



COMPASS

DICOM Conformance Statement

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1 Conformance Statement Overview

The application supports querying a remote system for a list of DICOM objects that may then be retrieved to the local system, receiving images sent to the application from the network and reading images from storage media.

All storage SOP Classes defined as of DICOM 2007 can be received and stored by the application, but only SOP classes specified below can be loaded and viewed.

Only hierarchical query and retrieval is supported.

SOP Classes	Use of Service (SCU)	Provider of Service (SCP)
CT Image Storage	No	Yes
RT Structure Set Storage	No	Yes
RT Dose Storage	No	Yes
RT Plan Storage	No	Yes
Query/Retrieve		
Study Root Information Model - FIND	Yes	No
Study Root Information Model – MOVE	Yes	No
Series Root Information Model – FIND	Yes	No
Series Root Information Model - MOVE	Yes	No

Table 1 Network Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
General Purpose CD-R	No	Yes
General Purpose DVD-RAM	No	Yes
Magneto - Optical Disc	No	Yes

Table 2 Media Services

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2 Introduction

2.1 Revision History

Document Version	Date of Issue	Description
01		

2.2 Scope and Field of Application

The scope of this DICOM Conformance Statement is to facilitate data exchange of COMPASS with other applications. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of COMPASS into an environment of medical devices. This Conformance Statement should be read in conjunction with the DICOM standard and its addenda.

2.3 Intended Audience

The intended audience is:

- (potential) customers
- marketing and sales staff interested in system functionality
- support and service personnel.
- system integrators of medical equipment

It is assumed, that the reader is familiar with the DICOM standard.

2.4 Contents and Structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2.

2.5 Used Definitions, Terms and Abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3 and PS 3.4.

2.6 Important Note to the Reader

This Conformance Statement by itself does not guarantee successful interoperability of COMPASS with equipment of other vendors. The user (or user's agent) should be aware of the following issues:

- **Interoperability**

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into a IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of COMPASS with equipment of other vendors.

It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates COMPASS with equipment from other vendors.

- **Validation**

COMPASS has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.

Where COMPASS is linked to equipment from other vendors, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

- **New versions of the DICOM Standard**

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. It is planned that COMPASS will be adapted to future versions of the DICOM Standard. In order to do so, changes in the application might be necessary.

The user should ensure that interfaced equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into COMPASS may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

2.7 General Acronyms and Abbreviations

This section provides the definitions of terms, acronyms, and abbreviations, which are used throughout the document.

AE	Application Entity
DICOM	Digital Imaging and Communications in Medicine, a standard on image communications in medical applications
NEMA	National Electrical Manufacturers Association
SCU	Service Class User
SCP	Service Class Provider
SOP	Service-Object-Pair, a definition of an information object (like an image) and of a service (like storage) that can be performed for the object
IE	Information Entity
TCP/IP	Transmission Control Protocol / Internet Protocol
Multi-frame Image	Image that contains multiple two-dimensional pixel planes
RLE	Run Length Encoding
UID	Unique Identifier
FSR	File Set Reader
FSC	File Set Creator

2.8 References

[1]	Digital Imaging and Communications in Medicine (DICOM), Parts 1-18 (2007), National Electrical Manufacturers Association (NEMA) 1300 N. 17th Street Rosslyn, VA 22209, United States of America
-----	--

3 Networking

3.1 Implementation Model

3.1.1 Application Data Flow

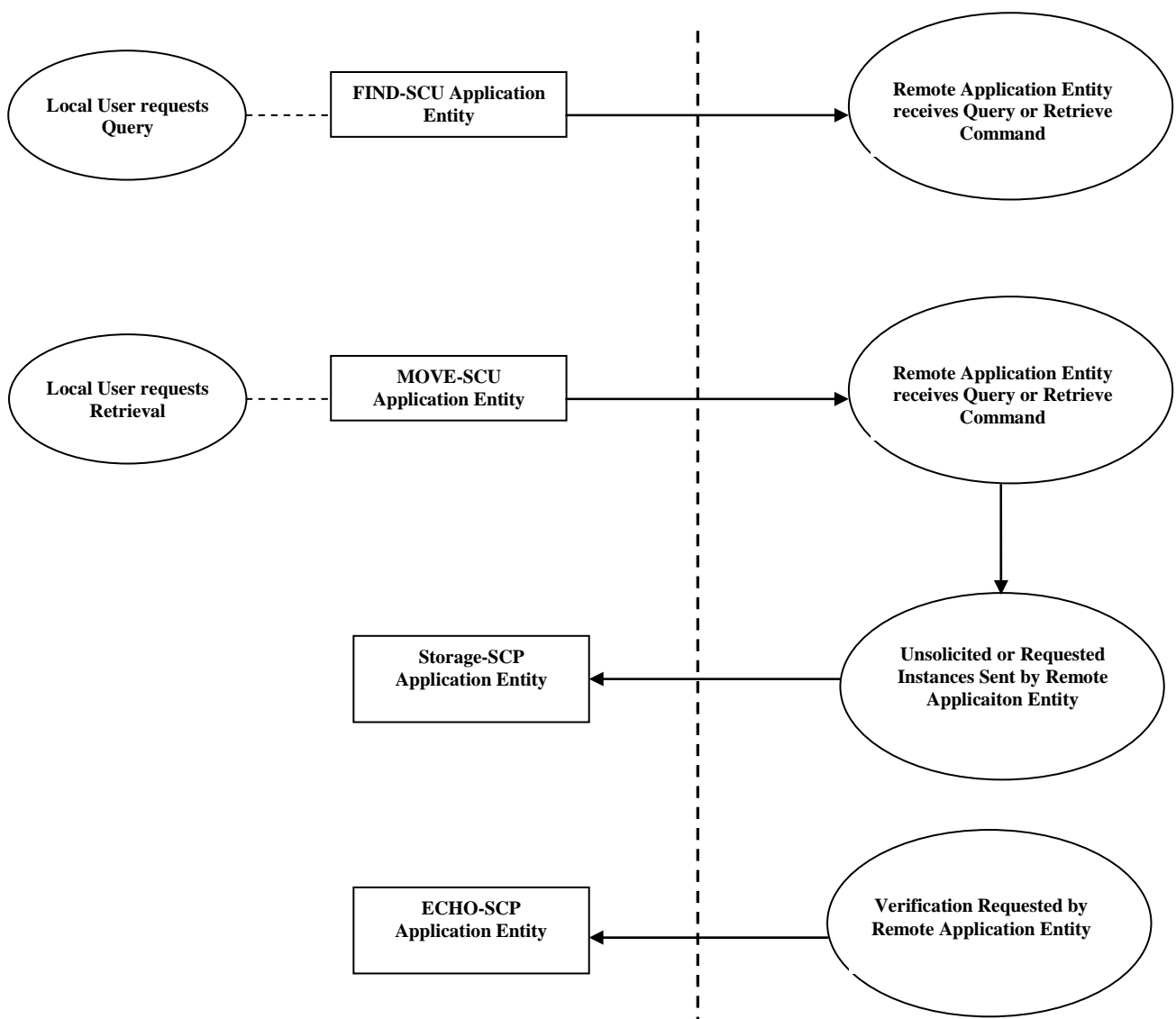


Figure 1 Networking Implementation Model

Conceptually the network services may be modeled as the following separate AEs, though in fact all AEs share a single (configurable) AE Title:

- ECHO-SCP, which responds to verification requests
- STORAGE-SCP, which receives incoming images and other composite instances
- FIND-SCU, which queries remote AEs for lists of studies, series and instances

- MOVE-SCU, which retrieves selected studies, series or instances

3.1.2 Functional Definitions of AE's

3.1.2.1 ECHO-SCP

ECHO-SCP waits in the background for connections, will accept associations with Presentation Contexts for SOP Class of the Verification Service Class, and will respond successfully to echo requests.

3.1.2.2 STORAGE-SCP

STORAGE-SCP waits in the background for connections, will accept associations with Presentation Contexts for SOP Classes of the Storage Service Class, and will store the received instances to the local directory structure where they may subsequently be listed and viewed through the user interface.

The storage SCP is implemented as a windows service which will be started during system boot and run continuously.

3.1.2.3 FIND-SCU

FIND-SCU is activated through the user interface when a user selects a remote AE to query, then initiates a query. Queries are performed recursively from the study through the series and instance levels until all matching instances have been listed.

3.1.2.4 MOVE-SCU

MOVE-SCU is activated through the user interface when a user selects a series or instance for retrieval. A connection to the remote AE is established to initiate and monitor the retrieval and the STORAGE-SCP AE receives the retrieved instances.

3.1.2.5 Sequencing of Real-World Activities

All SCP activities are performed asynchronously in the background and not dependent on any sequencing.

All SCU activities are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed.

3.2 AE Specifications

3.2.1 ECHO-SCP

3.2.1.1 SOP Classes

ECHO-SCP provide standard conformance to the following SOP Class

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	No	Yes

Table 3 SOP Classes supported by ECHO-SCU

3.2.1.2 Association Policies

3.2.1.2.1 General

ECHO-SCP accepts but never initiates associations.

Maximum PDU size received	Unlimited
---------------------------	-----------

Table 4 Maximum PDU size received as a SCP for ECHO-SCP

3.2.1.2.2 Number of Associations

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

Table 5 Number of associations as a SCP for ECHO-SCP

3.2.1.2.3 Asynchronous Nature

ECHO-SCP will only allow a single outstanding operation on an Association. Therefore, ECHO-SCP will not perform asynchronous operations window negotiation.

3.2.1.3 Association Initiation Policy

ECHO-SCP does not initiate associations.

3.2.1.4 Association Acceptance Policy

When ECHO-SCP accepts an association, it will respond to echo requests. If the Called AE Title does not match the pre-configured AE Title shared by all the SCPs of the application, the association will be rejected.

3.2.1.4.1 Activity - Receive Echo Request

3.2.1.4.2 Description and Sequencing of Activities

3.2.1.4.3 Accepted Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	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
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

Table 6 Acceptable presentation contexts for ECHO-SCP and receive ECHO request

3.2.1.4.3.1.1 Extended Negotiation

No extended negotiation is performed.

3.2.1.4.4 SOP Specific Conformance

3.2.1.4.4.1.1 SOP Specific Conformance to Verification SOP Class

ECHO-SCP provides standard conformance to the Verification Service Class

3.2.1.4.4.1.2 Presentation Context Acceptance Criterion

ECHO-SCP will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

3.2.1.4.4.1.3 Transfer Syntax Selection Policies

ECHO-SCP prefers explicit Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will apply the following priority to the choice of Transfer Syntax:

1. first encountered explicit Transfer Syntax,
2. default Transfer Syntax.

ECHO-SCP will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts, applying the same priority for selecting a Transfer Syntax for each.

3.2.2 Storage-SCP

3.2.2.1 SOP Classes

STORAGE-SCP provide Standard Conformance to the following SOP Class(es):

SOP Class Name	SOP Class UID	SCU	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	No	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes

Table 7 SOP Classes supported by Storage-SCP

3.2.2.2 Association Policies

3.2.2.2.1 General

STORAGE-SCP accepts but never initiates associations.

Maximum PDU size received	16384 bit
---------------------------	-----------

Table 8 Maximum PDU size received as a SCP for STORAGE-SCP

3.2.2.2.2 Number of Associations

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

Table 9 Number of associations as a SCP for STORAGE-SCP

3.2.2.2.3 Asynchronous Nature

STORAGE-SCP will only allow a single outstanding operation on an Association. Therefore, STORAGE-SCP will not perform asynchronous operations window negotiation.

3.2.2.3 Association Initiation Policy

STORAGE-SCP does not initiate associations.

3.2.2.4 Association Acceptance Policy

When STORAGE-SCP accepts an association, it will respond to echo requests. If the Called AE Title does not match the pre-configured AE Title shared by all the SCPs of the application, the association will be rejected.

3.2.2.4.1 Activity - Receive Storage Request

3.2.2.4.2 Description and Sequencing of Activities

All received instances are copied to the local file system and a record inserted into the local database by a windows service called "DICOM Storage SCP". COMPASS will connect to the service and provide access to the received files for the SOP classes listed in Table 7 SOP Classes supported by Storage-SCP. A browser will be displayed, from which instances may be selected and in turn loaded for further usage.

If the received instance is a duplicate of a previously received instance, the old file and database record will be overwritten with the new one.

3.2.2.4.3 Accepted Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
See Table 7	See Table 7	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 10 Proposed Presentation Contexts for STORAGE-SCU and receive storage request

3.2.2.4.3.1.1 Extended Negotiation

No extended negotiation is performed, though STORAGE-SCP:

- is a Level 2 Storage SCP (Full – does not discard any data elements)
- does not support digital signatures
- does not coerce any received data elements

3.2.2.4.4 SOP Specific Conformance

3.2.2.4.4.1 SOP Specific Conformance to Storage SOP Class

STORAGE-SCP provides standard conformance to the Storage Service Class.

3.2.2.4.4.1.2 Presentation Context Acceptance Criterion

STORAGE-SCP will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

3.2.2.4.4.1.3 Transfer Syntax Selection Policies

STORAGE-SCP prefers explicit Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will apply the following priority to the choice of Transfer Syntax:

1. first encountered explicit Transfer Syntax,
2. default Transfer Syntax.

STORAGE-SCP will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts, applying the same priority for selecting a Transfer Syntax for each.

3.2.3 FIND-SCU

3.2.3.1 SOP Classes

FIND-SCU provide standard conformance to the following SOP Class(es):

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

Table 11 SOP Classes supported by FIND-SCU

3.2.3.2 Association Policies

3.2.3.2.1 General

FIND-SCU initiates but never accepts associations.

Maximum PDU size received	16384 bit
---------------------------	-----------

Table 12 Maximum PDU size received as a SCP for FIND-SCU

3.2.3.2.2 Number of Associations

Maximum number of simultaneous associations	1
---	---

Table 13 Number of associations as a SCP for FIND-SCU

3.2.3.2.3 Asynchronous Nature

FIND-SCP will only allow a single outstanding operation on an Association. Therefore, FIND-SCU will not perform asynchronous operations window negotiation.

3.2.3.3 Association Initiation Policy

FIND-SCU attempts to initiate a new association when the user performs the query action from the user interface. If this involves recursive queries for lower query levels in the hierarchy, these will be performed on the same association.

3.2.3.3.1 Activity - Query Remote AE

3.2.3.3.2 Description and Sequencing of Activities

A single attempt will be made to query the remote AE. If the query fails, for whatever reason, no retry will be performed.

3.2.3.3.3 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
See Table 11	See Table 11	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
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

Table 14 Proposed Presentation Contexts for FIND-SCU and Query Remote AE

FIND-SCU will propose multiple Presentation Contexts, one for each of the supported Transfer Syntaxes, and an additional Presentation Context with all of the supported Transfer Syntaxes, in order to determine which Transfer Syntaxes the remote SCP supports, and which it prefers.

3.2.3.3.3.1.1 Extended Negotiation

No extended negotiation is performed.

In particular, relational queries are not supported.

3.2.3.3.4 SOP Specific Conformance

3.2.3.3.4.1.1 SOP Specific Conformance to C-FIND SOP Class

FIND-SCU provides standard conformance to the supported C-FIND SOP Classes.

Only a single information model, Study Root, is supported.

All queries are initiated at the highest level of the information model (the STUDY level), and then for each response received, recursively repeated at the next lower levels (the SERIES and then IMAGE levels), in order to completely elucidate the “tree” of instances available on the remote AE (from which the user may subsequently request a retrieval at any level).

No CANCEL requests are ever issued.

Non-matching responses returned by the SCP due to unsupported (hopefully optional) matching keys are not filtered locally by the FIND-SCU and thus will still be presented in the browser. No attempt is made to filter out duplicate responses.

Specific Character Set will not be included.

Name	Tag	Types of Matching
STUDY Level		
Patient's ID	(0010,0020)	S, *, U
Patient's Name	(0010,0010)	S, *, U
Patient's Birth Date	(0010,0030)	S, *, U, R
Patient's Sex	(0010,0040)	S, *, U
Accesssion Number	(0008,0050)	S, *, U
Study Date	(0008,0020)	S, *, U, R
Study Instance UID	(0020,000D)	Unique

Table 15 STUDY Root Request Identifier for FIND-SCU

Types of Matching:

The types of Matching supported by the C-FIND SCU. An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, an "*" indicates wildcard matching, a 'U' indicates Universal Matching, and an 'L' indicates that UID lists are sent. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned (i.e. universal matching), and "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.

3.2.3.3.4.1.2 Presentation Context Acceptance Criterion

FIND-SCU does not accept associations.

3.2.3.3.4.1.3 Transfer Syntax Selection Policies

FIND-SCP prefers explicit Transfer Syntaxes. If offered a choice of Transfer Syntaxes in a Presentation Context, it will apply the following priority to the choice of Presentation Context to use for the C-STORE operation:

1. first encountered explicit Transfer Syntax,
2. default Transfer Syntax.

3.2.3.4 Association Acceptance Policy

FIND-SCU does not accept associations.

3.2.4 Move - SCU

3.2.4.1 SOP Classes

FIND-SCU provide standard conformance to the following SOP Class(es):

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

Table 16 SOP Classes supported by MOVE-SCU

3.2.4.2 Association Policies

3.2.4.2.1 General

MOVE-SCU initiates but never accepts associations.

Maximum PDU size received	16384 bit
---------------------------	-----------

Table 17 Maximum PDU size received as a SCP for MOVE-SCU

3.2.4.2.2 Number of Associations

Maximum number of simultaneous associations 1

Table 18 Number of associations as a SCP for FIND-SCU

3.2.4.2.3 Asynchronous Nature

MOVE-SCP will only allow a single outstanding operation on an Association. Therefore, MOVE-SCU will not perform asynchronous operations window negotiation.

3.2.4.3 Association Initiation Policy

MOVE-SCU attempts to initiate a new association when the user performs the retrieve action from the user interface.

3.2.4.3.1 Activity – Retrieve From Remote AE

3.2.4.3.2 Description and Sequencing of Activities

For the entity (study, series or instance) selected from the user interface to be retrieved, a single attempt will be made to retrieve it from the selected remote AE. If the retrieve fails, for whatever reason, no retry will be performed.

3.2.4.3.3 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
See Table 16	See Table 16	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
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

Table 19 Proposed Presentation Contexts for MOVE-SCU and Retrieve from Remote AE

MOVE-SCU will propose multiple Presentation Contexts, one for each of the supported Transfer Syntaxes, and an additional Presentation Context with all of the supported Transfer Syntaxes, in order to determine which Transfer Syntaxes the remote SCP supports, and which it prefers.

3.2.4.3.3.1.1 Extended Negotiation

No extended negotiation is performed.
In particular, relational queries are not supported.

3.2.4.3.4 SOP Specific Conformance

3.2.4.3.4.1.1 SOP Specific Conformance to C-MOVE SOP Class

MOVE-SCU provides standard conformance to the supported C-MOVE SOP Classes.
Only a single information model, Study Root, is supported.

A retrieval will be performed at the STUDY, SERIES or IMAGE level depending on what level of entity has been selected by the user in the browser.

No CANCEL requests are ever issued.

The retrieval is performed from the AE that was specified in the previous C-FIND request. The instances are retrieved to the current application's local database by specifying the destination as the AE Title of the STORE-SCP AE of the local application. This implies that the remote C-MOVE SCP must be preconfigured to determine the presentation address corresponding to the STORE-SCP AE. The STORE-SCP AE will accept storage requests addressed to it from anywhere, so no pre-configuration of the local application to accept from the remote AE is necessary (except in so far as it was necessary to configure FIND-SCU).

Name	Tag	Unique, Matching or Return Key
STUDY Level		
Study Instance UID	(0020,000D)	U
SERIES Level		
Series Instance UID	(0020,000E)	U
IMAGE Level		
SOP Instance UID	(0008,0018)	U

Table 20 STUDY Root Request Identifier for MOVE-SCU

3.2.4.3.4.1.2 Presentation Context Acceptance Criterion

MOVE-SCU does not accept associations.

3.2.4.3.4.1.3 Transfer Syntax Selection Policies

MOVE-SCU prefers explicit Transfer Syntaxes. If offered a choice of Transfer Syntaxes in the accepted Presentation Contexts, it will apply the following priority to the choice of Presentation Context to use for the C-STORE operation:

1. first encountered explicit Transfer Syntax,

3.2.4.4 Sub-operation dependent behaviour

Since the C-MOVE operation is dependent on completion of C-STORE sub-operations that are occurring on a separate association, the question of failure of operations on the other association(s) must be considered.

MOVE-SCU completely ignores whatever activities are taking place in relation to the STORAGE-SCP AE that is receiving the retrieved instances. Once the C-MOVE has been initiated it runs to completion (or failure) as described in the C-MOVE response command message(s). There is no attempt by MOVE-SCU to confirm that instances have actually been successfully received or locally stored.

Whether or not completely or partially successfully retrievals are made available in the local database to the user is purely dependent on the success or failure of the C-STORE sub-operations, not on any explicit action by MOVE-SCU.

Whether or not the remote AE attempts to retry any failed C-STORE sub-operations is beyond the control of MOVE-SCU.

If the association on which the C-MOVE was issued is aborted for any reason, whether or not the C-STORE sub-operations continue is dependent on the remote AE; the local STORAGE-SCP will continue to accept associations and storage operations regardless.

3.2.4.5 Association Acceptance Policy

MOVE-SCU does not accept associations.

3.3 NETWORK INTERFACES

3.3.1 Physical Network Interface

The application is indifferent to the physical medium over which TCP/IP executes; which is dependent on the underlying operating system and hardware.

3.3.2 Additional Protocols

When host names rather than IP addresses are used in the configuration properties to specify presentation addresses for remote AEs, the application is dependent on the name resolution mechanism of the underlying operating system.

3.3.3 IPv4 and IPv6 Support

This product supports both IPv4 and IPv6. It does not utilize any of the optional configuration identification or security features of IPv6.

3.4 CONFIGURATION

All configuration is performed through the Options Dialog of the application. Refer to the User Manual for specific details.

3.4.1 Title/Presentation Address Mapping

The Calling AE Title of the local application is configurable in the Options Dialog. The mapping of the logical name by which remote AEs are described in the user interface to Called AE Titles as well as presentation address (hostname or IP address and port number) is configurable in the Options Dialog as well.

4 Media Interchange

4.1 Implementation Model

4.1.1 Application Data Flow

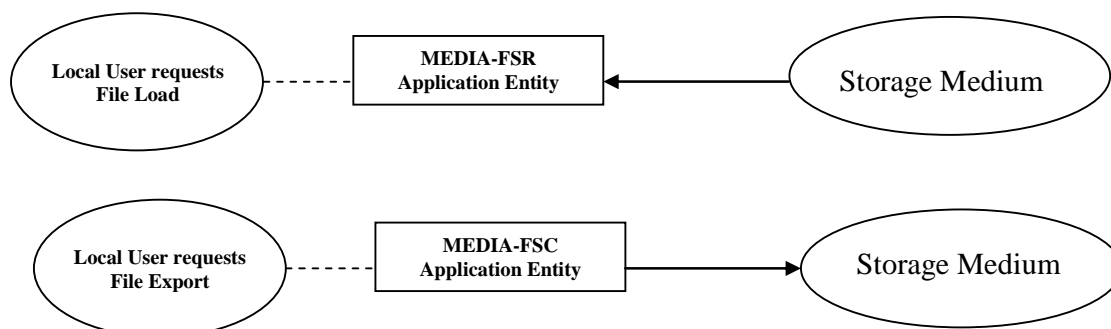


Figure 2 Media Interchange Implementation Model

The application provides a user interface, network support and media support as a File Set Reader and File Set Creator.

Conceptually it may be modeled as the following single AE:

- MEDIA-FSR, which loads a user-selected PS 3.10 compliant file, which may be a DICOMDIR or an image or spectroscopy object, either from the local file system or from PS 3.12 compliant media according to one of the General Purpose Media Application Profiles of PS 3.11 (CD-R or DVD-RAM)

In effect, the application is media-neutral, since the user is required to browse and locate the DICOMDIR file. Furthermore, any DICOM image out of Table 7 may be loaded, even in the absence of a PS 3.10 compliant meta-information header, in which case a “best guess” at the Transfer Syntax will be made.

4.1.2 Functional Definitions of AE’s

4.1.2.1 Media FSR

MEDIA-FSR is activated through the user interface to select directories or images for import into the local database or network transmission.

4.1.2.2 Media FSC

4.1.3 Sequenceing of Real-World Activities

All FSR activities are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed.

4.2 AE Specifications

4.2.1 Media - FSR

MEDIA-FSR provides standard conformance to the Media Storage Service Class.

Application Profiles Supported	Real World Activity	Role
STD-GEN-CD	Load directory or file	FSR
STD-GEN-DVD-RAM	Load directory or file	FSR

Table 21 Application Profiles, Activities, and Roles for MEDIA - FSR

4.2.1.2 Real World Activities

4.2.1.3 Activity – Load Directory or File

MEDIA-FSR is activated through the user interface when a user selects the Browse for DICOM Files or Browse from DICOMDIR operation. In both cases, a browser will be displayed, from which instances may be selected and in turn loaded for further usage.

4.2.1.3.1 Application Profile Specific Conformance

There are no extensions of specializations.

4.3 Augmented and Private Profiles

4.3.1 Augmented Profiles

None.

4.3.2 Private Profiles

None

4.3.3 Media Configuration

None.

5 Support of Extended Character Sets

Extended character sets are not directly supported.

6 Security

6.1 Security Profiles

None supported.

6.2 Association Level Security

None supported.

Any calling AE Title and/or IP address may open an association.

6.3 Application Level Security

None supported.

7 Annexes

7.1 IOD Contents

7.1.1 Created SOP Instance(s)

The following tables use a number of abbreviations. The abbreviations used in the “Presence of ...” column are:

VNAP Value Not Always Present (attribute sent zero length if no value is present)

ANAP Attribute Not Always Present

ALWAYS Always Present

EMPTY Attribute is sent without a value

7.1.1.1 RT Dose Image IOD

7.1.1.1.1 Overview

IE	Module	Reference	Presence
Patient Module	Patient	Table 23	ALWAYS
Study	General Study		
Series	RT Series	Table 25	ALWAYS
Dose	General Image		
	Image Plane	Table 27	ALWAYS
	Image Pixel	Table 29	ALWAYS
	Multi-Frame	Table 26	ALWAYS
	RT Dose	Table 28	ALWAYS
	SOP Common	Table 24	ALWAYS

Table 22 IOD of created RT Dose SOP Instances

7.1.1.1.2 Patient Module

Attribute name	Tag	Type	Attribute use
Patient's Name	(0010, 0010)	1	Written to file
Patient ID	(0010, 0020)	1	Not available
Patient's Birth Date	(0010, 0030)	2	Not available
Patient's Sex	(0010, 0040)	2	Not available

Table 23 Patient Module of created RT Dose SOP Instances

7.1.1.1.3 SOP Common Module

Attribute name	Tag	Type	Attribute use
SOP Class UID	(0008, 0016)	1	1.2.840.10008.5.1.4.1.1.481.2
SOP Instance UID	(0008, 0018)	1	Generated from RaySearch series
Specific Character Set	(0008, 0005)	1	ISO_IR 100
Instance Creation Date	(0008, 0012)	3	Not written
Instance Creation Time	(0008, 0013)	3	Not written
Instance Creator UID	(0008, 0014)	3	Not written
Instance Number	(0020, 0013)	3	Not written

Table 24 SOP Common Module of created RT Dose SOP Instances

7.1.1.1.4 RT Series Module

Attribute name	Tag	Type	Attribute use
Modality	(0008, 0060)	1	RTDOSE
Series Instance UID	(0020, 000E)	1	Generated series ID
Series Number	(0010, 0030)	2	1

Table 25 RT Series Module for created RT Dose SOP Instances

7.1.1.1.5 Multi Frame Module

Attribute name	Tag	Type	Attribute use
Number of Frames	(0028, 0008)	1	Number of dose slices in z-direction
Frame Increment Pointer	(0028, 0009)	1	(3004,000c)

Table 26 Multi Frame Module of created RT Dose SOP Instances

7.1.1.1.6 Image Plane Module

Attribute name	Tag	Type	Attribute use
Image Spacing	(0028, 0030)	1	Dose voxel x, y size
Image Orientation	(0020, 0037)	3	1/0/0/0/1/0
Image Position	(0020, 0032)	3	Corner of image position
Slice Thickness	(0018, 0050)	3	Not used
Slice Location	(0020, 1041)	1	Not used

Table 27 Image Plane Module of created RT Dose SOP Instances

7.1.1.1.7 RT Dose Module

Attribute name	Tag	Type	Attribute use
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Samples per Pixel	(0028, 0002)	1	Always set to 1
Photometric Interpretation	(0028, 0028)	3	Always set to MONOCHROME2
Bits Allocated	(0028, 0100)	3	Always set to 16
Bits Stored	(0028, 0101)	3	Always set to 16
High Bit	(0028, 0102)	1	Always set to 15
Pixel Representation	(0028, 0103)	1	Always set to 0x0001
Dose Units	(3004, 0002)	1	Always set to CGY
Dose Type	(3004, 0004)	1	Not used
Dose Comment	(3004, 0006)	3	Not used
Normalization Point	(3004, 0008)	1	Not used
Dose Summation Type	(3004, 000A)	1	Always set to PLAN
Referenced RT Plan Sequence	(300C, 0002)	1	Sequence
>Referenced SOP Class UID	(0008, 1150)	1	1.2.840.10008.5.1.4.1.1.481.5
>Referenced SOP Instance UID	(0008, 1155)	1	Plan UID
>Referenced Fraction Group Sequence	(300C, 0020)	1	Not written
>>Referenced Fraction Group Number	(300C, 0022)	1	Not written
>>Referenced Beam Sequence	(300C, 0004)	1	Not written
>>>Referenced Beam Number	(300C, 0006)	1	Not written
>>Referenced Brachy Application Setup Sequence	(300C, 000A)	1	Not written
>>>Referenced Brachy Application Setup Number	(300C, 000C)	1	Not written
Grid Frame Offset Vector	(3004, 000C)	1	Position offset for z-slices (always starting at 0)
Dose Grid Scaling	(3004, 000E)	1	

Table 28 RT Dose Module of created RT Dose SOP Instances

7.1.1.1.8 Image Pixel Module

Attribute name	Tag	Type	Attribute use
Samples per Pixel	(0028, 0002)	1	Always set to 1

Photometric Interpretation	(0028, 0004)	1	Always set to MONOCHROME2
Rows	(0028, 0010)	1	Number of x-voxels
Columns	(0028, 0011)	1	Number of y-voxels
Bits Allocated	(0028, 0100)	1	Always set to 16
Bits Stored	(0028, 0101)	1	Always set to 16
High Bit	(0028, 0102)	1	Always set to 15
Pixel Representation	(0028, 0103)	1	Always set to 0x0001
Pixel Data	(7FE0, 0010)	1	Reference to pixel data
Planar Configuration	(0028, 0006)	1	Not used
Pixel Aspect Ratio	(0028, 0034)	1	Not used
Smallest Image Pixel Value	(0028, 0106)	3	Not used
Largest Image Pixel Value	(0028, 0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028, 1101)	1	Not used
Blue Palette Color Lookup Table Descriptor	(0028, 1103)	1	Not used
Red Palette Color Lookup Table Data	(0028, 1201)	1	Not used
Green Palette Color Lookup Table Data	(0028, 1202)	1	Not used
Blue Palette Color Lookup Table Data	(0028, 1203)	1	Not used

Table 29 Image Pixel Module of created RT Dose SOP Instances

7.1.2 Usage of Attributes from received IOD's

7.1.2.1 RT Plan Storage SOP class

7.1.2.1.1 Overview

Module name	Use
SOP Common Module	Used
Patient Module	Used
General Study Module	Not used
RT Series Module	Used
General Equipment Module	Not used
RT General Plan Module	Used

Fraction Scheme Module	Used
Patient Setup Module	Used
Beam Module	Used

Table 30 IOD of received RT Plan Storage SOP class

7.1.2.1.2 Patient Module

Attribute name	Tag	Type	Attribute use
Patient's Name	(0010, 0010)	1	Stored as patient's name
Patient ID	(0010, 0020)	1	Stored as info
Patient's Birth Date	(0010, 0030)	2	Stored as info
Patient's Sex	(0010, 0040)	2	Not used

Table 31 Patient Module of received RT Plan Storage SOP class

7.1.2.1.3 General Study Module

Attribute name	Tag	Type	Attribute use
Study Instance UID	(0020, 000D)	1	Not used
Study Date	(0008, 0020)	2	Not used
Study Time	(0008, 0030)	2	Not used
Referring Physician's Name	(0008, 0090)	2	Not used
Study ID	(0020, 0010)	2	Not used
Accession Number	(0008, 0050)	2	Not used

Table 32 General Study Module of received RT Plan Storage SOP class

7.1.2.1.4 RT Series Module

Attribute name	Tag	Type	Attribute use
Modality	(0008, 0060)	1	Used in file map creation
Series Instance UID	(0020, 000E)	1	Not used
Series Number	(0010, 0030)	2	Not used

Table 33 RT Series Module of received RT Plan Storage SOP class

7.1.2.1.5 General Equipment Module

Attribute name	Tag	Type	Attribute use
Manufacturer	(0008, 0070)	2	Not used
Institute Name	(0008, 0080)	2	Not used

Station Name	(0008, 1010)	3	Not used
Manufacturer's Model Name	(0008, 1090)	3	Not used
Device Serial Number	(0018, 1000)	3	Not used
Software Version	(0018, 1020)	3	Not used

Table 34 General equipment Module of received RT Plan Storage SOP class

7.1.2.1.6 RT General Plan Module

Attribute name	Tag	Type	Attribute use
RT Plan Label	(300A, 0002)	1	Not used
Operators' Name	(0008, 1070)	2	Not used
RT Plan Date	(300A, 0006)	2	Not used
RT Plan Time	(300A, 0007)	2	Not used
RT Plan Geometry	(300A, 000C)	1	Assert this "TREATMENT_DEVICE"
Referenced Structure Set Sequence	(300C, 0060)	1	Sequence shall be of length 1
> Referenced SOP Class UID	(0008, 1150)	1	Not used
> Referenced SOP Instance UID	(0008, 1155)	1	Used to identify the structure set

Table 35 General Plan Module of received RT Plan Storage SOP class

7.1.2.1.7 RT Patient Setup

Attribute name	Tag	Type	Attribute use
Patient Setup Sequence	(300A, 0180)	1	Not used
Patient Position	(0018, 5100)	1	Must be HFS, HFP, FFS or FFP

Table 36 RT Patient Setup Module of received RT Plan Storage SOP class

7.1.2.1.8 RT Fraction Scheme

Attribute name	Tag	Type	Attribute use
Fraction Group Sequence	(300A, 0070)	1	Any number of fraction groups supported
> Fraction Group Number	(300A, 0071)	1	Used to identify fraction groups
> Number of Fractions Planned	(300A, 0078)	2	Used to create fraction schedule
> Number of Beams	(300A, 0080)	1	Not used
> Referenced Beam Sequence	(300C, 0004)	1	At least one beam per fraction group

>> Referenced Beam Number	(300C, 0006)	1	Used to reference beams
>> Beam Dose	(300A, 0084)	3	Not used
>> Beam Meterset	(300A, 0086)	3	When present used as beam MU
> Number of Brachy Application Setups	(300A, 00A0)	1	Must be 0

Table 37 RT Fraction Scheme Module of received RT Plan Storage SOP class

7.1.2.1.9 RT Beams Module

Attribute name	Tag	Type	Attribute use
Beam Sequence	(300A, 00B0)	1	Must be at least one beam
> Beam Number	(300A, 00C0)	1	Used to reference the beam
> Beam Name	(300A, 00C2)	1	Used for visualization
> Beam Type	(300A, 00C4)	2	“STATIC” and “DYNAMIC” are supported
> Radiation Type	(300A, 00C6)	1	“PHOTON” is supported
> Treatment Machine Name	(300A, 00B2)	1	Not used
> Source-Axis Distance	(300A, 00B4)	1	Not used
> Beam Limiting Device Sequence	(300A, 00B6)	1	MLC and JAW is supported
>> RT Beam Limiting Device Type	(300A, 00B8)	1	“X”, “Y”, “ASYMX”, “ASYMY”, and “MLCX” supported
>> Source to Beam Limiting Device Distance	(300A, 00BA)	3	Not used
>> Number of Leaf/Jaw Pairs	(300A, 00BC)	1	Not used
>> Leaf Position Boundaries	(300A, 00BE)	2	Not used
> Number of Wedges	(300A, 00D0)	1	Must be 0
> Number of Compensators	(300A, 00E0)	1	Must be 0
> Number of Boli	(300A, 00ED)	1	Must be 0
> Referenced Bolus Sequence	(300C, 00B0)	1	Not used
>> Referenced ROI Number	(3006, 00B0)	1	Not used
> Number of Blocks	(300A, 00F0)	1	Must be 0
> Final Cumulative Meterset Weight	(300A, 010E)	1	Used to compute beam MU and control point weight
> Number of Control Points	(300A, 0110)	1	Not used

> Control Point Sequence	(300A, 0111)	1	Must be at least 1
>> Control Point Index	(300A, 0112)	1	Used to identify the control point
>> Cumulative Meterset Weight	(300A, 0134)	2	Used to compute control point weight
>> Nominal Beam Energy	(300A, 0114)	2	Read from first control point and used as beam energy
>> Beam Limiting Device Position Sequence	(300A, 011A)	1	Must be 3
>>> RT Beam Limiting Device Type	(300A, 00B8)	1	“X”, “Y”, “ASYMX”, “ASYMY” and “MLCX” supported
>>> Leaf/Jaw Positions	(300A, 001C)	1	MLC and JAW positions
>> Gantry Angle	(300A, 011E)	1	Read from first control point
>> Beam Limiting Device Angle	(300A, 0120)	1	Read from first control point
>> Patient Support Angle	(300A, 0122)	1	Read from first control point
>> Isocenter Position	(300A, 012C)	1	Read from first control point

Table 38 RT Beams Module of received RT Plan Storage SOP class

7.1.2.2 RT Structure Set Storage SOP class

7.1.2.2.1 Overview

Module name	Use
Structure Set Module	Used
ROI Contour Module	Used
ROI Observation Module	Attempt to identify outline ROI

Table 39 IOD of received RT Structure Set Storage SOP class

7.1.2.2.2 Structure Set Module

Attribute name	Tag	Type	Attribute use
Structure Set Label	(3006, 0002)	1	Not used
Referenced Frame of Reference Sequence	(3006, 0010)	3	Must be 1
>RT Referenced Study Sequence	(3006, 0010)	3	
>>RT Referenced Series Sequence	(3006, 0012)	3	
>>>Contour Image Sequence	(3006, 0014)	1	Number of slices

>>>Structure Set ROI Sequence	(3006, 0020)	3	
>ROI Number	(3006, 0022)	1	
>ROI Name	(3006, 0026)	2	

Table 40 Structure Set Module of received RT Structure Set Storage SOP class

7.1.2.2.3 ROI Contour Module

Attribute name	Tag	Type	Attribute use
ROI Contour Sequence	(3006, 0039)	1	Sequence
>Referenced ROI Number	(3006, 0084)	1	Stored as ROI number
>ROI Display Color	(3006, 002A)	3	Used for visualization
>>Contour Sequence	(3006, 0046)	1	Sequence
>>Contour Data	(3006, 0050)	1	Converted to internal contour representation

Table 41 ROI Contour Module of received RT Structure Set Storage SOP class

7.1.2.2.4 RT ROI Observations Module

Attribute name	Tag	Type	Attribute use
RT ROI Observation Sequence	(3006, 0080)	1	Sequence
Observation Number	(3006, 0082)	1	Not used
ROI Type	(3006, 00A4)	3	Check if ROI type is EXTERNAL
Referenced ROI Number	(3006, 0084)	1	Used to reference EXTERNAL ROI

Table 42 RT ROI Observations Module of received RT Structure Set Storage SOP class

7.1.2.3 CT Image Storage SOP class

7.1.2.3.1 Overview

Module name	Use
Image Plane Module	Used
Image Pixel Module	Used
CT Image Module	Used

Table 43 IOD of received CT Image Storage SOP class

7.1.2.3.2 Image Plane Module

Attribute name	Tag	Type	Attribute use
----------------	-----	------	---------------

Image Spacing	(0028, 0030)	1	Used to establish pixel size
Image Orientation	(0020, 0037)	3	1/0/0/0/1/0, -1/0/0/0/1/0, 1/0/0/0/-1/0, -1/0/0/0/-1/0 supported
Image Position	(0020, 0032)	3	Used to establish image position
Slice Thickness	(0018, 0050)	3	Required for single slice series otherwise slice locations is used
Slice Location	(0020, 1041)	1	Used to establish slice location

Table 44 Image Plane Module of received CT Image Storage SOP class

7.1.2.3.3 Image Pixel Module

Attribute name	Tag	Type	Attribute use
Samples per Pixel	(0028, 0002)	1	Must be 1
Photometric Interpretation	(0028, 0004)	1	Must be MONOCHROME2
Rows	(0028, 0010)	1	Number of pixels
Columns	(0028, 0011)	1	Number of pixels
Bits Allocated	(0028, 0100)	1	Must be 16
Bits Stored	(0028, 0101)	1	Must be 16
High Bit	(0028, 0102)	1	Must be one less than Bits Allocated
Pixel Representation	(0028, 0103)	1	1 if signed, 0 if unsigned. Unsigned supported
Pixel Data	(7FE0, 0010)	1	Reference to pixel data
Planar Configuration	(0028, 0006)	1	Not used
Pixel Aspect Ratio	(0028, 0034)	1	Not used
Smallest Image Pixel Value	(0028, 0106)	3	Not used
Largest Image Pixel Value	(0028, 0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028, 1101)	1	Not used
Blue Palette Color Lookup Table Descriptor	(0028, 1103)	1	Not used
Red Palette Color Lookup Table Data	(0028, 1201)	1	Not used
Green Palette Color Lookup Table Data	(0028, 1202)	1	Not used
Blue Palette Color Lookup Table Data	(0028, 1203)	1	Not used

Table 45 Image Pixel Module of received CT Image Storage SOP class

7.1.2.3.4 CT Image Module

Attribute name	Tag	Type	Attribute use
Image Type	(0008, 0008)	1	Only CT supported
Samples per Pixel	(0028, 0002)	1	Must be 1
Photometric Interpretation	(0028, 0004)	1	Must be MONOCHROME2
Bits Allocated	(0028, 0100)	1	Must be 16
Bits Stored	(0028, 0101)	1	Must be 16
High Bit	(0028, 0102)	1	Must be one less than bits stored
Rescale Intercept	(0028, 1052)	1	Used to transform pixel data
Rescale Slope	(0028, 1053)	1	Used to transform pixel data

Table 46 CT Image Plane Module of received CT Image Storage SOP class

7.1.2.4 Information module definitions RT Dose storage SOP class

7.1.2.4.1 Overview

Module name	Use
General Equipment Module	Not used
RT Image Plane	Used
RT Dose Module	Used
RT Image Pixel	Used

Table 47 IOD of received RT Dose Image Storage SOP class

7.1.2.4.2 General Equipment Module

Attribute name	Tag	Type	Attribute use
Manufacturer	(0008, 0070)	2	Not used
Institute Name	(0008, 0080)	2	Not used
Station Name	(0008, 1010)	3	Not used
Manufacturer's Model Name	(0008, 1090)	3	Not used
Device Serial Number	(0018, 1000)	3	Not used
Software Version	(0018, 1020)	3	Not used

Table 48 General Equipment Module of received RT Dose Storage SOP class

7.1.2.4.3 Image Plane Module

Attribute name	Tag	Type	Attribute use
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Image Spacing	(0028, 0030)	1	Used to establish pixel size
Image Orientation	(0020, 037)	3	1/0/0/0/1/0, -1/0/0/0/1/0, 1/0/0/0/-1/0, -1/0/0/0/-1/0 supported
Image Position	(0020, 0032)	3	Used to establish dose grid corner
Slice Thickness	(0018, 0050)	3	Used
Slice Location	(0020, 1041)	1	Used

Table 49 Image Plane Module of received RT Dose Storage SOP class

7.1.2.4.4 RT Dose Module

Attribute name	Tag	Type	Attribute use
Samples per Pixel	(0028, 0002)	1	Must be 1
Photometric Interpretation	(0028, 0028)	3	Must be MONOCHROME2
Bits Allocated	(0028, 0100)	3	Must be 16 or 32
Bits Stored	(0028, 0101)	3	Must be 16 or 32
High Bit	(0028, 0102)	1	Must be one less than bits stored
Pixel Representation	(0028, 0103)	1	Not used
Dose Units	(3004, 0002)	1	Must be GY or CGY
Dose Type	(3004, 0004)	1	Not used
Dose Comment	(3004, 0006)	3	Not used
Normalization Point	(3004, 0008)	1	Not used
Dose Summation Type	(3004, 000A)	1	Must be PLAN, FRACTION or BEAM
Referenced RT Plan Sequence	(300C, 0002)	1	Sequence
>Referenced SOP Class UID	(0008, 1150)	1	1.2.840.10008.5.1.4.1.1.481.5
>Referenced SOP Instance UID	(0008, 1155)	1	Plan UID
>Referenced Fraction Group Sequence	(300C, 0020)	1	Must be one fraction group
>>Referenced Fraction Group Number	(300C, 0022)	1	Identify fraction group within plan
>>Referenced Beam Sequence	(300C, 0004)	1	Only all beams in fg is supported
>>>Referenced Beam Number	(300C, 0006)	1	Identify a beam within a plan
>>Referenced Brachy Application Setup Sequence	(300C, 000A)	1	Not supported

>>>Referenced Brachy Application Setup Number	(300C, 000C)	1	Not supported
Grid Frame Offset Vector	(3004, 000C)	1	If vector starts at z-coordinate for image it is treated as absolute positions. If it starts at zero it is treated as offset.
Dose Grid Scaling	(3004, 000E)	1	Scale dose grid

Table 50 RT Dose Module of received RT Dose Storage SOP class

7.1.2.4.5 Image Pixel Module

Attribute name	Tag	Type	Attribute use
Samples per Pixel	(0028, 0002)	1	Must be 1
Photometric Interpretation	(0028, 0004)	1	Must be MONOCHROME2
Rows	(0028, 0010)	1	Number of rows of pixel data
Columns	(0028, 0011)	1	Number of cols of pixel data
Bits Allocated	(0028, 0100)	1	Must be 16 or 32
Bits Stored	(0028, 0101)	1	Must be 16 or 32
High Bit	(0028, 0102)	1	Must be one less than Bits Allocated
Pixel Representation	(0028, 0103)	1	Not used
Pixel Data	(7FE0, 0010)	1	Reference to pixel data
Planar Configuration	(0028, 0006)	1	Not used
Pixel Aspect Ratio	(0028, 0034)	1	Not used
Smallest Image Pixel Value	(0028, 0106)	3	Not used
Largest Image Pixel Value	(0028, 0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028, 1101)	1	Not used
Blue Palette Color Lookup Table Descriptor	(0028, 1103)	1	Not used
Red Palette Color Lookup Table Data	(0028, 1201)	1	Not used
Green Palette Color Lookup Table Data	(0028, 1202)	1	Not used
Blue Palette Color Lookup Table Data	(0028, 1203)	1	Not used

Table 51 Image Pixel Module of received RT Dose Storage SOP class