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ImageBroker 4.2

DICOM Conformance Statement 1.0

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Table of Contents

1	Introduction	7
1.1	Purpose	7
1.2	Scope	8
1.3	Definitions, Acronyms and Abbreviations	8
1.3.1	Definitions	8
1.3.2	Acronyms and Abbreviations	9
1.4	References	9
2	Implementation Model	10
2.1	Application Data Flow Diagram	11
2.2	Functional Definition of Application Entities	13
2.3	Sequencing of Real-World Activities	14
3	ImageBroker Application Entity Specification	14
3.1	Association Establishment Policies	18
3.1.1	General	18
3.1.2	Number of Associations	18
3.1.3	Implementation Identifying Information	18
3.2	Association Initiation Policy	18
3.2.1	Operator Initiated Communication Verification	19
3.2.1.1	Associated Real-World Activity (User Echo)	19
3.2.1.2	Proposed Presentation Contexts	19
3.2.1.3	SOP Specific Conformance	19
3.2.1.4	Association Termination	19
3.2.2	User Initiated Image Send	20
3.2.2.1	Associated Real-World Activity (User Send)	20
3.2.2.2	Proposed Presentation Contexts	20
3.2.2.3	SOP Specific Conformance	21
3.2.2.4	Association Termination	21
3.2.3	Retrieve-Initiated Image Send	22
3.2.3.1	Associated Real-World Activity (Retrieval Send)	22
3.2.3.2	Proposed Presentation Contexts	22
3.2.3.3	SOP Specific Conformance	23
3.2.3.4	Association Termination	24
3.2.4	Auto Initiated Image Send	24
3.2.4.1	Associated Real-World Activity (Auto Send)	24
3.2.4.2	Proposed Presentation Contexts	24
3.2.4.3	SOP Specific Conformance	24
3.2.4.4	Association Termination	25
3.2.5	New Study initiated Study Content Notification	25
3.2.5.1	Associated Real-World Activity (Send Study Content Notifications)	25
3.2.5.2	Proposed Presentation Contexts	25
3.2.5.3	SOP Specific Conformance	25
3.2.6	Operator initiated Send MPPS	26
3.2.6.1	Associated Real-World Activity (Send MPPS)	26
3.2.6.2	Proposed Presentation Contexts	26
3.2.6.3	SOP Specific Conformance	27
3.2.6.4	Association Termination	27
3.2.7	Auto Initiated Storage Commitment Push	28
3.2.7.1	Associated Real-World Activity (Storage Commitment Push)	28
3.2.7.2	Proposed Presentation Contexts	28

3.2.7.3	SOP Specific Conformance.....	28
3.2.7.4	Association Termination	29
3.2.8	Auto Initiated Storage Commitment Request	29
3.2.8.1	Associated Real-World Activity (Storage Commitment Request)	29
3.2.8.2	Proposed Presentation Contexts.....	29
3.2.8.3	SOP Specific Conformance.....	29
3.2.8.4	Association Termination	29
3.2.9	Auto Initiated Modality Worklist Query.....	29
3.2.9.1	Associated Real-World Activity (Query Modality Worklist).....	29
3.2.9.2	Proposed Presentation Contexts.....	30
3.2.9.3	SOP Specific Conformance.....	30
3.2.9.3.1	Status codes for C-FIND.....	30
3.2.9.3.2	Supported DICOM Elements	30
3.3	Association Acceptance Policy	31
3.3.1	Respond to Communication Verification Requests	32
3.3.1.1	Associated Real-World Activity	32
3.3.1.2	Acceptable Presentation Contexts	32
3.3.1.3	SOP Specific Conformance.....	32
3.3.1.4	Presentation Context Acceptance Criteria	32
3.3.1.5	Transfer Syntax Selection Policies.....	32
3.3.2	Receive Images for Storage	32
3.3.2.1	Associated Real-World Activity	32
3.3.2.2	Acceptable Presentation Contexts	33
3.3.2.3	SOP Specific Conformance.....	35
3.3.2.4	Presentation Context Acceptance Criteria	36
3.3.2.5	Transfer Syntax Selection Policies.....	36
3.3.3	Query the Database and Retrieve Images	36
3.3.3.1	Associated Real-World Activity	36
3.3.3.2	Acceptable Presentation Contexts	37
3.3.3.3	SOP Specific Conformance for Query (C-FIND) SOP Classes	37
3.3.3.4	SOP Specific Conformance for Retrieve (C-MOVE) SOP Classes	41
3.3.3.5	Presentation Context Acceptance Criteria	43
3.3.3.6	Transfer Syntax Selection Policies.....	43
3.3.4	Forward MPPS.....	44
3.3.4.1	Associated Real-World Activity	44
3.3.4.2	Acceptable Presentation Contexts	44
3.3.4.3	SOP Specific Conformance.....	44
3.3.4.4	Presentation Context Acceptance Criteria	45
3.3.4.5	Transfer Syntax Selection Policies.....	45
3.3.5	SCU initiated Send Storage Commitment Archive	45
3.3.5.1	Associated Real-World Activity	45
3.3.5.2	Acceptable Presentation Contexts	46
3.3.5.3	SOP Specific Conformance.....	46
3.3.5.4	Presentation Context Acceptance Criteria	47
3.3.5.5	Transfer Syntax Selection Policies.....	47
3.3.6	SCU Initiated Send Modality Worklist.....	48
3.3.6.1	Associated Real-World Activity	48
3.3.6.2	Proposed Presentation Contexts.....	48
3.3.6.3	SOP Specific Conformance.....	48
3.3.6.3.1	Supported DICOM Elements	48
3.3.6.3.2	Status codes for C-FIND.....	49
3.3.6.3.3	Association Termination.....	50
4	Communication Profiles	50
4.1	Supported Communication Stacks.....	50
4.1.1	TCP/IP Stack	50

4.1.1.1 Physical Network Media Support 50

5 Configuration 51

6 Support of Extended Character Sets 52

Historie 53

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List of Figures

Figure 1: ImageBroker Implementation Model 11

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List of Tables

Table 1: Definitions.....	9
Table 2: Acronyms and Abbreviations.....	9
Table 3: Supported DICOM Verification SOP Classes and Roles	14
Table 4: Supported DICOM Study Content Notification SOP Classes and Roles	14
Table 5: Supported DICOM Storage Commitment SOP Classes and Roles	14
Table 6: Supported DICOM Storage SOP Classes and Roles	17
Table 7: Supported DICOM Query/Retrieve SOP Classes and Roles.....	17
Table 8: Supported DICOM Study Management SOP Classes and Roles.....	17
Table 9: Supported DICOM Modality Worklist SOP Classes and Roles.....	17
Table 10: Implementation Identifying Information	18
Table 11: Proposed presentation context for verification	19
Table 12: Proposed presentation contexts for operator-initiated image send.....	20
Table 13: Behavior when receiving C-STORE response status codes (operator initiated)	21
Table 14: Proposed presentation contexts for retrieve initiated image send	23
Table 15: Behavior when receiving C-STORE response status codes (retrieve initiated).....	23
Table 16: Behavior when receiving C-STORE response status codes (auto initiated).....	24
Table 17: Proposed presentation contexts for operator-initiated study content notification	25
Table 18: Behavior when receiving C-STORE response status codes (operator initiated)	26
Table 19: Proposed presentation contexts for operator initiated MPPS	27
Table 20: Behavior when receiving N-CREATE or N-SET response status codes (operator initiated) ..	27
Table 21: Proposed presentation contexts for Storage Commitment Push (N-EVENT-REPORT)	28
Table 22: Correspondence between flag in database and Event Type ID.....	28
Table 23: Proposed presentation contexts for Storage Commitment Push (N-ACTION)	29
Table 24: Proposed presentation contexts for Modality Worklist Query	30
Table 25 Behavior when receiving C-FIND response status codes.....	30
Table 26 Dicom attributes for Modality Worklist	31
Table 27: Acceptable presentation context for verification.....	32
Table 28: Acceptable presentation contexts for storage	34
Table 29 C-STORE response status codes	36
Table 30: Acceptable presentation contexts for Query/Retrieve	37
Table 31: Supported Patient Level Query Keys	38
Table 32: Supported Study Level Query Keys	38
Table 33: Supported Series Level Query Keys	38
Table 34: Supported Image Level Query Keys	40
Table 35: Supplementary Response Identifier Keys	41
Table 36: C-FIND response status codes	41
Table 37: C-MOVE response status codes	43
Table 38: Acceptable presentation contexts for Modality Performed Procedure Step	44
Table 39: N-CREATE or N-SET response status codes	45
Table 40: Acceptable presentation contexts for Storage Commitment Push (N-ACTION).....	46
Table 41: N-ACTION response status codes	47
Table 42 Proposed presentation contexts for operator initiated query for modality worklist.....	48
Table 43 Dicom attributes for Modality Worklist	49
Table 44: Behavior when receiving C-FIND response status codes.....	49

1 Introduction

1.1 Purpose

A DICOM Conformance Statement is intended to describe which components, optional components or extensions of the DICOM standard are supported by a particular implementation. The Conformance Statement of one implementation can be compared with the Conformance Statement from another implementation to determine which capabilities are commonly supported.

DICOM does not, by itself, guarantee interoperability. Furthermore, the identification of common capabilities by comparing DICOM Conformance Statements is also not sufficient to guarantee connectivity between devices.

A DICOM Conformance Statement cannot replace validation and cross-vendor testing with other devices. Validation and cross-vendor testing are still required to ensure that both devices are performing as intended.

The reader should be aware of a number of important issues:

- Even when comparing this Conformance Statement with the Conformance Statement of another device indicates that connectivity is possible, the system integrator is responsible for carrying out test procedures to ensure that the required connectivity is actually met.
- Neither the DICOM Standard nor this Conformance Statement can ensure interoperability when integrating devices from different vendors. It is the system integrator's responsibility to ensure that the application requirements of all devices within the complete system are met.
- The DICOM standard undergoes continual review and improvement in order to meet changing requirements. Corrections, extensions and additional services are added from time to time. Medigration reserves the right to make changes to the product described in this conformance statement in order to cover changes in the DICOM standard. Readers should be aware that connected devices should also follow changes in the DICOM standard in order to retain connectivity.

The intended audience for this Conformance Statement is hospital technical staff, system integrators and software engineers. The reader is assumed to have good understanding of the DICOM standard.

1.2 Scope

This conformance statement describes the DICOM capabilities of the medigration ImageBroker.

The ImageBroker is a combination of software components to store medical images and realize long term archival.

The software system is specifically designed to be integrated into a DICOM network environment containing Modalities and Workstations from different vendors. It supports those DICOM services needed to receive images and other objects for archival, to query the contents of the archive and to retrieve images and other objects from the archive. The ImageBroker is capable of archiving any kind of DICOM composite object such as images, overlays, lookup-tables, waveforms, presentation states or radiotherapy plans which can be stored using the Storage Service Class. In an effort not to increase the number of confusing acronyms and abbreviations, this document generally uses the term "image", to refer to any kind of object which can be stored by the ImageBroker.

The medigration ImageBroker supports a variety of long-term storage options from fixed magnetic disks, RAID subsystems, exchangeable BluRay, DVD-RAM/DVD-R and CD media to Jukeboxes containing hundreds of media.

This Conformance Statement describes the DICOM Conformance of the network interface. Images are written to offline media for archiving in the transfer syntax with which they were received using the DICOM File Format and accompanying DICOM Directory File (DICOMDIR). Although images are written to archive media using formats defined by DICOM, there currently exists no appropriate Media Application Profile allowing multiple transfer syntaxes and therefore no claim regarding the conformance of archive media to the DICOM standard can be made at this time.

1.3 Definitions, Acronyms and Abbreviations

1.3.1 Definitions

<i>Definition</i>	<i>Description</i>
System Integrator	A person or organization responsible for integrating devices into a new or existing system. The System Integrator takes responsibility for ensuring that the system works as a whole.
Offline	SOP Instances which are not readily available are said to be offline (e.g. images stored on a DVD-RAM media which is currently not accessible because it is located on an archive shelf).
Offline Media	Removable storage media such as disks or tapes which are not always accessible. (e.g. CD-ROM, DVD-RAM, DVD-R).
Online	SOP Instances which are readily available are said to be online (e.g. images stored on the local magnetic disk).

Restore	An operation causing SOP Instances which are offline to be brought online (e.g. by requesting an operator to insert a specific Offline Media in a device for reading).
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Table 1: Definitions

Other definitions can be found within the different parts of the DICOM standard [1].

1.3.2 Acronyms and Abbreviations

<i>Acronym/Abbreviation</i>	<i>Description</i>
AE	A pplication E ntity
DCO	D ICOM C omposite O bject. A DICOM object such as an image, overlay, lookup-table, waveform, presentation state or radiotherapy plan which can be stored using the Storage Service Class.
GSPS	G rayscale S oftcopy P resentation S tate
KIN	K ey I mage N ote
OM	O ffline M edia
MPPS	M odality P erformed P rocedure S tep
MWL	M odality W orklist
SCP	S ervice C lass P rovider
SCU	S ervice C lass U ser
SR	S tructured R eport
SW	S oftware

Table 2: Acronyms and Abbreviations

Other acronyms and abbreviations used within this document are defined within the different parts of the DICOM standard [1].

1.4 References

- [1] DICOM, Public Standard 3.1 - 2016b, NEMA 1300 N. 17th Street Rosslyn, Virginia 22209, USA.

2 Implementation Model

The ImageBroker is a software system for the archival of DICOM Composite Objects (DCOs). The objects which can be stored include a wide variety of DICOM images (e.g. CT, MR, US, etc.) and other objects (e.g. presentation states, print objects, radiotherapy objects, overlays, waveforms, look-up tables, etc.). ImageBroker receives DCOs over a network interface, stores them on local magnetic disks and archives them to offline media. It maintains a database of summary information about stored objects and allows this database to be queried and stored objects to be retrieved by other networked devices. In addition, ImageBroker provides a user interface for configuring and managing operating parameters, investigating the contents of the object store, managing offline media, manually sending selected studies over a network interface to remote devices and for verifying connectivity. This user interface is integrated into the ImageVision application, also a diagnostic workstation capable for displaying images from the ImageBroker.

The ImageBroker also acts as a Performed Procedure Step Manager to forward Modality Performed Procedure Step information sent from an acquisition modality or other image creator to any device which is interested in this information.

The ImageBroker is a combination of many independent software components, which act with each other.

2.1 Application Data Flow Diagram

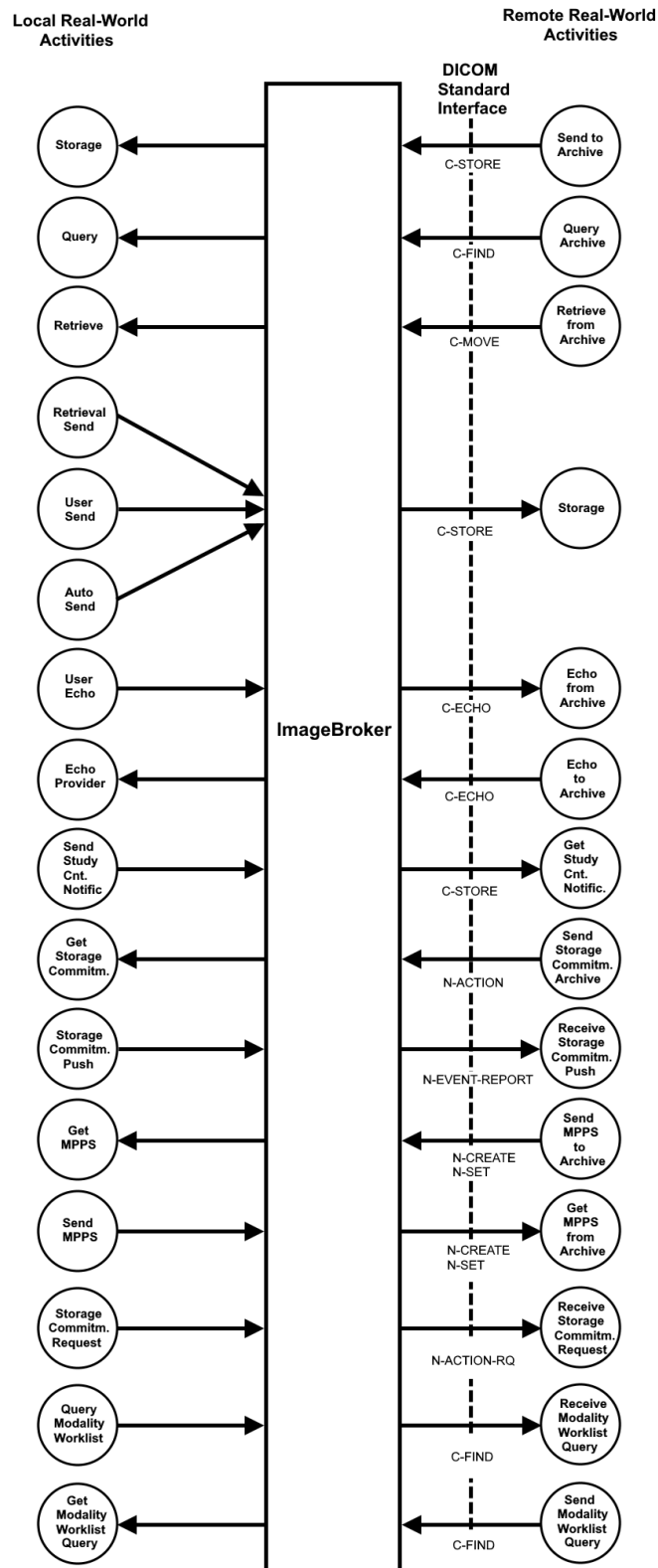


Figure 1: ImageBroker Implementation Model

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Figure 1 illustrates the relationships between the ImageBroker Application Entity (AE) and its associated Real-World Activities. The **Remote Real-World Activities** are shown on the right and the **Local Real-World Activities** are shown on the left.

Send to Archive is an activity performed by a remote device to send images to the ImageBroker to be stored by the **Storage** local activity.

Query and **Retrieve** are activities performed by the ImageBroker to answer queries of a remote device and to receive orders for sending images. The processing of Query/Retrieve requests is managed by the **Query Archive** and the **Retrieve from Archive** activity of the remote device.

Images can be sent either as the result of a retrieve request by the **Retrieval Send** local activity, upon operator request by the **User Send** local activity or automatically based on configurable rules by the **Auto Send** activity. They are stored by the **Storage** activity on the remote device.

User Echo is an activity performed by the ImageBroker to verify the ability of a remote device to respond to DICOM messages. Echo messages will be sent upon operation request. They are responded by the **Echo from Archive** activity on the remote device.

Echo to Archive is an activity performed by a remote device to verify the ability of the ImageBroker to respond to DICOM messages. The local activity **Echo Provider** will respond to a received echo message.

Send Study Content Notifications is an activity performed by the ImageBroker to send information about the content of newly arrived studies. The activity **Get Study Content Notifications** is performed by a remote device to receive the content of these studies.

A **Storage Commitment Push** is an activity performed by the ImageBroker to send information about the commitment of archived images. This information is received by the activity **Receive Storage Commitment Push** of a remote device.

The activity **Send Storage Commitment Archive** is performed by a remote device to initiate sending storage commitments. The associated local real-world activity is **Get Storage Commitment**.

Send MPPS to Archive is an activity performed by a remote device to send Modality Performed Procedure Step notifications to the ImageBroker to be stored by the **Get MPPS** local activity.

Send MPPS is an activity performed by the ImageBroker to send Modality Performed Procedure Step notifications to a remote device. The activity **Get MPPS from archive** is performed by a remote device to receive the Modality Performed Procedure Step notifications.

Storage Commitment Request is an activity performed by the ImageBroker to send storage commitment requests to an external archive. The activity **Receive Storage Commitment Request** is performed to receive the storage commitment requests.

Query Modality Worklist is an activity performed by the ImageBroker to send a worklist query request to a remote application entity. **Receive Modality Worklist Query** is performed by a remote device to receive the query.

Send Modality Worklist Query is an activity performed by an SCU to send modality worklist query (C-FIND) to the ImageBroker. **Get Modality Worklist Query** is performed by the ImageBroker to respond by sending a modality worklist response back to the querying SCU.

2.2 Functional Definition of Application Entities

The ImageBroker software acts as a single Application Entity (AE) providing a general archive service for medical images and other related objects. The AE is able to receive images for storage, respond to query and retrieve requests, to send images, study content notification, storage commitment (in role SCP) and other objects to remote devices and to verify connectivity. It is also able to act as a SCU and a SCP for the Modality Performed Procedure Step SOP Class.

The ImageBroker acts as an SCU of the following DICOM Service Classes:

- Verification
- Storage
- Study Content Notification
- Modality Performed Procedure Step
- Modality Worklist
- Storage Commitment

The ImageBroker acts as an SCP of the following DICOM Service Classes:

- Verification
- Storage
- Query/Retrieve
- Storage Commitment
- Modality Performed Procedure Step
- Modality Worklist Server

2.3 Sequencing of Real-World Activities

No sequencing of Real-World activities is relevant except that images must be available before they can be retrieved. Images can be made available by reception via the DICOM Storage Service Class or by import from offline media.

3 ImageBroker Application Entity Specification

The ImageBroker provides standard conformance to the Verification Service Class by supporting the SOP Class and roles listed in Table 3.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Verification	1.2.840.10008.1.1	SCU/SCP

Table 3: Supported DICOM Verification SOP Classes and Roles

The ImageBroker provides standard conformance to the Study Content Notification Service Class by supporting the SOP Class and roles listed in Table 4.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Basic Study Content Notification	1.2.840.10008.1.9	SCU

Table 4: Supported DICOM Study Content Notification SOP Classes and Roles

The ImageBroker provides standard conformance to the Storage Commitment Service Class by supporting the SOP Class and roles listed in Table 5.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Storage Commitment Push	1.2.840.10008.1.20.1	SCU/SCP

Table 5: Supported DICOM Storage Commitment SOP Classes and Roles

The ImageBroker provides standard conformance to the Storage Service class by supporting the SOP Classes and roles listed in Table 6.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCU/SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCU/SCP
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	SCU/SCP
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	SCU/SCP
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	SCU/SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCU/SCP

Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	SCU/SCP
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	SCU/SCP
Color Softcopy Presentation	1.2.840.10008.5.1.4.1.1.11.2	SCU/SCP
State Storage		SCU/SCP
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	SCU/SCP
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	SCU/SCP
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	SCU/SCP
X-Ray 3D Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.13.1.1	SCU/SCP
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	SCU/SCP
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	SCU/SCP
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	SCU/SCP
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1. 1	SCU/SCP
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2. 1	SCU/SCP
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4. 1	SCU/SCP
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5. 1	SCU/SCP
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5. 2	SCU/SCP
Ophthalmic Tomography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5. 4	SCU/SCP
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	SCU/SCP
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	SCU/SCP
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	SCU/SCP
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	SCU/SCP
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	SCU/SCP
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	SCU/SCP
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	SCU/SCP
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	SCU/SCP
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	SCU/SCP
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	SCU/SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	SCU/SCP
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	SCU/SCP
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	SCU/SCP
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3	SCU/SCP
Multi-frame True Color Secondary	1.2.840.10008.5.1.4.1.1.7.4	SCU/SCP

Capture Image Storage		
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	SCU/SCP
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	SCU/SCP
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	SCU/SCP
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	SCU/SCP
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	SCU/SCP
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	SCU/SCP
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	SCU/SCP
Stand-alone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	SCU/SCP
Stand-alone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	SCU/SCP
Stand-alone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	SCU/SCP
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	SCU/SCP
Standalone PET Curve Storage	1.2.840.10008.5.1.4.1.1.129	SCU/SCP
Stored Print Storage	1.2.840.10008.5.1.1.27	SCU/SCP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	SCU/SCP
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	SCU/SCP
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	SCU/SCP
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	SCU/SCP
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	SCU/SCP
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	SCU/SCP
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	SCU/SCP
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	SCU/SCP
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	SCU/SCP
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	SCU/SCP
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	SCU/SCP
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	SCU/SCP
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	SCU/SCP
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	SCU/SCP
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	SCU/SCP
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	SCU/SCP
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	SCU/SCP
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	SCU/SCP
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	SCU/SCP

Key Object Selection	1.2.840.10008.5.1.4.1.1.88.59	SCU/SCP
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	SCU/SCP
Encapsulated Document	1.2.840.10008.5.1.4.1.1.104.1	SCU/SCP

Table 6: Supported DICOM Storage SOP Classes and Roles

The ImageBroker provides standard conformance to the Query/Retrieve Service class by supporting the SOP Classes and roles listed in Table 7.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	SCP
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	SCP
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	SCP
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	SCP
Patient/Study Only Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	SCP
Patient/Study Only Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	SCP

Table 7: Supported DICOM Query/Retrieve SOP Classes and Roles

The ImageBroker provides standard conformance to the Study Management Service class by supporting the SOP Classes and roles listed in Table 8.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	SCU/SCP

Table 8: Supported DICOM Study Management SOP Classes and Roles

The ImageBroker provides standard conformance to the Modality Worklist Service class by supporting the SOP Classes and roles listed in Table 9.

<i>SOP Class Name</i>	<i>UID</i>	<i>Role</i>
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	SCU/SCP

Table 9: Supported DICOM Modality Worklist SOP Classes and Roles

3.1 Association Establishment Policies

3.1.1 General

All relevant DICOM communication parameters (AE Titles, hostnames or IP addresses, port numbers, etc.) are configurable. See section 5 for more information on configurable parameters. A maximum PDU size of 16 KB will be offered when establishing associations. Any maximum PDU size will be accepted although PDU sizes larger than 64 KB will never be sent.

3.1.2 Number of Associations

The number of concurrent associations which can be accepted is configurable. See section 5 for more information on configurable parameters.

No fixed limit exists on the number of associations which can be initiated other than the resource limits imposed by the underlying operating system.

3.1.3 Implementation Identifying Information

<i>Information</i>	<i>Value</i>
Implementation Class UID:	1.2.276.0.7230010.3.0.3.5.4
Implementation Version Name:	OFFIS_DCMTK_354

Table 10: Implementation Identifying Information

3.2 Association Initiation Policy

The ImageBroker will initiate associations in the following situations:

- When instructed by an operator (via the user interface) to verify communication.
- When instructed by an operator (via the user interface) to send images to a remote device
- As the result of a retrieve request (C-MOVE) in order to perform the sub-operations necessary to send the requested images to a remote device.
- After reception of a new study a Study Content Notifications will be sent.
- When instructed by an operator (Autoroute) to send images to remote devices.

- As the result of a query request (Storage Commitment) in order to send an N-EVENT Report about the committed images to the remote device.
- In regular intervals to query an external archive for Storage Commitment (when option is configured)
- In regular intervals to query an external Modality Worklist SCP for worklist data (when option is configured)

3.2.1 Operator Initiated Communication Verification

3.2.1.1 Associated Real-World Activity (User Echo)

An operator can – via a graphical user interface – initiate a test to verify communication. The associated local real-world activity is **User Echo** and the remote real-world activity is **Echo From Archive**. The communication verification test is considered successful if an association can be established, a presentation context for the Verification SOP Class can be negotiated, a response is received from a C-ECHO request and the association is released.

3.2.1.2 Proposed Presentation Contexts

A single presentation context will be proposed for *operator-initiated communication verification* as shown in Table 11.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 11: Proposed presentation context for verification

3.2.1.3 SOP Specific Conformance

Standard conformance is provided for the Verification SOP Class.

3.2.1.4 Association Termination

The association will be released upon receipt of the C-ECHO-RSP message.

3.2.2 User Initiated Image Send

3.2.2.1 Associated Real-World Activity (User Send)

An operator can – via a graphical user interface – initiate sending images to a remote application entity. The associated local real-world activity is **User Send** and the remote real-world activity is **Storage**. The operator can select any appropriate grouping of images (e.g. all patient images, all images of specific studies, selected series, individual images, etc.). All select images will be sent over a single association.

3.2.2.2 Proposed Presentation Contexts

One or more presentation contexts will be proposed for *user-initiated image send as outlined* in Table 12. However, only those Storage SOP Classes of images to actually be sent will be proposed (e.g. if only CT images are to be sent then only the CT Image Storage SOP Class will be proposed as an abstract syntax). Each abstract syntax will be proposed within at least 2 presentation contexts using different transfer syntax subsets. The presentation context proposal policy attempts to propose abstract syntax/transfer syntax combinations such that the original transfer syntax of received images can be maintained when sending images. This behavior is intended to eliminate transfer syntax conversion wherever possible and is particularly beneficial in the context of digitally signed images.

The presentation context proposal policy can be modified by configuration options so that only the default transfer syntax (Implicit VR Little Endian) is proposed during association negotiation with specific application entities.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Any of the Storage SOP Class names listed in Table 6.	Any of the Storage SOP Class UIDs listed in Table 6.	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2.	SCU	None

Table 12: Proposed presentation contexts for operator-initiated image send

3.2.2.3 SOP Specific Conformance

The behavior when receiving C-STORE response status codes is shown in Table 13. The operator will be informed by posting a message to the operator's user interface message area.

<i>Status Code</i>	<i>Meaning</i>	<i>Behavior when receiving status code</i>
	Any other status code not included in this table	The send activity will be terminated (the remaining images will not be sent). An error message will be posted to the operator and an error message recorded in a log file.
A7xx	Refused – Out of Resources	
A9xx	Error – Data Set does not match SOP Class	The remaining images will be sent if possible. An error message will be posted to the operator and an error message recorded in a log file.
Cxxx	Error – Cannot Understand	
B000	Warning – Coercion of Data Elements	The operator will be informed after all images have been sent.
B007	Warning – Data Set does not match SOP Class	
B006	Warning – Elements Discarded	
0000	Success	

Table 13: Behavior when receiving C-STORE response status codes (operator initiated)

Extended negotiation is not supported for the **User Send** Real-World Activity. All optional attributes included in Storage SOP Instances will be sent as originally received. Storage SOP Instances are stored without modification when received and are not modified when sent. No additional attributes are added. The ImageBroker application entity is bit-preserving and maintains the integrity of any embedded digital signatures when sending provided the original transfer syntax is supported by the remote Application Entity.

3.2.2.4 Association Termination

The association will be released upon receipt of the C-STORE-RSP message for the last sent image or upon receipt of refused or unknown status code.

If the peer AE aborts the association prematurely, all unsent SOP Instances are considered failed.

3.2.3 Retrieve-Initiated Image Send

3.2.3.1 Associated Real-World Activity (Retrieval Send)

A new association will be established in response to a retrieve request (C-MOVE) Received by the **Retrieve** Real-World Activity. The local real-world activity is **Retrieval Send** and the remote real-world activity is **Storage**. All images referenced by a single C-MOVE request will be sent over a single association.

3.2.3.2 Proposed Presentation Contexts

One or more presentation contexts will be proposed for *retrieve initiated image send as outlined* in Table 14. However, only those Storage SOP Classes of images to actually be sent will be proposed (e.g. if only CT images are to be sent then only the CT Image Storage SOP Class will be proposed as an abstract syntax). Each abstract syntax will be proposed within at least 2 presentation contexts using different transfer syntax subsets. The presentation context proposal policy attempts to propose abstract syntax/transfer syntax combinations such that the original transfer syntax of received images can be maintained when sending images. The behavior is intended to eliminate transfer syntax conversion wherever possible and is particularly beneficial in the context of digitally signed images.

The presentation context proposal policy can be modified by configuration options so that only the default transfer syntax (Implicit VR Little Endian) is proposed during association negotiation with specific application entities.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Any of the Storage SOP Class names listed in Table 6.	Any of the Storage SOP Class UIDs listed in Table 6.	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2.	SCU	None
		Medigration Explicit VR Little Endian	1.2.276.0.33.1	SCU	None
		Medigration Implicit VR Little Endian	1.2.276.0.33.2	SCU	None
		Medigration Explicit VR Big Endian	1.2.276.0.33.3	SCU	None
		Medigration	1.2.276.0.33.4	SCU	None

		Pyra Explicit VR Little Endian			
		Medigration Pyra Implicit VR Little Endian	1.2.276.0.33.5	SCU	None
		Medigration Pyra Explicit VR Big Endian	1.2.276.0.33.6	SCU	None

Table 14: Proposed presentation contexts for retrieve initiated image send

3.2.3.3 SOP Specific Conformance

The behavior when receiving C-STORE response status codes is shown in Table 15.

<i>Status Code</i>	<i>Meaning</i>	<i>Behavior when receiving status code</i>
	Any other status code not included in this table	An error message is recorded in a log file.
A7xx	Refused – Out of Resources	The Number of Failed Sub-Operations Count will be incremented (returned in C-MOVE responses).
A9xx	Error – Data Set does not match SOP Class	A message is recorded in a log file.
Cxxx	Error – Cannot Understand	The Number of Warning Sub-Operations Count will be incremented (returned in C-MOVE responses).
B000	Warning – Coercion of Data Elements	A message is recorded in a log file.
B007	Warning – Data Set does not match SOP Class	The Number of Successful Sub-Operations Count will be incremented (returned in C-MOVE responses).
B006	Warning – Elements Discarded	
0000	Success	

Table 15: Behavior when receiving C-STORE response status codes (retrieve initiated)

Extended negotiation is not supported for the **Retrieval Send** Real-World Activity. All optional attributes included in Storage SOP Instances will be sent as originally received. Storage SOP Instances are stored without modification when received and are not modified when sent. No additional attributes are added. The ImageBroker application entity is bit-preserving and maintains the integrity of any embedded digital signatures when sending provided the original transfer syntax is supported by the remote Application Entity.

3.2.3.4 Association Termination

The association will be released upon receipt of the C-STORE-RSP message for the last sent image or upon receipt of refused or unknown status code.

If the peer AE aborts the association prematurely, all unsent SOP Instances are considered failed.

3.2.4 Auto Initiated Image Send

3.2.4.1 Associated Real-World Activity (Auto Send)

All images received by the **Storage** Real-World Activity will be sent automatically – via certain routing rules – to one or more remote application entities. The associated local real-world activity is **Auto Send** and the remote real-world activity is **Storage**. All images for one remote application entity will be sent over a single association.

3.2.4.2 Proposed Presentation Contexts

The same presentation context is proposed for *auto initiated images send* as for *user- initiated images send* described in section 3.2.2.2.

3.2.4.3 SOP Specific Conformance

The behavior when receiving C-STORE response status codes is shown in Table 16.

Status Code	Meaning	Behavior when receiving status code
	Any other status code not included in this table	An error message is recorded in a log file.
A7xx	Refused – Out of Resources	
A9xx	Error – Data Set does not match SOP Class	A message is recorded in a log file.
Cxxx	Error – Cannot Understand	
B000	Warning – Coercion of Data Elements	A message is recorded in a log file.
B007	Warning – Data Set does not match SOP Class	
B006	Warning – Elements Discarded	
0000	Success	

Table 16: Behavior when receiving C-STORE response status codes (auto initiated)

Extended negotiation is not supported for the **Auto Send** Real-World Activity.

3.2.4.4 Association Termination

The association will be released as described in section 3.2.2.4.

3.2.5 New Study initiated Study Content Notification

3.2.5.1 Associated Real-World Activity (Send Study Content Notifications)

After detection of a new study a study content notification will be sent to the remote application entity. The associated local real-world activity is **Send Study Content Notifications** and the remote real-world activity is **Get Study Content Notifications**. The ImageBroker software sends the contents of all studies arrived since the last successful sending of study content notifications to a remote application entity. The Basic Study Content Notification SOP Class conveys only a minimum set of information to identify and retrieve the images of the Study.

3.2.5.2 Proposed Presentation Contexts

One presentation context will be proposed for *operator-initiated study content notification* as outlined in Table 17.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic Study Content Notification	1.2.840.10008.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 17: Proposed presentation contexts for operator-initiated study content notification

3.2.5.3 SOP Specific Conformance

The behavior when receiving C-STORE response status codes is shown in Table 18.

Status Code	Meaning	Behavior when receiving status code
	Any other status code not included in this table	The Send Study Content Notifications activity will be terminated (no more study content notifications will be sent). An error message will be recorded in a log file. The next time the operator will initiate the Send Study Content Notifications activity all study content notifications already sent during the terminated
Cxxx	Failed operation.	

		activity will be sent again.
0000	Success: Complete Study Content exists on system supporting SCP.	The ImageBroker software stores an index of the most recent image in its database. The next time the operator initiates study content notifications all images arrived after this image are taken to generate study content notifications.
0001	Success: Partial Study Content exists on system supporting SCP.	
0002	Success: None of the Study Content exists on system supporting SCP.	
0003	Success: It is unknown whether or not Study Content exists on system supporting SCP.	

Table 18: Behavior when receiving C-STORE response status codes (operator initiated)

Extended negotiation is not supported for the **Send Study Content Notifications** Real-World Activity.

The Type 2C Attribute Retrieve AE Title (0008,0054) is supported for the **Send Study Content Notifications** activity on series level. It is always set to the Application Entity Title of the ImageBroker. Other Type 2C Attributes are not supported.

3.2.6 Operator initiated Send MPPS

3.2.6.1 Associated Real-World Activity (Send MPPS)

The DICOM import process to the database can initiate sending Modality Performed Procedure Step notifications to a remote application entity e.g. a modality. The associated local real-world activity is **Send MPPS** and the remote real-world activity is **Get MPPS From Archive**. The ImageBroker software forwards the contents of former Modality Performed Procedure Steps retrieved from a remote device.

3.2.6.2 Proposed Presentation Contexts

One presentation context will be proposed for *operator-initiated Modality Performed Procedure Steps* as outlined in Table 19.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 19: Proposed presentation contexts for operator initiated MPPS

3.2.6.3 SOP Specific Conformance

The behavior when receiving N-CREATE and N-SET response status codes shown in Table 20.

<i>Status Code</i>	<i>Meaning</i>	<i>Behavior when receiving status code</i>
	Any other status code not included in this table	The ImageBroker software will try to send the N-CREATE or N-SET dataset again after a short period of time.
0000	Success	The ImageBroker software marks the N-CREATE or N-SET dataset as SENT and will not send it again.

Table 20: Behavior when receiving N-CREATE or N-SET response status codes (operator initiated)

Extended negotiation is not supported for the **Send MPPS** Real-World activity.

3.2.6.4 Association Termination

The association will be released upon receipt of the N-CREATE-RSP or N-SET-RSP message for the last sent MPPS notification or upon receipt of refused or unknown status code.

If the peer AE aborts the association prematurely, the remaining MPPS notifications will be sent again by the next **Send MPPS** activity.

3.2.7 Auto Initiated Storage Commitment Push

3.2.7.1 Associated Real-World Activity (Storage Commitment Push)

A SCU (e.g. a modality) can initiate sending storage commitment requests to the ImageBroker (SCP) (see section 3.3.5). The ImageBroker software opens a connection and commits the images archived with a storage commitment push (N-EVENT-REPORT). The associated local real-world activity is **Storage Commitment Push** and the remote real-world activity is **Receive Storage Commitment Push**.

3.2.7.2 Proposed Presentation Contexts

The presentation contexts shown in Table 21 are proposed.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment Push (N-EVENT-REPORT)	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

Table 21: Proposed presentation contexts for Storage Commitment Push (N-EVENT-REPORT)

The correspondence between the flag **Request State** and the N-EVENT-REPORT parameter **Event Type ID** is shown in Table 22.

Request State	Event Type ID (0000,1002)	Event Type Name
committed	1	Storage Commitment Request Successful
error	2	Storage Commitment Request Complete – Failures Exist

Table 22: Correspondence between flag in database and Event Type ID

Extended negotiation must be supported for the **Send Storage Commitment Push** Real-World Activity.

3.2.7.3 SOP Specific Conformance

Standard conformance is provided for the Storage Commitment Push SOP Class.

3.2.7.4 Association Termination

The association will be released after sending the N-EVENT-REPORT.

3.2.8 Auto Initiated Storage Commitment Request

3.2.8.1 Associated Real-World Activity (Storage Commitment Request)

The ImageBroker can send a storage commitment request to an external archive. The associated local real-world activity is **Storage Commitment Request** and the remote real-world activity is **Receive Storage Commitment Request**.

3.2.8.2 Proposed Presentation Contexts

The presentation contexts shown in Table 23 are proposed.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Storage Commitment Push (N-ACTION)	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

Table 23: Proposed presentation contexts for Storage Commitment Push (N-ACTION)

3.2.8.3 SOP Specific Conformance

Standard conformance is provided for the Storage Commitment Push SOP Class.

3.2.8.4 Association Termination

The association will be released after sending the N-ACTION.

3.2.9 Auto Initiated Modality Worklist Query

3.2.9.1 Associated Real-World Activity (Query Modality Worklist)

The ImageBroker can send a worklist query request to a remote application entity. The associated local real-world activity is **Query Modality Worklist** and the remote real world activity is **Receive Modality Worklist Query**.

3.2.9.2 Proposed Presentation Contexts

The presentation contexts shown in Table 24 are proposed.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

Table 24: Proposed presentation contexts for Modality Worklist Query

3.2.9.3 SOP Specific Conformance

3.2.9.3.1 Status codes for C-FIND

The behavior when receiving C-FIND response status codes is shown in Table 25.

<i>Status Code</i>	<i>Meaning</i>	<i>Behavior when receiving status code</i>
	Any other status code not included in this table.	The Query Modality Worklist activity will be terminated. An error message will be recorded in a log file.
Cxxx	Failed operation.	
0000	Success.	The Query Modality Worklist activity will be terminated. The results will be displayed on a user interface.
FFxx	Pending.	The Query Modality Worklist activity will be continued.

Table 25 Behavior when receiving C-FIND response status codes

Extended negotiation is not supported for the **Query Modality Worklist** Real-World Activity.

3.2.9.3.2 Supported DICOM Elements

The DICOM attributes sent in a C-FIND-RQ are listed in Table 26.

<i>Name/Module</i>	<i>Tag</i>	<i>Description</i>
Specific Character Set	(0008,0005)	
Scheduled Procedure Step Sequence	(0040,0100)	
>Scheduled Station AE Title	(0040,0001)	
>Scheduled Procedure Step Start Date	(0040,0002)	
>Scheduled Procedure Step Start Time	(0040,0003)	
>Modality	(0008,0060)	
Requested Procedure Description	(0032,1060)	
Study Instance UID	(0020,000D)	
Accession Number	(0008,0050)	
Referring Physician's Name	(0008,0090)	
Patient's Name	(0010,0010)	
Patient ID	(0010,0020)	
Patient's Birth Date	(0010,0030)	
Patient's Sex	(0010,0040)	
Patient's Size	(0010,1010)	
Patient's Weight	(0010,1030)	

Table 26 Dicom attributes for Modality Worklist

3.3 Association Acceptance Policy

The ImageBroker will accept associations for the following situations:

- To respond to communication verification requests from remote devices.
- To receive images for storage from remote devices.
- To process query and retrieve requests from remote devices.

Associations can be accepted at any time the ImageBroker application entity is active. The ImageBroker application entity may not be active if stopped or restarted by an operator.

Associations will be terminated (A-ABORT) if they are idle for more than 20 minutes.

3.3.1 Respond to Communication Verification Requests

3.3.1.1 Associated Real-World Activity

An association will be accepted from a remote Application Entity in order to respond to communication verification requests. The local real-world activity is **Echo Provider** and the remote real-world activity is **Echo to Archive**.

3.3.1.2 Acceptable Presentation Contexts

Any of the presentation contexts shown in Table 27 can be accepted.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Table 27: Acceptable presentation context for verification

3.3.1.3 SOP Specific Conformance

Standard conformance is provided for the Verification SOP Class.

3.3.1.4 Presentation Context Acceptance Criteria

A presentation context for the Verification SOP Class will always be accepted provided the transfer syntax selection policy is met. Presentation contexts for other supported activities may also be accepted on the same association.

3.3.1.5 Transfer Syntax Selection Policies

Only the default DICOM Transfer Syntax (Implicit VR Little Endian) will be accepted.

3.3.2 Receive Images for Storage

3.3.2.1 Associated Real-World Activity

An association will be accepted from a remote Application Entity in order to receive images for storage. The local real-world activity is **Storage** and the remote real-world activity is **Send to Archive**.

Received images are stored on local disk, summary information extracted from the image and inserted in a central database. The extraction of summary information is tolerant of encoding errors wherever possible. Invalid attribute values will be retained in the image files but may be ignored or truncated when inserted into the central database. The contents of the central database are searched when performing the **Query Archive** real-world activity (see section 3.3.3). Invalid attribute values may appear to be returned missing or truncated when performing a C-FIND operation. However, the complete image will always be sent when retrieved (including any invalid attribute values).

3.3.2.2 Acceptable Presentation Contexts

Any of the presentation contexts shown in Table 28 can be accepted.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Any of the Storage SOP Class names listed in Table 6.	Any of the Storage SOP Class UIDs listed in Table 6.	Explicit VR Little Endian	1.2.840.1000 8.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.1000 8.1.2.2	SCP	None
		Implicit VR Little Endian	1.2.840.1000 8.1.2	SCP	None
		Medigration Explicit VR Little Endian	1.2.276.0.33. 1	SCU	None
		Medigration Implicit VR Little Endian	1.2.276.0.33. 2	SCU	None
		Medigration Explicit VR Big Endian	1.2.276.0.33. 3	SCU	None
		Medigration Pyra Explicit VR Little Endian	1.2.276.0.33. 4	SCU	None
		Medigration Pyra Implicit VR Little Endian	1.2.276.0.33. 5	SCU	None
		Medigration Pyra Explicit VR Big Endian	1.2.276.0.33. 6	SCU	None

		JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8-bit Image Compression	1.2.840.1000 8.1.2.4.50	SCP	None
		JPEG Lossless, Nonhierarchical (Process 14)	1.2.840.1000 8.1.2.4.57	SCP	None
		JPEG Lossless, Nonhierarchical, First- Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression	1.2.840.1000 8.1.2.4.70	SCP	None
		JPEG 2000 Image Compression (Lossless Only)	1.2.840.1000 8.1.2.4.90	SCP	None
		JPEG 2000 Image Compression	1.2.840.1000 8.1.2.4.91	SCP	None
		JPEG-LS Lossless Image Compression	1.2.840.1000 8.1.2.4.80	SCP	None

Table 28: Acceptable presentation contexts for storage

3.3.2.3 SOP Specific Conformance

Conformance to the SOP Classes of the Storage Service Class is at Level 2 (Full). Moreover, all received attributes (Type 1, Type 2, Type, 3 and Private) are stored without modification. No attributes are discarded. Received images are written to local disk using the DICOM File Format. The storage architecture is bit-preserving and images are written to the Data Set portion of the File Format exactly as received over the network interface. The identity of the transfer syntax used to receive the image is recorded in the File Format meta header along with the Source Application Entity Title.

No specific policies are required concerning the attribute Lossy Image Compression (0028,2110).

No automatic coercion of attribute values will be performed.

If a success or warning status is returned in a C-STORE response the image has been stored to local disk and registered in the central database. If an image is received containing a SOP Instance UID which is already stored in the database then a success status is returned and the image will be updated.

Images from one patient are sent to the ImageBroker. If the patient is new or the patient already exists in the database, will be checked at the DICOM attributes PatientID, Patient's Name and Patient's Birth Date. If the Patient with the same Patient ID already exists, but the Patient's Name or the Patient's Birth Date is not the same, the archive generates a new patient. An existing patient record will only be selected, when Patient ID, Patient's Name and Patient's Birth Date are the same.

Stored images can be accessed via the **Query/Retrieve** and **User Send Real-World Activities**. The duration of storage is by default permanent (long term archival). However, images may be archived on offline media which are not always immediately accessible.

The meaning of status codes which can be returned in a C-STORE response are listed in Table 29. More detailed error information may be provided in the related fields Offending Element (0000,0901) and Error Comment (0000,0902).

<i>Status Code</i>	<i>Meaning</i>	<i>Detail</i>
A700	Refused – Out of Resources	Insufficient disk space is available or insufficient permissions exist to store the image. The image cannot be stored. An error message is recorded in a log file.
A900	Error – Data Set does not match SOP Class	A serious incompatibility between the dataset and the supposed SOP Class was detected. The image cannot be stored.

		An error message is recorded in a log file.
C000	Error – Cannot Understand	A serious error occurred while parsing the image or an error occurred while updating the database. The image cannot be stored. An error message is recorded in a log file.
0000	Success	The image has been successfully stored or an image with the same SOP Instance UID already exists. A message is recorded in a log file.

Table 29 C-STORE response status codes

3.3.2.4 Presentation Context Acceptance Criteria

Presentation contexts for any of the supported Storage SOP Classes will always be accepted provided the transfer syntax selection policy is met. Presentation contexts for other supported activities may also be accepted on the same association.

3.3.2.5 Transfer Syntax Selection Policies

Preference is by default given to receiving images encoded using an explicit transfer syntax. However, configuration options can be used to limit acceptance to only the default DICOM Transfer Syntax (Implicit VR Little Endian) when accepting associations from specific application entities (see section 5 for configuration options).

When multiple Transfer Syntaxes are presented, a selection is made using following priority:

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

3.3.3 Query the Database and Retrieve Images

3.3.3.1 Associated Real-World Activity

An association will be accepted from a remote Application Entity in order to query the database and initiate retrieval of images. The local real-world activity is **Query/Retrieve** and the remote real-world activity is **Query/Retrieve Archive**.

Received images are stored on local disk as part of the local real-world activity Storage (see section 3.3.2). As part of the Storage real-world activity, summary information extracted from the image and inserted in a central database. The

extraction of summary information is tolerant of encoding errors wherever possible. Invalid attribute values will be retained in the image files but may be ignored or truncated when inserted into the central database.

In order to perform the **Query/Retrieve Archive** real-world activity described in this section, the contents of the central database are searched. Invalid attribute values may appear to be returned missing or truncated when performing a C-FIND operation. However, the complete image will always be sent when retrieved (including any invalid attribute values).

3.3.3.2 Acceptable Presentation Contexts

Any of the presentation contexts shown in Table 30 can be accepted.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Any of the Query/Retrieve SOP Class names listed in Table 7.	Any of the Query/Retrieve SOP Class UIDs listed in Table 7.	Explicit VR Little Endian	1.2.840.1000 8.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.1000 8.1.2.2	SCP	None
		Implicit VR Little Endian	1.2.840.1000 8.1.2	SCP	None

Table 30: Acceptable presentation contexts for Query/Retrieve

3.3.3.3 SOP Specific Conformance for Query (C-FIND) SOP Classes

Standard conformance is provided for the C-FIND SOP Classes and Information Models listed in Table 7.

Priority processing is not supported. Relational queries are not supported. The attributes values returned by a C-FIND response may differ from the values stored in the images because the attribute value in the received image was invalid and could not be recorded in the database or because the attribute value was too long and was truncated prior to insertion in the database.

Fractional second components of time values are not stored in the database. Fractional seconds are truncated in C-FIND requests and responses. Fractional second components in Study Time or Image Time query keys will be ignored and a C-FIND response will not contain fractional seconds.

The query keys supported are listed in Table 31 Table 32, Table 33 and Table 34. The tables also indicate if the attribute is supported as a matching key. In the case of Query SOP Classes of the Study Root Information Model, the Patient Level Query Keys are also supported at the study level.

<i>Attribute Name</i>	<i>Tag</i>	<i>Matching</i>
Patient's Name	(0010,0010)	✓
Patient ID	(0010,0020)	✓
Patient's Birth Date	(0010,0030)	✓
Patient's Sex	(0010,0040)	✓
Number of Patient Related Studies	(0020,1200)	✗
Number of Patient Related Series	(0020,1202)	✗
Number of Patient Related Instances	(0020,1204)	✗

Table 31: Supported Patient Level Query Keys

<i>Attribute Name</i>	<i>Tag</i>	<i>Matching</i>
Study Date	(0008,0020)	✓
Study Time	(0008,0030)	✓
Accession Number	(0008,0050)	✓
Study ID	(0020,0010)	✓
Study Instance UID	(0020,000D)	✓
Referring Physician's Name	(0008,0090)	✓
Modalities in Study	(0008,0061)	✓
Study Description	(0008,1030)	✓
Name of Physician(s) Reading Study	(0008,1060)	✓
Number of Study Related Series	(0020,1206)	✗
Number of Study Related Instances	(0020,1208)	✗

Table 32: Supported Study Level Query Keys

<i>Attribute Name</i>	<i>Tag</i>	<i>Matching</i>
Modality	(0008,0060)	✓
Series Number	(0020,0011)	✓
Series Instance UID	(0020,000E)	✓
Body Part Examined	(0018,0015)	✓
Series Description	(0008,103E)	✓
Request Attribute Sequence	(0040,0275)	✓
> Requested Procedure ID	(0040,1001)	✓
> Scheduled Procedure Step ID	(0040,0009)	✓
Performed Procedure Step Start Date	(0040,0244)	✓
Performed Procedure Step Start Time	(0040,0245)	✓
Number of Series Related Images	(0020,1209)	✗

Table 33: Supported Series Level Query Keys

<i>Attribute Name</i>	<i>Tag</i>	<i>Matching</i>
<i>General Image Level Query Keys</i>		
Image Number	(0020,0013)	✓
SOP Class UID	(0008,0016)	✓
SOP Instance UID	(0008,0018)	✓
Content Date	(0008,0023)	✓
Content Time	(0008,0033)	✓
Number of Frames	(0028,0008)	✓
Bits Allocated	(0028,0100)	✓
Rows	(0028,0010)	✓
Columns	(0028,0011)	✓
Observation Date Time	(0040,A032)	x
<i>Image Level Query Keys for Presentation State</i>		
Presentation Label	(0070,0080)	x
Presentation Description	(0070,0081)	x
Presentation Creation Date	(0070,0082)	x
Presentation Creation Time	(0070,0083)	x
Presentation Creator's Name	(0070,0084)	x
Referenced Series Sequence	(0008,1115)	x
> Series Instance UID	(0020,000E)	x
> Referenced Image Sequence	(0008,1140)	x
>> Referenced SOP Class UID	(0008,1150)	x
>> Referenced SOP Instance UID	(0008,1155)	x
<i>Image Level Query Keys for Structured Report and Key Image Notes</i>		
Completion Flag	(0040,A491)	✓
Verification Flag	(0040,A493)	✓
Verifying Observer Sequence	(0040,A073)	✓
> Verifying Organization	(0040,A027)	x
> Verification DateTime	(0040,A030)	✓
> Verifying Observer Name	(0040,A075)	✓
> Verifying Observer Identification Code Sequence	(0040,A088)	x
>> Code Value	(0008,0100)	x
>> Coding Scheme Designator	(0008,0102)	x
>> Coding Scheme Version	(0008,0103)	x
>> Code Meaning	(0008,0104)	x
Referenced Request Sequence	(0040,A370)	x
> Study Instance UID	(0020,000D)	x
> Accession Number	(0008,0050)	x
> Requested Procedure ID	(0040,1000)	x
> Requested Procedure Code Sequence	(0032,1064)	x
>> Code Value	(0008,0100)	x
>> Coding Scheme Designator	(0008,0102)	x

>> Coding Scheme Version	(0008,0103)	x
>> Code Meaning	(0008,0104)	x
>> Concept Name Code Sequence	(0040,A043)	✓
> Code Value	(0008,0100)	✓
> Coding Scheme Designator	(0008,0102)	✓
> Coding Scheme Version	(0008,0103)	x
> Code Meaning	(0008,0104)	x

Table 34: Supported Image Level Query Keys

Related date and time query keys (e.g. Study Date and Study Time or Image Date and Image Time) are treated independently during matching. If both the date and time parts are included in a query request then results will only be returned for entries on the matching day and at the matching time. For example, specifying the date range 19990101-19990102 together with the time range 0900-1700 could match 1999.01.01 12:00 but would not match 1999.01.01 18:00 nor 1999.01.02 08:00.

The C-FIND response identifier will contain, in addition to the requested key attributes and the current query/retrieve level, the supplementary attributes listed in Table 35.

<i>Attribute Name</i>	<i>Tag</i>	<i>Conditions</i>
Specific Character Set	(0008,0005)	A value of "ISO_IR 100 is returned.
Retrieve AE Title	(0008,0054)	The ImageBroker application entity title is returned.
Storage Media File-Set ID	(0008,0130)	Returned if one or more SOP Instances associated with the C-FIND response are only available offline (e.g. on a media not present on online or nearline storage). Contains the identity of the first offline media which must be made available in order to satisfy a retrieve request on the unique key corresponding to the contents of the C-FIND response. The Storage Media File-Set ID corresponds to the label of an archive media.
Storage Media File-Set UID	(0008,0140)	
Instance Availability	(0008,0056)	A value of ONLINE, NEARLINE, OFFLINE is

		returned.
--	--	-----------

Table 35: Supplementary Response Identifier Keys

The meaning of status codes which can be returned in a C-FIND response are listed in Table 36. More detailed error information may be provided in the related fields Offending Element (0000,0901) and Error Comment (0000,0902).

<i>Status Code</i>	<i>Meaning</i>	<i>Detail</i>
A900	Failed – Identifier does not match SOP Class	A serious incompatibility between the identifier and the supposed SOP Class was detected. The query cannot be processed.
C000	Failed – Unable to process	A serious error occurred while parsing the query identifiers or an error occurred while searching the database. The query cannot be processed. An error message is recorded in a log file.
FE00	Cancel	Matching terminated due to Cancel request.
0000	Success	Matching is complete.
FF00	Pending	Matches are continuing – Current Match is supplied and Optional Keys were supported in the same manner as Required Keys.
FF01	Pending - Warning	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier.

Table 36: C-FIND response status codes

3.3.3.4 SOP Specific Conformance for Retrieve (C-MOVE) SOP Classes

Standard conformance is provided for the C-MOVE SOP Classes and Information Models listed in Table 7.

Requests to retrieve DCOs which are currently only accessible on offline media (e.g. on an inaccessible media) will cause a media load request to be posted to the operator to make the media available (i.e. to insert the required media). The processing of the C-MOVE request will proceed without waiting for the required media to become available and sub-operations for unavailable images will fail. The C-MOVE request should be repeated at a later time. An SCU can determine the availability of images prior to a C-MOVE by evaluating the Instance Availability (0008,0056) attribute in a C-FIND response.

Priority processing is not supported. Relational queries are not supported.

The behavior of retrieve sub-operations is described in section 3.2.3 and the supported Storage SOP Classes listed in Table 6. All Storage SOP Classes which can be received can also be retrieved.

The meaning of status codes which can be returned in a C-MOVE response are listed in Table 37. More detailed error information may be provided in the related fields Offending Element (0000,0901) and Error Comment (0000,0902).

<i>Status Code</i>	<i>Meaning</i>	<i>Detail</i>
A702	Refused – Out of Resources	Unable to perform sub-operations. None of the images could be sent. The move destination rejected the association, supports none of the required SOP Classes or failed all of the C-STORE sub-operations. An error message is recorded in a log file.
A801	Refused – Move Destination unknown	The application entity title specified in the C-MOVE request is not known to the system configuration. An error message is recorded in a log file.
A900	Failed – Identifier does not match SOP Class	A serious incompatibility between the retrieve identifiers and the supposed SOP Class was detected. The retrieve request cannot be processed. An error message is recorded in a log file.
C000	Failed – Unable to process	A serious error occurred while parsing the retrieve identifiers or an error occurred while searching the database. The retrieve request cannot be processed. An error message is recorded in a log file.
C101	Failed – SOP Instances Offline	All of the requested images are offline. None of the images could be sent. The operator will be requested to make the required offline media available. The C-MOVE operation should be repeated at a later time. An error message is recorded in a log file.
FE00	Cancel	Sub-operations terminated due to

		cancel indication.
B000	Warning	Sub-operations complete – One or more failures. One or more images could not be successfully sent. Some of the requested images may be offline, the move destination does not support one or more of the required SOP Classes or the move destination may have failed one or more C-STORE sub-operations. If some of the images are offline the operator will be requested to make the required to make the required offline media available. The C-MOVE operation should be repeated at a later time. An error message is recorded in a log file.
0000	Success	Sub-operations complete – No Failures. All requested images were successfully sent.
FF00	Pending	Sub-operations are continuing. A response with a pending status will be returned after each sub-operation has been performed.

Table 37: C-MOVE response status codes

3.3.3.5 Presentation Context Acceptance Criteria

Presentation contexts for any of the supported Query/Retrieve SOP Classes will always be accepted provided the transfer syntax selection policy is met. Presentation contexts for other supported activities may also be accepted on the same association.

3.3.3.6 Transfer Syntax Selection Policies

Preference is by default given to receiving query/retrieve identifiers encoded using an explicit transfer syntax. However, configuration options can be used to limit acceptance to only the default DICOM Transfer Syntax (Implicit VR Little Endian) when accepting associations from specific application entities (see section 5 for configuration options).

When multiple Transfer Syntaxes are presented, a selection is made using following priority:

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

3.3.4 Forward MPPS

3.3.4.1 Associated Real-World Activity

A SCU (e.g. a modality) can initiate sending MPPS to the ImageBroker (SCP). The associated local real-world activity is **Get MPPS** and the remote real-world activity is **Send MPPS to archive**. The ImageBroker software forwards the MPPS received to a remote device.

3.3.4.2 Acceptable Presentation Contexts

Any of the presentation contexts shown in Table 38 can be accepted.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
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

Table 38: Acceptable presentation contexts for Modality Performed Procedure Step

3.3.4.3 SOP Specific Conformance

Status codes which are returned in a N-CREATE or N-SET response are shown in Table 39.

<i>Status Code</i>	<i>Meaning</i>	<i>Detail</i>
0122	Refused: SOP class not supported	The UID of the Modality Performed Procedure Step SOP Class was not specified in the N-CREATE-RQ or N-SET-RQ. An error message is recorded in a log file.
0114	No such argument	No dataset was included with the N-CREATE-RQ or N-SET-RQ. An error message is recorded in a

		log file.
0213	Resource limitation	The limit on the number of concurrently active Storage Commitment requests has been reached. The problem is transitory. Resending the request at a later time may succeed. An error message is recorded in a log file.
0213	Resource limitation	There is no more memory available to process the N-CREATE-RQ or N-SET-RQ. The problem is transitory. Resending the request at a later time may succeed. An error message is recorded in a log file.
0000	Success	The MPPS request has been registered and processing will continue

Table 39: N-CREATE or N-SET response status codes

3.3.4.4 Presentation Context Acceptance Criteria

A presentation context for the Modality Performed Procedure Step SOP Class will always be accepted provided the transfer syntax selection policy is met. Presentation contexts for other supported activities may also be accepted on the same association.

3.3.4.5 Transfer Syntax Selection Policies

Only the default DICOM Transfer Syntax (Implicit VR Little Endian) will be accepted.

3.3.5 SCU initiated Send Storage Commitment Archive

3.3.5.1 Associated Real-World Activity

A SCU (e.g. a modality) can initiate sending storage commitment requests to the ImageBroker (SCP). The associated local real-world activity is **Get Storage Commitment** and the remote real-world activity is **Send Storage Commitment Archive**. The ImageBroker software commits the images archived with a storage commitment push (N-EVENT-REPORT) (3.2.7).

3.3.5.2 Acceptable Presentation Contexts

Only the presentation context shown in Table 40 can be accepted.

<i>Abstract Syntax</i>		<i>Transfer Syntax</i>		<i>Role</i>	<i>Extended Negotiation</i>
<i>Name</i>	<i>UID</i>	<i>Name</i>	<i>UID</i>		
Storage Commitment Push (N-ACTION)	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Table 40: Acceptable presentation contexts for Storage Commitment Push (N-ACTION)

3.3.5.3 SOP Specific Conformance

Status codes which are returned in a N-ACTION response are shown in Table 41.

<i>Status Code</i>	<i>Meaning</i>	<i>Detail</i>
0123	No such action type	The Action Type ID specified in the N-ACTION-RQ was not supported. [NOTE: this status code is missing in the 1998 documents. Added by CP 168]. An error message is recorded in a log file.
0115	Invalid argument value	The Action Information specified in the N-ACTION-RQ contained invalid values. An error message is recorded in a log file.
0110	Processing failure	An error occurred while parsing the request or an error occurred while updating the database. More detail is provided in the related Error Comment status field. An error message is recorded in a log file.
0213	Resource limitation	The limit on the number of concurrently active Storage Commitment requests has been reached. The problem is transitory. Resending the

		request at a later time may succeed. An error message is recorded in a log file.
0114	No such argument	No dataset was included with the N-ACTION-RQ. An error message is recorded in a log file.
0122	Refused: SOP class not supported	The UID of the Storage Commit Push Model SOP Class was not specified in the N-ACTION-RQ. An error message is recorded in a log file.
0119	Class-instance conflict	The well-known UID of the Storage Commit Push Model SOP Instance was not specified in the N-ACTION-RQ. An error message is recorded in a log file.
0000	Success	The Storage Commitment request has been registered and processing will continue.

Table 41: N-ACTION response status codes

3.3.5.4 Presentation Context Acceptance Criteria

A presentation context for the Storage Commitment Push SOP Class (N-ACTION) will always be accepted provided the transfer syntax selection policy is met. Presentation contexts for other supported activities may also be accepted on the same association.

3.3.5.5 Transfer Syntax Selection Policies

Only the default DICOM Transfer Syntax (Implicit VR Little Endian) will be accepted.

3.3.6 SCU Initiated Send Modality Worklist

3.3.6.1 Associated Real-World Activity

A SCU can send modality worklist query (C-FIND) to the ImageBroker (SCP). The ImageBroker will respond by sending a modality worklist response back to the querying SCU. The associated local real-world activity is **Get Modality Worklist Query** and the remote real-world activity is **Send Modality Worklist Query**.

3.3.6.2 Proposed Presentation Contexts

One presentation context will be proposed for *scu initiated send modality worklist* as outlined in Table 42.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 42 Proposed presentation contexts for operator initiated query for modality worklist

3.3.6.3 SOP Specific Conformance

Standard conformance is provided for the Modality Worklist Information Model – FIND SOP Class.

3.3.6.3.1 Supported DICOM Elements

The DICOM attributes which can be sent are listed in Table 43. The table also indicates if the listed attribute is supported as a query key or as a return key (if an attribute has no entry in the “Matching” column it is used as a return key).

<i>Name/Module</i>	<i>Tag</i>	<i>Matching</i>
Scheduled Procedure Step Sequence	(0040,0100)	
>Scheduled Station AE Title	(0040,0001)	✓
>Scheduled Procedure Step Start Date	(0040,0002)	✓
>Scheduled Procedure Step Start Time	(0040,0003)	✓
>Modality	(0008,0060)	✓
Study Instance UID	(0020,000D)	
Accession Number	(0008,0050)	
Referring Physician's Name	(0008,0090)	
Patient's Name	(0010,0010)	
Patient ID	(0010,0090)	
Patient's Birth Date	(0010,0030)	
Patient's Sex	(0010,0040)	
Patient's Size	(0010,1010)	
Patient's Weight	(0010,1030)	
Study Description	(0008,1030)	
Study Date	(0008, 0020)	

Table 43 Dicom attributes for Modality Worklist

3.3.6.3.2 Status codes for C-FIND

The behavior when receiving C-FIND response status codes is shown in Table 44.

<i>Status Code</i>	<i>Meaning</i>	<i>Behavior when receiving status code</i>
	Any other status code not included in this table	An error message will be posted to the operator and an error message is recorded in a log file.
A7xx	Refused – Out of Resources	
A8xx	Refused – SOP Class not supported	
A9xx	Failed – Identifier does not match SOP Class	
C000	Failed – Unable to process	The query results received up to the last C-FIND-RSP will be displayed to the user on the user interface. The message “Query Failed” will be displayed on the user interface.
FE00	Cancel – Matching terminated due to cancel request	
FF01	Warning – Unsupported Optional Keys	The query results will be displayed to the user on the user interface.
0000	Success	

Table 44: Behavior when receiving C-FIND response status codes

3.3.6.3.3 Association Termination

The association will be released upon receipt of the C-FIND-RSP message.

4 Communication Profiles

4.1 Supported Communication Stacks

TCP/IP Network Communication is supported as defined in PS 3.8.

4.1.1 TCP/IP Stack

The TCP/IP stack is inherited from the underlying operating system.

4.1.1.1 Physical Network Media Support

No dependency exists on the physical network medium over which TCP/IP executes. The supported physical network media are inherited from the underlying operating system. Typical physical network media options include 10BASE-T Ethernet, 100BASE-TX Ethernet, FDDI and ATM.

5 Configuration

The following DICOM-related network parameters are configurable by the user via a graphical user interface:

- The title of the ImageBroker Application Entity. Associations will not be accepted if the Called AE Title is not equal to the configured AE Title.
- The Port Number to use when listening for associations (default 104).
- The AE Titles, IP Address and Port Number for all peer application entities. These parameters must be configured before associations can be initiated or accepted. Association attempts from unknown AE Title and IP Address pairs will not be accepted.
- Support by peer application entities for the Verification SOP Class. If supported, a connectivity test can be performed upon user request.
- The preferred transfer syntax for each peer application entity. The transfer syntax selection policies can be configured such that only the Implicit VR Little Endian Transfer Syntax will be accepted for individual application entities.

The following DICOM-related network parameters are configurable by a field service engineer for the **Storage**, **Query/Retrieve**, **Retrieval Send** and **Echo Provider** local activities:

- The number of concurrent associations which can be accepted (default 20). This limit is bound only by the availability or underlying operating system resources.
- General association inactivity timeout (default 1800 seconds).
- Timeout waiting for a DIMSE request (default 1200 seconds).
- Timeout waiting for a DIMSE response (default 300 seconds).
- Maximum size of a received PDU (default 16KB).

The **User Send** and **User Echo** local activities use timeout and maximum PDU size parameters with defaults as defined above but are not configurable by a field service engineer.

6 Support of Extended Character Sets

The following extended character sets are supported:

ISO-IR 100 Latin Alphabet Supplementary Set No. 1 (ISO 8859-1)

Note: The DICOM default character set (ISO-IR 6) is a subset of ISO-IR 100.

Historie

<i>Datum</i>	<i>Version</i>	<i>Autor</i>	<i>Beschreibung</i>
<i>ImageBroker 4.2</i>			
14.07.2020	1.0	Raufer	Freigabe mit eingearbeiteten Änderungen.
13.07.2020	0.4	Raufer	Dokument überarbeitet.
08.07.2020	0.3	Raufer	Dokument überarbeitet.
06.07.2020	0.2	Raufer	Dokument überarbeitet.
24.04.2020	0.1	Raufer	Dokument ausgehend von ImageBroker 4.1 Conformance Statement überprüft und aktualisiert.

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