
Pending	Sub-operations are continuing	FF02		The Storage sub-operation is expected to require a long period of time to complete. The SCU may break the Association at any time but the operation will continue to completion.
Warning	Sub-Operations Complete	B000	(0000,1020)(0000,1022)(0000,1023)	One or more Failures
Success	Success	0000		Operation performed properly.

4 Communication Profiles

4.1 Supported Communication Stacks

Each Application provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard. It does not support OSI stack communications, physical media or point-to-point stack communications.

4.2 TCP/IP Stack

The TCP/IP communications stack is supported. Each Application inherits its TCP/IP stack from the computer system upon which it executes. Each Application is known to work successfully with the TCP/IP communications stack provided with the Microsoft NT 4.0 or XP Professional operating system.

5 Extensions/Specializations/Privatizations

Anywhere in this specification where support for a Standard SOP Class is stated, that support also applies to corresponding Standard Extended SOP Classes. The DICOM Gateway does not accept any other non-standard extensions, specialization or privatization in SOP Classes or Transfer Syntaxes.

6 Configuration

Unity RIS/PACS obtains setup information from system configuration files. Only Customer Support staff can modify these files.

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7 Support of Extended Character Sets

The DICOM Gateway supports the following character sets:

ISO_IR 6 (default)   Basic G0 Set

ISO_IR 100   Latin Alphabet No. 1
ISO_IR 101   Latin Alphabet No. 2

Appendix A   List of Potentially Coerced DICOM Tags

The following tables present a list of DICOM Tags that may be coerced as part of the normal operation of a Unity PACS Systems. During any normal DICOM Network operation, any or all these tags may be coerced.

The UID related tags (Table 78) may be coerced to ensure complete UID uniqueness and valid SOP references, where appropriate.

The Private Tags (Table 86) are used to store DR-specific, vital data that can not otherwise be stored in other DICOM Tags.

The rest of the Tags are coerced, as necessary, to provide a complete, DICOM-compliant study.

Table 78 - UID Related Tags

Tag	Name
(0002,0003)	File SOP Instance UID
(0008,0018)	SOP Instance UID
(0020,000D)	Study Instance UID
(0020,000E)	Series Instance UID
(0008,1155)	Referenced SOP Instance UID

Table 79 - Patient Related Tags

Tag	Name
(0010,0010)	Patient Name
(0010,0020)	Patient ID
(0010,0030)	Patient Birth Date
(0010,0040)	Patient's Sex
(0010,4000)	Patient Comments
(0008,1080)	Admitting Diagnosis
(0010,1010)	Patient's Age

Table 80 - Study Level Related Tags

Tag	Name
(0008,0020)	Study Date
(0008,0030)	Study Time
(0008,0050)	Accession Number
(0008,0090)	Referring Physician
(0008,1030)	Study Description
(0008,1060)	Reading Radiologist
(0020,0010)	Study ID

Table 81 - Windows Level Related Tags

Tag	Name
(0028,1050)	Window Center
(0028,1051)	Window Width
(0028,1055)	Window Explanation

Table 82 - Equipment/Institution Level Related Tags

Tag	Name
(0008,0070)	Manufacturer
(0008,0080)	Institution Name
(0008,0081)	Institution Address
(0008,1000)	Device Serial Number
(0008,1010)	Station Name
(0008,1020)	Software Version
(0008,1040)	Institutional Department Name
(0008,1050)	Spatial Resolution
(0008,1090)	Manufacturer Model Name
(0008,1200)	Date of Last Calibration
(0008,1201)	Time of Last Calibration
(0028,0120)	Pixel Padding

Table 83 - Series Level Related Tags

Tag	Name
(0008,0021)	Series Date
(0008,0031)	Series Time
(0008,0060)	Modality
(0008,103E)	Series Description
(0020,0011)	Series Number
(0028,0108)	Smallest Pixel Value in Series
(0028,0109)	Largest Pixel Value in Series

Table 84 - Secondary Capture Related Tags

Tag	Name
(0008,0060)	Modality Override Series Value
(0008,0064)	Conversion Type
(0018,0022)	Scan Options
(0018,0023)	MR Acquisition Type
(0018,1010)	Secondary Capture Device ID
(0018,1012)	Date of Secondary Capture
(0018,1014)	Time of Secondary Capture
(0018,1016)	Secondary Capture Device Manufacturer
(0018,1018)	Secondary Capture Device Manufacturer Model Name
(0018,1019)	Secondary Capture Software Version

Table 85 - Image Related Tags

Tag	Name
(0008,0008)	Image Type
(0008,0023)	Image Date
(0008,0033)	Image Time
(0008,2111)	Derivation Description
(0008,2112)	Source Image Sequence
(0008,9215)	Derivation Code Sequence
(0020,0013)	Image / Instance Number
(0020,0020)	Patient Orientation

Tag	Name
(0028,0002)	Samples per Pixel
(0028,0004)	Photometric Interpretation
(0028,0006)	Planar Configuration
(0028,0100)	Bits Allocated
(0028,0101)	Bits Stored
(0028,0102)	High Bit
(0028,0103)	Pixel Representation
(0028,0106)	Smallest Pixel Value i
(0028,0107)	Largest Pixel Value
(0028,0110)	Smallest Pixel Value in Plane
(0028,0111)	Largest Pixel Value in Plane
(0028,1101)	Red Palette Color Lookup Table Descriptor
(0028,1102)	Green Palette Color Lookup Table Descriptor
(0028,1103)	Blue Palette Color Lookup Table Descriptor
(0028,1201)	Red Palette Color Lookup Table Data
(0028,1202)	Green Palette Color Lookup Table Data
(0028,1203)	Blue Palette Color Lookup Table Data
(0028,2110)	Lossy Image Compression
(0028,2112)	Lossy Image Compression Ratio
(0028,2114)	Lossy Image Compression Method
(0028,3000)	Modality LUT Sequence

Table 86 - Private Tags

Tag	Name
(4453,0010)	Private Creator
(4453,1001)	DR Exam ID
(4453,1002)	DR Image Type
(4453,1004)	DR File Type
(4453,1005)	DR File Suffix
(4453,100a)	DR Annotation Type
(4453,100c)	DR Original Instance UID Sequence