

***intulo***

**Intulo v2 DICOM Conformance Statement**

## Overview

Intulo is a system for collection, storage and analysis of radiation doses within radiology.

Intulo supports the following SOP classes:

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Storage</b>		
X-Ray Radiation Dose SR Storage	Yes	Yes
Storage Commitment Push Model SOP Class	No	Yes
<b>Query</b>		
Study Root Query/Retrieve Information Model - FIND	Yes	Yes
<b>Retrieve</b>		
Study Root Query/Retrieve Information Model - MOVE	Yes	Yes
<b>MPPS</b>		
Modality Performed Procedure Step SOP Class	Yes	Yes

*Table 0-1 Network Services*

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# 1 Introduction

## 1.1 Revision History

Version	Date	Description
1.0	2008-11-17	Initial release

*Table 1.1-1 Revision history*

## 1.2 Audience

This document is intended for health system integrators. The reader is assumed to have a working knowledge of DICOM and TCP/IP networking.

## 1.3 Remarks

This conformance statement covers software version 2.0.0 and later releases of Intulo.

The DICOM standard does not guarantee system interoperability. Comparing Conformance Statements is one step to verify system compability. Further steps to check compability includes testing and verification.

The DICOM standard is a work in progress. It is continually developing and evolving to meet future requirements. Krucom AB reserves the rights to make changes to its products to reflect this.

## 1.4 Definitions, Terms and Abbreviations

**[AE]**

Application Entity

**[Destination Archive]**

Any device that supports Query/Retrive Find and Storage as an SCP, e.g. an archive

**[DICOM]**

Digital Imaging and Communications in Medicine

**[DIMSE]**

DICOM Message Service Element

**[PDU]**

Protocol Data Unit

**[SCP]**

Service Class Provider

**[SCU]**

Service Class User

**[SOP]**

DICOM Service-Object Pair

**[Source Archive]**

Any device that supports Query/Retrieve Find and Move as an SCP, e.g. an archive

**[TCP/IP]**

Transmission Control Protocol/Internet Protocol

**[UID]**

Unique Identifier

**[VR]**

Value Representation

## **1.5 References**

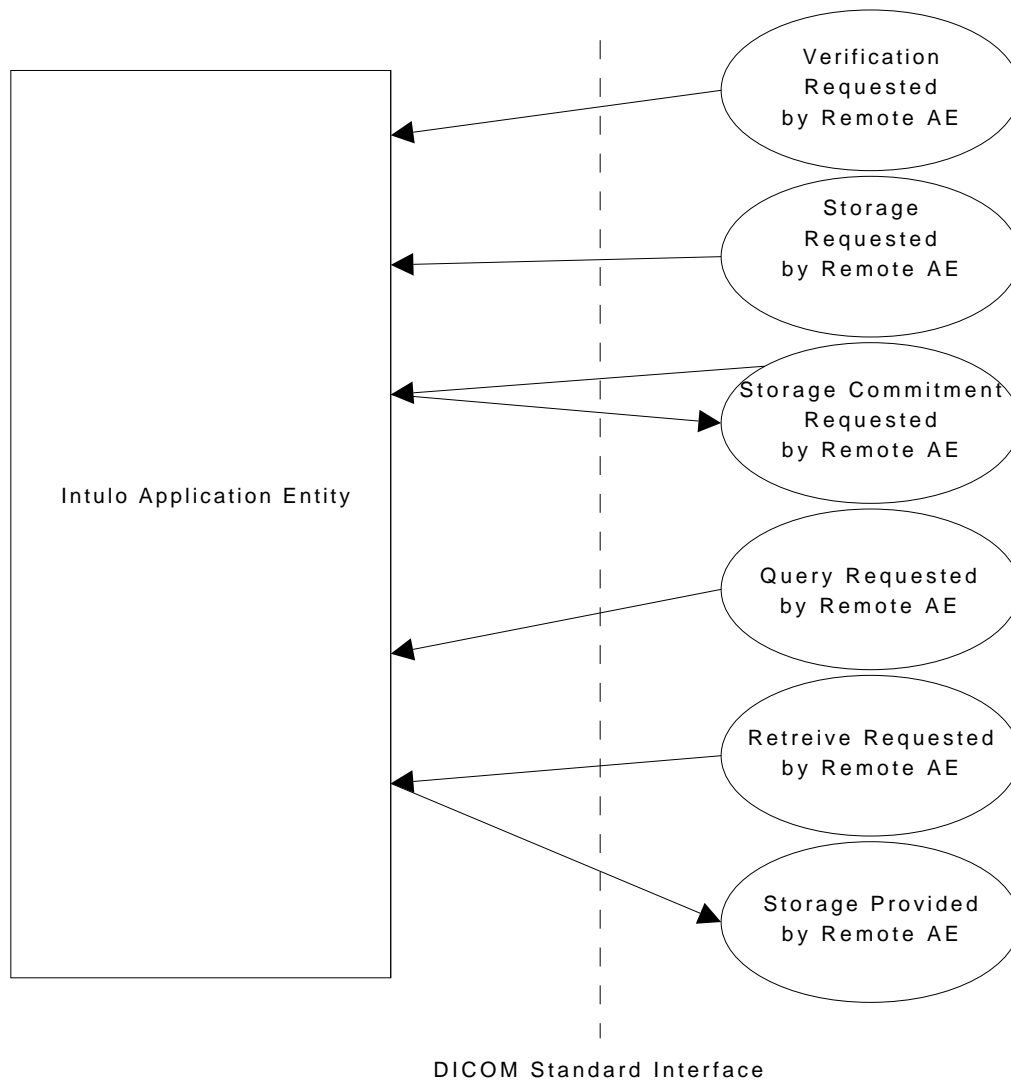
**[DICOM]**

Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18, 2008

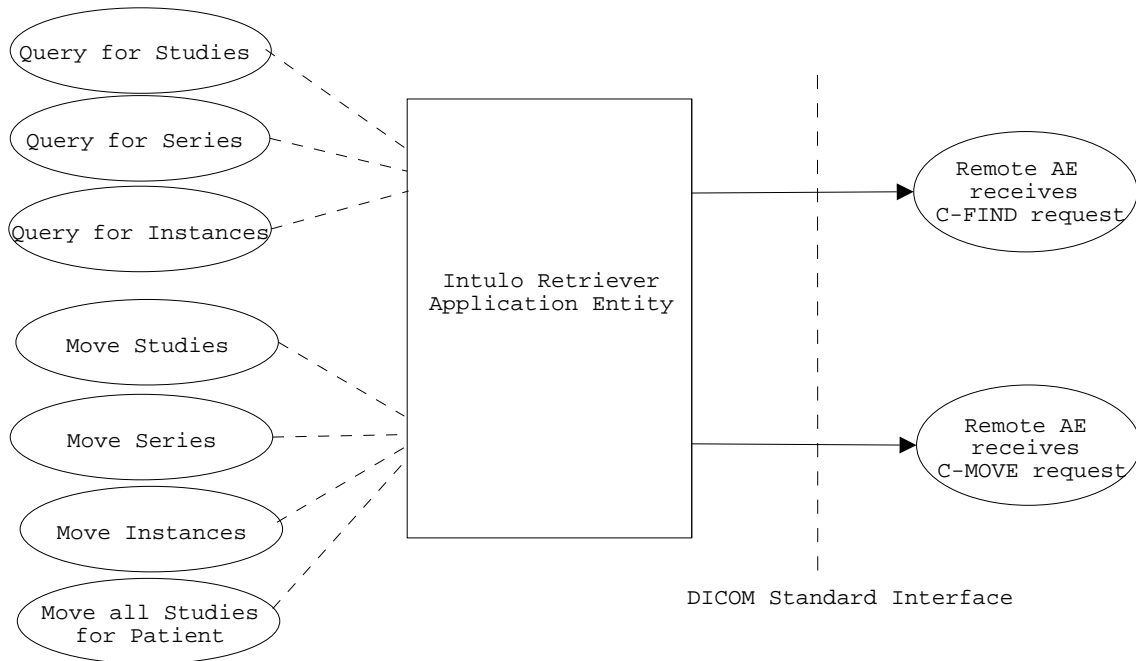
## 2 Networking

### 2.1 Implementation Model

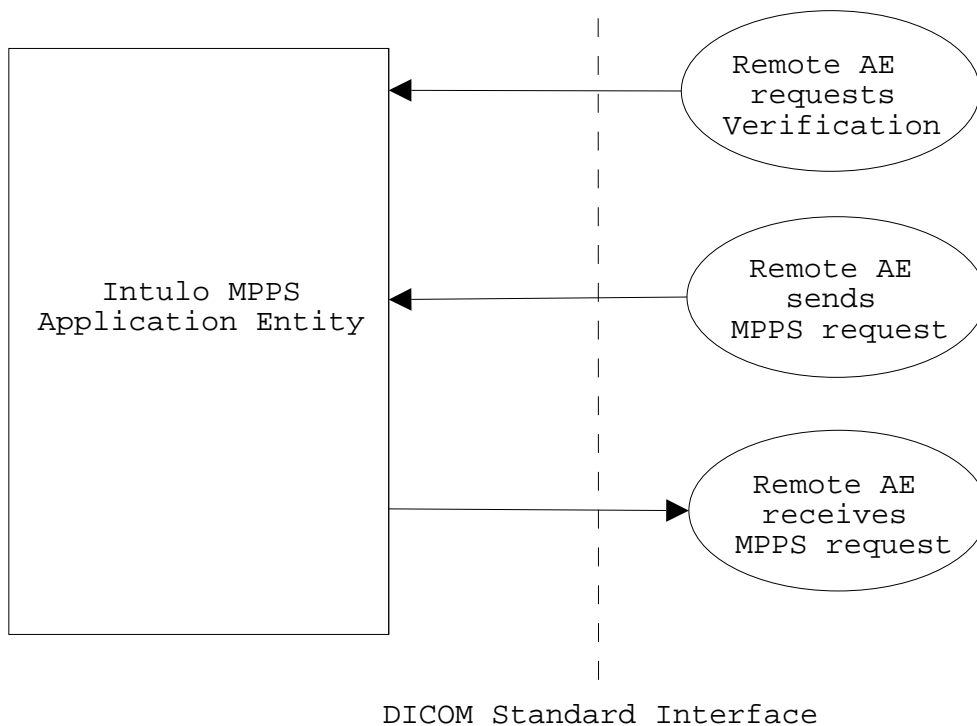
#### 2.1.1 Application Data Flow



*Figure 2.1.1-1 Implementation Model for Intulo AE*



**Figure 2.1.1-2 Implementation Model for Intulo Retriever AE**



**Figure 2.1.1-3 Implementation Model for Intulo MPPS AE**

- Intulo AE accepts requests for Storage, Query/Retrieve, Storage Commitment and verification, and formulates a response accordingly.
- Intulo Retriever AE sends requests for Query/Retrieve to remote AEs.
- Intulo MPPS AE accepts requests for verification and Modality Performed Procedure Step and formulates a response accordingly. Received MPPS requests are forwarded to the configured remote AEs.

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## 2.1.2 Functional Definition of Application Entity

### 2.1.2.1 Functional Definition of Intulo Application Entity

Intulo AE provides the following functionality:

- Can receive incoming DICOM objects and store them in the Intulo AE database. It can respond to external Storage Requests as a Service Class Provider (SCP) for C-STORE.
- It can respond to external Query/Retrieve Requests as a Service Class Provider (SCP) for C-FIND and C-MOVE. The latter will generate a new association where Intulo AE will operate as a Storage SCU.
- Handles Storage Commitment requests, which will generate a response over a new association there Intulo AE will operate as both SCP and association creator.
- Handles Verification Service requests and responds to them.

### 2.1.2.2 Functional Definition of Intulo Retriever Application Entity

Intulo Retriever AE provides the following functionality:

- Users can query Source Archives for studies, series and instances.
- For found entities, users can request moves on study, series and instance level.

### 2.1.2.3 Functional Definition of Intulo MPPS Application Entity

Intulo MPPS AE receives MPPS messages and forwards the messages to the configured remote AEs. Associations are accepted for Modality Performed Procedure Step SOP Class and received SOP Instances are temporarily stored on disk and queued for forwarding. The objects belonging to a SOP Instance will be sent in the same order as they were received.

Intulo MPPS AE also supports Verification as an SCP.

## 2.1.3 Sequencing of Real World Activities

All application entities perform their activities asynchronously in the background and are not dependent on any sequencing.

## 2.2 AE Specifications

### 2.2.1 Intulo Application Entity

#### 2.2.1.1 SOP Classes

Intulo Application Entity provides Standard Conformance to the following SOP classes:

SOP Class Name	SOP Class UID	SCU	SCP
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	No	Yes
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	No	Yes
Verification SOP Class	1.2.840.10008.1.1	No	Yes

*Table 2.2.1.1-1 SOP Classes*

## 2.2.1.2 Association Policies

### 2.2.1.2.1 General

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

*Table 2.2.1.2.1-1 Dicom Application Context*

Intulo AE accepts incoming associations and may initiate a outgoing association in response.

### 2.2.1.2.2 Number of Associations

Maximum number of simultaneous associations	Unlimited
---	-----------

*Table 2.2.1.2.2-1 Number of associations as an association initiator*

Maximum number of simultaneous associations	Unlimited
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*Table 2.2.1.2.2-2 Number of associations as an association acceptor*

### 2.2.1.2.3 Asynchronous Nature

Intulo supports synchronous communication. Asynchronous communication (multiple outstanding transactions over a single association) is not supported.

### 2.2.1.2.4 Implementation Identifying Information

Implementation Class UID	1.2.752.48.3.1.1.6.XXX
Implementation Version Name	KRUCOM_J1.6.1_1.0.0.0

*Table 2.2.1.2.4-1 DICOM implementation class and version*

### 2.2.1.3 Association Initiation Policy

Intulo AE initiates a new Association in the following Real World activities:

- The Storage Commitment Result is sent to the Remote AE.
- A Storage request is sent as a result of an incoming C-MOVE request.

#### 2.2.1.3.1 Activity - Send Storage Commitment Result

##### 2.2.1.3.1.1 Description and Sequencing of Activities

For each Storage Commitment Request received by Intulo AE, a response is built and sent back to the requesting Remote AE over a new Association.

##### 2.2.1.3.1.2 Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment Push Model	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

*Table 2.2.1.3.1.2-1 Proposed presentation contexts for Storage Commitment*

##### 2.2.1.3.1.3 SOP Specific Conformance for Storage Commitment SOP Class

See section "Activity - Receive Storage Commitment Request", "SOP Specific Conformance for Storage Commitment Push Model SOP Class" for more information.

#### 2.2.1.3.2 Activity - Send Storage Request

##### 2.2.1.3.2.1 Description and Sequencing of Activities

For each Retrieve Request received by Intulo AE, which results in a non-zero number of object instances from the Intulo database, a new Association to the indicated destination Remote AE is created, and one Storage Request per found object instance is sent to the Remote AE.

##### 2.2.1.3.2.2 Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Intulo AE supports the same SOP classes for outgoing Storage Requests as the SOP classes that are accepted for incoming Storage Requests. That is, it can send all image types it can receive. See section 'Activity - Receive Storage Request' for more information.		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

*Table 2.2.1.3.2.2-1 Proposed presentation contexts for Storage Request*

##### 2.2.1.3.2.3 SOP Specific Conformance for Storage Request

The Intulo AE will exhibit the following behavior according to the Status Code value returned in a Storage Response from a destination C-STORE SCP:

Service Status	Further Meaning	Status Codes	Behaviour
Refused	Out of Resources	A700	Transfer is considered failed.
Error	Data Set does not match SOP Class	A9xx	Transfer is considered failed.
	Cannot understand	C000	Transfer is considered failed.
Warning	Coercion of Data Elements	B000	Transfer is considered failed.
	Data Set does not match SOP Class	B007	Transfer is considered failed.
	Elements Discarded	B006	Transfer is considered failed.
Success	Data Set stored successfully	0000	Transfer is considered successful.

*Table 2.2.1.3.2.3-1 C-Store response status*

## 2.2.1.4 Association Acceptance Policy

Intulo AE will accept associations as an SCP to:

- Receive Storage Request
- Receive Storage Commitment
- Receive Query Request
- Receive Retrieve Request
- Receive Verification Request

### 2.2.1.4.1 Activity - Receive Storage Request

#### 2.2.1.4.1.1 Description and Sequencing of Activities

As SOP Instances are received they are stored in the Intulo database. If the received instance has a duplicate SOP Instance UID of a previously received instance, the received instance will be ignored and a response will be sent with status of success. Information about the received SOP Instance will also be logged in a specific error log.

#### 2.2.1.4.1.2 Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67	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

*Table 2.2.1.4.1.2-1 Accepted presentation contexts for Intulo AE and Receive Storage Request*

### 2.2.1.4.1.3 SOP Specific Conformance for X-Ray Radiation Dose SR SOP Class

Intulo AE provides Level 2 Conformance to the X-Ray Radiation Dose SR SOP Class. All Type 1, Type 2, and Type 3 Attributes defined in the Information Object Definition associated with the SOP Class will be stored.

Intulo AE does not support Digital Signatures.

In case of a successful C-Store operation, the received SOP Instances are stored in the Intulo database.

Stored SOP Instances can be retrieved at any time through the Query/Retrieve Service. The Optional Keys Concept Name Code Sequence and Content Template Sequence are only supported as Query Return Keys and not as Query Matching Keys.

Service Status	Further Meaning	Status Codes	Reason
Refused	Out of Resources	A700	Never sent
Error	Data Set does not match SOP Class	A9xx	Never sent - data set is not checked prior to processing
	Cannot understand	C000	The Data Set contains errors and cannot be handled
Warning	Coercion of Data Elements	B000	Never sent - data is never changed
	Data Set does not match SOP Class	B007	Never sent - data set is not checked prior to processing
	Elements Discarded	B006	Never sent - all elements are always handled
Success	Data Set stored successfully	0000	

*Table 2.2.1.4.1.3-1 C-Store response status*

### 2.2.1.4.2 Activity - Receive Storage Commitment Request

#### 2.2.1.4.2.1 Description and Sequencing of Activities

Intulo AE accepts incoming associations, receives Storage Commitment Requests, and immediately returns an N-ACTION Response confirming the arrival.

#### 2.2.1.4.2.2 Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment Push Model	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

*Table 2.2.1.4.2.2-1 Accepted presentation contexts for Intulo AE and Receive Storage Commitment Request*

### 2.2.1.4.2.3 SOP Specific Conformance for Storage Commitment Push Model SOP Class

Intulo AE provides standard conformance to the Storage Commitment Push Model SOP Class.

#### SCP Operations Statement:

The SCP never deletes any instances.

Instances are persisted in a database, although the Storage Commitment Request is not.

Instances can be retrieved at any time, without noteworthy latency, through the Query/Retrieve Service.

The optional Storage Media File-Set ID and UID Attributes in the N-ACTION request are not supported.

Service Status	Further Meaning	Status Codes	Behavior
Success	Request successfully received	0000	A Storage Commitment Result will be sent at a later time.
Cancel	Request rejected	fe00	No Storage Commitment Result will be sent.

*Table 2.2.1.4.2.3-1 Response status handling behaviors*

#### SCP Notifications Statement:

A Storage Commitment Result will only be sent as the response to an incoming N-ACTION request.

The optional Storage Media File-Set ID and UID Attributes in the N-EVENT-REPORT is not supported.

The optional Retrieve AE Title (0008,0054) Attribute in the N-EVENT-REPORT is not supported, since all instances are stored locally.

### 2.2.1.4.3 Activity - Receive Query Request

#### 2.2.1.4.3.1 Description and Sequencing of Activities

Intulo AE receives C-FIND requests and queries the database to find matching Studies, Series or Instances.

#### 2.2.1.4.3.2 Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	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

*Table 2.2.1.4.3.2-1 Accepted presentation contexts for Intulo AE and Receive Query Request*

#### 2.2.1.4.3.3 SOP Specific Conformance for C-FIND SOP Classes

Possible matching types for the supported elements in a query are:

- C - Case Insensitive Matching
- S - Single Value Matching
- L - List of UID Matching
- U - Universal Matching
- W - Wild Card Matching
- R - Range Matching
- NONE - No matching, only return key (i.e like universal matching)
- UNIQUE - indicates that this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching is used depending on the query level.

If Intulo AE manages an matching key of zero length, the value is considered unknown and all matching against the key is considered as a successful match. Return keys for which matching is not supported are processed in the same manner as a zero length matching key. That is, the value specified to be matched for the key is ignored but a value may be returned by Intulo AE for the key.

When matching an Attribute which has a value multiplicity of greater than one, if any of the values match, then all values will be returned.

Attribute Name	Tag	VR	Type
<b>Study Level</b>			
Study Date	(0008,0020)	DA	S, U, R
Study Time	(0008,0030)	TM	S, U, R
Accession Number	(0008,0050)	SH	S, U
Patient Name	(0010,0010)	PN	C, S, U
Patient ID	(0010,0020)	LO	S, U
Study ID	(0020,0010)	SH	S, U
Study Instance UID	(0020,000D)	UI	UNIQUE
Modalities in Study	(0008,0061)	CS	S, U
Referring Physician s Name	(0008,0090)	PN	C, S, U
Patient's Birth Date	(0010,0030)	DA	NONE
Patient's Sex	(0010,0040)	CS	NONE
Number of Study Related Series	(0020,1206)	IS	NONE
Number of Study Related Instances	(0020,1208)	IS	NONE
<b>Series Level</b>			
Modality	(0008,0060)	CS	S, U
Series Number	(0020,0011)	IS	S, U
Series Instance UID	(0020,000E)	UI	UNIQUE
Number of Series Related Instances	(0020,1209)	IS	NONE
Series Description	(0008,103E)	LO	NONE
<b>Instance Level</b>			

Attribute Name	Tag	VR	Type
SOP Class UID	(0008,0016)	UI	S, U
SOP Instance UID	(0008,0018)	UI	UNIQUE
Content Date	(0008,0023)	DA	NONE
Content Time	(0008,0033)	TM	NONE
Instance Number	(0020,0013)	IS	S, U
Referenced Request Sequence	(0040,A370)	SQ	U
>Study Instance UID	(0020,000D)	UI	NONE
>Accession Number	(0008,0050)	SH	NONE
>Requested Procedure ID	(0040,1001)	SH	NONE
>Requested Procedure Code Sequence	(0032,1064)	SQ	U
>>Code Value	(0008,0100)	SH	NONE
>>Coding Scheme Designator	(0008,0102)	SH	NONE
>>Coding Scheme Version	(0008,0103)	SH	NONE
>>Code Meaning	(0008,0104)	LO	NONE
Content Template Sequence	(0040,A504)	SQ	U
>Template Identifier	(0040,DB00)	CS	NONE
Concept Name Code Sequence	(0040,A043)	SQ	U
>Code Value	(0008,0100)	SH	NONE
>Coding Scheme Designator	(0008,0102)	SH	NONE
>Coding Scheme Version	(0008,0103)	SH	NONE
>Code Meaning	(0008,0104)	LO	NONE

**Table 2.2.1.4.3.3-1** Study Root C-FIND supported elements

If Specific Character Set (0008,0005) is included in the Request Identifier and the value is not supported by Intulo AE, the request will not be processed and Intulo AE will respond with an error. All Character Sets supported by Intulo AE are specified in section 3 .

Specific Character Set (0008,0005) is returned in the response and will always be set to 'ISO\_IR 100'.

Intulo AE does not support relational queries.

Intulo AE does not support extended negotiation of combined date-time matching and/or fuzzy semantic matching of person names.

Retrieve AE Title (0008,0054) is always returned as part of the response.

The following status codes may be returned in the response:

Service Status	Further Meaning	Status Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied
Refused	Out of Resources	A700	System reached the limit in disk space or memory usage
Failed	Identifier does not match SOP Class	A900	The C-FIND query identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class.
	Unable to process	C001	The C-FIND query identifier is valid for the specified SOP Class but cannot be used to query the database. For example, this can occur if a Patient Level query is issued but the identifier has only empty values for both the Patient ID and the Patient Name
Cancel	Matching terminated due to Cancel Request	FE00	The C-FIND SCU sent a Cancel Request. This has been acknowledged and the search for matches has been halted
Pending	Matches are continuing and current match is supplied	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. This status code is returned if all Optional keys in the query identifier are actually supported.
	Matches are continuing but one or more Optional Keys were not supported.	FF01	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. This status code is returned if there are Optional keys in the query identifier that are not supported.

*Table 2.2.1.4.3.3-2 C-FIND response status*

#### **2.2.1.4.4 Activity - Receive Retrieve Request**

##### **2.2.1.4.4.1 Description and Sequencing of Activities**

If Intulo AE receives a retrieval (C-MOVE) request then the responses will be sent over the same Association used to send the C-MOVE-Request. The Intulo AE will send the requested SOP Instances to the C-MOVE Destination over a new Association. Once the Intulo AE has finished attempting to transfer all the requested SOP Instances, it sends a final C-MOVE Response indicating the overall status of the attempted retrieval.

##### **2.2.1.4.4.2 Accepted Presentation Contexts**

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	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

*Table 2.2.1.4.4.2-1 Accepted presentation contexts for Intulo AE and Receive Retrieve Request*

### 2.2.1.4.4.3 SOP Specific Conformance for C-Move SOP Classes

The Intulo AE will start an Association with a DICOM Application Entity named as indicated by the MOVE Destination AE Title in the Retrieve Request. It will when perform C-STORE operations on specific instances as requested in the Retrieve Request.

The Intulo AE can support lists of UIDs in the C-MOVE Request at the Study, Series, Image Levels. The list of UIDs must be at the Level of the C-MOVE Request however. Incorrect values will result in zero matching instances, but not a specific Response Status Code. For example, if the C-MOVE Request is for Series Level retrieval but the identifier contains a list of Study UIDs, this situation will not be detected but will result in zero transferred instances.

No intermediate C-MOVE Responses will be sent during operation of the Request, only a final C-MOVE Response when all Storage operations has been finished. The following Response Status Codes are used:

Service Status	Further Meaning	Error Code	Reason
Failure	Refused: Move Destination unknown	A801	The Destination remote AE indicated in the Retrieve Request is unknown (not mapped by the Intulo AE configuration).
	Unable to process	C000	Some error situation not covered by other Status Response Codes, including communication issues like timeouts.
Warning	Sub-operations complete - One or more Failures	B000	Atleast one object instance was successfully transferred, and atleast one object instance failed to transfer.
Success	Sub-operations complete - No Failures	0000	All the Composite SOP Instances have been successfully sent to the C-MOVE Destination AE. It can also mean that the request resulted in zero matches, and that no transfers was done.

*Table 2.2.1.4.4.3-1 Response status handling behaviors*

### 2.2.1.4.5 Activity - Receive Verification Request

#### 2.2.1.4.5.1 Description and Sequencing of Activities

Intulo AE will respond successfully to any Verification Request made over an open association.

### 2.2.1.4.5.2 Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	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

*Table 2.2.1.4.5.2-1 Accepted presentation contexts for Verification*

### 2.2.1.4.5.3 SOP Specific Conformance for Verification SOP Class

Intulo AE provides standard conformance to the Verification Service class.

## 2.2.2 Intulo Retriever Application Entity

### 2.2.2.1 SOP Classes

Intulo Retriever Application Entity provides Standard Conformance to the following SOP classes:

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

*Table 2.2.2.1-1 SOP Classes*

### 2.2.2.2 Association Policies

#### 2.2.2.2.1 General

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

*Table 2.2.2.2.1-1 Dicom Application Context*

Intulo Retriever AE only initiates associations. No associations are accepted.

#### 2.2.2.2.2 Number of Associations

Intulo opens simultaneous associations to remote Application Entities in the following way:

- One association to a maximum of two different Remote AEs for FIND requests on study level
- One association to each Remote AE for FIND requests on series or image level
- One association to each Remote AE for MOVE requests

Maximum number of simultaneous associations	Unlimited
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*Table 2.2.2.2-1 Number of associations as an association initiator*

### 2.2.2.2.3 Asynchronous Nature

Intulo supports synchronous communication. Asynchronous communication (multiple outstanding transactions over a single association) is not supported.

### 2.2.2.2.4 Implementation Identifying Information

Implementation Class UID	1.2.752.48.3.1.1.6.XXX
Implementation Version Name	KRUCOM_J1.6.1_1.0.0.0

*Table 2.2.2.2.4-1 DICOM implementation class and version*

### 2.2.2.3 Association Initiation Policy

Associations to remote AEs are initiated by a user performing a C-FIND or a C-MOVE request.

#### 2.2.2.3.1 Activity - Query for Studies

##### 2.2.2.3.1.1 Description and Sequencing of Activities

A user can select one or many pre-configured Source Archives to be queried for studies matching specified criterias.

Each find request is placed in a Source Archive specific job queue which is common for all users.

##### 2.2.2.3.1.2 Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

*Table 2.2.2.3.1.2-1 Accepted presentation contexts for Intulo Retriever AE and Query for Studies*

##### 2.2.2.3.1.3 SOP Specific Conformance for Study Query

The request identifier for a study level query sent to the Source Archive is described in the table below. Type M means the attribute may be used for matching, U that it shall uniquely identify the entity, R that it is a required attribute and O that it is an optional attribute.

Unexpected attributes returned in a C-FIND response (those not requested) will be ignored.

Description	Tag	Type
<b>Study Level</b>		
Study Date	(0008,0020)	M
Study Time	(0008,0030)	M
Patient Name	(0010,0010)	M
Patient ID	(0010,0020)	M
Accession Number	(0008,0050)	M
Study ID	(0020,0010)	M
Study Instance UID	(0020,000D)	M
Modalities in Study	(0008,0061)	M
SOP Classes in Study	(0008,0062)	O
Referring Physician's Name	(0008,0090)	M
Study Description	(0008,1030)	O
Name of Physician(s) Reading Study	(0008,1060)	O
Admitting Diagnoses Description	(0008,1080)	O
Issuer of Patient ID	(0010,0021)	O
Patient's Birth Date	(0010,0030)	R
Patient's Birth Time	(0010,0032)	O
Patient's Sex	(0010,0040)	R
Other Patient IDs	(0010,1000)	O
Other Patient Names	(0010,1001)	O
Patient's Age	(0010,1010)	O
Patient's Size	(0010,1020)	O
Patient's Weight	(0010,1030)	O
Ethnic Group	(0010,2160)	O
Occupation	(0010,2180)	O
Additional Patient History	(0010,21B0)	O
Patient Comments	(0010,4000)	O
Other Study Numbers	(0020,1070)	O
Number of Patient Related Studies	(0020,1200)	O
Number of Patient Related Series	(0020,1202)	O
Number of Patient Related Instances	(0020,1204)	O
Number of Study Related Series	(0020,1206)	O
Number of Study Related Instances	(0020,1208)	O

Description	Tag	Type
Interpretation Author	(4008,010C)	O

**Table 2.2.2.3.1.3-1 C-FIND Request Identifier for STUDY Level Query**

Intulo Retriever AE will behave as described in the table below in response to the status returned in the C-FIND response command message.

Service Status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources	A7xx	Report error to application log and web GUI
Failed	Identifier does not match SOP Class	A900	Report error to application log and web GUI
	Unable to process	Cxxx	Report error to application log and web GUI
Cancel	Matching terminated due to Cancel request	FE00	Report success to web GUI
Success	Matching is complete. No final Identifier is supplied	0000	Report success to web GUI
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	Wait for next response.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier.	FF01	Wait for next response
Unknown	SCP returned non-standard code	xxxx	Report error to application log and web GUI

**Table 2.2.2.3.1.3-2 C-FIND response status handling behaviors**

### 2.2.2.3.2 Activity - Query for Series

#### 2.2.2.3.2.1 Description and Sequencing of Activities

A user can query for series belonging to studies found in Source Archives by checking the study and click on the Series Query button.

Each find request is placed in a Source Archive specific job queue which is common for all users.

#### 2.2.2.3.2.2 Proposed Presentation Contexts

Proposed presentation contexts are listed in Table 2.2.2.3.1.2-1.

### 2.2.2.3.2.3 SOP Specific Conformance for Series Query

The request identifier for a series level query sent to the Source Archive is described in the table below. The attribute Study Instance UID (0020,000D) is supplied with data based on the user's selection and are expected to be used for matching. Unexpected attributes returned in a C-FIND response (those not requested) will be ignored.

Type M means the attribute may be used for matching, U that it shall uniquely identify the entity, R that it is a required attribute and O that it is an optional attribute.

Description	Tag	Type
<b>Study Level</b>		
Study Instance UID	(0020,000D)	U
<b>Series Level</b>		
Modality	(0008,0060)	M
Series Number	(0020,0011)	M
Series Instance UID	(0020,000E)	M
Number of Series Related Instances	(0020,1209)	O
Series Description	(0008,103E)	R

*Table 2.2.2.3.2.3-1 C-FIND Request Identifier for SERIES Level Query*

Intulo Retriever AE will behave as described in 2.2.2.3.1.3-2 in response to the status returned in the C-FIND response command message.

### 2.2.2.3.3 Activity - Query for Instances

#### 2.2.2.3.3.1 Description and Sequencing of Activities

A user can query for instances belonging to series found in Source Archives by checking the selected series and clicking the Instance Query button.

Each find request is placed in a Source Archive specific job queue which is common for all users.

#### 2.2.2.3.3.2 Proposed Presentation Contexts

Proposed presentation contexts are listed in Table 2.2.2.3.1.2-1.

#### 2.2.2.3.3.3 SOP Specific Conformance for Instance Query

The request identifier for an instance level query sent to the Source Archive is described in the table below. The attributes Study Instance UID (0020,000D) and Series Instance UID (0020,000E) are supplied with data based on the user's selection and are expected to be used for matching. Unexpected attributes returned in a C-FIND response (those not requested) will be ignored.

Type M means the attribute may be used for matching, U that it shall uniquely identify the entity, R that it is a required attribute and O that it is an optional attribute.

Description	Tag	Type
<b>Study Level</b>		
Study Instance UID	(0020,000D)	U
<b>Series Level</b>		
Series Instance UID	(0020,000E)	U
<b>Composite object instance Level</b>		
Instance Number	(0020,0013)	M
SOP Instance UID	(0008,0018)	M
SOP Class UID	(0008,0016)	O
Referenced Request Sequence	(0040,A370)	R
>Study Instance UID	(0020,000D)	R
>Accession Number	(0008,0050)	R
>Requested Procedure ID	(0040,1001)	R
Content Template Sequence	(0040,A504)	R
>Template Identifier	(0040,DB00)	R
Concept Name Code Sequence	(0040,A043)	R
>Code Value	(0008,0100)	R
>Coding Scheme Designator	(0008,0102)	R
>Code Meaning	(0008,0104)	R

*Table 2.2.2.3.3.3-1 C-FIND Request Identifier for IMAGE Level Query*

Intulo Retriever AE will behave as described in 2.2.2.3.1.3-2 in response to the status returned in the C-FIND response command message.

## **2.2.2.3.4 Activity - Retrieve Studies**

### **2.2.2.3.4.1 Description and Sequencing of Activities**

A user can select one or several studies found in a Source Archive to be moved to a Destination Archive.

Each move request is placed in a Source Archive specific job queue which is common for all users.

### **2.2.2.3.4.2 Proposed Presentation Contexts**

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

*Table 2.2.2.3.4.2-1 Proposed presentation contexts for activity Retrieve Studies*

### 2.2.2.3.4.3 SOP Specific Conformance for Retrieve Studies

A user can select one or several studies found in Source Archives and request them to be moved to a Destination Archive. The request identifier sent to the Source Archive is described in the table below. Type U means the attribute shall uniquely identify the entity. Type M means the attribute is used for matching.

Description	Tag	Type
<b>Study Level</b>		
Study Instance UID	(0020,000D)	U,M

*Table 2.2.2.3.4.3-1 Study Root C-MOVE Request Identifier*

Intulo Retriever AE will behave as described in the table below in response to the status returned in the C-MOVE response command message.

Service Status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources - Unable to calculate number of matches	A701	Report error to failure log and web GUI
	Out of Resources - Unable to perform sub-operations	A702	Report error to failure log and web GUI
	Move destination unknown	A801	Report error to failure log and web GUI
Failed	Identifier does not match SOP Class	A900	Report error to failure log and web GUI
	Unable to process	Cxxx	Report error to failure log and web GUI
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Report success to web GUI
Warning	Matching is complete. One or more Failures	B000	Report success to web GUI and notify warning in application log

Service Status	Further Meaning	Status Codes	Behavior
Success	Matching is complete. No Failures	0000	Report success to web GUI
Pending	Sub-operations are continuing	FF00	Wait for next response.
Unknown	SCP returned non-standard code	xxxx	Report error to failure log and web GUI

*Table 2.2.2.3.4.3-2 C-MOVE response status handling behaviors*

### 2.2.2.3.5 Activity - Retrieve Studies for Patient

#### 2.2.2.3.5.1 Description and Sequencing of Activities

A user can select one or several studies found in a Source Archive and request all studies related to those patients to be moved to a Destination Archive.

Each move request is placed in a Source Archive specific job queue which is common for all users.

#### 2.2.2.3.5.2 Proposed Presentation Contexts

The proposed presentation contexts are listed in Table 2.2.2.3.4.2-1.

#### 2.2.2.3.5.3 SOP Specific Conformance for Retrieve Studies for Patient

A user can select found studies and request all studies related to patients of selected studies to be moved to a Destination Archive. The request identifier sent to the Source Archive is described in the table below. Type M means the attribute is used for matching.

Description	Tag	Type
<b>Study Level</b>		
Patient ID	(0010,0020)	M

*Table 2.2.2.3.5.3-1 Study Root C-MOVE Request Identifier*

Intulo Retriever AE will behave as described in Table 2.2.2.3.4.3-2 in response to the status returned in the C-MOVE response command message.

### 2.2.2.3.6 Activity - Retrieve Series

#### 2.2.2.3.6.1 Description and Sequencing of Activities

A user can request series found in Source Archives to be moved to a Destination Archive.

Each move request is placed in a Source Archive specific job queue which is common for all users.

#### 2.2.2.3.6.2 Proposed Presentation Contexts

The proposed presentation contexts are listed in Table 2.2.2.3.4.2-1.

### 2.2.2.3.6.3 SOP Specific Conformance for Retrieve Series

A user can select one or several series found in Source Archives and request them to be moved to a Destination Archive. The request identifier sent to the Source Archive is described in the table below. Type U means the attribute shall uniquely identify the entity. Type M means the attribute is used for matching.

Description	Tag	Type
<b>Study Level</b>		
Study Instance UID	(0020,000D)	M
<b>Series Level</b>		
Series Instance UID	(0020,000E)	U,M

*Table 2.2.2.3.6.3-1 Study Root C-MOVE Request Identifier*

Intulo Retriever AE will behave as described in Table 2.2.2.3.4.3-2 in response to the status returned in the C-MOVE response command message.

### 2.2.2.3.7 Activity - Retrieve Instances

#### 2.2.2.3.7.1 Description and Sequencing of Activities

A user can request instances found in Source Archives to be moved to a Destination Archive.

Each move request is placed in a Source Archive specific job queue which is common for all users.

#### 2.2.2.3.7.2 Proposed Presentation Contexts

The proposed presentation contexts are listed in Table 2.2.2.3.4.2-1.

#### 2.2.2.3.7.3 SOP Specific Conformance for Retrieve Instances

A user can select one or several instances found in Source Archives and request them to be moved to a Destination Archive. The request identifier sent to the Source Archive is described in the table below. Type U means the attribute shall uniquely identify the entity. Type M means the attribute is used for matching.

Description	Tag	Type
<b>Study Level</b>		
Study Instance UID	(0020,000D)	M
<b>Series Level</b>		
Series Instance UID	(0020,000E)	M
<b>Instance Level</b>		
SOP Instance UID	(0008,0018)	U,M

*Table 2.2.2.3.7.3-1 Study Root C-MOVE Request Identifier*

Intulo Retriever AE will behave as described in Table 2.2.2.3.4.3-2 in response to the status returned in the C-MOVE response command message.

## 2.2.3 Intulo MPPS Application Entity

### 2.2.3.1 SOP Classes

Intulo MPPS Application Entity provides Standard Conformance to the following SOP classes:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes	Yes
Verification SOP Class	1.2.840.10008.1.1	No	Yes

*Table 2.2.3.1-1 SOP Classes*

### 2.2.3.2 Association Policies

Intulo MPPS AE both accept and initiates associations.

#### 2.2.3.2.1 General

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

*Table 2.2.3.2.1-1 Dicom Application Context*

#### 2.2.3.2.2 Number of Associations

Maximum number of simultaneous associations	Unlimited
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*Table 2.2.3.2.2-1 Number of associations as an association initiator*

Maximum number of simultaneous associations	Unlimited
---	-----------

*Table 2.2.3.2.2-2 Number of associations as an association acceptor*

#### 2.2.3.2.3 Asynchronous Nature

Intulo supports synchronous communication. Asynchronous communication (multiple outstanding transactions over a single association) is not supported.

#### 2.2.3.2.4 Implementation Identifying Information

Implementation Class UID	1.2.752.48.3.1.1.6.XXX
Implementation Version Name	KRUCOM_J1.6.1_1.0.0.0

*Table 2.2.3.2.4-1 DICOM implementation class and version*

### 2.2.3.3 Association Initiation Policy

Intulo MPPS AE initiates associations to the configured remote AEs when new SOP Instances are available for forwarding. Several SOP Instances may be transferred over a single association.

#### 2.2.3.3.1 Activity - Forward MPPS

##### 2.2.3.3.1.1 Description and Sequencing of Activities

Intulo MPPS AE regularly checks the cache for new SOP Instances to send. If there is an error sending the SOP Instance, the application will wait a configured time and try again. When the limit of the number of attempts is reached, the SOP Instance will be moved from the cache to a quarantine folder.

The objects belonging to a SOP Instance will be sent in the same order as they were received.

##### 2.2.3.3.1.2 Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

*Table 2.2.3.3.1.2-1 Proposed presentation contexts for activity Forward MPPS*

##### 2.2.3.3.1.3 SOP Specific Conformance for MPPS SOP Class

Intulo MPPS AE forwards received N-CREATE and N-SET requests. Hence, the sent instances are not created nor modified by Intulo MPPS AE.

The response behavior for all status codes in a received N-CREATE response is as follows:

Service Status	Further Meaning	Status Codes	Behaviour
Success		0000	Report success
Failure	Class instance conflict	0119	Report error and retry according to policy
	Duplicate invocation	0210	Report error and retry according to policy
	Duplicate SOP Instance	0111	Report error and retry according to policy
	Invalid attribute value	0106	Report error and retry according to policy
	Invalid SOP Instance	0117	Report error and retry according to policy
	Missing attribute	0120	Report error and retry according to policy
	Missing attribute value	0121	Report error and retry according to policy
	Mistyped argument	0212	Report error and retry according to policy
	No such attribute	0105	Report error and retry according to policy
	No such SOP Class	0118	Report error and retry according to policy
	No such SOP Instance	0112	Report error and retry according to policy
	Processing failure	0110	Report error and retry according to policy
	Resource limitation	0213	Report error and retry according to policy
	Unrecognized operation	0211	Report error and retry according to policy

**Table 2.2.3.3.1.3-1** MPPS N-CREATE response status handling behaviour

The response behavior for all status codes in a received N-SET response is as follows:

Service Status	Further Meaning	Status Codes	Behaviour
Success		0000	Report success
Failure	Class instance conflict	0119	Report error and retry according to policy
	Duplicate invocation	0210	Report error and retry according to policy
	Invalid attribute value	0106	Report error and retry according to policy
	Invalid SOP Instance	0117	Report error and retry according to policy
	Missing attribute value	0121	Report error and retry according to policy
	Mistyped argument	0212	Report error and retry according to policy
	No such attribute	0105	Report error and retry according to policy
	No such SOP Class	0118	Report error and retry according to policy
	No such SOP Instance	0112	Report error and retry according to policy
	Processing failure	0110	Report error and retry according to policy
	Resource limitation	0213	Report error and retry according to policy
	Unrecognized operation	0211	Report error and retry according to policy

*Table 2.2.3.3.1.3-2 MPPS N-SET response status handling behaviour*

Communication errors are handled as follows:

Exception	Behavior
Timeout	Abort association, report error and retry according to policy
Association aborted	Report error and retry according to policy

*Table 2.2.3.3.1.3-3 Communication failure behavior for activity Forward MPPS*

### 2.2.3.4 Association Acceptance Policy

Intulo MPPS AE accepts incoming associations with a Called AE Title matching the configured Called AE Title.

Intulo MPPS AE can be configured to only accept associations with certain Calling AE Titles. The default setting is to accept associations from any Calling AE Title.

#### 2.2.3.4.1 Activity - Receive MPPS

##### 2.2.3.4.1.1 Description and Sequencing of Activities

Received instances are temporarily stored on disk for further forwarding to remote AEs.

### 2.2.3.4.1.2 Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	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

*Table 2.2.3.4.1.2-1 Accepted presentation contexts for activity Receive MPPS*

### 2.2.3.4.1.3 SOP Specific Conformance for MPPS SOP Class

Received N-CREATE and N-SET requests are stored temporarily on disk and will be removed when the request has been forwarded to all configured remote AEs.

No validation is performed on the received requests regarding for which attributes that values are provided.

All status codes that can be returned in a N-CREATE response by Intulo MPPS AE are as follows:

Service Status	Further Meaning	Status Codes	Behaviour
Success		0000	Report success
Failure	Processing failure	0110	Internal error within Intulo MPPS AE

*Table 2.2.3.4.1.3-1 MPPS N-CREATE response status*

All status codes that can be returned in a N-SET response by Intulo MPPS AE are as follows:

Service Status	Further Meaning	Status Codes	Behaviour
Success		0000	Report success
Failure	Processing failure	0110	Internal error within Intulo MPPS AE

*Table 2.2.3.4.1.3-2 MPPS N-SET response status*

### 2.2.3.4.2 Activity - Receive Verification Request

#### 2.2.3.4.2.1 Description and Sequencing of Activities

Intulo MPPS AE will respond successfully to any Verification Request made over an open association.

#### 2.2.3.4.2.2 Accepted Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	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

*Table 2.2.3.4.2.2-1 Accepted presentation contexts for Verification*

### 2.2.3.4.2.3 SOP Specific Conformance for Verification SOP Class

Intulo MPPS AE provides standard conformance to the Verification Service class.

## 2.3 Network Interfaces

### 2.3.1 Physical Network Interface

Intulo uses the TCP/IP networking capabilities provided by the system upon which it is installed.

### 2.3.2 Additional Protocols

Intulo uses operating system services for name resolution services.

## 2.4 Configuration

Configuration of Intulo is described in the Administrators Guide.

### 2.4.1 AE Title/Presentation Address Mapping

#### 2.4.1.1 Local AE Titles

Intulo uses the following AE Titles.

Application Entity	Default AE Title	Default TCP/IP Port
Intulo AE	KRUCOM_INTULO	104
Intulo MPPS AE	KRUCOM_SCP_MPPS	2350

*Table 2.4.1.1-1 Local AE Titles*

#### 2.4.1.2 Remote AE Title/Presentation Address Mapping

Intulo uses AE Titles to identify remote AEs and uses a one to one relationship between AE Title and Presentation Address. These are stored in the configuration file of Intulo. See Administrators Guide for more information.

## 2.4.2 Parameters

Parameter	Configurable (Yes/No)	Default Value
<b>General Parameters</b>		
Maximum PDU size	No	16 kB
Time-out waiting for acceptance or rejection Response to an Association Open Request. (Application Level timeout)	No	None
General DIMSE level time-out values	No	None
Time-out waiting for response to TCP/IP connect request. (Low-level timeout)	No	None
Time-out waiting for data between TCP/IP packets. (Low-level timeout)	No	None
Any changes to default TCP/IP settings, such as configurable stack parameters	No	None

*Table 2.4.2-1 Configuration Parameters*

---

### 3 SUPPORT OF CHARACTER SETS

Intulo supports the following character sets:

Defined Term	Description
ISO_IR 6	Default Repertoire
ISO_IR 100	Latin alphabet No. 1

*Table 3-1 Supported character sets*