etiam

Secure Medical Networking

ETIAM IDeal Broker

DICOM Conformance Statement

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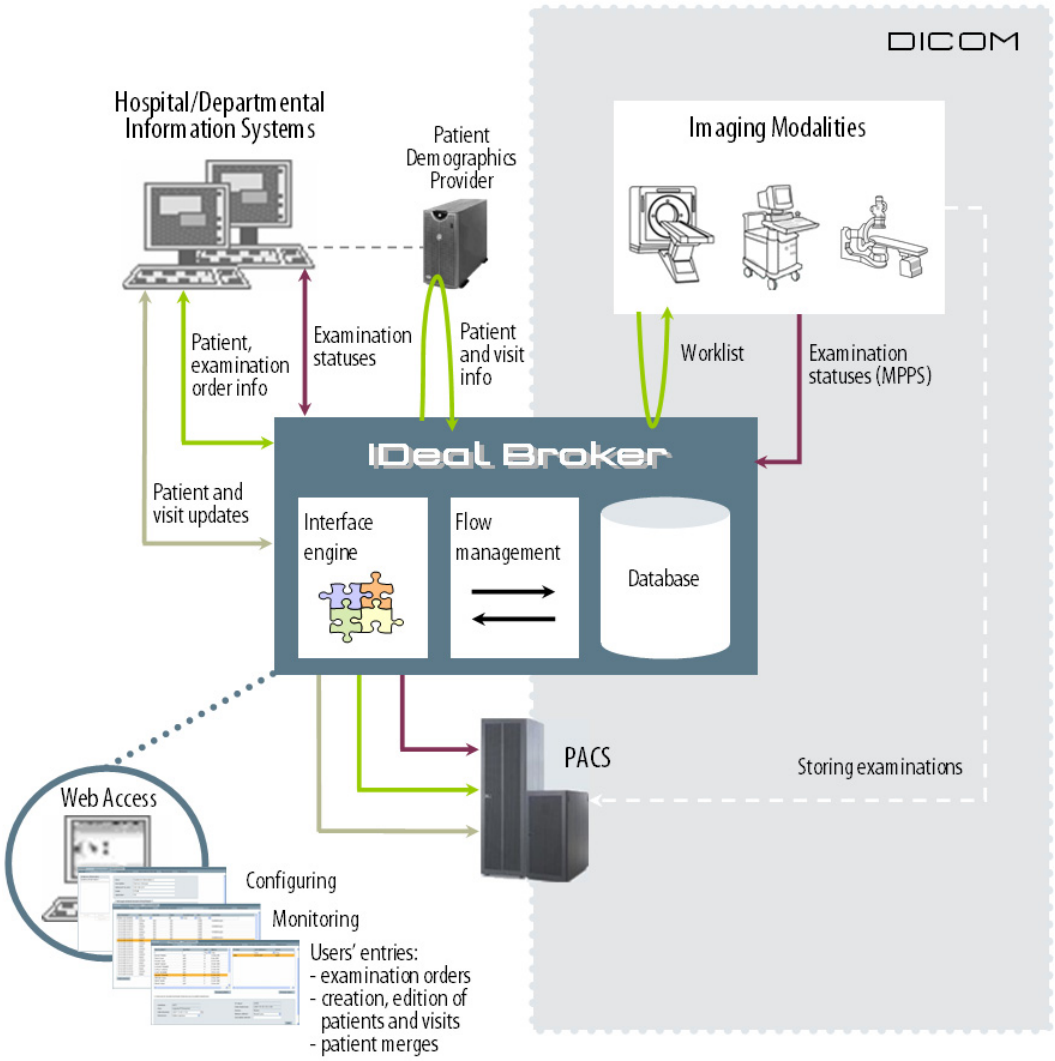
1. Conformance Statement Overview

IDeal Broker is a gateway product which enables integration between administrative systems (HIS/RIS) using the HL7 standard, and imaging modalities using the DICOM standard. It receives data from information systems, processes and stores them in a database for retrieval by DICOM imaging modalities through Worklist queries. IDeal Broker can also return study status information from imaging modalities to information systems after conversion to HL7.

IDeal Broker implements the services necessary to:

- Verify communication with other DICOM applications, by issuing both verification request and response
- Return Worklist items found in its internal database as a response to Find requests from other DICOM applications
- Integrate information about performed procedure step (for example study status) received from modalities

Figure 1-1: IDeal Broker Functional Overview



This document is intended to describe IDeal Broker's conformance to DICOM.

Table 1-2: Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Workflow Management		
Modality Worklist	No	Yes
Modality Performed Procedure Step	No	Yes
Communication		
Verification (Echo)	Yes	Yes

2. Table of Contents

3. Introduction

3.1 Revision History

Document Version	Date	Author	Description
1.0	January 06	Mélanie Férelloc	Creation of the document
1.1	June 07	Mélanie Férelloc	Update
1.2	November 07	Mélanie Férelloc	Update
1.3	March 08	Mélanie Férelloc	Update
1.4	September 08	Mélanie Férelloc	Update
1.5	March 2012	Nicolas Le Meur	Update
1.6	July 2013	Nicoals Le Meur	Update

3.2 Audience

This document is intended for:

- Potential users
- System integrators of medical equipment
- Software designers implementing DICOM interfaces

It is assumed that the reader has a working understanding of DICOM.

Experience and familiarity with DICOM Conformance Statements is helpful but not required.

3.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between IDeal Broker and other DICOM systems. The Conformance Statement should be read and understood in conjunction with the DICOM Standard (DICOM). However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different Conformance Statements is the first step towards assessing interconnectivity between IDeal Broker and other DICOM conformant equipment.
- Test procedures should be defined to validate the desired level of connectivity.
- The DICOM standard will evolve to meet the users' future requirements. ETIAM is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

3.4 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

AE	Application Entity
DICOM	Digital Imaging and Communications in Medicine
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier

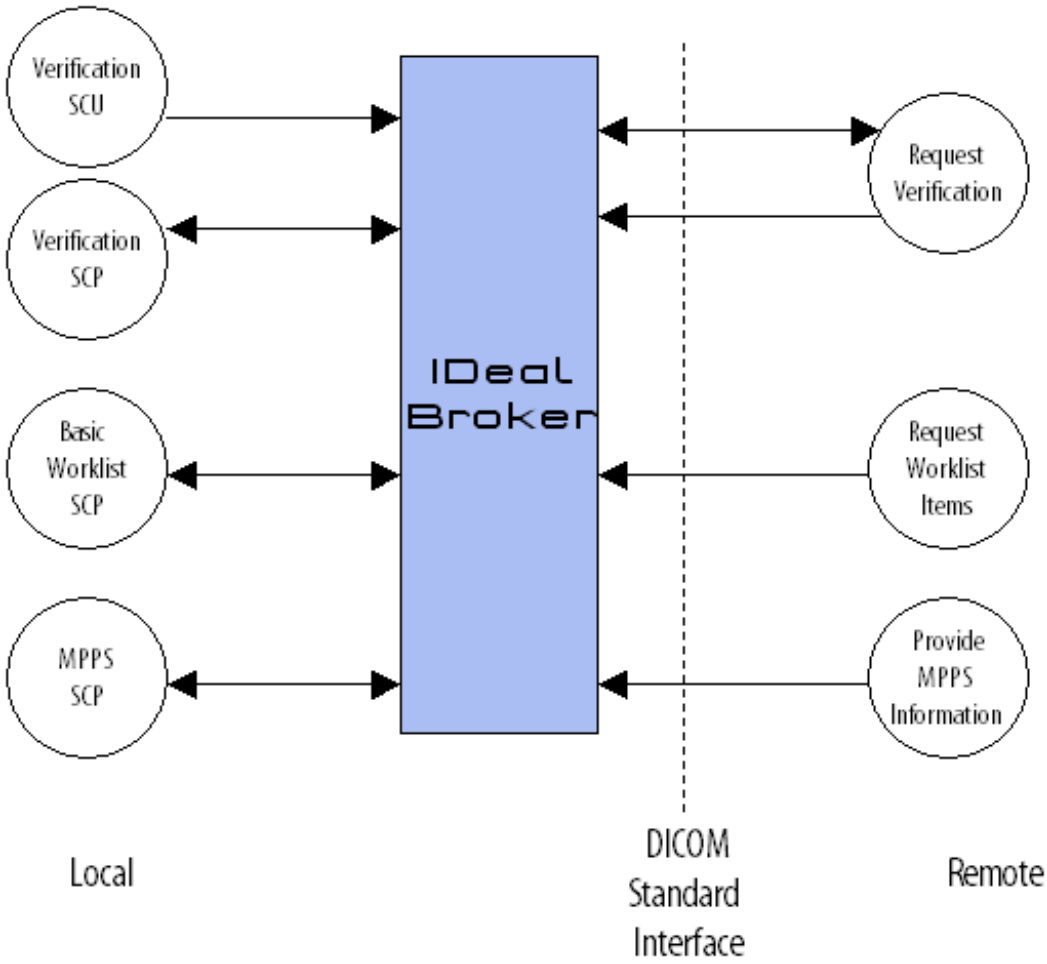
4. Networking

4.1 Implementation Model

IDeal Broker is implemented in one Application Entity.

4.1.1 Application Data flow

Figure 4.1-1: Application Data Flow



At installation or whenever a problem occurs, the network communication between IDeal Broker and other DICOM peers can be checked within the Verification service. This operation can be performed from within IDeal Broker Web interface as well as from other applications.

When IDeal Broker receives Worklist requests from imaging modalities, it searches for matching items and returns the resulting list.

IDeal Broker stores and updates information about performed procedure step (such as study status) as MPPS SCP.

4.1.2 Functional Definitions of the Application Entity

As a SCP, IDeal Broker waits for another application to connect using the presentation address configured for an Application Entity Title. When another application connects, IDeal Broker expects it to be a DICOM application.

As a SCU, IDeal Broker connects to other DICOM applications.

4.1.2.1 Verification Service as SCP

IDeal Broker will accept associations with Presentation Contexts for the Verification service SOP class. If IDeal Broker receives a C-ECHO request from another DICOM Application, it will return a C-ECHO response.

4.1.2.2 Verification Service as SCU

On user demand, IDeal Broker can initiate associations with Presentation Contexts for the Verification service SOP class. It will send a C-ECHO request to another DICOM application and wait for a response to complete the verification.

4.1.2.3 Basic Worklist Management Service as SCP

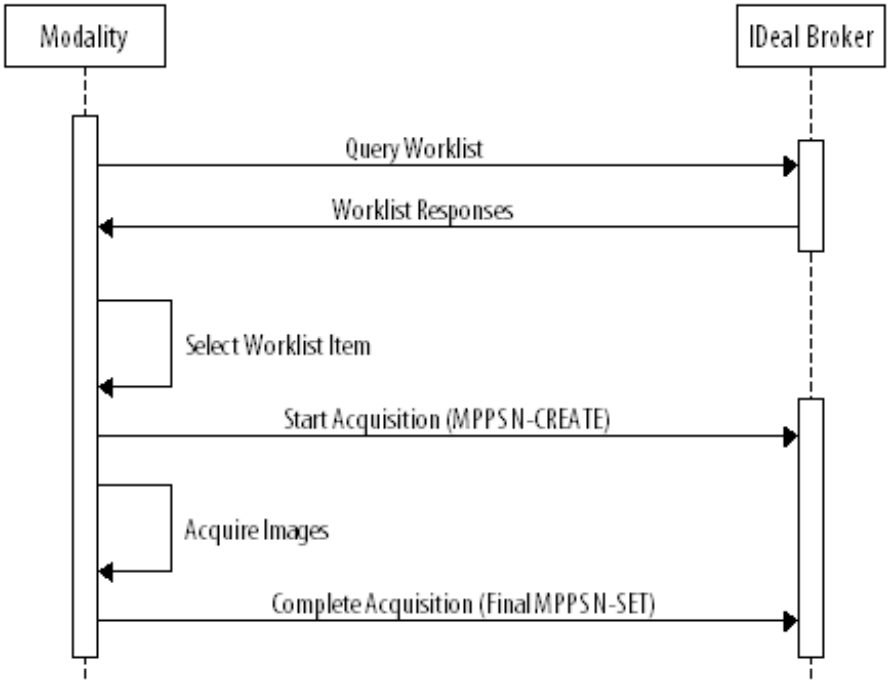
IDeal Broker will accept associations with Presentation Contexts for the Basic Worklist Management service SOP class. It will wait for Find requests, search for Worklist items in its internal database, and return its Find responses on the same association.

4.1.2.4 Modality Performed Procedure Step Service as SCP

IDeal Broker will accept associations with Presentation Contexts for the MPPS service SOP class. It will wait for N-Create / N-Set requests concerning a MPPS SOP Instance, and return its N-Create/N-Set response on the same association.

4.1.3 Sequencing of Real-Word Activities

Figure 4.1-2: Sequencing Constraints



Under normal scheduled workflow conditions the sequencing constraints illustrated in Figure 4.1-2 apply:

1. Query Worklist
2. Receive Worklist
3. Select item from Worklist
4. Start acquisition and create MPPS
5. Acquire images
6. Complete acquisition and finalize MPPS

4.2 Application Entity Specifications

4.2.1 SOP Classes

IDeal Broker AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 4.2-1: SOP Classes for IDeal Broker AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	Yes
Modality Worklist Information Model -FIND	1.2.840.10008.5.1.4.31	No	Yes
Modality Performed Procedure Step	1.2.84010008.3.1.2.3.3	No	Yes

4.2.2 Association Policies

4.2.2.1 General

IDeal Broker contains the following limitations for PDU size:

Minimum PDU size	8,192 bytes
Maximum PDU size	16,384 bytes

The following Application Context Name will be proposed and recognized by IDeal Broker:

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2 Number of Associations

Table 4.2-2: Number of Associations as an Association Initiator for IDeal Broker AE

Maximum number of simultaneous associations	No limitation (see note)

Note: This activity is available from IDeal Broker Web interface. So, there can be as much simultaneous associations initiations as web browsers connected to IDeal Broker web server.

IDeal Broker will only accept associations from known AE Titles and associations from unknown AE Titles will be rejected.

Table 4.2-3: Number of Associations as an Association Acceptor for IDeal Broker AE

Maximum number of simultaneous associations	100 (configurable)

This value may be configured on IDeal Broker **Configuration** panel.

4.2.2.3 Asynchronous Nature

IDeal Broker AE does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.2.4 Implementation Identifying Information

The implementation information for the Application Entity is:

Table 4.2-4: DICOM Implementation Class and Version for IDeal Broker AE

Implementation class UID	1.2.250.1.59.3.0.3.5.3
Implementation version name	ETIAM_DCMTK_353

4.2.2.5 Association Initiation Policy

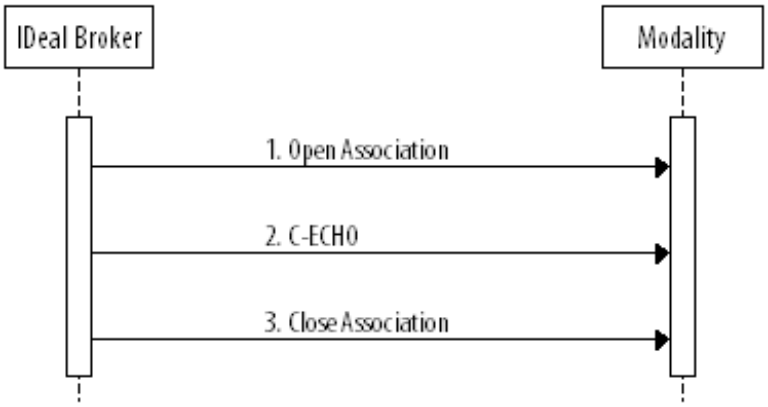
IDeal Broker AE initiates association only for implementation of the Verification service Class as a SCU.

4.2.2.5.1 Activity – Verification

4.2.2.5.1.1 Description and Sequencing of Activities

The Modality should accept associations from IDeal Broker that want to verify application-level communication using the C-ECHO command.

Figure 4.2-5: Sequencing of Activity – Verification



The figure above is a typical sequence of messages and events for the Verification activity:

1. IDeal Broker opens a DICOM association with a modality
2. IDeal Broker sends a C-ECHO request to the modality
3. IDeal Broker closes the association

4.2.2.5.1.2 Proposed Presentation Contexts

Table 4.2-6: Proposed Presentation Contexts for IDeal Broker AE and Verification Activity

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.2.5.1.3 SOP Specific Conformance to the Verification SOP Class

IDeal Broker provides standard conformance to the DICOM Verification Service Class as a SCU. The status code for the C-ECHO is shown in the following table:

Table 4.2-7: C-ECHO Response Status Handling Behaviour

Code	Status	Meaning
0000	Success	The C-ECHO request is accepted.

Table 4.2-8: C-ECHO Communication Failure Behaviour

Exception	Behaviour
Timeout	The Association is aborted using A-ABORT.
Other errors	

4.2.2.6 Association Acceptance Policy

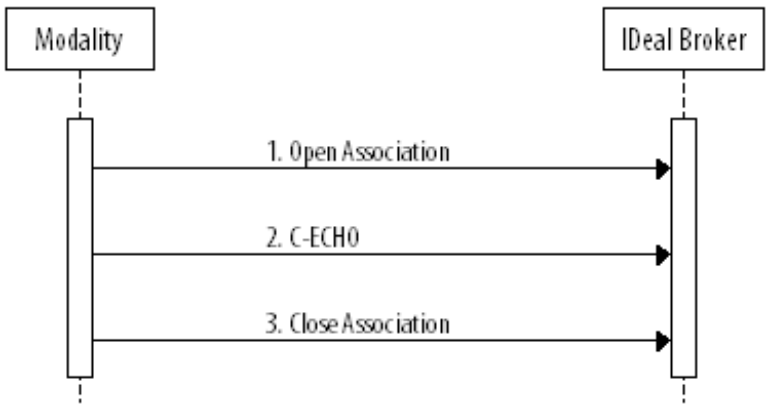
IDeal Broker will accept associations as long as the maximum number of associations is not reached. If the maximum number of associations is reached, the association is rejected.

4.2.2.6.1 Activity – Verification

4.2.2.6.1.1 Description and Sequencing of Activities

IDeal Broker will accept associations from systems that want to verify application-level communication using the C-ECHO command.

Figure 4.2-9: Sequencing of Activity – Verification



Under normal circumstances the sequencing depicted above applies:

1. The modality opens an association with IDeal Broker
2. It sends a C-ECHO request to IDeal Broker
3. It closes the association

4.2.2.6.1.2 Accepted Presentation Contexts

Table 4.2-10: Acceptable Presentation Contexts for IDeal Broker AE and Verification Activity

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

4.2.2.6.1.3 SOP Specific Conformance to Verification SOP Class

IDeal Broker provides standard conformance to the DICOM Verification Service Class as a SCP. The status code for the C-ECHO is shown in the following table:

Table 4.2-11: C-ECHO Response Status Handling Reason

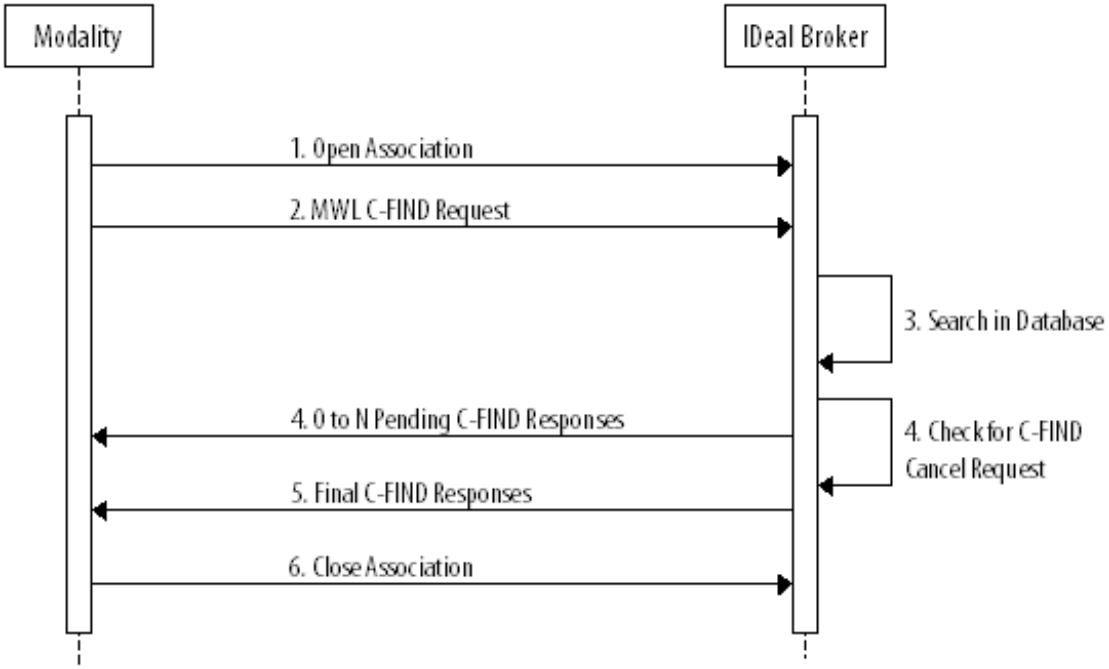
Code	Status	Reason
0000	Success	The C-ECHO request is accepted.

4.2.2.6.2 Activity Modality Worklist

4.2.2.6.2.1 Description and Sequencing of Activities

IDeal Broker AE will accept associations from systems that want to query IDeal Broker database using the C-FIND command.

Figure 4.2-12: Sequencing of Activity – Modality Worklist



The figure above is a typical sequence of messages between a Modality Worklist SCU and IDeal Broker:

1. The modality opens an association with IDeal Broker.
2. The modality sends a C-FIND request.
3. IDeal Broker searches for matching Worklist items in its internal database, according to request filters and additional filters (configurable).
4. IDeal Broker sends the list of work items to the modality.
5. The modality closes the association.

4.2.2.6.2.2 Accepted Presentation Contexts

Table 4.2-13: Acceptable Presentation Contexts for IDeal Broker AE and Modality Worklist Activity

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
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

4.2.2.6.3 SOP Specific Conformance to Modality Worklist SOP Class

IDeal Broker provides standard conformance to the DICOM Worklist Service Class.

Table 4.2-14: Modality Worklist Matching Key Type

Key Type Matching	
SV	Single value matching
WC	Wild card matching
RM	Range matching
	No matching. Returns value when available

Table 4.2-15: Modality Worklist Supported Attributes

Module	Attribute Name	Tag	Match
SOP Common	Specific Character Set	(0008,0005)	SV / WC
Scheduled Procedure Step	Scheduled Procedure Step Sequence	(0040,0100)	
	> Scheduled Station AETitle	(0040,0001)	SV
	> Scheduled Procedure Step Start Date	(0040,0002)	RM
	> Scheduled Procedure Step Start Time	(0040,0003)	
	> Modality	(0008,0060)	SV
	> Scheduled Performing Physician's Name	(0040,0006)	SV / WC
	> Scheduled Procedure Step Description	(0040,0070)	SV / WC
	> Scheduled Station Name	(0040,0010)	SV / WC
	> Scheduled Procedure Step Location	(0040,0011)	SV / WC
	> Pre Medication	(0040,0012)	SV / WC
	> Scheduled Procedure Step ID	(0040,0009)	SV / WC
	> Requested Contrast Agent	(0032,1070)	SV / WC
Requested Procedure	Requested Procedure ID	(0040,1001)	SV / WC
	Requesting Service	(0032,1033)	SV / WC
	Requested Procedure Description	(0032,1060)	SV / WC
	Study Instance UID	(0020,000D)	SV / WC
	Requested Procedure Priority	(0040,1003)	SV / WC
	Patient Transport Arrangements	(0040,1004)	SV / WC
Imaging Service Request	Accession Number	(0008,0050)	SV / WC
	Requesting Physician	(0032,1032)	SV / WC
	Referring Physician's Name	(0008,0090)	SV / WC
Visit Identification	Admission ID	(0038,0010)	SV / WC
	IssuerOfAdmissionID	(0038,0011)	SV / WC
Visit Status	Current Patient Location	(0038,0300)	SV / WC
Patient Identification	Patient's Name	(0010,0010)	SV / WC
	Other Patient Names	(0010,1001)	SV / WC
	Patient's Birth Name	(0010,1005)	SV / WC
	Patient ID	(0010,0020)	SV
Patient Demographic	Patient's Birth Date	(0010,0030)	RM
	Patient's Sex	(0010,0040)	SV
	Patient's Size	(0010,1020)	SV / WC
	Patient's Weight	(0010,1030)	SV / WC
Patient Medical	Patient State	(0038,0500)	SV / WC
	Medical Alerts	(0010,2000)	SV / WC
	Contrast Allergies	(0010,2110)	SV / WC
	Pregnancy Status	(0010,21C0)	SV / WC
	Special Needs	(0038,0050)	SV / WC

IDeal Broker configuration allows users to set additional filters to customize the list of items returned in C-Find responses, depending on the study status, scheduled date and scheduled AE. These filters override filters set in C-Find request.

Table 4.2-16: Additional Filters

Filter Name	Configuration Level	Possible Values	Behaviour
Calling AET Restriction	Remote Peer	YES	Returns only studies scheduled for this AE
		NO	Returns all matching studies regardless of their scheduled AE
Scheduled Date Restriction	Remote Peer	None	Returns all matching studies regardless of their scheduled date
		Today	Returns only matching studies scheduled for today
		+ or – one week	Returns only matching studies scheduled in an interval of one week (before and after)
		+ or – one month	Returns only matching studies scheduled in an interval of one month (before and after)
Filter upon status	IDeal Broker	Discontinued or Not Yet Started	Returns only matching studies with the "Discontinued" status or without status information, i.e. studies with the "In Progress" or "Completed" status.
		Not Completed	Returns all matching studies except studies with the "Completed" status
		All	Returns all matching studies regardless of their status

Table 4.2-17: Modality Worklist C-FIND Response Status Reasons

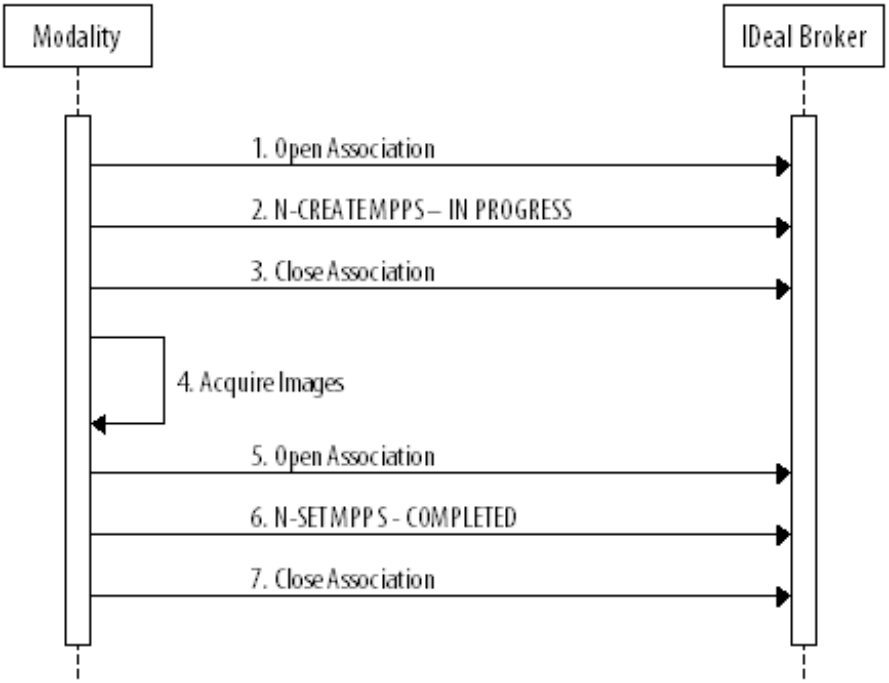
Service Status	Further Meaning	Error Code	Reason
Success	Matching is complete	0000	The response status and meaning are logged into the job log file.
Failure	Unable to process	C000	This status is returned due to internal errors within IDeal Broker. The response status and meaning are logged into the job log file.
Cancel	Matching terminated due to cancel request	FE00	This status is returned if a Cancel request is received from the SCU while processing a modality Worklist request.
Pending	Matching is continuing	FF00	The status is returned with each matching response.

4.2.2.6.4 Activity Modality Performed Procedure Step

4.2.2.6.4.1 Description and Sequencing of Activities

IDeal Broker AE will accept associations from systems that want to notify IDeal Broker database using the C-FIND command.

Figure 4.2-18: Sequencing of Activity – Modality Performed Procedure Step



The figure above is a typical sequence of messages between a MPPS SCU and IDeal Broker:

1. The modality opens an association with IDeal Broker.
2. The modality sends a N-CREATE request to IDeal Broker to create a MPPS instance with the "IN PROGRESS" status. IDeal Broker stores these data and acknowledges the MPPS creation with a N-CREATE response.
3. The modality closes the association with IDeal Broker.
4. Images are acquired and stored.
5. The modality opens an association with IDeal Broker.
6. The modality sends a N-SET request to IDeal Broker to update the MPPS instance with the "IN PROGRESS", "COMPLETED" or "DISCONTINUED" status. IDeal Broker updates the data and acknowledges the MPPS update with a N-SET response.
7. The modality closes the association with IDeal Broker

Steps 5 to 7 can be repeated until the MPPS instance has a final status.

4.2.2.6.4.2 Accepted Presentation Contexts

Table 4.2-19: Acceptable Presentation Contexts for IDeal Broker AE and MPPS Activity

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step	1.2.84010008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

4.2.2.6.5 SOP Specific Conformance to MPPS SOP Class

IDeal Broker provides standard conformance to the DICOM Modality Performed Procedure Step Service Class and handles all attributes for MPPS SOP class. However, IDeal Broker is only picking up the following attributes from the MPPS command:

Table 4.2-20: MPPS Used Attributes

Module	Attribute Name	Tag
Performed Procedure Step Relationship	Scheduled Step Attributes Sequence	(0040,0270)
	>Study Instance UID	(0020,000D)
Performed Procedure Step Information	Performed Station AE Title	(0040,0241)
	Performed Station Name	(0040,0242)
	Performed Location	(0040,0243)
	Performed Procedure Step Start Date	(0040,0244)
	Performed Procedure Step Start Time	(0040,0245)
	Performed Procedure Step End Date	(0040,0250)
	Performed Procedure Step End Time	(0040,0251)
	Performed Procedure Step Status	(0040,0252)
	Performed Procedure Step ID	(0040,0253)
	Performed Procedure Step Description	(0040,0254)
	Performed Procedure Type Description	(0040,0255)
Image Acquisition Results	Modality	(0008,0060)
	Study ID	(0020,0010)

IDeal Broker supports the following values for Performed Procedure Step Status:

- IN PROGRESS
- COMPLETED
- DISCONTINUED

Table 4.2-21: MPPS N-CREATE/N-SET Response Status Reasons

Service Status	Further Meaning	Error Code	Reason
Success	Successful completion of the N-SET or N-CREATE request	0000	The response status and meaning are logged into the job log file.
Failure	Invalid attribute value	0106	This status is returned if non-allowed an attribute not allowed to be sent in the N-SET has been sent.
	Missing attribute	0120	This status is returned if an attribute required to be sent in the N-CREATE or required to be sent before completion of the Procedure Step has not been sent.
	Missing attribute value	0121	This status is returned if an attribute required to be sent in the N-CREATE or required to be sent before completion of the Procedure Step has no value.

4.3 Network Interface

4.3.1 Physical Network Interface

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

IDeal Broker inherits its TCP/IP stack from the Windows system where it runs. Default Windows TCP/IP stack is supported.

4.3.2 Additional Protocols

None.

4.4 Configuration

IDeal Broker can be configured from its Web interface and from the **Configuration** panel available from the **IDeal Broker** icon in the system tray.

4.4.1 AE Titles / Presentation Address Mapping

AE Titles, host names and port numbers for remote applications are configured using the **Configuration / DICOM Applications** tab of the Web interface. Multiple remote Worklist SCPs and MPPS SCPs can be defined. This mapping is used by IDeal Broker for Verification Service Class as SCP.

4.4.2 Parameters

IDeal Broker configurable parameters can be defined in the **Configuration** panel. They are the following:

- TCP/IP port: default is 3104
- AE Title: default is either IDeal Broker or the PC hostname. However, IDeal Broker does not check this.
- Maximum number of simultaneous associations: default is 5.
- Debug and Verbose modes: to get or not detailed information about connections.

5. Media Interchange

Not applicable.

6. Support of Extended Character Sets

IDeal Broker supports the "ISO_IR 100" Latin Alphabet No. 1 Extended Character Set, supplementary set.

7. Security

IDeal Broker does not support any specific security measures.

It is assumed that IDeal Broker is used within a secured environment, including:

- Router protections to ensure that only approved external hosts have network access to IDeal Broker
- Router protections to ensure that IDeal Broker only has network access to approved external hosts and services
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels