RAYCARE V2025

RayCare PACS DICOM Conformance Statement

Declaration of conformity

CE 2862

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1. Overview

This document is the DICOM Conformance Statement for RayCare PACS, which is part of the RayCare Oncology Information System. It describes the DICOM interfaces for RayCare PACS. RayCare PACS supports import either from disk, over the DICOM network protocol or using the STOW-RS interface. RayCare PACS supports access to and retrieval of the stored DICOM objects using either manual export to disk, over the DICOM network protocol or using the QIDO-RS and WADO-RS interfaces.

Table 1-1 provides an overview of the DIMSE network services supported by RayCare PACS

Table 1-1. Network Services (RayCare PACS DIMSE AE)

SOP Class Name	**SOP Class UID**	**User of Service (SCU)**	**Provider of Service (SCP)**
Transfer *			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Yes	Yes
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	Yes
RT Physician Intent Storage	1.2.840.10008.5.1.4.1.1.481.10	Yes	Yes
RT Segment Annotation Storage	1.2.840.10008.5.1.4.1.1.481.11	Yes	Yes
RT Radiation Set Storage	1.2.840.10008.5.1.4.1.1.481.12	Yes	Yes
C-Arm Photon-Electron Radiation Storage	1.2.840.10008.5.1.4.1.1.481.13	Yes	Yes
Tomotherapeutic Radiation Storage	1.2.840.10008.5.1.4.1.1.481.14	Yes	Yes
Robotic-Arm Radiation Storage	1.2.840.10008.5.1.4.1.1.481.15	Yes	Yes
RT Radiation Record Set Storage	1.2.840.10008.5.1.4.1.1.481.16	Yes	Yes
RT Radiation Salvage Record Storage	1.2.840.10008.5.1.4.1.1.481.17	Yes	Yes

Tomotherapeutic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.18	Yes	Yes
C-Arm Photon-Electron Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.19	Yes	Yes
Robotic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.20	Yes	Yes
RT Beams Delivery Instruction Storage – Trial (RETIRED)	1.2.840.10008.5.1.4.34.1	Yes	Yes
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7	Yes	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Verification			
Verification	1.2.840.10008.1.1	Yes	Yes
Query / Retrieve			
Patient Root Query/Retrieve - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes **	Yes
Study Root Query/Retrieve - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Patient Root Query/Retrieve - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes **	Yes
Study Root Query/Retrieve - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Patient Root Query/Retrieve - GET	1.2.840.10008.5.1.4.1.2.1.3	Yes **	Yes
Study Root Query/Retrieve - GET	1.2.840.10008.5.1.4.1.2.2.3	Yes **	Yes
Workflow Management			
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	Yes

Table 1-2 provides an overview of the DICOM RESTful services supported by RayCare PACS

Table 1-2. Network Services (RayCare PACS DICOMWEB AE)

Network Service	**User of Service (Client)**	**Provider of Service (Server)**
Web Access to DICOM Objects (WADO)		
WADO - RS - Retrieve Study	No	Yes
WADO - RS - Retrieve Series	No	Yes
WADO - RS - Retrieve Instance	No	Yes

WADO - RS - Retrieve Bulk data	No	Yes
WADO - RS - Retrieve Metadata	No	Yes
Query by ID for DICOM Objects (QIDO)		
QIDO-RS - Search for Studies	No	Yes
QIDO-RS - Search for Series	No	Yes
QIDO-RS - Search for Instances	No	Yes
Storage over the web (STOW)		
STOW-RS - Store Instances	No	Yes

* More transfer services can be configured when needed
** Only used by the RayCare PACS DIMSE AE as PACS Rules SCU

2. Table of Contents

3. Introduction

3.1. Revision History

Table 3-1. Revision History

Date	Version	Comment
2025-06-16	1.0	Initial version

3.2. Audience

This document is written for the people that need to understand how RayCare PACS will integrate into their healthcare facility. It includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3. Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between RayCare PACS and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between RayCare PACS and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility

3.3.1. Interoperability Validation Needed

When using RayCare PACS together with other software, the DICOM conformance statements must be compared and relevant validation tests run. The DICOM standard by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first level comparison for interoperability between different applications supporting compatible DICOM functionality. RaySearch is also active within the IHE-RO. Contact RaySearch for more info regarding adherence to IHE-RO profiles.

3.4. Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax - The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) - An endpoint of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title (AET) - The externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context - The specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association - A network communication channel set up between *Application Entities*.

Attribute - A unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Index Database – A database with a subset of A*ttributes* of all the *SOP instances* that are stored in RayCare PACS, used to allow for searching on patients, studies, series and SOP instances that are stored in the PACS.

Information Object Definition (IOD) - The specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) - A set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile - The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Negotiation - First phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context - The set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) - A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile - A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) - Role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) - Role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair Class (SOP Class) - The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair Instance (SOP Instance) - An information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag - A 32-bit identifier for a data element, represented as a pair of four-digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax - The encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) - A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) - The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5. Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies several network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose

combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* - which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of a maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports) and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition* and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.6. Abbreviations

Table 3-2. Abbreviations

Name	Meaning
AE	Application Entity
AET	Application Entity Title
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
R	Required (Key Attribute)
RT	Radiotherapy
RTIMAGE	Radiotherapy Image

RTPLAN	Radiotherapy Plan
RTDOSE	Radiotherapy Dose
RTSTRUCT	Radiotherapy Structure Set
RTRECORD	Radiotherapy Treatment Record
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
VR	Value Representation

3.7. References

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

4. Networking

4.1. Implementation Model

4.1.1. RayCare PACS DIMSE AE Application Data Flow

Figure 1. RayCare PACS DIMSE AE as PACS GUI User (SCU) - Application Data Flow Diagram

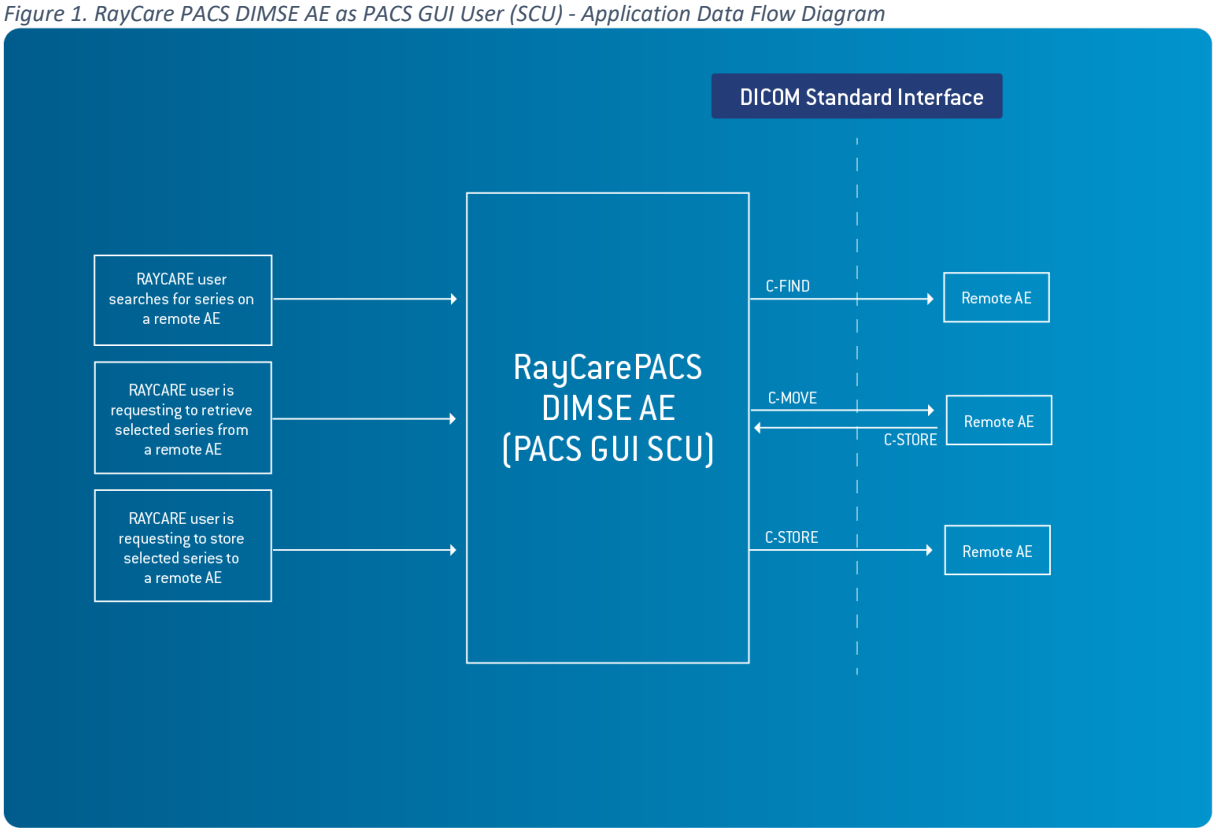


Figure 2. RayCare PACS DIMSE AE as PACS Rules User (SCU) - Application Data Flow Diagram

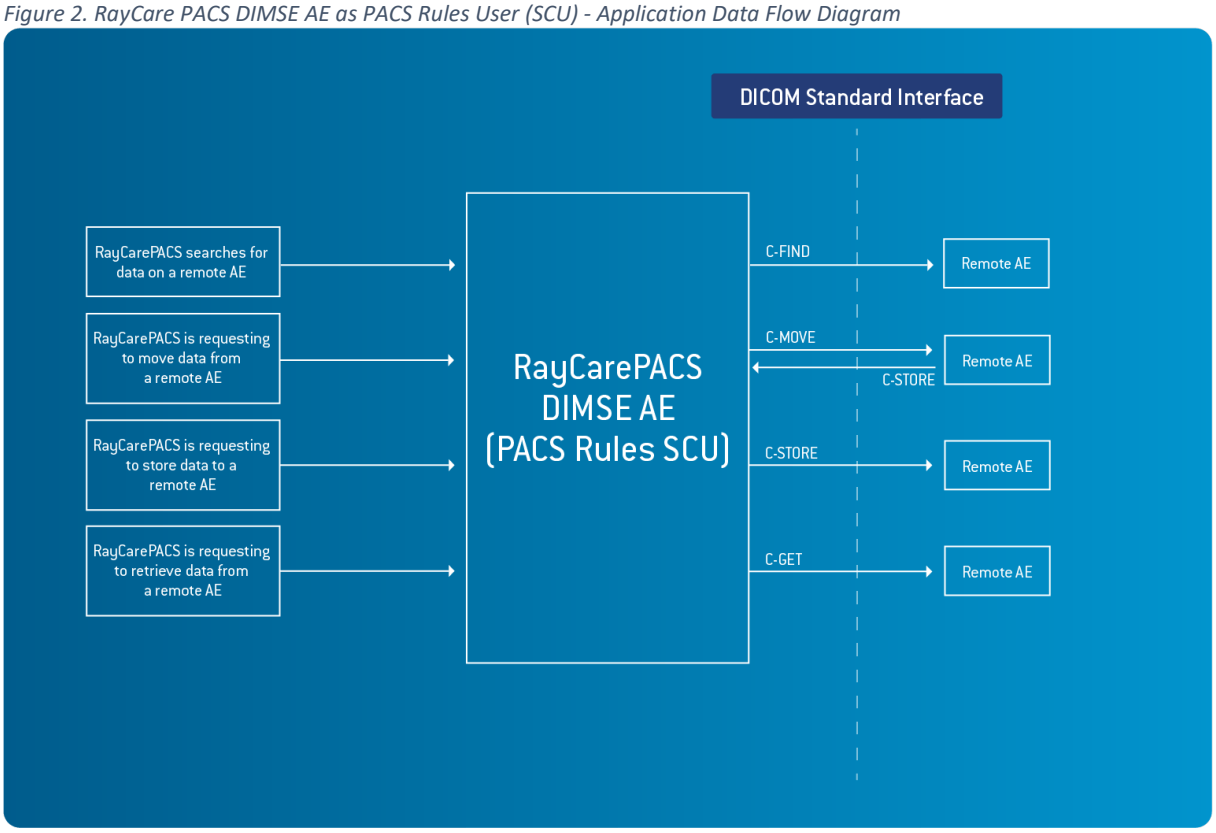
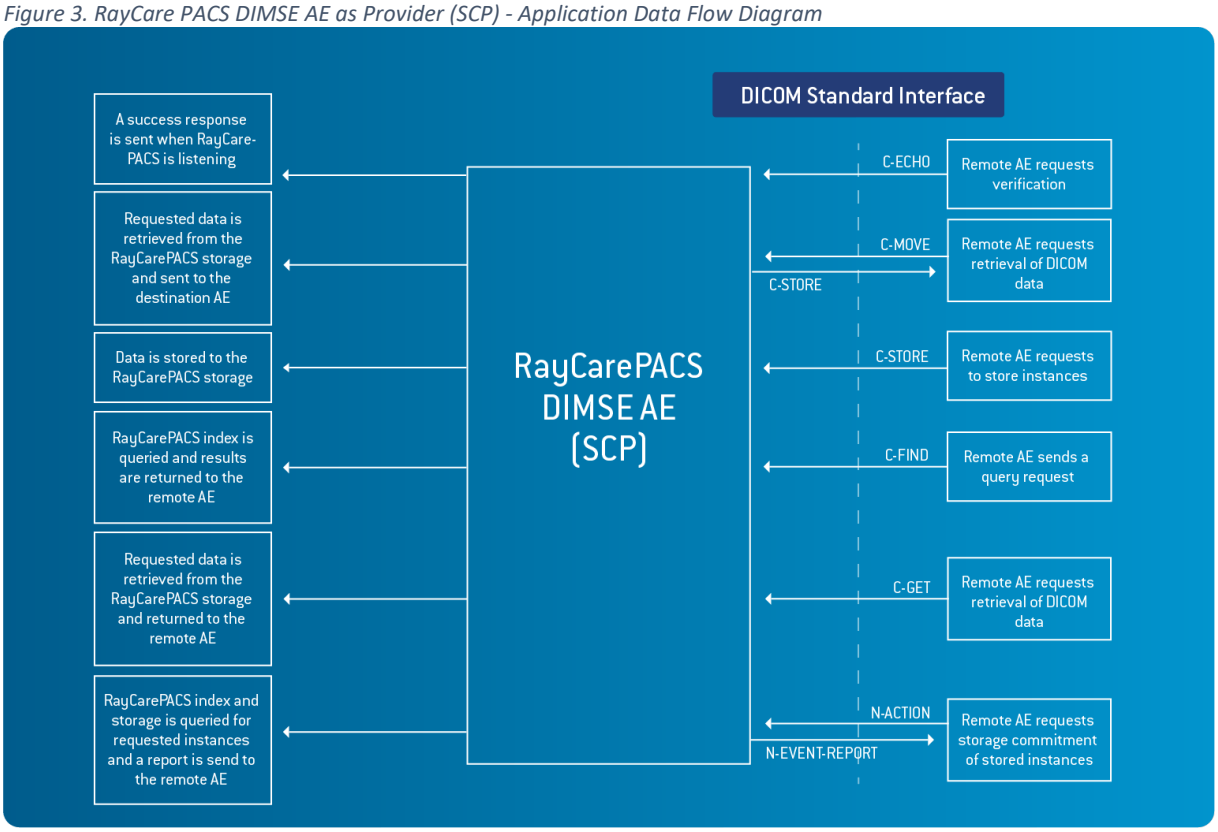
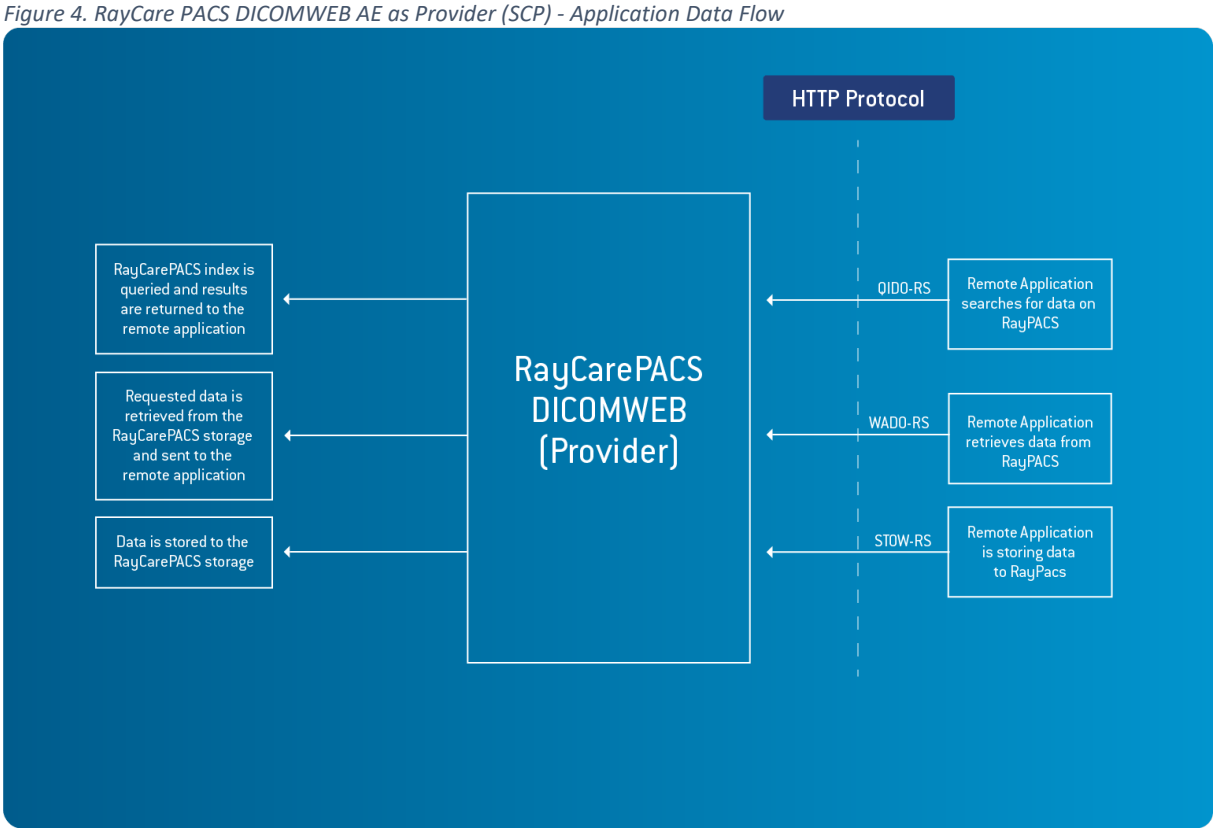


Figure 3. RayCare PACS DIMSE AE as Provider (SCP) - Application Data Flow Diagram



4.1.2. RayCare PACS DICOMWEB AE Application Data Flow

Figure 4. RayCare PACS DICOMWEB AE as Provider (SCP) - Application Data Flow



4.2. Functional Definitions of AEs

4.2.1. Functional definition of RayCare PACS DIMSE AE

The RayCare PACS DIMSE application entity can act both as a SCU and SCP. The following DICOM services are supported:

4.2.1.1. Storage SCP Service

The reception of a storage (C-Store) request from a remote application entity will activate the RayCare PACS Storage SCP service.

A received request will be validated before the composite SOP instance is stored in RayCare PACS. If the request and its contents do not contain the required attributes or the requesting host is not validated (if configured), the service will reject the instance(s) and return a failure status to the requestor.

In addition, storage will be skipped if the instance is already stored to RayCare PACS. When the SOP Instance UID is the same but the content of the instance is different, then also an error message will be returned.

Storage of composite SOP instances can be denied or ignored when a condition is not satisfied by optionally configurable import filters on the remote application entity. When storage is denied an error message will be returned.

RayCare PACS will store the actual instances using the standard DICOM media format as compressed files.

After the instances are stored, a set of attributes will be extracted from the composite SOP instance and stored in the RayCare PACS index database.

PACS rules can be configured to either automatically categorize, label, execute a script or send the complete series to a remote AE based on the Calling AE Title.

4.2.1.2. Storage SCU Service (GUI)

The Storage SCU service is activated through the RayCare PACS user interface when the user selects a Series and requests it to be sent to a remote AE (configured in the PACS Connections). In addition, the Storage SCU service can be activated as a sub action of a retrieve (move) request from the RayCare PACS Query/Retrieve SCP Service.

4.2.1.3. Storage SCU Service (Rules)

The Storage SCU service is activated through the RayCare PACS rules when a rule is configured to forward composite SOP instances to the remote AE.

4.2.1.4. Query/Retrieve SCP Service

The reception of a query (C-Find) or retrieve (C-Move or C-Get) request from a remote application entity will activate the Query/Retrieve SCP service.

The query/retrieve SCP service can process a Patient, Study, Series or Composite instance level query. When a request is received, the attributes in the request will be matched against the RayCare PACS index database and matching results will be returned as a response to the requestor.

When a retrieve is requested, the corresponding Patient, Study, Series or Instances will either be returned on the same association (C-Get) or be sent by the Storage SCU service to the remote AE whose AE Title is defined in the Destination AE Title attribute of the request (C-Move).

4.2.1.5. Query/Retrieve SCU Service (GUI)

The Query/Retrieve SCU service is activated through the RayCare PACS user interface when a user searches for a patient or study on a remote AE (configured in the PACS connections). By selecting one or more series in the search results and selecting retrieve, the Query/Retrieve SCU service will try to retrieve the series from the remote application entity.

4.2.1.6. Query/Retrieve SCU Service (Rules)

The Query/Retrieve SCU service can also be activated through the RayCare PACS rules when a rule is configured to perform either a query or retrieve. Both query (C-Find) and retrieve (C-Move and C-Get) requests can be send to a remote application entity using the Patient, Study, Series and Composite instance levels.

4.2.1.7. Storage Commitment SCP Service

The reception of a Storage Commitment N-Action request from a remote application entity will activate the Storage Commitment SCP service.

The Storage Commitment SCP service will check if the referenced SOP instances in the received N-Action request are stored in RayCare PACS. An N-Event-Report will be returned on a new association to the requesting application entity.

4.2.1.8. Storage Commitment SCU Service

The Storage Commitment SCU service is activated after the Storage SCU service has successfully sent the request for a Series to a remote AE as part of an action through the RayCare PACS user interface when the user selects a Series and requests it to be moved to another DICOM archive (configured in the PACS Archive locations).

4.2.2. Functional definition of RayCare PACS DICOMWEB AE

The RayCare PACS DICOMWEB AE application entity supports the following DICOM RESTful services

4.2.2.1. RayCare PACS STOW-RS Service

The reception of a STOW-RS POST request will activate the STOW-RS service of RayCare PACS. The storage request is based upon the multipart content-type header in the STOW-RS POST request. The STOW-RS request can either be a DICOM request message or a JSON Metadata and Bulk data request message (for Non-DICOM data). The response includes an HTTP status line, including a status-code and its associated textual phrase, followed by an JSON message indicating success, warning, or failure for each instance stored by the STOW-RS provider. The acceptance or rejection of the storage of the images or composite object instances will be handled by the same internal rules as defined in the RayCare PACS DIMSE AE Storage SCP Service. RayCare PACS is not able to initiate a STOW-RS request to a remote STOW-RS service itself.

4.2.2.2. RayCare PACS QIDO-RS Service

The reception of the QIDO-RS GET request will activate the QIDO-RS service of RayCare PACS. An internal query request is sent to the same internal search capabilities as defined in the RayCare PACS DIMSE AE Query/Retrieve SCP Service. The search result is based upon the URL of the QIDO-RS GET request. The response is a status code indicating the success, warning or failure of the search along with any matching results stored in RayCare PACS. RayCare PACS is not able to initiate a QIDO-RS request to a remote QIDO-RS service itself.

4.2.2.3. RayCare PACS WADO-RS Service

The reception of a WADO-RS request will activate the WADO-RS service of RayCare PACS. An internal query request is sent to the search capabilities of RayCare PACS. This request is based upon the request parameters or the URL resource endpoint of the request. The response is a list of all SOP instances stored in RayCare PACS that match the request parameters. If there are no matching instances, the AE will indicate this in the WADO response. For all matching instances, the AE will utilize the internal image transfer request to obtain a copy of each instance. If the request was for retrieval of instances, these instances will be returned. When a bulk data request is made, also encapsulated non-DICOM data can be retrieved. RayCare PACS is not able to initiate a WADO-RS request to a remote WADO-RS service itself.

4.3. AE Specifications

4.3.1. RayCare PACS DIMSE AE Specification

The RayCare PACS DIMSE AE utilizes all DIMSE services of RayCare PACS. The DIMSE services that are supported are, C-Echo, C-Store, C-Find, C-Get, C-Move and N-Action (Storage Commitment). All of them are completely specified in this section.

4.3.1.1. SOP Classes

RayCare PACS provides Standard Conformance to the following DICOM V3.0 SOP classes:

Table 4-1. Supported SOP Classes for RayCare PACS DIMSE AE

SOP Class Name	**SOP Class UID**	**User of Service (SCU)**	**Provider of Service (SCP)**
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Yes	Yes
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	Yes
RT Physician Intent Storage	1.2.840.10008.5.1.4.1.1.481.10	Yes	Yes
RT Segment Annotation Storage	1.2.840.10008.5.1.4.1.1.481.11	Yes	Yes
RT Radiation Set Storage	1.2.840.10008.5.1.4.1.1.481.12	Yes	Yes

C-Arm Photon-Electron Radiation Storage	1.2.840.10008.5.1.4.1.1.481.13	Yes	Yes
Tomotherapeutic Radiation Storage	1.2.840.10008.5.1.4.1.1.481.14	Yes	Yes
Robotic-Arm Radiation Storage	1.2.840.10008.5.1.4.1.1.481.15	Yes	Yes
RT Radiation Record Set Storage	1.2.840.10008.5.1.4.1.1.481.16	Yes	Yes
RT Radiation Salvage Record Storage	1.2.840.10008.5.1.4.1.1.481.17	Yes	Yes
Tomotherapeutic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.18	Yes	Yes
C-Arm Photon-Electron Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.19	Yes	Yes
Robotic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.20	Yes	Yes
RT Beams Delivery Instruction Storage – Trial (RETIRED)	1.2.840.10008.5.1.4.34.1	Yes	Yes
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7	Yes	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Patient Root Query/Retrieve - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Study Root Query/Retrieve - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Patient Root Query/Retrieve - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Study Root Query/Retrieve - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Patient Root Query/Retrieve - GET	1.2.840.10008.5.1.4.1.2.1.3	Yes	Yes
Study Root Query/Retrieve - GET	1.2.840.10008.5.1.4.1.2.2.3	Yes	Yes
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	Yes
Verification	1.2.840.10008.1.1	Yes	Yes

RayCare PACS can be configured to use additional storage SOP classes. It is also possible to configure the modalities that are allowed per application entity by enabling or disabling the modalities in the PACS Connections configuration.

4.3.1.2. Transfer Syntaxes

RayCare PACS provides standard conformance for the following transfer syntaxes

Table 4-2. Supported Transfer Syntaxes

Transfer Syntax	
Name	**UID**

Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

Table 4-3. Supported Image Transfer Syntaxes

Image Transfer Syntax	
Name	**UID**
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
JPEGLSLossless	1.2.840.10008.1.2.4.80
JPEG2000LosslessOnly	1.2.840.10008.1.2.4.90
JPEGLossless	1.2.840.10008.1.2.4.70
JPEGLosslessNonHierarchical14	1.2.840.10008.1.2.4.57
RLELossless	1.2.840.10008.1.2.5
JPEGLSLossyNearLossless	1.2.840.10008.1.2.4.81
JPEG2000	1.2.840.10008.1.2.4.91
JPEGBaseline1	1.2.840.10008.1.2.4.50
JPEGExtended24	1.2.840.10008.1.2.4.51

RayCare PACS cannot be configured to use additional transfer syntaxes.

4.3.1.3. Association Policies

4.3.1.3.1. General

The Application Context Name for DICOM 3.0 is the only Application Context proposed.

Table 4-4. DICOM Application Context for RayCare PACS DIMSE AE

Application Context Name	1.2.840.10008.3.1.1.1

4.3.1.3.2. Number of Associations

The maximum number of associations is unrestricted and cannot be configured in RayCare PACS.

Table 4-5. Number of associations for RayCare PACS DIMSE AE

Maximum number of simultaneous associations	Unrestricted

4.3.1.3.3. Asynchronous Nature

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

Table 4-6. Asynchronous Nature for RayCare PACS DIMSE AE

Maximum number of outstanding asynchronous transactions	1

4.3.1.3.4. Implementation Identifying Information

Table 4-7. DICOM Implementation Class and Version for RayCare PACS DIMSE AE

Implementation Class UID	1.2.752.243.2

Implementation Version Name	fo-dicom 5.1.3

4.3.1.4. Association Initiation Policy

When RayCare PACS initiates an association, it will initiate either a C-Echo, C-Store, C-Find, C-Move, C-Get or Storage Commitment N-Action request or as a response to a Storage Commitment N-Action request an N-Event-Report request. All these activities are described in the next sections.

4.3.1.4.1. Activity – Send Echo Request using PACS GUI

4.3.1.4.1.1. Description and Sequencing of Activities

A RayCare administrator can select a PACS connection in the RayCare PACS admin user interface and request it to be verified using an echo request. RayCare PACS will attempt to send the request to the remote AE, if no success response is returned, RayCare PACS will return an error message to the user.

4.3.1.4.1.2. Proposed Presentation Contexts

Table 4-8. Verification Presentation Context proposed by RayCare PACS DIMSE AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**				
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.3.1.4.1.3. Extended Negotiation

No extended negotiation is performed

4.3.1.4.1.4. SOP Specific Conformance for Verification SOP Class

RayCare PACS provides standard conformance to the Verification Service Class

4.3.1.4.2. Activity – Send Store Request using PACS GUI

4.3.1.4.2.1. Description and Sequencing of Activities

A user can select DICOM Series using the RayCare PACS user interface and request them to be sent to external destinations. RayCare PACS will attempt to send the selected series to the selected remote AE. If the attempt fails, an error message is shown. No retry will be made to send it again.

4.3.1.4.2.2. Proposed Presentation Contexts

Table 4-9. Storage Presentation Contexts proposed by RayCare PACS DIMSE AE

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
Name	**UID**			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See Table 4-3. Supported Image Transfer Syntaxes	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4			
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128			

Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7			
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1			
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	See Table 4-2. Supported Transfer Syntaxes		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3			
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4			
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5			
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6			
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7			
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8			
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9			
RT Physician Intent Storage	1.2.840.10008.5.1.4.1.1.481.10			
RT Segment Annotation Storage	1.2.840.10008.5.1.4.1.1.481.11			
RT Radiation Set Storage	1.2.840.10008.5.1.4.1.1.481.12			
C-Arm Photon-Electron Radiation Storage	1.2.840.10008.5.1.4.1.1.481.13			
Tomotherapeutic Radiation Storage	1.2.840.10008.5.1.4.1.1.481.14			
Robotic-Arm Radiation Storage	1.2.840.10008.5.1.4.1.1.481.15			
RT Radiation Record Set Storage	1.2.840.10008.5.1.4.1.1.481.16			
RT Radiation Salvage Record Storage	1.2.840.10008.5.1.4.1.1.481.17			
Tomotherapeutic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.18			
C-Arm Photon-Electron Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.19			
Robotic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.20			
RT Beams Delivery Instruction Storage – Trial (RETIRED)	1.2.840.10008.5.1.4.34.1			
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7			
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5			
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66			

Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1			
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67			
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1			
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59			

RayCare PACS will propose Presentation Context only for the SOP class of the instance that is to be transferred.

For that SOP class, RayCare PACS will propose one Presentation Context with only the transfer syntax associated to the instance to be transferred.

4.3.1.4.2.2.1. Extended Negotiation

No extended negotiation is performed

4.3.1.4.2.3. SOP Specific Conformance for Storage SOP Classes

RayCare PACS provides standard conformance to the Storage Service Class

RayCare PACS will behave as described in the table below in response to the status returned in the C-Store response command message.

Table 4-10. DICOM C-Store Command Response Status Handling Behavior

Service Status	Further Meaning	Status Codes	Behavior
Success	Storage is complete	0000	A success message will be logged and showed to the user
Warning		Bxxx	Storage will be treated as successful and a warning will be logged
Failure	Any	Axxx, Cxxx	Storing of pending instances will be canceled and an error message will be logged and showed to the user

4.3.1.4.3. Activity – Send Store Request using PACS rules

4.3.1.4.3.1. Description and Sequencing of Activities

When a RayCare PACS rule is configured to forward composite DICOM instances to one or more remote PACS connections, RayCare PACS will attempt to send a store request with the associated DICOM instances to the remote AE that is configured in the rule. If the attempt will fail, no retry will be made to send it again. The error message will be shown in the Rule log.

4.3.1.4.3.2. Proposed Presentation Contexts

See table Table 4-9. Storage Presentation Contexts proposed by RayCare PACS DIMSE AE

RayCare PACS will propose only for the SOP classes of the instances that will be transferred.

For those SOP classes, RayCare PACS will propose one Presentation Context per SOP class with only the transfer syntax associated to the instances to be transferred.

4.3.1.4.3.2.1. Extended Negotiation

No extended negotiation is performed

4.3.1.4.3.3. SOP Specific Conformance for Storage SOP Classes

RayCare PACS provides standard conformance to the Storage Service Class

RayCare PACS will behave as described in the table below in response to the status returned in the C-Store response command message.

Table 4-11. DICOM C-Store Command Response Status Handling Behavior

Service Status	Further Meaning	Status Codes	Behavior
Success	Storage is complete	0000	A success message will be logged
Warning		Bxxx	Storage will be treated as successful and a warning will be logged
Failure	Any	Axxx, Cxxx	Storing of pending instances will be canceled and an error message will be logged

4.3.1.4.4. Activity – Send Find Request using PACS GUI

4.3.1.4.4.1. Description and sequencing of activities

RayCare PACS attempts to initiate a new association when the user performs a search action from the RayCare PACS user interface. The query performed by the users search action is initiated on Series level of the Study Root information model.

4.3.1.4.4.2. Proposed Presentation Contexts

Table 4-12. Query Presentation Contexts proposed by RayCare PACS DIMSE AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID				
Study Root Q/R 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		

4.3.1.4.4.2.1. Extended negotiation

No extended negotiation is performed

4.3.1.4.4.3. SOP Specific Conformance for Query SOP Classes

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

Only Study Root information model is supported. Queries from the RayCare PACS user interface are initiated at STUDY and SERIES level.

No CANCEL requests are ever issued, but the association will be closed when the search action is canceled by the user or when the connection is timed out.

Unexpected attributes returned in a C-FIND response (those not requested) are ignored. Requested return attributes not returned by the SCP are also ignored.

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 to the user. No attempt is made to filter out duplicate responses.

Specific Character Set will never be included in the request and will be ignored if present in the response.

Table 4-13. Study Level Request Identifier for search actions initiated from the RayCare PACS user interface

Attribute Name	Tag	VR	Types of Matching
Patient ID	0010,0020	LO	S, *, U
Patient's Name	0010,0010	PN	S, *, U
Patient's Birth Date	0010,0030	DA	S, U
Patient's Sex	0010,0040	CS	NONE
Study Instance UID	0020,000D	UI	NONE
Study Description	0008,1030	LO	NONE
Study Date	0008,0020	DA	S, U, R
Study Time	0008,0030	TM	NONE
Accession Number	0008,0050	SH	S, U
Modalities in Study	0008,0061	CS	S, U
Number of Study Related Series	0020,1206	IS	NONE
Query/Retrieve Level	0008,0052	CS	S

Table 4-14. Series Level Request Identifier for search actions initiated from the RayCare PACS user interface.

Attribute Name	Tag	VR	Types of Matching
Study Instance UID	0020,000D	UI	UNIQUE
Series Instance UID	0020,000E	UI	NONE
Series Description	0008,103E	LO	NONE
Series Date	0008,0021	DA	NONE
Series Time	0008,0031	TM	NONE
Modality	0008,0060	CS	S, U
Number of Series Related Instances	0020,1209	IS	NONE
Query/Retrieve Level	0008,0052	CS	S

The table should be read as follows:

Attribute Name – Attributes that are part of the C-Find request identifier.

Tag –DICOM Tag used for this attribute.

VR –DICOM Value Representation used for this attribute.

Types of matching (See section C.2.2.2 "Attribute Matching" in PS3.4):

S - indicates the identifier attributes uses Single Value Matching

U - indicates Universal Matching

***** - indicates Wild Card Matching

R - indicates Range Matching

NONE - indicates that no values will be provided, but that values for this Element are requested to be returned

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 (see Section C.2.2.1.1 “Unique Keys” in PS3.4).

Table 4-15. DICOM CFind Command Response Status Handling Behavior

Service Status	Further Meaning	Status Codes	Behavior
Success	Matching is complete – No final identifier is supplied	0000	Current query is terminated
Cancel	Matching terminated due to Cancel request	FE00	Cancel is ignored (is not supported)
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier used to return results to the user
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Warning is ignored, Identifier used to return results to the user
Failure	Any	Axxx, Cxxx	Query is terminated and the error message will be logged and returned to the user.

4.3.1.4.5. Activity – Send Find Request using PACS Rules

4.3.1.4.5.1. Description and sequencing of activities

RayCare PACS attempts to initiate a new association when a PACS rule with a query request is executed. The query performed by the PACS rule can be initiated on any level of the Patient Root or Study Root information model.

4.3.1.4.5.2. Proposed Presentation Contexts

Table 4-16. Query Presentation Contexts proposed by RayCare PACS DIMSE AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**				
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.3.1.4.5.2.1. Extended negotiation

No extended negotiation is performed

4.3.1.4.5.3. SOP Specific Conformance for Query SOP Classes

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

Both Patient Root and Study Root information model is supported. All queries initiated from a PACS rule can be performed on any level of supported information models.

No CANCEL requests are ever issued, but the association will be closed when the search action is canceled by the PACS rule.

Unexpected attributes returned in a C-FIND response (those not requested) are ignored. Requested return attributes not returned by the SCP are also ignored.

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 returned to the PACS rule. No attempt is made to filter out duplicate responses.

Specific Character Set can be included in the request and will be ignored if present in the response.

Table 4-17. Patient Root or Study Root Identifier for search actions initiated from a PACS rule.

Attribute Name	Tag	VR	Types of Matching
PATIENT Level – Patient Root			
Patient ID	0010,0020	LO	UNIQUE
Any attribute provided by rule	-	-	S, U, *, R or NONE
STUDY Level – Study Root			
Patient ID	0010,0020	LO	S, *, U
Study Instance UID	0020,000D	UI	UNIQUE
Any attribute provided by rule	-	-	S, U, *, R or NONE
SERIES Level – Study Root			
Patient ID	0010,0020	LO	S, *, U
Study Instance UID	0020,000D	UI	S, *, U
Series Instance UID	0020,000E	UI	UNIQUE
Any attribute provided by rule	-	-	S, U, *, R or NONE
COMPOSITE INSTANCE Level – Study Root			
Patient ID	0010,0020	LO	S, *, U
Study Instance UID	0020,000D	UI	S, *, U
Series Instance UID	0020,000E	UI	S, *, U
SOP Instance UID	0008,0018	UI	UNIQUE
Any attribute provided by rule	-	-	S, U, *, R or NONE

The table should be read as follows:

Attribute Name – Attributes that are part of the C-Find request identifier.

Tag –DICOM Tag used for this attribute.

VR –DICOM Value Representation used for this attribute.

Types of matching (See section C.2.2.2 “Attribute Matching” in PS3.4):

S - indicates the identifier attributes uses Single Value Matching

U - indicates Universal Matching

***** - indicates Wild Card Matching

R - indicates Range Matching

NONE - indicates that no values will be provided, but that values for this Element are requested to be returned

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 (see Section C.2.2.1.1 “Unique Keys” in PS3.4).

Table 4-18. DICOM CFind Command Response Status Handling Behavior

Service Status	Further Meaning	Status Codes	Behavior
Success	Matching is complete – No final identifier is supplied	0000	Current query is terminated
Cancel	Matching terminated due to Cancel request	FE00	Cancel is ignored (is not supported)
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier used to return results to the PACS rule
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Warning is ignored, Identifier used to return results to the PACS rule
Failure	Any	Axxx, Cxxx	Query is terminated and the error message will be logged

4.3.1.4.6. Activity – Send Retrieve Request using PACS GUI

4.3.1.4.6.1. Description of activities

When the user selects a series in the user interface and selects retrieve, RayCare PACS will attempt to retrieve the series from the selected remote AE with the RayCare PACS DIMSE AE configured AE-Title as destination.

4.3.1.4.6.2. Proposed Presentation Contexts

Table 4-19. Retrieve Presentation Contexts proposed by RayCare PACS DIMSE AE

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

Study Root Q/R 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		

4.3.1.4.6.2.1. Extended negotiation

No extended negotiation is performed

4.3.1.4.6.3. SOP Specific Conformance for Move SOP Class

RayCare PACS 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 SERIES level when initiated from the RayCare PACS user interface.

Table 4-20. CMove request identifier for retrieval initiated from the RayCare PACS user interface

Attribute Name	Tag	VR	Types of Matching
SERIES Level – Study Root			
Study Instance UID	0020,000D	UI	UNIQUE
Series Instance UID	0020,000E	UI	UNIQUE

Table 4-21. DICOM CMove Command Response Status Handling Behavior

Service Status	Further Meaning	Status Codes	Related Fields	Behavior
Success	Sub-operations Complete – No Failures	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval is terminated and a success message is logged and returned to the user
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Cancel is ignored (is not supported)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval continues
Warning	Sub-operations Complete - One or more Failures or Warnings	B000	(0000,1020) (0000,1022) (0000,1023)	Warning is considered as successful, except when a list with failed SOP instances is returned. Retrieval is terminated and a success or failure message is logged and returned to the user
Failure	Any	Axxx, Cxxx		Retrieval is terminated and an

				error message is logged and returned to the user

4.3.1.4.7. Activity – Send Retrieve Request using PACS rules

4.3.1.4.7.1. Description of activities

When a PACS rule is configured to use a retrieve request, a retrieve action can be performed on either Patient, Study, Series or Composite instance level. The retrieve will be sent to the remote application entity with the in the PACS rule configured AE-Title as destination.

4.3.1.4.7.2. Proposed Presentation Contexts

Table 4-22. Retrieve Presentation Contexts proposed by RayCare PACS DIMSE AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**				
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Patient Root Q/R Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
See Table 4-31. Storage Presentation Contexts Accepted by RayCare PACS		See Table 4-2. Supported Transfer Syntaxes and Table 4-3. Supported Image Transfer Syntaxes		SCP	None

4.3.1.4.7.2.1. Extended negotiation

No extended negotiation is performed

4.3.1.4.7.3. SOP Specific Conformance for C-Move and C-Get SOP Classes

RayCare PACS provides standard conformance to the supported C-MOVE and C-GET SOP Classes.

Both the Patient Root and Study Root information models are supported.

A retrieval can be performed on all levels of supported information models when initiated from a PACS rule.

Table 4-23. Patient Root or Study Root CMove/CGet request identifiers for retrieval initiated from a PACS rule

Attribute Name	**Tag**	**VR**	**Types of Matching**

PATIENT Level – Patient Root			
Patient ID	0010,0020	LO	UNIQUE
STUDY Level – Study Root			
Study Instance UID	0020,000D	UI	UNIQUE
SERIES Level – Study Root			
Study Instance UID	0020,000D	UI	UNIQUE
Series Instance UID	0020,000E	UI	UNIQUE
COMPOSITE INSTANCE Level – Study Root			
Study Instance UID	0020,000D	UI	UNIQUE
Series Instance UID	0020,000E	UI	UNIQUE
SOP Instance UID	0008,0018	UI	UNIQUE

Table 4-24. DICOM CMove/CGet Command Response Status Handling Behavior

Service Status	Further Meaning	Status Codes	Related Fields	Behavior
Success	Sub-operations Complete – No Failures	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval is terminated and a success message is logged
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Cancel is ignored (is not supported)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval continues
Warning	Sub-operations Complete - One or more Failures or Warnings	B000	(0000,1020) (0000,1022) (0000,1023)	Warning is considered as successful, except when a list with failed SOP instances is returned. Retrieval is terminated and a success or failure message is logged
Failure	Any	Axxx, Cxxx		Retrieval is terminated and an error message is logged

4.3.1.4.8. Activity – Send Store and Storage Commitment Request

4.3.1.4.8.1. Description of activities

A user can select DICOM Series or a patient using the RayCare PACS user interface and request them to be moved to another archive. RayCare PACS will attempt to send the selected series to the remote AE that is configured as archive location. After successful storage, RayCare PACS will attempt to send a storage commitment request for the same DICOM series to the same remote AE after a configurable number of minutes. If the attempt fails, an error message is logged. No retry will be made to send the requests again.

4.3.1.4.8.2. Proposed Presentation Contexts

Table 4-25. Retrieve Presentation Contexts proposed by RayCare PACS DIMSE AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**				
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
See Table 4-9. Storage Presentation Contexts proposed by RayCare PACS DIMSE AE		See Table 4-2. Supported Transfer Syntaxes and Table 4-3. Supported Image Transfer Syntaxes		SCU	None

4.3.1.4.8.2.1. Extended negotiation

No extended negotiation is performed

4.3.1.4.8.3. SOP Specific Conformance for Storage SOP Classes

RayCare PACS provides standard conformance to the Storage Service Class

RayCare PACS will behave as described in the table below in response to the status returned in the C-Store response command message.

Table 4-26. DICOM C-Store Command Response Status Handling Behavior

Service Status	**Further Meaning**	**Status Codes**	**Behavior**
Success	Storage is complete	0000	A success message will be logged and showed to the user
Warning		Bxxx	Storage will be treated as successful and a warning will be logged
Failure	Any	Axxx, Cxxx	Storing of pending instances will be canceled and an error message will be logged and showed to the user

4.3.1.4.8.4. SOP Specific Conformance for Storage Commitment SOP Classes

RayCare PACS provides standard conformance to the supported Storage Commitment Push Model SOP Class.

RayCare PACS will request storage commitment (N-Action) for all successfully sent instances to the remote AE that is defined as an archive location.

The Storage commitment will be considered as failed when no N-Event-Report is received (on a separate association) for the in the N-Action provided Transaction UID, within the configurable archiving time-out for the archiver location.

RayCare PACS does not include the optional Storage Media File-Set ID & UID Attributes in the N-Action request.

RayCare PACS will behave as described in the table below in response to the status returned in the N-Action response command message.

Service Status	Further Meaning	Status Codes	Behavior
Success	Storage is complete	0000	A success message will be logged and showed to the user
*	*	Bxxx, Cxxx	The association is closed, and the request will be handled as failed. The archive status of the DICOM series referenced in the request will be set to restored and a failure message will be logged.

4.3.1.4.9. Activity – Send Storage Commitment Notification Request

4.3.1.4.9.1. Description of activities

When RayCare PACS has received a Storage Commitment (N-Action) Request then it will try to initiate a new association with the same remote AE to return the Storage Commitment Notification (N-Event-Report).

4.3.1.4.9.2. Proposed Presentation Contexts

Table 4-27. Storage Commitment Notification Presentation Context proposed by RayCare PACS DIMSE AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**				
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.3.1.4.9.3. SOP Specific Conformance for Storage Commitment SOP Class

RayCare PACS provides standard conformance to the supported Storage Commitment Push Model SOP Class.

The reception of a storage commitment (N-Action) request will immediately trigger the activation of the Storage Commitment service. The referenced composite SOP instances will be queried against the RayCare PACS index and storage database and a report will be generated. Immediately after that a Storage Commitment Notification (N-Event-Report) containing the report will be send to the remote AE in a new association. RayCare PACS will not cache the request.

RayCare PACS doesn't include the optional Storage Media File-Set ID & UID Attributes in the N-Event-Report request.

The Retrieve AE Title (0008,0054) attribute will be added to the N-Event-Report containing the AE-title of the RayCare PACS DIMSE AE where the Composite SOP instances can be retrieved.

4.3.1.5. Association Acceptance Policy

When RayCare PACS accepts an association, it will respond to C-Echo, C-Find, C-Store, C-Get, C-Move and N-Action requests. RAYCARE PACS will reject an association if the Called AE Title is incorrect (case sensitive), but it can also reject an association if the following is true:

- When none of the requested Presentation Contexts are supported
- When the calling AE title is unknown
- When host validation is enabled, and the IP-address of the requesting AE is not valid

When the association is established, but no request is received in a configurable amount of time, RayCare PACS will automatically close the association.

The following general association level failure messages can be returned:

Table 4-28. Association Rejection Reasons

Result	Source	Reason	Explanation
Rejected Permanent	Service User	Called AE Not Recognized	The association request contained an unrecognized Called AE Title. An association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason occurs when the association initiator is incorrectly configured and attempts to address the association acceptor (RayCare PACS) using the wrong AE Title. (default AE Title: RAYPACS)
Rejected Permanent	Service User	Calling AE Not Recognized	The association request contained an unrecognized Calling AE Title. An association request with the same parameters will not succeed at a later time, unless configuration changes are made. This rejection occurs when the association initiator AE is not (correctly) configured as a remote application entity in the PACS connections configuration.
Rejected Permanent	Service User	No Reason Given	The association request could not be parsed. An association request with the same format will not succeed at a later time.

The supported activities are described in the following sections.

4.3.1.5.1. Activity – Receive Echo Request

4.3.1.5.1.1. Description and Sequencing of Activities

When RayCare PACS receives an echo request, it will respond with a success message indicating that the RayCare PACS DIMSE AE is available and ready for use.

4.3.1.5.1.2. Accepted Presentation Contexts

Table 4-29. Verification Presentation Context accepted by RayCare PACS

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

Verification	1.2.840.10008.1.1	See Table 4-2. Supported Transfer Syntaxes	SCP	None

4.3.1.5.1.3. SOP Specific Conformance for Verification SOP Class

RayCare PACS provides standard conformance for the verification service class.

Table 4-30. Verification Status Messages

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The verification request was successfully received

4.3.1.5.2. Activity – Receive Store Request

4.3.1.5.2.1. Description and Sequencing of Activities

When RayCare PACS receives instances from a store request they are validated on several conditions before it is stored to the RayCare PACS storage. If the instance already exists in RayCare PACS storage or when the minimal required tags are not included, then the instance will be rejected. After storage, an internal message will be send indicating that a new instance is stored. When the series of instances is complete, a subset of attributes will be stored to the RayCare PACS Index database. After successful storage, the requesting AE will receive a success response.

4.3.1.5.2.2. Accepted Presentation Contexts

RayCare PACS accepts the following storage presentation contexts by default

Table 4-31. Storage Presentation Contexts Accepted by RayCare PACS

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
Name	**UID**			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See Table 4-3. Supported Image Transfer Syntaxes	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4			
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128			
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7			
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1			
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	See Table 4-2. Supported Transfer Syntaxes		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3			
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4			
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5			
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6			
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7			
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8			
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9			

RT Beams Delivery Instruction Storage – Trial (RETIRED)	1.2.840.10008.5.1.4.34.1			
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7			
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1			
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5			
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66			
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1			
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67			
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1			
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59			

4.3.1.5.2.2.1. Extended Negotiation

RayCare PACS DIMSE AE does not support Extended Negotiation for Storage SOP Classes. The default conditions are:

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

4.3.1.5.2.3. SOP Specific Conformance for Storage SOP Classes

RayCare PACS is Level 2 (Full) conformant for the SOPs as a Storage SCP.

The RayCare PACS DIMSE AE is configured to retain the original DICOM data in DICOM part 10 compliant format when stored to RayCare PACS storage, but the actual files will always be compressed by default. In addition, a subset of the data is stored in the RayCare PACS index database to support query and retrieve on Patient, Study, Series and Composite instance level and query and retrieve on the RayCare PACS DICOMWEB AE services. The index database will also allow updating of patient data by internal RayCare PACS demographic related messages or by performing the Patient associate function where DICOM data will be mapped to the RayCare patient.

Incoming DICOM Series can be categorized or labeled for internal RayCare needs. When an incoming DICOM series already exists in the RayCare PACS index database and has any categories set, storage will be denied. Categories and labels will be stored in private attributes, see annex Data dictionary of private attributes.

RayCare PACS can be configured to use filters (modalities or import script) for the remote application entity that is sending the C-Store request. The filters can be used to reject or ignore storage of incoming composite SOP instances or modify (normalize) data.

In addition, PACS rules can be configured to trigger scripts on incoming series or automatically forward retrieved composite SOP instances to a remote AE based on the Calling AE Title of the sending AE.

The following status messages can be returned by the Storage service of the RayCare PACS DIMSE AE.

Table 4-32. Storage Status Messages

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The composite SOP instance was successfully received, validated and stored in the RayCare PACS storage.
Failure	Processing Failure	0110	A processing failure occurred while storing received composite instance
	Got invalid DICOM data	C00x	The validation on the minimal required DICOM data for received composite instance where failed.
	Not enough disk space	C016	RayCare PACS Storage does not have enough diskspace to store the incoming composite instance.
	Modality not allowed	C018	Storage of incoming composite instance is not allowed because the Modality is not configured for the remote AE.
	Modified data for existing SOP Instance UID cannot be imported	C02A	Storage of incoming composite instance is not allowed because another instance with the same SOP instance UID already exists.
	Import was rejected by script	C03B	Storage of incoming composite instance is rejected by a RayCare PACS Import script.

4.3.1.5.3. Activity – Receive Find Request

4.3.1.5.3.1. Description and Sequencing of Activities

If the RayCare PACS DIMSE AE receives a query (C-FIND) request, then the response(s) will be sent over the same association used to send the C-Find request.

4.3.1.5.3.2. Accepted Presentation Contexts

RayCare PACS accepts the following query presentation contexts

Table 4-33. Query Presentation Contexts accepted by RayCare PACS

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
Name	**UID**			
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	See Table 4-2. Supported Transfer Syntaxes	SCP	Yes (partly)
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1			

4.3.1.5.3.2.1. Extended Negotiation

RayCare PACS DIMSE AE partly supports Extended Negotiation for the Patient Root Query SOP Class, but only for fuzzy semantic matching of the patient name in patient Level queries.

This means that default conditions are:

- No relational-query support
- Separate range matching of date and time attributes (for RayCare PACS only date attributes)
- Literal matching of person names with case sensitivity unspecified
- Time zone query unspecified
- No enhanced multi-frame image conversion support

Regardless of when fuzzy semantic matching is negotiated, condition for patient level queries is:

- Fuzzy semantic matching of the Patient's Name (0010,0010) attribute is supported as described in the next section

4.3.1.5.3.3. SOP Specific Conformance for Query SOP Classes

RayCare PACS supports hierarchical queries only. When querying on RayCare PACS only the attributes in the request identifier are always returned by default, except for the Retrieve AETitle attribute which is always returned.

Although extended negotiation can be used for fuzzy matching, RayCare PACS does support fuzzy matching of the person name attribute Patient's Name (0010,0010) when queried on Patient level, regardless of whether it is requested or not. Fuzzy matching is implemented as followed:

The requested Person Name attribute will match when all substrings in the query value individually and case insensitively are part of the in RayCare PACS stored Person Name. Substrings are divided by whitespaces. The wildcards '*' and '?' can be used in every substring.

Notes:
- The '*' wildcard is interpreted as a zero-to-many letter wildcard
- The '?' wildcard is interpreted as an exactly-one-letter wildcard
- Whitespaces themselves are not included in the match.
- Multiple consecutive whitespaces or tabs are treated as one whitespace

Example:
- The query value, '^sV?n Sven*n' will match a stored Person Name attribute with the encoded value 'Svensson^Sven^^^'

When the query request identifier contains the attribute Specific Character Set (0008,0005), then it will always be ignored and not included in the response identifier as there will never be a replacement character set used.

If the query request identifier contains the 'Timezone Offset From UTC (0008,0201)' attribute, then it can only be used for matching the attribute itself. Attributes of time will always be returned like it is stored originally, since extended negotiation on 'Timezone query adjustment' is not supported.

Table 4-34. Supported Patient Root Attributes

Attribute Name	Tag	VR	Types of Matching
PATIENT Level			
Patient's Name	0010,0010	PN	S, *, U
Patient ID	0010,0020	LO	UNIQUE, *
Patient's Birth Date	0010,0030	DA	S, U, R
Patient Sex	0010,0040	CS	S, U
Other Patient IDs Sequence	0010,1002	SQ	SEQUENCE
> Patient ID	0010,0020	LO	S, U

> Issuer of Patient ID	0010,0021	LO	S, U
STUDY Level			
Study Instance UID	0020,000D	UI	UNIQUE
Study Date	0008,0020	DA	S, U, R
Study Time	0008,0030	TM	S, U
Accession Number	0008,0050	SH	S, U
Study ID	0020,0010	SH	S, *, U
Modalities in Study	0008,0061	CS	S, U
Referring Physicians Name	0008,0090	PN	S, *, U
Study Description	0008,1030	LO	S, *, U
Patient Age	0010,1010	AS	S, U
Patient Size	0010,1020	DS	S, U
Patient Weight	0010,1030	DS	S, U
Number of Study Related Series	0020,1206	IS	S, U
Number of Study Related Instances	0020,1208	IS	S, U
SERIES Level			
Modality	0080,0060	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	S, U
Series Date	0008,0021	DA	S, U, R
Series Time	0008,0031	TM	S, U
Series Description	0008,103E	LO	S, *, U
Body Part Examined	0018,0015	CS	S, U
Frame of Reference UID	0020,0052	UI	S, U
Request Attributes Sequence	0040,0275	SQ	SEQUENCE
> Requested Procedure ID	0040,1001	SH	S, U
> Scheduled Procedure Step ID	0040,0009	SH	S, U
Performed Procedure Step Start Date	0040,0244	DA	S, U, R
Performed Procedure Step Start Time	0040,0245	TM	S, U
RayCare Category	4011,1002	CS	S, U
RayCare Custom Label	4011,1003	CS	S, U
RayCare Import DateTime	4011,1007	DT	S, U, R
RayCare Import AE Title	4011,1008	AE	S, U
RayCare Import UserName	4011,1009	LO	S, U
COMPOSITE INSTANCE Level			
SOP Class UID	0008,0016	UI	S, L, U
SOP Instance UID	0008,0018	UI	UNIQUE
Instance Number	0020,0013	IS	S, U
Registration Sequence	0070,0309	SQ	SEQUENCE
> Frame of Reference UID	0020,0052	UI	S, U
Common			
Retrieve AE Title	0008,1190	AE	NONE
Timezone Offset From UTC	0008,0201	SH	S, U (NONE for PATIENT Level)

Table 4-35. Supported Study Root Query Attributes

Attribute Name	Tag	VR	Types of Matching
STUDY Level			

Study Instance UID	0020,000D	UI	UNIQUE
Study Date	0008,0020	DA	S, U, R
Study Time	0008,0030	TM	S, U
Accession Number	0008,0050	SH	S, U
Patient's Name	0010,0010	PN	S, *, U
Patient ID	0010,0020	LO	S, *, U
Study ID	0020,0010	SH	S, *, U
Modalities in Study	0008,0061	CS	S, U
Referring Physicians Name	0008,0090	PN	S, *, U
Study Description	0008,1030	LO	S, *, U
Patient's Birth Date	0010,0030	DA	S, U, R
Patient Sex	0010,0040	CS	S, U
Patient Age	0010,1010	AS	S, U
Patient Size	0010,1020	DS	S, U
Patient Weight	0010,1030	DS	S, U
Number of Study Related Series	0020,1206	IS	S, U
Number of Study Related Instances	0020,1208	IS	S, U
Other Patient IDs Sequence	0010,1002	SQ	SEQUENCE
> Patient ID	0010,0020	LO	S, U
> Issuer of Patient ID	0010,0021	LO	S, U
SERIES Level			
Modality	0080,0060	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	S, U
Series Date	0008,0021	DA	S, U, R
Series Time	0008,0031	TM	S, U
Series Description	0008,103E	LO	S, *, U
Body Part Examined	0018,0015	CS	S, U
Frame of Reference UID	0020,0052	UI	S, U
Request Attributes Sequence	0040,0275	SQ	SEQUENCE
> Requested Procedure ID	0040,1001	SH	S, U
> Scheduled Procedure Step ID	0040,0009	SH	S, U
Performed Procedure Step Start Date	0040,0244	DA	S, U, R
Performed Procedure Step Start Time	0040,0245	TM	S, U
RayCare Category	4011,1002	CS	S, U
RayCare Custom Label	4011,1003	CS	S, U
RayCare Import DateTime	4011,1007	DT	S, U, R
RayCare Import AE Title	4011,1008	AE	S, U
RayCare Import UserName	4011,1009	LO	S, U
COMPOSITE INSTANCE Level			
SOP Class UID	0008,0016	UI	S, L, U
SOP Instance UID	0008,0018	UI	UNIQUE
Instance Number	0020,0013	IS	S, U
Registration Sequence	0070,0309	SQ	SEQUENCE
> Frame of Reference UID	0020,0052	UI	S, U
Common			
Retrieve AETitle	0008,1190	AE	NONE
Timezone Offset From UTC	0008,0201	SH	S, U

The tables should be read as follows:

Attribute Name – Attributes supported for returned C-Find responses.

Tag – Appropriate DICOM Tag for this attribute.

VR – Appropriate DICOM VR for this attribute.

Types of matching (See section C.2.2.2 “Attribute Matching” in PS3.4):

S - indicates the identifier attributes uses Single Value Matching

L - indicates UID list mapping

U - indicates Universal Matching

***** - indicates Wild Card Matching

R - indicates Range Matching

SEQUENCE - indicates Sequence Matching

NONE - indicates that no matching is supported, but that values for this Element requested will be returned with all requests

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 (see Section C.2.2.1.1 “Unique Keys” in PS3.4).

Table 4-36. Query Status Messages

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	Matching is complete. No final identifier is supplied
Pending	Matches are ongoing 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.
Failure	Processing Failure	0110	Indicates that there was a processing failure occurred while querying on the internal RayCare PACS index database

4.3.1.5.4. Activity – Receive Retrieve Request

4.3.1.5.4.1. Description and Sequencing of Activities

If the RayCare PACS DIMSE AE receives a retrieval (C-GET or C-MOVE) request, then the status response(s) will be sent over the same association used to send the request. The store (C-Store) sub-requests with the containing composite SOP instances will also be returned on the same association in case of a C-Get request but will be send to the Destination AE Title on a new association when a C-Move was requested.

4.3.1.5.4.2. Accepted Presentation Contexts

RayCare PACS accepts the following retrieval presentation contexts

Table 4-37. Retrieve Presentation Contexts accepted by RayCare PACS

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
Name	**UID**			
Patient Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	See Table 4-2. Supported Transfer Syntaxes	SCP	None
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2			
Patient Root Q/R Information Model – GET	1.2.840.10008.5.1.4.1.2.1.3			
Study Root Q/R Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3			
See Storage SOP Classes listed in Proposed Presentation Contexts of Activity - Send Store Request		See Table 4-3. Supported Image Transfer Syntaxes	SCU	None

4.3.1.5.4.2.1. Extended Negotiation

RayCare PACS DIMSE AE does not support Extended Negotiation for Retrieval SOP Classes. This means that default conditions are:

- No relational-query support
- no Enhanced Multi-Frame Image Conversion support

4.3.1.5.4.3. SOP Specific Conformance for C-Move SOP Classes

RayCare PACS provides standard conformance to the C-MOVE Patient Root and the Study Root information model SOP Classes. The Patient/Study Only information model is not supported.

The C-Move request will fail when the Move Destination AE Title is not found in the RayCare PACS DICOM Connections configuration or when RayCare PACS is not allowed to export data to the configured Destination AE.

Only when the 'Allow unsolicited remote AE' configuration is enabled, then the storage sub-actions will try to store the data on calling host (port 104) when the requested Move Destination AE Title is unknown.

Table 4-38. C-Move Retrieval Status Messages

Service Status	**Further Meaning**	**Error Code**	**Reason**
Success	Sub-operations complete – No Failures	0000	All the composite SOP instances have been successfully sent to the C-Move Destination AE
Warning	Sub-operations complete – One or more failures or warnings	B000	All C-Store sub-operations are complete, but one or more SOP Instances were not successfully sent to the Destination AE or one or more warnings were returned.

			A sub-operation can fail if RayCare PACS is not allowed to send the requested SOP Instance with a certain modality to the Destination AE.
Pending	Sub-operations are continuing	FF00	A pending response is sent every time a Composite SOP Instance has been sent to the C-Move Destination AE.
Failure	Move Destination AE Is Missing	C01A	The move request failed because the identifier of the request did not contain a Destination AE Title
	AE Title Not Found	C017	The move request failed because the Destination AE Title of the request is not configured as an AE in the RayCare PACS DICOM Connections configuration.
	Unable to Perform Sub operations	A702	All C-Store sub-operations are complete, but none of the SOP instances were successfully sent to the destination AE.
	Unable to Process	Cxxx	The move request failed because it was not able to process the request. This can be caused due to an invalid request.
	Processing Failure	0110	Indicates that there was a processing failure occurred while receiving information from the internal RayCare PACS index database

4.3.1.5.4.4. SOP Specific Conformance for C-Get SOP Classes

RayCare PACS provides standard conformance to the C-GET Patient Root and the Study Root information model SOP Classes. The Patient/Study Only information model is not supported.

The C-Get request will fail when RayCare PACS is configured to not allow to export data to the configured AE.

The C-Get request will also fail when insufficient storage presentation contexts are proposed.

Table 4-39. C-Get Retrieval Status Messages

Service Status	**Further Meaning**	**Error Code**	**Reason**
Success	Sub-operations complete – No Failures	0000	All the composite SOP instances have been successfully sent to the requesting AE
Warning	Sub-operations complete – One or more failures or warnings	B000	All C-Store sub-operations are complete, but one or more SOP Instances were not successfully sent to the requesting AE. A sub-operation can fail if RayCare PACS is not allowed to send the requested SOP Instance with a certain modality to the requesting AE.
Pending	Sub-operations are continuing	FF00	A pending response is sent every time a Composite SOP Instance has been successfully sent to the requesting AE.
Failure	Unable to Process	Cxxx	The get request failed because it was not able to process the request due to an invalid request.

	Unable to Perform Sub operations	A702	All C-Store sub-operations are complete, but none of the SOP instances were successfully returned to the requesting client
	Processing Failure	0110	Indicates that there was a processing failure occurred while receiving information from the internal RayCare PACS index database

4.3.1.5.5. Activity – Receive Storage Commitment Request

4.3.1.5.5.1. Description and Sequencing of Activities

When the RayCare PACS DIMSE AE receives a Storage Commitment N-Action request then the request will be validated first. If the requesting AE is not allowed to request for storage commitment or when the request doesn't contain a list with referenced SOP instances then a failure message will be returned to the remote AE, RayCare PACS will return a success message after successful processing of the request to the requesting AE.

RayCare PACS will immediately start with verification of the referenced SOP instances by querying the RayCare PACS index and storage database. After that a report will be generated and returned using the N-Event-Report primitive using a new association with the remote AE.

4.3.1.5.5.2. Accepted Presentation Contexts

RayCare PACS accepts the following storage commitment presentation contexts

Table 4-40. Storage Commitment Presentation Contexts accepted by RayCare PACS

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
Name	**UID**			
Storage Commitment Push Model	1.2.840.10008.1.20.1	See Table 4-2. Supported Transfer Syntaxes	SCP	None

4.3.1.5.5.3. SOP Specific Conformance for Storage Commitment SOP Class

RayCare PACS provides standard conformance to the Storage Commitment Push Model SOP Class.

The Storage Commitment SCP service uses the Referenced SOP Instances list in the Storage Commitment N-Action request to verify the existence of the composite SOP instances in both the RayCare PACS index and storage database. RayCare PACS will consider the storage successful when the composite SOP instance can be retrieved from both databases.

Immediately after the verification, an N-Event-Report will always be sent over a new association. RayCare PACS will request a new association with the remote AE that requested the Storage Commitment. The Storage Commitment SCP service will not cache the N-Action request for composite SOP instances that are not (yet) stored to RayCare PACS. The Storage Commitment SCP service will not commit responsibility for such composite SOP instances.

RayCare PACS never automatically deletes composite SOP instances from the RayCare PACS storage, however an administrator can delete individual series when the situation requires it. The persistence and the maximum capacity of the RayCare PACS storage is dependent on the actual configuration of RayCare PACS at the clinic.

The Storage Commitment SCP Service will support Storage Commitment requests for SOP instances of any of the Storage SOP Classes that are supported by the Storage SCP Service of the RayCare PACS DIMSE AE.

RayCare PACS doesn't support (ignores) the optional Storage Media File-Set ID & UID Attributes in the received N-ACTION primitive.

Table 4-41. Storage Commitment N-Action Status Messages

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The N-Action request is received successfully
Failure	No Such Action Type	0123	The Action Type ID of the N-Action request is not a valid Storage Commitment action type
	Not Authorized	0124	The remote AE is not authorized to perform the Storage Commitment Request.
	AE Title Not Found	C017	The remote AE is not (correctly) configured in the PACS connections configuration
	No Such Object Instance	0112	The SOP instance UID of the N-Action request is not valid.
	Processing Failure	0110	Indicates that there was a processing failure occurred while handling the N-Action request.

4.3.1.5.6. Activity – Receive Storage Commitment Response

4.3.1.5.6.1. Description and Sequencing of Activities

When the RayCare PACS DIMSE AE receives a Storage Commitment N-Event-Report request as result of the N-Action request sent by RayCare PACS, then the request will be validated first.

RayCare PACS will return a success response when the N-Event-Report request is validated successfully and the Transaction UID is matching the UID from the requested N-Action request.

For every image series referenced by the N-Event-Report, RayCare PACS will verify if it is storage committed by the same remote AE as the one defines as archive location. The archive status of the image series will be set to restored when storage commitment was unsuccessful or when the archiving time-out was reached before the N-Event-Report was received.

4.3.1.5.6.2. Accepted Presentation Contexts

RayCare PACS accepts the following storage commitment presentation contexts for the N-Event-Report request

Table 4-42. Storage Commitment Presentation Contexts accepted by RayCare PACS

Presentation Context Table				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
Name	**UID**			
Storage Commitment Push Model	1.2.840.10008.1.20.1	See Table 4-2. Supported Transfer Syntaxes	SCP	None

4.3.1.5.6.3. SOP Specific Conformance for Storage Commitment SOP Class

RayCare PACS provides standard conformance to the Storage Commitment Push Model SOP Class.

The following statuses can be returned as response to the N-Event-Report request.

Service Status	**Further Meaning**	**Error Code**	**Reason**
Success	Success	0000	The N-Event-Report request is received successfully
Failure	No Such Event Type	0113	The Event Type ID of the N-Event-Report request is not a valid Storage Commitment event type
	Not Authorized	0124	The remote AE is not configured as the archive location for the Storage Commitment Request.
	AE Title Not Found	C017	The remote AE is not (correctly) configured in the PACS connections configuration
	No Such Object Instance	0112	The SOP instance UID of the N-Event-Report request is not valid.
	SOP class not supported	0122	The SOP Class UID of the N-Event-Report request is not supported.
	Processing Failure	0110	Indicates that there was a processing failure occurred while handling the N-Event-Report request.

4.3.2. RayCare PACS DICOMWEB AE Specification

The RayCare PACS DICOMWEB AE utilizes all RESTful DICOMWEB services of RayCare PACS. The DICOMWEB services that are supported are WADO-RS, QIDO-RS and STOW-RS. All of them are completely specified in this section.

4.3.2.1. SOP Classes

RayCare PACS DICOMWEB AE provides Standard Conformance to the following DICOM V3.0 SOP classes:

Table 4-43. Default SOP Classes for RayCare PACS DICOMWEB AE

SOP Class Name	**SOP Class ID**	**User of Service (Client)**	**Provider of Service (Server)**
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	RayCare Image Viewer Only	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	RayCare Image Viewer Only	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	RayCare Image Viewer Only	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	RayCare Image Viewer Only	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	RayCare Image Viewer Only	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	RayCare Image Viewer Only	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	RayCare Image Viewer Only	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	No	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	No	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	No	Yes
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	No	Yes
RT Physician Intent Storage	1.2.840.10008.5.1.4.1.1.481.10	No	Yes
RT Segment Annotation Storage	1.2.840.10008.5.1.4.1.1.481.11	No	Yes
RT Radiation Set Storage	1.2.840.10008.5.1.4.1.1.481.12	No	Yes
C-Arm Photon-Electron Radiation Storage	1.2.840.10008.5.1.4.1.1.481.13	No	Yes
Tomotherapeutic Radiation Storage	1.2.840.10008.5.1.4.1.1.481.14	No	Yes
Robotic-Arm Radiation Storage	1.2.840.10008.5.1.4.1.1.481.15	No	Yes
RT Radiation Record Set Storage	1.2.840.10008.5.1.4.1.1.481.16	No	Yes
RT Radiation Salvage Record Storage	1.2.840.10008.5.1.4.1.1.481.17	No	Yes

Tomotherapeutic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.18	No	Yes
C-Arm Photon-Electron Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.19	No	Yes
Robotic Radiation Record Storage	1.2.840.10008.5.1.4.1.1.481.20	No	Yes
RT Beams Delivery Instruction Storage – Trial (RETIRED)	1.2.840.10008.5.1.4.34.1	No	Yes
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7	No	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	No	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	RayCare Image Viewer Only	Yes
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	No	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	No	Yes
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	No	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Key Object Selection Storage	1.2.840.10008.5.1.4.1.1.88.59	No	Yes

4.3.2.2. WADO-RS Specifications

4.3.2.2.1. WADO-RS Retrieve Study

Table 4-44. WADO-RS Retrieve Study API

Verb	Path	Reference	Description
GET	{s}/studies/{studyInstanceUID}	PS3.18 6.5.1	Retrieve entire study
GET	{s}/studies/{studyInstanceUID}/metadata	PS3.18 6.5.6	Retrieve study metadata

Table 4-45. WADO-RS Retrieve Study Specification

Options	Restrictions
Data Types Supported (Accept Type)	multipart/related; type="application/dicom" multipart/related; type="application/dicom+json" multipart/related; type="application/octet-stream"
Transfer Syntaxes Supported	Any Transfer Syntax supported by RayCare PACS DIMSE AE
Transfer-syntax accept type parameter	The use of the transfer-syntax parameter is not supported. Requested composite sop instances will always be returned as stored in RayCare PACS
SOP Class Restrictions	Restricted to SOP Classes supported by RayCare PACS DICOMWEB AE
Size Restriction	No explicit size restriction is defined
Anonymization	Retrieve the entire study anonymized by using the {?anonymize=true} query parameter

4.3.2.2.2. WADO-RS Retrieve Series

Table 4-46. WADO-RS Retrieve Series API

Verb	Path	Reference	Description
GET	{s}/studies/{studyInstanceUID}/series/{seriesInstanceUID}	PS3.18 6.5.2	Retrieve entire series
GET	{s}/studies/{studyInstanceUID}/series/ {seriesInstanceUID}/metadata	PS3.18 6.5.6	Retrieve series metadata

Table 4-47. WADO-RS Retrieve Series API extensions

Extensions to the DICOMweb standard:

Verb	Path	Reference	Description
GET	{s}/series/{seriesInstanceUID}	PS3.18 6.5.2	Retrieve entire series
GET	{s}/series/ {seriesInstanceUID}/metadata	PS3.18 6.5.6	Retrieve series metadata

Table 4-48. WADO-RS Retrieve Series Specification

Options	Restrictions
Data Types Supported (Accept Type)	multipart/related; type="application/dicom" multipart/related; type="application/dicom+json" multipart/related; type="application/octet-stream"
Transfer Syntaxes supported	Any Transfer Syntax supported by RayCare PACS DIMSE AE
Transfer-syntax accept type parameter	The use of the transfer-syntax parameter is not supported. Requested composite sop instances will always be returned as stored in RayCare PACS
SOP Class Restrictions	Restricted to SOP Classes supported by RayCare PACS DICOMWEB AE
Size Restriction	No explicit size restriction is defined
Anonymization	Retrieve the entire study anonymized by using the {?anonymize=true} query parameter

4.3.2.2.3. WADO-RS Retrieve Instance

Table 4-49. WADO-RS Retrieve Instance API

Verb	Path	Reference	Description
GET	{s}/studies/{studyInstanceUID}/series/ {seriesInstanceUID}/instances/{sopInstanceUID}	PS3.18 6.5.3	Retrieve instance
GET	{s}/studies/{studyInstanceUID}/series/ {seriesInstanceUID}/instances/{sopInstanceUID}/metadata	PS3.18 6.5.6	Retrieve instance metadata

Table 4-50. WADO-RS Retrieve Instance API extensions

Extensions to the DICOMweb standard:

Verb	Path	Reference	Description

GET	{s}/series/ {seriesInstanceUID}/instances/{sopInstanceUID}	PS3.18 6.5.3	Retrieve instance
GET	{s}/series/ {seriesInstanceUID}/instances/{sopInstanceUID}/metadata	PS3.18 6.5.6	Retrieve instance metadata

Table 4-51. WADO-RS Retrieve Instance Specification

Options	Restrictions
Data Types Supported (Accept Type)	multipart/related; type="application/dicom" multipart/related; type="application/dicom+json" multipart/related; type="application/octet-stream"
Transfer Syntaxes Supported	Any Transfer Syntax supported by RayCare PACS DIMSE AE
Transfer-syntax accept type parameter	The use of the transfer-syntax parameter is not supported. Requested composite sop instances will always be returned as stored in RayCare PACS
SOP Class Restrictions	Restricted to SOP Classes supported by RayCare PACS DICOMWEB AE
Size Restriction	No explicit size restriction is defined
Anonymization	Retrieve the entire study anonymized by using the {?anonymize=true} query parameter

4.3.2.2.4. WADO-RS Retrieve Frames

Not supported since Multi Frame images are not supported in RayCare PACS

4.3.2.2.5. WADO-RS Retrieve Bulkdata

Table 4-52. WADO-RS Retrieve Bulkdata API

Verb	Path	Reference	Description
GET	{s}/{bulkDataReference}	PS3.18 6.5.5	Retrieve bulk data

Table 4-53. WADO-RS Retrieve Bulkdata Specification

Options	Restrictions
Data Types Supported (Accept Type)	multipart/related; type="application/octet-stream" multipart/related; type="application/pdf"
Transfer Syntaxes supported	Any Transfer Syntax supported by RayCare PACS DIMSE AE
Transfer-syntax accept type parameter	The use of the transfer-syntax parameter is not supported. Requested composite sop instances will always be returned as stored in RayCare PACS
SOP Class Restrictions	Restricted to SOP Classes supported by RayCare PACS DICOMWEB AE
Size Restriction	No explicit size restriction is defined
Anonymization	Retrieve the entire study anonymized by using the {?anonymize=true} query parameter

4.3.2.2.6. WADO-RS Retrieve Metadata

Table 4-54. WADO-RS Retrieve Metadata API

Verb	Path	Reference	Description
GET	{s}/studies/{studyInstanceUID}/metadata	PS3.18 6.5.6	Retrieve Study metadata
GET	{s}/studies/{studyInstanceUID}/series/{seriesInstanceUID}/metadata	PS3.18 6.5.6	Retrieve Series metadata
GET	{s}/studies/{studyInstanceUID}/series/{seriesInstanceUID}/instances/{sopInstanceUID}/metadata	PS3.18 6.5.6	Retrieve Instance metadata

Table 4-55. WADO-RS Retrieve Metadata API extensions

Extensions to the DICOMweb standard:

Verb	Path	Reference	Description
GET	{s}/series/{seriesInstanceUID}/metadata	PS3.18 6.5.6	Retrieve Series metadata
GET	{s}/series/{seriesInstanceUID}/instances/{sopInstanceUID}/metadata	PS3.18 6.5.6	Retrieve Instance metadata

Table 4-56. WADO-RS Retrieve Metadata Specification

Options	Restrictions
Data Types Supported (Accept Type)	multipart/related; type="application/dicom+json"
Transfer Syntaxes Supported	Any Transfer Syntax supported by RayCare PACS DIMSE AE
Transfer-syntax accept type parameter	The use of the transfer-syntax parameter is not supported. Requested composite sop instances will always be returned as stored in RayCare PACS
SOP Class Restrictions	Restricted to SOP Classes supported by RayCare PACS DICOMWEB AE
Size Restriction	No explicit size restriction is defined
Anonymization	Retrieve the entire study anonymized by using the {?anonymize=true} query parameter

4.3.2.2.7. WADO-RS Connection Policies

4.3.2.2.7.1. General

All Standard RS connection policies apply, there are no extensions for RS options.

4.3.2.2.7.2. Number of Connections

All Standard RS connection policies apply, there are no extensions for RS options

4.3.2.2.7.3. Asynchronous Nature

RayCare PACS does not support RS asynchronous response

4.3.2.2.7.4. Response Status

Table 4-57. HTTP Standard Response Codes for WADO-RS

Service Status	HTTP Status Code	Description
Failure	400 – Bad request	This indicates that RayCare PACS was unable to retrieve any instances due to bad syntax.

	401 – Unauthorized	This indicates that RayCare PACS refused to retrieve any instances because the client is not authenticated
	404 – Not Found	Specified resource does not exist
	406 – Not Acceptable	Accept type, Transfer Syntax or decompression method not supported / or when multiple sop instances exist with same SOP instance UID
	409 – Conflict	This indicates that the WADO-RS request was formed correctly but RayCare PACS was unable to retrieve any instances due to a conflict in the request (e.g. unsupported SOP Class or Study Instance UID mismatch). Additional information can be found in the JSON response message body.
	500 – Internal Server Error	This indicates that RayCare PACS was unable to retrieve any instances because something unexpected happened.
Success	200 – OK	This indicates that RayCare PACS successfully retrieved the data.

The RayCare specific failure message will be returned in both the Reason phrase of the HTTP response status and in the HTTP response warning header.

4.3.2.3. QIDO-RS Specifications

4.3.2.3.1. QIDO-RS Search for Studies

Table 4-58. QIDO-RS Search for Studies API

Verb	Path	Reference	Description
GET	{s}/studies{?query*,fuzzymatching,limit,offset}	PS3.18 6.7.1	Query for matching studies

Table 4-59. QIDO-RS Search for Studies Specification

Parameter	Restrictions
Media Types	Restricted to application/dicom+json (or application/json)
Matching Attributes	See Table 4-60. QIDO-RS Study Attribute Matching
Return Attributes	See Table 4-60. QIDO-RS Study Attribute Matching
Sort Attributes	See Table 4-60. QIDO-RS Study Attribute Matching and 4.3.2.3.5 QIDO-RS Sorting results
Desc (Sort descending)	See 4.3.2.3.5 QIDO-RS Sorting results
Limit and Offset supported	Yes
Person Name Matching	Literal, Case insensitive, Fuzzy (See 4.3.2.3.4 QIDO-RS Fuzzy matching)

Table 4-60. QIDO-RS Study Attribute Matching

Attribute Name	Tag	Types of Matching
STUDY Level		
Study Instance UID	0020,000D	UNIQUE, SORT
Study Date	0008,0020	S, U, R, SORT
Study Time	0008,0030	S, U, SORT
Accession Number	0008,0050	S, U, SORT
Patient Name	0010,0010	S, *, U, SORT
Patient ID	0010,0020	S, *, U, SORT
Study ID	0020,0010	S, *, U, SORT
Modalities in Study	0008,0061	S, U, SORT
Referring Physicians Name	0008,0090	S, *, U, SORT
Study Description	0008,1030	S, *, U, SORT
Patient Birth Date	0010,0030	S, U, R, SORT
Patient Sex	0010,0040	S, U, SORT
Patient Age	0010,1010	S, U, SORT
Patient Size	0010,1020	S, U, SORT
Patient Weight	0010,1030	S, U, SORT
Other Patient IDs Sequence	0010,1002	SEQUENCE
> Patient ID	0010,0020	S, U, SORT
> Issuer of Patient ID	0010,0021	S, U, SORT
Number Of Related Series	0020,1206	S, U
Number Of Related Instances	0020,1208	S, U
Timezone Offset From UTC	0008,0201	U
Specific Character Set	0008,0005	NONE
Instance Availability	0008,0056	NONE
RetrieveURL	0008,1190	NONE

Types of matching (See section C.2.2.2 “Attribute Matching” in PS3.4):

S - indicates the identifier attributes uses Single Value Matching

L - indicates UID list mapping

U - indicates Universal Matching (note: if only universal matching is supported for an attribute then that attribute can only be passed as an “includefield” query key)

***** - indicates Wild Card matching

R - indicates Range Matching

SEQUENCE - indicates Sequence Matching

NONE - indicates that no matching is supported, but that values for this Element requested will be returned with all requests

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 (see Section C.2.2.1.1 “Unique Keys” in PS3.4).

SORT - indicates that sorting is supported, can be used in combination with “desc” parameter to sort descending.

4.3.2.3.2. QIDO-RS Search for Series

Table 4-61. QIDO-RS Search For Series API

Verb	Path	Reference	Description
GET	{s}/studies/{studyInstanceUID}/series/{?query*,fuzzymatching,limit,offset}	PS3.18 6.7.1	Query for matching series in a study
GET	{s}/series/{?query*,fuzzymatching,limit,offset}	PS3.18 6.7.1	Query for matching series

Table 4-62. QIDO-RS Search for Series Specification

Parameter	Restrictions
Media Types	Restricted to application/dicom+json (or application/json)
Matching Attributes	See Table 4-63. QIDO-RS Series Attribute Matching
Return Attributes	See Table 4-63. QIDO-RS Series Attribute Matching
Sort Attributes	See Table 4-63. QIDO-RS Series Attribute Matching and 4.3.2.3.5 QIDO-RS Sorting results
Desc (Sort descending)	See 4.3.2.3.5 QIDO-RS Sorting results
Limit and Offset supported	Yes
Relational queries supported	Yes studies only (see Study Attribute Matching Table)

Table 4-63. QIDO-RS Series Attribute Matching

Attribute Name	Tag	Types of Matching
SERIES Level		
Modality	0080,0060	S, U, SORT
Series Number	0020,0011	S, U, SORT
Series Instance UID	0020,000E	UNIQUE, SORT
Number of Series Related Instances	0020,1209	S, U, SORT
Number of Frames	0028,0008	S, U, SORT
Series Date	0008,0021	S, U, R, SORT
Series Time	0008,0031	S, U, SORT
Series Description	0008,103E	S, *, U, SORT
Body Part Examined	0018,0015	S, U, SORT
Frame of Reference UID	0020,0052	S, U, SORT
Request Attributes Sequence	0040,0275	SEQUENCE
> Requested Procedure ID	0040,1001	S, U, SORT
> Scheduled Procedure Step ID	0040,0009	S, U, SORT
Performed Procedure Step Start Date	0040,0244	S, U, R, SORT
Performed Procedure Step Start Time	0040,0245	S, U, SORT
RayCare Category	4011,1002	S, U, SORT
RayCare Custom Label	4011,1003	S, U, SORT
Timezone Offset From UTC	0008,0201	U
Specific Character Set	0008,0005	NONE

Instance Availability	0008,0056	NONE
RetrieveURL	0008,1190	NONE

Types of matching: See QIDO-RS Search for Studies

4.3.2.3.3. QIDO-RS Search for Instances

Table 4-64. QIDO-RS Search for Instances API

Verb	Path	Reference	Description
GET	{s}/studies/{studyInstanceUID}/series/{seriesInstanceUID}/instances{?query*,fuzzymatching,limit,offset}	PS3.18 6.7.1	Query for matching instances in a series
GET	{s}/studies/{studyInstanceUID}/instances{?query*,fuzzymatching,limit,offset}	PS3.18 6.7.1	Query for matching instances in a study
GET	{s}/instances{?query*,fuzzymatching,limit,offset}	PS3.18 6.7.1	Query for matching instances

Table 4-65. QIDO-RS Search for Instances Specification

Parameter	Restrictions
Media Types	Restricted to application/dicom+json (or application/json)
Matching Attributes	See Table 4-66. QIDO-RS Instance Attribute Matching
Return Attributes	See Table 4-66. QIDO-RS Instance Attribute Matching
Sort Attributes	See Table 4-66. QIDO-RS Instance Attribute Matching and 4.3.2.3.5 QIDO-RS Sorting results
Desc (Sort descending)	See 4.3.2.3.5 QIDO-RS Sorting results
Limit and Offset supported	Yes
Relational queries supported	Yes studies and series (see Study Attribute Matching Table and Series Attribute Matching Table)

Table 4-66. QIDO-RS Instance Attribute Matching

Attribute Name	Tag	Types of Matching
COMPOSITE INSTANCE Level		
SOP Class UID	0008,0016	S, L, U, SORT
SOP Instance UID	0008,0018	UNIQUE, SORT
Instance Number	0020,0013	S, U, SORT
Registration Sequence	0070,0309	SEQUENCE
>Frame of Reference UID	0020,0052	S, U
Specific Character Set	0008,0005	NONE
Timezone Offset From UTC	0008,0201	U
Instance Availability	0008,0056	NONE
RetrieveURL	0008,1190	NONE
Rows	0028,0010	NONE
Columns	0028,0011	NONE
Bits Allocated	0028,0100	NONE
Number Of Frames	0028,0008	NONE

Types of matching: Section QIDO-RS Search for Studies

4.3.2.3.4. QIDO-RS Fuzzy matching

RayCare PACS DICOMWEB AE supports the “fuzzymatching” query key for the QIDO-RS service. If requested, it will perform fuzzy matching on attributes with value representation PersonName. For RayCare PACS this applies to:

- Patient’s Name (0010,0010)
- Referring Physician’s Name (0008,0090)

4.3.2.3.5. QIDO-RS Sorting results

RayCare PACS DICOMWEB AE supports the “sort” and the “desc” query keys for sorting results in the QIDO-RS service if there are more than one study, series or instance.

If “sort” is requested, the attributes where to sort on should be supplied as a comma separated value of the sort key. The attributes that can be sorted are defined in the QIDO-RS Attribute Matching tables in this conformance statement.

If the “desc” query key is supplied, all attributes in the sort key value list will be sorted in descending order.

By default, if no explicit sorting is given, results are sorted in hierarchal order depending on the returned attributes, with the highest available level first.

4.3.2.3.6. QIDO-RS Limit and Offset

RayCare PACS DICOMWEB AE supports the “Limit” and the “Offset” query keys to allow paging of data. When the supplied limit value and the configured maximum query results value is lower than the number of found results, then no results will be returned.

4.3.2.3.7. QIDO-RS Connection Policies

4.3.2.3.7.1. General

All Standard RS connection policies apply, there are no extensions for RS options.

4.3.2.3.7.2. Number Of Connections

All Standard RS connection policies apply, there are no extensions for RS options

4.3.2.3.7.3. Asynchronous Nature

RayCare PACS does not support RS asynchronous response

4.3.2.3.7.4. Response Status

RayCare PACS shall provide a response message header containing the appropriate status code indicating success, warning or failure as shown in the following table.

Table 4-67. HTTP Standard Response Codes for QIDO-RS

Service Status	HTTP Status Code	Description
Failure	400 – Bad request	This indicates that RayCare PACS was unable to retrieve any data due to bad syntax.
	401 – Unauthorized	This indicates that RayCare PACS refused to retrieve any data because the client is not authenticated
	406 – Not Acceptable	This indicates that RayCare PACS doesn’t accept the requested content type. Only application/json and

		application/dicom+json is supported for QIDO-RS requests
	409 – Conflict	This indicates that the QIDO-RS request was formed correctly but RayCare PACS was unable to retrieve any responses
	413 – Request Entity Too Large	This indicates that RayCare PACS refused to retrieve any data because the number of query results exceeded the maximum query results configuration
	500 – Internal Server Error	This indicates that RayCare PACS refused the request because of an internal server error
Success	200 – OK	This indicates that RayCare PACS successfully retrieved the data.

The RayCare specific failure message will be returned in both the Reason phrase of the HTTP response status and in the HTTP response warning header.

4.3.2.4. STOW-RS Specifications

The RayCare PACS STOW-RS service supports one action type which is the STOW-RS Store Instances type. This action type stores and appends the given binary SOP instances into RayCare PACS or creates and appends new SOP instances when a JSON Metadata and bulk data request is send. Non-DICOM data can be stored using a JSON Metadata and bulk data request, see http://dicom.nema.org/medical/dicom/2017d/output/pdf/part18.pdf#page=68. Non-DICOM bulk data will be automatically wrapped or encapsulated, see 8.1.1 Created SOP Instance(s).

4.3.2.4.1. STOW-RS Store Instances

Table 4-68. STOW-RS Store Instances API

Verb	Path	Reference	Description
POST	{s}/studies/{studyInstanceUID}	PS3.18 6.6.1	Store Instances for study
POST	{s}/studies	PS3.18 6.6.1	Store instances

Table 4-69. STOW-RS Store Instances Specification

Category	Restrictions
Media Types Supported (Content-Type header)	multipart/related; type=application/dicom, multipart/related; type=application/dicom+json multipart/form-data (only for DICOM Requests)
Transfer Syntaxes Supported	Any Transfer Syntax by the RayCare PACS DIMSE AE
Transfer-syntax media type parameter	The use of the transfer-syntax parameter is not supported. Binary data in JSON Metadata and bulk data requests will be encoded using the default transfer syntax: Explicit VR Little Endian.
SOP Class Restrictions	Restricted to SOP Classes supported by RayCare PACS DICOMWEB AE
Size Restriction	There are no explicit size restrictions defined.

4.3.2.4.2. STOW-RS Connection Policies

4.3.2.4.2.1. General

All Standard RS connection policies apply, there are no extensions for RS options.

4.3.2.4.2.2. Number Of Connections

All Standard RS connection policies apply, there are no extensions for RS options

4.3.2.4.2.3. Asynchronous Nature

RayCare PACS does not support RS asynchronous response

4.3.2.4.2.4. Response Status

The STOW-RS response message header contains status codes indicating success, warning or failure as shown in the following table below. No additional status codes are used.

Table 4-70. HTTP Standard Response Codes for STOW-RS

Service Status	HTTP Status Code	Description
Failure	400 – Bad request	This indicates that RayCare PACS was unable to store any instances due to bad syntax.
	401 – Unauthorized	This indicates that RayCare PACS refused to store any instances because the client is not authenticated
	409 – Conflict	This indicates that the STOW-RS request was formed correctly but RayCare PACS was unable to store any instances due to a conflict in the request (e.g. unsupported SOP Class or Study Instance UID mismatch). Additional information can be found in the JSON response message body.
	500 – Internal Server Error	This indicates that RayCare PACS refused the request because of an internal server error
Success	200 – OK	This indicates that RayCare PACS successfully stored all instances.

The RayCare specific failure message will be returned in both the Reason phrase of the HTTP response status and in the HTTP response warning header.

4.4. Network Interfaces

4.4.1. Physical network interfaces

RayCare PACS is indifferent to the physical medium over which TCP/IP executes, which is dependent on the underlying operating system and hardware.

4.4.2. Additional Protocols

Besides IPv4, no additional protocols are supported.

4.4.3. IPv4 and IPv6 Support

RayCare PACS has support only for IPv4

4.5. Configuration

4.5.1. Local AE Titles

RayCare PACS uses the same AE Title for both SCU (Calling AE Title) and SCP (Called AE Title) by default. The AE Title and TCP/IP Port can be changed by a RaySearch representative.

Table 4-71. Local DIMSE configuration

Application Entity	Role	Default AE Title	Default TCP/IP Port
RayCare PACS DIMSE AE	SCP	RAYPACS	10104
	SCU	RAYPACS	

4.5.2. Remote AE Title

The mapping of remote AE titles to IPv4 addresses and ports can be configured in the PACS Connections configuration by a local administrator.

The IP address of the incoming request will be validated against the remote AE title and IP address mapping when host validation for the remote AE is enabled.

An admin can configure whether a remote AE supports querying or storing data. In addition, it can define modalities which are allowed for import by the remote AE and allowed to export to the remote AE.

4.5.3. Parameters

The following parameters are applicable for RayCare PACS. The configurable parameters can only be changed by a RaySearch representative.

Table 4-72. Configuration Parameters (RaySearch representative)

Parameter	Configurable	Default Value
Max Send PDU size	No	16384
Max Receive PDU size	No	16384
Transfer Syntax Support	No	See AE Specifications
DICOM Storage Compression	No	True
AE-Title	Yes	RAYPACS
Calling AE-Title	Yes	RAYPACS
Listening Port	Yes	10104

Inactive Association Time-out	Yes	60000 ms

The following parameters can be changed by the user.

Table 4-73. Configuration Parameters (user)

Parameter	**Configurable**	**Default Value**
SOP Class Support	Yes	See AE Specifications
Maximum query results	Yes	1000
Maximum number of files import	Yes	10000
Import failure on available disk space percentage	Yes	5%

5. Media Interchange

RayCare PACS allows import and export of DICOM Composite Object Instance Files to and from disk. It allows the use of DICOMDIR files for DICOM import. However, RayCare PACS does not support any of the Media Storage Application Profiles.

6. Support of character sets

RayCare PACS supports the following character sets:

Table 6-1. Supported character sets

Character Set Description	Defined Term
Latin alphabet No. 1	ISO_IR 100
Unicode in UTF-8 Level 3	ISO_IR 192

RayCare PACS does not convert character sets when storing binary Composite Object Instances to the internal RayCare PACS Storage. The characters set of exported instances will be converted to the ISO_IR 100 by default when patient info is changed, or custom labels are added. If configured, ISO_IR 192 will be used.

RayCare PACS supports UTF-8 for all DICOMWEB transactions.

7. Security

It is assumed that RayCare PACS is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to RayCare PACS.
- Firewall and router protections to ensure that RayCare PACS only has access to approved external hosts and services.
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN))

7.1. Association Level Security

Any Application Entity can open an association to the RayCare PACS DIMSE AE to perform a verification request. RayCare PACS can be configured to validate the IP-address of the requester for C-Find, C-Store and C-Move requests by enabling Host validation for the configured application entity.

7.2. Application Level Security

The RayCare PACS user interface can be accessed by users that are authenticated in RayCare.

The RayCare PACS DICOMWEB AE will be configured to use SSL (HTTPS). For a client (user) to connect to one of the DICOMWEB services a client certificate and token issued by RayCare is needed.

8. Annexes

8.1. IOD Contents

8.1.1. Created SOP Instance(s)

RayCare PACS will create new DICOM SOP instances when non-DICOM data is imported in the PACS or when manual rigid registration is saved. The non-DICOM file will be wrapped or encapsulated in a composite SOP instance. Depending on the type of the non-DICOM file, either a Secondary Capture IOD, Encapsulated PDF IOD or Raw Data IOD is used. For the rigid registration the Spatial Registration IOD is used.

The following table describes the meaning of the used attributes:

Table 8-1. Meaning of Source and Presence of module/value

Presence of module/value	**Meaning**
ALWAYS	Always Present
VNAP	Value Not Always Present
ANAP	Attribute Not Always Present
EMPTY	Attribute is sent without value
Source	**Meaning**
USER	The attribute value source is from User input
AUTO	The attribute value is generated automatically
FIXED	The attribute value is a fixed value

The following IODS can be created by RayCare PACS.

8.1.1.1. Secondary Capture Image IOD

A secondary capture image SOP instance is created when the user stores a Jpeg image to the PACS. This image is converted into a 24 bits per pixel RGB image and stored in the pixel data tag of this IOD.

Table 8-2. Secondary Capture Image Modules

IE	**Module**	**Presence of Module**
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Series	General Series	ALWAYS
Equipment	General Equipment	ALWAYS
	SC Equipment	ALWAYS
Image	General Image	ALWAYS
	Image Pixel	ALWAYS
	SC Image	ALWAYS
	SOP Common	ALWAYS
	RayCare Encapsulated Source	ALWAYS

Table 8-3. Secondary Capture Image Attributes

Attribute Name	**Tag**	**VR**	**Value**	**Presence of Value**	**Source**

Patient Module					
Patient's Name	0010,0010	PN		ALWAYS	AUTO / USER
Patient ID	0010,0020	LO		ALWAYS	AUTO / USER
Patient's Birth Date	0010,0030	DA		VNAP	AUTO / USER
Patient's Sex	0010,0040	CS		VNAP	AUTO / USER
General Study Module					
Study Instance UID	0020,000D	UI	RayCare Generated UID if not attached to existing study	ALWAYS	AUTO / USER
Study Date	0008,0020	DA	Study Creation Date	ALWAYS	AUTO
Study Time	0008,0030	TM	Study Creation Time	ALWAYS	AUTO
Referring Physician's Name	0008,0090	PN		EMPTY	FIXED
Study ID	0020,0010	SH		EMPTY	FIXED
Accession Number	0008,0050	SH		EMPTY	FIXED
Study Description	0008,1030	LO	"RayCare Image"	ALWAYS	FIXED
General Series Module					
Modality	0008,0060	CS	"XC"	ALWAYS	FIXED
Series Instance UID	0020,000E	UI	RayCare Generated UID	ALWAYS	AUTO
Series Number	0020,0011	IS	"1"	ALWAYS	FIXED
Series Date	0008,0021	DA	Series Creation Date	ALWAYS	AUTO
Series Time	0008,0031	TM	Series Creation Time	ALWAYS	AUTO
Series Description	0008,103E	LO	The name of the source image if provided in the Content-Disposition header	VNAP	AUTO / USER
General Equipment Module					
Manufacturer	0008,0070	LO	"RaySearch Laboratories"	ALWAYS	FIXED
Manufacturer's Model Name	0008,1090	LO	"RayCare"	ALWAYS	FIXED
Software Version(s)	0018,1020	LO	RayCare Version Number	ALWAYS	AUTO
Station Name	0008,1010	SH	Server Host Name that created this instance	ALWAYS	AUTO
SC Equipment Module					
Conversion Type	0008,0064	CS	"WSD"	ALWAYS	FIXED
General Image Module					
Instance Number	0020,0013	IS	"1"	ALWAYS	FIXED
Patient Orientation	0020,0020	CS		EMPTY	
Content Date	0008,0023	DA	Pixel Data Creation Date	ALWAYS	AUTO
Content Time	0008,0033	TM	Pixel Data Creation Time	ALWAYS	AUTO
Image Pixel Module					
Samples per Pixel	0028,0002	US	"3"	ALWAYS	FIXED
Photometric Interpretation	0028,0004	CS	"RGB"	ALWAYS	FIXED

Rows	0028,0010	US	Image Height	ALWAYS	AUTO
Columns	0028,0011	US	Image Width	ALWAYS	AUTO
Bits Allocated	0028,0100	US	"8"	ALWAYS	FIXED
Bits Stored	0028,0101	US	"8"	ALWAYS	FIXED
High Bit	0028,0102	US	"7"	ALWAYS	FIXED
Pixel Representation	0028,0103	US	"0" (Unsigned)	ALWAYS	FIXED
Planar Configuration	0028,0006	US	"0" (Interleaved)	ALWAYS	FIXED
Pixel Data	7FE0,0010	OB	Image Pixel data Converted To 24 bpp RGB	ALWAYS	AUTO
SC Image Module					
Date of Secondary Capture	0018,1012	DA	Secondary Capture Creation Date	ALWAYS	AUTO
Time of Secondary Capture	0018,1014	TM	Secondary Capture Creation Time	ALWAYS	AUTO
SOP Common Module					
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.7"	ALWAYS	FIXED
SOP Instance UID	0008,0018	UI	RayCare Generated UID	ALWAYS	AUTO
Specific Character Set	0008,0005	CS	"ISO_IR 100"	ALWAYS	FIXED
RayCare Encapsulated Source Module					
RayCare Private Creator	4011,0010	LO	"RAYSEARCHLABS 2.0"	ANAP	FIXED
RayCare Encapsulated Source	4011,1004	OB	The original source image	ANAP	USER
MIME Type of RayCare Encapsulated Source	4011,1005	LO	The MIME-type of the source image	ANAP	USER
Filename of RayCare Encapsulated Source	4011,1006	LT	The filename of the source image if provided in the Content-Disposition header	ANAP	USER

8.1.1.2. Encapsulated PDF IOD

An encapsulated PDF SOP instance is created when the user stores a PDF document to the PACS. This PDF is stored as a byte array to the Encapsulated Document tag of this IOD.

Table 8-4. Encapsulated PDF Modules

IE	Module	Presence of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Series	Encapsulated Document Series	ALWAYS
Equipment	General Equipment	ALWAYS
	SC Equipment	ALWAYS
Encapsulated Document	Encapsulated Document	ALWAYS
	SOP Common	ALWAYS
	RayCare Encapsulated Source	ALWAYS

Table 8-5. Encapsulated PDF Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Module					
Patient's Name	0010,0010	PN		ALWAYS	AUTO / USER
Patient ID	0010,0020	LO		ALWAYS	AUTO / USER
Patient's Birth Date	0010,0030	DA		VNAP	AUTO / USER
Patient's Sex	0010,0040	CS		VNAP	AUTO / USER
General Study Module					
Study Instance UID	0020,000D	UI	RayCare Generated UID if not attached to existing study	ALWAYS	AUTO / USER
Study Date	0008,0020	DA	Study Creation Date	ALWAYS	AUTO
Study Time	0008,0030	TM	Study Creation Time	ALWAYS	AUTO
Referring Physician's Name	0008,0090	PN		EMPTY	FIXED
Study ID	0020,0010	SH		EMPTY	FIXED
Accession Number	0008,0050	SH		EMPTY	FIXED
Study Description	0008,1030	LO	"RayCare Document"	ALWAYS	FIXED
Encapsulated Document Series Module					
Modality	0008,0060	CS	"DOC"	ALWAYS	FIXED
Series Instance UID	0020,000E	UI	RayCare Generated UID	ALWAYS	AUTO
Series Number	0020,0011	IS	"1"	ALWAYS	FIXED
Series Description	0008,103E	LO	The name of the source document if provided in the Content-Disposition header	VNAP	USER
General Series Module					
Series Date	0008,0021	DA	Series Creation Date	ALWAYS	AUTO
Series Time	0008,0031	TM	Series Creation Time	ALWAYS	AUTO
General Equipment Module					
Manufacturer	0008,0070	LO	"RaySearch Laboratories"	ALWAYS	FIXED
Manufacturer's Model Name	0008,1090	LO	"RayCare"	ALWAYS	FIXED
Software Version(s)	0018,1020	LO	RayCare Version Number	ALWAYS	AUTO
Station Name	0008,1010	SH	Server Host Name that created this instance	ALWAYS	AUTO
SC Equipment Module					
Conversion Type	0008,0064	CS	"WSD"	ALWAYS	FIXED
Encapsulated Document Module					
Instance Number	0020,0013	IS	"1"	ALWAYS	FIXED
Content Date	0008,0023	DA	Pixel Data Creation Date	ALWAYS	AUTO
Content Time	0008,0033	TM	Pixel Data Creation Time	ALWAYS	AUTO
Acquisition Date Time	0008,002A	DT		EMPTY	

Burned in Annotation	0028,0301	CS	"YES"	ALWAYS	FIXED
Document Title	0042,0010	ST	The name of the source document if provided in the Content-Disposition header	VNAP	USER
Concept Name Code Sequence	0040,A043	SQ		EMPTY	
MIME Type of Encapsulated Document	0042,0012	LO	"application/pdf"	ALWAYS	FIXED
Encapsulated Document	0042,0011	OB	The actual PDF document	ALWAYS	USER
SOP Common Module					
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.104.1"	ALWAYS	FIXED
SOP Instance UID	0008,0018	UI	RayCare Generated UID	ALWAYS	AUTO
Specific Character Set	0008,0005	CS	"ISO_IR 100"	ALWAYS	FIXED
RayCare Encapsulated Source Module					
RayCare Private Creator	4011,0010	LO	"RAYSEARCHLABS 2.0"	ANAP	FIXED
RayCare Encapsulated Source	4011,1004	OB	The original source document when saved	ANAP	USER
MIME Type of RayCare Encapsulated Source	4011,1005	LO	The MIME-type of the source document	ANAP	USER
Filename of RayCare Encapsulated Source	4011,1006	LT	The filename of the source document if provided in the Content-Disposition header	ANAP	USER

8.1.1.3. Raw Data IOD

A raw data SOP instance is created when the user stores any file to the PACS that is not a Jpeg image or a PDF document. This file is stored as a byte array to the RayCare Encapsulated Source tag of this IOD.

Table 8-6. Raw Data Modules

IE	Module	Presence of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Series	General Series	ALWAYS
Equipment	General Equipment	ALWAYS
Raw Data	Acquisition Context	ALWAYS
	Raw Data	ALWAYS
	SOP Common	ALWAYS
	RayCare Encapsulated Source	ALWAYS

Table 8-7. Raw Data Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source

Patient Module					
Patient's Name	0010,0010	PN		ALWAYS	AUTO / USER
Patient ID	0010,0020	LO		ALWAYS	AUTO / USER
Patient's Birth Date	0010,0030	DA		VNAP	AUTO / USER
Patient's Sex	0010,0040	CS		VNAP	AUTO / USER
General Study Module					
Study Instance UID	0020,000D	UI	RayCare Generated UID if not attached to existing study	ALWAYS	AUTO / USER
Study Date	0008,0020	DA	Study Creation Date	ALWAYS	AUTO
Study Time	0008,0030	TM	Study Creation Time	ALWAYS	AUTO
Referring Physician's Name	0008,0090	PN		EMPTY	FIXED
Study ID	0020,0010	SH		EMPTY	FIXED
Accession Number	0008,0050	SH		EMPTY	FIXED
Study Description	0008,1030	LO	"RayCare File"	ALWAYS	FIXED
General Series Module					
Modality	0008,0060	CS	"OT"	ALWAYS	FIXED
Series Instance UID	0020,000E	UI	RayCare Generated UID	ALWAYS	AUTO
Series Number	0020,0011	IS	"1"	ALWAYS	FIXED
Series Date	0008,0021	DA	Series Creation Date	ALWAYS	AUTO
Series Time	0008,0031	TM	Series Creation Time	ALWAYS	AUTO
Series Description	0008,103E	LO	The name of the source document if provided in the Content-Disposition header	VNAP	USER
General Equipment Module					
Manufacturer	0008,0070	LO	"RaySearch Laboratories"	ALWAYS	FIXED
Manufacturer's Model Name	0008,1090	LO	"RayCare"	ALWAYS	FIXED
Software Version(s)	0018,1020	LO	RayCare Version Number	ALWAYS	AUTO
Station Name	0008,1010	SH	Server Host Name that created this instance	ALWAYS	AUTO
Acquisition Context Module					
Acquisition Context Sequence	0040,0555	SQ		EMPTY	
Acquisition Context Description	0040,0556	ST		EMPTY	
Raw Data Module					
Instance Number	0020,0013	IS	"1"	ALWAYS	FIXED
Content Date	0008,0023	DA	Content Creation Date	ALWAYS	AUTO
Content Time	0008,0033	TM	Content Creation Time	ALWAYS	AUTO
Content Label	0070,0080	CS		EMPTY	
Content Description	0070,0081	LO		EMPTY	

Creator Version UID	0008,9123	UI	"1.2.752.243.2.0.{RayCareVersionNumber}"	ALWAYS	FIXED
SOP Common Module					
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.66"	ALWAYS	FIXED
SOP Instance UID	0008,0018	UI	RayCare Generated UID	ALWAYS	AUTO
Specific Character Set	0008,0005	CS	"ISO_IR 100"	ALWAYS	FIXED
RayCare Encapsulated Source Module					
RayCare Private Creator	4011,0010	LO	"RAYSEARCHLABS 2.0"	ANAP	FIXED
RayCare Encapsulated Source	4011,1004	OB	The original source file	ALWAYS	USER
MIME Type of RayCare Encapsulated Source	4011,1005	LO	The MIME-type of the source document	ALWAYS	USER
Filename of RayCare Encapsulated Source	4011,1006	LT	The filename of the source document if provided in the Content-Disposition header	ANAP	USER

8.1.1.4. Spatial Registration IOD

A spatial registration SOP instance is created when the user performs rigid registration in the image viewer and saves the results. The registration instance that is used as a starting point for the registration will be used as source for the new spatial registration SOP instance. All private tags from the source instance will be discarded in the newly created instance.

Table 8-8. Spatial Registration Modules

IE	Module	Presence of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Series	General Series	ALWAYS
	Spatial Registration Series	ALWAYS
Frame of Reference	Frame of Reference	ALWAYS
Equipment	General Equipment	ALWAYS
Spatial Registration	Spatial Registration	ALWAYS
	Common Instance Reference	ALWAYS
	General Reference	ALWAYS
	SOP Common	ALWAYS

Table 8-9. Spatial Registration Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Module					
Patient's Name	0010,0010	PN	Copied from original registration	ALWAYS	AUTO
Patient ID	0010,0020	LO	Copied from original registration	ALWAYS	AUTO

Patient’s Birth Date	0010,0030	DA	Copied from original registration	VNAP	AUTO
Patient’s Sex	0010,0040	CS	Copied from original registration	VNAP	AUTO
General Study Module					
Study Instance UID	0020,000D	UI	Copied from original registration	ALWAYS	AUTO
Study Date	0008,0020	DA	Copied from original registration	VNAP	AUTO
Study Time	0008,0030	TM	Copied from original registration	VNAP	AUTO
Referring Physician's Name	0008,0090	PN	Copied from original registration	VNAP	AUTO
Study ID	0020,0010	SH	Copied from original registration	VNAP	AUTO
Accession Number	0008,0050	SH	Copied from original registration	VNAP	AUTO
General Series Module					
Modality	0008,0060	CS	"REG"	ALWAYS	FIXED
Series Instance UID	0020,000E	UI	RayCare Generated UID	ALWAYS	AUTO
Series Date	0008,0021	DA	Series Creation Date	ALWAYS	AUTO
Series Time	0008,0031	TM	Series Creation Time	ALWAYS	AUTO
Series Description	0008,103E	LO	"RayCare Registration"	ALWAYS	FIXED
Spatial Registration Series Module					
Modality	0008,0060	CS	"REG"	ALWAYS	FIXED
Frame of Reference Module					
Frame of Reference UID	0020,0052	UI	Copied from original registration	ALWAYS	AUTO
Position Reference Indicator	0020,1040	LO	Copied from original registration	VNAP	AUTO
General Equipment Module					
Manufacturer	0008,0070	LO	"RaySearch Laboratories"	ALWAYS	FIXED
Manufacturer's Model Name	0008,1090	LO	"RayCare"	ALWAYS	FIXED
Software Version(s)	0018,1020	LO	RayCare Version Number	ALWAYS	AUTO
Spatial Registration Module					
Instance Number	0020,0013	IS	Copied from original registration	VNAP	AUTO
Content Date	0008,0023	DA	Instance Creation Date	ALWAYS	AUTO
Content Time	0008,0033	TM	Instance Creation Time	ALWAYS	AUTO
Content Label	0070,0080	CS	"REG_" + Instance Creation Date	ALWAYS	AUTO
Content Description	0070,0081	LO	"RayCare Registration"	ALWAYS	FIXED
Content Creator's Name	0070,0084	PN	Name of the user creating the registration	VNAP	AUTO
Registration Sequence	0070,0308	SQ		ALWAYS	AUTO
>Frame of Reference UID	0020,0052	UI	Frame of reference UID	ALWAYS	AUTO

>Referenced Image Sequence	0008,1140	SQ		ALWAYS	AUTO
>>Referenced SOP Class UID	0008,1150	UI	Referenced image SOP Class UID	ALWAYS	AUTO
>>Referenced SOP Instance UID	0008,1155	UI	Referenced image SOP Instance UID	ALWAYS	AUTO
>Matrix Registration Sequence	0070,0309	SQ		ALWAYS	AUTO
>>Frame of Reference Transformation Comment	3006,00C8	LO	Copied from original registration	ANAP	AUTO
>>Registration Type Code Sequence	0070,030D	SQ	Copied from original registration	ANAP	AUTO
>>>Code Value	0008,0100	SH	Copied from original registration	ANAP	AUTO
>>>Coding Scheme Designator	0008,0102	SH	Copied from original registration	ANAP	AUTO
>>>Coding Scheme Version	0008,0103	SH	Copied from original registration	ANAP	AUTO
>>>Code Meaning	0008,0104	LO	Copied from original registration	ANAP	AUTO
>>Matrix Sequence	0070,030A	SQ		ALWAYS	AUTO
>>>Frame of Reference Transformation Matrix	3006,00C6	DS	Registration Matrix	ALWAYS	AUTO/ USER
>>>Frame of Reference Transformation Matrix Type	0070,030C	CS	"RIGID"	ALWAYS	FIXED
Common Instance Reference Module					
Referenced Series Sequence	0008,1115	SQ	Copied from original registration	ANAP	AUTO
>Series Instance UID	0020,000E	UI	Copied from original registration	ANAP	AUTO
>Referenced Instance Sequence	0008,114A	SQ	Copied from original registration	ANAP	AUTO
>>Referenced SOP Class UID	0008,1150	UI	Copied from original registration	ANAP	AUTO
>>Referenced SOP Instance UID	0008,1155	UI	Copied from original registration	ANAP	AUTO
Studies Containing Other Referenced Instances Sequence	0008,1200	SQ	Copied from original registration	ANAP	AUTO
>Study Instance UID	0020,000D	UI	Copied from original registration	ANAP	AUTO
>Referenced Series Sequence	0008,1115	SQ	Copied from original registration	ANAP	AUTO
>>Series Instance UID	0020,000E	UI	Copied from original registration	ANAP	AUTO

>>Referenced Instance Sequence	0008,114A	SQ	Copied from original registration	ANAP	AUTO
>>>Referenced SOP Class UID	0008,1150	UI	Copied from original registration	ANAP	AUTO
>>>Referenced SOP Instance UID	0008,1155	UI	Copied from original registration	ANAP	AUTO
General Reference Module					
Referenced Instance Sequence	0008,114A	SQ		ALWAYS	FIXED
>Referenced SOP Class UID	0008,1150	UI	"1.2.840.10008.5.1.4.1.1.66.1"	ALWAYS	FIXED
>Referenced SOP Instance UID	0008,1155	UI	SOP Instance UID of referenced registration	ALWAYS	AUTO
>Purpose of Reference Code Sequence	0040,A170	SQ		ALWAYS	AUTO
>>Code Value	0008,0100	SH	"RCREG-1"	ALWAYS	FIXED
>>Coding Scheme Designator	0008,0102	SH	"RAYSEARCH"	ALWAYS	FIXED
>>Code Meaning	0008,0104	LO	"Original registration during treatment"	ALWAYS	FIXED
SOP Common Module					
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.66.1"	ALWAYS	FIXED
SOP Instance UID	0008,0018	UI	RayCare Generated UID	ALWAYS	AUTO
Instance Creation Date	0008,0012	DA		ALWAYS	AUTO
Instance Creation Time	0008,0013	TM		ALWAYS	AUTO

8.1.1.5. Key Object Selection Document IOD

A key object selection document SOP instance is created when the user creates image annotations. The SOP instance contains the title, a description, and a reference to the selected Key slices with an optional reference to a grayscale presentation state SOP instance if graphical annotations are added.

Table 8-10. Key Object Selection Document Modules

IE	Module	Presence of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Series	Key Object Document Series	ALWAYS
Equipment	General Equipment	ALWAYS
Document	Key Object Document	ALWAYS
	SR Document Content	ALWAYS
	SOP Common	ALWAYS

Table 8-11. Key Object Selection Document Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Module					

Patient's Name	0010,0010	PN	RayCare Patient name	ALWAYS	AUTO
Patient ID	0010,0020	LO	RayCare Patient ID	ALWAYS	AUTO
Patient's Birth Date	0010,0030	DA	RayCare Patient Birth Date	ALWAYS	AUTO
Patient's Sex	0010,0040	CS	RayCare Patient Gender	ALWAYS	AUTO
General Study Module					
Study Instance UID	0020,000D	UI	Copied from referenced images	ALWAYS	AUTO
Study Date	0008,0020	DA	Copied from referenced images	VNAP	AUTO
Study Time	0008,0030	TM	Copied from referenced images	VNAP	AUTO
Referring Physician's Name	0008,0090	PN	Copied from referenced images	VNAP	AUTO
Study ID	0020,0010	SH	Copied from referenced images	VNAP	AUTO
Accession Number	0008,0050	SH	Copied from referenced images	VNAP	AUTO
Key Object Document Series Module					
Modality	0008,0060	CS	"KO"	ALWAYS	FIXED
Series Instance UID	0020,000E	UI	RayCare Generated UID	ALWAYS	AUTO
Series Number	0020,0011	IS	"1"	ALWAYS	FIXED
Series Date	0008,0021	DA	Date key object document created	ALWAYS	AUTO
Series Time	0008,0031	TM	Time key object document created	ALWAYS	AUTO
Series Description	0008,103E	LO	"RayCare Annotation -" + Selected Image Annotation Title Name	ALWAYS	FIXED
Referenced Performed Procedure Step Sequence	0008,1111	SQ	-	EMPTY	FIXED
General Equipment Module					
Manufacturer	0008,0070	LO	"RaySearch Laboratories"	ALWAYS	FIXED
Manufacturer's Model Name	0008,1090	LO	"RayCare"	ALWAYS	FIXED
Software Version(s)	0018,1020	LO	RayCare Version Number	ALWAYS	AUTO
Key Object Document Module					
Instance Number	0020,0013	IS	"1"	ALWAYS	FIXED
Content Date	0008,0023	DA	Date key object document created	ALWAYS	AUTO
Content Time	0008,0033	TM	Time key object document created	ALWAYS	AUTO
Current Requested Procedure Evidence Sequence	0040,A375	SQ	Referenced Images and Presentation States	ALWAYS	AUTO
> Study Instance UID	0020,000D	UI		ALWAYS	AUTO
> Referenced Series Sequence	0008,1115	SQ		ALWAYS	AUTO
- Referenced Series Sequence Item 1	-	-	Referenced Image Series		
>> Series Instance UID	0020,000E	UI	Referenced image Series Instance UID	ALWAYS	AUTO

>> Referenced SOP Sequence	0008,1199	SQ		ALWAYS	AUTO
>> - Referenced SOP Sequence item 1-n					
>>> Referenced SOP Class UID	0008,1150	UI	Referenced image SOP Class UID	ALWAYS	AUTO
>>> Referenced SOP Instance UID	0008,1155	UI	Referenced image SOP Instance UID	ALWAYS	AUTO
- Referenced Series Sequence Item 2 (optional)	-	-	*referenced presentation state series*		
>> Series Instance UID	0020,000E	UI	Referenced presentation state Series Instance UID	ALWAYS	AUTO
>> Referenced SOP Sequence	0008,1199	SQ		ALWAYS	AUTO
>>> Referenced SOP Class UID	0008,1150	UI	Referenced presentation state SOP Class UID	ALWAYS	AUTO
>>> Referenced SOP Instance UID	0008,1155	UI	Referenced presentation state SOP Instance UID	ALWAYS	AUTO
SR Document Content Module					
Value Type	0040,A040	CS	"CONTAINER"	ALWAYS	FIXED
Concept Name Code Sequence	0040,A043	SQ		ALWAYS	AUTO
> Code Value	0008,0100	SH	Selected Image Annotation Title Code	ALWAYS	AUTO
> Coding Scheme Designator	0008,0102	SH	"DCM"	ALWAYS	FIXED
> Code Meaning	0008,0104	LO	Selected Image Annotation Title Name	ALWAYS	AUTO
Continuity Of Content	0040,A050	CS	"SEPARATE"	ALWAYS	FIXED
Content Template Sequence	0040,A504	SQ		ALWAYS	FIXED
> Mapping Resource	0008,0105	CS	"DCMR"	ALWAYS	FIXED
> Template Identifier	0040,DB00	CS	"2010"	ALWAYS	FIXED
Content Sequence	0040,A730	SQ		ALWAYS	FIXED
- Content 1	-	-	-	-	-
> Relationship Type	0040,A010	CS	"CONTAINS"	ALWAYS	FIXED
> Value Type	0040,A040	CS	"TEXT"	ALWAYS	FIXED
> Text Value	0040,A160	UT	Provided Image Annotation Description	ALWAYS	AUTO
> Concept Name Code Sequence	0040,A043	SQ		ALWAYS	FIXED
>> Code Value	0008,0100	SH	"113012"	ALWAYS	FIXED
>> Coding Scheme Designator	0008,0102	SH	"DCM"	ALWAYS	FIXED
>> Code Meaning	0008,0103	LO	"Key Object Description"	ALWAYS	FIXED
- Content 2	-	-	-	ALWAYS	FIXED
> Relationship Type	0040,A010	CS	"HAS OBS CONTEXT"	ALWAYS	FIXED

> Value Type	0040,A040	CS	"PNAME"	ALWAYS	FIXED
> Person Name	0040,A123	PN	Name of observation user	ALWAYS	AUTO
> Concept Name Code Sequence	0040,A043	SQ		ALWAYS	FIXED
>> Code Value	0008,0100	SH	"121008"	ALWAYS	FIXED
>> Coding Scheme Designator	0008,0102	SH	"DCM"	ALWAYS	FIXED
>> Code Meaning	0008,0103	LO	"Person Observer Name"	ALWAYS	FIXED
- Content 3-n	-	-	-	-	-
> Relationship Type	0040,A010	CS	"CONTAINS"	ALWAYS	FIXED
> Value Type	0040,A040	CS	"IMAGE"	ALWAYS	FIXED
> Referenced SOP Sequence	0008,1199	SQ	Referenced Key Image	ALWAYS	AUTO
>> Referenced SOP Class UID	0008,1150	UI	SOP Class UID of Referenced Image	ALWAYS	AUTO
>> Referenced SOP Instance UID	0008,1155	UI	SOP Instance UID of Referenced Image	ALWAYS	AUTO
>> Referenced SOP Sequence	0008,1199	SQ	Referenced Presentation State with Graphical Annotations	ALWAYS	AUTO
>>> Referenced SOP Class UID	0008,1150	UI	SOP Class UID of Referenced Presentation State	ALWAYS	AUTO
>>> Referenced SOP Instance UID	0008,1155	UI	SOP Instance UID of Referenced Presentation State	ALWAYS	AUTO
SOP Common Module					
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.88.59"	ALWAYS	FIXED
SOP Instance UID	0008,0018	UI	RayCare Generated UID	ALWAYS	AUTO
Specific Character Set	0008,0005	CS	ISO_IR 192	ALWAYS	FIXED

8.1.1.6. Grayscale Presentation State IOD

A grayscale presentation state SOP instance is created when the user creates image annotations. The SOP instance contains graphical annotations and is referenced by the key object selection document SOP instance.

Table 8-12. Grayscale Presentation State Modules

IE	Module	Presence of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Series	General Series	ALWAYS
Series	Presentation Series	ALWAYS
Equipment	General Equipment	ALWAYS
Presentation State	Presentation State Identification	ALWAYS
	Presentation State Relationship	ALWAYS
	Presentation State Shutter	NEVER
	Presentation State Mask	NEVER
	Mask	NEVER
	Display Shutter	NEVER
	Bitmap Display Shutter	NEVER
	Overlay Plane	NEVER

	Overlay Activation	NEVER
	Displayed Area	ALWAYS
	Graphic Annotation	ALWAYS
	Spatial Transformation	NEVER
	Modality LUT	NEVER
	Softcopy VOI LUT	NEVER
	Softcopy Presentation LUT	ALWAYS
	SOP Common	ALWAYS

Table 8-13. Grayscale Presentation State Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Module					
Patient's Name	0010,0010	PN	RayCare Patient name	ALWAYS	AUTO
Patient ID	0010,0020	LO	RayCare Patient ID	ALWAYS	AUTO
Patient's Birth Date	0010,0030	DA	RayCare Patient Birth Date	ALWAYS	AUTO
Patient's Sex	0010,0040	CS	RayCare Patient Gender	ALWAYS	AUTO
General Study Module					
Study Instance UID	0020,000D	UI	Copied from referenced images	ALWAYS	AUTO
Study Date	0008,0020	DA	Copied from referenced images	VNAP	AUTO
Study Time	0008,0030	TM	Copied from referenced images	VNAP	AUTO
Referring Physician's Name	0008,0090	PN	Copied from referenced images	VNAP	AUTO
Study ID	0020,0010	SH	Copied from referenced images	VNAP	AUTO
Accession Number	0008,0050	SH	Copied from referenced images	VNAP	AUTO
General Series Module					
Modality	0008,0060	CS	"PR"	ALWAYS	FIXED
Series Instance UID	0020,000E	UI	RayCare Generated UID	ALWAYS	AUTO
Series Date	0008,0021	DA	Date presentation state created	ALWAYS	AUTO
Series Time	0008,0031	TM	Time presentation state created	ALWAYS	AUTO
Series Description	0008,103E	LO	"RayCare Annotation - Presentation State"	ALWAYS	FIXED
Presentation Series Module					
Modality	0008,0060	CS	"PR"	ALWAYS	FIXED
General Equipment Module					
Manufacturer	0008,0070	LO	"RaySearch Laboratories"	ALWAYS	FIXED
Manufacturer's Model Name	0008,1090	LO	"RayCare"	ALWAYS	FIXED
Software Version(s)	0018,1020	LO	RayCare Version Number	ALWAYS	AUTO
Presentation State Identification Module					
Presentation Creation Date	0070,0082	DA	Date presentation state created	ALWAYS	AUTO
Presentation Creation Time	0070,0083	TM	Time presentation state created	ALWAYS	AUTO
Instance Number	0020,0013	IS	"1"	ALWAYS	FIXED
Content Label	0070,0080	CS	"ANNOTATIONS"	ALWAYS	FIXED

Content Description	0070,0081	LO	"Graphical annotations"	ALWAYS	FIXED
Content Creator's Name	0070,0084	PN	RayCare User	ALWAYS	AUTO
Presentation State Relationship Module					
Referenced Series Sequence	0008,1115	SQ	All referenced images in this presentation state	ALWAYS	AUTO
> Series Instance UID	0020,000E	UI	Referenced image Series Instance UID	ALWAYS	AUTO
> Referenced Image Sequence	0008,1140	SQ		ALWAYS	AUTO
>> Referenced SOP Class UID	0008,1150	UI	Referenced image SOP Class UID	ALWAYS	AUTO
>> Referenced SOP Instance UID	0008,1155	UI	Referenced image SOP Instance UID	ALWAYS	AUTO
>> Referenced Frame Number	0008,1160	IS		VNAP	AUTO
Presentation State Shutter Module (not used)					
Presentation State Mask Module (not used)					
Displayed Area Module					
Displayed Area Selection Sequence	0070,005A	SQ		ALWAYS	AUTO
> Display Area Top Left Hand Corner	0070,0052	SL	[1,1]	ALWAYS	FIXED
> Display Area Bottom Right Hand Corner	0070,0053	SL	Bottom Right Hand Corner of image, for example: [512,512]	ALWAYS	AUTO
> Presentation Size Mode	0070,0100	CS	"SCALE TO FIT"	ALWAYS	FIXED
> Presentation Pixel Aspect Ratio	0070,0102	IS	[1,1]	ALWAYS	FIXED
Graphic Annotation Module					
Graphic Annotation Sequence	0070,0001	SQ	An item for every image slice/frame that is annotated	ALWAYS	AUTO
- Graphic Annotation Sequence Item 0-n					
> Referenced Image Sequence	0008,1140	SQ		ALWAYS	AUTO
>> Referenced SOP Class UID	0008,1150	UI	Referenced image SOP Class UID	ALWAYS	AUTO
>> Referenced SOP Instance UID	0008,1155	UI	Referenced image SOP Instance UID	ALWAYS	AUTO
>> Referenced Frame Number	0008,1160	IS		VNAP	AUTO
> Graphic Layer	0070,0002	CS	"ANNOTATIONS"	ALWAYS	FIXED

> Graphic Object Sequence	0070,0009	SQ	One or more annotation object items	VNAP	FIXED
>- Graphic Object Sequence Item	0070,0009	-	Graphical object for: Ellipse	VNAP	AUTO
>> Graphic Annotation Units	0070,0005	CS	"PIXEL"	ALWAYS	FIXED
>> Graphic Dimensions	0070,0020	US	"2"	ALWAYS	FIXED
>> Number of Graphic Points	0070,0021	US	"4"	ALWAYS	FIXED
>> Graphic Data	0070,0022	FL	Position of ellipse, for example: [218.0, 138.0, 218.0, 195.0, 196.0, 167.0, 241.0, 167.0]	ALWAYS	AUTO
>> Graphic Type	0070,0023	CS	"ELLIPSE"	ALWAYS	FIXED
>> Graphic Filled	0070,0024	CS	"N"	ALWAYS	FIXED
>- Graphic Object Sequence Item	0070,0009	-	Graphical object for: Rectangle	VNAP	AUTO
>> Graphic Annotation Units	0070,0005	CS	"PIXEL"	ALWAYS	FIXED
>> Graphic Dimensions	0070,0020	US	"2"	ALWAYS	FIXED
>> Number of Graphic Points	0070,0021	US	"5"	ALWAYS	FIXED
>> Graphic Data	0070,0022	FL	Position of rectangle, for example: [200.0, 200.0, 250.0, 200.0, 250.0, 150.0, 200.0, 150.0, 200.0, 200.0]	ALWAYS	AUTO
>> Graphic Type	0070,0023	CS	"POLYLINE"	ALWAYS	FIXED
>> Graphic Filled	0070,0024	CS	"N"	ALWAYS	FIXED
>- Graphic Object Sequence Item	0070,0009	-	Graphical object for: Line	VNAP	AUTO
>> Graphic Annotation Units	0070,0005	CS	"PIXEL"	ALWAYS	FIXED
>> Graphic Dimensions	0070,0020	US	"2"	ALWAYS	FIXED
>> Number of Graphic Points	0070,0021	US	"2"	ALWAYS	FIXED
>> Graphic Data	0070,0022	FL	Position of line, for example: [300.0, 75.0, 225.0, 115.0]	ALWAYS	AUTO
>> Graphic Type	0070,0023	CS	"POLYLINE"	ALWAYS	FIXED
>> Graphic Filled	0070,0024	CS	"N"	ALWAYS	FIXED
> Text Object Sequence	0070,0008	SQ	One or more annotation object items	VNAP	FIXED
>- Text Object Sequence Item	0070,0008	-	Text object for: arrow	VNAP	AUTO

>> Bounding Box Annotation Units	0070,0003	CS	"PIXEL"	ALWAYS	FIXED
>> Anchor Point Annotation Units	0070,0004	CS	"PIXEL"	ALWAYS	FIXED
>> Unformatted Text Value	0070,0006	ST	" "	ALWAYS	FIXED
>> Bounding Box Top Left Hand Corner	0070,0010	FL	Position of arrow foot, for example: [300.0, 100.0]	ALWAYS	AUTO
>> Bounding Box Bottom Right Hand Corner	0070,0011	FL	Position of arrow foot, for example: [301.0, 101.0]	ALWAYS	AUTO
>> Bounding Box Text Horizontal Justification	0070,0012	CS	"LEFT"	ALWAYS	FIXED
>> Anchor Point	0070,0014	FL	Position of arrow head, for example: [280.0, 150.0]	ALWAYS	AUTO
>> Anchor Point Visibility	0070,0015	CS	"Y"	ALWAYS	FIXED
Graphic Layer Module					
Graphic Layer Sequence	0070,0060	SQ		ALWAYS	FIXED
> Graphic Layer	0070,0002	CS	"ANNOTATIONS"	ALWAYS	FIXED
> Graphic Layer Order	0070,0062	IS	"1"	ALWAYS	FIXED
Softcopy Presentation LUT Module					
Presentation LUT Shape	2050,0020	CS	"IDENTITY"	ALWAYS	FIXED
SOP Common Module					
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.11.1"	ALWAYS	FIXED
SOP Instance UID	0008,0018	UI	RayCare Generated UID	ALWAYS	AUTO

8.1.2. Usage of attributes from received IODs

To be able to import SOP instances into RayCare PACS, a minimum set of attributes is required. The value of the attributes must meet the value representation (VR) requirements as described in section 6.2 of Part 5 of the DICOM standard. See DICOM Standard PS3.5 6.2 See DICOM Standard PS3.5 6.2

Attribute Name	**Tag**	**VR**	**VM**	**Comment**
SOP Class UID	0008,0016	UI	1	
SOP Instance UID	0008,0018	UI	1	
Modality	0008,0060	CS	1	
Patient's Name	0010,0010	PN	1	
Patient ID	0010,0020	LO	1	
Study Instance UID	0020,000D	UI	1	

Series Instance UID	0020,000E	UI	1	

The following IODs are supported for viewing by the RayCare Image Viewer. It is required for the RayCare Image Viewer that the IODs are stored using a non-compressed format.

8.1.2.1. CT Image IOD

Table 8-14. CT Image IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	General Series	Yes
Frame of Reference	Frame of Reference	Yes
Equipment	General Equipment	No
Image	General Image	Yes
	Image Plane	Yes
	Image Pixel	Yes
	CT Image	Yes
	SOP Common	Yes
	VOI LUT	Yes

Table 8-15. CT Image IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
Study Date	0008,0020	DA	2	
Study Time	0008,0030	TM	2	
General Series Module				
Modality	0008,0060	CS	1	Supported Value: CT
Series Instance UID	0020,000E	UI	1	Used to verify references from RT Structure Sets
Series Date	0008,0021	DA	3	
Series Description	0008,103E	LO	3	
Series Time	0008,0031	TM	3	
Patient Position	0018,5100	CS	2C	Supported values: HFS, HFP, FFS, FFP
General Image Module				
Content Time	0008,0033	TM	2C	
Content Date	0008,0023	DA	2C	
Frame of Reference Module				
Frame of Reference UID	0020,0052	UI	1	Used to get referenced datasets

Image Plane Module				
Pixel Spacing	0028,0030	DS	1	
Image Orientation (Patient)	0020,0037	DS	1	All image orientations are supported
Image Position (Patient)	0020,0032	DS	1	Converted to internal image corner. Used to find slice direction, which must be constant throughout the series and along the main axis depending on image orientation.
Image Pixel Module				
Rows	0028,0010	US	1	
Columns	0028,0011	US	1	
Pixel Representation	0028,0103	US	1	Supported values: 0, 1
Pixel Data	7FE0,0010	OB or OW	1C	
CT Image Module				
Samples per Pixel	0028,0002	US	1	Supported value: 1
Photometric Interpretation	0028,0004	CS	1	Supported value: MONOCHROME2
Bits Allocated	0028,0100	US	1	Supported value: 16
Bits Stored	0028,0101	US	1	Supported values: 8, 9, 10, 11, 12, 13, 14, 15, 16
High Bit	0028,0102	US	1	High Bit must be Bits Stored - 1
Rescale Intercept	0028,1052	DS	1	
Rescale Slope	0028,1053	DS	1	
Rescale Type	0028,1054	LO	1C	Supported value: HU and US
Image Type	0008,0008	CS	1	Supported value: AXIAL and LOCALIZER
SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.2
SOP Instance UID	0008,0018	UI	1	
Instance Creation Date	0008,0012	DA	3	
Instance Creation Time	0008,0013	TM	3	
VOI LUT				
Window Center	0028,1050	DS	1C	
Window Width	0028,1051	DS	1C	

8.1.2.2. MR Image IOD

Table 8-16. MR Image IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	General Series	Yes

Frame of Reference	Frame of Reference	Yes
Equipment	General Equipment	No
Image	General Image	Yes
	Image Plane	Yes
	Image Pixel	Yes
	MR Image	Yes
	SOP Common	Yes
	VOI LUT	Yes

Table 8-17. MR Image IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
Study Date	0008,0020	DA	2	
Study Time	0008,0030	TM	2	
General Series Module				
Modality	0008,0060	CS	1	Supported value: MR
Series Instance UID	0020,000E	UI	1	Used to verify references from RT Structure Sets
Series Date	0008,0021	DA	3	
Series Description	0008,103E	LO	3	
Series Time	0008,0031	TM	3	
Patient Position	0018,5100	CS	2C	Supported values: HFS, HFP, FFS, FFP
General Image Module				
Content Time	0008,0033	TM	2C	
Content Date	0008,0023	DA	2C	
Frame of Reference Module				
Frame of Reference UID	0020,0052	UI	1	Used to get referenced datasets
Image Plane Module				
Pixel Spacing	0028,0030	DS	1	
Image Orientation (Patient)	0020,0037	DS	1	All image orientations are supported
Image Position (Patient)	0020,0032	DS	1	Converted to internal image corner. Used to find slice direction, which must be constant throughout the series and along the main axis depending on image orientation.
Image Pixel Module				
Rows	0028,0010	US	1	
Columns	0028,0011	US	1	
Pixel Representation	0028,0103	US	1	Supported values: 0, 1

Pixel Data	7FE0,0010	OB or OW	1C	
MR Image Module				
Samples per Pixel	0028,0002	US	1	Supported value: 1
Photometric Interpretation	0028,0004	CS	1	Supported value: MONOCHROME2
Bits Allocated	0028,0100	US	1	Supported value: 16
Bits Stored	0028,0101	US	1	Supported values: 8, 9, 10, 11, 12, 13, 14, 15, 16
High Bit	0028,0102	US	1	High Bit must be Bits Stored - 1
Image Type	0008,0008	CS	1	
SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.4
SOP Instance UID	0008,0018	UI	1	
Instance Creation Date	0008,0012	DA	3	
Instance Creation Time	0008,0013	TM	3	
VOI LUT				
Window Center	0028,1050	DS	1C	
Window Width	0028,1051	DS	1C	

8.1.2.3. PET Image IOD

Table 8-18. PET Image IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
	Patient Study	Yes
Series	General Series	Yes
	PET Series	Yes
	PET Isotope	No
Frame of Reference	Frame of Reference	Yes
Equipment	General Equipment	Yes
Image	General Image	Yes
	Image Plane	Yes
	Image Pixel	Yes
	PET Image	Yes
	SOP Common	Yes
	VOI LUT	Yes

Table 8-19. PET Image IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	

Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
General Series Module				
Modality	0008,0060	CS	1	Supported value: PT
Series Instance UID	0020,000E	UI	1	Used to verify references from RT Structure Sets
Series Description	0008,103E	LO	3	
Patient Position	0018,5100	CS	2C	Supported values: HFS, HFP, FFS, FFP
PET Series Module				
Series Date	0008,0021	CS	1	
Series Time	0008,0031	TM	1	
Units	0054,1001	CS	1	Supported values: CNTS, NONE, CM2, CM2ML, PCNT, CPS, BQML, MGMINML, UMOLMINML, MLMING, MLG, 1CM, UMOLML, PROPCNTS, PROPCPS, MLMINML, MLML, GML, STDDEV
Frame of Reference Module				
Frame of Reference UID	0020,0052	UI	1	Used to get referenced datasets
General Equipment Module				
General Image Module				
Instance Number	0020,0013	IS	**2**	
Content Time	0008,0033	TM	2C	
Content Date	0008,0023	DA	2C	
Image Plane Module				
Pixel Spacing	0028,0030	DS	1	
Image Orientation (Patient)	0020,0037	DS	1	All image orientations are supported
Image Position (Patient)	0020,0032	DS	1	Converted to internal image corner. Used to find slice direction, which must be constant throughout the series and along the main axis depending on image orientation.
Image Pixel Module				
Rows	0028,0010	US	1	
Columns	0028,0011	US	1	
Pixel Representation	0028,0103	US	1	Supported values: 0, 1
Pixel Data	7FE0,0010	OB or OW	1C	
PET Image Module				
Samples per Pixel	0028,0002	US	1	Supported value: 1
Photometric Interpretation	0028,0004	CS	1	Supported value: MONOCHROME2
Bits Allocated	0028,0100	US	1	Supported value: 16
Bits Stored	0028,0101	US	1	Supported values: 8, 9, 10, 11, 12, 13, 14, 15, 16

High Bit	0028,0102	US	1	Must be equal to "Bits Stored - 1"
Rescale Intercept	0028,1052	DS	1	Supported value: 0.0
Rescale Slope	0028,1053	DS	1	
Image Type	0008,0008	CS	1	
SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.128
SOP Instance UID	0008,0018	UI	1	
Instance Creation Date	0008,0012	DA	3	
Instance Creation Time	0008,0013	TM	3	
VOI LUT				
Window Center	0028,1050	DS	1C	
Window Width	0028,1051	DS	1C	

8.1.2.4. RT Dose IOD

Table 8-20. RT Dose IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	RT Series	Yes
Frame of Reference	Frame of Reference	Yes
Equipment	General Equipment	Yes
Dose	Image Plane	Yes
	Image Pixel	Yes
	Multi-frame	Yes
	RT Dose	Yes
	SOP Common	Yes

Table 8-21. RT Dose IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
Study Date	0008,0020	DA	2	
Study Time	0008,0030	TM	2	
Referring Physician's Name	0008,0090	PN	2	
Study ID	0020,0010	SH	2	
Accession Number	0008,0050	SH	2	
Study Description	0008,1030	LO	3	

RT Series Module				
Modality	0008,0060	CS	1	Supported Value: RTDOSE
Series Instance UID	0020,000E	UI	1	
Series Description	0008,103E	LO	3	
Series Date	0008,0021	DA	3	
Series Time	0008,0031	TM	3	
Frame of Reference Module				
Frame of Reference UID	0020,0052	UI	1	
General Equipment Module				
Image Plane Module				
Pixel Spacing	0028,0030	DS	1	
Image Orientation (Patient)	0020,0037	DS	1	Image orientation must be transversal
Image Position (Patient)	0020,0032	DS	1	Note that this is the center of the first pixel, i.e. the corner of the image offset by half a pixel.
Image Pixel Module				
Rows	0028,0010	US	1	
Columns	0028,0011	US	1	
Pixel Data	7FE0,0010	OB or OW	1C	
Multi-Frame Module				
Number of Frames	0028,0008	IS	1	
Frame Increment Pointer	0028,0009	AT	1	
RT Dose Module				
Content Time	0008,0033	TM	2C	
Content Date	0008,0023	DA	2C	
Samples per Pixel	0028,0002	US	1C	Supported Value: 1
Photometric Interpretation	0028,0004	CS	1C	Supported Value: MONOCHROME2
Bits Allocated	0028,0100	US	1C	Supported value: 16, 32
Bits Stored	0028,0101	US	1C	Bits Stored must be equal to Bits Allocated
High Bit	0028,0102	US	1C	High Bit must be Bits Stored - 1
Pixel Representation	0028,0103	US	1C	Supported value: 0
Dose Units	3004,0002	CS	1	Supported value: GY
Dose Type	3004,0004	CS	1	Supported values: PHYSICAL, EFFECTIVE
Dose Comment	3004,0006	LO	3	
Dose Summation Type	3004,000A	CS	1	Supported values: PLAN, FRACTION, BEAM

Grid Frame Offset Vector	3004,000C	DS	1C	First element must be exactly zero. Elements must be positive and monotonically increasing.
Dose Grid Scaling	3004,000E	DS	1C	Must be positive
Referenced Spatial Registration Sequence	0070,0404	SQ	2C	
>Referenced SOP Class UID	0008,1150	UI	1	
>Referenced SOP Instance UID	0008,1155	UI	1	
Referenced RT Plan Sequence	300c,0002	SQ	1C	
>Referenced SOP Class UID	0008,1150	UI	1	
>Referenced SOP Instance UID	0008,1155	UI	1	
>Referenced Fraction Group Sequence	300c,0020	SQ	1C	
>>Referenced Fraction Group Number	300c,0022	IS	1	
>>Referenced Beam Sequence	300C,0004	SQ	1C	
>>>Referenced Beam Number	300C,0006	IS	1	
>>>Referenced Control Point Sequence	300C,00F2	SQ	1	
>>>>Referenced Start Control Point Index	300C,00F4	IS	1	
>>>>Referenced Stop Control Point Index	300C,00F6	IS	1	
>>Referenced Brachy Application Setup Sequence	300C,000A	SQ	1C	
>>>Referenced Brachy Application Setup Number	300C,000C	IS	1	

Referenced Treatment Record Sequence			1C	
>Referenced SOP Class UID	0008,1150	UI	1	
>Referenced SOP Instance UID	0008,1155	UI	1	
>Referenced Beam Sequence	300C,0004	SQ	1C	
>>Referenced Beam Number	300C,0006	IS	1	
SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.481.2
SOP Instance UID	0008,0018	UI	1	
Instance Creation Date	0008,0012	DA	3	
Instance Creation Time	0008,0013	TM	3	

8.1.2.5. RT Image IOD

Table 8-22 RT Image IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	RT Series	Yes
Frame of Reference	Frame of Reference	Yes
Equipment	General Equipment	Yes
Image	General Image	Yes
	Image Pixel	Yes
	RT Image	Yes
	VOI LUT	Yes
	Modality LUT	Yes
	Approval	Yes
	SOP Common	Yes

Table 8-23. RT Image IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
Study Date	0008,0020	DA	2	
Study Time	0008,0030	TM	2	
Study ID	0020,0010	SS	2	

Accession Number	0008,0050	SH	2	
Referring Physician's Name	0008,0090	PN	2	
RT Series Module				
Series Time	0008,0031	TM	3	
Series Date	0008,0021	DA	3	
Series Description	0008,103E	LO	3	
Modality	0008,0060	CS	1	Used for display. Supported Value: RTIMAGE
Series Instance UID	0020,000E	UI	1	
Frame of Reference Module				
Frame of Reference UID	0020,0052	UI	1	Optional, but must be the same for all RT images in a series. If this tag is non-existent or empty the series cannot be used for any type of fusion, but the images can still be displayed.
General Equipment Module				
Manufacturer	0008,0070	LO	2	Validated for 2D/2D and 2D/3D fusion
Manufacturer's Model Name	0008,1090	LO	3	Validated for 2D/3D fusion
General Image Module				
Content Time	0008,0033	TM	2C	Used for display
Content Date	0008,0023	DA	2C	Used for display
Image Pixel Module				
Rows	0028,0010	US	1	
Columns	0028,0011	US	1	
Pixel Data	7FE0,0010	OB or OW	1C	
RT Image Module				
Samples per Pixel	0028,0002	US	1	Supported value: 1
Photometric Interpretation	0028,0004	CS	1	Supported value: MONOCHROME2
Bits Allocated	0028,0100	US	1	Supported value: 16
Bits Stored	0028,0101	US	1	Supported values: 12, 13, 14, 15, 16
High Bit	0028,0102	US	1	High Bit must be Bits Stored - 1
Pixel Representation	0028,0103	US	1	Supported value: 0, 1
RT Image Label	3002,0002	SH	1	Used for display
Image Type	0008,0008	CS	1	Used for display. Modality Specific Characteristics used to determine if the RT image is a radiograph, portal or DRR image.
RT Image Plane	3002,000C	CS	1	Supported value: NORMAL
X-Ray Image Receptor Angle	3002,000E	DS	2	Defaults to zero if not present in radiograph, portal and DRR images
X-Ray Image Receptor Translation	3002,000D	DS	3	For image display, It is required that two out of three of the following fields are known, the third can be calculated from the other two: 1. Radiation Machine SAD 2. RT Image SID 3. X-Ray Image Receptor Translation

				If not present, X-Ray Image Receptor Translation is assumed to be (0, 0, SAD – SID)
Image Plane Pixel Spacing	3002,0011	DS	2	Required.
RT Image Position	3002,0012	DS	2	Required.
RT Image Orientation	3002,0010	DS	2C	If not present defaults to { row direction = (1,0,0); column direction = (0,-1,0) } for radiograph/portal/DRR images. For other RT images defaults to { row direction = (1,0,0); column direction = (0,1,0) }
Radiation Machine SAD	3002,0022	DS	2	Required for fusion display. For single image display, it is required that two out of three of the following fields are known, the third can be calculated from the other two: 1. Radiation Machine SAD 2. RT Image SID 3. X-Ray Image Receptor Translation Formula: X-Ray Image Receptor Translation.Z = SAD – SID
RT Image SID	3002,0026	DS	2	Required for fusion display. For single image display, It is required that two out of three of the following fields are known, the third can be calculated from the other two: 1. Radiation Machine SAD 2. RT Image SID 3. X-Ray Image Receptor Translation Note: For DRR images, if SID is not present, it is assumed that SID equals SAD. Formula: X-Ray Image Receptor Translation.Z = SAD – SID
RT Image Name	3002,0003	LO	3	Used for display
Referenced Beam Number	300C,0006	IS	3	Used for display
Patient Position	0018,1150	CS	1C	Required for display. Supported values: HFS, HFP, FFS, FFP.
Gantry Angle	300A,011E	DS	3	Required for display
Gantry Pitch Angle	300A,014A	FL	3	Defaults to zero if not present in radiograph, portal and DRR images
Isocenter Position	300A,012C	DS	3	Required for display
Patient Support Angle	300A,0122	DS	3	Defaults to zero if not present in radiograph, portal and DRR images
Table Top Vertical Position	300A,0128	DS	3	Defaults to zero if not present in radiograph, portal and DRR images
Table Top Longitudinal Position	300A,0129	DS	3	Defaults to zero if not present in radiograph, portal and DRR images
Table Top Lateral Position	300A,012A	DS	3	Defaults to zero if not present in radiograph, portal and DRR images

Table Top Pitch Angle	300A,0140	FL	3	Defaults to zero if not present in radiograph, portal and DRR images
Table Top Roll Angle	300A,0144	FL	3	Defaults to zero if not present in radiograph, portal and DRR images
Table Top Eccentric Axis Distance	300A,0124	DS	3	Defaults to zero if not present in radiograph, portal and DRR images
Table Top Eccentric Angle	300A,0125	DS	3	Defaults to zero if not present in radiograph, portal and DRR images
SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.481.1
SOP Instance UID	0008,0018	UI	1	
Instance Creation Date	0008,0012	DA	3	
Instance Creation Time	0008,0013	TM	3	
VOI LUT				
Window Center	0028,1050	DS	1C	
Window Width	0028,1051	DS	1C	
Modality LUT				
Rescale Intercept	0028,1052	DS	1C	Defaults to zero if not present
Rescale Slope	0028,1053	DS	1C	Defaults to one if not present

8.1.2.6. RT Structure Set IOD

Table 8-24. RT Structure Set IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	RT Series	Yes
Frame of Reference	Frame of Reference	No
Equipment	General Equipment	Yes
Structure Set	Structure Set	Yes
	ROI Contour	Yes
	RT ROI Observations	Yes
	Approval	Yes
	SOP Common	Yes

Table 8-25. RT Structure Set IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
RT Series Module				
Modality	0008,0060	CS	1	Supported Value: RTSTRUCT

Series Instance UID	0020,000E	UI	1	
General Equipment Module				
Manufacturer	0008,0070	LO	2	Used to handle ROI Physical Properties from TomoTherapy Hi-Art and Nucletron during import
Structure Set Module				
Structure Set Label	3006,0002	SH	1	
Structure Set Date	3006,0008	DA	2	
Structure Set Time	3006,0009	TM	2	
Referenced Frame of Reference Sequence	3006,0010	SQ	3	May contain one or more items. A single referenced examination must exist. Contours on unknown examinations are ignored
>Frame of Reference UID	0020,0052	UI	1	Used to match referenced image set
>RT Referenced Study Sequence	3006,0012	SQ	3	Must contain exactly one referenced study
>>Referenced SOP Class UID	0008,1150	UI	1	
>>Referenced SOP Instance UID	0008,1155	UI	1	
>RT Referenced Series Sequence	3006,0014	SQ	1	Must contain exactly one referenced series
>>Series Instance UID	0020,000E	UI	1	
>Contour Image Sequence	3006,0016	SQ	1	
>>Referenced SOP Class UID	0008,1150	UI	1	
>>Referenced SOP Instance UID	0008,1155	UI	1	Referenced image has to be imported into RayCare PACS
Structure Set ROI Sequence	3006,0020	SQ	3	Number of elements must match number of elements in ROI Contour Sequence (3006,0039). At least one sequence must be defined
>ROI Number	3006,0022	IS	1	Stored but only used internally.
>Referenced Frame of Reference UID	3006,0024	UI	1	
>ROI Name	3006,0026	LO	2	ROI:s are shared internally between multiple structure sets. If a ROI with the same name is already contoured on the referenced examination these contours will be skipped
ROI Contour Module				
ROI Contour Sequence	3006,0039	SQ	1	
>Referenced ROI Number	3006,0084	IS	1	
>ROI Display Color	3006,002A	IS	3	Used for visualization
>Contour Sequence	3006,0040	SQ		
>>Attached Contours	3006,0049	IS	3	

>>Contour Image Sequence	3006,0016	SQ	3	
>>>Referenced SOP Class UID	0008,1150	UI	1	
>>>Referenced SOP Instance UID	0008,1155	UI	1	Must be found in the referenced Examination
>>Contour Geometric Type	3006,0042	CS	1	Supported values: CLOSED_PLANAR, POINT
>>Number of Contour Points	3006,0046	IS	1	
>>Contour Data	3006,0050	DS	1	Converted to internal contour representation. All contour vertices must be located on the same slice
RT ROI Observations Module				
RT ROI Observations Sequence	3006,0080	SQ	1	
>Observation Number	3006,0082	IS	1	
>Referenced ROI Number	3006,0084	IS	1	
>RT ROI Interpreted Type	3006,00A4	CS	**2**	Stored but only used internally.
Approval Module				
Approval Status	300E,0002	CS	1	
Review Date	300E,0004	DA	2C	
Review Time	300E,0005	TM	2C	
Reviewer Name	300E,0008	PN	2C	
SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.481.3
SOP Instance UID	0008,0018	UI	1	

8.1.2.7. Spatial Registration IOD

Table 8-26. Spatial Registration IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	General Series	Yes
	Spatial Registration Series	Yes
Frame of Reference	Frame of Reference	Yes
Equipment	General Equipment	No
Spatial Registration	Spatial Registration	Yes
	SOP Common	Yes
	Common Instance Reference	No

Table 8-27. Spatial Registration IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
General Series Module				
Modality	0008,0060	CS	1	Supported Value: REG
Series Instance UID	0020,000E	UI	1	
Series Number	0020,0011	IS	2	
Series Date	0008,0021	DA	3	
Series Time	0008,0031	TM	3	
Series Description	0008,103E	LO	3	
Spatial Registration Series Module				
Modality	0008,0060	CS	1	Supported Value: REG
Frame of Reference Module				
Frame of Reference UID	0020,0052	UI	1	Used to match referenced image set
Spatial Registration Module				
Instance Number	0020,0013	IS	1	
Content Description	0070,0081	LO	2	Used to display description about registration in the user interface
Registration Sequence	0070,0308	SQ	1	
>Frame of Reference UID	0020,0052	UI	1C	Used to match referenced image sets
>Referenced Image Sequence	0008,1140	SQ	1C	
>>Referenced SOP Class UID	008,1150	UI	1	
>>Referenced SOP Instance UID	0008,1155	UI	1	
>Matrix Registration Sequence	0070,0309	SQ	1	
>>Matrix Sequence	0070,030A	SQ	1	
>>>Frame of Reference Transformation Matrix	3006,00C6	DS	1	
>>>Frame of Reference Transformation Matrix Type	0070,030C	CS	1	Supported value: RIGID
>>Frame Of Reference Transformation Comment	3006,00C8	LO	3	Used to display description about the transformation matrix in the user interface (only for the non-identity matrix)
SOP Common Module				

SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.66.1
SOP Instance UID	0008,0018	UI	1	

8.1.2.8. Secondary Capture Image IOD

Table 8-28. SC Image IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	General Series	Yes
Equipment	SC Equipment	Yes
Image	General Image	No
	Image Pixel	Yes
	SC Image	No
	SOP Common	Yes

Table 8-29. SC Image IOD attributes required for viewing

Attribute Name	Tag	VR	Type	Comment
Patient Module				
Patient's Name	0010,0010	PN	2	
Patient ID	0010,0020	LO	2	
General Study Module				
Study Instance UID	0020,000D	UI	1	
General Series Module				
Modality	0008,0060	CS	1	
Series Instance UID	0020,000E	UI	1	
Series Date	0008,0021	DA	3	
Series Description	0008,103E	LO	3	
SC Equipment Module				
Image Pixel Module				
Samples per Pixel	0028,0002	US	1	Supported value: 1, 3
Photometric Interpretation	0028,0004	CS	1	Supported value: If samples per pixel is 1: Monochrome2. If samples per pixel is 3: RGB
Rows	0028,0010	US	1	
Columns	0028,0011	US	1	
Bits Allocated	0028,0100	US	1	Supported values: If samples per pixel is 1: 16, If samples per pixel is 3: 8
Bits Stored	0028,0101	US	1	Supported value: If samples per pixel is 1: 12, 13, 14, 15, 16. If samples per pixel is 3: 8
High Bit	0028,0102	US	1	Supported value: Bits stored minus 1.
Pixel Representation	0028,0103	US	1	Supported value: 0, 1
Pixel Data	7FE0,0010	OB or OW	1C	

SOP Common Module				
SOP Class UID	0008,0016	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	0008,0018	UI	1	
Instance Creation Date	0008,0012	DA	3	
Instance Creation Time	0008,0013	TM	3	

8.1.2.9. Key Object Selection Document IOD

Table 8-30. Key Object Selection Document IOD Modules

IE	**Module**	**Used**
Patient	Patient	Yes
Study	General Study	Yes
Series	Key Object Document Series	Yes
Equipment	General Equipment	Yes
Document	Key Object Document	Yes
	SR Document Content	Yes
	SOP Common	Yes

Table 8-31. Key Object Selection Document IOD for viewing

Attribute Name	**Tag**	**VR**	**Comment**
Patient Module			
Patient's Name	0010,0010	PN	
Patient ID	0010,0020	LO	
Patient's Birth Date	0010,0030	DA	
Patient's Sex	0010,0040	CS	
General Study Module			
Study Instance UID	0020,000D	UI	
Study Date	0008,0020	DA	
Study Time	0008,0030	TM	
Referring Physician's Name	0008,0090	PN	
Study ID	0020,0010	SH	
Accession Number	0008,0050	SH	
Key Object Document Series Module			
Modality	0008,0060	CS	Supported value: KO
Series Instance UID	0020,000E	UI	
Series Number	0020,0011	IS	
Series Date	0008,0021	DA	
Series Time	0008,0031	TM	
Series Description	0008,103E	LO	
Referenced Performed Procedure Step Sequence	0008,1111	SQ	

General Equipment Module			
Manufacturer	0008,0070	LO	
Manufacturer's Model Name	0008,1090	LO	
Software Version(s)	0018,1020	LO	
Key Object Document Module			
Instance Number	0020,0013	IS	
Content Date	0008,0023	DA	Used to show the date when image annotation was created
Content Time	0008,0033	TM	Used to show the time when image annotation was created
Current Requested Procedure Evidence Sequence	0040,A375	SQ	Only one study instance is supported in the evidence sequence
> Study Instance UID	0020,000D	UI	
> Referenced Series Sequence	0008,1115	SQ	
- Referenced Series Sequence Item 1	-	-	
>> Series Instance UID	0020,000E	UI	
>> Referenced SOP Sequence	0008,1199	SQ	
>> - Referenced SOP Sequence item 1-n			
>>> Referenced SOP Class UID	0008,1150	UI	
>>> Referenced SOP Instance UID	0008,1155	UI	
- Referenced Series Sequence Item 2 (optional)	-	-	
>> Series Instance UID	0020,000E	UI	
>> Referenced SOP Sequence	0008,1199	SQ	
>>> Referenced SOP Class UID	0008,1150	UI	
>>> Referenced SOP Instance UID	0008,1155	UI	
SR Document Content Module			
Value Type	0040,A040	CS	"CONTAINER"
Concept Name Code Sequence	0040,A043	SQ	
> Code Value	0008,0100	SH	Required to view image annotation
> Coding Scheme Designator	0008,0102	SH	
> Code Meaning	0008,0104	LO	Required to view image annotation
Continuity Of Content	0040,A050	CS	"SEPARATE"

Content Template Sequence	0040,A504	SQ	
> Mapping Resource	0008,0105	CS	"DCMR"
> Template Identifier	0040,DB00	CS	"2010"
Content Sequence	0040,A730	SQ	
- Content 1	-	-	-
> Relationship Type	0040,A010	CS	"CONTAINS"
> Value Type	0040,A040	CS	"TEXT"
> Text Value	0040,A160	UT	Used to show description of image annotation (optional)
> Concept Name Code Sequence	0040,A043	SQ	
>> Code Value	0008,0100	SH	"113012"
>> Coding Scheme Designator	0008,0102	SH	"DCM"
>> Code Meaning	0008,0103	LO	"Key Object Description"
- Content 2	-	-	-
> Relationship Type	0040,A010	CS	"HAS OBS CONTEXT"
> Value Type	0040,A040	CS	"PNAME"
> Person Name	0040,A123	PN	Used to show observation user of image annotation (optional)
> Concept Name Code Sequence	0040,A043	SQ	
>> Code Value	0008,0100	SH	"121008"
>> Coding Scheme Designator	0008,0102	SH	"DCM"
>> Code Meaning	0008,0103	LO	"Person Observer Name"
- Content 3-n	-	-	Used to get key slices from referenced image sequence
> Relationship Type	0040,A010	CS	"CONTAINS"
> Value Type	0040,A040	CS	"IMAGE"
> Referenced SOP Sequence	0008,1199	SQ	
>> Referenced SOP Class UID	0008,1150	UI	
>> Referenced SOP Instance UID	0008,1155	UI	
>> Referenced SOP Sequence	0008,1199	SQ	If reference exists the same reference requires to exist in the Current Requested Procedure Evidence Sequence (0040, A375) in Key Object Document Module
>>> Referenced SOP Class UID	0008,1150	UI	
>>> Referenced SOP Instance UID	0008,1155	UI	
SOP Common Module			
SOP Class UID	0008,0016	UI	"1.2.840.10008.5.1.4.1.1.88.59"
SOP Instance UID	0008,0018	UI	

Specific Character Set	0008,0005	CS	

8.1.2.10. Grayscale Softcopy Presentation State IOD

Table 8-32. Grayscale Presentation State IOD Modules

IE	Module	Used
Patient	Patient	Yes
Study	General Study	Yes
Series	General Series	Yes
Series	Presentation Series	Yes
Equipment	General Equipment	Yes
Presentation State	Presentation State Identification	Yes
	Presentation State Relationship	Yes
	Presentation State Shutter	No
	Presentation State Mask	No
	Mask	No
	Display Shutter	No
	Bitmap Display Shutter	No
	Overlay Plane	No
	Overlay Activation	No
	Displayed Area	Yes
	Graphic Annotation	Yes
	Spatial Transformation	No
	Modality LUT	No
	Softcopy VOI LUT	No
	Softcopy Presentation LUT	Yes
	SOP Common	Yes

Attribute Name	Tag	VR	Value
Patient Module			
Patient's Name	0010,0010	PN	
Patient ID	0010,0020	LO	
Patient's Birth Date	0010,0030	DA	
Patient's Sex	0010,0040	CS	
General Study Module			
Study Instance UID	0020,000D	UI	
Study Date	0008,0020	DA	
Study Time	0008,0030	TM	
Referring Physician's Name	0008,0090	PN	
Study ID	0020,0010	SH	
Accession Number	0008,0050	SH	
General Series Module			
Modality	0008,0060	CS	Supported value: PR
Series Instance UID	0020,000E	UI	

Series Date	0008,0021	DA	
Series Time	0008,0031	TM	
Series Description	0008,103E	LO	
Presentation Series Module			
Modality	0008,0060	CS	Supported value: PR
General Equipment Module			
Manufacturer	0008,0070	LO	
Manufacturer's Model Name	0008,1090	LO	
Software Version(s)	0018,1020	LO	
Presentation State Identification Module			
Presentation Creation Date	0070,0082	DA	
Presentation Creation Time	0070,0083	TM	
Instance Number	0020,0013	IS	
Content Label	0070,0080	CS	
Content Description	0070,0081	LO	
Content Creator's Name	0070,0084	PN	
Presentation State Relationship Module			
Referenced Series Sequence	0008,1115	SQ	
> Series Instance UID	0020,000E	UI	
> Referenced Image Sequence	0008,1140	SQ	
>> Referenced SOP Class UID	0008,1150	UI	
>> Referenced SOP Instance UID	0008,1155	UI	
>> Referenced Frame Number	0008,1160	IS	
Presentation State Shutter Module (not used)			
Presentation State Mask Module (not used)			
Displayed Area Module			
Displayed Area Selection Sequence	0070,005A	SQ	
> Display Area Top Left Hand Corner	0070,0052	SL	[1,1]
> Display Area Bottom Right Hand Corner	0070,0053	SL	Bottom Right Hand Corner of image, for example: [512,512]
> Presentation Size Mode	0070,0100	CS	Supported value: SCALE TO FIT
> Presentation Pixel Aspect Ratio	0070,0102	IS	Should match the pixel aspect ratio of the referenced image
Graphic Annotation Module			
Graphic Annotation Sequence	0070,0001	SQ	An item for every image that is annotated

- Graphic Annotation Sequence Item 0-n			
> Referenced Image Sequence	0008,1140	SQ	
>> Referenced SOP Class UID	0008,1150	UI	
>> Referenced SOP Instance UID	0008,1155	UI	
>> Referenced Frame Number	0008,1160	IS	
> Graphic Layer	0070,0002	CS	
> Graphic Object Sequence	0070,0009	SQ	An item for every ellipse, rectangle and measurement line annotation
>- Graphic Object Sequence Item	0070,0009	-	
>> Graphic Annotation Units	0070,0005	CS	Supported value: PIXEL
>> Graphic Dimensions	0070,0020	US	Supported value: 2
>> Number of Graphic Points	0070,0021	US	Supported value: 2 (measurement lines), 4 (ellipses) or 5 (rectangles)
>> Graphic Data	0070,0022	FL	Required for data points of the annotation
>> Graphic Type	0070,0023	CS	Supported value: POLYLINE or ELLIPSE
>> Graphic Filled	0070,0024	CS	Supported value: N
> Text Object Sequence	0070,0008	SQ	An item for every arrow annotation
>- Text Object Sequence Item	0070,0008	-	
>> Bounding Box Annotation Units	0070,0003	CS	Supported value: PIXEL
>> Anchor Point Annotation Units	0070,0004	CS	Supported value: PIXEL
>> Unformatted Text Value	0070,0006	ST	Supported value: white space
>> Bounding Box Top Left Hand Corner	0070,0010	FL	Required for data points of the annotation
>> Bounding Box Bottom Right Hand Corner	0070,0011	FL	Required for data points of the annotation
>> Bounding Box Text Horizontal Justification	0070,0012	CS	Supported value: LEFT
>> Anchor Point	0070,0014	FL	Required for data points of the annotation

>> Anchor Point Visibility	0070,0015	CS	Supported value: Y
Graphic Layer Module			
Graphic Layer Sequence	0070,0060	SQ	
> Graphic Layer	0070,0002	CS	
> Graphic Layer Order	0070,0062	IS	
Softcopy Presentation LUT Module			
Presentation LUT Shape	2050,0020	CS	"IDENTITY"
SOP Common Module			
SOP Class UID	0008,0016	UI	
SOP Instance UID	0008,0018	UI	

8.1.3. Attribute mapping

Not applicable

8.1.4. Coerced/Modified Fields

The following attributes will be updated when the IOD is linked with a RayCare patient. The IOD attributes will only be updated when the respective RayCare patient attributes are different from the ones in the original SOP instance.

Table 8-33. Coerced attributes when linked to a RayCare Patient with different patient identification

Attribute Name	Tag	VR	VM	Comment
Patient's Name	0010,0010	PN	1	The RayCare Patient's Name will be stored as follows: "LastName^FirstName^MiddleName^^"
Patient ID	0010,0020	LO	1	
Patient's Birth Date	0010,0030	DA	1	
Patient's Sex	0010,0040	CS	1	

The following attributes will be made empty or removed from the IOD when it is linked to a RayCare patient and when the attributes in the table above are coerced.

Table 8-34. Attributes removed or made empty on export when linked to a RayCare Patient

Attribute Name	Tag	Comment
Referenced Patient Sequence	0008,1120	Will be removed on export
Issuer Of Patient ID	0010,0021	Will be removed on export
Issuer of Patient ID Qualifiers Sequence	0010,0024	Will be removed on export
Source Patient Group Identification Sequence	0010,0026	Will be removed on export
Group of Patients Identification Sequence	0010,0027	Will be removed on export
Patient's Birth Time	0010,0032	Will be made empty on export
Patient's Birth Date in Alternative Calendar	0010,0033	Will be removed on export
Patient's Death Date in Alternative Calendar	0010,0034	Will be removed on export

Patient's Alternative Calendar	0010,0035	Will be removed on export
Patient's Insurance Plan Code Sequence	0010,0050	Will be removed on export
Patient's Primary Language Code Sequence	0010,0101	Will be removed on export
Strain Description	0010,0212	Will be removed on export
Strain Nomenclature	0010,0213	Will be removed on export
Strain Stock Sequence	0010,0216	Will be removed on export
Strain Additional Information	0010,0218	Will be removed on export
Strain Code Sequence	0010,0219	Will be removed on export
Other Patient IDs	0010,1000	Will be removed on export
Other Patient Names	0010,1001	Will be removed on export
Other Patient IDs Sequence	0010,1002	Will be removed on export
Patient's Birth Name	0010,1005	Will be removed on export
Patient's Age	0010,1010	Will be removed on export
Patient's Size Code Sequence	0010,1021	Will be removed on export
Patient's Address	0010,1040	Will be removed on export
Patient's Mother's Birth Name	0010,1060	Will be removed on export
Military Rank	0010,1080	Will be removed on export
Branch Of Service	0010,1081	Will be removed on export
Medical Record Locator	0010,1090	Will be removed on export
Referenced Patient Photo Sequence	0010,1100	Will be removed on export
Country of Residence	0010,2150	Will be removed on export
Region of Residence	0010,2152	Will be removed on export
Patient's Telephone Numbers	0010,2154	Will be removed on export
Ethnic Group	0010,2160	Will be removed on export
Occupation	0010,2180	Will be removed on export
Patient's Religious Preference	0010,21F0	Will be removed on export
Patient Species Description	0010,2201	Will be removed on export
Patient Species Code Sequence	0010,2202	Will be removed on export
Patient Breed Description	0010,2292	Will be removed on export
Patient Breed Code Sequence	0010,2293	Will be removed on export
Breed Registration Sequence	0010,2294	Will be removed on export
Responsible Person	0010,2297	Will be removed on export
Responsible Person Role	0010,2298	Will be removed on export
Responsible Organization	0010,2299	Will be removed on export
Patient Comments	0010,4000	Will be made empty on export
Patient Identity Removed	0012,0062	Will be removed on export
De-identification Method	0012,0063	Will be removed on export
De-identification Method Code Sequence	0012,0064	Will be removed on export
Confidentiality Constraint On Patient Data Description	0040,3001	Will be made empty on export

The original values of coerced and removed attributes will be stored in a sequence that will be added to the SOP Common Module of the IOD.

Table 8-35. Original Attribute Sequence Attributes added when IOD contents are coerced/modified

Attribute Name	Tag	VR	VM	Comment
Original Attributes Sequence	0400,0561	SQ	1	
>Modified Attributes Sequence	0400,0550	SQ	1	This sequence will contain all the coerced or removed attributes with the original values
>Attribute Modification DateTime	0400,0562	DT	1	Date and time of modification
>Modifying System	0400,0563	LO	1	RayCare
>Source of Previous Values	0400,0564	LO	1	Will be empty
>Reason for the Attribute Modification	0400,0565	CS	1	COERCE

8.2. Data dictionary of private attributes

RayCare PACS reserves private attribute values in group 4011. The private attributes added to stored SOP instances are listed in the following table:

Table 8-36. Overview of private attributes

Attribute Name	Tag	VR	VM	Attribute Description
RaySearch Private Creator	4011,0010	LO	1	RAYSEARCHLABS 2.0
RayCare Category	4011,1002	CS	1-n	
RayCare Custom Label	4011,1003	CS	1-n	Note: Will be added to exported SOP instances when a user has assigned one or more custom labels.
RayCare Encapsulated Source	4011,1004	OB	1	
RayCare MIME Type of Encapsulated Source	4011,1005	LO	1	
RayCare File Name of Encapsulated Source	4011,1006	LO	1	
RayCare Import DateTime	4011,1007	DT	1	
RayCare Import AE Title	4011,1008	AE	1	
RayCare Import UserName	4011,1009	LO	1	

8.3. Preconditions for 2D/2D match

2D/2D fusion of RT Image pairs is performed using a Spatial Registration between the Frames of Reference of the primary and the secondary images.
(2D/2D fusion between RT Images in the same Frame of Reference is not supported.)
Besides adhering to chapter *RT Image IOD*, the following conditions must be met for 2D/2D fusion to be possible:

- For the primary image in the pair, the tag (0008,0008) Image Type must be equal to DERIVED\SECONDARY\DRR.
- For the secondary image in the pair, the tag (0008,0008) Image Type must be equal to ORIGINAL\PRIMARY\PORTAL.
- For the secondary image in the pair, the tag (0008,0070) Manufacturer must be equal to Varian Medical Systems

The following conditions must be met for both the primary and the secondary images in the pair:

- (3002,0026) RT Image SID shall be greater than or equal to SAD.
- (For DRR images, if SID is not present, it is assumed that SID equals SAD)
- (300A,0140) Table Top Pitch angle shall be less than or equal to 3.0 degrees, if present.
- (300A,0144) Table Top Roll Angle shall be less than or equal to 3.0 degrees, if present.
- (300A,014A) Gantry Pitch Angle shall be less than or equal to 3.0 degrees, if present.

The following parameters shall have the same value in the primary and secondary image in the pair:

- (300C,0006) Referenced Beam Number
- (300A,011E) Gantry Angle (tolerance 3.0 degrees)
- (0018,1150) Patient Position
- (3002,0022) Radiation Machine SAD (tolerance 10 mm)
- (300A,0122) Patient Support Angle (tolerance 3.0 degrees)

8.4. Preconditions for 2D/3D match

2D/3D fusion of a primary RT Image and secondary volumetric Image is performed using a Spatial Registration between the Frames of Reference of the primary and the secondary images.

2D/3D fusion is only supported for primary images originating from Varian Medical Systems and medPhoton.

Besides the primary image of the fusion pair adhering to chapter *RT Image IOD*, the following conditions must be met for 2D/3D fusion to be possible:

- For 2D/3D fusion of image pairs including a primary image originating from Varian Medical Systems, the following conditions must be met
    - For the primary image in the pair, the tag (0008,0070) Manufacturer must be equal to Varian Medical Systems
    - For the primary image in the pair, Modality Specific Characteristics of the tag (0008,0008) Image Type must be equal to PORTAL
    - For the secondary image in the pair, the tag (0008, 0060) Modality must be equal to CT

- For fusion of 2D/3D image pairs including a primary image originating from medPhoton, the following conditions must be met
    - For the primary image in the pair, the tag (0008,0070) Manufacturer must be equal to medPhoton
    - For the primary image in the pair, the tag (0008,1090) Manufacturer's Model Name must be equal to Imaging Ring

- For all supported images:
    - For the primary image in the pair, the value of tag (3002,0026) RT Image SID shall be greater than or equal to the value of tag (3002,0022) Radiation Machine SAD.

CONTACT INFORMATION

RaySearch Laboratories AB (publ)
Eugeniavägen 18C
SE-113 68 Stockholm
Sweden

Contact details head office
P.O. Box 45169
SE-104 30 Stockholm, Sweden
Phone: +46 8 510 530 00
Fax: +46 8 510 530 30
info@raysearchlabs.com
www.raysearchlabs.com

RaySearch Americas
Phone: +1 347 477 1935

RaySearch China
Phone: +86 137 0111 5932

RaySearch India
E-mail: manish.jaiswal@raysearchlabs.com

RaySearch Singapore
Phone: +65 8181 6082

RaySearch Australia
Phone: +61 411 534 316

RaySearch France
Phone: +33 (0)1 76 53 72 02

RaySearch Japan
Phone: +81 (0)3 44 05 69 02

RaySearch UK
Phone: +44 (0)2039 076791

RaySearch Belgium
Phone: +32 475 36 80 07

RaySearch Germany
Phone: +49 (0)172 7660837

RaySearch Korea
Phone: +82 01 9492 6432

RaySearch Laboratories