BRIT Systems

DICOM Conformance Statement

Roentgen Works

Release 2.2

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Revision History

Date	Release Number	Revised By	Sections Affected	Comments
03/20/2020	2.0	Kyle A Boyd	All	Updated Layout
10/05/2020	2.1	Kyle A Boyd		Updated Supported SOP Classes
03/06/2025	2.2	Kyle A Boyd		Updated Supported SOP Classes

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1 Conformance Statement Overview

Table 1 – Supported SOP Classes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Image Transfer		
Image Store C-Store	Yes	Yes
Storage Commit	Yes	Yes
Query Retrieve		
Patient Root Model C-FIND	Yes	Yes
Study Root Model C-FIND	Yes	Yes
Study Root Model C-MOVE	Yes	Yes
Study C-GET	No	Yes
Workflow Management		
Modality Worklist Query C-FIND	No	Yes
General		
Verification ECHO	Yes	Yes

2 Introduction

The BRIT Systems Roentgen Works is a fully integrated system that provides the tools necessary to implement a filmless radiology department. The Archive is the component of the Roentgen Works that manages the long-term storage of images. Depending on the customer need, the Archive can be configured to include Disk Arrays, Tape Drives, CD-ROM writer, and Jukeboxes. The Archive manages archival and retrieval of data between the various storage devices. The Archive also manages conversion of data format for images stored in the Archive (ex. convert DICOM to JPEG).

The Archive uses DICOM and HL7 as an interface to the external world. The Archive accepts DICOM association requests for the purpose of storing images, image query and retrieve, and modality workflow management. The Archive will initiate DICOM association requests for the purpose of sending images to an external server and to retrieve images via image query and retrieve. The Archive also responds to requests via the World Wide Web (www). The Archive accepts HL7 request for the purpose of storing orders and reports. The archive initiates HL7 sends for the purpose of forwarding orders and reports to other devices like a CD Burner. BRIT Systems also offers diagnostic quality viewing stations that can communicate with the Archive either with a proprietary interface or pure DICOM.

2.1 Acronyms and Abbreviations

Definitions, terms, and abbreviations used in this document are defined within the DICOM standard. Abbreviations and terms are as follows:

Table 2 – Acronyms and Abbreviations

Abbreviations	Definition
DICOM	Digital Imaging and Communications in Medicine
HL7	Health Level 7
PACS	Picture Archiving and Communication
RIS	Radiology Information System
SCU	Service Class User (the client initiating the service)
SCP	Service Class Provider (the server providing the service)
TCP / IP	Transmission Control Protocol / Internet Protocol

2.2 Related Documents

- DICOM Standard (see www.dicomstandard.org)

3 Implementation Model

The Archive is designed to be highly customizable so it can be molded to fit very unique workflows. It is built on a Unix platform and runs as a single node or in a HA environment. The system saves data to both a rational database and files on the server.

- DICOM Access – The Archive may be defined to allow any calling application entity access or only allow a defined application entity access. Filters may be applied to any defined application entity to limit access, give permissions, or improve performance.
- Image Transfer – The Archive can receive images from multiple sources simultaneously. Then based on the configured rules the Archive will determine which images need to be auto routed and what studies need to be prefetched.
- Query Retrieve – The Archive can handle simultaneous query and retrieve request. A filter may be applied to any application entity to determine what studies can be accessed via query retrieve.
- Workflow Management – Modalities may make simultaneous request from the Archive at any time. A filter may be applied to the modality work list query (MWLQ) for a variety of reasons. The most common reason is to return a smaller subset of data.
- Storage – The Archive has built in processes which run in real time to manage cache and long term storage. By default the Archive stores all long term data in lossless format.
- Synchronization – The Archive can synchronize itself in real time with another Archive using proprietary methods and DICOM. This process provides instant redundancy and is transparent to all users.
- User Access - A user interface is provided to manage the day to day task. The Archive logs all patient access including every user who views or accesses a study.

4 Application Data Flow Diagram

Figure 1 shows the relationship of the Archive to external applications. Other functions, like space management, pre-fetching, worklist generation, etc., are performed by the Archive automatically or via an explicit external request.

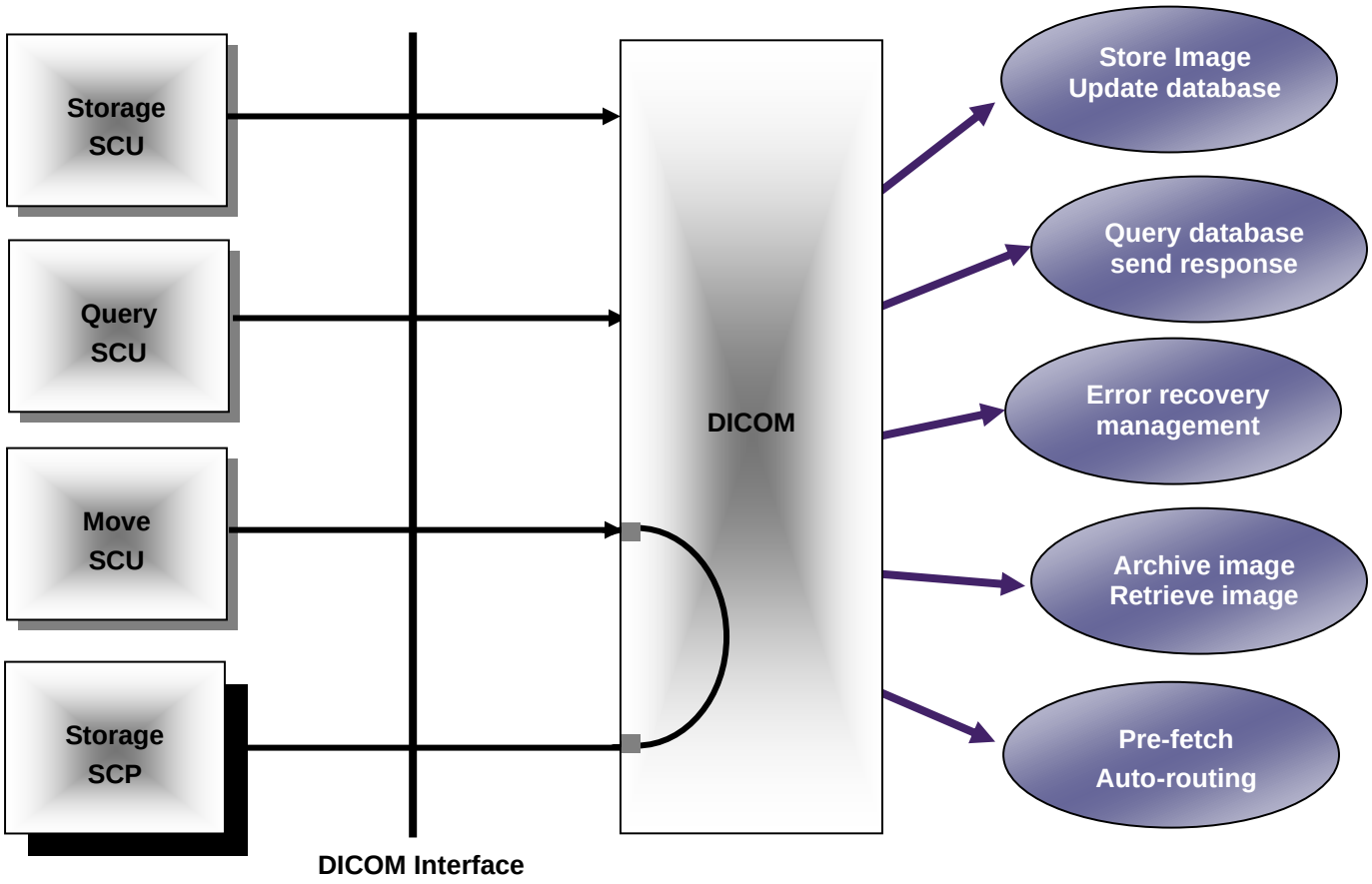

Figure 1 - The Archive Implementation Model

5 Functional Definition of Application Entities

Each site within the Archive has a single application entity used in both SCP and SCU roles. The title of the Archive's application entity may by customized for each site.

The Archive may be defined to allow any calling application entity access or only allow a defined application entity access. Once an application entity is defined, a user may apply filters to this entity to limit access, give permission, or improve performance.

6 Sequencing of Real-World Activities

An example of a study with a matching order:

1) The Archive receives an order for the patient John Doe via HL7 from the RIS.
2) A modality queries the Archive for a list of scheduled orders. The archive returns the complete list with the order for John Doe.
3) The modality starts sending a new study to the Archive for John Doe.
4) Once the modality association is closed, the Archive marks the John Doe study as ready to read.
5) A radiologist will dictate the study and mark the study as READ in the Archive.
6) The reporting engine will send the Archive the radiologist report via HL7.
7) The Archive will save the report with the study and mark the John Doe study as REPORTED.

   Note. Under this scenario the Archive believes the study is ready to read immediately after the modality DICOM association is closed. It is better to use the tech complete study workflow which tells the Archive the study is ready to read.

An example of a study without a matching order:

1) The Archive receives an order for the patient Jane Fisher via HL7 from the RIS.
2) A modality starts sending a new study to the Archive for Jane Smith.
3) Once the modality association is closed, the Archive marks the Jane Smith study as unmatched.
4) A PACS Administrator will use the interface to match the Jane Smith study with the Jane Fisher order. The interface will give them the ability to choose the correct name, ID, and accession number.
5) Once matched, the Archive will mark the study as ready to read.
6) A radiologist will dictate the study and mark the study as READ in the Archive.
7) The reporting engine will send the Archive the radiologist report via HL7.
8) The Archive will save the report with the study and mark the study as COMPLETE.

7 Archive Specification

The Archive provides Standard Conformance to the following DICOM 3.0 SOP Classes as a Storage Class User (SCU) and as a Storage Class Provider (SCP).

The Archive may invoke multiple server processes and instances to handle each SCP and SCU job on a single machine. All of the processes and instances may operate simultaneously.

7.1 Supported SOP Classes

Table 2 – Supported SOP Classes

SOP Class Name	SOP Class UM	SCP	SCP
Image Transfer			
CR (Computed Radiography) Image Information Object Storage	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
US Multi-Frame Image Storage 1993	1.2.840.10008.5.1.4.1.1.3	Yes	Yes
US Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
MR Enhanced Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes
NM Image Storage	1.2.840.10008.5.1.4.1.1.5	Yes	Yes
US Image Storage 1993	1.2.840.10008.5.1.4.1.1.6	Yes	Yes
US Image Information Object Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
SC/HC (Secondary Capture) Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
SC/HC (Secondary Capture) Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Stand Alone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	Yes	Yes
Stand Alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Yes	Yes
Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1	Yes	Yes
SECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
SECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	Yes	Yes
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
PET Curve Storage	1.2.840.10008.5.1.4.1.1.129	Yes	Yes
VL Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes

VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes
Digital Mammo – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital Mammo – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammo – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammo – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Mammo – For Presentation	1.2.840.10008.5.1.4.1.1.3.	Yes	Yes
Digital Mammo – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
Private SOP Classes			
Philips Private Gyroscan MR Series Data	1.3.46.670589.11.0.0.12.2	Yes	Yes
Private Philips MR Examcard Storage	1.3.46.670589.11.0.0.12.4	Yes	Yes
Query / Retrieve			
Patient Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Patient Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Patient Root Query/Retrieve Model – GET	1.2.840.10008.5.1.4.1.2.1.3	Yes	Yes
Study Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Study Root Query/Retrieve Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	Yes
Patient/Study Root Q/R Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	Yes
Patient/Study Root Q/R Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	Yes
Patient/Study Root Q/R Model – GET	1.2.840.10008.5.1.4.1.2.3.3	Yes	Yes
Workflow Management			
Modality Worklist Model – FIND	1.2.840.10008.5.1.4.31	No	Yes
General			
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes

8 Association Establishment Policies

8.1 General Association Information

8.1.1 Implementation Identifying Information

The Archive uses the implementation class UID of 1.2.840.113797.2.1.

8.1.2 Number of Associations

The number of simultaneous associations is not limited by the Archive, but may be limited by the system kernel. Each association accepted by the Archive is spawned off into a dedicated thread from the thread pool.

8.1.3 Asynchronous Nature

The Archive supports asynchronous operations and will perform asynchronous window negotiation. There is no limit to the size of the outstanding asynchronous operations.

8.1.3 PDU Size

The Archive uses the PDU size of unlimited.

8.2 TLS Negotiation

Secure DICOM Connections can be achieved by connecting to Roentgen Works using TLS Negotiation. A different port (3222) must be called to create a TLS connection. All connections are anonymous. Client authentication parameters will be ignored. AES_128_CBC is the required cypher/protocol.

8.3 C-Store Association Policy

The Archive may act as the SCP or SCU for a C-STORE operation.

As the SCP the Archive accept a C-STORE request from a modality, a DICOM Workstation, QC Workstation, CD Importer, another archive, and more. During the negotiation stage the Archive will request images as lossless.

- Modality – The archive will accept images from any DICOM modality.
- DICOM Workstation – A DICOM Workstation like BRIT Vision and PACS View may be configured to send PR and KO images to the Archive
- QC Workstation – A QC Workstation may be configured to send images to the Archive
- CD Importer – A CD Importer may be configured to send images to the Archive.
- Another Archive – Another PACS archive may be configured to C-STORE images to the Archive.

As the SCU the Archive may request a C-STORE for auto routing, as part of a C-MOVE operation, or to fulfill a user request.

- Auto Routing – The server may send new objects to an unlimited number of other C-STORE SCPs.
- Part of a C-MOVE Operation – The server will initiate a C-STORE operation in order to fulfill a C-MOVE request.
- Fulfill a user request – A user may request to send a complete study, series, or an individual image via C-STORE using the interface.

8.3.1 Real World Activity – C-Store Association

Example of real-world activity as an SCP,

1) A modality requests a C-Store request to the Archive.
2) The Archive checks to see if it can accept images from the modality.
    a. If not, an error is returned.
3) The Archive begins accepting images from the modality.
4) The Archive validates each image as it is received.
    a. An error message is returned for the following conditions:
        i. Study UID exist under another patient
        ii. Patient name does not match
        iii. Out of disk space
5) The images are compressed using Lossless JPEG.
6) The images are saved to disk and the Archive's database is updated.
7) Once all the images are received and the association is closed, the archive marks the study as ready to read.

Example of real world activity as an SCU,

1) A new image arrives from a modality.
2) The image matches 1 of the Archive auto routing rules.
3) The Archive adds the image to the route list
4) The Archive routing process initiates a C-STORE request to route the image to specified routing destination (may occur will the study is still being received)

5) If the other destination accepts the C-STORE request and image the route queue event for the image is updated to SENT. If not the event shows FAILED along with the reason.

8.3.2 Supported Presentation Context

Any of the Presentation Contexts shown in Table 3 are acceptable to the Archive for receiving images.

Table 3 – Acceptable Presentation Contexts for the Archive

Abstract Syntax		Transfer Syntax				Role
Name	**UID**	**ILE**	**ELE**	**EBE**	**JPEG**	
Computed Radiography Image	1.2.840.10008.5.1.4.1.1	Yes	Yes	Yes	Yes	SCP
CT Image	1.2.840.10008.5.1.4.1.1.2	Yes	Yes	Yes	Yes	SCP
US Multi-Frame Image Storage 1993	1.2.840.10008.5.1.4.1.1.3	Yes	Yes	Yes	Yes	SCP
US Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes	Yes	Yes	SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes	Yes	Yes	SCP
MR Enhanced Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes	Yes	Yes	SCP
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes	Yes	Yes	SCP
NM Image Storage	1.2.840.10008.5.1.4.1.1.5	Yes	Yes	Yes	Yes	SCP
US Image 1993	1.2.840.10008.5.1.4.1.1.6	Yes	Yes	Yes	Yes	SCP
US Image	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes	Yes	Yes	SCP
SC/HC Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Yes	Yes	Yes	Yes	SCP
SC/HC (Secondary Capture) Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes	Yes	Yes	SCP
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	Yes	Yes	Yes	Yes	SCP
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Yes	Yes	Yes	Yes	SCP
Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1	Yes	Yes	Yes	Yes	SCP
SECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes	Yes	Yes	SCP
SECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes	Yes	Yes	SCP
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes	Yes	Yes	SCP
X-Ray RadiofluoroScopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes	Yes	Yes	SCP
X-Ray Angiographic Bi-Plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes	Yes	Yes	SCP

Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	Yes	Yes	Yes	SCP
Breast Projection X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.13.1.4	Yes	Yes	Yes	Yes	SCP
Breast Projection X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.13.1.5	Yes	Yes	Yes	Yes	SCP
Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	Yes	Yes	Yes		SCP
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes	Yes		SCP
VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	Yes	Yes	Yes		SCP
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes	Yes	Yes	SCP
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	Yes	Yes	SCP
PET Curve Storage	1.2.840.10008.5.1.4.1.1.129	Yes	Yes	Yes	Yes	SCP
VL Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes	Yes	Yes	SCP
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	Yes	Yes		SCP
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes	Yes	Yes	SCP
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes	Yes	Yes	SCP
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes	Yes	Yes	SCP
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.4	Yes	Yes	Yes		SCP
Digital Mammo – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes	Yes	Yes	SCP
Digital Mammo – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes	Yes	Yes	SCP
Digital Mammo – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes	Yes	Yes	SCP
Digital Mammo – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes	Yes	Yes	SCP
Digital Mammo – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes	Yes	Yes	SCP
Digital Mammo – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes	Yes	Yes	SCP
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes	Yes	Yes	SCP
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes	Yes		SCP
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes	Yes		SCP
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes	Yes		SCP
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes	Yes		SCP
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes	Yes		SCP
Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes	Yes		SCP
Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes	Yes		SCP
Structured Report	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes	Yes		SCP
Greyscale Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes	Yes		SCP

Philips Private Gyroscan MR Series Data	1.3.46.670589.11.0.0.12.2	Yes	Yes	Yes		SCP
Private Philips MR Examcard Storage	1.3.46.670589.11.0.0.12.4	Yes	Yes	Yes		SCP

ILE = Implicit Little Endian = 1.2.840.10008.1.2

ELE = Explicit Little Endian = 1.2.840.10008.1.2.1

EBE = Explicit Big Endian = 1.2.840.10008.1.2.2

JPEG = Lossy and Lossless, 8 and 12-16 bit = 1.2.840.100081.2.4.5.1 and 1.2.840.10008.1.2.4.70

JPEG = JPEG 2000 Lossy and Lossless = 1.2.840.10008.1.2.4.90 and 1.2.840.10008.1.2.4.91

8.3.2 Presentation Context Acceptance Criteria

The Archive accepts any number of storage SOP classes that are listed in Table 3 above, provided that the requesting application is known to the Archive and has been enabled to store images on the Archive (via a configuration step). The Archive defines no limit on the number of presentation contexts accepted. In the event that the Archive runs out of resources when trying to accept multiple presentation contexts, the Archive will reject the association request.

8.3.2 Transfer Syntax Selection Policies

The Archive supports multiple transfer syntaxes. If the first proposed transfer syntax is supported by the Archive, it will be accepted. If not, the Implicit VR Little Endian transfer syntax will be chosen.

8.3.2 SOP Class Storage and Conformance

An Archive implements Level 2 (Full) Conformance for the Storage SOP Class.

The Archive may be configured to modify any of the values in the DICOM header. The following attributes are always modified by converting the characters to upper case before the data is stored..

1. Patient Name
2. Patient ID
3. Accession Number
4. Study ID

8.3.2 Storage Validation and Errors

Before accepting the image, the Archive will test validity of the Patient Name, Patient ID, Study Instance UID, Series Instance UID, and SOP Instance UID against the values already in the database. If a conflict is detected, the image may be rejected. Specific details will be included in the DICOM Attribute Error Comment (0x00000902).

In the event that an image is successfully stored by the Archive, it may be accessed by requesting associations with the Archive and performing query/retrieve operations. The Archive stores images for a configurable period.

The Archive returns the following status values in response to a C-STORE request:

0000H	Image successfully stored
A700H	Refused – out of resources (unable to create local file, or other failure)
A900H	Error – data set does not match SOP Class
C000H	Error – cannot understand

In the case of an error storing an image, notification via e-mail or other mechanism can be performed based on configured setting.

8.4 Storage Commit – Push Model Policy

The Archive can be configured to allow or not allow storage commit for each known application entity.

8.4.1 Real World Activity – Storage Commitment Policy

The real world activity associated with Storage Commitment is that an external node wishes to request that the archive commit images/studies to long term storage. At the completion of the commitment operation, the archive will contact the external node using a separate association and send a storage commitment N-Event report to inform the external node that images/studies have been committed.

8.5 C-Move Association Policy

The Archive may act as the SCP or SCU for a C-MOVE operation.

As the SCP the archive attempts to initiate an association in response to C-MOVE requests from other Application Entities. The Archive will only initiate associations in response to valid C-MOVE requests for images that are known to the server (stored in the database). Images will be automatically retrieved from disk if necessary.

As the SCU the archive may request a C-MOVE operation in when prefetching from a third-party server (remote server).

8.5.1 Real World Activity – C-Move Association

Example of real world activity as an SCP,

1) A third party server sends a C-MOVE request to the Archive
2) The archive will verify the destination is an application entity defined in the database
    a. If not defined, then an error message is returned.
3) The archive will verify it has the study to be moved.
    a. If not an error, an error message is returned.

4) If the images are not in memory, the Archive will pull them from long term storage.
5) The archive begins a C-Store operation with the destination server
6) The original third party server will be notified of the progress and success.

Example of real world activity as an SCU,

1) The archive starts receiving a study from a modality.
2) The archive checks the routing rules to see if a prefetch for this study is required. If a prefetch is required it then checks if a remote destination is configured or if we are prefetching from long term storage to cache.
    a. If not a remote destination, then we are done.
3) If we are prefetching from a remote destination, then a C-MOVE may be required.
4) We query the remote destination and check if a match is found (comp).
5) If a comp is found, the Archive initializes a C-MOVE from the third party server to itself.

8.6 C-Find Association Policy

The Archive may act as the SCP or SCU for a C-FIND operation.

As the SCP the Archive accepts C-FIND request and returns the results based on the permissions of the calling ae title.

As the SCU the Archive may initiate a C-FIND request when looking for prior patient studies on a third-party server.

8.6.1 Real World Activity – C-Find Association

An example of a C-Find query,

1) Another archive wishes to query the Archive for a list of today's studies.
2) The other archive initiates a Patient/Study Root Model C-FIND.
3) The Archive validates the calling ae title.
4) The Archive applies access control lists for the calling ae title and performs the search.
5) The Archive returns the results to the other archive

8.6.2 SOP Class Query Conformance

The Archive supports both Patient and Study Root Information Model searching.

- Patient Root Information Model – Table 4 shows all keys supported by this query type.
- Study Root Information Model – Table 4, 5, 6, and 7 show all keys supported by this query type.
- Patient/Study Root Information Model – Table 4, 5, 6, and 7 show all keys supported by this query type.

Table 4 – Keys Supported for Patient Root Information Model

Level	Description	Tag	Type
Patient	Patient Name	00100010	R
Patient	Patient ID	00100020	U
Patient	Patient Birth Date	00100030	O
Patient	Patient Birth Time	00100032	O
Patient	Patient Sex	00100040	O

Table 5 – Keys Supported for Patient and Study Information Model

Level	Description	Tag	Type
Study	Root Level		
Study	Study Date	0008,0020	R
Study	Study Time	0008,0030	R
Study	Accession Number	0080,0050	R
Study	Institution Name	0008,0080	O
Study	Modality	0008,0060	O
Study	Modalities in Study	0008,0061	O
Study	Referring Physician Name	0008,0090	O
Study	Study Description	0008,1030	O
Study	Patient's Age	0010,1010	O
Study	Patient's Weight	0010,1030	O
Study	Patient's Size	0010,1020	O
Study	Medical Alerts	0010,2000	O
Study	Allergies	0010,2110	O
Study	Pregnancy Status	0010,21C0	O
Study	Body Part Examined	0018,0015	O
Study	Study ID	0020,0010	R
Study	Study Instance UID	0020,000D	U
Study	Number of Study Related Series	0020,1206	O
Study	Number of Study Related Images	0020,1208	O
Study	Study Status ID	0032,000A	O

Study	Special Needs	0038,0050	O
Study	Patient State	0038,0500	O
Study	Patient Transport Arrangements	0040,1004	O
Study	Confidentiality Constraint on Patient Data	0040,3001	O
Study	Scheduled Procedure Step Sequence		
Study	Requested Contrast Agent	0040,0100->0032,1070	O
Study	Scheduled Performing Physician's Name	0040,0100->0040,0006	R
Study	Scheduled Procedure Step Description	0040,0100->0040,0007	O
Study	Scheduled Procedure Step ID	0040,0100->0040,0009	O
Study	Scheduled Procedure Step Location	0040,0100->0040,0011	O
Study	Pre-Medication	0040,0100->0040,0012	O

Table 6 – Keys Supported for Patient and Study Information Model

Level	Description	Tag	Type
Series	Modality	00080060	R
Series	Series Number	00200011	R
Series	Series Instance UID	0020000E	U
Series	Series Description	0008103E	O
Series	Number of Series Related Images	00201209	O
Series	View Position	00185101	O
Series	Body Part Examined	00180015	O

Table 7 – Keys Supported for Patient and Study Information Model

Level	Description	Tag	Type
Image	Image Number	00200013	R
Image	SOP Instance UID	00080018	U
Image	SOP Class UID	00080016	O
Image	Samples per Pixel	00280002	O
Image	Rows	00280010	O
Image	Columns	00280011	O
Image	Bits Allocated	00280100	O
Image	Bits Stored	00280101	O
Image	Image Location	00280020	O
Image	Patient Orientation	00200020	O

Image	Photometric Interpretation	00280004	O
Image	Pixel Representation	00280103	O

8.7 Query Retrieve Policy

The Archive may act as the SCP or SCU for a query retrieve operation.

As the SCP the Archive accepts a Patient or Study C-FIND request, C-MOVE request, and C-GET request.

As the SCU the Archive may request a Patient or Study C-FIND request and a C-MOVE request.

8.7.1 Real World Activity – Query Retrieve Policy

An example of a query retrieve,

1) Another archive wishes to query the Archive for a list of today's studies.
2) The other archive initiates a Study Root Model C-FIND.
3) The Archive validates the calling ae title.
4) The Archive applies access control lists for the calling ae title and performs the search.
5) The Archive returns the results to the other archive
6) The other archive then initiates a C-MOVE-RQ (request)
7) The archive will verify the destination is an application entity defined in the database
   i. If not defined, then an error message is returned.
8) The archive will verify it has the study to be moved.
   i. If not an error, an error message is returned.
9) If the images are not in memory, the Archive will pull them from long term storage.
10) The archive begins a C-Store operation with the destination server
11) The original third-party server will be notified of the progress and success.

8.7.2 SOP Class Query Conformance

The Archive supports both Patient and Study Root Information Model searching.

- Patient Root Information Model – C-Find Table 4 shows all keys supported by this query type.
- Study Root Information Model – C-Find Table 4, 5, 6, and 7 show all keys supported by this query type.
- Patient/Study Root Information Model – C-Find Table 4, 5, 6, and 7 show all keys supported by this query type.

8.8 C-ECHO Verification Policy

The Archive accepts C-ECHO request from any device without restrictions. The verification process can check the following information:

- Ip Address
- Port Number
- Calling AE Title – The Archive will respond to any calling AE Title. Note. All other associations require the ae title to be defined in the database.
- Called AE Title – The Archive will respond successfully even if the called ae title is wrong.
- Network – Confirms the device which initiated the verification can communicate with the Archive across the network. It does not confirm the stability of the network

8.8.1 Real World Activity – Verification Policy

An example of a verification process,

1) A new modality is being installed.
2) The tech configures the Archive's ip address and port number
3) The tech performs a C-ECHO verification test from the modality to the Archive. If successful the tech knows the ip address and port number are correct, and the modality can see the Archive across the network.

8.8.2 Presentation Context

Table 7 shows the Presentation Contexts that may be accepted by the Archive for verification operations.

Table 8 – Acceptable Presentation Contexts for Verification

Abstract Syntax		Transfer Syntax		Role
Name	**UID**	**Name**	**UID**	
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP

9 Communications Profiles

9.1 TCP/IP Stack

The Archive provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

9.2 TCP/IP API

The Archive uses the TCP/IP stack from the UNIX system upon which it executes. It uses a subroutine library that is based on a Berkeley socket interface.

9.3 Physical Media Support

The Archive exists as a software application that can be compiled on various UNIX platforms. As such, it places no restrictions on the physical network. The Archive has been tested using TCP/IP over Ethernet (Thick Wire, Thin Wire, 10BaseT), ATM, and PPP modem connections.

10 Extensions / Specializations / Privatizations

10.1 Private Element Policy

BRIT Systems' software products use the private group number **0x0021**. Each product complies with the DICOM specification for assignment and use of private elements (PS 3.5-2007, Sec. 7.8).

10.2 Attribute Table

Table 9 – BRIT Object Action IOD Attribute Table

Attribute Name	Tab	Type	Descriptions
PrivateCreatorData	(0021,00xx)	*Auto*	**DICOM standard identifier for private tags.** The value in this element should always be **"BRIT Systems, Inc."**. This element will be automatically added by all BRIT DICOM toolkits when any BRIT private element is added to an object, if it does not already exist. If it exists, all BRIT DICOM toolkits will automatically use this element to identify and adjust the element numbers used with any BRIT Private elements
BritOriginalSenderAETitle	(0021,xx90)	1	**The AE Title of the original sending modality.** This represents the first AE to send this object to a BRIT Systems DICOM SCP. This element is required if it does not already exist. Once it exists, it should **never** be changed or removed. *There is no way to record which AEs have handled or processed an object before it arrived at the first BRIT Systems SCP.*
BritObjectActionSequence	(0021,xxA0)	1	**Sequence of items describing actions performed on the object by BRIT software products that resulted in the object being received or modified.** This sequence is required if it does not already exist. Whenever a BRIT application receives or modifies a DICOM object, this sequence should be appended with a new item describing the action performed.

>PrivateCreatorData	(0021,00yy)	*Auto*	**DICOM standard identifier for private tags.** The value in this element should always be **"BRIT Systems, Inc."**. This element will be automatically added by all BRIT DICOM toolkits when any BRIT private element is added to an object, if it does not already exist. If it exists, all BRIT DICOM toolkits will automatically use this element to identify and adjust the element numbers used with any BRIT Private elements.
>BritSoftwareTitle	(0021,yy91)	1	**Name of the BRIT software package that inserted this item into the sequence.**
>BritSoftwareVersion	(0021,yy92)	1	**Version of the BRIT software package that inserted this item into the sequence.**
>BritSerialNumber	(0021,yy93)	2	**Serial number of the system running the BRIT software that inserted this item into the sequence, if known.** BRIT PC numbers can be used as serial numbers. This is intended as a way to trace events back to specific hardware.
>BritObjectAction	(0021,yyA1)	1	**Description of the action performed.**
>BritObjectActionDate	(0021,yyA2)	1	**Date when the action was performed.**
>BritObjectActionTime	(0021,yyA3)	1	**Time when the action was performed.**
>BritObjectActionUser	(0021,yyA4)	2	**Login name of the user logged in when this item was inserted into the sequence, if available.** This element is required for client applications (e.g. viewers, RRis client). Actions performed by BRIT server products may choose to omit this element or insert some other identifying information (e.g. AE title and IP of the server).
>BritLocalAETitle	(0021,yyA5)	2	**AE Title assigned to the BRIT software/SCU performing the action.**
>BritLocalIPAddress	(0021,yyA6)	2	**IP Address assigned to the BRIT software/SCU performing the action.** If a DICOM association is used to transfer the object being acted upon, the IP address should be obtained from the open socket as this will represent the actual network adapter being used which can be useful on a multi-homed system. Otherwise, the value assigned to the host in its configuration files should be used.
>BritRemoteAETitle	(0021,yyA7)	2	**AE Title disclosed by the remote AE.** This element is only required in the sequence item if the object being acted upon is being received by (or sent to) a remote AE.
>BritRemoteIPAddress	(0021,yyA8)	2	**IP Address of the remote AE.** This element is only required in the sequence item if the object

			being acted upon is being received by (or sent to) a remote AE. The IP address stored here should be obtained from the open socket for the association, if possible.

11 Security Features

11.1 Association Level Security

The Archive will only accept images or return data to a known calling aetitle and ip address. The aetitle and ip address is considered known only if it is defined in the Archive prior to the association attempt. If an unknown aetitle opens an association with the archive, it will log the activity in the DICOM logs.

11.2 Application Level Security

The Archive uses DICOM communication and is expected to be used within a secure environment which includes:

- Virtual Private Network (VPN) access to devices outside of the secured local network
- Secure TLS connections can be used to avoid the need for a VPN
- Firewall or router protection to ensure only authorized devices have access

11.3 Audit Records

The Archive only gives authorized users the ability access and change data. A user's actions are recorded in audit records which can be used to answers the following types of questions:

- Who accessed the study or report?
- Who exported the study or report and where did they send it?
- Who changed the status of the study or report?
- Who made the change?
- Who deleted the object?

12 Configuration

12.1 SCP Configuration

The following parameters may be configured for the Archive:

- Application Entity Title
- TCP/IP Port Number (default=3200)

12.2 Living Configuration

Similar to a living document the Archive configuration may evolve overtime to fulfill the needs of the workflow. The Archive has a very large set of configurable options which can be mixed and matched

based on the desired workflow. Once saved most configuration options take effect immediately, and a few of the options require a process restart. Two of the common configuration's options are shows below:

12.3 Application Entity Configuration

A user may use the provided interface to manage a list of application entities used by the Archive. Below is a list of some options you can manage.

- Manage the Ip address, port number, and title
- Setup secure TLS connection parameters

12.4 Auto Routing and Prefetching Configuration

The server may be configured to auto routing and prefetch studies with the following options:

- Add rules to determine if a study should be auto routed and where it should be routed
- Number of concurrent auto routing and prefetching processes

12.5 Storage Retention

Storage retention rules may be configured on the Archive to meet the needs of hospitals, imaging centers, and teleradiology.