GE Healthcare

Technical Publications

DIRECTION 5357330-1EN

Revision 2

Xeleris™ 3.0 and Xeleris™ 3.1 Conformance Statement for DICOM V3.0

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LIST OF REVISIONS

REV	DATE	DESCRIPTION	PAGES
1	August 2010	Initial Release for Xeleris 3	All
2	February 2013	Xeleris 3.1 release: • Conformance statement overview • Communication protocols updates • Xeleris Private Multi-Gated Acquisition Module, Table 3-32 • Xeleris Private Data Dictionary, Table A-2	 Preface Chapter 2, Section 2.4 Chapter 3, Section 3.5.8.11 Appendix A

CONFORMANCE STATEMENT OVERVIEW

Important: Throughout this document, Xeleris 3.x refers to the following products:

- Xeleris 3.0
- Xeleris 3.1

The Xeleris 3.x DICOM implementation allows the user to send images, curves and reports, acquired through a front-end acquisition system, created by Xeleris processing functionality, or received from any other DICOM compliant system, to another DICOM station.

Xeleris 3.x DICOM implementation supports storage commitment for the already transferred data. This guarantees the user that acquired image data, as well as processing results are safely archived for future use.

Xeleris 3.x is capable of receiving DICOM objects from another DICOM compliant station.

Xeleris also allows query and retrieve of data stored in its local database from a remote station and can query and retrieve images stored in a remote DICOM station.

The Xeleris 3.x DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the Xeleris DICOM Server. Also provided is a mechanism by which a Xeleris user can verify application-level communication with a remote DICOM AE.

The DICOM Print Services for Xeleris 3.x are defined in a separate document published by **Cedara Inc**. The Cedara document "*Conformance Statement for Cedara Hardcopy Server as DICOM Print Management SCU*" has been attached to the end of this document with permission (Appendix B).

The DICOM Media Services for Xeleris 3.x are defined in a separate document published by **CDP Ltd**. The CDP document "*CD Printer 5.6.3 DICOM Conformance Statement*" has been attached to the end of this document with permission (Appendix C).

Table 1 provides an overview of the network services supported by Xeleris 3.x.

Table 1. Network Services

SOP Classes	User of Service	Provider of Service (SCP)
Transfer		
CT Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes

Table 1. Network Services

SOP Classes	User of Service	Provider of Service (SCP)
Enhanced SR	Yes	Yes
Positron Emission Tomography Image Storage	Yes	Yes
Standalone Curve Storage	Yes	Yes
Xeleris Private SOP Class Storage	No	Yes
Query/Retrieve		
Patient Root Query/Retrieve Infomration Model - FIND	No	Yes
Patient Root Query/Retrieve Infomration Model - MOVE	No	Yes
Study Root Query/Retrieve Infomration Model - FIND	Yes	Yes
Study Root Query/Retrieve Infomration Model - MOVE	Yes	Yes
Print Management		
Basic Grayscale Print Management Meta SOP Class	Yes	No
Basic Color Print Management Meta SOP Class	Yes	No
Workflow Management		
Storage Commitment Push Model SOP Class	Yes	No

Table 2 provides an overview of the Media Storage Application Profiles supported by Xeleris 3.x.

Table 2. Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk - Recordable		
General Purpose CD - R	Option	No
DVD		
General Purpose DVD - JPEG	Option	No

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SECTION 1
INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections and Appendices as described below:

Section 1- Introduction, which describes the overall structure, intent, and references for this Conformance Statement

Section 2 - Network Conformance Statement, which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

Section 3 - Nuclear Medicine Information Object Implementation, which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a Nuclear Medicine Information Object.

Section 4 - Patient Root Query/Retrieve Information Model, which specifies the information model used for the implementation of the Patient Root Query/Retrieve Information Model.

Section 5 - Study Root Query/Retrieve Information Model, which specifies the information model used for the implementation of the Study Root Query/Retrieve Information Model.

Section 6 - Secondary Capture Information Object Implementation, which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Model and Multi-Frame Secondary Capture Information Model.

Section 7 - Independent Curve Information Object Implementation, which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a Independent Curve Information Model. Note nevertheless DICOM Standard Curve SOP Class have been retired, Xeleris 3.x is still able to generate objects of this SOP Class.

Section 8 - Xeleris Storage Commitment PUSH Model Implemetation, which is used both for N-action storage commitment requests by the SCU and N-EVENT-REPORT storage commitment notificiations by the SCP.

Appendix A - Xeleris Private Data Dictionary

Appendix B - Cedara Hardcopy Server as DICOM Print Management SCU Conformance Statement

Appendix C - CD Printer 5.6.3 DICOM Conformance Statement

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in Illustration 1-1 on next page.

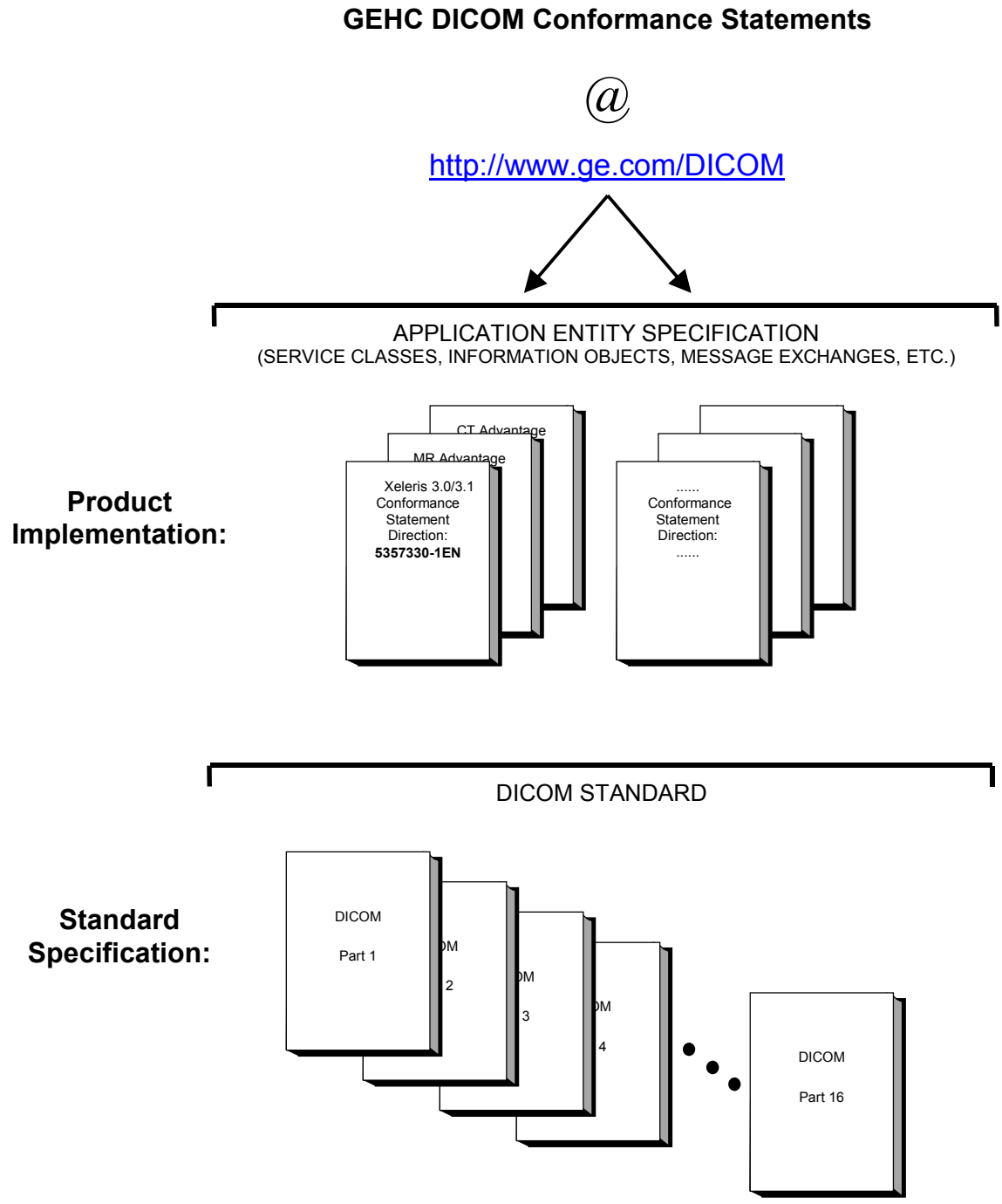

Illustration 1-1. Documentation Structure

This document specifies the DICOM v3.0 implementation. It is titled:

Xeleris 3.0 and Xeleris 3.1
Conformance Statement for DICOM
Direction 5357330-1EN

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required interoperating with the GEHC network interface.
The GEHC Conformance Statement, contained in this document, also specifies the Lower Layer communications, which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard. For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1752
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts, which are used in that Standard.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions, which define all data elements, used by this GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements, which are sent by GEHC devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful**. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the user should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.
  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices, which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements**. The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failures to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

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

1.7 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 end point 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 – 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).

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).

Module – a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

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 (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 (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.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
AET	Application Entity Title
CD-R	Compact Disk Recordable
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MFSC	Multi-Frame Secondary Capture
MPEG	Moving Picture Experts Group
MPPS	Modality Performed Procedure Step

MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MWL	Modality Worklist
NM	Nuclear Medicine
NTP	Network Time Protocol
O	Optional (Key Attribute)
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
R	Required (Key Attribute)
RIS	Radiology Information System
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
VR	Value Representation

SECTION 2
NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant **Networking** features on this GEHC product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

Xeleris systems provide sophisticated image processing and storage functions on nuclear image data acquired through the front end acquisition system. In view of the requirements to conform to a global standard that permits interoperability across equipment produced by different vendors, Xeleris system will provide support for DICOM 3.0.

This section details the roles and DICOM Service Classes supported by the Xeleris version 3.x.

The Xeleris DICOM implementation allows the user to send images, curves and reports, acquired through a front-end acquisition system, created by Xeleris processing functionality, or received from any other DICOM compliant system, to another DICOM station. In this situation Xeleris is providing the DICOM C-STORE service as a service class user (SCU).

Xeleris is capable of receiving DICOM objects from another DICOM compliant station. In this situation Xeleris provides the DICOM C-STORE service as a service class provider (SCP).

Xeleris also allows query and retrieve of data stored in its local database from a remote station and can query and retrieve images stored in a remote DICOM station. In this situation Xeleris is providing the DICOM C-FIND and C-MOVE services as a service class provider (SCP) and that of a DICOM C-FIND and C-MOVE service class user (SCU).

Xeleris DICOM implementation supports storage commitment for the already transferred data. This guarantees the user that acquired image data, as well as processing results are safely archived for future use. In this situation Xeleris provides the DICOM Storage Commitment Service as Service Class User (SCU).

The Xeleris DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the Xeleris DICOM Server. Also provided is a mechanism by which a Xeleris user can verify application-level communication with a remote DICOM AE. In these situations, Xeleris provides the DICOM C-ECHO service as both a SCP and SCU, respectively.

2.2 IMPLEMENTATION MODEL

All DICOM functionality on the Xeleris product is logically provided by the CPIPC_DICOM Server AE. The CPIPC_DICOM Server AE is commanded to perform DICOM services through the use of the Xeleris user interface. The CPIPC_DICOM Server AE also listens on a pre-defined port for incoming connections from remote DICOM AEs.

2.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in Illustration 2-1, below.

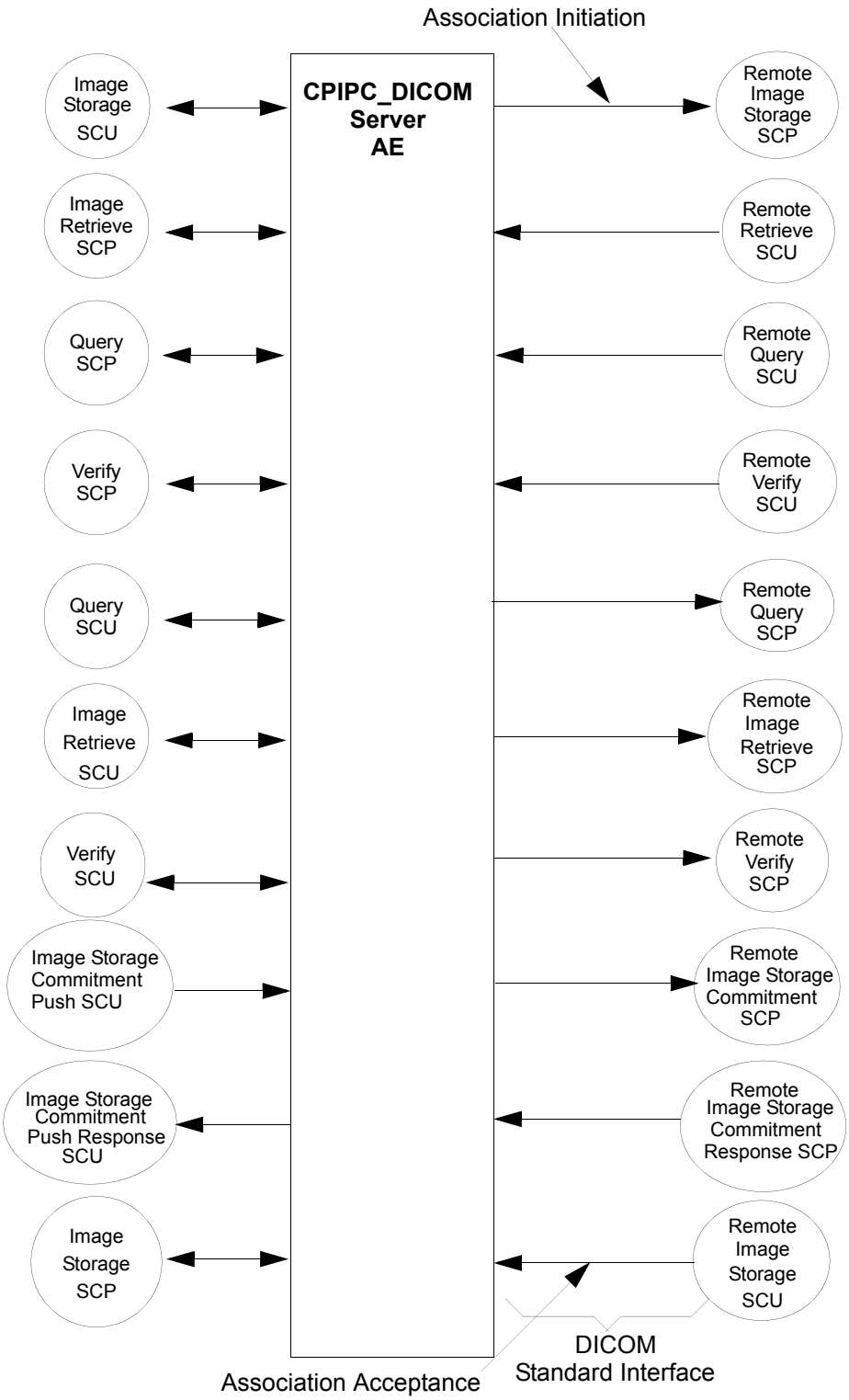

Illustration 2-1. Basic and Specific Application Models

2.2.2 Functional Definitions of Application Entities

The Xeleris CPIPC_DICOM Server Application Entity (AE) initiates the following functions:

- *Store*: Initiates a DICOM association in order to send images to a remote AE. If the remote AE accepts a presentation context applicable to the image(s) being sent, the CPIPC_DICOM Server will send the images via the C-STORE service.
- *Verify*: Initiates a DICOM association in order to send a verification message to a remote AE via a C-ECHO-RQ message.
- *Query*: Initiates a DICOM association in order to query images on a remote AE. If the remote AE accepts a presentation context applicable to the query request(s) being sent, the CPIPC_DICOM Server will receive appropriate query responses via the C-FIND service. Xeleris 3.x does not issue a C-FIND-CANCEL-RQ to terminate initiated query.
- *Retrieve* Initiates a DICOM association in order to fetch images from a remote AE. If the remote AE accepts a presentation context applicable to the retrieve request(s), the remote AE initiates a DICOM association for C-STORE-RQ to the CPIPC_DICOM Server AE. If this is acceptable to the CPIPC_DICOM Server AE, then, the image(s) is (are) sent to the CPIPC_DICOM Server AE. CPIPC_DICOM Server AE can terminate the retrieve by sending a C-CANCEL-MOVE-RQ message.
- *Storage commitment:* Initiates a DICOM association in order to request a storage commitment from a remote AE. If the remote AE supports storage commitment the CPIPC_DICOM Server will request a storage commitment for the image(s) previously sent successfully via the N-ACTION-RQ.

The Xeleris CPIPC_DICOM Server AE responds to the following functions:

- *Store*: Responds to incoming C-STORE -RQ messages by storing the incoming data stream onto the disk.
- *Query*: Responds to incoming C-FIND-RQ messages by searching its local database for the requested attributes and returning a C-FIND-RSP message containing a match and a status of “pending.” All other matches are also returned in C-FIND-RSP messages with status of “pending” until the last message which is returned with a status of “success.” The remote AE can terminate the query by sending a C-CANCEL-FIND-RQ message.
- *Retrieve*: Responds to incoming C-MOVE-RQ messages by searching its local database for the requested image(s) and returning each via a C-STORE-RQ message. The CPIPC_DICOM Server will return a C-MOVE -RSP message after each image is sent. The status returned is “pending” until the last image is sent, in which case the appropriate status is returned. The remote AE can terminate the retrieve by sending a C-CANCEL-MOVE-RQ message.
- *Verify*: Responds to incoming C-ECHO-RQ messages by returning a C-ECHO-RSP message with a status of “success.”
- Storage Commitment Response: Responds to incoming N-EVENT_REPORT messages arriving from Remote AE with the status of storage commitment for images previously requested by CPIPC_DICOM Server AE.

2.2.3 Sequencing of Real-World Activities

Xeleris Application Entity receives images acquired through a front-end acquisition station or performs query and retrieves images from PACS or another DICOM station; creates derived images using Xeleris processing functionality ; stores images and then requests Storage Commitment for previously stored images.

2.3 AE SPECIFICATIONS

2.3.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Verification - ECHO	1.2.840.10008.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Storage Commitment Push Model SOP Class UID	1.2.840.10008.1.20.1
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP Classes as an **SCP**:

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Xeleris Private SOP Class Storage	1.2.840.113619.4.27
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Verification - ECHO	1.2.840.10008.1.1
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22

Note Stand-alone Curve Storage has been retired in DICOM, but it is still supported by Xeleris 3.x.

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for an association initiated by the CPIPC_DICOM Server is:

Maximum Length PDU	128000 Bytes

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 13. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntaxes.

The user information Items sent by this product are:

- PDU Maximum length (PDU maximum length is 128000, and is not configurable)
- Implementation Version Name
- Implementation UID

2.3.1.1.2 Number of Associations

The CPIPC_DICOM AE (SCU) will initiate a single DICOM association to perform a store of all images from any selected Study or Series to a remote AE. Multiple Send/Query/Retrieve and Verify operations can not be performed. The Storage Commitment Request (SCU) initiates a new single association for all the images that were successfully stored on the remote AE. The Maximum Number of associations that the CPIPC_DICOM Server AE (SCU) can open in parallel is 4.

The CPIPC_DICOM Server AE (SCP) can have multiple DICOM associations open simultaneously to service verifications, as well as query, retrieve, store requests, and receiving N-Event-Report for Storage Commitment as SCU.. The Maximum Number of associations that the CPIPC_DICOM Server AE (SCP) can accept in parallel is 5.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

Xeleris Implementation Class UID	1.2.840.113619.6.281
Xeleris Implementation Version Name	Xeleris X3.xxxx

xxx is the official software release number.

2.3.1.2 Association Initiation Policy

The CPIPC_DICOM Server AE initiates a new association

- Due to an image send operation being initiated from the Xeleris user interface.
- Due to a Verify operation initiated to determine whether the remote DICOM station is operational.
- Due to image data being Queried from a Remote AE.
- Due to image data being Retrieved from a Remote AE.
- Due to a storage commitment request operation being initiated after successful image transfer.

When the CPIPC_DICOM Server AE initiates a new association for any Real-World activity, it will propose the Presentation Contexts for all Real-World activities.

2.3.1.2.1 Real-World Activity: Image Send

2.3.1.2.1.1 Associated Real-World Activity

The operator must select elements (study(ies)/ serie(s)/ image(s)/ curve(s)) to be transferred from the Patient Selector. Once these selections have been made, the operator selects any DICOM station as target to initiate image send job(s). DICOM station is added to the list of target repositories if “Send Images” flag is checked in the Remote DICOM Station definition.

All created jobs are registered in the Job Browser where job status is indicated. The status can be QUEUED, ACTIVE, COMPLETED, FAILED and CANCELED. Initial status of each job is QUEUED.

The CPIPC_DICOM Server AE will then initiate an association with the remote AE in order to perform send job. Status of Job becomes ACTIVE. The exception to this is that, if image send fails due to network problems, the current association is closed and another is opened to finish the current send (if possible) and sending the remaining elements.

If all elements selected for transfer of the ACTIVE send job are successfully transferred, job status is changed to COMPLETED.

If transfer of at least one of the selected elements of the ACTIVE job fails, job final status is set to FAILED. Reason of failure is displayed in Job Browser.

Operator may cancel send job(s) from the Job Browser. He selects job(s) and push “Cancel” button. Job final status becomes CANCELED.

2.3.1.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the CPIPC_DICOM Server AE after real-world activity “Image Send” has been initiated:

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name List	UID List		Negotiation
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Secondary Image Capture Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.100008.1.2 1.2.840.100008.1.2.1	SCU	None

Note Stand-alone Curve Storage SOP Class has been retired in DICOM, but it is still supported by Xeleris 3.x.

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

This implementation can perform multiple C-STORE operations over a single association. There is not any Time-outs defined in CPIPC_DICOM Server for C-STORE operation.

Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a status other than Successful, this implementation consider the request of the current images store to be a failure but will continue to attempt to send any remaining images in the same association.

Following are the status codes that are more specifically processed when receiving messages from **Storage** SCP equipment:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code	Related Fields
Failed	A700	Refused: Out of resources	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A710	Refused: Write to remote database failed	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A720	Refused: Remote DICOM Toolkit problems	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A730	Refused: Remote cannot understand received DICOM message	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A740	Refused: Cannot find Pixel data	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A750	Refused: Remote cannot store data on the archive device	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A760	Refused: Default destination for PET RAW data re-direction is not defiled on the Remote station	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A780	Refused: Sender is not defined on remote DICOM station	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	A900	Error: Data set does not match SOP Class	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	C000	Error: Cannot understand	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
Warning	B000	Coercion of Data Elements	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	B006	Elements Discarded	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
	B007	Data Set does not match SOP Class	Final image send job status is set to FAILED, appropriate reason message is displayed in the “Reason” column	None
Success	0000		Final image send job status is set to COMPLETED	None

Note The error codes A700-A770 are Xeleris Private Status Codes. Xeleris stations will return one of the above mentioned status codes (Refused and Error) in case of Image Send failure. DICOM PS3.4 provides the flexibility of returning private status codes. Xeleris uses them to provide more information to the Xeleris user in case of an Image Send failure.
If Non-Xeleris stations SCP return the same status code, Xeleris SCU will interpret them as per the table above. The non-Xeleris station's interpretation of the status code will not be considered.

2.3.1.2.2 Real-World Activity: Verify

2.3.1.2.2.1 Associated real-World Activity

Service personnel invoke the DICOM "Echo" from the Xeleris Configuration. The operator selects one of the remote DICOM stations from list and presses "Echo" Button. The user may also select any remote DICOM station as Source or Destination system in the Patient Selector user interface and choose "Check Status" entry from associated menu. The CPIPC_DICOM server will initiate an association with the remote DICOM AE in order to verify communication at the application level. The status of the verification process is displayed to the user.

2.3.1.2.2.2 Proposed Presentation Context Table

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

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The CPIPC_DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

2.3.1.2.3 Real-World Activity: Query

2.3.1.2.3.1 Associated Real-World Activity

Xeleris implements the query operation in 3 levels. The first level of query provides query results pertaining to the Patient and Study objects only. The second level of query provides results regarding the series for the given Study. The third level of query provides results regarding the images for the both given Study and Series.

The First Level Query operation is initiated by the selection of DICOM station from the pool of source repositories. DICOM station is added to pool of source repositories if "Query/Retrieve" flag is checked in the Remote DICOM Station definition dialog.

Before First Level Query, Verification of Remote station DICOM status is performed. If Verification returns "Online" status only, Query operation proceeds.

The operator can define Search Criteria for the First level Query, if "Filtered" flag is checked in the Remote DICOM Station definition.

If “Filtered” flag is checked and operator selects remote DICOM station as source repository “Filter Dialog” is opened. Operator may define search criteria by “Patient Name”, “Patient Id”, “Study ID”, “Study Description”, “Accession Number”, “Study Date” and “Modalities in Study” attributes or any combination of them. The operator must push “OK” button to initiate the Query operation.

If “Filtered” flag is not checked, the operator initiates Query operation without any search criteria by selection of the remote DICOM station as source repository. The CPIPC_DICOM Server will then initiate an association with remote AE in order to query remote AE for the given search parameters. The results of the Query operation are indicated in the Patient Selector of Xeleris.

The operator may press on the folder icon of any Study entry from the Patient selector to initiate Second Level Query Operation. The CPIPC_DICOM Server will then initiate an association with remote AE in order to query remote AE for the given Study UID as search criteria. The results of the Query operation are inserted as Series under the expanded Study in the Patient Selector.

The operator may press on the folder icon of any Series entry from the Patient selector to initiate Third Level Query Operation. The CPIPC_DICOM Server will then initiate an association with remote AE in order to query remote AE for the given Study UID and SeriesUID as search criteria. The results of the Query operation are inserted as Datasets under the expanded Series in the Patient Selector.

No additional search criteria rather then “Study UID” and “Series UID” is provided for the Second Level Query and the Third Level Query.

Note that once initiated the Query operation cannot be cancelled by the operator from Xeleris UI.

Xeleris makes use of the Study Root Query/Retrieve Model to initiate a Query operation. Details of this model are provided in Section 5 of this document. Note that for each level of query operation, a singe association is established.

2.3.1.2.3.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the CPIPC_DICOM Server AE after real-world activity “Image Query” has been initiated:

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

2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for all Query SOP Classes

This implementation can perform multiple C-FIND operations over a single association. There is not any Time-outs defined in CPIPC_DICOM Server for C-FIND operations.

Upon receiving a C-FIND confirmation containing a Successful status, this implementation will perform the next C-FIND operation. The association will be maintained if possible.

Upon receiving a C-FIND confirmation containing a Pending status, this implementation will wait for further C-FIND responses from the remote DICOM AE.

Upon receiving a C-FIND confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-FIND confirmation containing a status other than Successful, Pending or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining query requests with a different association.

Following are the status codes that are more specifically processed when receiving, messages from **Query** SCP equipment:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields
Failed	A700	Refused: Out of resources	No results are displayed in the Xeleris Patient Selector	None
	A900	Error: Identifier does not match SOP Class	No results are displayed in the Xeleris Patient Selector	None
	C000	Error: Unable to process	No results are displayed in the Xeleris Patient Selector	None
Success	0000	Matching is complete - No final identifier is supplied	Query results are displayed in the Xeleris Patient Selector	None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	- No Visible User Output -	None
	FF01	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier.	- No Visible User Output -	None

2.3.1.2.4 Real-World Activity: Retrieve

2.3.1.2.4.1 Associated Real-World Activity

The Xeleris operator initiates invocation of the Retrieve (Fetch) operation by the selection of one or more search results (Study/Series/Image results) on the Patient Selector UI of the remote DICOM station and then by selection the move destination. This mechanism assumes that the operator has preceded the Fetch with a Query operation. The Fetch job is registered in the Job Browser where job status is indicated. The status can be QUEUED, ACTIVE, COMPLETED, FAILED and CANCELED. Initial status of each job is QUEUED.

CPIPC_DICOM Server will then initiate an association with the remote AE in order to fetch DICOM images from the remote AE for the given Study/Series/Image selection. The status of operation becomes ACTIVE.

Xeleris makes use of the Study Root Query\Retrieve Model to initiate a Retrieve (Fetch) operation. Details of this model are provided in Section 5 of this document.

Note that multiple C-MOVE requests may be sent within one association established. There is not any Time-outs defined in CPIPC_DICOM Server for C-MOVE operations.

The final status of Retrieve job is stated according to the final status returned by Retrieve SCP.

Operator may cancel Retrieve job(s) from the Job Browser. He selects job(s) and pushes “Cancel” button.
Job final status becomes CANCELED.

2.3.1.2.4.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the CPIPC_DICOM Server AE after real-world activity “Image Retrieve” has been initiated:

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

2.3.1.2.4.2.1 SOP Specific DICOM Conformance Statement for all Retrieve SOP Classes

This implementation can perform multiple C-MOVE operations over a single association.

Upon receiving a C-MOVE confirmation containing a Successful status, this implementation will proceed with next C-MOVE request. When all C-MOVE requests are processed, the implementation will close the association.

Upon receiving a C-MOVE confirmation containing a Pending status, this implementation will wait for further C-MOVE responses from the remote DICOM AE.

Upon receiving a C-MOVE confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-MOVE confirmation containing a status other than Successful, Pending or Warning, this implementation will consider the current request to be a failure.

Following are the status codes that are more specifically processed when receiving messages from **Retrieve** SCP equipment:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields
Failed	A701	Refused: Out of resources - Unable to calculate number of matches	Retrieve Job is moved to FAILED state Failure Reason is displayed in the Job Browser	None
	A702	Refused: Out of resources - Unable to perform sub-operations	Retrieve Job is moved to FAILED state Failure Reason is displayed in the Job Browser	None
	A801	Refused: Move Destination Unknown	Retrieve Job is moved to FAILED state Failure Reason is displayed in the Job Browser	None
	A900	Error: Identifier does not match SOP Class	Retrieve Job is moved to FAILED state Failure Reason is displayed in the Job Browser	None
	C000	Error: Unable to process	Retrieve Job is moved to FAILED state Failure Reason is displayed in the Job Browser	None
Success	0000	Sub-operations Complete - No Failures.	Retrieve Job is moved to COMPLETED state	None
Cancel	FE00	Sub-operations terminated due to a Cancel indication	Retrieve Job is moved to CANCELLED state	None
Warning	B000	Sub-operations Complete - One or more Failures	- No Visible User Output -	None
Pending	FF00	Sub-operations are continuing	- No Visible User Output -	None

2.3.1.2.5 Real -world Activity: Storage Commitment Push Model

2.3.1.2.5.1 Associated Real-World Activity

The operator must both select image(s) to be transferred from the Patient Selector and select a destination by pressing the “Destination” button. The CPIPC_DICOM server will then initiate an association with the remote AE in order to send the selected image(s) and will accept interparty responses received from the remote AE. If the destination is configured as storage commitment capable or the destination is configured to use other storage commitment capable devices, the CPIPC_DICOM Server will initiate an association with the remote storage commitment capable AE in order to request a storage commitment for the successfully transferred image(s).

Note The storage commitment request it will always use a new association for requesting a commitment for the successfully transferred image(s). The storage commitment response will usually require the remote AE to initiate a new association with the CPIPC_DICOM.

The UI shows the status of the storage commitment request progress. The status can be either WAITING FOR COMMITMENT, SUCCESS, or FAILURE. The associated error messages due to a failure can be found in the system log.

2.3.1.2.5.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the CPIPC_DICOM Server AE after real-world

activity “Storage Commitment Request” has been initiated:

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Name	**UID**	**Name List**	**UID List**		**Negotiation**
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

2.3.1.2.5.2.1 SOP Specific DICOM Conformance Statement for Storage Commitment Push Model SOP Class SCU

The storage commitment request (N-ACTION) can perform a storage commitment request for multiple images over a single association. A new association is initiated for the storage commitment request for list of successfully transferred image(s) belonging to the same study. There is not any Time-outs defined in CPIPC_DICOM Server for Storage Commitment N-ACTION request.

Upon receiving a N-ACTION confirmation containing a “Successful” status, the next N_ACTION_RQ operation is performed for the new association.

Upon receiving a N-ACTION confirmation containing a “Failed” status, the association is terminated. The reason for termination is recorded in the system log file.

The CPIPC_DICOM Server AE uses DICOM network storage services to transfer SOP Instances which are to be committed. It does not support the optional Storage Media File-Set ID and UID Attributes in the Storage Commitment N-ACTION for transfer of SOP Instances by media for Storage Commitment.

The CPIPC_DICOM Server AE may request Storage Commitment for Instances of any of the Composite SOP Classes it supports as an SCU (see Section 2.3.1.2.1.2.1).

The Storage Commitment Information Object is described in Section 8.

The CPIPC_DICOM Server AE waits for a N-EVENT-REPORT during predefined time limit, which is configurable in user interface. Default value is 24 Hours. If N-EVENT_REPORT is not arrived during this period, storage commitment request status is changed to FAILURE and appropriate error message is logged.

Following are the status codes that are more specifically processed when receiving N-ACTION Response from remote AE.

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Codes	Related Fields
Failed	0210	Duplicate invocation: the Message ID (0000,0110) specified is allocated to another notification or operation.	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None

	0119	Class-instance conflict: the specified SOP Instance is not a member of the specified SOP Class	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	0115	Invalid argument value: the action information value specified was out of range or otherwise inappropriate	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	0117	Invalid SOP Instance: the SOP Instance UID specified implied a violation of the UID construction rules.	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	0212	Mistyped argument: one of the parameters supplied has not been agreed for use on the Association between the DIMSE-service users.	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	A114	No such action: the action type specified was not supported.	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	0118	No such SOP class: the SOP Class was not recognized.	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	0112	No such SOP Instance: the SOP Instance was not recognized	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
	0110	Processing failure: a general failure in processing the operation was encountered	Transfer Job is moved to FAILED state. Failure Reason is displayed in the Job Browser	None
Success	0000	Success: successful operation	Transfer Job is moved to WAITING FOR COMMITMENT state	

Upon receiving a N-ACTION confirmation containing a status other than the defined values, the current request is considered to be a failure and will terminate the association. The reason for termination is recorded in the system log file.

As part of the storage commitment implementation, Remote AE (SCP) will initiate an association to this implementation and will send an N-EVENT-REPORT. The attribute of the N-EVENT-REPORT message will include an indication on all images for which a commitment has succeeded and those for which it has failed.

The receipt of a N-EVENT-REPORT on an association that CPIPC_DICOM has initiated is not supported. The Remote AE (SCP) must initiate a new association in order to return the new N-EVENT-REPORT.

2.3.1.3 Association Acceptance Policy

Only those remote DICOM AE added to Xeleris DICOM configuration may connect to the CPIPC_DICOM Server AE. The maximum number of associations accepted in parallel is limited to 5.

The CPIPC_DICOM Server AE responds to image store operations from remote AE's. Any Remote AE can send data (CT/PT/MR/NM/SC/MFSC/ Structure Reports/Stand alone Curves) to Xeleris to be stored in the local Xeleris database.

Any remote AE can open an association to the DICOM Server AE for the purpose of application level communication verification.

The CPIPC_DICOM Server AE responds to query requests from remote AE's with matching responses. Any remote AE can also request the CPIPC_DICOM Server AE to retrieve image data from Xeleris, and to send this data to the remote AE.

As part of the storage commitment implementation, the CPIPC_DICOM Server responds to N-EVENT-REPORT received from remote AE.

2.3.1.3.1 Real-World Activity: Image Storage SCP

2.3.1.3.1.1 Associated Real-World Activity

The DICOM Server AE is always listening for associations. No operator action is required to respond to a Store request.

The real-world activity associated with the Store request is to store the image data in the local database and send a C-STORE -RSP message with the status of "success" for each image that can be stored in the local database. A C-STORE-RSP message with the status "failed" is sent for each image that cannot be stored in the local database.

2.3.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table - Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Xeleris Private SOP Class Storage	1.2.840.113619.4.27	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Secondary Image Capture Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Note

Xeleris supports Level 0 SCP storage for NM images, Stand-alone Curves, Secondary capture and Multi-frame Secondary Capture Storage SOP Classes
Xeleris supports Level 2 SCP storage for CT, PET, MR and Enhanced SR SOP Classes.
Stand-alone Curve Storage SOP Class has been retired in DICOM, but it is still supported by Xeleris 3.x.

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for the STORE SOP Class

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Store**:

Service Status	Status Codes	Further Meaning	Status Codes generated by C_STORE SCP	Related Fields
Failed	A700	Refused: Out of resources	Returned if the DICOM Server runs out of resources (e.g. memory); error logged.	None
	A710	Refused: Out of Resources	Returned if Dataset not written into the remote database; error logged.	None
	A720	Refused: Out of Resources	Returned if Internal error in the DICOM AE; error logged.	None
	A730	Refused: Out of Resources	Returned if DICOM AE failed to understand DICOM stream; error logged.	None
	A740	Refused: Out of Resources	Returned if DICOM AE failed to access pixel data in the DICOM stream; error logged.	None
	A900	Error: Dataset does not match SOP Class	Returned by DICOM Server if affected SOP Class is not supported by Xeleris, the Store operation failed; error logged.	None
	C000	Error: Cannot Understand	Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Store operation failed; error logged.	None
Warning	B000	Coercion of Data Elements	Warning! Dataset does not match SOP Class or Coercion of Data Elements	None
	B007	Data Set does not match SOP Class	Warning! Dataset does not match SOP Class or Coercion of Data Elements	None
	B006	Elements Discarded	Warning! Dataset does not match SOP Class or Coercion of Data Elements	None
Success	0000	Image store onto Xeleris is complete	Returned when the DICOM Server completes the store operation.	None

Note

The error codes A700-A740 are Xeleris Private Status Codes. Xeleris stations will return one of the above mentioned status codes (Refused and Error) in case of Image Receive Failure. DICOM PS3.4 provides the flexibility of returning private status codes. Xeleris uses them to provide more information to the Xeleris user in case of an Image Receive failure.

There is not any Time-outs defined in CPIPC_DICOM Server for Image Storage operation.

2.3.1.3.1.3 Presentation Context Acceptance Criterion

The CPIPC_DICOM Server evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for Image Storage SCP Real-World Activity.

2.3.1.3.1.4 Transfer Syntax Selection Policies

Within each Presentation Context, the CPIPC_DICOM Server will select Transfer Syntaxes according to the following priority (highest priority first):

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

2.3.1.3.2 Real-World Activity: Query SCP

2.3.1.3.2.1 Associated Real-World Activity

The CPIPC_DICOM Server AE is always listening for associations. No operator action is required to respond to Query request.

The real-world activity associated with the Query request is to search the local database for all entries that match the request and send a C-FIND-RSP message with the status of "pending" for each matching entry. The exception to this is the last message which is sent with a status of "success."

2.3.1.3.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Name	**UID**	**Name List**	**UID List**		**Negotiation**
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Note This implementation does not support extended negotiation for the C-FIND Service, including that for relational-queries.

2.3.1.3.2.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - Find and Study Root Query/Retrieve Information Model - FIND SOP Classes

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Query**:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields
Failed	A700	Refused: Out of resources	Returned if the DICOM Server runs out of resources (e.g. memory); error logged.	None
	C000	Error: Unable to process	Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Find operation failed; error logged.	None
Cancel	FE00	Matching terminated due to cancel	Returned if the DICOM Server receives a C-CANCEL-FIND-RQ message; error logged.	None
Success	0000	Matching is complete - No final identifier is supplied	Returned when the DICOM Server completes the find operation.	None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.		None
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier		None

Note There is not any Time-out defined in CPIPC_DICOM Server for Query SCP operation.

2.3.1.3.2.3 Presentation Context Acceptance Criterion

The CPIPC_DICOM Server evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for Query SCP Real-World Activity.

2.3.1.3.2.4 Transfer Syntax Selection Policies

Within each Presentation Context, the CPIPC_DICOM Server will select Transfer Syntaxes according to the following priority (highest priority first):

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

2.3.1.3.3 Real-World Activity: Image Retrieve SCP

2.3.1.3.3.1 Associated Real-World Activity

The DICOM Server AE is always listening for associations. No operator action is required to respond to an Image Retrieve request.

The real-world activity associated with the Image Retrieve request is to send all images corresponding to the C-MOVE request to the specified Move destination AE through a separate association. Xeleris supports Move Destination set with a different AE Title than the one initiating the association for the C-MOVE.

2.3.1.3.3.2 Accepted Presentation Context Table

Presentation Context Table – Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Name	**UID**	**Name List**	**UID List**		**Negotiation**
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Note This implementation does not support extended negotiation for the C-MOVE Service, including that for relational-retrieve.

2.3.1.3.3.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE and Study Root Query/Retrieve Information Model - MOVE SOP Classes

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Retrieve**:

Service Status	Status Codes	Further Meaning	Status Codes generated by SCP	Related Fields
Failed	A701	Refused: Out of resources - Unable to calculate number of matches	Returned if the DICOM Server can't find requested SOP instance(s); error logged.	None
	A702	Refused: Out of resources - Unable to perform sub-operations	Returned if the DICOM Server runs out of resources (e.g. memory); error logged.	None
	A801	Refused: Move Destination Unknown	Returned if the DICOM Server has no information on destination AE; error logged.	None
	A900	Error: Identifier does not match SOP Class	Returned if the DICOM Server receives other than the Patient Root Query/Retrieve Information Model or Study Root Query/Retrieve Information Model SOP class.	None
	C000	Error: Unable to process	Returned if the DICOM Server cannot successfully interpret the C-MOVE-RQ message.	None
Cancel	FE00	Sub-operations terminated due to a Cancel indication	Returned if the DICOM Server receives a C-CANCEL-MOVE-RQ message.	None
Warning	B000	Sub-operations Complete - One or more Failures.	Returned upon completion if one or more of the specified images failed to transfer to the destination AE.	None
Success	0000	Sub-operations Complete - No Failure	Returned after the transfer of the last image.	None
Pending	FF00	Sub-operations are continuing	Returned after the transfer of each image except for the last.	None

Note There is not any Time-out defined in CPIPC_DICOM Server for Image Retrieve SCP operation.

2.3.1.3.3.3 Presentation Context Acceptance Criterion

The CPIPC_DICOM Server evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for Image Retrieve SCP Real-World Activity.

2.3.1.3.3.4 Transfer Syntax Selection Policies

Within each Presentation Context, the CPIPC_DICOM Server will select Transfer Syntaxes according to the following priority (highest priority first):

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

2.3.1.3.4 Real-World Activity: Verify SCP

2.3.1.3.4.1 Associated Real-World Activity

The CPIPC_DICOM Server AE is always listening for associations. No operator action is required to respond to a Verification request.

The real-world activity associated with the Verification request is to send a C-ECHO-RSP message with a status of "success" to the requesting AE.

2.3.1.3.4.2 Accepted Presentation Context Table

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

2.3.1.3.4.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The CPIPC_DICOM Server AE provides standard conformance to the DICOM verification service class.

Note There is not any Time-out defined in CPIPC_DICOM Server for Verify SCP operation.

2.3.1.3.4.3 Presentation Context Acceptance Criterion

The CPIPC_DICOM Server evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for Verify SCP Real-World Activity.

2.3.1.3.4.4 Transfer Syntax Selection Policies

Within each Presentation Context, the CPIPC_DICOM Server will select Transfer Syntaxes according to the following priority (highest priority first):

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

2.3.1.3.5 Real-World Activity: Receive N-EVENT-REPORT from Storage Commitment SCP

2.3.1.3.5.1 Associated Real-World Activity

As part of the storage commitment implementation, Remote AE (SCP) initiates an association to this implementation and sends an N-EVENT-REPORT. The attribute of the N-EVENT-REPORT message includes an indication on all images for which a commitment has succeeded and those for which it has failed.

The receipt of an N-EVENT-REPORT on an association that CPIPC_DICOM Server AE has initiated is not supported. The Remote AE (SCP) must initiate a new association in order to send the new N-EVENT-REPORT.

On reception of a successful N-EVENT-REPORT-RQ notification from the Storage Commitment Provider, the images are flagged as committed in the database and appropriate entry is added to Archive History if Archive functionality is enabled on the Xeleris.

Note There is not any Time-out defined in CPIPC_DICOM Server for Receive N-EVENT-REPORT operation.

2.3.1.3.5.2 Accepted Presentation Context Table

The following table shows the proposed presentation contexts for the CPIPC_DICOM Server AE after real-world activity "Storage Commitment Request" has been initiated.

Presentation Context Table - Accepted					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

2.3.1.3.5.2.1 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU

The CPIPC_DICOM Server AE will only accept the SCU role (which must be proposed via SCP/SCU Role Selection Negotiation) within a Presentation Context for the Storage Commitment Push Model SOP Class.

Upon receiving a Storage Commitment N-EVENT-REPORT (Storage Commitment Result), the CPIPC_DICOM Server AE will validate the Transaction UID against its list of outstanding Storage Commitment Request Transaction UIDs. If it matches an outstanding Request, the AE will mark all SOP Instances for which a success status is indicated with an Archived flag, shown on the user interface with "Archived" icon. In addition appropriate entry is added to Archive History if Archive functionality is enabled on the Xeleris.

When at least one Instance associated with a Study is "Archived", the Study on the user interface will also be shown on the user interface with "Archived icon.

If the Storage Commitment Result indicates any failure status, an error message will be written to the error log. Any retry must be manually reinitiated as a new Storage Commitment Request (see Section 2.3.1.2.5). The list of specific Failure Reason Codes that this AE will be able to process is described in Section 8.2.3.

Following are the status codes the Application may send back in the N-Event-Report response command to the Storage Commitment SCP Equipment that sent the N-Event-Report request:

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to SCU
Failure	0119	Class-instance conflict	SOPClassUID of Notification does not match Storage Commitment Push Model SOP Class	None
	0113	No such event type	Event type ID is not recognized	(0000,0002) (0000,1002)
	0110	Processing failure	Any general error occurred	(0000,0002) (0000,1000)
Success	0000		N-EVENT-REPORT message is successfully processed	None

2.3.1.3.5.3 Presentation Context Acceptance Criterion

The CPIPC_DICOM Server evaluates each Presentation Context independently, and accepts any Presentation Context that matches Abstract Syntax for Receive N-EVENT-REPORT from Storage Commitment SCP Real-World Activity.

2.3.1.3.5.4 Transfer Syntax Selection Policies

Within each Presentation Context, the CPIPC_DICOM Server will select Transfer Syntaxes according to the following priority (highest priority first):

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

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks (PS 3.8)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

2.4.2 OSI Stack

The OSI Communication Stack is not supported by this implementation.

2.4.3 TCP/IP Stack

For Xeleris 3.0, the TCP/IP stack is inherited from the Windows XP (SP3) Operating System.

For Xeleris 3.1, the TCP/IP stack is inherited from the Windows Embedded Standard 7 Operating System.

2.4.3.1 API

Not applicable to this product.

2.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

2.4.4 Additional Protocols

Product supports DHCP.

2.4.5 IPv4 and IPv6 Support

Product supports Internet Protocol version 4 (IPv4).

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1 Standard Extended/Specialized/Private SOPs

Xeleris NM Images are Standard Extended NM Image Storage SOP Class (see Section 3 for a complete description).

Xeleris Secondary Capture Images are Standard Extended Secondary Capture Image Storage SOP Class (see Section 6 for a complete description).

Xeleris Multi-Frame Secondary Capture Images are Standard Extended Multi-Frame Secondary Capture Image Storage SOP Class (see Section 6 for a complete description).

Xeleris Curve Objects are Standard Extended Stand-Alone Curve Storage SOP Class (see Section 7 for a complete description).

2.5.2 Private Transfer Syntaxes

Xeleris does not implement any private transfer syntaxes.

2.6 CONFIGURATION

The Xeleris system is configured by GEHC Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer but are not accessible through the Xeleris user interface.

2.6.1 AE Title/Presentation Address Mapping

Xeleris allows for the configuration of the mapping of remote AE titles to IP addresses and ports. The IP address of a remote AE may be in a different subnet (using routing). A router is configurable to ensure communication from one sub-net to another. This configuration is performed by GEHC Field Service Engineers.

2.6.2 Configuration Parameters

The following parameters are configurable for the CPIPC_DICOM Server AE:

- Local AE Title – default Value is XELERIS
- Local IP address
- Local DICOM Port Number – default value is 104
- Time limit (in hours) of SCU waiting for a Storage Commitment N-EVENT-REPORT from SCP - default value is 24 Hours.

Note that the default port on which Xeleris receives DICOM incoming TCP/IP connections is **104.** The configuration of IP routers and subnet mask is available on a OS level.

The following parameters are configurable for Remote AE:

- Remote AE Title
- Remote IP address
- Remote DICOM Port Number
- Remote AE functionality flags:
  - Store Images
  - Query/Retrieve
  - Pre-filter
  - PET Raw data destination
  - Storage commit server
  - Storage commit on: (AE Title of one of previously defined Storage Commitment Servers)

2.7 SUPPORT OF EXTENDED CHARACTER SETS

Xeleris will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets.

2.8 CODES AND CONTROLLED TERMINOLOGY

2.8.1 Fixed Coded Terminology

The product uses the fixed (non-configurable, non-extensible) coded terminology in Image SOP Instance:

- (0040,0555) - Acquisition Context Module (See Section 3.5.6.6)
- (0054, 0300) - Radionuclide Code Sequence (See Section 3.5.8.4)
- (0054, 0304) - Radiopharmaceutical Code Sequence (See Section 3.5.8.4)
- (0054, 0410) - Patient Orientation (See Section 3.5.3.3)
- (0054, 0412) - Patient Orientation Modifier (See Section 3.5.3.3)
- (0054, 0414) - Patient Gantry Relationship (See Section 3.5.3.3)
- (0054, 0200) - View (See Section 3.5.8.6)

2.8.2 Mapped Coded Terminology

The product uses no mapped coded terminology.

2.8.3 Configurable Coded Terminology

The product uses no configurable coded terminology.

2.9 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is recommended that the product is used within a secured environment that includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.

Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN).

SECTION 3
NUCLEAR MEDICINE (NM) INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM NM Image IOD to represent the information included in NM images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

3.2 NM IOD IMPLEMENTATION

The Xeleris implementation of DICOM uses the Nuclear Medicine multi-frame image format when creating image objects. In order to preserve full fidelity when transferring data to a Xeleris station, some specialized database information is encoded as private DICOM attributes. All of the Standard and private attributes used are defined in the module tables. The Xeleris private data dictionary is included in Appendix A.

3.3 NM ENTITY-RELATIONSHIP MODE

The Entity-Relationship diagram for the NM Image interoperability schema is shown in Illustration 3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box.
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. For example, the relationship between Series and Image can have up to n NM Images per Series, but the NM Image can only belong to 1 Series.

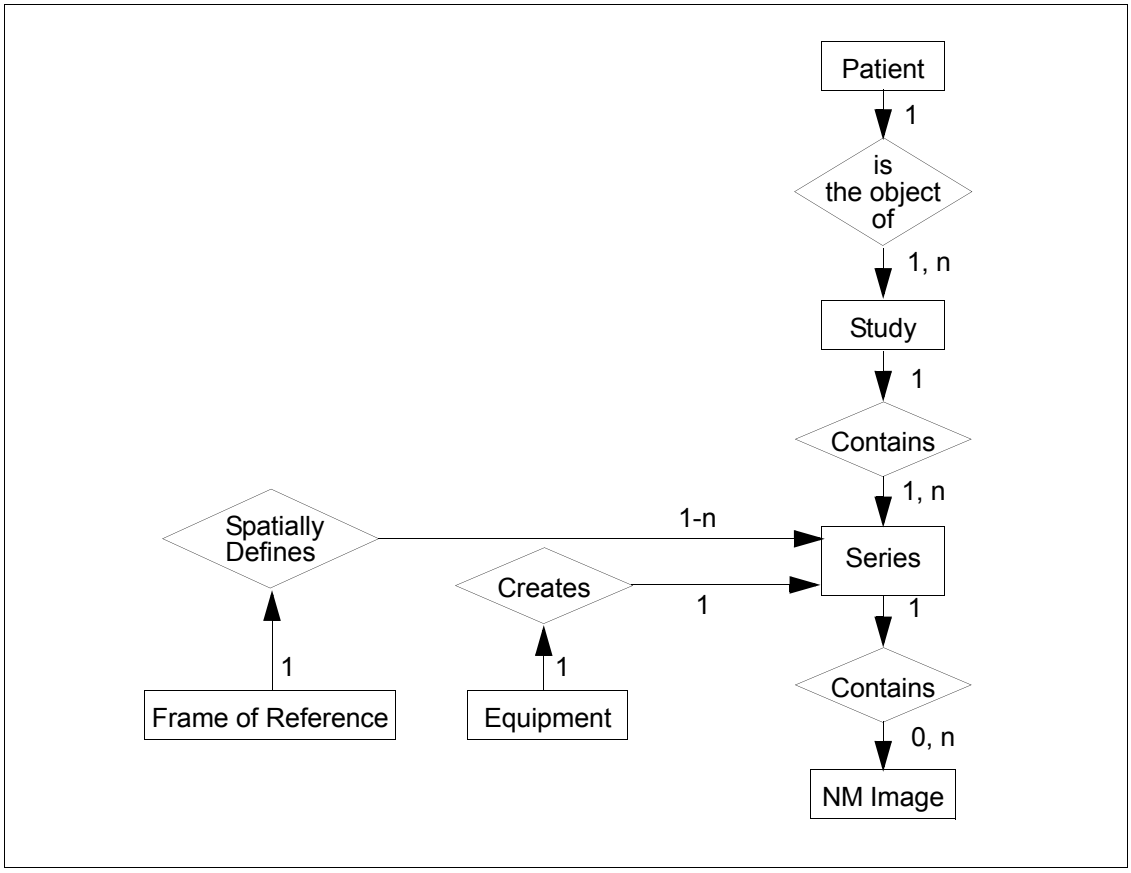

Illustration 3-1. NM Image Entity Relationship Diagram

3.3.1 Entity Descriptions

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the NM Information Object.

3.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

3.3.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

3.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

3.3.1.4 Equipment Entity Description

The Equipment Entity describes the particular imaging device which produced the series of images. An imaging device may produce one or more series within a study. The Equipment Entity does not describe the data acquisition or image creation attributes used to generate images within a series.

3.3.1.5 Frame of Reference Entity Description

The Frame of Reference Entity identifies the coordinate system which conveys spatial and/or temporal information of images in a series.

3.3.1.6 NM Image Entity Description

The NM Image Entity defines the attributes which describe the pixel data of a NM image. The pixel data is generated as a direct result of patient scanning (an ORIGINAL image) or it is derived from an original image through image processing steps (a DERIVED image). An image is defined by its image plane, pixel data characteristics, gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

3.3.2 Xeleris Mapping of DICOM Entities

Table 3-1. Mapping of DICOM Entities to Xeleris Entities

DICOM	Xeleris Entity
Patient	Patient
Study	Study
Series	Series
Image	Dataset

3.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 NM IOD, attributes are grouped into related sets of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related to each other. A module grouping does not infer any encoding of information into datasets.

Table 3-2 identifies the defined modules within the entities which comprise the DICOM v3.0 NM IOD. Modules are identified by Module Name.

Please refer to the DICOM v3.0 Standard Part 3 for a complete definition of the entities, modules, and attributes.

Table 3-2. NM Image IOD Modules

Entity Name	Module Name	Reference
Patient	Patient	Section 3.5.1.1
	Xeleris Private Patient	Section 3.5.1.2
Study	General Study	Section 3.5.2.1
	Patient Study	Section 3.5.2.2
	Xeleris Private Study	Section 3.5.2.3
Series	General Series	Section 3.5.3.1
	Xeleris Private Series	Section 3.5.3.2
	NM/PET Orientation	Section 3.5.3.3
Frame of Reference	Frame of Reference	Section 3.5.4.1
Equipment	General Equipment	Section 3.5.5.1

Table 3-2. NM Image IOD Modules (Continued)

Image	General Image	Section 3.5.6.1
	Xeleris Image	Section 3.5.6.2
	Image Pixel	Section 3.5.6.3
	NM Image Pixel	Section 3.5.8.1
	Xeleris Image Pixel	Section 3.5.6.4
	Multi-frame	Section 3.5.6.5
	Acquisition context	Section 3.5.6.6
	NM Multi-frame	Section 3.5.8.2
	NM Image	Section 3.5.8.3
	NM Isotope	Section 3.5.8.4
	Xeleris Isotope	Section 3.5.8.5
	NM Detector	Section 3.5.8.6
	Xeleris Detector	Section 3.5.8.7
	NM TOMO Acquisition	Section 3.5.8.8
	Xeleris TOMO Acquisition	Section 3.5.8.9
	NM Multi-gated Acquisition	Section 3.5.8.10
	Xeleris Multi-gated Acquisition	Section 3.5.8.11
	NM Phase	Section 3.5.8.12
	NM Reconstruction Module	Section 3.5.8.13
	Xeleris Private SPECT Reconstruction Module	Section 3.5.8.14
	Xeleris Private SPECT Backprojection Module	Section 3.5.8.15
	Xeleris Private SPECT Oblique Reformat Module	Section 3.5.8.16
	VOI LUT	Section 3.5.6.7
	SOP Common	Section 3.5.7.1

Note Modules not listed in Table 3-2 are not supported.

3.5 INFORMATION MODULE DEFINITIONS

Please refer to the DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the Standard entities and modules contained within the NM Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same as those defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

Xeleris Private attributes are defined in private modules, each of which follow the related Standard module. Private data element tags are assigned following the rules given in Part 5 of the DICOM v3.0 Standard, and are identified using the (gggg,xxnn) format, where xx represents a reserved block of element numbers within the group gggg.

Note Any element not listed in table(s) means that it is not supported (not stored in the created images).

3.5.1 Common Patient Entity Modules

3.5.1.1 Patient Module

This section specifies the Attributes of the patient that describe and identify the patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

Table 3-3. Patient Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient’s full name
Patient ID	(0010,0020)	2	Primary hospital identification number or code for the patient.
Patient's Birth Date	(0010,0030)	2	Patient's date of birth
Patient's Sex	(0010,0040)	2	Sex of the named patient. Enumerated Values: M = male F = female O = other
Other Patient IDs	(0010,1000)	3	Other identification numbers or codes used to identify the patient.
Other Patient Names	(0010,1001)	3	Other names used to identify the patient.
Ethnic Group	(0010,2160)	3	Ethnic group or race of the patient.
Patient Comments	(0010,4000)	3	User-defined additional information about the patient.

3.5.1.2 Xeleris Private Patient Module

This section specifies the Attributes of the patient that describe and identify the patient who is the subject of a diagnostic Study. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

Table 3-4. Xeleris Private Patient Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Patient Object Name	(0009,xx40)	3	GEMS_GENIE_1	Name of the Database Patient Object
Patient Flags	(0009,xx41)	3	GEMS_GENIE_1	Defines patient information.
Patient Creation Date	(0009,xx42)	3	GEMS_GENIE_1	Date of Patient Entity creation
Patient Creation Time	(0009,xx43)	3	GEMS_GENIE_1	Time of Patient Entity creation

3.5.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Modules contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

3.5.2.1 General Study Modules

This section specifies the Attributes which describe and identify the study performed upon the patient.

Table 3-5. General Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the Study. Internally generated for locally created study or when any Study attributes is modified by user in Xeleris UI.
Study Date	(0008,0020)	2	Creation date of study entity.
Study Time	(0008,0030)	2	Creation time of study entity.
Referring Physician's Name	(0008,0090)	2	Name of the patient's referring physician.
Study ID	(0020,0010)	2	User or equipment generated Study identifier.
Accession Number	(0008,0050)	2	A RIS generated number that identifies the order for the Study.
Study Description	(0008,1030)	3	Study Description
Name of Physician(s) Reading Study	(0008,1060)	3	Name of Physician(s) Reading Study

3.5.2.2 Patient Study Modules

This section defines Attributes that provide information about the Patient at the time the Study was performed.

Table 3-6. Patient Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Age of the Patient.
Patient's Size	(0010,1020)	3	Length or size of the Patient, in meters, Default Value is "0".
Patient's Weight	(0010,1030)	3	Weight of the Patient, in kilograms; Default Value is "0".
Occupation	(0010,2180)	3	Patient Occupation.
Additional Patient’s History	(0010,21B0)	3	Additional information about the Patient's medical history.

3.5.2.3 Xeleris Private Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

Table 3-7. Xeleris Private Study Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Study Name	(0009,xx10)	3	GEMS_GENIE_1	Name of the Database Study Object
Study Flags	(0009,xx11)	3	GEMS_GENIE_1	Defines study information.
Study Type	(0009,xx12)	3	GEMS_GENIE_1	Defines type of study.
Study Comments	(0013,xx26)	3	GEMS_GENIE_1	User-defined additional information about the study.
Protocol Data SQ	(0033,xx50)	3	GEMS_XELPRV_01	SQ with items encoding Protocol data Object (PDO) attributes; May contain 0 or more items
>Object Type	(0033,xx08)	3	GEMS_XELPRV_01	Always set to "PROTOCOL DATA"
>Modified	(0033,xx10)	3	GEMS_XELPRV_01	Modified Flag; Default value is 0, not modified.
>Name	(0033,xx11)	3	GEMS_XELPRV_01	Name
>Database Object Unique ID	(0033,xx16)	3	GEMS_XELPRV_01	Database UID of PDO; contains value of PDO UID tag (0033, xx52) generated at time of object creation.
>Date	(0033,xx17)	3	GEMS_XELPRV_01	Date
>Time	(0033,xx18)	3	GEMS_XELPRV_01	Time
>ProtocolDataFlags	(0033,xx19)	3	GEMS_XELPRV_01	ProtocolDataFlags
>ProtocolName	(0033,xx1A)	3	GEMS_XELPRV_01	ProtocolName
>Relevant data UID	(0033,xx1B)	3	GEMS_XELPRV_01	Contains value of StudyID.

Table 3-7. Xeleris Private Study Module Attributes (Continued)

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
>BulkData	(0033,xx1C)	3	GEMS_XELPRV_01	BulkData
>IntData	(0033,xx1D)	3	GEMS_XELPRV_01	IntData
>DoubleData	(0033,xx1E)	3	GEMS_XELPRV_01	DoubleData
>StringData	(0033,xx1F)	3	GEMS_XELPRV_01	StringData
>BulkDataFormat	(0033,xx20)	3	GEMS_XELPRV_01	BulkDataFormat
>IntDataFormat	(0033,xx21)	3	GEMS_XELPRV_01	IntDataFormat
>DoubleDataFormat	(0033,xx22)	3	GEMS_XELPRV_01	DoubleDataFormat
>StringDataFormat	(0033,xx23)	3	GEMS_XELPRV_01	StringDataFormat
>Description	(0033,xx24)	3	GEMS_XELPRV_01	Description
>Internal SOPClassUID	(0033,xx51)	3	GEMS_XELPRV_01	PDO Private SOP Class UID
>Internal Instance UID	(0033,xx52)	3	GEMS_XELPRV_01	PDO Instance UID; Internally generated
ReviewTemplatesSequence	(0033,xx60)	3	GEMS_XELPRV_01	SQ with items encoding Private Review Templates Objects (RTO) attributes; May contain 0 or more items
>Object Type	(0033,xx08)	3	GEMS_XELPRV_01	Private object type. Contains String "REVIEW DATA"
>Modified	(0033,xx10)	3	GEMS_XELPRV_01	Modified Flag
>Name	(0033,xx11)	3	GEMS_XELPRV_01	Name
>StudyId	(0033,xx14)	3	GEMS_XELPRV_01	StudyId
>Database Object Unique ID	(0033,xx16)	3	GEMS_XELPRV_01	Database UID of RTO contains value of RTO UID tag (0033,xx62) generated at time of object creation
>CreationDate	(0033,xx17)	3	GEMS_XELPRV_01	CreationDate
>CreationTime	(0033,xx18)	3	GEMS_XELPRV_01	CreationTime
>RTName	(0033,xx28)	3	GEMS_XELPRV_01	RTName
>RTSpecification	(0033,xx29)	3	GEMS_XELPRV_01	RTSpecification
>Review TemplatesFlags	(0033,xx2A)	3	GEMS_XELPRV_01	Review TemplatesFlags
>DataValidationSpec	(0033,xx2B)	3	GEMS_XELPRV_01	DataValidationSpec
>Description	(0033,xx2C)	3	GEMS_XELPRV_01	Description
>IconDescription	(0033,xx2D)	3	GEMS_XELPRV_01	IconDescription
>Internal SOP Class UID	(0033,xx61)	3	GEMS_XELPRV_01	RTO Private SOP Class UID
>Internal InstanceUID	(0033,xx62)	3	GEMS_XELPRV_01	RTO Instance UID; Internally generated

3.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

3.5.3.1 General Series Modules

This section specifies the Attributes which identify and describe general information about the Series within a Study.

Table 3-8. General Series Module Attributes

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. Defined Terms used for data created on this system: NM = Nuclear Medicine OT = Other
Series Instance UID	(0020,000E)	1	Unique identifier of the Series. Internally generated for locally created series or when any Series attribute is modified by user in Xeleris UI.
Series Number	(0020,0011)	2	A number that identifies this Series. Internally generated.
Laterality	(0020,0060)	2C	Laterality of (paired) body part examined. Enumerated Values: R = right L = left
Series Date	(0008,0021)	3	Date the Series started.
Series Time	(0008,0031)	3	Time the Series started.
Protocol Name	(0018,1030)	3	User-defined description of the conditions under which the Series was performed.
Series Description	(0008,103E)	3	Description of the Series
Operators' Name	(0008,1070)	3	Name(s) of the operator(s) supporting the Series.
Body Part Examined	(0018,0015)	3	Text description of the part of the body examined.
Patient Position	(0018,5100)	2C	Patient position descriptor relative to the equipment. The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Request Attributes Sequence	(0040, 0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items.

Table 3-8. General Series Module Attributes

>Requested Procedure ID	(0040, 1001)	1	Identifier that identifies the Requested Procedure in the Imaging Service Request. Required if procedure was scheduled. May be present otherwise.
>Scheduled Procedure Step ID	(0040, 0009)	1	Identifier that identifies the Scheduled Procedure Step. Required if procedure was scheduled.
>Scheduled Procedure Step Description	(0040, 0007)	3	Institution-generated description or classification of the Scheduled Procedure Step to be performed.
Performed Procedure Step ID	(0040, 0253)	3	User or equipment generated identifier of that part of a Procedure that has been carried out within this step. Not sent for DERIVED NM Images.

3.5.3.2 Xeleris Private Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study. This Module contains *private* Attributes that convey information not contained in related DICOM Standard v3.0 Module(s).

Table 3-9. Xeleris Private Series Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Series Object Name	(0009,xx20)	3	GEMS_GENIE_1	Name of the Database Series Object.
Series Flags	(0009,xx21)	3	GEMS_GENIE_1	Defines series information.
User Orientation	(0009,xx22)	3	GEMS_GENIE_1	User specified patient orientation.
Initiation Type	(0009,xx23)	3	GEMS_GENIE_1	Acquisition initiation type. The Defined Terms are: 0 = started on count rate 1 = started after time delay 2 = started manually
Initiation Delay	(0009,xx24)	3	GEMS_GENIE_1	Acquisition start delay time.
Initiation Count Rate	(0009,xx25)	3	GEMS_GENIE_1	Acquisition start count rate
Number Energy Sets	(0009,xx26)	3	GEMS_GENIE_1	Number of energy sets in this Series.
Number Detectors	(0009,xx27)	3	GEMS_GENIE_1	Number of detectors.
Number R-R Windows	(0009,xx28)	3	GEMS_GENIE_1	Number of R-R Interval Windows.
Number MG Time Slots	(0009,xx29)	3	GEMS_GENIE_1	Number of R-R Interval time bins.
Number View Sets	(0009,xx2A)	3	GEMS_GENIE_1	Number of view sets in this Series.
Trigger History UID	(0009,xx2B)	3	GEMS_GENIE_1	UID of Private Trigger Object relevant to the Series.
Series Comments	(0009,xx2C)	3	GEMS_GENIE_1	User-defined additional information about the series.
Distance Prescribed	(0009,xx2E)	3	GEMS_GENIE_1	User prescribed whole body scanning distance.
Table Direction	(0009, xx2F)	3	GEMS_GENIE_1	Table Direction
Series Type	(0011,xx0A)	3	GEMS_GENIE_1	Defines type of series. The Defined Terms are: 0 = static 1 = whole body 3 = multi-gated 6 = dynamic 9 = tomographic 15 = results
Effective Series Duration	(0011,xx0B)	3	GEMS_GENIE_1	Calculated duration of series acquisition.
Number Beats	(0011,xx0C)	3	GEMS_GENIE_1	Number of physiological triggers during acquisition.

Table 3-9. Xeleris Private Series Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Seriesdata SQ	(0033,xx70)	3	GEMS_XELPRV_01	SQ with items encoding Series Data Object (SDO) attributes; May contain 0 or more items.
>Object Type	(0033,xx08)	3	GEMS_XELPRV_01	Data Object Type. Contains string “SERIES DATA”
>Modified	(0033,xx10)	3	GEMS_XELPRV_01	Modified Flag
>Name	(0033,xx11)	3	GEMS_XELPRV_01	Name
>Database Object Unique ID	(0033,xx16)	3	GEMS_XELPRV_01	Database UID of SDO; contains value of SDO UID tag (0033, xx72) generated at time of object creation
>Date	(0033,xx17)	3	GEMS_XELPRV_01	SDO Creation Date
>Time	(0033,xx18)	3	GEMS_XELPRV_01	SDO Creation Time
>SeriesDataFlags	(0033,xx19)	3	GEMS_XELPRV_01	SeriesDataFlags
>ProtocolName	(0033,xx1A)	3	GEMS_XELPRV_01	Name of Protocol created SDO
>RelevantDataUID	(0033,xx1B)	3	GEMS_XELPRV_01	UID(s) of SOP Instance(s) relative to SDO
>BulkData	(0033,xx1C)	3	GEMS_XELPRV_01	SDO parameter(s) stored as binary buffer(s)
>IntData	(0033,xx1D)	3	GEMS_XELPRV_01	List of SDO parameters stored as integers
>DoubleData	(0033,xx1E)	3	GEMS_XELPRV_01	List of SDO parameters stored as doubles
>StringData	(0033,xx1F)	3	GEMS_XELPRV_01	List of SDO parameters stored as list of strings
>BulkDataFormat	(0033,xx20)	3	GEMS_XELPRV_01	Format of bulk parameters; contains information about name and size of bulk bufferters
>IntDataFormat	(0033,xx21)	3	GEMS_XELPRV_01	Format of integer parameters; contains information about name and number of integers in list
>DoubleDataFormat	(0033,xx22)	3	GEMS_XELPRV_01	Format of double parameters; contains information about name and number of doubles in list
>StringDataFormat	(0033,xx23)	3	GEMS_XELPRV_01	Format of string parameters; contains information about name and number of strings in list
>Description	(0033,xx24)	3	GEMS_XELPRV_01	User or equipment generated SDO description
>DoubleDataSQ	(0033,xx73)	3	GEMS_XELPRV_01	Sequence of items to store SDO parameters as lists of doubles. May contain 0 or more items.
>>DoubleData	(0033,xx1E)	3	GEMS_XELPRV_01	List of SDO parameters stored as doubles
>Series Data Private SOP Class UID	(0033,xx71)	3	GEMS_XELPRV_01	SDO Private SOP Class UID
>Series Data Instance UID	(0033,xx72)	3	GEMS_XELPRV_01	SDO Instance UID; Internally generated in time of object creation

3.5.3.3 NM/PET Patient Orientation Module

This section specifies the Attributes that describe the NM/PET Patient Orientation.

Table 3-10. NM/PET Patient Orientation Module Attribute

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Describes the orientation of the patient with respect to gravity. Zero or one item shall be present in the sequence.
> Code Value	(0008,0100)	1C	See Table 3-10a
> Code Scheme Designator	(0008,0102)	1C	See Table 3-10a
> Code Meaning	(0008,0104)	3	See Table 3-10a
> Patient Orientation Modifier Code Sequence	(0054,0412)	2C	Patient Orientation Modifier. Required if needed to fully specify the orientation of the patient with respect to gravity. Zero or one item shall be present in the sequence. Always sent if Patient Orientation Code Sequence contains at least one item.
> Code Value	(0008,0100)	1C	See Table 3-10b
> Code Scheme Designator	(0008,0102)	1C	See Table 3-10b
> Code Meaning	(0008,0104)	3	See Table 3-10b
Patient Gantry Relationship Code Sequence	(0054,0414)	2	Describes the orientation of the patient with respect to the gantry. Zero or one item shall be present in the sequence.
> Code Value	(0008,0100)	1C	See Table 3-10c
> Code Scheme Designator	(0008,0102)	1C	See Table 3-10c
> Code Meaning	(0008,0104)	3	See Table 3-10c

Table 3-10a. Patient Orientation Code Sequence Values (Baseline ID 19)

Code Value	Coding Scheme Designator	Code Meaning
F-10440	99SDM	erect
F-10450	99SDM	recumbent
F-10460	99SDM	semi-erect

Table 3-10b. Patient Orientation Modifier Code Sequence Values (Baseline ID 20)

Code Value	Coding Scheme Designator	Code Meaning
F-10310	99SDM	prone

Code Value	Coding Scheme Designator	Code Meaning
F-10316	99SDM	semi-prone
F-10317	99SDM	right lateral decubitus
F-10318	99SDM	lateral decubitus
F-10319	99SDM	left lateral decubitus
F-10320	99SDM	standing
F-10326	99SDM	anatomical
F-10330	99SDM	kneeling
F-10336	99SDM	knee-chest
F-10340	99SDM	supine
F-10346	99SDM	lithotomy
F-10348	99SDM	Trendelenburg
F-10349	99SDM	inverse Trendelenburg
F-10380	99SDM	frog
F-10390	99SDM	stooped-over
F-103A0	99SDM	sitting
F-10410	99SDM	curled-up

Table 3-10c. Patient Gantry Relationship Code Sequence Values (Baseline ID 21)

Code Value	Coding Scheme Designator	Code Meaning
F-10470	99SDM	headfirst
F-10480	99SDM	feet-first
F-10516	99SDM	oblique
F-10515	99SDM	transverse

3.5.4 Common Frame of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

3.5.4.1 Frame of Reference Modules

This section specifies the Attributes necessary to uniquely identify a Frame Of Reference which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

Xeleris systems group spatially and/or temporally related Images in the same Series. Acquisition data created on other systems may be missing frame of reference information, and for these cases Xeleris fills this attribute with Series UID.

Table 3-11. Frame of Reference Module Attributes

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Uniquely identifies the frame of reference for a Series.
Position Reference Indicator	(0020,1040)	2	Part of the patient's anatomy used as a reference. Always sends as ZERO length value.

3.5.5 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

3.5.5.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images. For Series created on the Xeleris system, the values are generally copied from the original data.

Table 3-12. General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the composite instances. Default Value is "GE MEDICAL SYSTEMS, NUCLEAR"
Institution Name	(0008,0080)	3	Institution where the equipment that produced the composite instances is located.
Station Name	(0008,1010)	3	User defined name identifying the machine that produced the composite instances.
Manufacturer's Model Name	(0008,1090)	3	Manufacturer’s model name of the equipment that produced the composite instances.
Device Serial Number	(0018,1000)	3	Manufacturer’s serial number of the equipment that produced the composite instances.
Software Version(s)	(0018,1020)	3	Manufacturer’s designation of software version of the equipment that produced the composite instances.

3.5.6 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

3.5.6.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

Table 3-13. General Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	A number that identifies this image.
Content Date	(0008,0023)	2C	The date the image pixel data creation started.
Content Time	(0008,0033)	2C	The time the image pixel data creation started.
Image Type	(0008,0008)	3	Image identification characteristics. See NM Image module (Section 3.5.8.3)
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started.
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started.
Image Comments	(0020,4000)	3	User-defined comments about the image

3.5.6.2 Xeleris Private Image Module

This section specifies the Attributes which identify and describe an image within a particular series. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between Xeleris systems.

Table 3-14. Xeleris Private Image Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Workstation DICOM data Identifier	(0009,xx01)	3	GEMS_GENIE_1	Always "GEMS_GENIE"
DatasetUID	(0009,xx1E)	3	GEMS_GENIE_1	
Dataset UID List	(0009,xx45)	3	GEMS_GENIE_1	
Radio Nuclide Name	(0011,xx0D)	3	GEMS_GENIE_1	Name of radionuclide used.
Database Object Name	(0011,xx10)	3	GEMS_GENIE_1	Name of the Database Dataset Object.
Dataset Modified	(0011,xx11)	3	GEMS_GENIE_1	Dataset Modified Flag
Dataset Name	(0011,xx12)	3	GEMS_GENIE_1	Dataset Name
Dataset Type	(0011,xx13)	3	GEMS_GENIE_1	Defines type of dataset. The Defined Terms are: 0 = static 2 = whole body 8 = dynamic 11 = multi-gated 12 = tomographic planar 13 = transaxial 14 = saggital 15 = coronal 16 = oblique VLA 17 = oblique HLA 18 = oblique SA 22 = sinogram 43 = linogram
Completion Time	(0011,xx14)	3	GEMS_GENIE_1	Completion Time
Detector Number	(0011,xx15)	3	GEMS_GENIE_1	Detector number image was acquired by.
Energy Number	(0011,xx16)	3	GEMS_GENIE_1	Energy set number.
RR Interval Window Number	(0011,xx17)	3	GEMS_GENIE_1	R-R interval number.
MG Bin Number	(0011,xx18)	3	GEMS_GENIE_1	Multi-gated time bin number.
Radius Of Rotation	(0011,xx19)	3	GEMS_GENIE_1	Distance to the center of detector rotation.

Table 3-14. Xeleris Private Image Module Attributes (Continued)

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Detector Count Zone	(0011,xx1A)	3	GEMS_GENIE_1	FOV zone for count-based acquisition termination criteria. The Defined Terms are: 0 = none specified 1 = total (all) counts 2 = counts in energy set 3 = counts inside an ROI 4 = counts outside an ROI
Image Orientation	(0011,xx1F)	3	GEMS_GENIE_1	Orientation of the image. The Defined Terms are: 0 = no rotation, no mirroring 1 = no rotation, mirrored
Table Orientation	(0011,xx26)	3	GEMS_GENIE_1	Orientation of the table for whole body acquisition. The Defined Terms are: 0 = direction in/out 1 = direction left/right
ROI Top Left	(0011,xx27)	3	GEMS_GENIE_1	Acquisition count zone ROI, top left coordinate.
ROI Bottom Right	(0011,xx28)	3	GEMS_GENIE_1	Acquisition count zone ROI, bottom right coordinate.
View X Adjustment	(0011,xx2C)	3	GEMS_GENIE_1	View X Adjustment
View Y Adjustment	(0011,xx2D)	3	GEMS_GENIE_1	View Y Adjustment
Pixel Overflow Flag	(0011,xx2E)	3	GEMS_GENIE_1	Pixel Overflow Flag (Starcam)
Pixel Overflow Level	(0011,xx2F)	3	GEMS_GENIE_1	Pixel Overflow Level
Acquisition Parent UID	(0011,xx31)	3	GEMS_GENIE_1	Acquisition Parent UID
Processing Parent UID	(0011,xx32)	3	GEMS_GENIE_1	Processing Parent UID
Energy Correct Name	(0011,xx33)	3	GEMS_GENIE_1	Name of applied energy correction.
Spatial Correct Name	(0011,xx34)	3	GEMS_GENIE_1	Name of applied spatial correction.
Tuning Calib Name	(0011,xx35)	3	GEMS_GENIE_1	Name of applied tuning calibration data.
Uniformity Correct Name	(0011,xx36)	3	GEMS_GENIE_1	Name of associated uniformity correction.
Acquisition Specific Correct Name	(0011,xx37)	3	GEMS_GENIE_1	Name(s) of associated acquisition specific correction(s).
Dataset Flags	(0011,xx3F)	3	GEMS_GENIE_1	Defines dataset information.
Period	(0011,xx55)	3	GEMS_GENIE_1	Period
Elapsed Time	(0011,xx56)	3	GEMS_GENIE_1	Elapsed Time
FOV	(0011,xx57)	3	GEMS_GENIE_1	FOV

Table 3-14. Xeleris Private Image Module Attributes (Continued)

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Digital FOV	(0013,xx10)	3	GEMS_GENIE_1	Digital FOV
Source Translator	(0013,xx11)	3	GEMS_GENIE_1	Source Translator. Default value = 4.
RAL Flags	(0013,xx12)	3	GEMS_GENIE_1	RAL Flags
Xeleris Frame Sequence	(0055,xx65)	3	GEMS_GENIE_1	Xeleris Frame Sequence. Present for historical reasons. Always contains 0 items.
Annotation Sequence	(0019, xx5F)	3	GEMS_GENIE_1	Annotations attached to image; May contain 0 or more Items
>Modified	(0019, xx60)	3	GEMS_GENIE_1	Modified Flag
>Name	(0019, xx61)	3	GEMS_GENIE_1	Name of Database Annotation Object
>Aid	(0019, xx62)	3	GEMS_GENIE_1	Database Annotation Unique ID
>DatabaseAnnotationMap-ping	(0019, xx63)	3	GEMS_GENIE_1	
>DatabaseObjectClassID	(0019, xx64)	3	GEMS_GENIE_1	
>DatabaseObjectUniqueID	(0019, xx65)	3	GEMS_GENIE_1	
>TextFgColour	(0019, xx66)	3	GEMS_GENIE_1	Text Foreground Color
>TextBgColour	(0019, xx67)	3	GEMS_GENIE_1	Text Background Color
>MarkerColour	(0019, xx68)	3	GEMS_GENIE_1	
>LineColour	(0019, xx69)	3	GEMS_GENIE_1	
>LineThickness	(0019, xx6A)	3	GEMS_GENIE_1	
>Font	(0019, xx6B)	3	GEMS_GENIE_1	
>TextBackingMode	(0019, xx6C)	3	GEMS_GENIE_1	
>TextJustification	(0019, xx6D)	3	GEMS_GENIE_1	
>TextShadowOffsetX	(0019, xx6E)	3	GEMS_GENIE_1	
>TextShadowOffsetY	(0019, xx6F)	3	GEMS_GENIE_1	
>GeomColour	(0019, xx70)	3	GEMS_GENIE_1	
>GeomThickness	(0019, xx71)	3	GEMS_GENIE_1	
>GeomLineStye	(0019, xx72)	3	GEMS_GENIE_1	
>GeomDashLength	(0019, xx73)	3	GEMS_GENIE_1	
>GeomFillPattern	(0019, xx74)	3	GEMS_GENIE_1	
>MarkerSize	(0019, xx75)	3	GEMS_GENIE_1	
>Interactivity	(0019, xx76)	3	GEMS_GENIE_1	Interactivity Flag
>TextLoc	(0019, xx77)	3	GEMS_GENIE_1	
>TextString	(0019, xx78)	3	GEMS_GENIE_1	

Table 3-14. Xeleris Private Image Module Attributes (Continued)

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
>TextAttachMode	(0019, xx79)	3	GEMS_GENIE_1	
>TextCursorMode	(0019, xx7A)	3	GEMS_GENIE_1	
>LineCtrlSize	(0019, xx7B)	3	GEMS_GENIE_1	
>LineType	(0019, xx7C)	3	GEMS_GENIE_1	
>LineStyle	(0019, xx7D)	3	GEMS_GENIE_1	
>LineDashLength	(0019, xx7E)	3	GEMS_GENIE_1	
>LinePtCount	(0019, xx7F)	3	GEMS_GENIE_1	
>LinePts	(0019, xx80)	3	GEMS_GENIE_1	
>LineAttachMode	(0019, xx81)	3	GEMS_GENIE_1	
>MarkerType	(0019, xx82)	3	GEMS_GENIE_1	
>MarkerLoc	(0019, xx83)	3	GEMS_GENIE_1	
>MarkerAttachMode	(0019, xx84)	3	GEMS_GENIE_1	
>FrameNumber	(0019, xx86)	3	GEMS_GENIE_1	
OrigSOP Instance UID	(0033,xx07)	3	GEMS_GENIE_1	List of SOP UIDs of Xeleris associated datasets encapsulated into the DICOM NM Information Image.
Trigger History Modified Flag	(0033,xx30)	3	GEMS_GENIE_1	Triggers Modification Flag
Database Object Name	(0033,xx31)	3	GEMS_GENIE_1	Name of Database Trigger History Object
Trigger History Software Version	(0033,xx32)	3	GEMS_GENIE_1	Trigger History Software Version
Number of Triggers	(0033,xx33)	3	GEMS_GENIE_1	Number of Triggers
Trigger Size	(0033,xx34)	3	GEMS_GENIE_1	Size of one Trigger data slot
Trigger Data Size	(0033,xx35)	3	GEMS_GENIE_1	Size of Trigger Data Size
Trigger Data	(0033,xx36)	3	GEMS_GENIE_1	Buffer with trigger data information
Trigger History Description	(0033,xx37)	3	GEMS_GENIE_1	
Trigger History Flags	(0033,xx38)	3	GEMS_GENIE_1	
Trigger History Private Instance UID	(0033,xx39)	3	GEMS_GENIE_1	Internally Generated
Trigger History SOP Class UID	(0033,xx3A)	3	GEMS_GENIE_1	Internal SOP Class UID value, set to "1.2.840.10008.5.1.4.1.1.20" for historical reasons
ROI Sequence	(0057,xx01)	3	GEMS_XELPRV_01	ROI created on image; may contain 0 or more items.
>PrivateSOPClassUID	(0057,xx02)	3	GEMS_XELPRV_01	ROI SOP Class UID, contains value "1.2.840.10008.5.1.4.1.1.9"

Table 3-14. Xeleris Private Image Module Attributes (Continued)

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
>ObjectInstanceUID	(0057,xx03)	3	GEMS_XELPRV_01	ROI SOP Instance UID; internally generated.
>Index	(0057,xx10)	3	GEMS_XELPRV_01	Index of ROI
>Dimensions	(0057,xx11)	3	GEMS_XELPRV_01	ROI Dimensions. Contain value: 1
>Points	(0057,xx12)	3	GEMS_XELPRV_01	Number of Points
>Type	(0057,xx13)	3	GEMS_XELPRV_01	ROIType
>Description	(0057,xx14)	3	GEMS_XELPRV_01	ROI Description
>DValueRepresentation	(0057,xx15)	3	GEMS_XELPRV_01	DataValueRepresentation; Contains value: 3
>ROI Label	(0057,xx16)	3	GEMS_XELPRV_01	ROI Label
>Data	(0057,xx17)	3	GEMS_XELPRV_01	List of ROI Shape points
>Modified	(0057,xx41)	3	GEMS_XELPRV_01	Modified
>DatabaseObjectName	(0057,xx42)	3	GEMS_XELPRV_01	Name of ROI Database Object
>DatabaseObjectClass ID	(0057,xx45)	3	GEMS_XELPRV_01	
>DatabaseObjectUID	(0057,xx46)	3	GEMS_XELPRV_01	ROI Object SOP Instance UID; internally generated
>Normal Colour	(0057,xx47)	3	GEMS_XELPRV_01	Normal Colour
>NameFont	(0057,xx48)	3	GEMS_XELPRV_01	NameFont
>FillPattern	(0057,xx49)	3	GEMS_XELPRV_01	FillPattern
>LineStyle	(0057,xx4A)	3	GEMS_XELPRV_01	LineStyle
>LineDashLength	(0057,xx4B)	3	GEMS_XELPRV_01	LineDashLength
>LineThickness	(0057,xx4C)	3	GEMS_XELPRV_01	LineThickness
>Interactivity	(0057,xx4D)	3	GEMS_XELPRV_01	Interactivity Flag
>Name Position	(0057,xx4E)	3	GEMS_XELPRV_01	Name Position
>NameDisplay	(0057,xx4F)	3	GEMS_XELPRV_01	NameDisplayFlag
>Label	(0057,xx50)	3	GEMS_XELPRV_01	ROI Label; contains the same value as ROILabel attribute (0057,xx16)
>BpSeg	(0057,xx51)	3	GEMS_XELPRV_01	BpSeg
>BpSegpairs	(0057,xx52)	3	GEMS_XELPRV_01	BpSegpairs
>SeedSpace	(0057,xx53)	3	GEMS_XELPRV_01	SeedSpace
>Seeds	(0057,xx54)	3	GEMS_XELPRV_01	Seeds
>Shape	(0057,xx55)	3	GEMS_XELPRV_01	Shape
>ShapeTilt	(0057,xx56)	3	GEMS_XELPRV_01	ShapeTilt
>ShapePtsSpace	(0057,xx59)	3	GEMS_XELPRV_01	ShapePtsSpace
>ShapeCtrlPtsCount	(0057,xx5A)	3	GEMS_XELPRV_01	ShapeCtrlPtsCount

Table 3-14. Xeleris Private Image Module Attributes (Continued)

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
>Shap CtrlPts	(0057,xx5B)	3	GEMS_XELPRV_01	Shap CtrlPts
>ShapeCPSpace	(0057,xx5C)	3	GEMS_XELPRV_01	ShapeCPSpace
>ROIFlags	(0057,xx5D)	3	GEMS_XELPRV_01	ROIFlags
>FrameNumber	(0057,xx5E)	3	GEMS_XELPRV_01	FrameNumber
>DatasetROI Mapping	(0057,xx60)	3	GEMS_XELPRV_01	DatasetROI Mapping

3.5.6.3 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

Table 3-15. Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	See NM Image Pixel module.
Photometric Interpretation	(0028,0004)	1	See NM Image Pixel module.
Rows	(0028,0010)	1	Rows
Columns	(0028,0011)	1	Columns
Bits Allocated	(0028,0100)	1	See NM Image Pixel module.
Bits Stored	(0028,0101)	1	See NM Image Pixel module.
High Bit	(0028,0102)	1	See NM Image Pixel module.
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated Values: 0000H = unsigned integer. 0001H = 2's complement
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples that comprise the Image.
Smallest Image Pixel Value	(0028,0106)	3	The minimum actual pixel value encountered in this image.
Largest Image Pixel Value	(0028,0107)	3	The maximum actual pixel value encountered in this image.

3.5.6.4 Xeleris Private Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between Xeleris systems.

Table 3-16. Xeleris Private Image Pixel Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Picture Name	(0011,xx30)	3	GEMS_GENIE_1	Name of the database Picture Object
Byte Order	(0011,xx38)	3	GEMS_GENIE_1	Defines pixel data byte order.
Compression Type	(0011,xx39)	3	GEMS_GENIE_1	Compression information
Picture Format	(0011,xx3A)	3	GEMS_GENIE_1	Xeleris IAP image format
Pixel Scale	(0011,xx3B)	3	GEMS_GENIE_1	Set to 1.0.
Pixel Offset	(0011,xx3C)	3	GEMS_GENIE_1	Set to 0.0.
Viewing Name	(0011,xx40)	3	GEMS_GENIE_1	Name of the database Viewing Object
Orientation Angle	(0011,xx41)	3	GEMS_GENIE_1	Orientation Angle
Rotation Angle	(0011,xx42)	3	GEMS_GENIE_1	Rotation Angle
Window Inverse Flag	(0011,xx43)	3	GEMS_GENIE_1	Window Inverse Flag
Threshold Center	(0011,xx44)	3	GEMS_GENIE_1	
Threshold Width	(0011,xx45)	3	GEMS_GENIE_1	
Interpolation Type	(0011,xx46)	3	GEMS_GENIE_1	
Where Name	(0011,xx50)	3	GEMS_GENIE_1	Name of the database Where Object
FScalar	(0013,xx15)	3	GEMS_GENIE_1	Scaling Factor for Floating Point pixel data

3.5.6.5 Multi-Frame Module

This section specifies the Attributes of a Multi-frame pixel data Image.

Table 3-17. Multi-Frame Module Attributes

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image.
Frame Increment Pointer	(0028,0009)	1	Contains the Data Element Tags of one or more frame index vectors. See NM Multi-Frame Module, Section 3.5.8.2 for further specialization.

3.5.6.6 Acquisition Context Module

This section specifies Attributes for description of the conditions present during data acquisition. The Acquisition Context Module and the Acquisition Context Sequence (0040,0555) contained within it are required for cardiac stress/rest images. The sequence is empty if scan type is other than Tomo or gated Tomo or when acquisition context is left “Unknown”.

Table 3-18. Acquisition Context Module Attributes

Attribute Name	Tag	Type	Attribute Description
Acquisition context sequence	(0040,0555)	2	A sequence of Items that describes the conditions present during the acquisition of the data of the SOP Instance. Zero or more items may be included in this sequence.
> Concept-Name Code Sequence	(0040,A043)	1	A concept that constrains the meaning of (i.e. defines the role of) the Observation Value.
>>Code Value	(0008,0100)	1C	Always contains string "109054"
>>Code Scheme Designator	(0008,0102)	1C	Always contains string "DCM”
>>Code Meaning	(0008,0104)	3	Always contains string "Patient State"
> Concept Code Sequence	(0040,A168)	1C	This is the Value component of a Name/Value pair when the Concept implied by Concept Name Code Sequence (0040,A043) is a Coded Value. This sequence shall contain exactly one item.
>>Code Value	(0008,0100)	1C	See Table 3-18a
>>Code Scheme Designator	(0008,0102)	1C	See Table 3-18a
>>Code Meaning	(0008,0104)	1C	See Table 3-18a

Table 3-18a. Concept Code Sequence Values

Coding Scheme Designator	Code Value	Code Meaning
SRT	F-01604	Resting State
SRT	F-05019	Cardiac Stress State
DCM	109092	Reinjection State
DCM	109093	Redistribution State
DCM	109094	Delayed Redistribution State

3.5.6.7 VOI LUT Module

This section specifies Attributes that describe the VOI LUT.

Table 3-19. VOI LUT Module Attributes

Attribute Name	Tag	Type	Attribute Description
WindowCenter	(0028,1050)	1C	Window Center for display.
WindowWidth	(0028,1051)	1C	Window Width for display.

3.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.5.7.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

Table 3-20. SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Set to “1.2.840.10008.5.1.4.1.1.20”, Nuclear Medicine Image Storage SOP Class UID.
SOP Instance UID	(0008,0018)	1	Internally generated.
Specific Character Set	(0008,0005)	1C	Not used when the default character set (ISO 646) is used. Set to “ISO_IR 100” when extended character sets are used.
Instance Creation Date	(0008,0012)	3	Date of instance creation.
Instance Creation Time	(0008,0013)	3	Time of instance creation.
Instance Creator UID	(0008,0014)	3	Set to the Implementation UID (see Section 2.3.1.1.4)
Instance Number	(0020,0013)	3	A number that identifies this Composite object instance.

3.5.8 Nuclear Medicine Modules

This Section describes NM Image Modules. These Modules contain Attributes that are specific to the NM Image IOD.

NM images always use the NM Multi-frame module and the appropriate frame vectors even if there is only one frame in the Image sent. If the user selects an entire Series for one Send operation, individual datasets in the Series will be combined into multi-frame NM Images as appropriate.

If the user selects and sends individual datasets within a Series, then each is sent as a separate DICOM Image. For example, for Multi-gated Tomographic acquisitions, if the dataset for each gate interval is sent individually, then each is encoded into a separate SOP Instance as a separate Multi-gated Tomographic image. It is valid for the receiving AE to recombine the SOP Instances, per the structure of the NM IOD, to form a new SOP Instance.

3.5.8.1 NM Image Pixel Module

This section specifies the Attributes that describe the pixel data of a NM image.

Table 3-21. NM Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image (always 1 for NM)
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. Always set to "MONOCHROME2"
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. Enumerated Values: 8, 16
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel ample. Each sample shall have the same number of bits stored. The value is the same as the value in Bits Allocated (0028,0100).
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.Its value is one less than the value in Bits Stored (0028,0101).
Pixel Spacing	(0028,0030)	2	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing, in mm.

3.5.8.2 NM Multi-Frame Module

This section specifies the Attributes of a NM Multi-frame Image. This module is always included in a NM SOP instance, even if there is only one frame in the image.

Table 3-22. NM Multi-Frame Module Attributes

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1	See for specialization by NM image type (see Section 3.5.8.2.1).
Energy Window Vector	(0054,0010)	1C	Defines energy set window to which each frame belongs.
Number of Energy Windows	(0054,0011)	1	Number of energy set windows in SOP Instance.
Detector Vector	(0054,0020)	1C	Defines detector to which each frame belongs.
Number of Detectors	(0054,0021)	1	Number of detectors in SOP Instance.
Phase Vector	(0054,0030)	1C	Defines phase to which each frame belongs.
Number of Phases	(0054,0031)	1C	Number of phases in SOP Instance.
Rotation Vector	(0054,0050)	1C	Defines rotation to which each frame belongs.
Number of Rotations	(0054,0051)	1C	Number of Rotations in SOP Instance.
R-R Interval Vector	(0054,0060)	1C	Defines R-R Interval to which each frame belongs.
Number of R-R Intervals	(0054,0061)	1C	Number of R-R Intervals in SOP Instance.
Time Slot Vector	(0054,0070)	1C	Defines time slot, within cardiac cycle, to which each frame belongs.
Number of Time Slots	(0054,0071)	1C	Number of time slots in SOP Instance.
Slice Vector	(0054,0080)	1C	Defines image slice to which each frame belongs.
Number of Slices	(0054,0081)	1C	Number of images slices in SOP Instance.
Angular View Vector	(0054,0090)	1C	Defines angular view number to which each frame belongs.
Time Slice Vector	(0054,0100)	1C	Defines frame numbers within each phase.

3.5.8.2.1 NM Multi-Frame Attribute Description

3.5.8.2.1.1 Frame Increment Pointer

The Frame Increment Pointer (0028,0009) defines which frame index vectors are present in the NM Image instance. The Frame Increment Pointer is supported per the DICOM specification for all image types defined in Table 3-23.

Table 3-23. Enumerated Values for Frame Increment Pointer

Image Type (0008,0008), Value 3	Frame Increment Pointer (0028,0009)
STATIC or WHOLE BODY	0054H 0010H \ 0054H 0020H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020)
DYNAMIC	0054H 0010H \ 0054H 0020H \ 0054H 0030H \ 0054H 0100H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020) Phase Vector (0054,0030), Time Slice Vector (0054,0100)
GATED	0054H 0010H \ 0054H 0020H \ 0054H 0060H \ 0054H 0070H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070)
TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), Angular View Vector (0054,0090)
GATED TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0060H \ 0054H 0070H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070), Angular View Vector (0054,0090).
RECON TOMO	0054H 0080H Sequencing is by Slice Vector (0054,0080)
RECON GATED TOMO	0054H 0060H \ 0054H 0070H \ 0054H 0080H Sequencing is by R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070), Slice Vector (0054,0080)

3.5.8.3 NM Image Module

This section contains the Attributes that describe Nuclear Medicine Images.

Table 3-24. NM Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Image identification characteristics (for specialization, see Table 3-23).
Image ID	(0054,0400)	3	User or equipment generated Image identifier.
Counts Accumulated	(0018,0070)	2	Sum of all gamma events for all frames in the image.
Acquisition Termination Condition	(0018,0071)	3	Description of how the data collection was stopped. Defined Terms used: CNTS = count limit reached DENS = count limit reached within ROI MANU = manual TIME = time limit reached TRIG = number of beats limit reached
Table Height	(0018,1130)	3	Table Height - Height of table at acquisition start.
Table Traverse	(0018,1131)	3	Location of the patient table (or gantry relative to the table) in mm.
Actual Frame Duration	(0018,1242)	1C	Elapsed time for data acquisition in msec.
Count Rate	(0018,1243)	3	Maximum count rate during image acquisition.
Corrected Image	(0028,0051)	3	Corrections are applied to all frames in the image. Sent for RECON TOMO and RECON GATED TOMO data only. Defined Terms: ATTN = attenuation corrected SCAT = scatter corrected
Whole Body Technique	(0018,1301)	3	Enumerated Values used: 1PS, 2PS, PCN, MSP
Scan Velocity	(0018,1300)	2C	Whole body scan speed
Scan Length	(0018,1302)	2C	Whole body scan length
Trigger Source or Type	(0018,1061)	3	Text indicating trigger source. Defined Terms used: EKG

3.5.8.3.1 NM Image Module Attribute Description

3.5.8.3.1.1 Image Type

The following Image Type (0008,0008) values are sent:

- Value 1 shall have one of the following Enumerated Values:
  - -1 ORIGINAL Identifies an Original Image
  - -2 DERIVED An image modified by processing steps
- Value 2 shall have the following Enumerated Value:
  - -1 PRIMARY Identifies a Primary Image
- Value 3 shall have the following Enumerated Values:
  - -1 STATIC Identifies a Static Image
  - -2 DYNAMIC Identifies a Dynamic Image
  - -3 GATED Identifies a Multi-gated Image
  - -4 WHOLE BODY Identifies a Whole Body Image
  - -5 TOMO Identifies a Tomographic Image
  - -6 RECON TOMO Identifies a reconstructed Tomographic Image
  - -7 GATED TOMO Identifies a Multi-gated Tomographic Image
  - -8 RECON GATED TOMO A reconstructed Multi-gated Tomographic Image
- Value 4 shall have the following Enumerated Values:
  - -1 EMISSION Transmission source NOT active during image acquisition
  - -2 TRANSMISSION Transmission source active during image acquisition

3.5.8.4 NM ISotope Module

This section contains Attributes that describe the isotope administered for the acquisition.

Table 3-25. NM Isotope Module Attributes

Attribute Name	Tag	Type	Attribute Description
Energy Window Information Sequence	(0054,0012)	2	Sequence of Items that describe the energy window groups used. Zero or more Items may be included in this sequence. The number of items is equal to Number of Energy Windows (0054,0011).
> Energy Window Name	(0054,0018)	3	A user defined name which describes this Energy Window.
>Energy Window Range Sequence	(0054,0013)	3	Sequence of Items that describes this energy window group. One or more Items may be included in this Sequence. Xeleris supports up to 4 items.
>> Energy Window Lower Limit	(0054,0014)	3	Lower energy limit in KeV.
>> Energy Window Upper Limit	(0054,0015)	3	Upper energy limit in KeV.
Radiopharmaceutical Information Sequence	(0054,0016)	2	Sequence of Items that describe isotope information. Zero or more Items may be included in this sequence.
> Radionuclide Code Sequence	(0054,0300)	2C	Sequence that identifies the radionuclide. Zero or one item shall be present in the sequence.
> Code Value	(0008,0100)	1C	See Table 3-25a
> Code Scheme Designator	(0008,0102)	1C	See Table 3-25a
> Code Meaning	(0008,0104)	3	See Table 3-25a
> Radiopharmaceutical Volume	(0018,1071)	3	Volume of injection in cubic cm.
> Radionuclide Total Dose	(0018,1074)	3	Total amount of radionuclide injected.
> Radiopharmaceutical	(0018,0031)	3	Name of the radiopharmaceutical.
> Radiopharmaceutical Code Sequence	(0054,0304)	3	Sequence that identifies the radiopharmaceutical. If presented, this sequence contains exactly one item.
> Code Value	(0008,0100)	1C	See Table 3-25b
> Code Scheme Designator	(0008,0102)	1C	See Table 3-25b
> Code Meaning	(0008,0104)	3	See Table 3-25b

Table 3-25a. Radionuclide Code Sequence Values (Baseline ID 18)

Code Value	Coding Scheme Designator	Code Meaning
C-105A1	99SDM	^11^Carbon
C-107A1	99SDM	^13^Nitrogen
C-111A1	99SDM	^18^Fluorine
C-114A4	99SDM	^123^Iodine

Table 3-25a. Radionuclide Code Sequence Values (Baseline ID 18)

C-114A6	99SDM	^125^Iodine
C-114B1	99SDM	^131^Iodine
C-122A5	99SDM	^133^Barium
C-128A2	99SDM	^68^Germanium
C-131A2	99SDM	^67^Gallium
C-138A9	99SDM	^201^Thallium
C-144A3	99SDM	^57^Cobalt
C-145A4	99SDM	^111^Indium
C-155A1	99SDM	^22^Sodium
C-159A2	99SDM	^82^Rubidium
C-163A8	99SDM	^99m^Technetium
C-172A8	99SDM	^133^Xenon
C-173A7	99SDM	^85^Krypton
C-178A8	99SDM	^153^Gadolinium

Table 3-25b. Radionuclide Code Sequence Values (Baseline ID 25)

Code Value	Coding Scheme Designator	Code Meaning
C-B1000	SRT	Diagnostic radioisotope
C-B1010	SRT	Therapeutic radioisotope
C-B1011	SRT	Sodium chromate Cr^51^
C-B1012	SRT	Chromium^51^ albumin
C-B1013	SRT	Chromium^51^ chloride
C-B1016	SRT	Copper^64^ versenate
C-B1017	SRT	Copper^64^ acetate
C-B1018	SRT	Copper^67^ ceruloplasmin
C-B1021	SRT	Cyanocobalamin Co^57^
C-B1022	SRT	Cyanocobalamin Co^58^
C-B1023	SRT	Cyanocobalamin Co^60^
C-B1031	SRT	Fluorodeoxyglucose F^18^
C-B1032	SRT	Sodium fluoride F^18^
C-B1037	SRT	Rubidium chloride Rb^82^
C-B103C	SRT	Ammonia N^13^

Table 3-25b. Radionuclide Code Sequence Values (Baseline ID 25)

C-B1041	SRT	Gallium^67^ citrate
C-B1051	SRT	Colloidal gold Au^198^
C-B1061	SRT	Indium^111^ pentetate
C-B1062	SRT	Disodium indium^111^
C-B1063	SRT	Colloidal Indium^111^
C-B1065	SRT	Indium^111^-Fe(OH)>3<
C-B1066	SRT	Indium^111^ red cell label
C-B1067	SRT	Indium^111^ transferrin
C-B1068	SRT	Indium^113^ bleomycin
C-B1069	SRT	Indium^113^ chloride
C-B1070	SRT	Indium^113^ pentetate
C-B1071	SRT	Indium^113^ oxoquinoline WBC label
C-B1072	SRT	Indium^113^ oxoquinoline platelet label
C-B1073	SRT	Indium^113^ oxoquinoline RBC label
C-B1081	SRT	Sodium iodide I^123^
C-B1082	SRT	Fibrinogen I^123^
C-B1083	SRT	Oleic acid I^125^
C-B1084	SRT	Iodinated I^125^ albumin
C-B1085	SRT	Rose Bengal sodium I^131^
C-B1086	SRT	Sodium iodide I^131^
C-B1087	SRT	Iodocholesterol I^131^
C-B1088	SRT	Iothalamate sodium I^125^
C-B1089	SRT	Iodinated I^131^ albumin
C-B1090	SRT	Iodinated I^131^ aggregated albumin
C-B1091	SRT	Iodohippurate I^131^ sodium
C-B1092	SRT	Diiodofluorecein I^131^
C-B1093	SRT	Iodinated I^125^ oleic acid and triolein
C-B1094	SRT	Iodinated I^125^ levothyroxine
C-B1095	SRT	Iodohippurate I^123^ sodium
C-B1096	SRT	Iodinated I^125^ povidone
C-B1097	SRT	Iodinated I^125^ Rose Bengal
C-B1098	SRT	Iodinated I^125^ sealed source
C-B1099	SRT	Iodinated I^125^ sodium iodine

Table 3-25b. Radionuclide Code Sequence Values (Baseline ID 25)

C-B1100	SRT	Iodinated I^125^ human serum albumin
C-B1105	SRT	Iodohippurate I^125^ sodium
C-B1108	SRT	Iofetamine I^123^ hydrochloride
C-B1109	SRT	Iodine^131^ polyvinylpyrrolidone
C-B1111	SRT	Iodinated I^131^ gamma globulin
C-B1121	SRT	Ferrous citrate Fe^59^
C-B1122	SRT	Ferrous chloride Fe^59^
C-B1123	SRT	Ferrous sulfate Fe^59^
C-B1124	SRT	Iron Fe^59^ labeled dextran
C-B1140	SRT	Chromic phosphate P^32^
C-B1142	SRT	Sodium phosphate P^32^
C-B1150	SRT	Potassium chloride K^43^
C-B1151	SRT	Potassium carbonate K^42^
C-B1152	SRT	Potassium chloride K^42^
C-B1171	SRT	Selenomethionione Se^75^
C-B1172	SRT	Selenium^75^ HCAT
C-B1175	SRT	Sodium chloride Na^24^
C-B1176	SRT	Sodium chloride Na^22^
C-B1180	SRT	Strontium chloride Sr^85^
C-B1181	SRT	Strontium chloride Sr^87^
C-B1182	SRT	Strontium nitrate Sr^85^
C-B1183	SRT	Strontium nitrate Sr^87^
C-B1200	SRT	Technetium Tc^99m^ aggregated albumin
C-B1203	SRT	Technetium Tc^99m^ microaggregated albumin
C-B1204	SRT	Technetium Tc^99m^ albumin colloid
C-B1205	SRT	Technetium Tc^99m^ albumin microspheres
C-B1206	SRT	Sodium pertechnetate Tc^99m^
C-B1207	SRT	Technetium Tc^99m^ disofenin
C-B1208	SRT	Technetium Tc^99m^ mebrofenin
C-B1209	SRT	Technetium Tc^99m^ lidofenin
C-B1210	SRT	Technetium Tc^99m^ iron ascorbate
C-B1211	SRT	Technetium Tc^99m^ stannous etidronate
C-B1212	SRT	Technetium Tc^99m^ medronate

Table 3-25b. Radionuclide Code Sequence Values (Baseline ID 25)

C-B1213	SRT	Technetium Tc^99m^ oxidronate
C-B1214	SRT	Technetium Tc^99m^ pentetate
C-B1215	SRT	Technetium Tc^99m^ pyro and polyphosphates
C-B1216	SRT	Technetium Tc^99m^ serum albumin
C-B1220	SRT	Technetium Tc^99m^ sodium glucoheptonate
C-B1221	SRT	Technetium Tc^99m^ succimer
C-B1222	SRT	Technetium Tc^99m^ sulfur colloid
C-B1223	SRT	Technetium Tc^99m^ exametazine
C-B1224	SRT	Technetium Tc^99m^ tagged red cells
C-B1225	SRT	Technetium Tc^99m^ N-substituted iminodiacetate
C-B1231	SRT	Thallous chloride Tl^201^
C-B1251	SRT	Pentetate calcium trisodium Yb^169^
C-B1300	SRT	Carbon^14^ triolein
C-B1302	SRT	Carbon^14^ D-xylose
C-B1304	SRT	Cholyl-carbon^14^ glycine
Y-X1743	99SDM	FDG -- fluorodeoxyglucose
Y-X1744	99SDM	FDOPA -- fluoroDOPA
Y-X1745	99SDM	F- -- Fluorine
Y-X1746	99SDM	NH3 -- Ammonia
Y-X1747	99SDM	H2O --water
Y-X1748	99SDM	O2 -- Oxygen
Y-X1749	99SDM	[150]CO -- carbon monoxide
Y-X1750	99SDM	[150]CO2 -- carbon dioxide
Y-X1751	99SDM	OAc -- Acetate
Y-X1752	99SDM	Palmitate
Y-X1753	99SDM	[11C]CO -- carbon monoxide
Y-X1754	99SDM	[11C]CO2 -- carbon dioxide
Y-X1755	99SDM	Rubidium cation
Y-X1756	99SDM	FluoroSpiperone
Y-X1757	99SDM	L-2-Fluorotyrosine
Y-X1758	99SDM	Misonidazole
Y-X1759	99SDM	[11C]Butanol

Table 3-25b. Radionuclide Code Sequence Values (Baseline ID 25)

Y-X1760	99SDM	Deoxyglucose
Y-X1761	99SDM	Glucose
Y-X1762	99SDM	Methionine
Y-X1763	99SDM	N-MethylSpiperone
Y-X1764	99SDM	Raclopride
Y-X1765	99SDM	Thymidine
Y-X1766	99SDM	L-1-Tyrosine
Y-X1767	99SDM	[15O]Butanol
Y-X1768	99SDM	EDTA
Y-X1769	99SDM	PTSM
PHRM-MIBI	CSMC-AIM	Technetium Tc^99m^ sestamibi
PHRM-TETRO	CSMC-AIM	Technetium Tc^99m^ tetrofosmin

3.5.8.5 Xeleris Private Isotope Module

This section contains Attributes that describe the isotope administered for the acquisition. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

Table 3-26. Xeleris Private Isotope Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Xeleris Energy Window Information Sequence	(0055,xx12)	3	GEMS_GENIE_1	The number of items in the Xeleris Energy Window sequence is the same as tag value of tag (0054,0011)
>Xeleris Energy Window Range Sequence	(0055,xx13)	3	GEMS_GENIE_1	May contain from 0 to 4 items.
>>Energy Offset	(0011,xx1C)	3	GEMS_GENIE_1	Energy window offset as a percentage of the energy peak.
>>Energy Range	(0011,xx1D)	3	GEMS_GENIE_1	The Defined Terms are: 0 = low energy range, X-series detector 1 = high energy range, X-series detector 2 = GE 511 Camera Range 3 = Unknown
>>AutoTrack Peak	(0013,xx16)	3	GEMS_GENIE_1	Optima AutoTrack energy peak.
>>AutoTrack Width	(0013,xx17)	3	GEMS_GENIE_1	Optima AutoTrack energy width.

3.5.8.6 NM Detector Module

This section contains IOD Attributes that describe Nuclear Medicine Detectors used to produce an image.

Table 3-27. NM Detector Module Attributes

Attribute Name	Tag	Type	Attribute Description
Detector Information Sequence	(0054,0022)	2	Sequence of Items that describe the detectors used. Zero or more Items may be included in this sequence. The number of items is equal to Number of Detectors (0054,0021).
> Collimator/Grid Name	(0018,1180)	3	Name of collimator used on this detector.
> Collimator Type	(0018,1181)	2C	Defined Terms used: PARA = Parallel PINH = Pinhole FANB = Fan-beam CONE = Cone-beam SLNT = Slant hole ASTG = Astigmatic DIVG = Diverging NONE = No collimator UNKN = Unknown

Table 3-27. NM Detector Module Attributes (Continued)

> Field of View Shape	(0018,1147)	3	Defined Terms used: RECTANGLE ROUND
> Field of View Dimension(s)	(0018,1149)	3	Dimensions of the field of view in mm.
> Focal Distance	(0018,1182)	2C	Focal distance in mm.
> X Focus Center	(0018,1183)	3	Center of focus along a row.
> Y Focus Center	(0018,1184)	3	Center of focus along a column.
> Zoom Center	(0028,0032)	3	The amount of offset from (0,0) applied to each pixel in the image before application of the zoom factor, specified by a numeric pair: row value (delimiter) column value (in mm).
> Zoom Factor	(0028,0031)	3	The amount of magnification applied to each pixel in the image, specified by a numeric pair: row value (delimiter) column value. Typical range: 1.00 to 4.00.
> Center of Rotation Offset	(0018,1145)	3	Offset between detector center and mechanical center
> Gantry/Detector Tilt	(0018,1120)	3	Angle of tilt in degrees of the detector.
> Distance Source to Detector	(0018,1110)	2C	Distance between transmission source and detector during transmission scanning.
> Start Angle	(0054,0200)	3	Position of the detector about the patient for the start of the acquisition, in degrees.
> Radial Position	(0018,1142)	3	Radial distance of the detector from the center of rotation, in mm.
> Image Orientation (Patient)	(0020,0037)	2	The direction cosines of the first row and the first column with respect to the patient. Set for first frame in dataset.
> Image Position (Patient)	(0020,0032)	2	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the image, in mm. Set for first frame in dataset
> View Code Sequence	(0054,0220)	3	Sequence that describes the projection of the anatomic region of interest on the image receptor. Zero or 1 item may exist.
> Code Value	(0008,0100)	1C	See Table 3-27a
> Code Scheme Designator	(0008,0102)	1C	See Table 3-27a
> Code Meaning	(0008,0104)	3	See Table 3-27a

Table 3-27a. View Code Sequence Values (Baseline ID 26)

Code Value	Coding Scheme Designator	Code Meaning
G-5206	SRT	Right anterior oblique
G-5207	SRT	Left anterior oblique
G-5208	SRT	Right posterior oblique
G-5209	SRT	Left posterior oblique
G-5210	SRT	Oblique axial
G-5212	SRT	Sagittal-oblique axial
G-5215	SRT	Anterior projection
G-5216	SRT	Posterior projection
G-5220	SRT	Medial-lateral
G-5221	SRT	Lateral-medial
G-5222	SRT	Right lateral projection
G-5223	SRT	Left lateral projection
G-5224	SRT	Medial-lateral oblique
G-5225	SRT	Latero-medial oblique
G-A104	SRT	Lateral
G-A117	SRT	Transverse
G-A138	SRT	Coronal
G-A145	SRT	Sagittal
G-A147	SRT	Axial
G-A186	SRT	Short Axis
G-A18A	SRT	Vertical Long Axis
G-A18B	SRT	Horizontal Long Axis

3.5.8.7 Xeleris Private Detector Module

This section contains Attributes that describe Nuclear Medicine Detectors used to produce an image. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

Table 3-28. Xeleris Private Detector Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Xeleris Detector Information Sequence	(0055,xx22)	3	GEMS_GENIE_1	Xeleris detector information. May contain one or more items.
>Use FOV Mask	(0011,xx23)	3	GEMS_GENIE_1	Whether FOV mask used during image acquisition. The Defined Terms are: 0 = no mask used 1 = FOV mask used
>FOV Mask Y Cutoff Distance	(0011,xx24)	3	GEMS_GENIE_1	Hexagonal FOV mask Y cutoff angle.
>FOV Mask Cutoff Angle	(0011,xx25)	3	GEMS_GENIE_1	Hexagonal FOV mask cutoff angle.
>Uniformity Mean	(0011,xx29)	3	GEMS_GENIE_1	Uniformity Mean value
>FOV Shape	(0011,xx3E)	3	GEMS_GENIE_1	GEHC NM system detector type. The Defined Terms are: 1 = 400AC 6 = Optima 7 = MAXXUS 8 = Millennium MPS 9 = Millennium MPR 10 = Millennium MG 12 = Other 13 = VARICAM 14 = DST 21 = Optima V3.0 22 = MAXXUS V3.0 23 = Millennium MPS V3.0 24= Millennium MPR V3.0 25 = Millennium MG V3.0 27 = Discovery NM530c
>Transmission Scan Time	(0013,xx18)	3	GEMS_GENIE_1	Attenuation correction transmission scan duration.
>Transmission Mask Width	(0013,xx19)	3	GEMS_GENIE_1	Attenuation correction transmission scan mask width.
>Copper Attenuator Thickness	(0013,xx1A)	3	GEMS_GENIE_1	Thickness of transmission scan copper attenuator.
>Tomo View Offset	(0013,xx1E)	3	GEMS_GENIE_1	Tomo view detector offset (vector)
>Start Angle	(0035,xx01)	3	GEMS_GENIE_1	Detector start angle

3.5.8.8 NM TOMO Module

This section contains Attributes that describe Rotation information of a tomographic image performed on the patient. This module is present when the Image Type (0008,0008) Value 3, is equal to TOMO, GATED TOMO, RECON TOMO or RECON GATED TOMO.

Table 3-29. NM TOMO Module Attributes

Attribute Name	Tag	Type	Attribute Description
Rotation Information Sequence	(0054,0052)	2	Provides TOMO rotation information. Zero or more Items may be included in this sequence.
> Start Angle	(0054,0200)	1	Detector start angle at start of acquisition.
> Angular Step	(0018,1144)	1	Incremental rotational angle change per view.
> Rotation Direction	(0018,1140)	1	Direction of rotation of the detector about the patient. Enumerated Values: CW = clockwise (decreasing angle) CC = counter-clockwise (increasing angle).
> Scan Arc	(0018,1143)	1	The effective angular range of the scan data in degrees.
> Actual Frame Duration	(0018,1242)	1	Nominal acquisition time per angular position, in msec.
> Radial Position	(0018,1142)	3	Radial distance of the detector from the center of rotation, in mm. Xeleris inserts a single value which is an average value for this rotation.
> Distance Source to Detector	(0018,1110)	2C	Distance between transmission source and detector during transmission scanning.
> Number of Frames in Rotation	(0054,0053)	1	Number of angular views in this rotation.
> Table Traverse	(0018,1131)	3	Table longitudinal position at acquisition start.
> Table Height	(0018,1130)	3	Height of table above floor at acquisition start.
Type of Detector Motion	(0054,0202)	3	Enumerated Values used: STEP AND SHOOT (Used as Default for data arrived to Xeleris without this attribute or with empty value) CONTINUOUS ACQ DURING STEP

3.5.8.9 Xeleris Private TOMO Acquisition Module

This section contains Attributes that describe Rotation information of a tomographic acquisition image performed on the patient. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. Note that only one rotation is provided for in Xeleris acquisition data.

Table 3-30. Xeleris Private TOMO Acquisition Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Rotational Continuous Speed	(0009,xx33)	3	GEMS_GENIE_1	Rotational Continuous Speed
Gantry Locus Type	(0009,xx35)	3	GEMS_GENIE_1	Locus type of gantry motion during acquisition. The Defined Terms are: 0 = circular 1 = elliptical
Num ECT Phases	(0015,xx12)	3	GEMS_GENIE_1	Number of ECT Phases
Num WB Scans	(0015,xx13)	3	GEMS_GENIE_1	Number of WB Scans
Det Ang Separation	(0013,xx1B)	3	GEMS_GENIE_1	Detector Ang Separation
Xeleris Rotation Information Sequence	(0055,xx52)	3	GEMS_GENIE_1	May contain one or more items.
>ECT Phase Num	(0015,xx14)	3	GEMS_GENIE_1	ECT Phase Number
>WB Scan Num	(0015,xx15)	3	GEMS_GENIE_1	WB Scan Number
>Comb Head Number	(0015,xx16)	3	GEMS_GENIE_1	Comb Head Number
>Axial Acceptance Angle	(0013,xx1C)	3	GEMS_GENIE_1	Axial Acceptance Angle
>Theta Acceptance Value	(0013,xx1D)	3	GEMS_GENIE_1	Theta Acceptance Value

3.5.8.10 NM Multi-Gated Acquisition Module

This section contains Attributes that describe a multi-gated acquisition performed on the patient. This refers to frames acquired while the patient is connected to a gating device. This module is present when the Image Type (0008,0008) Value 3, is equal to GATED or GATED TOMO.

Table 3-31. NM Multi-Gated Acquisition Module Attributes

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	3	Whether a bad beat rejection algorithm used. Enumerated values: Y = bad beat rejection algorithm used N = bad beat rejection algorithm NOT used
Skip Beats	(0018,1086)	3	Beats skipped for each rejected beat
Heart Rate	(0018,1088)	3	Average heart rate during acquisition.
Gated Information Sequence	(0054,0062)	2C	Sequence of Items that describe R-R intervals. Zero or more Items may be included in this sequence.
> Data Information Sequence	(0054,0063)	2C	Sequence of Items that describe gating criteria. Zero or more Items may be included in this sequence.
>> Frame Time	(0018,1063)	1	Nominal time per individual frame in msec.
>> Low R-R Value	(0018,1081)	3	Minimum R-R interval value accepted.
>> High R-R Value	(0018,1082)	3	Maximum R-R interval value accepted.
>> Intervals Acquired	(0018,1083)	3	Number of accepted intervals.
>> Intervals Rejected	(0018,1084)	3	Number of rejected intervals.
>> Time Slot Information Sequence	(0054,0072)	2C	Sequence of Items that describe Time Slot Information. Zero or more Items may be included in this sequence.
>>> Time Slot Time	(0054,0073)	3	The total amount of time, in msec, that the acquisition accumulates gamma events into this frame.

3.5.8.11 Xeleris Private Multi-Gated Acquisition Module

This section contains Attributes that describe a multi-gated acquisition performed on the patient. This refers to frames acquired while the patient is connected to a gating device. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

Table 3-32. Xeleris Private Multi-Gated Acquisition Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Starting Heart Rate	(0009,xx37)	3	GEMS_GENIE_1	Heart rate at start of acquisition.
Track Beat Average	(0009,xx2D)	3	GEMS_GENIE_1	Heart rate tracking used during acquisition.
Percent Cycle Imaged	(0009,xx3A)	3	GEMS_GENIE_1	Percent Cycle Imaged
Preceding Beat	(0015,xx17)	3	GEMS_GENIE_1	Preceding Beat
Series AverageHeartRate	(0017,xx01)	3	GEMS_XELPRV_01	Series Average Heart Rate
Image AverageHeartRate	(0017,xx02)	3	GEMS_XELPRV_01	Image Average Heart Rate
Series AcceptedBeats	(0017,xx03)	3	GEMS_XELPRV_01	Series Accepted Beats
Image AcceptedBeats	(0017,xx04)	3	GEMS_XELPRV_01	Image Accepted Beats
Series RejectedBeats	(0017,xx05)	3	GEMS_XELPRV_01	Series Rejected Beats
Image RejectedBeats	(0017,xx06)	3	GEMS_XELPRV_01	Image Rejected Beats
Xeleris Gated Information Sequence	(0055,xx62)	3	GEMS_GENIE_1	May contain 0 or more items.
>Xeleris Data Information Sequence	(0055,xx63)	3	GEMS_GENIE_1	May contain 0 or more items.
>>RR Window Width	(0009,xx38)	3	GEMS_GENIE_1	Width of RR acceptance window as percentage of rate.
>>RR Window Offset	(0009,xx39)	3	GEMS_GENIE_1	Offset of RR acceptance window as percentage of rate.
>>Accepted Beat Time	(0013,xx20)	3	GEMS_GENIE_1	Accepted Beat Time

3.5.8.12 NM Phase Module

This section contains Attributes that describe dynamic phases of a dynamic acquisition image performed on the patient. This module is present when the Image Type (0008,0008) Value 3, is equal to DYNAMIC.

Table 3-33. NM Phase Module Attributes

Attribute Name	Tag	Type	Attribute Description
Phase Information Sequence	(0054,0032)	2	One sequence item per dynamic phase. Zero or more Items (up to 4) may be included in this sequence.
> Phase Delay	(0054,0036)	1	Time paused between the last frame of the previous phase and the first frame of this phase, in msec.
> Actual Frame Duration	(0018,1242)	1	Nominal time of acquisition per individual frame, in msec. (same for all frames in this phase).

Table 3-33. NM Phase Module Attributes

> Pause Between Frames	(0054,0038)	1	Time paused between each frame of this phase (in msec).
> Number of Frames in Phase	(0054,0033)	1	Number of frames in this phase.
>Trigger Vector	(0054,0210)	3	An array of trigger times when gating information is acquired simultaneously with the dynamic image data.
>Number of Triggers in Phase	(0054,0211)	1C	The number of entries in the Trigger Vector (0054,0210) for this phase.

3.5.8.13 NM Reconstruction Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO**.**

Table 3-34. NM Reconstruction Module Attributes

Attribute Name	Tag	Type	Attribute Description
Spacing Between Slices	(0018,0088)	2	Spacing between slices, in mm, measured from center-to-center of each slice along the normal to the first image.
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.
Slice Progression Direction	(0054,0500)	3	Describes the anatomical direction that slices are progressing as the slices are considered in order (as defined by the Slice Vector (0054,0080)). Meaningful only for cardiac images. When View Code Sequence (0054,0220) indicates a short axis view, then Enumerated Values are: APEX_TO_BASE BASE_TO_APEX

3.5.8.14 Xeleris Private SPECT Reconstruction Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO**.** This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. Note that each of these attributes may have multiple values when gated reconstructed data is combined into a single DICOM dataset.

Table 3-35. Xeleris Private SPECT Reconstruction Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Image Size	(0011,xx61)	3	GEMS_GENIE_1	Image Size
Linear FOV	(0011,xx62)	3	GEMS_GENIE_1	Linear FOV
Spatial Offset	(0011,xx63)	3	GEMS_GENIE_1	Spatial Offset
Spatial Orientation	(0011,xx64)	3	GEMS_GENIE_1	Spatial Orientation
ReferenceDatasetUID	(0011,xx65)	3	GEMS_GENIE_1	Reference Dataset UID
Starcam Reference Dataset	(0011,xx66)	3	GEMS_GENIE_1	Starcam Reference Dataset
Reference Frame Number	(0011,xx67)	3	GEMS_GENIE_1	Reference Frame Number
Cursor Length	(0011,xx68)	3	GEMS_GENIE_1	Cursor Length
Number of Cursors	(0011,xx69)	3	GEMS_GENIE_1	Number of Cursors
Cursor Coordinates	(0011,xx6A)	3	GEMS_GENIE_1	Cursor Coordinates
Recon Options Flag	(0011,xx6B)	3	GEMS_GENIE_1	Recon Options Flag

Table 3-35. Xeleris Private SPECT Reconstruction Module Attributes

Motion Threshold	(0011,xx6C)	3	GEMS_GENIE_1	Motion Threshold
Motion Curve UID	(0011,xx6D)	3	GEMS_GENIE_1	Motion Curve UID
UnifDateTime	(0013,xx23)	3	GEMS_GENIE_1	Unif Date Time

3.5.8.15 Xeleris Private SPECT Backprojection Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO**.** This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. Note that each of these attributes may have multiple values when gated reconstructed data is combined into a single DICOM dataset.

Table 3-36. Xeleris Private SPECT Backprojection Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Name
Recon Type	(0011,xx6E)	3	GEMS_GENIE_1	Recon Type
Pre Filter Type	(0011,xx6F)	3	GEMS_GENIE_1	Pre Filter Type
Back Proj Filter Type	(0011,xx71)	3	GEMS_GENIE_1	Back Proj Filter Type
Recon Arc	(0011,xx72)	3	GEMS_GENIE_1	Recon Arc
Recon Pan AP Offset	(0011,xx73)	3	GEMS_GENIE_1	Recon Pan AP Offset
Recon Pan LR Offset	(0011,xx74)	3	GEMS_GENIE_1	Recon Pan LR Offset
Recon Area	(0011,xx75)	3	GEMS_GENIE_1	Recon Area
Start View	(0011,xx76)	3	GEMS_GENIE_1	Start View
Attenuation Type	(0011,xx77)	3	GEMS_GENIE_1	Attenuation Type
Dual Energy Processing	(0011,xx78)	3	GEMS_GENIE_1	Dual Energy Processing
Pre Filter Param	(0011,xx79)	3	GEMS_GENIE_1	Pre Filter Param
Pre Filter Param 2	(0011,xx7A)	3	GEMS_GENIE_1	Pre Filter Param 2
BackProjFilterParam	(0011,xx7B)	3	GEMS_GENIE_1	Back Proj Filter Param
Back Proj Filter Param 2	(0011,xx7C)	3	GEMS_GENIE_1	Back Proj Filter Param 2
Attenuation Coef	(0011,xx7D)	3	GEMS_GENIE_1	Attenuation Coef
Ref Slice Width	(0011,xx7E)	3	GEMS_GENIE_1	Ref Slice Width
Ref Trans Pixel Volume	(0011,xx7F)	3	GEMS_GENIE_1	Ref Trans Pixel Volume
Attenuation Threshold	(0011,xx81)	3	GEMS_GENIE_1	Attenuation Threshold
Interpolation Distance	(0011,xx82)	3	GEMS_GENIE_1	Interpolation Distance
Interpolation Center X	(0011,xx83)	3	GEMS_GENIE_1	Interpolation Center X
Interpolation Center Y	(0011,xx84)	3	GEMS_GENIE_1	Interpolation Center Y

Table 3-36. Xeleris Private SPECT Backprojection Module Attributes

Quant Filter Flag	(0011,xx85)	3	GEMS_GENIE_1	Quant Filter Flag
Head Conversion	(0011,xx86)	3	GEMS_GENIE_1	Head Conversion
Slice Width Pixels	(0013,xx87)	3	GEMS_GENIE_1	Slice Width Pixels

3.5.8.16 Xeleris Private SPECT Oblique Reformat Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008) Value 3, is equal to RECON TOMO or RECON GATED TOMO**.** Note that each of these attributes may have multiple values when gated reconstructed data is combined into a single DICOM dataset.

Table 3-37. Xeleris Private SPECT Oblique Reformat Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Name
Rfmtr Trans Ref	(0011,xx88)	3	GEMS_GENIE_1	Rfmtr Trans Ref
Rfmtr Trans Ref mm	(0011,xx89)	3	GEMS_GENIE_1	Rfmtr Trans Ref mm
Two Line Trans Ref	(0011,xx8A)	3	GEMS_GENIE_1	Two Line Trans Ref
Three–D Zero	(0011,xx8B)	3	GEMS_GENIE_1	Three–D Zero
Three–D Zero Length	(0011,xx8C)	3	GEMS_GENIE_1	Three–D Zero Length
Three–D Zero In	(0011,xx8D)	3	GEMS_GENIE_1	Three–D Zero In
Threshold	(0013,xx21)	3	GEMS_GENIE_1	Threshold
LinearDepth	(0013,xx22)	3	GEMS_GENIE_1	Linear Depth

SECTION 4
PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

4.1 INTRODUCTION

This section specifies the use of the DICOM Patient Root Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

4.2 PATIENT ROOT INFORMATION MODEL DESCRIPTION

The Patient Root Query/Retrieve Information Model is based upon a four level hierarchy:

-1 Patient
-2 Study
-3 Series
-4 Image

The patient level is the top level and contains Attributes associated with the Patient Information Entity (IE) of Image IODs. Patient IEs are modality independent.

The study level is below the patient level and contains Attributes associated with the Study IE of Image IODs. A study belongs to a single patient. A single patient may have multiple studies. Study IEs are modality independent.

The series level is below the study level and contains Attributes associated with the Series, Frame of Reference and Equipment IEs of Image IODs. A series belongs to a single study. A single study may have multiple series. Series IEs are modality dependent.

The lowest level is the image level and contains Attributes associated with the Image IE of Image IODs. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent.

4.3 PATIENT ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Patient Root Information Model schema is shown in Illustration 4-1. In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has one Patient for each Study (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

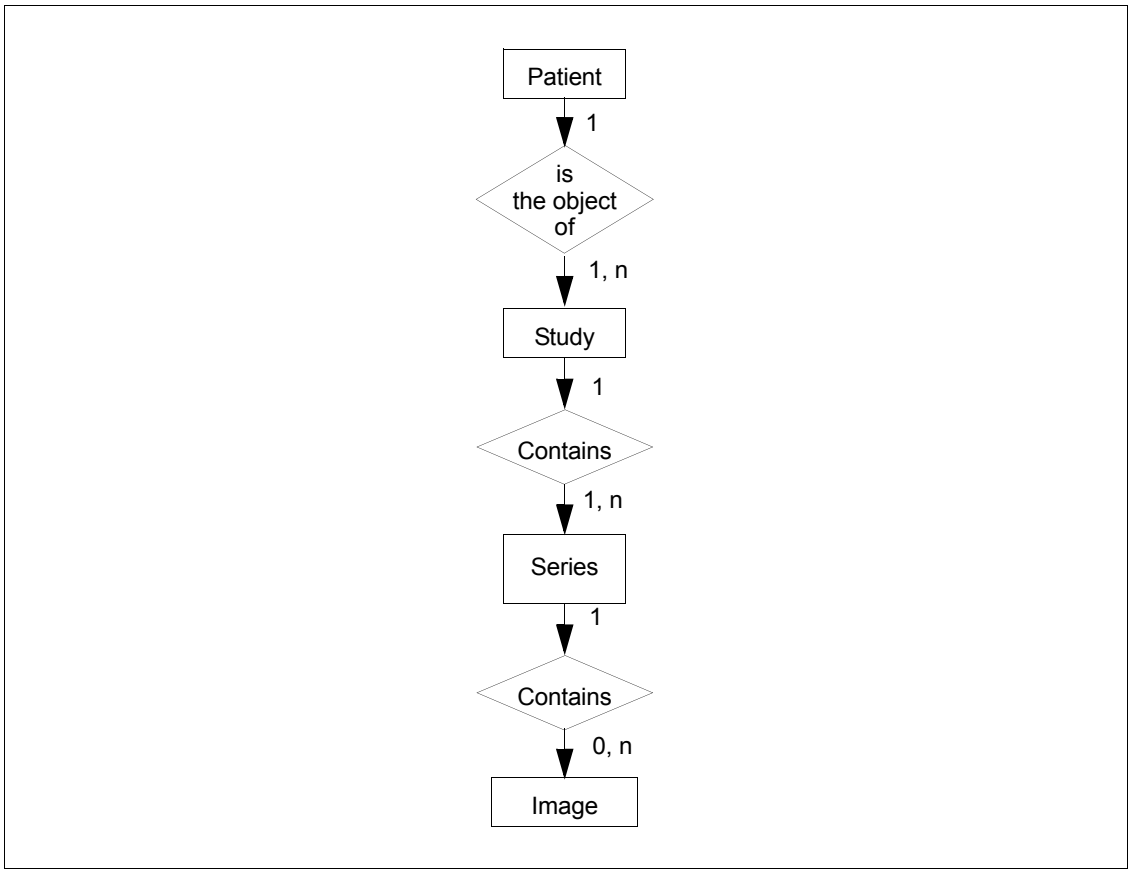

Illustration 4-1. Patient Root Query/Retrieve Information Model E/R Diagram

4.3.1 Entity Descriptions

Please refer to the DICOM v3.0 Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model.

4.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

4.3.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

4.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

4.3.1.4 Image Entity Description

The Image Entity defines the attributes which describe the pixel data of an image. The pixel data is generated as a direct result of patient scanning (an Original image). An image is defined by its image plane, pixel data characteristics gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

4.3.2 Xeleris Acquisition Mapping of DICOM Entities

Table 4-1. Mapping of DICOM Entities to Xeleris Entities

DICOM	Xeleris Entity
Patient	Patient
Study	Study
Series	Series
Image	Dataset

4.4 INFORMATION MODEL KEYS

Please refer to the DICOM v3.0 Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model.

The following Level descriptions are included to specify which data elements are supported and what type of filtering can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

4.4.1 Supported Filtering

Following are the types of matching that are supported by SCP in this implementation:

-1 Single Value matching
-2 Wild Card Matching
-3 Range of date, Range of Time
Note that Patient Root Query/Retrieve Information Model is not supported by SCU

4.4.2 Patient Level

This section defines the keys at the Patient Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

Table 4-2. Patient Level Attributes for the Patient Root Query/Retrieve Information Model

Attribute Name	Tag	Type	SCP Use
Patient's Name	(0010,0010)	R	Matched. Matching performed without regard to the PN VR individual component values. Wild Card Value matching is supported.
Patient ID	(0010,0020)	U	Matched. Single Value matching is supported.

Table 4-3. Patient Level and Location for the Retrieve Attributes

Attribute Name	Tag	Type	SCP Use
Query Retrieve Level	(0008,0052)	-	Value = PATIENT

4.4.3 Study Level

This section defines the keys at the Study Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

Table 4-4. Study Level Attributes for the Patient Room Query/Retrieve Information Model

Attribute Name	Tag	Type	SCP Use
Study Date	(0008,0020)	R	Matched. Range of date matching is supported
Study Time	(0008,0030)	R	Returned.
Accession Number	(0008,0050)	R	Matched. Single Value and Wildcard Value matching is supported.
Study ID	(0020,0010)	R	Matched. Single Value and Wildcard Value matching is supported.
Study Instance UID	(0020,000D)	U	Matched. Single Value matching is supported.
Study Description	(0008,1030)	O	Matched. Single Value and Wildcard Value Matching are supported.

Table 4-5. Q/R Study Level and Location for Retrieve Attributes

Attribute Name	Tag	Type	SCP Use
Query Retrieve Level	(0008,0052)	-	Value = STUDY

4.4.4 Series Level

This section defines the keys at the Series Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

Table 4-6. Series Level Attributes for the Patient Root Query/Retrieve Information Model

Attribute Name	Tag	Type	SCP Use
Modality	(0008,0060)	R	Matched. Single Value Matching is supported.
Series Number	(0020,0011)	R	Matched. Single Value Matching is supported.
Series Instance UID	(0020,000E)	U	Matched. Single Value Matching is supported.
Series Date	(0008,0021)	O	Returned.
Series Time	(0008,0031)	O	Returned.
Series Description	(0008,103E)	O	Returned.

Table 4-7. Q/R Series Level and Location for Retrieve Attributes

Attribute Name	Tag	Type	SCP Use
Query Retrieve Level	(0008,0052)	-	Value = SERIES

4.4.5 Image Level

This section defines the keys at the Image Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

Table 4-8. Image Level Attributes for the Patient Root Query/Retrieve Information Model

Attribute Name	Tag	Type	SCP Use
Image Number	(0020,0013)	R	Matched. Single Value Matching is supported.
SOP Instance UID	(0008,0018)	U	Matched. Single Value Matching is supported.
Image Type	(0008,0008)	O	Returned.
Image ID	(0054,0400)	O	Returned.
Rows	(0028,0010)	O	Returned.
Columns	(0028,0011)	O	Returned.
Number of Frames	(0028,0008)	O	Returned.

Table 4-9. Q/R Image Level and Location for Retrieve Attributes

Attribute Name	Tag	Type	SCP Use
Query Retrieve Level	(0008,0052)	-	Value = IMAGE

SECTION 5
STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

5.1 INTRODUCTION

This section specifies the use of the DICOM Study Root Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

5.2 STUDY ROOT INFORMATION MODEL DESCRIPTION

The Study Root Query/Retrieve Information Model is based upon a three level hierarchy:

-1 Study
-2 Series
-3 Image

The study level is the top level and contains Attributes associated the Study IE of Image IODs. Attributes of patients are considered to be attributes of studies. Study IEs are modality independent.

The series level is below the study level and contains Attributes associated with the Series, Frame of Reference and Equipment IEs of Image IODs. A series belongs to a single study. A single study may have multiple series. Series IEs are modality dependent.

The lowest level is the image level and contains Attributes associated with the Image IE of Image IODs. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent.

5.3 STUDY ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Study Root Information Model schema is shown in Illustration 5-1. In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series.

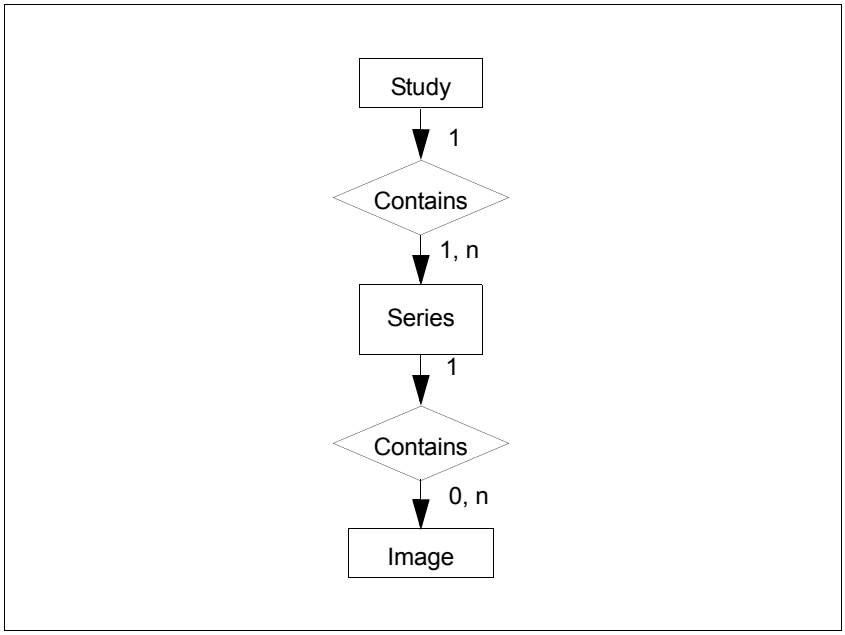

Illustration 5-1. Study Root Query/Retrieve Information Model, E/R Diagram

5.3.1 Entity Description

Please refer to the DICOM v3.0 Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model.

5.3.1.1 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

5.3.1.2 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

5.3.1.3 Image Entity Description

The Image Entity defines the attributes which describe the pixel data of an image. The pixel data is generated as a direct result of patient scanning (an Original image). An image is defined by its image plane, pixel data characteristics gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

5.3.2 Xeleris Mapping of DICOM Entities

Table 5-1. Mapping of DICOM entities to Xeleris Entities

DICOM	Xeleris Entity
Study	Study
Series	Series
Image	Dataset

5.4 INFORMATION MODEL KEYS

Please refer to the DICOM v3.0 Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model.

The following Level descriptions are included to specify what data elements are supported and what type of filtering can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

5.4.1 Supported Filtering

Following are the types of matching that are supported by SCP and may be defined by SCU in this implementation:

- 1 Single Value matching
- 2 Wild Card Matching
- 3 Range of date, Range of Time

5.4.2 Study Level

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

Table 5-2. Study Level Attributes for the Root Query/Retrieve Information Model

Attribute Name	Tag	Type	SCU Use	SCP Use
Study Date	(0008,0020)	R	Matching Key. Range Date matching is available.	Matched. Range of date Matching is supported.
Study Time	(0008,0030)	R	Requested.	Returned.
Accession Number	(0008,0050)	R	Matching key. Single Value or Wildcard Value may be used.	Matched. Single Value and Wildcard Value Matching are supported.
Patient's Name	(0010,0010)	R	Matching key. Wildcard Value may be used.	Matched. Matching performed without regard to the PN VR individual component values. Wildcard Value matching is supported.
Patient ID	(0010,0020)	R	Matching key. Single Value may be used.	Matched. Single Value Matching is supported.
Study ID	(0020,0010)	R	Matching key. Single Value or Wildcard Value may be used.	Matched. Single Value and Wildcard Value Matching are supported.
Study Instance UID	(0020,000D)	U	Requested.	Matched. Single Value Matching is supported.
Study Description	(0008,1030)	O	Matching key. Single Value or Wildcard Value may be used.	Matched. Single Value and Wildcard Value Matching are supported..
Modalities in Study	(0008,0061)	R	Matching Key. Possible query values: "NM", "PT", "CT", "MR","*"	Matched. Single Value and Wildcard Value Matching are supported.

Table 5-3. Q/R Study Level and Location for Retrieve Attributes

Attribute Name	Tag	Type	SCU/SCP Use
Query Retrieve Level	(0008,0052)	-	Value = STUDY

5.4.3 Series Level

This section defines the keys at the Series Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

Table 5-4. Series Level Attributes for the Root Query/Retrieve Information Model

Attribute Name	Tag	Type	SCU Use	SCP Use
Modality	(0008,0060)	R	Requested	Matched. Single Value and Wildcard Value Matching are supported.

Table 5-4. Series Level Attributes for the Root Query/Retrieve Information Model

Series Number	(0020,0011)	R	Requested	Matched. Single Value Matching is supported.
Series Instance UID	(0020,000E)	U	Requested	Matched. Single Value Matching is supported.
Series Date	(0008,0021)	O	Requested	Returned.
Series Time	(0008,0031)	O	Requested	Returned.
Series Description	(0008,103E)	O	Requested	Returned.
Study Instance UID	(0020,000D)	U	Unique key. Single value is used in request.	Returned. Single Key Matching is used.

Table 5-5. Q/R Series Level and Location for Retrieve Attributes

Attribute Name	Tag	Type	SCU/SCP Use
Query Retrieve Level	(0008,0052)	-	Value = SERIES

5.4.4 Image Level

This section defines the keys at the Image Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

Table 5-6. Image Level Attributes for the Root Query/Retrieve Information Model

Attribute Name	Tag	Type	SCU Use	SCP Use
Image Number	(0020,0013)	R	Requested	Matched. Single Value Matching is supported.
SOP Instance UID	(0008,0018)	U	Requested	Matched. Single Value Matching is supported.
Image ID	(0054,0400)	O	Requested	Returned.
Rows	(0028,0010)	O	Requested	Returned.
Columns	(0028,0011)	O	Requested	Returned.
Number of Frames	(0028,0008)	O	Requested	Returned.
Series Instance UID	(0020,000E)	U	Unique key. Single value is used in request.	Returned. Single Key Matching is used.

Table 5-7. Q/R Image Level and Location for Retrieve Attributes

Attribute Name	Tag	Type	SCU/SCP Use
Query Retrieve Level	(0008,0052)	-	Value = IMAGE

SECTION 6
SC INFORMATION OBJECT IMPLEMENTATION

6.1 INTRODUCTION

This section specifies the use of the DICOM SC Image IOD to represent the information included in SC images produced by this implementation. SC Object attributes are conveyed using the module construct. The contents of this section are:

6.2 SC IOD IMPLEMENTATION

Screen Save images created on the Xeleris system are sent as DICOM Secondary Capture images and Multi-frame Secondary Capture images.

The following secondary captures IODs are supported:

- Single frame secondary Capture Image IOD
- Multi-frame Grayscale Byte Secondary Capture Image IOD
- Multi-frame True Color Secondary Capture Image IOD

6.3 SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 6-1 In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box.
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. For example, the relationship between Series and SC Image can have up to n SC Images per Series, but the SC Image can only belong to 1 Series.

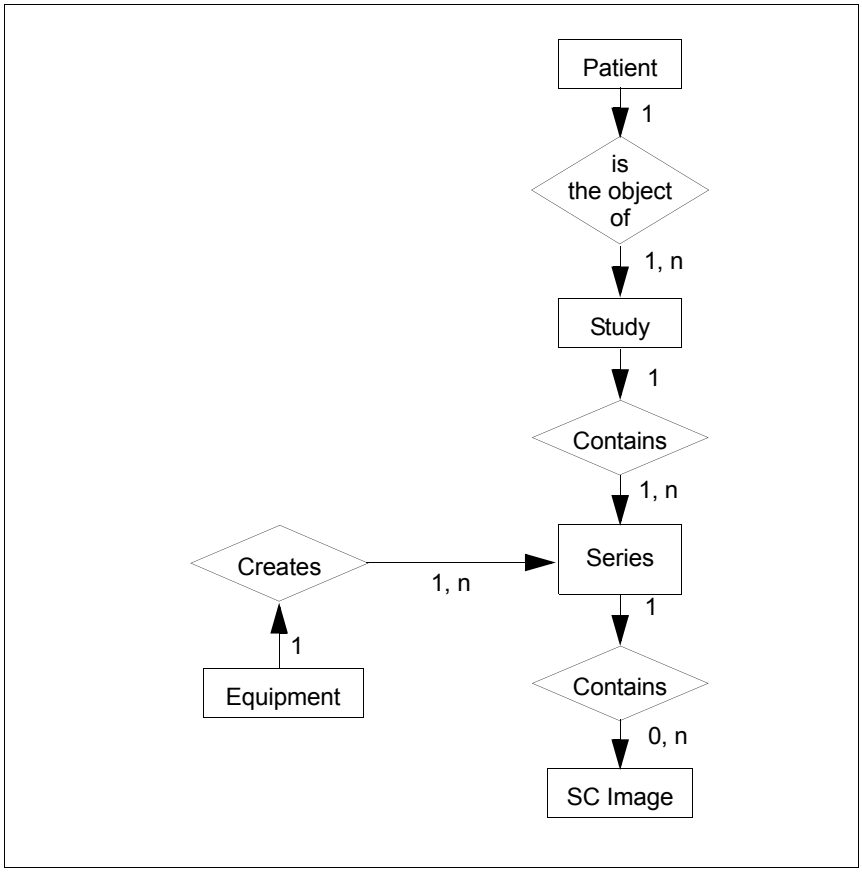

Illustration 6-1. SC Image Entity Relationship Diagram

6.3.1 Entity Descriptions

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the SC Information Object.

6.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

6.3.1.2 Study Entity Description

The Study Entity describes the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

6.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

6.3.1.4 Equipment Entity Description

The Equipment Entity describes the particular imaging device which produced the series of images. An imaging device may produce one or more series within a study. The Equipment Entity does not describe the data acquisition or image creation Attributes used to generate images within a series.

6.3.1.5 SC Image Entity Description

The SC Image Entity defines the attributes which describe the pixel data of a Secondary Capture image. The pixel data is derived from an original image through image processing steps (a DERIVED image). An image is defined by its image plane, pixel data characteristics, gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

6.3.2 Xeleris Mapping of DICOM Entities

Table 6-1. Mapping DICOM Entities to Xeleris Entities

DICOM	Xeleris Entity
Patient	Patient
Study	Study
Series	Series
Image	Dataset

6.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 SC IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into DICOM datasets.

Table 6-2 identifies the defined modules within the entities which comprise the DICOM v3.0 SC IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

Table 6-2. SC Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	Section 3.5.1.1	
	Xeleris Patient	Section 3.5.1.2	
Study	General Study	Section 3.5.2.1	
	Patient Study	Section 3.5.2.2	
	Xeleris Study	Section 3.5.2.3	
Series	General Series	Section 6.5.1.1	
	Xeleris Private SC Series	Section 6.5.4.3	
Equipment	General Equipment	Section 3.5.5.1	
	SC Equipment	Section 6.5.4.1	
Image	General Image	Section 6.5.2.1	
	Xeleris SC Image	Section 6.5.4.4	
	Image Pixel	Section 6.5.2.2	
	Xeleris SC Image Pixel	Section 6.5.4.5	For SC IOD only.
	SC Image	Section 6.5.4.2	For SC IOD only.
	SOP Common	Section 6.5.3.1	
	Cine	Section 6.5.2.3	For MFSC IOD only.
	Multi-Frame	Section 6.5.2.4	For MFSC IOD only.
	SC Multi-Frame Image	Section 6.5.4.6	For MFSC IOD only.
	SC Multi-Frame Vector	Section 6.5.4.7	For MFSC IOD only.
	4DM SPECT Result Private Module	Section 6.5.4.8	For SC IOD only.

6.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the SC Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Attributes from the DICOM Standard modules are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

6.5.1 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

6.5.1.1 General Series Module

This section specifies the Attributes which identify and describe general information about the SC Series within a Study.

Table 6-3. General Series Module Attributes

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	For specification, see SC Equipment Module (Section 6.5.4.1)
Series Instance UID	(0020,000E)	1	Unique identifier of the Series. Internally Generated.
Series Number	(0020,0011)	2	Series Number
Laterality	(0020,0060)	2C	Laterality. Always ZERO-LENGTH value.
Series Date	(0008,0021)	3	Date the Series started.
Series Time	(0008,0031)	3	Time the Series started.
Protocol Name	(0018,1030)	3	User-defined description of the conditions under which the Series was performed.
Series Description	(0008,103E)	3	Description of the Series.
Operators' Name	(0008,1070)	3	Name(s) of the operator(s) supporting the Series.
Body Part Examined	(0018,0015)	3	Body Part Examined
Patient Position	(0018,5100)	2C	Patient position descriptor relative to the equipment. Always ZERO-LENGTH value.
Request Attributes Sequence	(0040,0275	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items.
>Requested Procedure ID	(0040,1001)	3	Identifier that identifies the Requested Procedure in the Imaging Service Request. Required if procedure was scheduled. May be present otherwise.

Table 6-3. General Series Module Attributes (Continued)

>Scheduled Procedure Step ID	(0040,0009)	1C	Identifier that identifies the Scheduled Procedure Step. Required if procedure was scheduled.
>Scheduled Procedure Step Description	(0040,0007)	1C	Institution-generated description or classification of the Scheduled Procedure Step to be performed.
Performed Procedure Step ID	(0040,0253)	3	User or equipment generated identifier of that part of a Procedure that has been carried out within this step. Not sent for SC and MFSC Images, created by Xeleris.

6.5.2 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

6.5.2.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

Table 6-4. General Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	A number that identifies this image.
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. Always sent as ZERO LENGTH.
Content Date	(0008,0023)	2C	The date the image pixel data creation started. Set for MFSC IOD only.
Content Time	(0008,0033)	2C	The time the image pixel data creation started. Set for MFSC IOD only.
Image Type	(0008,0008)	3	See Image Type, Section 6.5.2.1.1
Acquisition Date	(0008,0022)	3	The date the creation of data that resulted in this image started.
Acquisition Time	(0008,0032)	3	The time the creation of data that resulted in this image started.
Derivation Description	(0008,2111)	3	A text description of how this image was derived. Composed of two parts separated by “$$”. First part is specific description generated by user and the second part is a description of the nature of the results and/or processing that generated the secondary capture object.
Image Comments	(0020,4000)	3	User-defined comments about the image.

Table 6-4. General Image Module Attributes

Burned In Annotation	(0028, 0301)	3	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired. Enumerated Values: YES NO

6.5.2.1.1 General Image Attribute Description

Image Type

Value 1 shall have the following Enumerated Value:
-1 DERIVED – identifies a Derived Image

Value 2 shall have the following Enumerated Value:
-2 SECONDARY – identifies a Secondary Image

6.5.2.2 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

Table 6-5. Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1 for MONOCHROME2, 3 for RGB
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. Defined Terms: MONOCHROME2 - used for Single frame secondary Capture Image IOD and Multi-frame Grayscale Byte Secondary Capture Image IOD RGB - used for Single frame secondary Capture Image IOD and Multi-frame True Color Secondary Capture Image IOD
Rows	(0028,0010)	1	Number of rows in the image.
Columns	(0028,0011)	1	Number of columns in the image.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. Always set to 8.
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel ample. Each sample has the same number of bits stored (always 8).
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample has the same high bit. Always set to 7.

Table 6-5. Image Pixel Module Attributes

Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample has the same pixel representation. Enumerated Values used: 0000H = unsigned integer.
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples that comprise the Image.
Planar Configuration	(0028,0006)	1C	Indicates whether the pixel data are sent color-by-plane or color-by-pixel. For RGB data: Always set to 0.
Smallest Image Pixel Value	(0028,0106)	3	The minimum actual pixel value encountered in this image. Always set to 0.
Largest Image Pixel Value	(0028,0107)	3	The maximum actual pixel value encountered in this image. Always set to 255.

6.5.2.3 Cine Module

This section specifies the Attributes of a Multi-frame Cine image. This Module is sent if Frame Increment Pointer (0028,0009) points to Frame Time.

Table 6-6. Cine Module Attributes

Attribute Name	Tag	Type	Attribute Description
Preferred Playback Sequencing	(0018,1244)	3	Describes the preferred playback sequencing for a multi-frame image. Enumerated Values: = Looping (1,2...n,1,2,...n,1,2,....n,...) - 0 = Sweeping (1,2,...n,n-1,...2,1,2,...n,...) - 1
Frame Time	(0018,1063)	1	Nominal time (in msec) per individual frame. Required if Frame Increment Pointer (0028,0009) points to Frame Time.
Recommended Display Frame Rate	(0008,2144)	1	Recommended rate at which the frames of a Multi-frame image should be displayed in frames/second.
Cine Rate	(0018,0040)	1C	Number of frames per second.

6.5.2.4 Muti-Frame Module

This section specifies the attributes of a Multi-frame pixel data of SC Image.

Table 6-7. Multi-Frame Module Attributes

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image.

Table 6-7. Multi-Frame Module Attributes

FrameIncrementPointer	(0028,0009)	1	Contains the Data Element Tags of one or more frame index vectors. See Section 6.5.4.6 SC MULTI-FRAME IMAGE Module for specialization.

6.5.3 General Modules

The SOP Common Module is mandatory for all SC IODs.

6.5.3.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

Table 6-8. SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. "1.2.840.10008.5.1.4.1.1.7" "1.2.840.10008.5.1.4.1.1.7.2" "1.2.840.10008.5.1.4.1.1.7.4"
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance. Internally generated.
Specific Character Set	(0008,0005)	1C	Not used when the default character set (ISO 646) is used. Set to “ISO_IR 100” when extended character sets are used.
Instance Creation Date	(0008,0012)	3	Date the SOP Instance was created.
Instance Creation Time	(0008,0013)	3	Time the SOP Instance was created.
InstanceNumber	(0020,0013)	3	A number that identifies this Composite object instance.

6.5.4 Secondary Capture Modules

6.5.4.1 SC Equipment Module

This Module describes equipment used to convert images into a DICOM format.

Table 6-9. SC Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Workstation image conversion “WSD”
Modality	(0008,0060)	3	Source equipment for the image. SC Images created by Xeleris generally have this attribute set to the value found in the original image. Defined Terms used: NM = Nuclear Medicine CT = Computed Tomography PT = Positron emission tomography (PET) MR = Magnetic Resonance OT = Other
Secondary Capture Device ID	(0018,1010)	3	Secondary Capture Device ID
Secondary Capture Device Manufacturer	(0018,1016)	3	Secondary Capture Device Manufacturer
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Secondary Capture Device Manufacturer's Model Name
Secondary Capture Device Software Version	(0018,1019)	3	Secondary Capture Device Software Version

6.5.4.2 SC Image Module

The table in this Section contains IOD Attributes that describe SC images.

Table 6-10. SC Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	The date the Secondary Capture Image was captured.
Time of Secondary Capture	(0018,1014)	3	The time the Secondary Capture Image was captured.

6.5.4.3 Xeleris Private SC Series Module

This section specifies the Attributes which identify and describe general information about the SC Series within a Study. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

Table 6-11. Xeleris Private SC Series Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
Series Object Name	(0009,xx20)	3	GEMS_GENIE_1	Name of the Database Series Object. For SC IOD only.
Series Flags	(0009,xx21)	3	GEMS_GENIE_1	Series Flags. Defines series information. For SC IOD only.
Series Type	(0011,xx0A)	3	GEMS_GENIE_1	Type of Secondary Capture Series. Defined Terms used: 0 - SC Series 25 - MFSC Series
Series DataSequence	(0033,xx70)	3	GEMS_XELPRV_01	SQ with items encoding Series Data Object (SDO) attributes. May contain 0 or more items.
>Object Type	(0033,xx08)	3	GEMS_XELPRV_01	Contains string "SERIES DATA "
>Modified Flag	(0033,xx10)	3	GEMS_XELPRV_01	Default value = 0 (Not Modified)
>Name	(0033,xx11)	3	GEMS_XELPRV_01	SDO Name
>Database Object Unique ID	(0033,xx16)	3	GEMS_XELPRV_01	Database UID of SDO; contains value of SDO UID tag (0033, xx72) generated at time of object creation
>Date	(0033,xx17)	3	GEMS_XELPRV_01	SDO Creation date
>Time	(0033,xx18)	3	GEMS_XELPRV_01	SDO Creation time
>Series Data Flags	(0033,xx19)	3	GEMS_XELPRV_01	Default value = 0
>ProtocolName	(0033,xx1A)	3	GEMS_XELPRV_01	Name of Protocol created SDO
>Relevant Data UID	(0033,xx1B)	3	GEMS_XELPRV_01	UID of SOP Instance relative to SDO
>Bulk Data	(0033,xx1C)	3	GEMS_XELPRV_01	SDO parameter(s) stored as binary buffer(s)
>Int Data	(0033,xx1D)	3	GEMS_XELPRV_01	List of SDO parameters stored as integers
>DoubleData	(0033,xx1E)	3	GEMS_XELPRV_01	List of SDO parameters stored as doubles
>StringData	(0033,xx1F)	3	GEMS_XELPRV_01	List of SDO parameters stored as list of strings.
>BulkDataFormat	(0033,xx20)	3	GEMS_XELPRV_01	Format of bulk parameters; contains information about name and size of bulk buffers.
>IntDataFormat	(0033,xx21)	3	GEMS_XELPRV_01	Format of integer parameters; contains information about name and number of integers in list.
>DoubleDataFormat	(0033,xx22)	3	GEMS_XELPRV_01	Format of double parameters; contains information about name and number of doubles in list.
>StringDataFormat	(0033,xx23)	3	GEMS_XELPRV_01	Format of string parameters; contains information about name and number of strings in list.
>Description	(0033,xx24)	3	GEMS_XELPRV_01	User or equipment generated SDO description.
>Seriesdata Private SOPClassUID	(0033,xx71)	3	GEMS_XELPRV_01	SDO Private SOP Class UID
>Seriesdata InstanceUID	(0033,xx72)	3	GEMS_XELPRV_01	SDO InstanceUID; Internally generated.
>Double Data SQ	(0033,xx73)	3	GEMS_XELPRV_01	Sequence of items to store SDO parametes as lists of doubles. May contain 0 or more items.
>>Double Data	(0033,xx1E)	3	GEMS_XELPRV_01	List of SDO parameters stored as doubles.

6.5.4.4 Xeleris Private SC Image Module

This section specifies the Attributes which identify and describe an image within a particular series. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between Xeleris systems. If the SC object instance was derived from Xeleris original images, then some of the attributes listed in the table below may be set to values copied from the original images.

Table 6-12. Xeleris Private SC Image Module Attributes

Attribute Name	Tag	Type	PrivateCreator	Attribute Description
Workstation DICOM data Identifier	(0009,xx01)	3	GEMS_GENIE_1	Always "GEMS_GENIE"
Dataset UID	(0009,xx1E)	3	GEMS_GENIE_1	
Database Object Name	(0011,xx10)	3	GEMS_GENIE_1	Name of the Database Dataset Object. For SC IOD only.
Dataset Modified	(0011,xx11)	3	GEMS_GENIE_1	Modified Flag. For SC IOD only.
Dataset Name	(0011,xx12)	3	GEMS_GENIE_1	Dataset Name. For SC IOD only.
Dataset Type	(0011,xx13)	3	GEMS_GENIE_1	Defines type of SC Object. For SC IOD only. The Defined Terms are: 6 = Grayscale SC 30 = RGB SC
Dataset Flags	(0011,xx3F)	3	GEMS_GENIE_1	Dataset Flags - defines Dataset status
FOV	(0011,xx57)	3	GEMS_GENIE_1	Field Of View. For SC IOD only.
Source Translator	(0013,xx11)	3	GEMS_GENIE_1	Source Translator. Default Value is 4.
Annotation Sequence	(0019, xx5F)	3	GEMS_GENIE_1	Annotations attached to image; May contain 0 or more Items
>Modified	(0019, xx60)	3	GEMS_GENIE_1	Modified flag
>Name	(0019, xx61)	3	GEMS_GENIE_1	Name of Database Annotation Object
>Aid	(0019, xx62)	3	GEMS_GENIE_1	Database Annotation Unique ID
>DatasetAnnotationMap-ping	(0019, xx63)	3	GEMS_GENIE_1	
>DatabaseObjectClassID	(0019, xx64)	3	GEMS_GENIE_1	
>DatabaseObjectUniqueID	(0019, xx65)	3	GEMS_GENIE_1	
>TextFgColour	(0019, xx66)	3	GEMS_GENIE_1	Text Foreground Color
>TextBgColour	(0019, xx67)	3	GEMS_GENIE_1	Text Bckground Color
>MarkerColour	(0019, xx68)	3	GEMS_GENIE_1	
>LineColour	(0019, xx69)	3	GEMS_GENIE_1	
>LineThickness	(0019, xx6A)	3	GEMS_GENIE_1	
>Font	(0019, xx6B)	3	GEMS_GENIE_1	
>TextBackingMode	(0019, xx6C)	3	GEMS_GENIE_1	
>TextJustification	(0019, xx6D)	3	GEMS_GENIE_1	
>TextShadowOffsetX	(0019, xx6E)	3	GEMS_GENIE_1	
>TextShadowOffsetY	(0019, xx6F)	3	GEMS_GENIE_1	
>GeomColour	(0019, xx70)	3	GEMS_GENIE_1	
>GeomThickness	(0019, xx71)	3	GEMS_GENIE_1	
>GeomLineStyle	(0019, xx72)	3	GEMS_GENIE_1	
>GeomDashLength	(0019, xx73)	3	GEMS_GENIE_1	

Table 6-12. Xeleris Private SC Image Module Attributes (Continued)

>GeomFillPattern	(0019, xx74)	3	GEMS_GENIE_1	
>MarkerSize	(0019, xx75)	3	GEMS_GENIE_1	
>Interactivity	(0019, xx76)	3	GEMS_GENIE_1	Interactivity Flag
>TextLoc	(0019, xx77)	3	GEMS_GENIE_1	
>TextString	(0019, xx78)	3	GEMS_GENIE_1	
>TextAttachMode	(0019, xx79)	3	GEMS_GENIE_1	
>TextCursorMode	(0019, xx7A)	3	GEMS_GENIE_1	
>LineCtrlSize	(0019, xx7B)	3	GEMS_GENIE_1	
>LineType	(0019, xx7C)	3	GEMS_GENIE_1	
>LineStyle	(0019, xx7D)	3	GEMS_GENIE_1	
>Line DashLength	(0019, xx7E)	3	GEMS_GENIE_1	
>LinePtCount	(0019, xx7F)	3	GEMS_GENIE_1	
>LinePts	(0019, xx80)	3	GEMS_GENIE_1	
>LineAttachMode	(0019, xx81)	3	GEMS_GENIE_1	
>MarkerType	(0019, xx82)	3	GEMS_GENIE_1	
>MarkerLoc	(0019, xx83)	3	GEMS_GENIE_1	
>MarkerAttachMode	(0019, xx84)	3	GEMS_GENIE_1	
>FrameNumber	(0019, xx85)	3	GEMS_GENIE_1	
OrigSOPInstance UID	(0033, xx07)	3	GEMS_GENIE_1	List of SOP UIDs of Xeleris associated datasets encapsulated into the DICOM NM Information Image
ROI Sequence	(0057, xx01)	3	GEMS_XELPRV_01	ROI created on image; may contain 0 or more items.
>Private SOPClassUID	(0057, xx02)	3	GEMS_XELPRV_01	ROI SOP Class UID, contains value "1.2.840.10008.5.1.4.1.1.9"
>Object InstanceUID	(0057, xx03)	3	GEMS_XELPRV_01	ROI SOP Instance UID; internally generated
>Index	(0057, xx10)	3	GEMS_XELPRV_01	
>Dimensions	(0057, xx11)	3	GEMS_XELPRV_01	Contain value: 1
>ShapePtsCount	(0057, xx12)	3	GEMS_XELPRV_01	Number of Points
>TypeOfData	(0057, xx13)	3	GEMS_XELPRV_01	Contains string "ROI"
>Description	(0057, xx14)	3	GEMS_XELPRV_01	ROI Description
>DValueRepresentation	(0057, xx15)	3	GEMS_XELPRV_01	DataValueRepresentation; Contains value: 3
>ROILabel	(0057, xx16)	3	GEMS_XELPRV_01	
>Data	(0057, xx17)	3	GEMS_XELPRV_01	List of ROI Shape points
>Modified	(0057, xx41)	3	GEMS_XELPRV_01	Modified Flag
>Database Object Name	(0057, xx42)	3	GEMS_XELPRV_01	Name of ROI Database Object
>Database Object Class ID	(0057, xx45)	3	GEMS_XELPRV_01	Internal
>Database Object UID	(0057, xx46)	3	GEMS_XELPRV_01	ROI Object SOP Instance UID; internally generated
>Normal Colour	(0057, xx47	3	GEMS_XELPRV_01	
>Name Font	(0057, xx48)	3	GEMS_XELPRV_01	
>Fill Pattern	(0057, xx49)	3	GEMS_XELPRV_01	
>Line Style	(0057, xx4A)	3	GEMS_XELPRV_01	

Table 6-12. Xeleris Private SC Image Module Attributes (Continued)

>Line Dash Length	(0057, xx4B)	3	GEMS_XELPRV_01	
>LineThickness	(0057, xx4C)	3	GEMS_XELPRV_01	
>Interactivity	(0057, xx4D)	3	GEMS_XELPRV_01	Interactivity Flag
>NamePos	(0057, xx4E)	3	GEMS_XELPRV_01	Name Position
>NameDisplay	(0057, xx4F)	3	GEMS_XELPRV_01	Name Display Flag
>Label	(0057, xx50)	3	GEMS_XELPRV_01	ROI Label; contains the same value as ROILabel attribute (0057,xx16)
>BpSeg	(0057, xx51)	3	GEMS_XELPRV_01	
>BpSegPairs	(0057, xx52)	3	GEMS_XELPRV_01	
>SeedSpace	(0057, xx53)	3	GEMS_XELPRV_01	
>Seeds	(0057, xx54)	3	GEMS_XELPRV_01	List of Seeds
>Shapes	(0057, xx55)	3	GEMS_XELPRV_01	List of Shapes
>ShapeTilt	(0057, xx56)	3	GEMS_XELPRV_01	
>ShapePtsSpace	(0057, xx59)	3	GEMS_XELPRV_01	
>ShapeCtrlPtsCount	(0057, xx5A)	3	GEMS_XELPRV_01	
>ShapeCtrlPts	(0057, xx5B)	3	GEMS_XELPRV_01	
>ShapeCPSpace	(0057, xx5C)	3	GEMS_XELPRV_01	
>ROIFlags	(0057, xx5D)	3	GEMS_XELPRV_01	
>FrameNumber	(0057, xx5E)	3	GEMS_XELPRV_01	
>DatasetROIMapping	(0057, xx60)	3	GEMS_XELPRV_01	

6.5.4.5 Xeleris Private SC Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between Xeleris systems. If the SC object instance was derived from Xeleris original images, then some of the attributes listed in the table below may be set to values copied from the original images.

Table 6-13. Xeleris Private SC Image Pixel Module Attributes

Attribute Name	Tag	Type	Private Creator	Attribute Description
Threshold Width	(0011,xx45)	3	GEMS_GENIE_1	(4096.0)
Interpolation Type	(0011,xx46)	3	GEMS_GENIE_1	(2)

6.5.4.6 SC Multi-Frame Image Module

This section specifies the IOD Attributes that describe SC Multi-frame Images.

Table 6-14. SC Multi-Frame Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Burned in Annotation	(0028,0301)	1	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired.
Presentation LUT Shape	(2050,0020)	1C	Specifies an identity transformation for the Presentation LUT, such that the output of all grayscale transformations defined in the IOD containing this Module are defined to be P-Values. Enumerated Values: IDENTITY - output is in P-Values.
Rescale Intercept	(0028,1052)	1C	The value b in the relationship between stored values (SV) in Pixel Data (7FE0,0010) and the output units specified in Rescale Type (0028,1054). Output units = m*SV + b. Enumerated Value: 0. Required if Photometric Interpretation (0028,0004) is MONOCHROME2, and BitsStored (0028,0101) is greater than 1.
Rescale Slope	(0028,1053)	1C	The value b in the relationship between stored values (SV) in Pixel Data (7FE0,0010) and the output units specified in Rescale Type (0028,1054). Output units = m*SV + b. Enumerated Value: 0. Required if Photometric Interpretation (0028,0004) is MONOCHROME2, and BitsStored (0028,0101) is greater than 1.
Rescale Type	(0028,1054)	1C	Specifies the output units of Rescale Slope (0028,1053) and Rescale Intercept (0028,1052). Enumerated Value: US = Unspecified. Required if Photometric Interpretation (0028,0004) is MONOCHROME2, and BitsStored (0028,0101) is greater than 1.
Frame Increment Pointer	(0028,0009)	1C	Contains the Data Element Tag of the attribute which is used as the frame increment in Multi-frame pixel data - Frame Time (0018, 1063).

6.5.4.7 SC Multi-Frame Vector Module

This section specifies the IOD Attributes that may be the target of the Frame Increment Pointer (0028,0009) for SC Multi-frame images.

Attributes of this module are not included into MFSC Images created by Xeleris, because Frame Increment Pointer (0028,0009) always points to Frame Time attribute (0018, 1063), which is used as the frame increment in Multi-frame pixel data.

6.5.4.8 4DM SPECT Results Private Module

This section specifies the Private Attributes that included to SC Image created by 4DM SPECT Processing Protocol.

Table 6-15. 4DM SPECT Results Private Module Attributes

Attribute Name	Tag	Type	Private Creator ID	Attribute Description
InviaResultsBulk	(1817,xx01)	3	INVIA_RESULTS	4DM SPECT Protocol results stored as bulk.

SECTION 7
INDEPENDENT CURVE INFORMATION OBJECT IMPLEMENTATION

7.1 INTRODUCTION

The DICOM Standalone Curve Object (SOP Class 1.2.840.10008.5.1.4.1.1.9) is implemented for conveying curve and ROI data. This section specifies the use of the DICOM Standalone Curve IOD to represent the information included in curve data produced by this implementation. Xeleris Curve objects include time activity curves, image profile histograms, and acquisition energy spectrum histograms. Curve object attributes are described using the module construct. The contents of this section are:

Standalone Curve SOP Class is retired but Xeleris 3.x implementation still supports it for historical reasons.

7.2 STANDALONE CURVE IOD IMPLEMENTATION

The DICOM Standalone Curve Object implementation is used for DICOM transfer of curve and ROI data listed in the patient selector on Xeleris. Standard and private elements are used in representing curve data for preserving all database attributes between compatible Xeleris systems.

7.3 CURVE ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the independent Curve interoperability schema is shown in Illustration 7-1**.** In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. For example, the relationship between Series and Curve can have up to n Curves per Series, but the Curve can only belong to 1 Series.

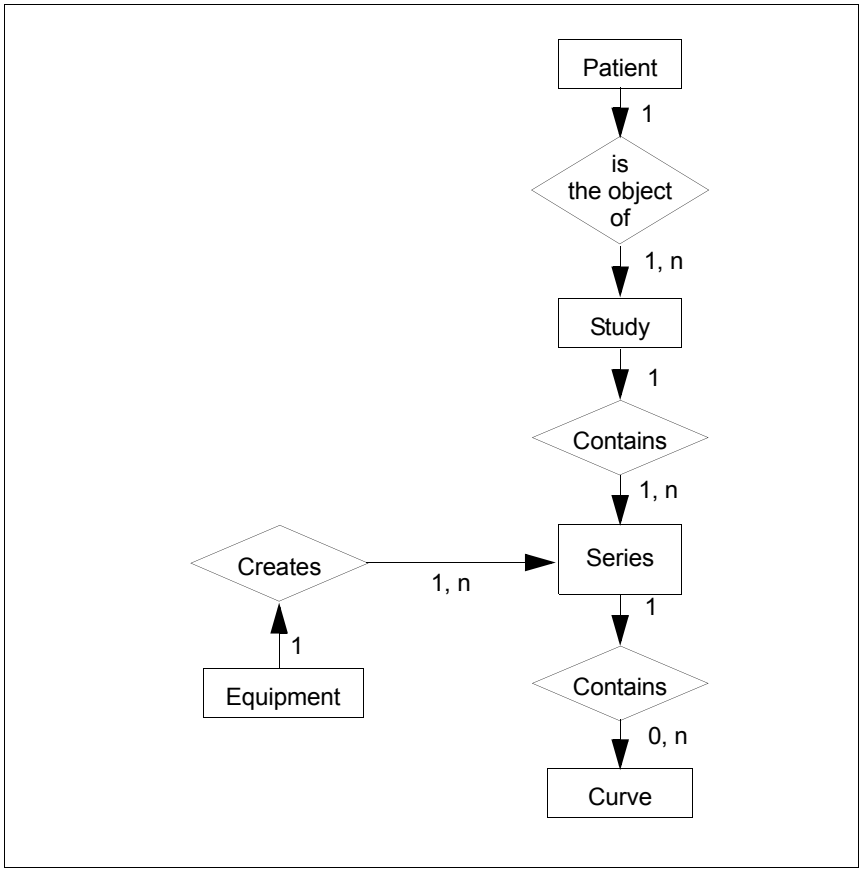

Illustration 7-1. Curve Entity Relationship Diagram

7.3.1 Entity Description

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Curve Information Object.

7.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

7.3.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

7.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

7.3.1.4 Equipment Entity Description

The Equipment Entity describes the particular imaging device which produced the series of images. An imaging device may produce one or more series within a study. The Equipment Entity does not describe the data acquisition or image creation Attributes used to generate images within a series.

7.3.1.5 Curve Entity Description

The Curve Entity represents graphical information which can be defined as a series of connected points. The independent curve represents data derived from images or other data.

7.3.2 Xeleris Mapping of DICOM Entities

Table 7-1. Mapping of DICOM Entities to Xeleris Entities

DICOM	Xeleris Entity
Patient	Patient
Study	Study
Series	Series
Curve	Curve

7.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 Curve IOD, attributes are grouped into related sets of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into DICOM datasets.

Table 7-2 identifies the defined modules within the entities which comprise the DICOM v3.0 Curve IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the Standard entities, modules, and attributes.

Table 7-2. Xeleris Curve IOD Modules

Entity Name	Module Name	Reference
Patient	Patient	Section 3.5.1.1
	Xeleris Patient	Section 3.5.1.2
Study	General Study	Section 3.5.2.1
	Patient Study	Section 3.5.2.2
	Xeleris Study	Section 3.5.2.3
Series	General Series	Section 3.5.3.1
	Xeleris Series	Section 3.5.3.2
Equipment	General Equipment	Section 3.5.5.1
Curve	Curve Identification	Section 7.5.1.1
	Standard Curve	Section 7.5.1.2
	Xeleris Private Image	Section 3.5.6.2
	Meta4 Private Curve	Section 7.5.1.3
	Xeleris Private Curve	Section 7.5.1.4
	SOP Common	Section 7.5.1.5

7.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Standalone Curve Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Attributes from the DICOM Standard modules are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

7.5.1 Independent Curve Entity Modules

The following Modules define the attributes for the Curve IE.

7.5.1.1 Curve Identification Module

This section specifies the Attributes which identify and describe a curve within a particular series.

Table 7-3. Curve Identification Module Attributes

Attribute Name	Tag	Type	Attribute Description
Curve Number	(0020,0024)	2	Curve Index.
Curve Date	(0008,0025)	3	Creation date
Curve Time	(0008,0035)	3	Creation time

7.5.1.2 Standard Curve Module

This section specifies the Attributes which identify and describe a curve within a particular series.

Table 7-4. Standard Curve Module Attributes

Attribute Name	Tag	Type	Attribute Description
Curve Dimensions	(5000,0005)	1	Curve Dimensions
Number of Points	(5000,0010)	1	Number of Points
Type of Data	(5000,0020)	1	Type of Data: TAC for discrete interval plots HIST for discrete interval bar graphs PROF for image profile plots ROI for ROI objects
Data Value Representation	(5000,0103)	1	Data Value Representation: set to 0003H = Floating Point Double (DICOM type FD)
Curve Data	(5000,3000)	1	Curve Data
Curve Description	(5000,0022)	3	Curve Legend or Curve Name
Axis Units	(5000,0030)	3	Units of measure for the axes; one value for each dimension. The order for the units is the same order as the dimensions for the curve data in Curve Data (50xx,3000) - (x-units/y-units). Defined Terms Used: SEC CNTS BPM DEG GM M2
Axis Labels	(5000,0040)	3	Set to defaults for export. Not used for import.
Minimum Coordinate Value	(5000,0104)	3	value 1 = x, value 2 = y
Maximum Coordinate Value	(5000,0105)	3	value 1 = x, value 2 = y
Curve Label	(5000,2500)	3	Curve Label (Curve Legend or Curve Name)

7.5.1.3 Meta4 Private Curve Module

This section specifies the Attributes used for Meta4 curve manipulation and display This module is a private extended set of the DICOM curve attributes. These attributes are required for full fidelity transfer of curve data between Xeleris systems.

Table 7-5. Meta4 Private Curve Module Attributes

Attribute Name	Tag	Type	Private Creator	Attribute Description
Modified	(5001,xx01)	3	GEMS_GENIE_1	Modified
Name	(5001,xx02)	3	GEMS_GENIE_1	Name
Cid	(5001,xx03)	3	GEMS_GENIE_1	Cid
Srid	(5001,xx04)	3	GEMS_GENIE_1	Srid
CurveSOPClassUID	(5001,xx05)	3	GEMS_GENIE_1	Internal Curve SOP Class UID.
CurveInstanceUID	(5001,xx06)	3	GEMS_GENIE_1	Internally Generated
CurveType	(5001,xx07)	3	GEMS_GENIE_1	CurveType
GraphType	(5001,xx08)	3	GEMS_GENIE_1	GraphType
Legend	(5001,xx09)	3	GEMS_GENIE_1	Legend
XUnits	(5001,xx0A)	3	GEMS_GENIE_1	XUnits
YUnits	(5001,xx0B)	3	GEMS_GENIE_1	YUnits
Edit	(5001,xx0C)	3	GEMS_GENIE_1	Edit
Suspend	(5001,xx0D)	3	GEMS_GENIE_1	Suspend
StyleLine	(5001,xx0E)	3	GEMS_GENIE_1	StyleLine
StyleFill	(5001,xx0F)	3	GEMS_GENIE_1	StyleFill
StyleColour	(5001,xx10)	3	GEMS_GENIE_1	StyleColour
StyleWidth	(5001,xx11)	3	GEMS_GENIE_1	StyleWidth
StylePoint	(5001,xx12)	3	GEMS_GENIE_1	StylePoint
StylePColour	(5001,xx13)	3	GEMS_GENIE_1	StylePColour
StylePSize	(5001,xx14)	3	GEMS_GENIE_1	StylePSize
Segments	(5001,xx15)	3	GEMS_GENIE_1	Segments
SegType	(5001,xx16)	3	GEMS_GENIE_1	SegType
SegStart	(5001,xx17)	3	GEMS_GENIE_1	SegStart
SegEnd	(5001,xx18)	3	GEMS_GENIE_1	SegEnd
SegStyleLine	(5001,xx19)	3	GEMS_GENIE_1	SegStyleLine
SegStyleFill	(5001,xx1A)	3	GEMS_GENIE_1	SegStyleFill
SegStyleColour	(5001,xx1B)	3	GEMS_GENIE_1	SegStyleColour
SegStyleWidth	(5001,xx1C)	3	GEMS_GENIE_1	SegStyleWidth
SegStylePoint	(5001,xx1D)	3	GEMS_GENIE_1	SegStylePoint
SegStylePColour	(5001,xx1E)	3	GEMS_GENIE_1	SegStylePColour
SegStylePSize	(5001,xx1F)	3	GEMS_GENIE_1	SegStylePSize
SegName	(5001,xx20)	3	GEMS_GENIE_1	SegName
SegAllowDirInt	(5001,xx21)	3	GEMS_GENIE_1	SegAllowDirInt

Table 7-5. Meta4 Private Curve Module Attributes (Continued)

TextAnnots	(5001,xx22)	3	GEMS_GENIE_1	TextAnnots
TxtX	(5001,xx23)	3	GEMS_GENIE_1	TxtX
TxtY	(5001,xx24)	3	GEMS_GENIE_1	TxtY
TxtText	(5001,xx25)	3	GEMS_GENIE_1	TxtText
TxtName	(5001,xx26)	3	GEMS_GENIE_1	TxtName

7.5.1.4 Xeleris Private Curve Module

This section specifies the Attributes used for Xeleris curve manipulation and display. This module is a private extended set of the DICOM curve attributes. These attributes describe the parental image and ROI objects, and are required for full fidelity transfer of curve data between Xeleris systems.

Table 7-6. Xeleris PRIVATE Curve Module Attributes

Attribute Name	Tag	Type	Private Creator	Attribute Description
ROIName	(5001,xx30)	3	GEMS_GENIE_1	ROIName
DerivedFromImageUID	(5001,xx31)	3	GEMS_GENIE_1	DerivedFromImageUID
DerivedFromImages	(5001,xx32)	3	GEMS_GENIE_1	DerivedFromImages
CurveFlags	(5001,xx33)	3	GEMS_GENIE_1	CurveFlags
CurveName	(5001,xx34)	3	GEMS_GENIE_1	CurveName
DatasetName	(5001,xx35)	3	GEMS_GENIE_1	DatasetName
CurveUID	(5001,xx36)	3	GEMS_GENIE_1	CurveUID
ROIArea	(5001,xx37)	3	GEMS_GENIE_1	ROIArea

7.5.1.5 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

Table 7-7. SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. Always "1.2.840.10008.5.1.4.1.1.9"
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP instance. Internally generated.
Specific Character Set	(0008,0005)	1C	Not used when the default character set ISO IR6 is used. Set to “ISO_IR 100” when extended character sets are used.
Instance Creator UID	(0008,0014)	3	Uniquely identifies device which created the SOP Instance. Always set equal to Implementation Class UID ="1.2.840.113619.6.281"

SECTION 8
STORAGE COMMITMENT PUSH MODEL IMPLEMENTATION

8.1 INTRODUCTION

This section describes the Xeleris 3.x storage commitment information object definition. The storage commitment information object is used both for N-ACTION storage commitment request by the SCU and N-EVENT-REPORT storage commitment notifications by the SCP.

8.2 IOD MODULE TABLE

8.2.1 Storage Commitment Module for N-ACTION

Table 8-1. Storage Commitment Module for N-action

Attribute Name	Tag	Attribute Description
Transaction UID	(0008,1195)	Internally generated
Referenced SOP Sequence	(0008,1199)	
>Referenced SOP Class UID	(0008,1150)	Storage SOP classes supported as SCU
>Referenced SOP Instance UID	(0008,1155)	

8.2.2 Storage Commitment Module For N-EVENT-REPORT

Table 8-2. Storage Commitment Module For N-EVENT-REPORT

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU/SCP
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	-/1
		Retrieve AE Title	(0008,0054)	-/3
		Storage Media File-Set ID	(0088,0130)	-/3
		Storage Media File-Set UID	(0088,0140)	-/3
		Referenced SOP Sequence	(0008,1199)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Retrieve AE Title	(0008,0054)	-/3
		>Storage Media File-Set ID	(0088,0130)	-/3
		>Storage Media File-Set UID	(0088,0140)	-/3
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)	-/1
		Retrieve AE Title	(0008,0054)	-/3
		Storage Media File-Set ID	(0088,0130)	-/3
		Storage Media File-Set UID	(0088,0140)	-/3
		Referenced SOP Sequence	(0008,1199)	-/1C
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Retrieve AE Title	(0008,0054)	-/3
		>Storage Media File-Set ID	(0088,0130)	-/3
		>Storage Media File-Set UID	(0088,0140)	-/3
		Failed SOP Sequence	(0008,1198)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Failure Reason	(0008,1197)	-/1

8.2.3 Processing of Failure Reasons Received in a N-Event-Report

When a N-Event-Report request with a Event Type ID equal to 2 is received, this indicates that Storage Commitment is complete, but a failure exists. The following table lists the set of value that this Storage Commitment SCU AE is able to process.

Table 8-3. Storage Commitment Failure Reasons for N-EVENT-REPORT

Failure Reason	Meaning	SCU Behavior
0110H	Processing failure	Error logged
0112H	No such object instance	Error logged
0213H	Resource limitation	Error logged
0122H	Referenced SOP Class not supported	Error logged
0119H	Class / Instance conflict	Error logged
0131H	Duplicate transaction UID	Error logged

APPENDIX A
XELERIS PRIVATE DATA DICTIONARY

Table A-1. Private Creator Identification "GEMS_GENIE_1"

Attribute Name	Tag	VR	VM
Workstation DICOM data Identifier	(0009,xx01)	SH	1
Study Name	(0009,xx10)	LO	1
Study Flags	(0009,xx11)	SL	1
Study Type	(0009,xx12)	SL	1
Dataset UID	(0009,xx1E)	UI	1
Series Object Name	(0009,xx20)	LO	1
Series Flags	(0009,xx21)	SL	1
User Orientation	(0009,xx22)	SH	1
Initiation Type	(0009,xx23)	SL	1
Initiation Delay	(0009,xx24)	SL	1
Initiation Count Rate	(0009,xx25)	SL	1
Number Energy Sets	(0009,xx26)	SL	1
Number Detectors	(0009,xx27)	SL	1
Number RR Windows	(0009,xx28)	SL	1
Number MG Time Slots	(0009,xx29)	SL	1
Number View Sets	(0009,xx2A)	SL	1
Trigger History UID	(0009,xx2B)	LO	1
Series Comments	(0009,xx2C)	LO	1
Track Beat Average	(0009,xx2D)	SL	1
Distance Prescribed	(0009,xx2E)	FD	1
Table Direction	(0009,xx2F)	SL	1
Rotational Continuous Speed	(0009,xx33)	FD	1
Gantry Locus Type	(0009,xx35)	UL	1
Starting Heart Rate	(0009,xx37)	SL	1
RR Window Width	(0009,xx38)	SL	1
RR Window Offset	(0009,xx39)	SL	1
Percent Cycle Imaged	(0009,xx3A)	SL	1
Patient Object Name	(0009,xx40)	PN	1
Patient Flags	(0009,xx41)	SL	1
Patient Creation Date	(0009,xx42)	DA	1

Table A-1. Private Creator Identification "GEMS_GENIE_1" (Continued)

Attribute Name	Tag	VR	VM
Patient Creation Time	(0009,xx43)	TM	1
Dataset UID List	(0009,xx45)	LT	1
Series Type	(0011,xx0A)	SL	1
Effective Series Duration	(0011,xx0B)	SL	1
Num Beats	(0011,xx0C)	SL	1
Radio Nuclide Name	(0011,xx0D)	LO	1
Database Object Name	(0011,xx10)	LO	1-n
Dataset Modified	(0011,xx11)	SL	1-n
Dataset Name	(0011,xx12)	LO	1-n
Dataset Type	(0011,xx13)	SL	1
Completion Time	(0011,xx14)	LO	1
Detector Number	(0011,xx15)	SL	1-n
Energy Number	(0011,xx16)	SL	1-n
RR Interval Window Number	(0011,xx17)	SL	1-n
MG Bin Number	(0011,xx18)	SL	1-n
Radius Of Rotation	(0011,xx19)	FD	1-n
Detector Count Zone	(0011,xx1A)	SL	1-n
Energy Offset	(0011,xx1C)	SL	4
Energy Range	(0011,xx1D)	SL	1
Image Orientation	(0011,xx1F)	SL	1-n
Use FOV Mask	(0011,xx23)	SL	1
FOV Mask Y Cutoff Distance	(0011,xx24)	SL	1
FOV Mask Cutoff Angle	(0011,xx25)	SL	1
Table Orientation	(0011,xx26)	SL	1-n
ROI Top Left	(0011,xx27)	SL	1-n
ROI Bottom Right	(0011,xx28)	SL	1-n
Uniformity Mean	(0011,xx29)	SL	1
View X Adjustment	(0011,xx2C)	FD	1-n
View Y Adjustment	(0011,xx2D)	FD	1-n
Pixel Overflow Flag	(0011,xx2E)	SL	1-n
Overflow Level	(0011,xx2F)	SL	1-n
Picture Object Name	(0011,xx30)	LO	1-n
Acquisition Parent UID	(0011,xx31)	LO	1-n
Processing Parent UID	(0011,xx32)	LO	1-n
Energy Correct Name	(0011,xx33)	LO	1-n
Spatial Correct Name	(0011,xx34)	LO	1-n

Table A-1. Private Creator Identification "GEMS_GENIE_1" (Continued)

Attribute Name	Tag	VR	VM
Tuning Calib Name	(0011,xx35)	LO	1-n
Uniformity Correct Name	(0011,xx36)	LO	1-n
Acquisition Specific Correction Name	(0011,xx37)	LT	1
Byte Order	(0011,xx38)	SL	1-n
Compression Type	(0011,xx39)	SL	1-n
Picture Format	(0011,xx3A)	SL	1-n
Pixel Scale	(0011,xx3B)	FD	1-n
Pixel Offset	(0011,xx3C)	FD	1-n
FOV Shape	(0011,xx3E)	SL	1
Dataset Flags	(0011,xx3F)	SL	1-n
Viewing Object Name	(0011,xx40)	LO	1-n
Orientation Angle	(0011,xx41)	SL	1-n
Rotation Angle	(0011,xx42)	FD	1-n
Window Inverse Flag	(0011,xx43)	SL	1-n
Threshold Center	(0011,xx44)	FD	1-n
Threshold Width	(0011,xx45)	FD	1-n
Interpolation Type	(0011,xx46)	SL	1-n
Where Object Name	(0011,xx50)	LO	1-n
Period	(0011,xx55)	FD	1-n
Elapsed Time	(0011,xx56)	FD	1-n
FOV	(0011,xx57)	FD	1-n
Image Size	(0011,xx61)	SL	1-n
Linear FOV	(0011,xx62)	FD	1-n
Spatial Offset	(0011,xx63)	FD	1-n
Spatial Orientation	(0011,xx64)	FD	1-n
Reference Dataset UID	(0011,xx65)	LO	1-n
Starcam Reference Dataset	(0011,xx66)	LO	1-n
Reference Frame Number	(0011,xx67)	SL	1-n
Cursor Length	(0011,xx68)	SL	1-n
Number of Cursors	(0011,xx69)	SL	1-n
Cursor Coordinates	(0011,xx6A)	SL	1-n
Recon Options Flag	(0011,xx6B)	SL	1-n
Motion Threshold	(0011,xx6C)	FD	1-n
Motion Curve UID	(0011,xx6D)	UI	1-n
Recon Type	(0011,xx6E)	SL	1-n
Pre Filter Type	(0011,xx6F)	SL	1-n

Table A-1. Private Creator Identification "GEMS_GENIE_1" (Continued)

Attribute Name	Tag	VR	VM
Back Proj Filter Type	(0011,xx71)	SL	1-n
Recon Arc	(0011,xx72)	SL	1-n
Recon Pan AP Offset	(0011,xx73)	FD	1-n
Recon Pan LR Offset	(0011,xx74)	FD	1-n
Recon Area	(0011,xx75)	FD	1-n
Start View	(0011,xx76)	SL	1-n
Attenuation Type	(0011,xx77)	SL	1-n
Dual Energy Processing	(0011,xx78)	SL	1-n
Pre Filter Param	(0011,xx79)	SH	1-n
Pre Filter Param 2	(0011,xx7A)	SH	1-n
Back Proj Filter Param	(0011,xx7B)	SH	1-n
Back Proj Filter Param 2	(0011,xx7C)	SH	1-n
Attenuation Coef	(0011,xx7D)	SH	1-n
Ref Slice Width	(0011,xx7E)	SL	1-n
Ref Trans Pixel Volume	(0011,xx7F)	FD	1-n
Attenuation Threshold	(0011,xx81)	SH	1-n
Interpolation Distance	(0011,xx82)	FD	1-n
Interpolation Center X	(0011,xx83)	FD	1-n
Interpolation Center Y	(0011,xx84)	FD	1-n
Quant Filter Flag	(0011,xx85)	SL	1-n
Head Conversion	(0011,xx86)	SL	1-n
Slice Width Pixels	(0011,xx87)	SL	1-n
Rfmtr Trans Ref	(0011,xx88)	SL	1-n
Rfmtr Trans Ref mm	(0011,xx89)	FD	1-n
Two Line Trans Ref	(0011,xx8A)	SL	1-n
Three–D Zero	(0011,xx8B)	SL	1-n
Three–D Zero Length	(0011,xx8C)	SL	1-n
Three–D Zero In	(0011,xx8D)	SL	1-n
Digital FOV	(0013,xx10)	FD	1-n
Source Translator	(0013,xx11)	SL	1
RAL Flags	(0013,xx12)	SL	1-n
Fscalar	(0013,xx15)	FD	1-n
AutoTrack Peak	(0013,xx16)	SL	1
AutoTrack Width	(0013,xx17)	SL	1
Transmission Scan Time	(0013,xx18)	FD	1
Transmission Mask Width	(0013,xx19)	FD	1

Table A-1. Private Creator Identification "GEMS_GENIE_1" (Continued)

Attribute Name	Tag	VR	VM
Copper Attenuator Thickness	(0013,xx1A)	FD	1
Det Ang Separation	(0013,xx1B)	FD	1
Axial Acceptance Angle	(0013,xx1C)	SL	1
Theta Acceptance Value	(0013,xx1D)	SL	1
Tomo View Offset	(0013,xx1E)	FD	1-n
Accepted Beats Time	(0013,xx20)	FD	1-n
Threshold	(0013,xx21)	FD	1-n
Linear Depth	(0013,xx22)	FD	1-n
Unif Date Time	(0013,xx23)	LO	1-n
Study Comments	(0013,xx26)	LT	1
Num ECT Phases	(0015,xx12)	SL	1
Num WB Scans	(0015,xx13)	SL	1
ECT Phase Num	(0015,xx14)	SL	1
WB Scan Num	(0015,xx15)	SL	1
Comb Head Number	(0015,xx16)	SL	1
Preceding Beat	(0015,xx17)	UL	1
Annotation Sequence	(0019,xx5F)	SQ	1
Modified	(0019,xx60)	SL	1
Name	(0019,xx61)	LO	1
Aid	(0019,xx62)	LO	1
DatasetAnnotationMapping	(0019,xx63)	LO	1-n
DatabaseObjectClassID	(0019,xx64)	LO	1
DatabaseObjectUniqueID	(0019,xx65)	LO	1
TextFgColour	(0019,xx66)	LO	1
TextBgColour	(0019,xx67)	LO	1
MarkerColour	(0019,xx68)	LO	1
LineColour	(0019,xx69)	LO	1
LineThickness	(0019,xx6A)	SL	1
Font	(0019,xx6B)	LT	1
TextBackingMode	(0019,xx6C)	SL	1
TextJustification	(0019,xx6D)	SL	1
TextShadowOffsetX	(0019,xx6E)	SL	1
TextShadowOffsetY	(0019,xx6F)	SL	1
GeomColour	(0019,xx70)	LT	1
GeomThickness	(0019,xx71)	SL	1
GeomLineStyle	(0019,xx72)	SL	1

Table A-1. Private Creator Identification "GEMS_GENIE_1" (Continued)

Attribute Name	Tag	VR	VM
GeomDashLength	(0019,xx73)	SL	1
GeomFillPattern	(0019,xx74)	SL	1
MarkerSize	(0019,xx75)	SL	1
Interactivity	(0019,xx76)	SL	1
TextLoc	(0019,xx77)	FD	1-n
TextString	(0019,xx78)	LT	1
TextAttachMode	(0019,xx79)	SL	1-n
TextCursorMode	(0019,xx7A)	SL	1-n
LineCtrlSize	(0019,xx7B)	SL	1
LineType	(0019,xx7C)	SL	1-n
LineStyle	(0019,xx7D)	SL	1
LineDashLength	(0019,xx7E)	SL	1
LinePtCount	(0019,xx7F)	SL	1-n
LinePts	(0019,xx80)	FD	1-n
LineAttachMode	(0019,xx81)	SL	1-n
MarkerType	(0019,xx82)	SL	1-n
MarkerLoc	(0019,xx83)	FD	1-n
MarkerAttachMode	(0019,xx84)	SL	1-n
FrameNumber	(0019,xx86)	UL	1
Orig SOP Instance UID	(0033,xx07)	LO	1-n
Trigger History Modified Flag	(0033,xx30)	SL	1
Database Object Name	(0033,xx31)	LO	1
Trigger History Software Version	(0033,xx32)	LO	1
Number of Triggers	(0033,xx33)	SL	1
Trigger Size	(0033,xx34)	SL	1
Trigger Data Size	(0033,xx35)	SL	1
Trigger Data	(0033,xx36)	OB	1
Trigger History Description	(0033,xx37)	LO	1
Trigger History Flags	(0033,xx38)	SL	1
Trigger History Prvate Instance UID	(0033,xx39)	LO	1
Trigger History SOP Class UID	(0033,xx3A)	LO	1
Start Angle	(0035,xx01)	FD	1
Xeleris Energy Window Information Sequence	(0055,xx12)	SQ	1
Xeleris Energy Window Range Sequence	(0055,xx13)	SQ	1
Xeleris Detector Information Sequence	(0055,xx22)	SQ	1
Xeleris Rotation Information Sequence	(0055,xx52)	SQ	1

Table A-1. Private Creator Identification "GEMS_GENIE_1" (Continued)

Attribute Name	Tag	VR	VM
Xeleris Gated Information Sequence	(0055,xx62)	SQ	1
Xeleris Data Information Sequence	(0055,xx63)	SQ	1
Frame Sequence	(0055,xx65)	SQ	1
Modified	(5001,xx01)	SL	1
Name	(5001,xx02)	LO	1
Cid	(5001,xx03)	SL	1
Srid	(5001,xx04)	SL	1
SOPClassUID	(5001,xx05)	LO	1
SOPInstanceUID	(5001,xx06)	LO	1
CurveType	(5001,xx07)	SL	1
GraphType	(5001,xx08)	SL	1
Legend	(5001,xx09)	LO	1
XUnits	(5001,xx0A)	LO	1
YUnits	(5001,xx0B)	LO	1
Edit	(5001,xx0C)	SL	1
Suspend	(5001,xx0D)	SL	1
StyleLine	(5001,xx0E)	SL	1
StyleFill	(5001,xx0F)	SL	1
StyleColour	(5001,xx10)	LO	1
StyleWidth	(5001,xx11)	SL	1
StylePoint	(5001,xx12)	SL	1
StylePColour	(5001,xx13)	LO	1
StylePSize	(5001,xx14)	SL	1
Segments	(5001,xx15)	SL	1
SegType	(5001,xx16)	SL	1-n
SegStart	(5001,xx17)	FD	1-n
SegEnd	(5001,xx18)	FD	1-n
SegStyleLine	(5001,xx19)	SL	1-n
SegStyleFill	(5001,xx1A)	SL	1-n
SegStyleColour	(5001,xx1B)	LO	1
SegStyleWidth	(5001,xx1C)	SL	1-n
SegStylePoint	(5001,xx1D)	SL	1-n
SegStylePColour	(5001,xx1E)	LO	1
SegStylePSize	(5001,xx1F)	SL	1-n
SegName	(5001,xx20)	LO	1
SegAllowDirInt	(5001,xx21)	SL	1-n

Table A-1. Private Creator Identification “GEMS_GENIE_1” (Continued)

Attribute Name	Tag	VR	VM
TextAnnots	(5001,xx22)	SL	1
TxtX	(5001,xx23)	FD	1-n
TxtY	(5001,xx24)	FD	1-n
TxtText	(5001,xx25)	LO	1
TxtName	(5001,xx26)	LO	1
ROIName	(5001,xx30)	LO	1
DerivedFromImageUID	(5001,xx31)	LO	1
DerivedFromImages	(5001,xx32)	SL	1-n
CurveFlags	(5001,xx33)	UL	1
CurveName	(5001,xx34)	LO	1
DatasetName	(5001,xx35)	LO	1
CurveUID	(5001,xx36)	LO	1
ROIArea	(5001,xx37)	FD	1-n

Table A-2. Private Creator Identification - "GEMS_XELPRV_01"

Attribute Name	Tag	VR	VM
Series AverageHeartRate	(0017,xx01)	IS	1
Image AverageHeartRate	(0017,xx02)	IS	1
Series AcceptedBeats	(0017,xx03)	IS	1
Image AcceptedBeats	(0017,xx04)	IS	1
Series RejectedBeats	(0017,xx05)	IS	1
Image RejectedBeats	(0017,xx06)	IS	1
Object Type	(0033,xx08)	CS	1
Modified Flag	(0033,xx10)	SL	1
Name	(0033,xx11)	LO	1
StudyId	(0033,xx14)	LO	1
Database Object Unique ID	(0033,xx16)	LO	1
Date	(0033,xx17)	SH	1
Time	(0033,xx18)	SH	1
Object Flags	(0033,xx19)	UL	1
ProtocolName	(0033,xx1A)	LO	1
Relevant Data UID	(0033,xx1B)	LO	1
BulkData	(0033,xx1C)	OB	1
IntData	(0033,xx1D)	SL	1-n

Table A-2. Private Creator Identification - "GEMS_XELPRV_01" (Continued)

Attribute Name	Tag	VR	VM
DoubleData	(0033,xx1E)	FD	1-n
StringData	(0033,xx1F)	OB	1
BulkDataFormat	(0033,xx20)	OB	1
IntDataFormat	(0033,xx21)	OB	1
DoubleDataFormat	(0033,xx22)	OB	1
StringDataFormat	(0033,xx23)	OB	1
Description	(0033,xx24)	LT	1
RTName	(0033,xx28)	LO	1
RTSpecification	(0033,xx29)	LT	1
RTO Flags	(0033,xx2A)	UL	1
DataValidationSpec	(0033,xx2B)	LT	1
Description	(0033,xx2C)	LT	1
Icon Description	(0033,xx2D)	LT	1
ProtocolDataSequence	(0033,xx50)	SQ	1
Internal Protocol Data SOPClassUID	(0033,xx51)	UI	1
Internal Protocol Data Instance UID	(0033,xx52)	UI	1
ReviewTemplateSequence	(0033,xx60)	SQ	1
Internal Review Template SOPClassUID	(0033,xx61)	UI	1
Internal Review Template InstanceUID	(0033,xx62)	UI	1
Series Data Sequence	(0033,xx70)	SQ	1
Internal Seriesdata SOPClassUID	(0033,xx71)	UI	1
Internal Seriesdata InstanceUID	(0033,xx72)	UI	1
Double Data SQ	(0033,xx73)	SQ	1
ROI Sequence	(0057,xx01)	SQ	1
Internal ROI SOPClassUID	(0057,xx02)	UI	1
ROI Object InstanceUID	(0057,xx03)	UI	1
Index	(0057,xx10)	IS	1
Dimensions	(0057,xx11)	US	1
ShapePtsCount	(0057,xx12)	US	1
TypeOfData	(0057,xx13)	CS	1
Description	(0057,xx14)	LO	1
DValueRepresentation	(0057,xx15)	US	1
ROILabel	(0057,xx16)	LO	1
Data	(0057,xx17)	OW	1
Modified	(0057,xx41)	SL	1
Database Object Name	(0057,xx42)	LO	1

Table A-2. Private Creator Identification - "GEMS_XELPRV_01" (Continued)

Attribute Name	Tag	VR	VM
Database Object Name Class ID	(0057,xx45)	LO	1
Database Object UID	(0057,xx46)	LO	1
Normal Colour	(0057,xx47)	LO	1
Name Font	(0057,xx48)	LT	1
Fill Pattern	(0057,xx49)	SL	1
Line Style	(0057,xx4A)	SL	1
Line Dash Length	(0057,xx4B)	SL	1
LineThickness	(0057,xx4C)	SL	1
Interactivity	(0057,xx4D)	SL	1
NamePos	(0057,xx4E)	SL	1
NameDisplay	(0057,xx4F)	SL	1
Label	(0057,xx50)	LO	1
BpSeq	(0057,xx51)	SL	1-n
BpSeqPairs	(0057,xx52)	US	1-n
SeedSpace	(0057,xx53)	SL	1
Seeds	(0057,xx54)	FD	1-n
Shapes	(0057,xx55)	SL	1-n
ShapeTilt	(0057,xx56)	FD	1-n
ShapePtsSpace	(0057,xx59)	SL	1-n
ShapeCtrlPtsCount	(0057,xx5A)	SL	1
ShapeCtrlPts	(0057,xx5B)	FD	1-n
ShapeCPSpace	(0057,xx5C)	SL	1
ROIFlags	(0057,xx5D)	UL	1
FrameNumber	(0057,xx5E)	UL	1
DatasetROIMapping	(0057,xx60)	LO	1-n

Table A-3. Private Creator Identification - INVIA_RESULTS

Attribute Name	Tag	VR	VM
InviaResultsBulk	(1817,xx01)	OB	1

APPENDIX B
CONFORMANCE STATEMENT FOR CEDARA HARDCOPY SERVER AS DICOM PRINT MANAGEMENT SCU

Conformance Statement for
Cedara Hardcopy Server as DICOM Print Management SCU

Document Number: 286-213-0174-00-00

Updated: $Date: 1996/04/17 20:03:28 $
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Repository: $Source: /isg/proj/iap/rcs/doc/designs/printing/docPrnDICOM/PrnDICOM.conf.ms,v $

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* *The signature of the Program Manager attests that the mandatory reviewers have approved this document.*

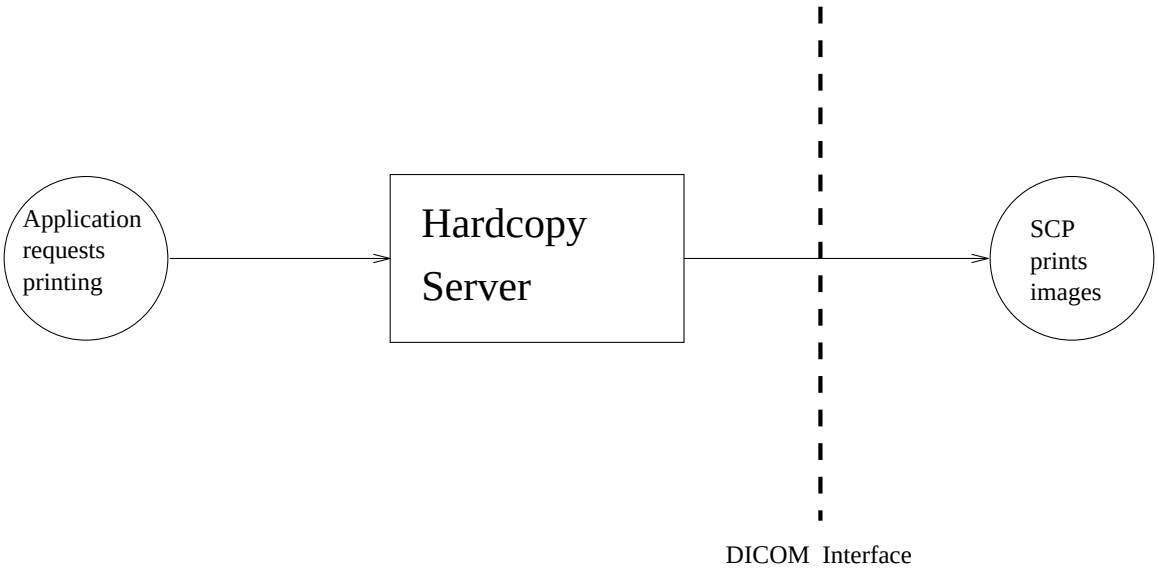
1. Introduction

The ISG Hardcopy Server (*hcserver*) supports printing to DICOM Print Management SCP. The *hcserver* acts as an SCU of the DICOM print management SOP classes. It uses a configuration file for specifying the behaviour specific to different DICOM SCPs.

2. Implementation Model

2.1. Application Data Flow Diagram

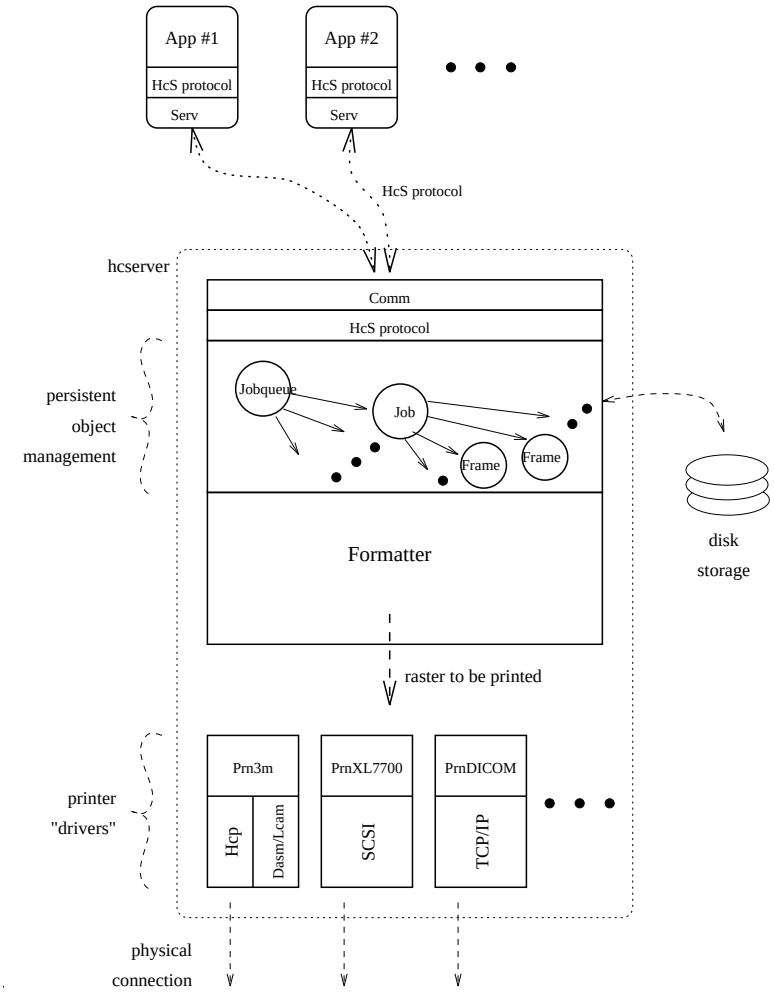
The relationship of the *hcserver* use of DICOM to real world activities is presented in the following diagram.



The application using the Hardcopy Server requests printing to a print device. The Hardcopy Server initiates an association with a DICOM print SCP for the purpose of printing the job requested by the application. The Hardcopy Server can handle simultaneous associations with a number of DICOM print SCPs.

2.2. Functional Definition of Application Entities

The model of the *hcserver* is presented in the following diagram.



Multiple client applications are connected to an instance of the Hardcopy server. Each connection can be made locally, if both the client and the server are executing on the same machine, or remotely, when the client and the server are running on different machines connected via networking.

The Hardcopy server consists of a Comm layer, which handles the communications, and a layer for interpreting the HcS command and data protocol. Commands and data result in various objects being created:

Jobqueue — A jobqueue in the model of IAP Hardcopy server consists of several jobs, queued in priority and FIFO order. This permits pre-emptive printing of high priority jobs, if desired.

Job — A job is composed of several frames, each of which defines a physical region of a film and the contents thereof. A job has an associated set of formatting commands. which specify such details as film layout, number of copies, choice of printer, and other parameters that pertain to the entire job.

Frame A frame is a set of formatting commands, such as commands to display an image with overlay text and graphics, the location of the image on the film, and other relevant information required for printing images onto films.

When a job appears at the front of a queue, the Formatter will prepare the job prior to sending it to the printer. Image viewing transformations are applied, contrast and brightness adjustment are performed, and text and graphics overlays are added. A formatted image is passed to the appropriate printer driver, which handles the physical link to the printer, the data communication between the host computer and the printer, and the processing of status and error messages from the printer.

For printing to a DICOM print server, a DICOM print SCU driver is provided. Multiple instances of DICOM print SCU driver can co-exist, and each instance handles the association with one DICOM print server.

2.3. Sequencing of Real-World Activities

N/A.

3. Application Entity (AE) Specifications

The *hcserver* represents a single Application Entity. It acts independently of other DICOM applications that may be running on the same system. The *hcserver* can support printing to multiple DICOM printers at the same time, each printer being uniquely identified by an Application Entity Title.

3.1. AE Print User - Specification

The *hcserver* provides Standard Conformance to the following DICOM 3.0 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18

3.1.1. Association Establishment Policies

3.1.1.1. General

The *hcserver* maintains a separate association with each DICOM SCP. It releases the association with DICOM SCP if no operation is done on the association in a selected time period.

3.1.1.2. Number of Associations

There is no limit on the number of associations maintained simultaneously with one or different DICOM SCPs.

3.1.1.3. Asynchronous Nature

The *hcserver* does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4. Implementation Identifying Information

The *hcserver* implementation class UID is 2.16.124.113531.1.3.1, the implementation version name is ISG_HCS_V1.0.96.

3.1.2. Association Initiation Policy

The *hcserver* maintains a list of valid print servers and can present that list to the applications upon request. When the application submits a print job designated for a listed print server to the *hcserver*, the *hcserver* will request an association with the selected print server.

3.1.2.1. Printing encoded with Implicit or Explicit VR

3.1.2.1.1. Associated Real-World Activity

The application's print request causes the *hcserver* to initiate an Association.

3.1.2.1.2. Proposed Presentation Contexts

The *hcserver* will propose one of the presentation contexts listed in the Presentation Context Table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic GrayScale Print Management	1.2.840.10008 .5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Basic Color Print Management	1.2.840.10008 .5.1.1.18	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

3.1.2.1.2.1. SOP Specific Conformance to Basic Grayscale Print Management Meta SOP Class

The *hcserver* supports the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class:

Name	UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Printer SOP Class	1.2.840.10008.5.1.1.14

The *hcserver* supports the following optional SOP class attributes and DIMSE services for the Basic Grayscale Print Management Meta SOP Class.

SOP Class	DISME Service	Optional Attribute	Tag
Basic Film Session SOP Class	N-CREATE	Number of Copies	(2000,0010)
		Print Priority	(2000,0020)
		Medium Type	(2000,0030)
		Film Destination	(2000,0040)
		Film Session Label	(2000,0050)
		Memory Allocation	(2000,0060)
Basic Film Box SOP Class	N-CREATE	Film Orientation	(2010,0040)
		Film Size ID	(2010,0050)
		Magnification Type	(2010,0060)
		Max Density	(2010,0130)
		Configuration Information	(2010,0150)
		Smoothing Type	(2010,0080)
		Border Density	(2010,0100)
		Empty Image Density	(2010,0110)
		Min Density	(2010,0120)
		Trim	(2010,0140)
	N-DELETE		
Basic Grayscale Image Box SOP Class	N-SET	Polarity	(2020,0020)
Printer SOP Class	N-GET		

3.1.2.1.2.1.1. Basic Film Session SOP Class (1.2.840.10008.5.1.1.1) attributes

The *hcserver* supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Number of Copies	(2000,0010)	Integer String
Print Priority	(2000,0020)	HIGH, MED, LOW
Medium Type	(2000,0030)	PAPER, CLEAR FILM, BLUE FILM
Film Destination	(2000,0040)	MAGAZINE, PROCESSOR
Film Session Label	(2000,0050)	Long String
Memory Allocation	(2000,0060)	Integer String

3.1.2.1.2.1.2. Basic Film Box SOP Class (1.2.840.10008.5.1.1.2) attributes

The *hcserver* supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Image Display Format	(2010,0010)	STANDARD, ROW, COL, SLIDE, SUPERSLIDE, CUSTOM
Film Orientation	(2010,0040)	PORTRAIT, LANDSCAPE
Film Size ID	(2010,0050)	8INX10IN, 10INX14IN, 14INX14IN,24CMX24CM,10INX12IN, 11INX14IN, 14INX17IN, 24CMX30CM
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Border Density	(2010,0100)	BLACK, WHITE, i where i represents the desired density in hundredths of OD
Empty Image Density	(2010,0110)	BLACK, WHITE, i where i represents the desired density in hundredths of OD
Min Density	(2010,0120)	Unsigned Short
Max Density	(2010,0130)	Unsigned Short
Trim	(2010,0140)	YES, NO
Configuration Information	(2010,0150)	SCP specific

3.1.2.1.2.1.3. Basic Grayscale Image Box SOP Class (1.2.840.10008.5.1.1.4) attributes

The *hcserver* supports the following mandatory and optional attributes in this SOP class:

Attribute Name	Tag	Supported values
Image Position	(2020,0010)	Unsigned Short
Polarity	(2020,0020)	NORMAL, REVERSE
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Requested Image Size	(2020,0030)	Unsigned Short
Preformatted Grayscale Image Sequence	(2020,0110)	
>Samples Per Pixel	(0028,0002)	1
>Photometric Interpretation	(0028,0004)	MONOCHROME1, MONOCHROME2
>Rows	(0028,0010)	Unsigned Short
>Columns	(0028,0011)	Unsigned Short
>Pixel Aspect Ratio	(0028,0034)	1:1
>Bits Allocated	(0028,0100)	8
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	0000H (unsigned integer)
>Pixel Data	(7FE0,0010)	Other Byte String

3.1.2.1.2.1.4. Printer SOP Class (1.2.840.10008.5.1.1.14) attributes

The *hcserver* makes use of the following attributes and attribute values in this SOP class:

Attribute Name	Tag	Supported values
Printer Status	(2110,0010)	NORMAL, WARNING, FAILURE
Printer Status Info	(2110,0020)	SUPPLY EMPTY, SUPPLY LOW, RECEIVER FULL, FILM JAM
Printer Name	(2110,0030)	Long String
Manufacturer	(0008,0070)	Long String
Manufacturer Model Name	(0008,1090)	Long String
Device Serial Number	(0018,1000)	Long String
Software Versions	(0018,1020)	Long String(s)

3.1.2.1.2.2. SOP Specific Conformance to Basic Color Print Management Meta SOP Class

The *hcserver* supports the following mandatory SOP classes which are defined under the Basic Color Print Management Meta SOP Class.

Name	UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Printer SOP Class	1.2.840.10008.5.1.1.14

The optional SOP class attributes and DIMSE services for the Basic Film Session,Basic Film Box and Printer SOP classes are listed in the SOP Specific Conformance section for the Basic Grayscale Print Management Meta SOP Class.

The *hcserver* supports the following optional SOP class attributes and DIMSE services for the Basic Color Image Box SOP Class.

SOP Class	DISME Service	Optional Attribute	Tag
Basic Color Image Box SOP Class	N-SET	Polarity	(2020,0020)

3.1.2.1.2.2.1. Basic Color Image Box SOP Class (1.2.840.10008.5.1.1.4.1) attributes

The *hcserver* supports the following attributes in this SOP class:

Image Position	(2020,0010)	Unsigned Short
Polarity	(2020,0020)	NORMAL, REVERSE
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Requested Image Size	(2020,0030)	Unsigned Short
Preformatted Color Image Sequence	(2020,0111)	
>Samples Per Pixel	(0028,0002)	3
>Photometric Interpretation	(0028,0004)	RGB
>Rows	(0028,0010)	Unsigned Short
>Columns	(0028,0011)	Unsigned Short
>Pixel Aspect Ratio	(0028,0034)	1:1
>Bits Allocated	(0028,0100)	8
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	0000H (unsigned integer)
>Pixel Data	(7FE0,0010)	Other Byte String

3.1.3. Association Acceptance Policy

The *hcserver* does not accept associations.

4. Communication Profiles

4.1. TCP/IP Stack

The *hcserver* provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.1.1. TCP/IP API

The *hcserver* uses the TCP/IP stack upon which it executes.

4.1.2. Physical Media Support

The *hcserver* is indifferent to the physical medium over which TCP/IP executes.

5. Extensions/Specifications/Privatisations

N/A.

6. Configuration

The *hcserver* configuration is loaded into the running server.

6.1. AE Title/ Presentation Address Mapping

A DICOM print server is identified by a "printer name" with associated parameters such as AE title, host name and port number. The IP address corresponding to a given host name is determined using the name lookup database mechanisms provided on the hosting platform.

6.2. Definition of Target Print Servers

The list of target print servers is loaded into the running *hcserver*.

6.3. Configurable Parameters

The following parameters may be configured for the *hcserver*

Application Entity Title (Default ISG_PRINT_SCU).

Film layout formats.

Association timeout.

6.4. Support of Extended Character Sets

The *hcserver* provides no support for extended character sets in the communication with DICOM SCPs.

APPENDIX C
CD PRINTER 5.6.3 DICOM CONFORMANCE STATEMENT

CD Printer 5.6.3

DICOM Conformance Statement

Revision History			
Rev	**Description**	**Date**	
1.0	Initial version	10/06/2010	

1. DICOM CONFORMANCE STATEMENT OVERVIEW

The CD Printer system is a DICOM media burning service provider for medical images and other object instances.

The CD Printer provides the following DICOM data exchange features:

- It receives instances sent to it by remote systems (e.g. PACS, workstations or imaging modalities) and stores them in a database.
- It provides additional services for instances distribution.
- It is able to write DICOM CD-ROM disks.
- It is able to write DICOM DVD disks.

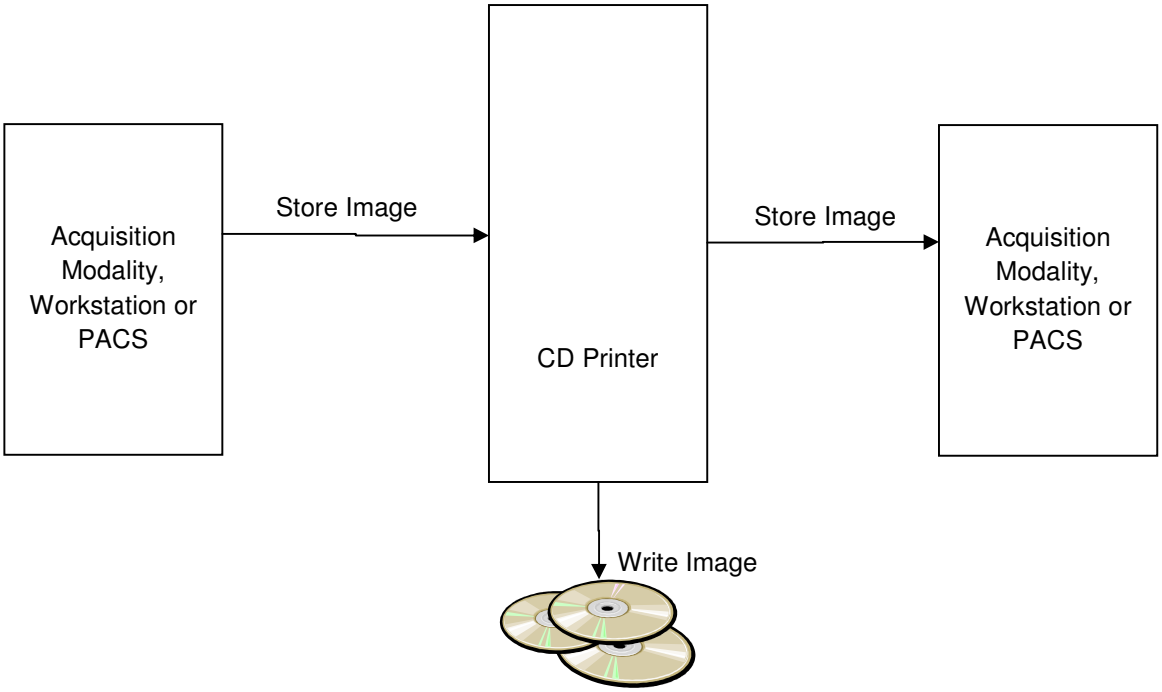


Figure 1: CD Printer in a DICOM Network

CD Printer allows the operator also to monitor queues and burning process of the images received. CD Printer includes DICOM media viewer software in root of each burned media. Some advanced analysis and processing applications are primarily designed for images generated by Philips equipment when sent to the CD Printer. **Table 5** shows limitation for internal viewing option.

This version of DICOM Conformance Statement applies to the CD Printer version 5.6.2.

Table 1 presents an overview of all network services and the applicable SOP classes as provided by CD Printer.

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Storage			
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	Yes	Yes
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	Yes	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	Yes
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	Yes
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	Yes
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	Yes
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	Yes
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	Yes
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	Yes
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes

Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	Yes	Yes
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	Yes
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	Yes	Yes
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	Yes	Yes
Pseudo-Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.3	Yes	Yes
Blending Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.4	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radio-fluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	Yes
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	Yes

Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	Yes
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	Yes
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	Yes
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	Yes
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	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 Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	Yes
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	Yes
Structured Reporting			
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Yes	Yes
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	Yes
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	Yes
Workflow Management			
Verification	1.2.840.10008.1.1	No	Yes

Table 1: All Network Services

Table 2 lists the Supported Media Storage Application Profiles (with roles).

Media Storage Application Profile	Roles			Supported Media
	Write Files (FSC)	Read Files (FSR)	Update Files (FSU)	
CD – R Disk				
General Purpose CD-R	Yes	No	No	CD +R/-R
Private General Purpose CD-DVD	Yes	No	No	CD +R/-R
DVD Disk				
General Purpose DVD-JPEG	Yes	No	No	DVD +R/-R and +RW/-RW
Private General Purpose CD-DVD	Yes	No	No	DVD +R/-R and +RW/-RW

Table 2: Media Services

Note: *Private General Purpose CD-DVD Media Storage Application Profile allows creating DICOM CD and DVD without transfer syntax control of writing DICOM Instance files. Usage of Private or Standard Profile is configurable.*

CD Printer can be configured to not control content and format of distributing on media data. In such case data will be written "as is" (as received from remote DICOM node) and all responsibility for normality of data format and contents shall be borne by the source of the information from which the data was received by CD Printer.

CD Printer can be configured explicitly to change format of distributing on media data by system administrator of CD Printer. In such case all responsibility for normality of data format and contents shall be borne by the system administrator.

The supported Transfer Syntaxes UID's by the CD Printer System for all **Storage** SOP Classes are showed in the **Table 3**.

Transfer Syntaxes Name	Transfer Syntaxes UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline (Process 1): Lossy JPEG 8 Bit Image Compression	1.2.840.10008.1.2.4.50
JPEG Extended (Process 2 & 4): Lossy JPEG 12 Bit Compression	1.2.840.10008.1.2.4.51
JPEG Lossless Compression (Process 14)	1.2.840.10008.1.2.4.70
RLE Compression	1.2.840.10008.1.2.5

Table 3: Transfer Syntaxes for all Storage SOP Classes - Images

The supported Transfer Syntaxes UID's by the CD Printer System for all NOT Storage SOP Classes as: **Structured Reporting** and **Workflow Management**, are showed in **Table 4**.

Transfer Syntaxes Name	Transfer Syntaxes UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

Table 4: Transfer Syntaxes for all NOT Storage SOP Classes – Non-Images

Table 5 gives an overview of the image formats that can be viewed or stored.

Photometric Interpretation	Storage	Viewing
MONOCHROME1	+	+
MONOCHROME2	+	+
RGB	+	+
YBR_FULL	+	-
YBR_FULL_422	+	+
YBR_PARTIAL_422	+	-
PALETTE COLOR	+	+
Other	+	-

Table 5: Support for Photometric Interpretation

2. TABLE OF CONTENTS

3. INTRODUCTION

3.1 INTENDED USE

This DICOM Conformance Statement is intended for:

- (potential) customers
- system integrators of medical equipment
- marketing staff interested in system functionality
- software designers implementing DICOM interfaces

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

3.2 REMARKS

The DICOM Conformance Statement is contained in chapter 1 through 8 and follows the contents and structuring requirements of the DICOM Standard PS 3.2.

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

Interoperability

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

It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

Validation

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

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

New versions of the DICOM Standard

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery.

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

3.3 DEFINITIONS, TERMS AND ABBREVIATIONS

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

The word Philips in this document refers to Philips Medical Systems.

The following acronyms and abbreviations may be used in this document.

AE	Application Entity
BOT	Basic Offset Table
CD	Compact Disc
CD-R	CD-Recordable
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DVD-JPEG	Digital Video Disc – JPEG
EBE	DICOM Explicit VR Big Endian
ELE	DICOM Explicit VR Little Endian
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
GUI	Graphical User Interface
HIPAA	Health Insurance Portability and Accountability Act
HASP	Hardware Security Key

ILE	DICOM Implicit VR Little Endian
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
JPEG	Joint Photographic Experts Group
MR	Magnetic Resonance
N/A	Not applicable
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
PMS(N)	Philips Medical Systems (Nederland B.V.)
Q/R	Query/Retrieve (Service Class)
RWA	Real-World Activity
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Value Representation
UID	Unique Identifier

3.4 REFERENCES

[DICOM] Digital Imaging and Communications in Medicine (DICOM), Part 1 – 18 (NEMA PS 3.1 – PS 3.18), National Electrical Manufacturers Association (NEMA)
Publication Sales 1300 N. 17th Street, Suite 1847
Rosslyn, Virginia. 22209, United States of America

4. NETWORKING

This section contains networking related services vs. the media related ones in Chapter 5.

4.1 IMPLEMENTATION MODEL

The implementation model consists of the following sections:

- The Application Data Flow Diagram, specifying the relationship between the CD Printer Application Entities and the "external world" or Real-World activities,
- A functional description of the CD Printer Application Entities, and the sequencing constraints among them.

4.1.1 APPLICATION DATA FLOW

The CD Printer communication is based on the DICOM v3.0 standard. This enables the CD Printer to communicate with any DICOM v3.0 compliant products (e.g., modalities, workstations, PACS, hardcopy units). The CD Printer can function both as a server and as a client. Thus it can send DICOM objects to other stations, and other stations can receive from the CD Printer and send DICOM objects to it. The DICOM objects are transferred in the DICOM v3.0 protocol based on TCP/IP as a transport layer.

The CD Printer implements and provides DICOM services using the following Application Entities:

- Storage Provider AE.
- Distribution Manager AE
- Media AE (No Network AE, See Chapter 5).

Figure 2 shows the CD Printer application data flow as a functional overview of the CD Printer AE's. As depicted in **Figure 2**, the CD Printer AE's incorporate the following functionality.

- After RWA Request Verification, the Storage Provider AE and Archive-Manager AE act as a C-ECHO SCP it receives a Verification request and responds successfully to the requesting SCU.
- After RWA Storage Data Flow, the Storage Provider AE acts as C-STORE SCP. It receives requests for instance storage from external AE, converts it into assigned destination transfer syntax and collects the instances on its disk.
- After RWA Forward Data Flow, the Distribution Manager AE acts as C-STORE SCU. It provides a non-standard service for dispatching instances that originate in one AE to one or more target AE(s). Once a data collection is ready for distribution, the Distribution Manager AE further checks to see if there are any Forward-Rules defined for the data collection. For each Forward-Rule that

the Distribution Manager AE found, the Distribution Manager AE initiates an association with the target AE and transmits the instances to it.

- Forwarding of received data to the Media AE is performed by the Distribution Manager AE according to special Forward-Rule.

The CD Printer stores received data only temporarily. The data is removed automatically after distribution (forwarding and/or media burning).

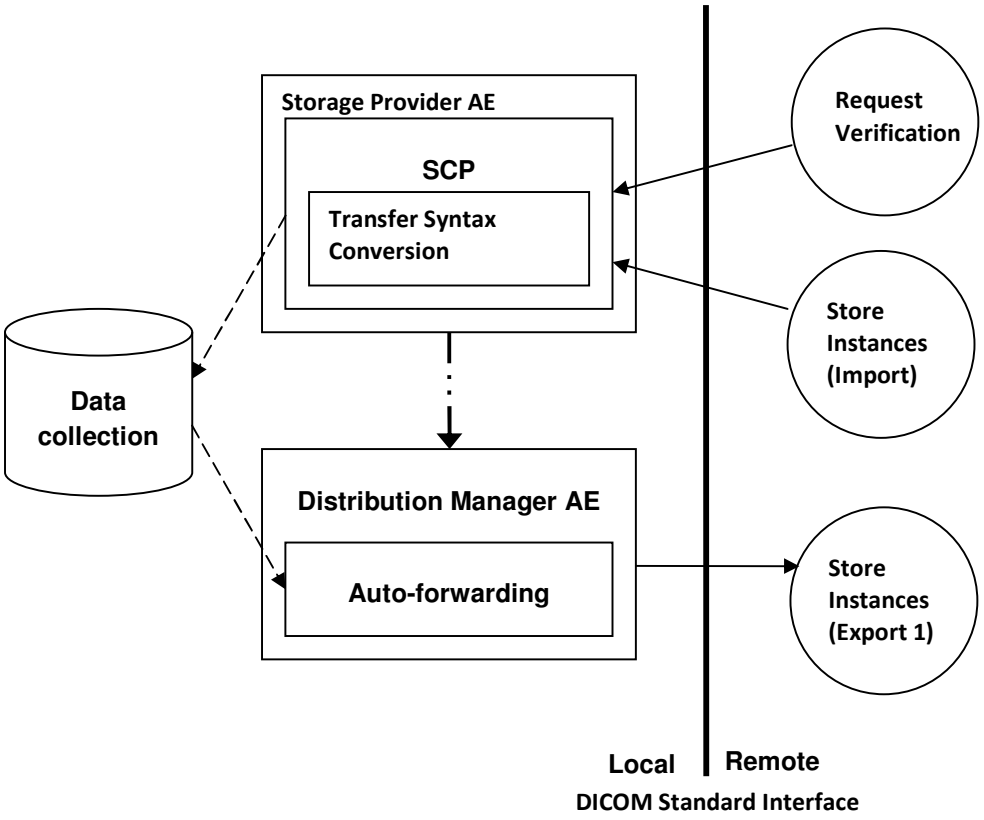


Figure 2: Networking Application Data Flow Diagram

4.1.2 FUNCTIONAL DEFINITION OF AE'S

This section describes in general the functions to be performed by the Application Entities (AE's), and the DICOM services used to accomplish these functions.

4.1.2.1 FUNCTIONAL DEFINITION OF STORAGE PROVIDER AE

The Storage Provider constantly waits for association requests from external applications.

For each association it verifies the access privileges that was defined for the requesting AE, decides whether to accept the association runs in a separate thread.

The Storage Provider accepts association for verify connectivity and import instances.

Verification Service Class

The Storage Provider AE can perform the Verification service as SCP (RWA Request Verification).

A remote SCU shall request an association with the Storage Provider AE for Verification SOP class. After accepting the association, the AE shall receive and respond to the Verification request to check the network connection to the AE and make sure that the AE is up and running, and release the association when requested successfully.

Storage Service Class

The Storage Provider AE waits for incoming associations and can perform the Storage service as SCP (RWA Store Instances, Import).

Incoming associations are approved or rejected according to the settings in the Storage Provider AE control database.

A remote SCU shall request an association with the Storage Provider AE for Storage SOP classes. After accepting the association, the Storage Provider AE shall receive the Storage requests, store the data in the data collection storage, send the applicable Storage responses, and release the association when requested.

The received instances are divided into collections by patient identification for which Patient's Name (0010,0010) and Patient ID (0010,0020) are used.

The division can be passed round by sending of Storage requests to special AE Title that contains MULTIPATIENT key word. In the case all received from one remote SCU AE Title to the same special AE Title data will be collected into one data set. The collection can include examinations of different patients. The data can be sent in one or several associations. The collection will be closed in accordance to defined transmission completion Timeout.

The Storage Provider AE can convert received instances from source transfer syntax into destination transfer syntax, if this is assigned by configuration.

4.1.2.2 FUNCTIONAL DEFINITION OF DISTRIBUTION MANAGER AE

The CD Printer provides a unique Forward-Rules feature that enables to use it as a DICOM network hub. When instances are stored, the CD Printer can forward these instances to other AE's according to these Forward-Rules. In this case the CD Printer acts as a C-STORE SCP (Storage Provider AE) and a C-STORE SCU (Distribution Manager AE).

The Distribution Manager AE can forward receive instances to one or more target AE(s).

Once a data collection is ready for distribution, the Distribution Manager AE further checks if there are any Forward-Rules defined for the data collection (for the called AE Title or received objects). For each Forward-Rule that the Distribution Manager AE found, the Distribution Manager AE initiates an association with the target AE and transmits the instances to it.

Storage Service Class
The Distribution Manager AE can perform the Storage service as SCU (RWA Store Instances, Export 1) if there are any Forward-Rules defined for the called AE Title or received objects.

The Distribution Manager AE shall request an association with the selected remote SCP for one applicable Storage SOP class. When the association is accepted, the Distribution Manager AE shall send the Storage request, receive the Storage responses and act accordingly, and release the association. Such sequence of actions will be repeated for each instance of the stored data collection.

The Distribution Manager AE can forward receive from the Storage Provider AE data to the Media AE for CD producing and to the Archive-Manager AE for processing, populating its local database and storage of the data according to special Forward-Rule.

4.1.3 SEQUENCING OF REAL WORLD ACTIVITIES

This section contains a description of specific sequencing as well as potential constraints of Real-World Activities, including any applicable user interactions, as performed by AE-s of the CD Printer.

The CD Printer has no way of knowing when it has a complete study or what constitutes a complete study. If it receives an instance query while also receiving storage requests, the query response may not include all of the instances that are in the study. The completion of receiving data set is controlled by configurable transmission completion Timeout.

Note: The transmission completion Timeout is not term defined by DICOM standard and is not described in the conformance statement. See CD PRINTER Administrator Guide for full explanation of the setting, it specification and usage.

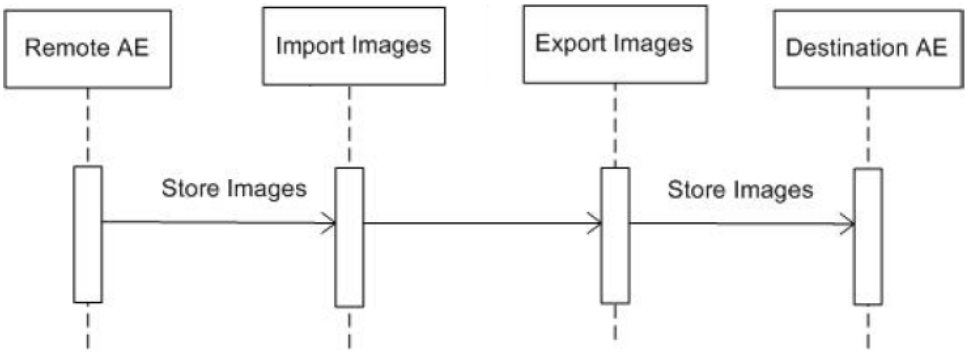


Figure 3: RWA Sequencing for Retrieve Local Instances

4.2 AE SPECIFICATIONS

4.2.1 STORAGE PROVIDER AE

Every detail of this specific Application Entity shall be completely specified under this section.

Depending on configuration, the Storage Provider AE may be accessible for remote AE simultaneously under several AE Titles, each representing the one Application Entity.

4.2.1.1 SOP CLASSES

This Application Entity provides extended Standard Conformance to the following SOP classes.

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	No	Yes
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	No	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	No	Yes
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	No	Yes
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes

Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Single Bit Secondary Capture Image Storage *	1.2.840.10008.5.1.4.1.1.7.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color Secondary Capture Image Storage *	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
Standalone Overlay Storage *	1.2.840.10008.5.1.4.1.1.8	No	Yes
Standalone Curve Storage *	1.2.840.10008.5.1.4.1.1.9	No	Yes
12-lead ECG Waveform Storage *	1.2.840.10008.5.1.4.1.1.9.1.1	No	Yes
General ECG Waveform Storage *	1.2.840.10008.5.1.4.1.1.9.1.2	No	Yes
Ambulatory ECG Waveform Storage *	1.2.840.10008.5.1.4.1.1.9.1.3	No	Yes
Hemodynamic Waveform Storage *	1.2.840.10008.5.1.4.1.1.9.2.1	No	Yes
Cardiac Electrophysiology Waveform Storage *	1.2.840.10008.5.1.4.1.1.9.3.1	No	Yes
Basic Voice Audio Waveform Storage *	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes
Standalone Modality LUT Storage *	1.2.840.10008.5.1.4.1.1.10	No	Yes
Standalone VOI LUT Storage *	1.2.840.10008.5.1.4.1.1.11	No	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	No	Yes
Pseudo-Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.3	No	Yes
Blending Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.4	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radio-fluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	No	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
Spatial Registration Storage *	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
Spatial Fiducials Storage *	1.2.840.10008.5.1.4.1.1.66.2	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	No	Yes
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes

Video Photographic Image Storage *	1.2.840.10008.5.1.4.1.1.77.1.4.1	No	Yes
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	No	Yes
Stereometric Relationship Storage *	1.2.840.10008.5.1.4.1.1.77.1.5.3	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
RT Image Storage *	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Dose Storage *	1.2.840.10008.5.1.4.1.1.481.2	No	Yes
RT Structure Set Storage *	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT 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 Brachy Treatment Record Storage *	1.2.840.10008.5.1.4.1.1.481.6	No	Yes
RT Treatment Summary Record Storage *	1.2.840.10008.5.1.4.1.1.481.7	No	Yes
Basic Text SR *	1.2.840.10008.5.1.4.1.1.88.11	No	Yes
Enhanced SR *	1.2.840.10008.5.1.4.1.1.88.22	No	Yes
Comprehensive SR *	1.2.840.10008.5.1.4.1.1.88.33	No	Yes
Mammography CAD SR *	1.2.840.10008.5.1.4.1.1.88.50	No	Yes
Key Object Selection Document *	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
Chest CAD SR *	1.2.840.10008.5.1.4.1.1.88.65	No	Yes
Verification	1.2.840.10008.1.1	No	Yes

Table 6: SOP Classes for Storage Provider AE

Note: Any SOP specific behavior is documented later in the Conformance Statement in the applicable SOP specific conformance section.

*Note: Marked as * SOP Class instances are not supported for viewing or presentation by DICOM media viewer software, only supported for storage.*

Note: Enhanced IOD Modules, Synchronization, Cardiac Synchronization, Respiratory Synchronization, Bulk Motion Synchronization, Supplemental Palette Color Lookup Table, Multi-frame Functional Groups, Multi-frame Dimension, MR Pulse Sequence and XA/XRF Multi-frame Presentation are not supported for viewing or presentation, only supported for storage. Some of them are supported partially.

4.2.1.2 ASSOCIATION POLICIES

This section contains a description of the General Association Establishment and Acceptance policies of the AE.

4.2.1.2.1 GENERAL

Storage Provider accepts Associations for the following purposes:

- To allow remote applications to verify application level communication with Storage Provider; refer to Request Verification section.
- To allow remote applications to store instances in the Storage Provider database (i.e. instance import); refer to Store Instances (Import) section.

The maximum PDU size, which can be received the Storage Provider, is configurable (default value is 16kBytes).

Application Context Name	1.2.840.10008.3.1.1.1

Table 7: DICOM Application Context

4.2.1.2.2 NUMBER OF ASSOCIATIONS

The Storage Provider manages an association resources pool. Each incoming association is assigned to one of the pool members. The size of this pool is configurable and the maximum size is limited only by the underling operating system and by hardware limits (default is 5).

When the maximum number of associations is reached, Storage Provider will reject associations.

Maximum number of simultaneous associations	Configurable

Table 8: Number of Associations as an Association Acceptor for Storage Provider

Nevertheless, the number of simultaneous associations shall be limited by the available resources (CPU, memory, disk space).

4.2.1.2.3 ASYNCHRONOUS NATURE

Asynchronous communication is not supported.

4.2.1.2.4 IMPLEMENTATION IDENTIFYING INFORMATION

Following Implementation Class UID and Version Name are defined.

Implementation Class UID	1.2.826.0.1.3680043.8.195
Implementation Version Name:	CDP_V3

Table 9: DICOM Implementation Class and Version for Storage Provider AE

4.2.1.3 ASSOCIATION INITIATION POLICY

Storage Provider never initiates an association.

4.2.1.4 ASSOCIATION ACCEPTANCE POLICY

Storage Provider shall accept Associations for the following purposes:

- To allow remote applications to verify application level communication with Storage Provider; refer to Request Verification section.
- To allow remote applications to store instances in the Storage Provider database (i.e. instance import); refer to Store Instances (Import) section.

The Storage Provider will acknowledge an association from an external AE if the following conditions are met all conditions:

- The association request application context is DICOM,
- The requesting AE title is configured in the Storage Provider control database,
- The requesting AE network node matches the configured node,
- The responding AE title in the association request matches the one of defined Storage Provider AE titles,
- The number of active associations has not reached the maximum concurrent associations limit.

4.2.1.4.1 REQUEST VERIFICATION

4.2.1.4.1.1 DESCRIPTION AND SEQUENCING OF ACTIVITIES

The Storage Provider AE shall accept associations from systems that wish to verify application level communication using the C-ECHO command.

The real-world activity associated with the C-ECHO request is verification activity made by an external AE wishing to verify that the network connection is operating properly and that the Storage Provider is up and running.

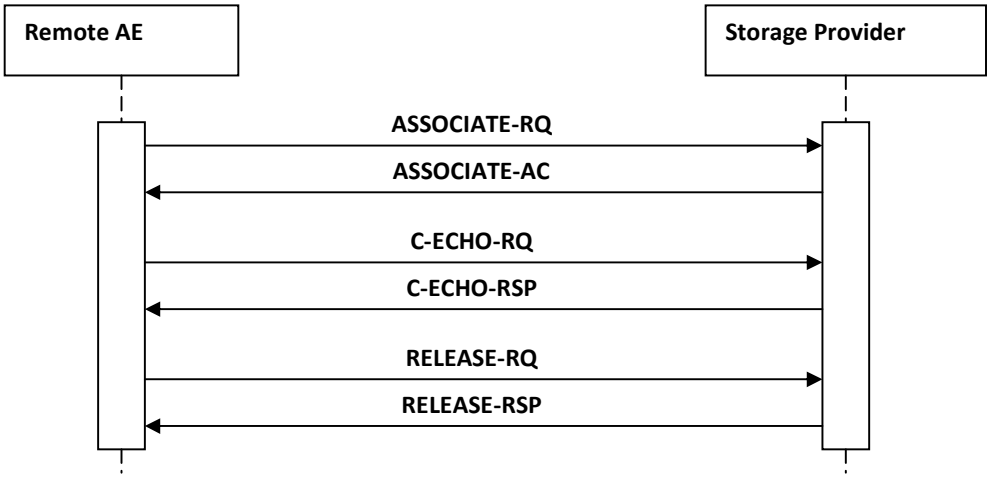


Figure 4: Sequencing of RWA Request Verification

4.2.1.4.1.2 ACCEPTED PRESENTATION CONTEXTS

The Storage Provider will accept any number of Verification SOP classes that are listed in **Table 6**, provided that the requesting application configured and granted storage access.

The Storage Provider accepts presentation contexts with multiple transfer syntaxes, presentation contexts differing only by their transfer syntax as well as duplicate presentation contexts.

There is no check for duplicate contexts, and these will therefore be accepted.

The Storage Provider does not limit the number of accepted presentation contexts.

In the unlikely event that the Storage Provider runs out of resources while trying to accept multiple presentation contexts, the Storage Provider will gracefully reject the association.

The Storage Provider shall be able to accept the presentation contexts as specified in **Table 10**.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Table 10: Acceptable Presentation Contexts for Request Verification

4.2.1.4.1.3 SOP SPECIFIC CONFORMANCE FOR SOP CLASS VERIFICATION

The Storage Provider AE provides standard conformance to the Verification service class.

4.2.1.4.2 STORE INSTANCES (IMPORT)

4.2.1.4.2.1 DESCRIPTION AND SEQUENCING OF ACTIVITIES

The Storage Provider AE shall accept associations from systems that wish to store instances in the data collection storage using the C-STORE command to store the instances on the Storage Provider disk.

The instances are divided into collections by patient identification for which Patient's Name (0010,0010) and Patient ID (0010,0020) are used.

The Storage Provider AE will issue a failure status in the following cases:

- The Storage Provider AE is unable to store the instances on the disk.
- The SOP class used for transmission does not match the instance structure and data.

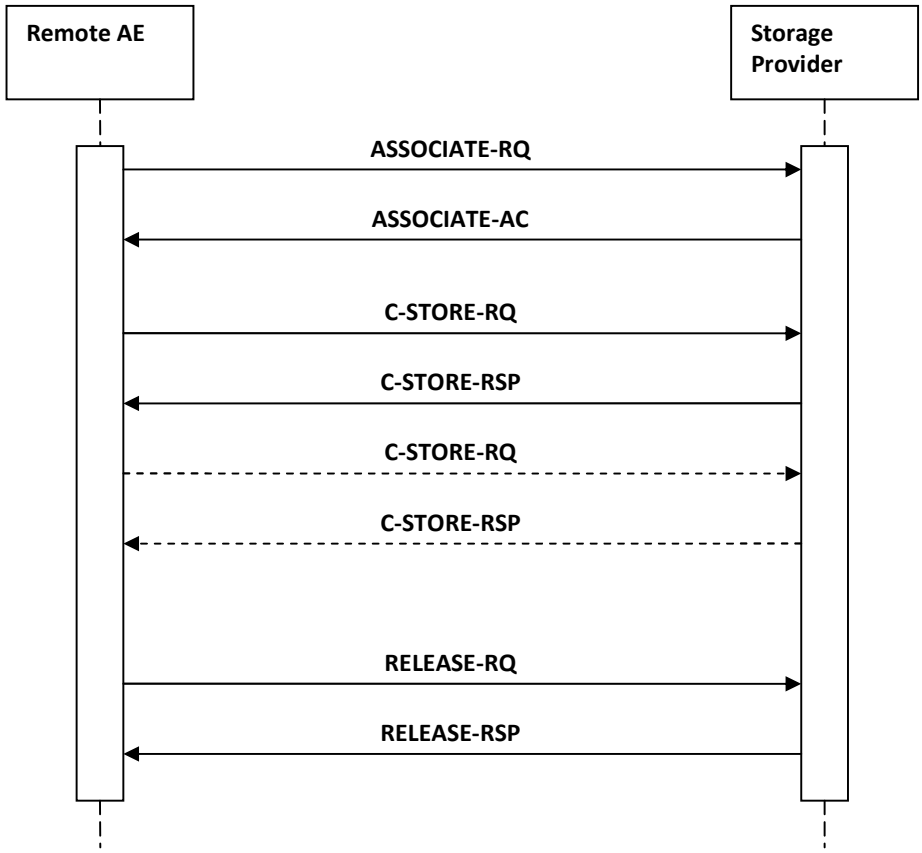


Figure 5: Sequencing of RWA Store Instances (Import)

4.2.1.4.2.2 ACCEPTED PRESENTATION CONTEXTS

The Storage Provider AE will accept any number of Storage SOP Classes that are listed in **Table 11**, provided that the requesting application configured and granted storage access.

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List (note)**	**UID List**		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Digital Mammography Image Storage - for Presentation	1.2.840.10008.5.1.4.1.1.1.2	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Digital Mammography Image Storage - for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Digital Intra-oral X-Ray Image Storage - for Presentation	1.2.840.10008.5.1.4.1.1.1.3	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Digital Intra-oral X-Ray Image Storage - for Processing	1.2.840.10008.5.1.4.1.1.1.3.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

		Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5		
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	ILE ELE Lossy 8 Lossy 12	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	SCP	None

		JPEG LL RLE	1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Multi-frame Single Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Hemodynamic ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Standalone modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Pseudo-Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.3	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Blending Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.4	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
X-Ray Radio-fluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Ophthalmic Photographic 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
Ophthalmic Photographic 16	1.2.840.10008.5.1.4.1.1.77.1.5.2	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Bit Image Storage		Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5		
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	ILE ELE Lossy 8 Lossy 12 JPEG LL RLE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5	SCP	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	ILE	1.2.840.10008.1.2	SCP	None

		ELE	1.2.840.10008.1.2.1		

Table 11: Acceptable Presentation Contexts for Store Instances (Import)

Note: Read for Lossy 8 = JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression.

Read for Lossy 12 = JPEG Extended (Process 2 & 4): Default Transfer Syntax for Lossy JPEG 12 Bit Image Compression (Process 4 only).

Read for JPEG LL = JPEG Lossless Compression (Process 14).

Read for RLE = RLE Compression.

The Storage Provider accepts presentation contexts with multiple transfer syntaxes, the presentation contexts differing only by their Transfer Syntax as well as duplicate presentation contexts.

There is no check for duplicate contexts, and these will therefore be accepted.

The Storage Provider AE does not limit the number of accepted presentation contexts.

In the unlikely event that the Storage Provider AE runs out of resources while trying to accept multiple presentation contexts, the CD Printer will gracefully reject the association.

The Storage Provider AE supports Transfer Syntaxes for Storage as can be seen in **Table 11**, and supports for all other SOP Classes, other than Storage only the ILE and ELE Transfer Syntaxes, as can be seen in **Table 4**.

On accepting of presentation contexts with multiple transfer syntaxes the Storage Provider selects proposed Transfer Syntax that loads network less (Usually it is *JPEG Extended (Process 2 & 4)* Transfer Syntax). It is responsibility of device specialists for proper configuration of sending DICOM devices to provide DICOM images within lossy, lossless or native format.

4.2.1.4.2.3 SOP SPECIFIC CONFORMANCE FOR STORAGE SOP CLASSES

The DICOM standard does not guarantee that the Storage Provider AE applications can process the received instances. This depends on the presence and consistency of a set of attributes in these instances. The conditions for running the Storage Provider AE applications shall be specified in separate Annexes.

The Storage Provider AE conforms to the SOP's of the Storage Service Class at Level 2 (Full) conformance.

The Storage Provider AE does not attempt any extended negotiation.

The Storage Provider AE does not discard any elements.

The Storage Provider takes no further action in case of warnings or errors in the C-STORE operations. The store response status is saved in the extended log.

After instances receiving Storage Provider AE can convert the transfer syntax according to **Table 12**.

Transfer Syntax / Stored Destination	Received Source	ILE	ELE	RLE	JPEG Lossless	JPEG Baseline (Process 1)	JPEG Extended (Process 2 & 4)
ILE		N/A	+	+	+	+	+
ELE		+	N/A	+	+	+	+
RLE		+	+	N/A	-	-	-
JPEG Lossless		+	+	-	N/A	+	+
JPEG Baseline (Process 1)		-	-	-	-	N/A	-
JPEG Extended (Process 2 & 4)		-	-	-	-	-	N/A

Table 12: Transfer Syntax Conversion

Note: JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]): Default Transfer Syntax for Lossless JPEG Image Compression.

JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression.

JPEG Extended (Process 2 & 4): Default Transfer Syntax for Lossy JPEG 12 Bit Image Compression (Process 4 only).

Table 13 gives an overview of the image formats that can be stored.

Photometric Interpretation	Storage	Viewing
MONOCHROME1	+	N/A
MONOCHROME2	+	N/A
RGB	+	N/A
YBR_FULL	+	N/A
YBR_FULL_422	+	N/A
PALETTE COLOR	+	N/A
Other	+	N/A

Table 13: Support for Photometric Interpretation

Note: The Storage Provider AE does not have internal viewing option.

Following are the details regarding the specific conformance, including response behavior to all applicable status codes, both from an application level and communication errors.

Service Status	Further Meaning	Error Code	Behavior
Success	Storage is complete	0000	The instance(s) shall be stored in the CD Printer database.
Error	Cannot understand	C000	The instance(s) cannot be parsed. Storage Provider shall send a notification, log the condition, and wait next store request.

Table 14: DICOM Command Response Status Handling Behavior

Exception	Behavior
ARTIM Time-out	The association shall be dropped. Storage Provider waits next association.
Association Time-out SCU	The association shall be dropped. Storage Provider waits next association.
Association aborted	The association shall be dropped. Storage Provider waits next association.

Table 15: DICOM Command Communication Failure Behavior

4.2.2 DISTRIBUTION MANAGER AE

Every detail of this specific Application Entity shall be completely specified under this section.

Note: Configuring of Storage Provider AE to convert format of received data from original Transfer Syntax to Implicit Little Endian is compulsory condition for usage of data distribution via DICOM protocol.

4.2.2.1 SOP CLASSES

This Application Entity provides Standard Conformance to the following SOP classes.

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	UID		
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	Yes	No
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	Yes	No
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	No
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Yes	No
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Yes	No
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Yes	No

CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Yes	No
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes	No
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	No
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Yes	No
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Yes	No
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Yes	No
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes	No
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes	No
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	No
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes	No
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	Yes	No
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Yes	No
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	No
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	No
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	No
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	No
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	No
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	No
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	Yes	No
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	Yes	No
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	No
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	Yes	No
Pseudo-Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.3	Yes	No
Blending Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.4	Yes	No
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radio-fluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	No

X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Yes	No
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	Yes	No
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Yes	No
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	Yes	No
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Yes	No
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Yes	No
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	Yes	No
Ophthalmic Photography 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	Yes	No
Ophthalmic Photography 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	Yes	No
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	Yes	No
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	No
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Yes	No
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Yes	No
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Yes	No
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Yes	No
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

Table 16: SOP Classes for Distribution Manager AE

Note: Any SOP specific behavior is documented later in the Conformance Statement in the applicable SOP specific conformance section.

4.2.2.2 ASSOCIATION POLICIES

This section contains a description of the General Association Establishment and Acceptance policies of the AE.

4.2.2.2.1 GENERAL

The Distribution Manager AE will initiate associations as a result of Forward-Rules.

The Distribution Manager AE attempts to establish an association once. If this attempt fails or if the association is unexpectedly terminated, the Distribution Manager AE tries to establish an association for next exporting instance. After last instance export attempt the Distribution Manager AE displays a transferring error in the GUI and stops the related activity if only for one instance the store operation fails. The Distribution Manager AE will retry the forwarding operation during the time interval, as written in the Distribution Manager AE configuration file.

The maximum PDU size, which can be transmitted by the CD Printer, is 16kBytes.

Application Context Name	1.2.840.10008.3.1.1.1

Table 17: DICOM Application Context

4.2.2.2.2 NUMBER OF ASSOCIATIONS

The Distribution Manager will not initiate more than one association. The association may be used to issue store request.

Maximum number of simultaneous associations	1

Table 18: Number of Associations as an Association Initiator for Distribution Manager

4.2.2.2.3 ASYNCHRONOUS NATURE

Asynchronous communication is not supported.

4.2.2.2.4 IMPLEMENTATION IDENTIFYING INFORMATION

Following Implementation Class UID and Version Name are defined.

Implementation Class UID	1.2.840.113704.7.1.20011113
Implementation Version Name:	CDP_LTD_V1

Table 19: DICOM Implementation Class and Version for Distribution Manager AE

4.2.2.3 ASSOCIATION INITIATION POLICY

Distribution Manager shall initiate associations in the following cases:

- As a result of a received data collection for which there is an active Forward-Rule, the Distribution Manager will attempt to initiate an association to the target AE and transmit the instances to it.
- Multiple Forward-Rules can be defined for a data collection.
- Forward-Rules are processed in sequence post the association termination.

4.2.2.3.1 STORE INSTANCES (EXPORT 1)

4.2.2.3.1.1 DESCRIPTION AND SEQUENCING OF ACTIVITIES

The RWA Store Instances (Export 1) involves the storage of instances from the local Storage Provider data collection storage to a remote system.

The Distribution Manager AE initiates Store Instances (Export 1) after receiving of data collection from an external AE by Storage Provider AE for which collection or data there is one or more active Forward-Rules defined in the Distribution Manager control database.

Forward-Rules make the CD Printer act as a hub in the DICOM applications network. This mechanism enables the distribution of instances that originate from one AE to other AE's.

Once a data collection is render to Distribution Manager AE, the AE checks if there are any active Forward-Rules for the called AE Title or received objects.

For each Forward-Rule that the Distribution Manager AE found, it initiates an association with the target AE stated in that rule and transmits the instances to it.

The associations will be initiated in sequence, one after the other for each instance within data collection.

The sending process will be repeated for each target AE.

If several Forward-Rules direct to Distribution Manager to send one data collection to one target AE, the collection will be sent to the target AE once.

The Distribution Manager AE attempts to forward the instance once. If this attempt fails, the Distribution Manager AE tries to forward the next instance. After last instance export attempt the Distribution Manager AE displays a transferring error in the GUI and stops the related activity if only for a one instance the store operation fails.

The Distribution Manager AE will retry to forward the whole instance collection during the time interval, as written in the Distribution Manager AE configuration file.

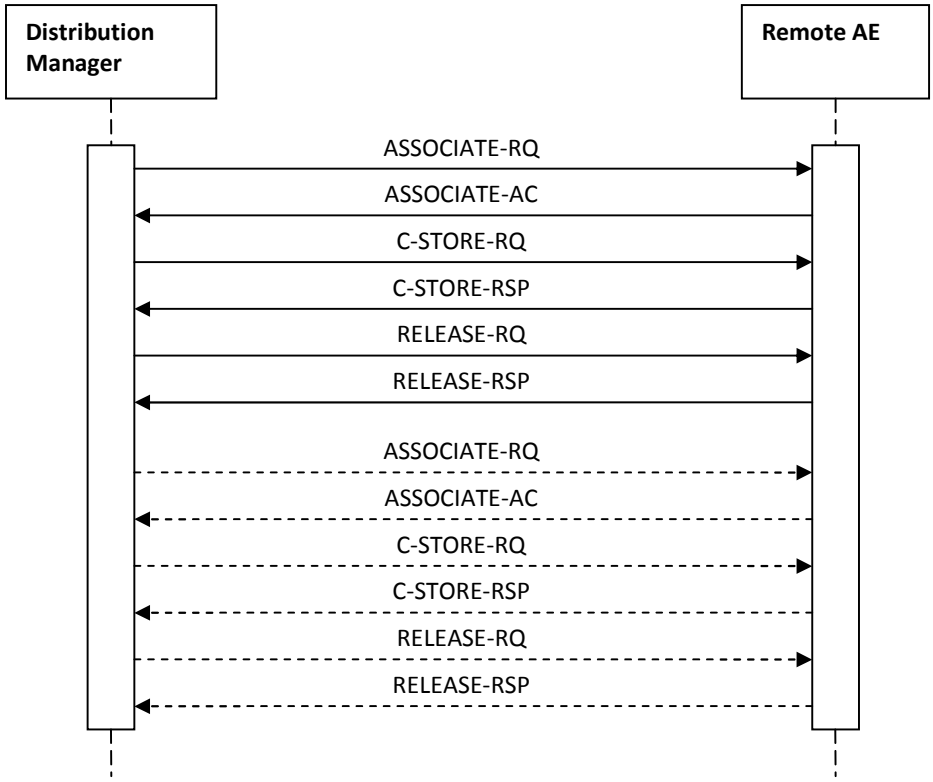


Figure 6: Sequencing of RWA Store Instances (Export 1)

4.2.2.3.1.2 PROPOSED PRESENTATION CONTEXTS

Each time an association is initiated, the association initiator proposes one Presentation Context to be used on that association. The Presentation Contexts proposed by the Distribution Manager AE for export instances are defined in **Table 20**.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List (note)	UID List		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	ILE	1.2.840.10008.1.2	SCU	None
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	ILE	1.2.840.10008.1.2	SCU	None
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	ILE	1.2.840.10008.1.2	SCU	None
Digital Mammography Image Storage - for Presentation	1.2.840.10008.5.1.4.1.1.1.2	ILE	1.2.840.10008.1.2	SCU	None
Digital Mammography Image Storage - for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	ILE	1.2.840.10008.1.2	SCU	None
Digital Intra-oral X-Ray Image Storage - for Presentation	1.2.840.10008.5.1.4.1.1.1.3	ILE	1.2.840.10008.1.2	SCU	None
Digital Intra-oral X-Ray Image Storage - for Processing	1.2.840.10008.5.1.4.1.1.1.3.1	ILE	1.2.840.10008.1.2	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	ILE	1.2.840.10008.1.2	SCU	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	ILE	1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	ILE	1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	ILE	1.2.840.10008.1.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	ILE	1.2.840.10008.1.2	SCU	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	ILE	1.2.840.10008.1.2	SCU	None
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	ILE	1.2.840.10008.1.2	SCU	None
Nuclear Medicine	1.2.840.10008.5.1.4.1.1.5	ILE	1.2.840.10008.1.2	SCU	None

Image Storage (Ret.)					
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	ILE	1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	ILE	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	ILE	1.2.840.10008.1.2	SCU	None
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	ILE	1.2.840.10008.1.2	SCU	None
Multi-frame Single Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	ILE	1.2.840.10008.1.2	SCU	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	ILE	1.2.840.10008.1.2	SCU	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	ILE	1.2.840.10008.1.2	SCU	None
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	ILE	1.2.840.10008.1.2	SCU	None
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	ILE	1.2.840.10008.1.2	SCU	None
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	ILE	1.2.840.10008.1.2	SCU	None
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	ILE	1.2.840.10008.1.2	SCU	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	ILE	1.2.840.10008.1.2	SCU	None
Hemodynamic ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	ILE	1.2.840.10008.1.2	SCU	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	ILE	1.2.840.10008.1.2	SCU	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	ILE	1.2.840.10008.1.2	SCU	None
Standalone modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	ILE	1.2.840.10008.1.2	SCU	None
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	ILE	1.2.840.10008.1.2	SCU	None

Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	ILE	1.2.840.10008.1.2	SCU	None
Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.2	ILE	1.2.840.10008.1.2	SCU	None
Pseudo-Color Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.3	ILE	1.2.840.10008.1.2	SCU	None
Blending Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.4	ILE	1.2.840.10008.1.2	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	ILE	1.2.840.10008.1.2	SCU	None
X-Ray Radio-fluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	ILE	1.2.840.10008.1.2	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	ILE	1.2.840.10008.1.2	SCU	None
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	ILE	1.2.840.10008.1.2	SCU	None
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	ILE	1.2.840.10008.1.2	SCU	None
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	ILE	1.2.840.10008.1.2	SCU	None
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	ILE	1.2.840.10008.1.2	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	ILE	1.2.840.10008.1.2	SCU	None
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	ILE	1.2.840.10008.1.2	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	ILE	1.2.840.10008.1.2	SCU	None
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	ILE	1.2.840.10008.1.2	SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	ILE	1.2.840.10008.1.2	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	ILE	1.2.840.10008.1.2	SCU	None
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	ILE	1.2.840.10008.1.2	SCU	None

Ophthalmic Photographic 8 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.1	ILE	1.2.840.10008.1.2	SCU	None
Ophthalmic Photographic 16 Bit Image Storage	1.2.840.10008.5.1.4.1.1.77.1.5.2	ILE	1.2.840.10008.1.2	SCU	None
Stereometric Relationship Storage	1.2.840.10008.5.1.4.1.1.77.1.5.3	ILE	1.2.840.10008.1.2	SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	ILE	1.2.840.10008.1.2	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	ILE	1.2.840.10008.1.2	SCU	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	ILE	1.2.840.10008.1.2	SCU	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	ILE	1.2.840.10008.1.2	SCU	None
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	ILE	1.2.840.10008.1.2	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	ILE	1.2.840.10008.1.2	SCU	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	ILE	1.2.840.10008.1.2	SCU	None
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	ILE	1.2.840.10008.1.2	SCU	None
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	ILE	1.2.840.10008.1.2	SCU	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	ILE	1.2.840.10008.1.2	SCU	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	ILE	1.2.840.10008.1.2	SCU	None
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	ILE	1.2.840.10008.1.2	SCU	None
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	ILE	1.2.840.10008.1.2	SCU	None
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	ILE	1.2.840.10008.1.2	SCU	None

Table 20: Proposed Presentation Contexts for Store Instances (Export 1)

4.2.2.3.1.3 SOP SPECIFIC CONFORMANCE FOR STORAGE SOP CLASSES

Important remarks about the exported instances:

- The Distribution Manager does not attempt any extended negotiation.
- The Distribution Manager continues sending the remaining instances after unsuccessful C-STORE responses.

- The Distribution Manager takes no further action in case of warnings or errors in the C-STORE operations during transferring attempt. After finishing of transferring attempt a user error will be displayed in the GUI if only for a one instance the store operation fails.
- The Distribution Manager AE sends the instances using the same transfer syntax as they were stored by the Storage Provider AE.

Configuring of Storage Provider AE to convert format of received data from original Transfer Syntax to Implicit Little Endian is compulsory condition for usage of data distribution via DICOM protocol.

Following are the details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors.

Service Status	Further Meaning	Error Code	Behavior
Success	Storage is complete	0000	Continues with next store until completed thereafter the store job is marked as completed and the association is released.
Refused	Out of Resources	A7xx	Continues with next store until end of data collection. The store job is marked as failed. The job status is reported to user.
Error	Data set does not match SOP Class	A9xx	Continues with next store until end of data collection. The store job is marked as failed. The job status is reported to user.
	Cannot understand	Cxxx	Continues with next store until end of data collection. The store job is marked as failed. The job status is reported to user.
Warning	Coercion of Data Elements	B000	Continues with next store until completed thereafter the store job is marked as completed and the association is released.
	Elements discarded	B006	Continues with next store until completed thereafter the store job is marked as completed and the association is released.
	Data set does not match SOP class	B007	Continues with next store until completed thereafter the store job is marked as completed and the association is released.

Table 21: DICOM Command Response Status Handling Behavior

Exception	Behavior
ARTIM Time-out	Continues with next store until end of data collection. The store job is marked as failed. The job status is reported to user.
Reply Time-out	Continues with next store until end of data collection. The store job is marked as failed. The job status is reported to user.
Association Time-out SCU	Continues with next store until end of data collection.

Exception	Behavior
	The store job is marked as failed. The job status is reported to user.
Association aborted	Continues with next store until end of data collection. The store job is marked as failed. The job status is reported to user.

Table 22: DICOM Command Communication Failure Behavior

4.2.2.4 ASSOCIATION ACCEPTANCE POLICY

Distribution Manager never accepts an association.

4.3 NETWORK INTERFACES

4.3.1 PHYSICAL NETWORK INTERFACE

The CD Printer applications provide DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of [DICOM].

CD Printer supports a single network interface: Ethernet ISO.8802-3. With standard supported physical medium include:

- IEEE 802.3 10BASE-TX
- IEEE 802.3 100BASE-TX (Fast Ethernet)
- IEEE 802.3 1000BASE-X (Fiber Optic Gigabit Ethernet).

4.3.2 OSI STACK

OSI Stack is not supported

4.3.3 TCP/IP

TCP/IP stack is inherited from the Operating System.

The CD Printer is available on Windows 2000 Professional operating system (i.e. the operating system platform).

4.3.4 PHYSICAL MEDIA SUPPORT

The CD Printer is indifferent to the physical media over which TCP/IP operates. It inherits the medium from the operating system upon which it executes.

The CD Printer is available on Windows 2000 Professional.

4.3.5 POINT -TO-POINT STACK

Point-to-Point stack is not supported.

4.4 CONFIGURATION

The CD Printer uses a centralized control database for configuration.

The CD Printer for Windows 2000 uses InterBase v. 7.5.

CD Printer system is configured by means of a configuration program. This program is accessible during operating of the CD Printer system. It is password protected and intended to be used by Philips Customer Support Engineers only.

The configuration program shall prompt the Customer Support Engineer to enter configuration information as required by the CD Printer applications.

4.4.1 AE TITLE/PRESENTATION ADDRESS MAPPING

AE Title / Presentation-Address mapping is stored in The CD Printer control database and is configured using administration utilities.

How this is performed is described in this section.

4.4.1.1 LOCAL AE TITLES

The local AE title mapping and configuration shall be specified. Default AE titles are listed in **Table 23**.

Application Entity	Default AE Title	Default TCP/IP Listening Port
Storage Provider	CDP_PRINTER	104
Distribution Manager	CDP_SENDER	Not applicable

Table 23: AE Title Configuration Table

The AE titles in the CD Printer can be changed independently.

Number of defined AE titles for Storage Provider is unlimited.

4.4.1.2 REMOTE AE TITLE/PRESENTATION ADDRESS MAPPING

4.4.1.2.1 REMOTE ASSOCIATION INITIATORS

All relevant remote applications able to setup a DICOM association towards CD Printer applications must be configured at CD Printer configuration time. The Customer Support Engineer must provide the following information for each remote application:

- The Application Entity Title.
- The host name/IP address on which the remote application resides.

4.4.1.2.2 REMOTE ASSOCIATION ACCEPTORS

The following information must be provided for all relevant remote applications that are able to accept DICOM associations from CD Printer:

- The Application Entity Title.
- The host name/IP address on which the remote application resides.
- The port number at which the remote application accepts association requests.

4.4.2 PARAMETERS

The specification of important operational parameters, their default value and range (if configurable) is specified here.

The configuration parameters are given in **Table 24**, categorized in the following sections:

- General Parameters of CD Printer AE's.
- Local Configurable Parameters of the CD Printer AE's.
- Remote Configurable Parameters of the CD Printer AE's.

Parameter	Configurable	Default Value
General Parameters of CD Printer		
Time-out waiting for acceptance or rejection Response to an Association Open Request. (Application Level timeout - ARTIM)	Yes	10 sec.
General DIMSE level time-out values	Yes	30 sec.
Time-out waiting for response to TCP/IP connect request. (Low-level timeout) [1]	No	-
Time-out waiting for acceptance of a TCP/IP message over the network. (Low-level timeout) [1]	No	-
Time-out for waiting for data between TCP/IP packets. (Low-level timeout) [1]	No	-
Any changes to default TCP/IP settings, such as configurable stack parameters [1]	No	-
Local Configurable Parameters of the CD Printer AE		
Size constraint in maximum object size (see note)	No	-
Maximum PDU size the AE can receive	Yes	16 kBytes Min 4 kBytes Max 64 kBytes
Maximum PDU size the AE can send	Yes	16 kBytes Min 4 kBytes Max 64 kBytes
AE specific DIMSE level time-out values	Yes	30 sec.
Number of simultaneous associations by Service and/or SOP class	Yes	5
SOP class support	No	As listed in the DCS
Transfer Syntax support [2]	No	As listed in the DCS
Remote Configurable Parameters of the CD Printer AE		
Size constraint in maximum object size (see note)	No	-
Maximum PDU size the AE can receive	No	No limit
Maximum PDU size the AE can send	No	No limit
AE specific DIMSE level time-out values	Yes	30 sec.
Number of simultaneous associations by Service and/or SOP class	No	No limit
SOP class support	No	As listed in the DCS
Transfer Syntax support	No	As listed in the DCS
Storage Commitment request must be sent after Storage request	N/A	-
Storage Commitment time-out (synchronous to asynchronous)	N/A	-
Export of pure DICOM instances (i.e. only the standard DICOM attributes as defined in the related IOD) or extended DICOM instances (with additional Standard DICOM, Private and Retired attributes)	No	allow all attributes

Support of overlays for DICOM node not supporting Presentation State objects [3]	No	-
Support of overlays for DICOM node supporting Presentation State objects [3]	No	-
Support of overlays for CD [3]	No	-

Table 24: Configuration Parameters table

Note 1: The parameters depend on operation system configuration.

Note 2: The JPEG Baseline transfer syntax is only supported for monochrome images. The RLE Lossless Image Compression transfer syntax is only supported for RGB; therefore JPEG Baseline may NOT be configured for systems that are capable of handling storage of color images too and RLE Lossless Image Compression may NOT be configured for systems that are capable of handling storage of monochrome images too.

Note 3: The CD Printer Copy-tool supports only storing functions for overlays.

The CD Printer configuration is done using administration utilities. Please refer to Installation Manual and Administration's Manual for complete documentation.

In addition, the CD Printer provides a variety of dynamic application configurations for managing the instances distributing:

- Forward Rules provide a robust mechanism for instances distribution enabling to use the CD Printer as a DICOM network hub.

Important implementation remarks and restrictions:

Forward-Rules are a set of rules that is used to select the received by Storage Provider AE instances, for the Receiver application (Distribution Manager AE) to send studies to the CD Printer (Media AE), other locations on the network (DICOM), or any combination thereof.

Note: Configuring of Storage Provider AE to convert format of received data from original Transfer Syntax to Implicit Little Endian is compulsory condition for usage of data distribution via DICOM protocol.

For complete documentation of the CD Printer Forward-Rules please refer to the CD Printer Administration's Manual.

5. MEDIA INTERCHANGE

5.1 IMPLEMENTATION MODEL

5.1.1 APPLICATION DATA FLOW

The Media AE will act as a FSC for a CD-R and DVD, when writing the selected instances in a data folder onto the medium.

Figure 7 shows the Media Interchange Application Data Flow as a functional overview of the CD Printer AE for CD-R and DVD.

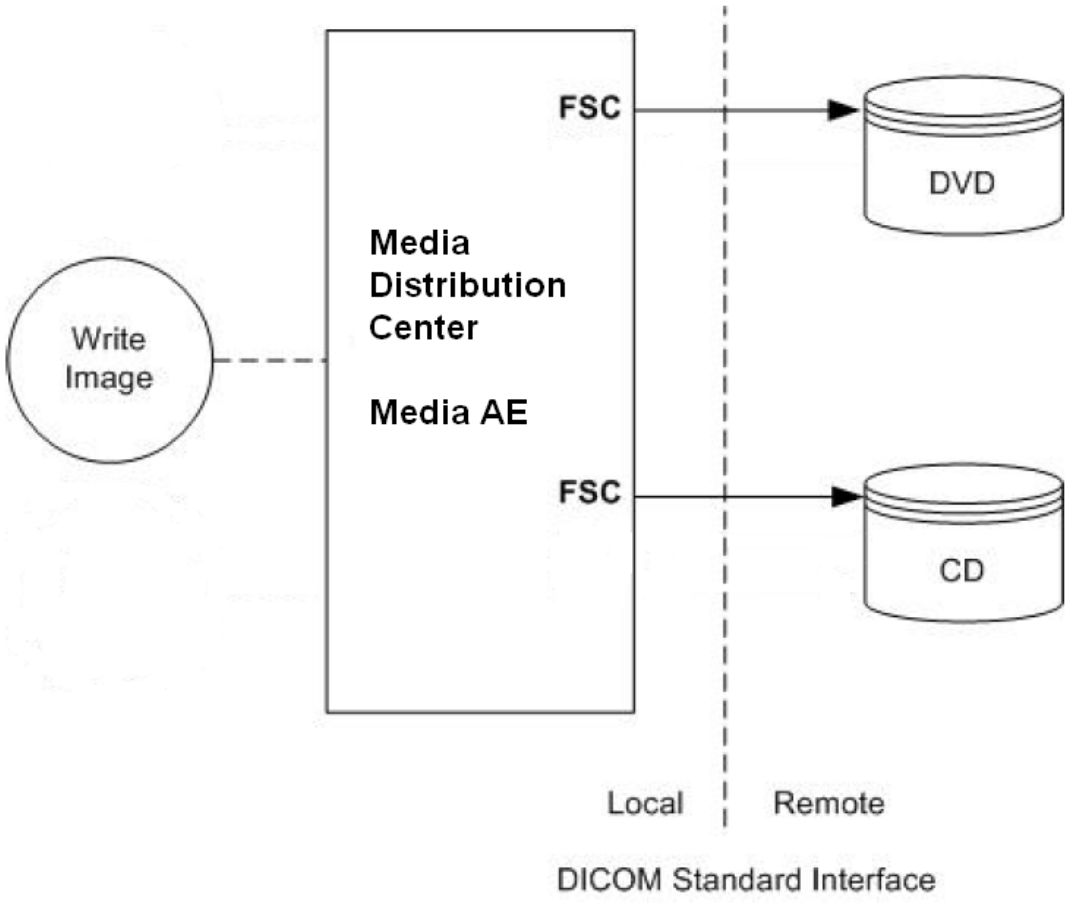


Figure 7: Media Interchange Application Data Flow Diagram

- The Media AE exports DICOM instances (Images, Presentation States, Structured Reports, etc.) to a disk Storage medium. It is associated with local real-world activity "Write Image". "Write Image" is performed upon Distribution Manager AE delivery of DICOM data collection (set of patients, studies, series or instances).

- Throughout this section, the term “Media” refers to any of the media: CD-R, CD-RW, DVD-R, DVD+R, DVD-RW and DVD+RW.

The Media AE can be configured for automatic selection of creating media.

5.1.2 FUNCTIONAL DEFINITION OF AE’S

This section describes in general the functions to be performed by the AE, and the DICOM services used to accomplish these functions.

5.1.2.1 FUNCTIONAL DEFINITION OF MEDIA AE

Distribution Manager AE will pass the DICOM data collection to Media AE. Media AE will select appropriate media in accordance to total volume of data collection, target media capacity and allowance of automatic media selection. The data collection will be divided into one or more export jobs in accordance to total volume of data collection and selected media capacity. The contents of each export job will be written to a single media. Executing of export job is performed automatically. Each media is automatically labeled with appropriate information.

Note: Label content and view are customizable and depend on local needs. For more details see Administrator Guide of the CD Printer.

The Media AE includes DICOM media viewer software in root of each burned media. The DICOM media viewer software supports images with the following DICOM Photometric Interpretations as shows in **Table 25**.

Photometric Interpretation	Import	Export	Viewing
MONOCHROME1	NO	YES	YES
MONOCHROME2	NO	YES	YES
RGB	NO	YES	YES
YBR_FULL	NO	YES	NO
YBR_FULL_422	NO	YES	YES
YBR_PARTIAL_422	NO	YES	NO
PALETTE COLOR	NO	YES	YES
YBR_RCT	NO	YES	NO
YBR_ICT	NO	YES	NO

Table 25: Photometric interpretations supported by Media AE

The CD Printer Media AE includes the following service class.

Media Storage Service Class for CD and DVD

The Media AE can perform the CD-R Media Storage service as SCU, with capabilities for RWA Write Instances (as FSC).

For DVD the Media AE can perform the Media Storage service as SCU, with capabilities for RWA Write Instances (as FSC).

5.1.3 SEQUENCING OF REAL WORLD ACTIVITIES

Whenever a CD or DVD has to written the Media AE first reads required DICOM instances from CD Printer temporary storage and builds the DICOMDIR for the instances set. The Media AE will compile the DICOMDIR, required DICOM instances and unique high quality self-playing image viewing and manipulation program (DiagNET) into a CD or DVD media image; this CD or DVD media image will be written to CD or DVD.

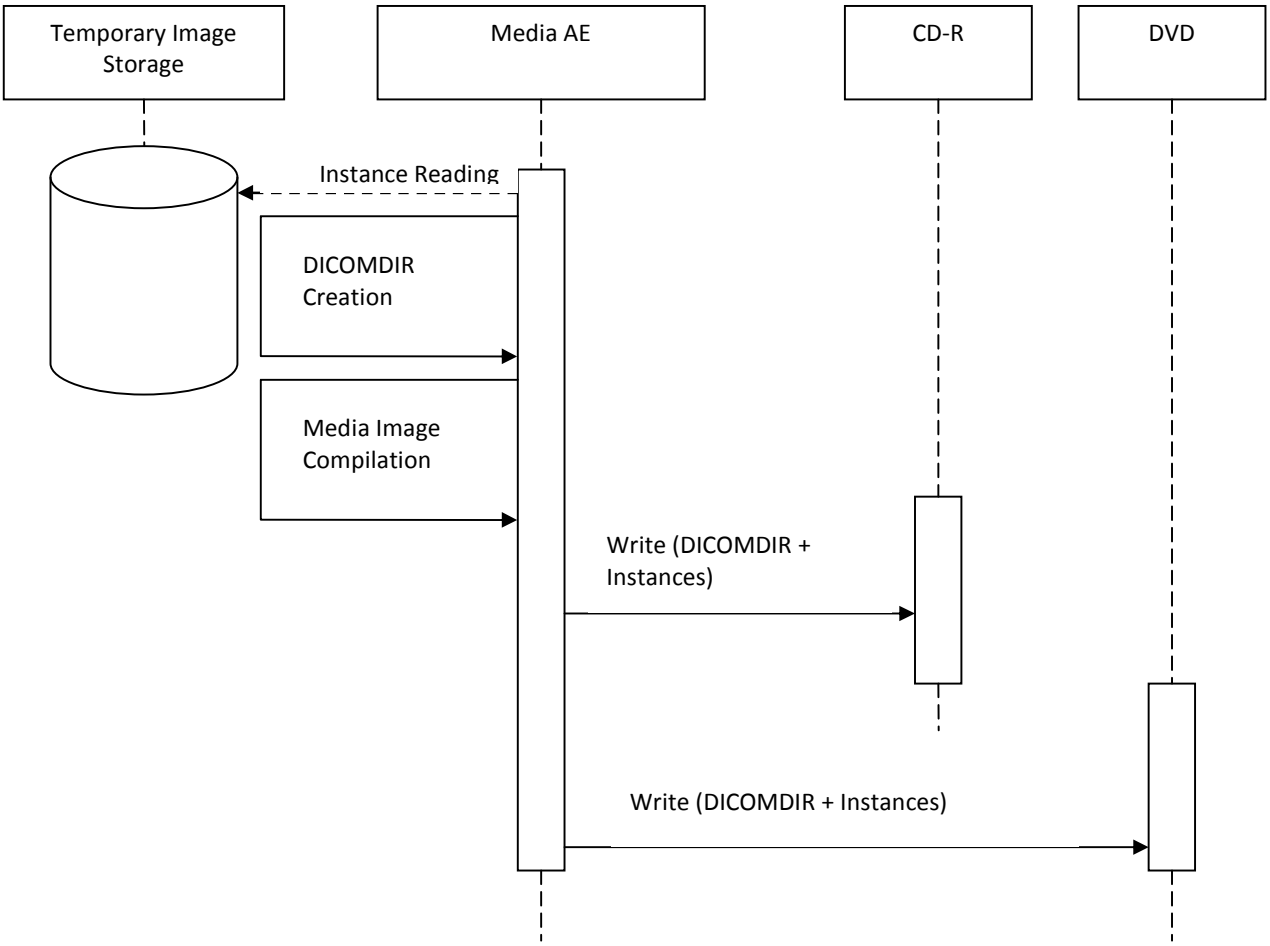


Figure 8: Sequencing of RWA Write Instances

5.1.4 FILE META INFORMATION FOR IMPLEMENTATION CLASS AND VERSION

This section is used to list the values assigned to the File Meta Information attributes (ref. [DICOM] PS 3.10) that pertain to the Implementation Class and Version.

The Implementation Class UID and the Implementation Version Name in the File Meta Header are specified in following table.

File Meta Information Version	00,01
Implementation Class UID	1.2.826.0.1.3680043.8.195.0.20041017
Implementation Version Name:	CDP_V3

Table 26: DICOM Implementation Class and Version for Media AE

5.2 AE SPECIFICATIONS

5.2.1 MEDIA AE

The Media AE provides Standard Conformance to the DICOM Media Storage Service and File Format ([DICOM] PS 3.10), the Media Storage Application Profile STD-GEN-CD ([DICOM] PS 3.11) and the Media Storage Application Profile STD-GEN-DVD-JPEG ([DICOM] PS 3.11) and Private Conformance to the Media Storage Application Profile PRI-GEN-CD-DVD (5.3.2 chapter in the document) for Writing.

The supported Application Profiles, their Roles and the Service Class (SC) options, all defined in DICOM terminology, are listed in **Table 27**.

Supported Application Profile	Real-World Activity	Roles	SC Option
PRI-GEN-CD-DVD	Write Instances	FSC	Interchange
STD-GEN-CD	Write Instances	FSC	Interchange
STD-GEN-DVD-JPEG	Write Instances	FSC	Interchange

Table 27: AE Related Application Profiles, Real-World Activities, and Roles for CD-R and DVD

Supported media profiles per media are shown in **Table 28**.

Media	CD	DVD+RW / DVD+R / DVD-R / DVD-RW
Application Profile	STD-GEN-CD / PRI-GEN-CD-DVD	STD-GEN-DVD-JPEG / PRI-GEN-CD-DVD

Table 28: Media Profiles supported by Media AE

Note: Private General Purpose PRI-GEN-CD-DVD Media Storage Application Profile allows creating DICOM CD and DVD without transfer syntax control of writing DICOM Instance files. Usage of Private or Standard Profile is configurable.

The CD Printer can be configured to not control content and format of distributing on media data. In such case data will be written "as is" (as received from remote DICOM node) and all

responsibility for normality of data format and contents shall be borne by the source of the information from which the data was received by CD Printer.

The CD Printer and/or Media AE can be configured explicitly to change format of distributing on media data by system administrator of The CD Printer. In such case all responsibility for normality of data format and contents shall be borne by the system administrator.

Media AE supports multi-patient CD-R / DVD disks for Writing.

5.2.1.1 FILE META INFORMATION FOR THE MEDIA AE

The Media AE has no specific File Meta Information.

5.2.1.2 REAL-WORLD ACTIVITIES

5.2.1.2.1 WRITE INSTANCES

When an instance transfer to CD-R or DVD is initiated then the Media AE acts as an FSC using the interchange option to export SOP Instances from the temporary location to a CD-R or DVD medium.

The contents of the export job will be written together with corresponding DICOMDIR and DICOM media viewer software to media. The user can cancel an export job in the job queue and manage the queue by changing priority of the jobs.

5.2.1.2.1.1 MEDIA STORAGE APPLICATION PROFILE

As depicted in **Table 27**, the Media AE supports the RWA Write Instances for the STD-GEN-CD, STD-GEN-DVD-JPEG and PRI-GEN-CD-DVD Application Profile.

5.2.1.2.1.1.1 OPTIONS

All existing in received instance Optional, Retired and Private Attributes are kept, stored and exported.

The DICOMDIR file will be created for the whole set of instances during creating of media image. In case some attributes are not present in an instance but are specified as mandatory in the DICOMDIR definition in DICOM Media, a generated value will be filled in.

Implementation remarks and restrictions

When writing the DICOMDIR records, key values are generated when no value of the corresponding attribute is supplied, according to **Table 29**.

Key	Tag	Generated Value
Patient Keys		
Patient ID	(0010,0020)	At import CD Printer creates a value based on the Accession Number, if the Patient ID does not exists or has empty value. If Accession Number attribute does not exist or has empty value, attribute value is created on base of the Study Instance UID for each new study written to the CD-R/ DVD (even if this study belongs to a patient recorded earlier).
Study Keys		
Study Date	(0008,0020)	Current date
Study Time	(0008,0030)	Current time
Study ID	(0020,0010)	"UNKNOWN"
Series Keys		
Series Number	(0020,0011)	1

Table 29: Generated Keys

The Media AE writes DICOMDIR using Explicit Little Endian transfer syntax always regardless of applied Media Storage Application Profile.

The Media AE supports all Storage SOP Classes listed in **Table 6**. Put attention to note about SOP Classes supported for presentation (viewing).

The Media AE supports all Transfer Syntaxes represented in list of Acceptable Presentation Contexts for Store Instances (Import) depicted in **Table 11**.

Note: DICOM instances are exported within Transfer Syntaxes in accordance to configuration.

CD Printer can write data on volumes of the media.

CD Printer writes next disk if data is spanning over more CD-R / DVD disks.

CD Printer can be configured to automatic selection of appropriate media.

CD Printer will select DVD media for data set that was initially proposed for writing on CD if total volume of exporting data set exceeds CD media capacity.

CD Printer will select CD media for data set that was initially proposed for writing on DVD if total volume of exporting data set is less than CD media capacity.

The unique high quality self-playing image viewing and manipulation program (DiagNET) will be written on each medium.

5.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

This section is used for the description of Augmented and Private Application Profiles.

5.3.1 AUGMENTED APPLICATION PROFILES

None

5.3.2 PRIVATE APPLICATION PROFILES

5.3.2.1 PRIVATE APPLICATION PROFILE PRI-GEN-CD-DVD

5.3.2.1.1 PRI-GEN-CD-DVD PRIVATE APPLICATION PROFILE

The Application Profile Class is intended to be used for the interchange of Composite SOP Instances via CD-R and DVD media for general purpose applications. Objects from multiple modalities may be included on the same media.

The Media Storage SOP Class is detailed in **Table 30**.

Application Profile	Identifier	Description
Private General Purpose CD-DVD Interchange	PRI-GEN-CD-DVD	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms, either uncompressed (including Implicit Little Endian format) or with lossless or lossy JPEG.

Table 30: AE Related Application Profiles, Real-World Activities, and Roles for CD-R and DVD

5.3.2.1.2 CLINICAL CONTENT

This Application Profile Class facilitates the interchange of images and related data on CD or DVD media. Typical interchange would be between acquisition devices, archives and workstations.

This Application Profile Class facilitates the creation of a multi-modality and multi-patient medium for image interchange, useful for clinical, patient record, teaching and research applications, within and between institutions.

5.3.2.1.3 ROLES AND SERVICE CLASS OPTIONS

####### 5.3.2.1.3.1 FILE SET CREATOR

File Set Creator generates a File Set under this Interchange Class of Application Profile and generates the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Instance SOP Classes stored in the File Set.

5.3.2.1.4 SOP CLASSES AND TRANSFER SYNTAXES

This Application Profile is proposed for support of any Standard, Standard Extended and Private SOP Classes and any Standard Transfer Syntaxes.

Note: In fact the Media AE receives export jobs that contain data received by Storage Provider AE. So created media will contain only supported by the Storage Provider AE SOP Classes and in format of only supported by the Storage Provider AE Transfer Syntaxes.

DICOMDIR file (Class UID of the object is 1.2.840.10008.1.3.10) should be coded using Explicit Little Endian transfer syntax.

5.3.2.1.5 PHYSICAL MEDIUM AND MEDIUM FORMAT

The PRI-GEN-CD-DVD application profile requires the 120 mm CD-R physical medium with the ISO/IEC 9660 Media Format or the 120 mm DVDRAM medium, as defined in PS 3.12.

5.3.2.1.6 DIRECTORY INFORMATION IN DICOMDIR

The PRI-GEN-CD-DVD application profile has the same requirements to DICOMDIR content that General Purpose CD-R and DVD Interchange Profiles have, as defined in PS 3.11 (Annex D) of DICOM Standard.

5.3.2.1.7 OTHER PARAMETERS

None

5.3.2.1.8 SECURITY PARAMETERS

None

5.4 MEDIA CONFIGURATION

The Media AE uses initialization file (PRINTER.INI) for configuration.

The Media AE is configured by means of any text editor. This configuration is intended to be made by Philips Customer Support Engineers only.

5.4.1 GENERAL PARAMETERS OF MEDIA AE

5.4.1.1 AUTOMATIC SELECTION OF TARGET MEDIA

Distribution Manager AE initiates export to specific media. The Media AE will perform the export to the specified media or will automatically select more appropriate media for the export task.

AutoMediaSelect parameter in [Printer] section defines when such automatic selection will be performed (value shall be equal 1) or will not be performed (value shall be equal 0).

Default value defines operating without automatic media selection (parameter has 0 value).

5.4.1.2 NUMBER OF SUPPORTED MEDIA TYPES

Different configuration of CD Printer can support different media types. This depends on installed hardware and license.

Number of attributes can be specified individually for each media type. The attributes form the so-called configuration set.

MediaCount parameter in [MediaList] section defines a number of such media configuration sets.

Default value defines is 2 (CD-R and DVD).

5.4.2 MEDIA SPECIFIC PARAMETERS OF MEDIA AE

The parameters are specified in [MediaList] section.

The parameters can be specified individually for each media type (CD-R, DVD). The parameter names end by a number of the media type in the list (a number shall be in range from 1 up to value of Number of Supported Media Types parameter). The number is represented by N symbol in explanations below.

The media specific parameters, their default value and range are specified in **Table 31**.

Parameter	Default Value for CD-R	Default Value for DVD	Note
The type of the media that is recognized by burning software (MediaTypeN parameter)	CDR	DVDR	Depends on installed hardware
Capacity in megabytes of data that can be stored to the media (MediaCapacityN parameter)	650	4000	The value is used for data collection splitting to several discs and automatic media selection. The value is typically smaller than the physical capacity of the media allowing additional files (such as DICOMDIR and DiagNET viewer) to be included.
Data representation type for regular burning (MediaRepresentationTypeN parameter)	2	2	Possible values are 0, 1, 2 and 3. See full description below.

Table 31: Configuration Parameters table

The data representation type parameter specifies representation of data for regular burning and applying Media Storage Application Profile as result from using data representation:

- 0 value defines that received by Media AE data will be stored "as is" without changing of Transfer Syntax. So data can be stored in any Transfer Syntax. The setting dictates usage of PRI-GEN-CD-DVD application profile in media creating.

- 1 value defines that received by Media AE data will be stored within Implicit Little Endian Transfer Syntax. The Transfer Syntax does not correspond to standard application profiles. The setting dictates usage of PRI-GEN-CD-DVD application profile in media creating.

- 2 value defines that received by Media AE data will be stored within Explicit Little Endian Transfer Syntax. The Transfer Syntax corresponds to STD-GEN-CD and STD-GEN-DVD-JPEG standard application profiles. So STD-GEN-CD application profile will be used in CD-R creating and STD-GEN-DVD-JPEG will be used in DVD creating.

- 3 value defines that received by Media AE data will be stored within compression Transfer Syntaxes. The Transfer Syntax corresponds to STD-GEN-DVD-JPEG standard application profile for DVD creating and does not correspond to STD-GEN-CD standard application profile for CD creating. So PRI-GEN-CD-DVD application profile will be used in CD-R creating and STD-GEN-DVD-JPEG will be used in DVD creating.

Note: The Media AE reserves the right to switch applying application profile in cases of creating media changing via automatic media selection and errors in Transfer Syntax conversion of data and Private SOP Class IOD-s.

6. SUPPORT OF CHARACTER SETS

CD Printer supports All Extended Character Sets.

Note: If an extended or replacement character set is used in one of the attributes, the attributes will be stored and exported "as is". The CD Printer processes coded part of the attributes as binary data.

Note: The CD Printer uses default language character set of operation system for non-Unicode programs. In the reason the attributes, coded with Extended Character Set, may be unreadable in internal applications of CD Printer.

7. SECURITY

7.1 SECURITY PROFILES

None supported.

7.2 ASSOCIATION LEVEL SECURITY

The CD Printer accepts associations only from known applications or an application whose “calling AE Title” is defined in its configuration file.

The CD Printer will reject association requests from unknown applications, i.e. applications that offer an unknown “calling AE title”. An application entity (AE) is known if – and only if – it is defined during configuration of the CD Printer, which is done via the configuration application.

7.3 APPLICATION LEVEL SECURITY

The CD Printer supports security measure for secure authentication of a node.

The CD Printer will reject association requests from applications on unknown nodes, i.e. nodes that offer an unknown “IP Address”. A node is known if – and only if – it is defined during configuration of the CD Printer, which is done via the configuration application.

8. ANNEXES

8.1 IOD CONTENTS

8.1.1 CREATED SOP INSTANCES

Not applicable.

8.1.2 ATTRIBUTE MAPPING

Not applicable.

8.1.3 COERCED/MODIFIED FIELDS

8.1.3.1 COERCED FIELDS

Coerced fields and conditions for the coercion are listed in **Table 32**.

Attribute Name	Tag	Coercion Conditions
Patient ID	(0010,0020)	Value is missing in received instance.
Study Date	(0008,0020)	Value is missing in received instance.
Study Time	(0008,0030)	Value is missing in received instance.
Study ID	(0020,0010)	Value is missing in received instance.
Series Number	(0020,0011)	Value is missing in received instance.

Table 32: Coerced fields and conditions for the coercion

8.1.3.2 MODIFIED FIELDS

None

8.2 DATA DICTIONARY OF PRIVATE ATTRIBUTES

Not applicable.

8.3 CODED TERMINOLOGY AND TEMPLATES

Not applicable.

8.4 GRAYSCALE IMAGE CONSISTENCY

The high-resolution display monitor attached to the product must be earlier calibrated by using the device specific tools.

8.5 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOPS

Not applicable.

8.6 PRIVATE TRANSFER SYNTAXES

None