



*GE Medical Systems*

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# **Technical Publications**

**IIS FP 10617**  
**Revision 6**

**Centricity™ PACS Version 1.0**  
**DICOM CONFORMANCE STATEMENT**

**GE Medical Systems (GEMS)**  
**Information Technologies**

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## Revision History

Revision	Date	Description
0	August 21, 2000	Creation of the document.
1	September 18, 2000	Add GE Private Thumbnail Image Sequence description (Appendix 1) Correct the list of modality codes for image display support.
2	April 3, 2001	Add PACS 8.1 supports: 1) CJK, 2) Unknown object support for Storage Commitment 3) Original value of renamed UID saved as private tags, 4) DICOM Print Support, and 5) Other minor changes.
3	July 11, 2003	Cleanup pass. Improved readability. Updated headers, removed year 1999 as a ref. for DICOM docs, Part 14 became Part 16, revised intro per GCC template, changed all GEMS to GE for consistency, fixed misc. errors, added TM symbol on all Centricity text, revised all drawings to correct spelling errors and change PathSpeed to Centricity, changed MIU to DAS globally, changed Film Session Label value from DICOM_RPINT to DICOM_PRINT, changed "Patient Name" to "Patient's Name" to match DICOM spec, changed "JPEG Baseline 1" to "JPEG Baseline (Process 1)", Table 9-1 – changed "...group 0009..." to "... group 0907...", changed Implementation Version Name for DPS AE from CENTRICITY_8.1 to CENTRICITY_1.0, changed "Storage Commitment Report" to "Storage Commitment Result" to match DICOM Spec., changed "Window Level" to "Window Width" to match DICOM Spec, fixed some incorrect DICOM tag numbers, created a section called "Related DICOM Conformance Statements".
4	August 5, 2003	(1) In Section 2.2.1.2, changed "a DICOM Push Command" to "the Send Exam Command". (2) Removed Section 4.1.2.3.3.1 "Data Caching" since it applied to the legacy MIU and is N/A for this document. (3) Reworded second paragraph under Table 3-2 to clarify meaning. (4) Cleaned up Section 3.1.2.1 to more clearly state response behavior. (5) Cleaned up Section 2.3.1.2 (6) Cleaned up Section 2.3.3 to remove dangling sentence. (7) Added block diagram of the PACS System (new Figure 2-1). (8) Changed "DICOM Application Server" to "DICOM Application Services" for consistency with the new Figure 2-1 and Tech Comm docs. (9) Renumbered figures to accommodate new Figure 2-1. (10) Made small cosmetic changes (activity -> activities, accepted-> acceptable, etc.). (11) "Presentation Syntax(es)" was globally changed to "Presentation Context(s)" to match the DICOM Spec. (12) Spell-checked entire document.
5	August 6, 2003	Revised Figure 2-1. Changed title of Section 1.9 from "Symbols and Abbreviations" to "Symbols, Terms and Abbreviations".
6	September 22, 2003	Updated per GCC comments. Removed all refs to "DICOM V3.0" and just made it "DICOM". Added Sections 2.8, 2.9, 7.8, 7.9 for Codes and Controlled Terminology, and Security Profiles. Added Sections 4.1.2.1.1.1, 4.1.2.1.1.2, 5.1.2.1.1.1, 5.1.2.1.1.2., 5.2.2.1.1.1, 5.2.2.1.1.2., 6.1.2.1.1.1, 6.1.2.1.1.2 and cleaned up all Transfer Syntax proposed or accepted sections. Changed Section 4.1.2.4. from "No specialized or privatized Storage SOP Classes can be accepted" to "No specialized Storage SOP Classes can be accepted." Clarified in Sections 2.1 and 4.1.1 that the Modality Worklist is available from Broker and not directly from PACS. Revised Figure 2-1 to include Broker. Added paragraph to Section 8. Cleaned up Table 8-1. Changed "Store SCU" to "Storage SCU" for consistency. "GEPACS_PRIVATE_IMS IOD" was changed to "GEPACS_PRIVATE_IMS_INFO IOD" for better accuracy. Revised Section 2.6.2 and Table 2-4. Fixed broken Table, Figure and Section numbers internal links. Added RIS to Abbreviations Section. Changed "Conformance Statement for DICOM" to "DICOM Conformance Statement" in 3 places. Changed "N-

		CREATION" to "N-CREATE".
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## 1. INTRODUCTION

### 1.1 OVERVIEW

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

**Section 1 (Introduction)** describes the overall structure, intent, and references for this Conformance Statement.

**Section 2 (Network Conformance Statement)** specifies compliance of the Centricity™ PACS DICOM Communication Server to DICOM Standards requirements for network communication for all SOP classes it supports. This part generally follows the DICOM Standard Conformance Statement as specified in the DICOM Standard V3.0, Part 2. General network operations are described in this section. In the places that individual real-work activities should be described, references to the following sections are made, instead of including all SOP classes in this part.

**Section 3 (DICOM Storage Service (SCU) Conformance Statement)** specifies compliance of the Centricity™ PACS SOP Instance Send functions to DICOM Standards requirements for Storage SOP Classes.

**Section 4 (DICOM Storage Service (SCP) Conformance Statement)** specifies the compliance of the Centricity™ PACS SOP Instance Receive functions to DICOM Standards requirements for Storage SOP Classes.

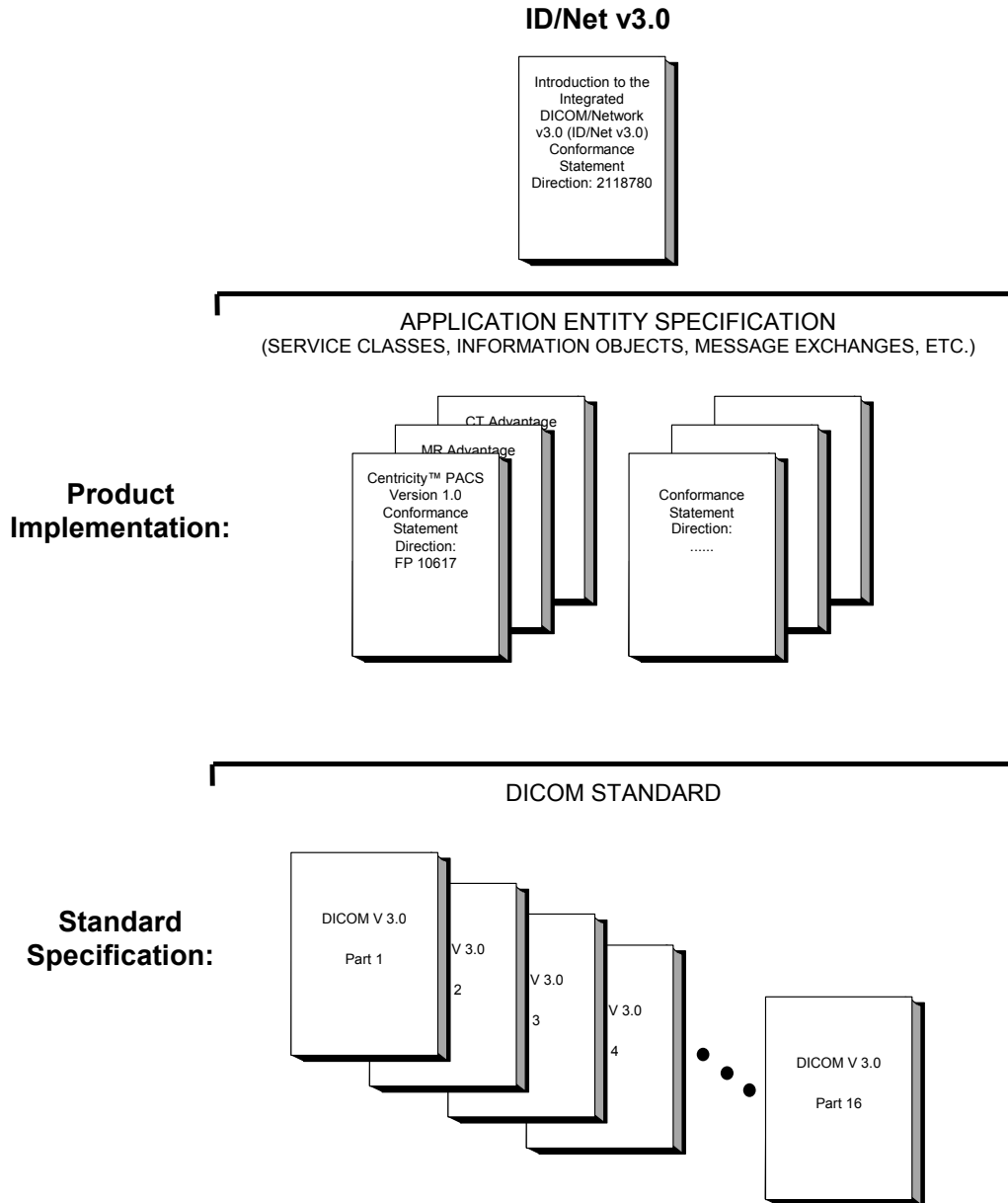
**Section 5 (DICOM Query/Retrieve Service Conformance Statement)** specifies the compliance of the Centricity™ PACS information query and data retrieval functions to DICOM Standards requirements for Query and Retrieve SOP Classes.

**Section 6 (DICOM Storage Commitment Service Conformance Statement)** specifies the compliance of the Centricity™ PACS SOP Instance Storage Commitment functions to DICOM Standards requirements for Storage Commitment SOP Classes.

**Section 7 (DICOM Print Service Conformance Statement)** contains a complete DICOM Standards Conformance Statement for the print service in the Centricity™ PACS.

## 1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GE Conformance Statements and their relationship to the DICOM Conformance Statements is shown in the illustration below.



This document specifies the DICOM implementation supported by the GE Medical Systems Centricity™ PACS. It is entitled:

*Centricity™ PACS Version 1.0*

*DICOM Conformance Statement*

*Direction IIS FP 10617*

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GE network interface. The GE 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.

This DICOM Conformance Statement document does not include the DICOM Conformance Statements for the Centricity™ Archive or Centricity™ Web. These Conformance Statements are available as separate documents. Refer to the GE Medical Systems Web Site: <http://ge.com/Dicom>.

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Introductory information, which is applicable to all GE Conformance Statements, is described in the following GE document:

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)*

*Conformance Statement*

*Direction: 2118780*

This document familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading the individual products' Conformance Statements.

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For more information regarding the DICOM Standard, 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  
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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 that are used in that Standard.

If readers are unfamiliar with DICOM terminology they should first refer to the GE document listed below, then read the DICOM Standard itself, prior to reading this DICOM Conformance Statement document.

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)  
Conformance Statement  
Direction: 2118780*

## 1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document, in conjunction with the GE document, *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GE implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GE medical data exchanged using DICOM. The GE Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GE devices are capable of using different Information Object Definitions. For example, a GE 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 GE implementation. If the user encounters unspecified private data elements while parsing a GE 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 GE 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), 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 Standards. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GE 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, as 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 Standards. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standards change 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

A list of references which are applicable to all GE Conformance Statements is included in the GE Document, *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

Additional references used in this Conformance Statement document are listed in Table 1-1.

TABLE 1-1. ADDITIONAL REFERENCE DOCUMENTS

Document Name	Organization	Document Number(s)
Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement	GE Medical Systems	Direction: 2118780
GE PACS Broker v1.5.2 (Modality Worklist Interfaces) DICOM Conformance Statement	GE Medical Systems	MM10001
Digital Imaging and Communications in Medicine (DICOM), 16 Parts, 2003 Edition.	National Electrical Manufacturers Association (NEMA)	PS 3.1-2003 through PS 3.16-2003
ASCII Graphic Character Set. ISO 646, USA Version X3.4 - 1968	Information Processing Society of Japan/Information Technology Standards Commission of Japan (IPSJ/ITSCJ)	ISO-IR-6
Japanese Katakana Character Set JIS C6220-1969	IPSJ/ITSCJ	ISO-IR-13
Japanese Version of ISO 646 for Roman Characters JIS C6220-1969	IPSJ/ITSCJ	ISO-IR-14
Japanese Character Set JIS C 6226-1983	IPSJ/ITSCJ	ISO-IR-87
96-Character Graphic Character Set. Right-hand Part of Latin Alphabet No.1 ISO 8859/1, ECMA-94	IPSJ/ITSCJ	ISO-IR-100
Korean Graphic Character Set, Korean Standard KSC 5601-1987	IPSJ/ITSCJ	ISO-IR-149
CCITT Chinese Set	IPSJ/ITSCJ	ISO-IR-165

## 1.7 RELATED DICOM CONFORMANCE STATEMENTS

Modality Worklist service is optionally available using the Centricity™ PACS Broker but its DICOM Conformance Statement is not included in this document. For more information, refer to the GE PACS Broker DICOM Conformance Statement, Document # MM10001. Refer to Table 1-1.

## 1.8 DEFINITIONS

A set of definitions which are applicable to all GE Conformance Statements is included in the GE Document, *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

Additional definitions used in this Conformance Statement document are listed below:

DICOM Server - “The DICOM Server” refers to all of its DICOM Application Entities for their common properties and behaviors. The DICOM Server is a software module of Centricity™ PACS and runs on the Centricity™ DAS (DICOM Application Services) subsystem.

## **1.9 SYMBOLS, TERMS AND ABBREVIATIONS**

A list of symbols, terms and abbreviations which are applicable to all GE Conformance Statements is included in the GE Document, *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

Additional abbreviations and terms used in this Conformance Statement document are listed below:

<b>TERM</b>	<b>DESCRIPTION</b>
DAS	DICOM Application Services
DPS	DICOM Print Server
GEMS	General Electric Medical Systems
ID/Net	Integrated DICOM/Network
PACS	Picture Archiving and Communications System
Q/R	Query/Retrieve
RIS	Radiology Information System
UL service-provider	DICOM Upper Layer Service Provider
UL service-user	DICOM Upper Layer Service User
WKS	Workstation

## 2. NETWORK CONFORMANCE STATEMENT

### 2.1 INTRODUCTION

Centricity™ PACS provides (image and non-image) data management and archival services. It implements a DICOM Communication Server (denoted DICOM Server for short in this document) for the following services to external systems (e.g., acquisition modalities, review workstations, etc.):

- Receive DICOM Storage SOP Instances from an acquisition modality for data storage.
- Serve long-term Storage Commitment request for the SOP Instances. These SOP Instances can be already sent to the PACS previously or delivered at a later time after the Storage Commitment Request.
- Send DICOM Storage SOP Instances to an external system for data distribution.
- Serve information query and data retrieval to the Patient / Study / Series / SOP Instances maintained in the Centricity™ PACS system.

The DICOM Server creates a number of DICOM Application Entities (AEs) to support these services. Each DICOM AE will be dedicated to a particular type of the DICOM services, as explained in the rest of the document.

Centricity™ PACS also supports the DICOM Print as SCU. The DICOM Print Service has been implemented in a separate subsystem other than the DICOM Server. Section 7 includes a complete DICOM Standards Conformance Statement for the Print Service.

**Note:**

In this document, we use the term “DICOM Storage SOP Instance” or “SOP Instance” in places where the term “Image” is usually used. A SOP Instance generally refers to a DICOM Standards Composite IOD, which can be an image or non-image data set. The SOP class to which an instance is associated determines the data type of the instance in the most cases. For more details, the reader is referred to DICOM PS 3.3 and PS 3.4.

Centricity™ PACS supports a RIS interface to receive study orders as well as patient / study updates. Alternatively, the Centricity™ Exam Manager operator can also create a study order directly in the database. The Centricity™ PACS Broker supports a DICOM Modality Worklist information query to the ordered studies from an acquisition modality. The modality includes the patient / study information received in the query responses to the DICOM Storage SOP instances it generates and sends these to the Storage AE of the DICOM Server.

After receiving the DICOM SOP instances, the Storage AE will match the SOP instances to the associated study in the Centricity™ database, using the patient / study information embedded in the data sets of the instances. Using the worklist query is highly recommended for all acquisition modalities. If a modality cannot support the worklist query, it usually relies on the operator’s input for the patient / study information. Without the use of a Modality Worklist, manual errors increase the number of mismatching SOP instances to the studies in the Centricity™ database significantly.



A block diagram of the GE PACS System is shown in Figure 2-1.

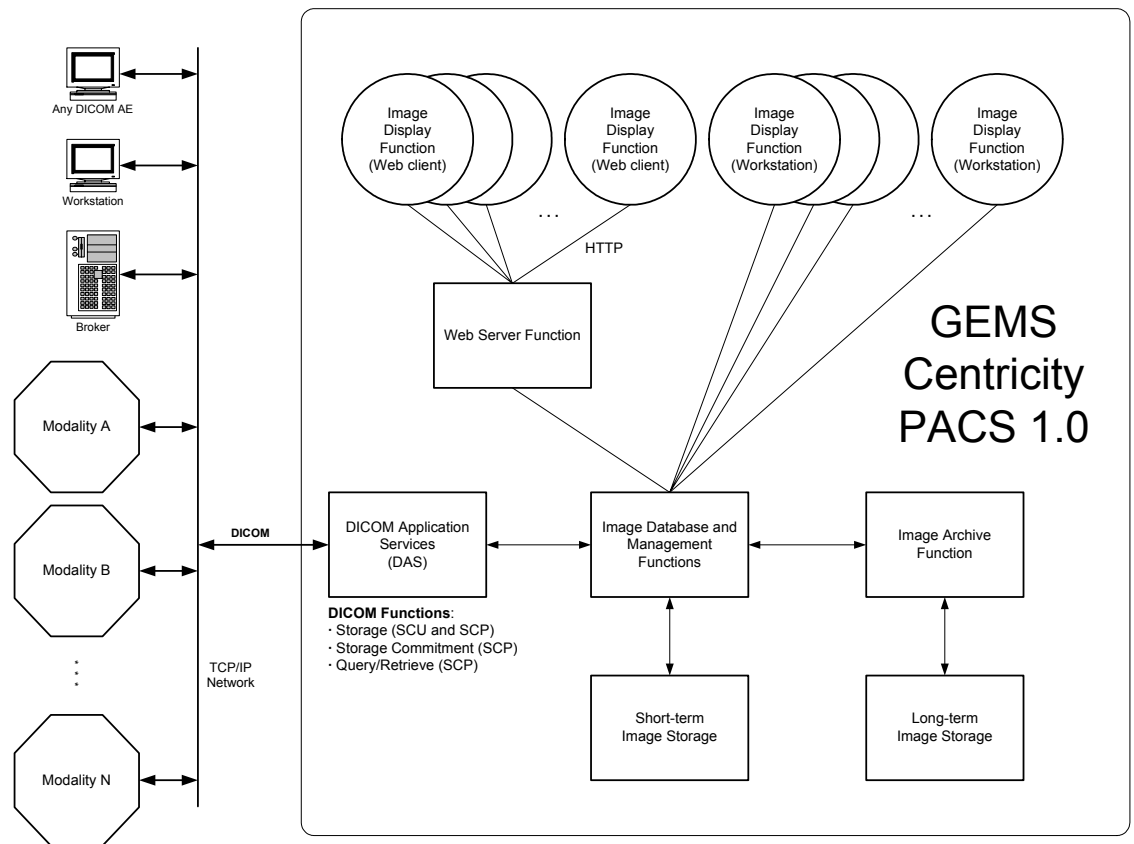


FIGURE 2-1. BLOCK DIAGRAM OF GE PACS SYSTEM

## 2.2 IMPLEMENTATION MODEL

Centricity™ PACS provides a number of DICOM Standard as well as private services with separate DICOM Application Entities (AEs) of the DICOM Server:

- SOP Instance Storage and Commitment Application Entity (Storage AE)
- SOP Instance Send Application Entity (Send AE)
- Information Query and Data Retrieve Application Entity (Q/R AE)

In this document, the term “The DICOM Server” refers to all of its DICOM Application Entities for their common properties and behaviors. The DICOM Server is a software module of Centricity™ PACS and runs on the Centricity™ DAS (DICOM Application Services) subsystem.

The DICOM Server is automatically started when the Centricity™ DAS is booted.

The following subsections give the implementation data flow diagrams of these AEs.

### 2.2.1 Application Data Flow Diagrams

#### 2.2.1.1 Application Data Flow Diagram of Storage AE

The Storage AE implements both the SCP role of the DICOM Storage SOP Class and the SCP role of the DICOM Storage Commitment SOP Class.

The SCP role of the DICOM Storage SOP Class is responsible for receiving DICOM Storage SOP Instances from a remote AE.

The SCP role of the DICOM Storage Commitment SOP Class is responsible for the support of long-term Storage Commitment Request from a remote AE.

There is no local real-world activity required for the Storage AE to respond incoming DICOM associations to receive SOP Instances and/or Storage Commitment Requests. The Storage AE is always waiting for an incoming association and will automatically respond a Verification request.

After receiving a SOP Instance, the Storage AE will start the following local real-world activities:

1. Match the received SOP Instances to an ordered study, or create a new study (unordered study) if no match is found. This is referred to as the Study Profiling procedure, see Section 4.2.1.
2. Store the received SOP Instances in the Centricity™ PACS storage system, for use within Centricity™ PACS and for archiving.

**Note:**

The Storage AE always saves the successfully received SOP Instances, so that they will be archived. However, the Storage AE does not guarantee that the data will be archived. The remote AE submitting data to the Storage AE should verify the data archiving commitment by sending a Storage Commitment Request– in the same association it sent the SOP Instances or in another dedicated, separate association.

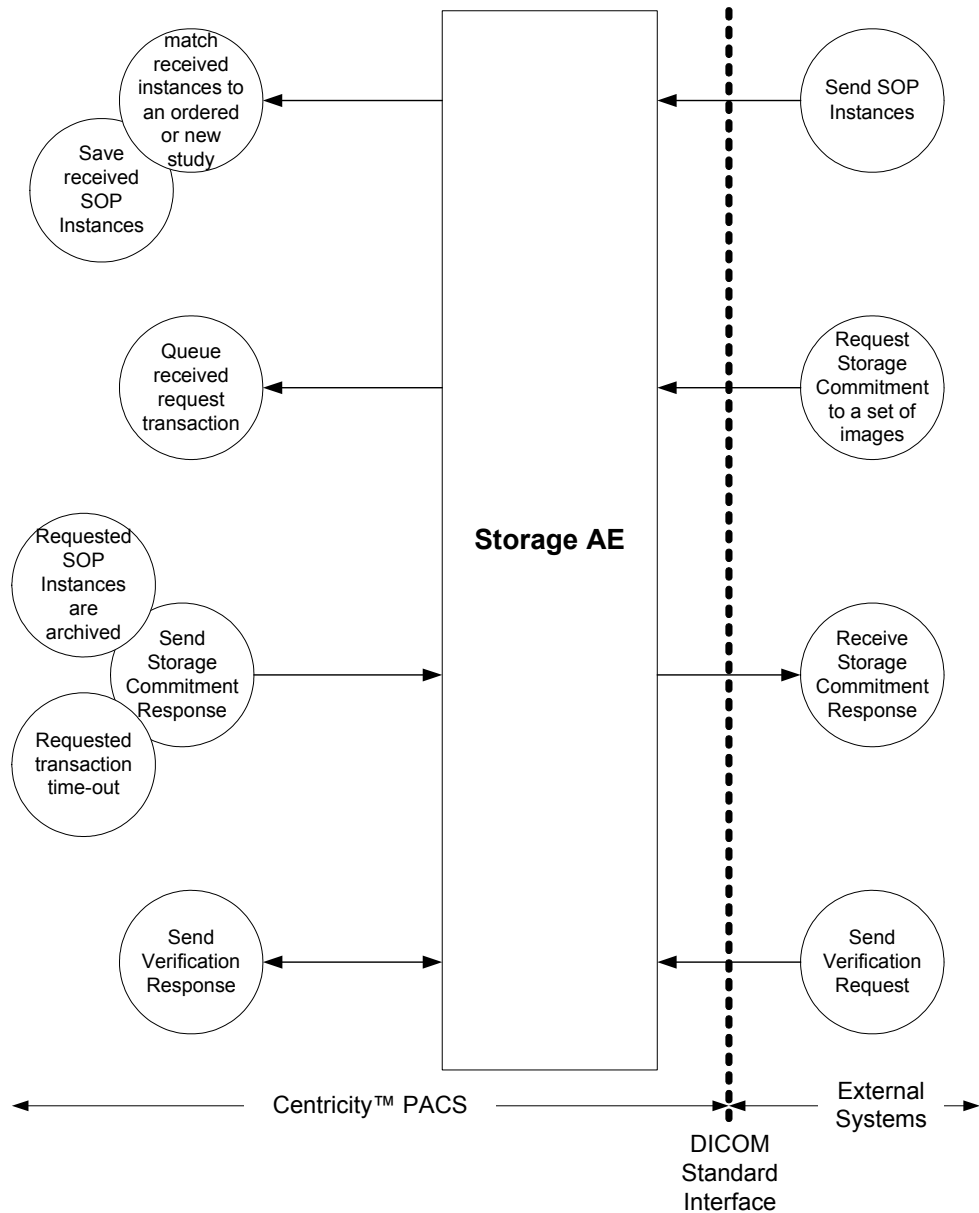


FIGURE 2-2. DATA FLOW DIAGRAM OF STORAGE AE

After receiving a Storage Commitment Request, the request transaction is queued into the Centricity™ database (Storage Commitment Queue) and a timer of a configured time-out value (see Section 2.6.5) associated with the transaction is started. The Storage AE periodically polls all outstanding Storage Commitment Transactions in the queue, and will send a Storage Commitment Result back to the remote AE in the following two cases:

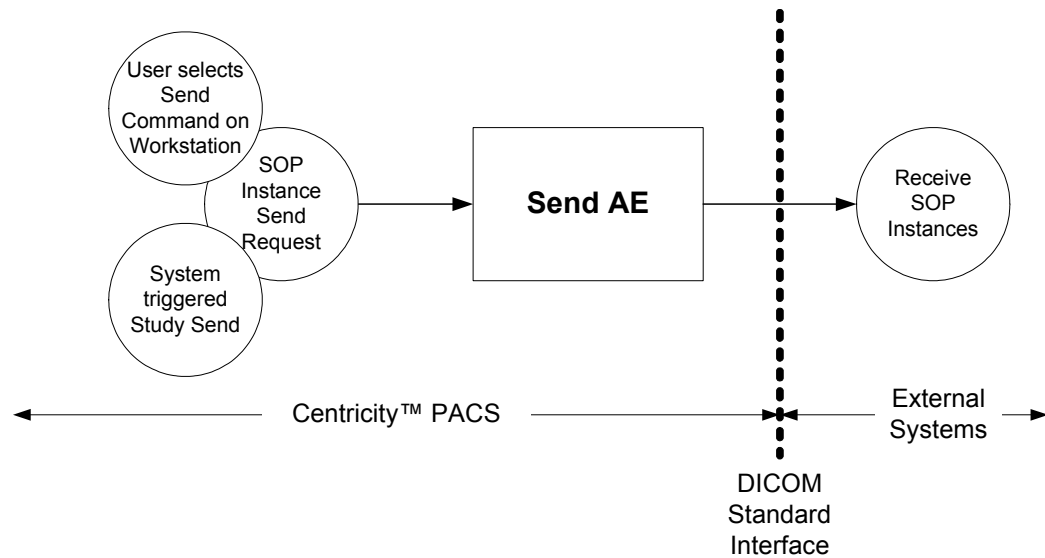
1. All images requested in one outstanding, queued Storage Commitment transaction have been successfully archived in the long-term archiving media.

2. The pre-configured time-out is expired, but not all images requested in one outstanding, queued Storage Commitment transaction have been successfully archived.

The Storage AE supports a Storage Commitment Request for the SOP Instances unknown to the Centricity™ PACS at the moment that the request is received. The Storage AE assumes that these SOP Instances will be received at a later time.

**2.2.1.2 Application Data Flow Diagram of Send AE**

The Send AE implements the SCU roles of the DICOM Storage SOP Classes for sending DICOM Storage SOP Instances to a remote AE.



**FIGURE 2-3. DATA FLOW DIAGRAM OF SEND AE**

There are two real-world activities, which will cause the Send AE to initiate a DICOM association to a remote DICOM AE for sending SOP Instances:

1. A user selected the “Send Exam” command on the Centricity™ Workstation for a specified study to a specified destination DICOM AE.
2. A study changed its status to a particular value, which is pre-configured in the Centricity™ PACS to trigger a DICOM Send of the study to a specified destination DICOM AE.

**Note:** The trigger mechanism and the configuration method for these triggers are beyond the scope of this document.

**2.2.1.3 Application Data Flow Diagram of Query/Retrieve (Q/R) AE**

The Q/R AE implements the SCP role of the DICOM Query/Retrieve SOP Classes for a remote AE to query the Patient / Study / Series / SOP Instance information, as well as to retrieve the SOP Instances from Centricity™ PACS.

As the DICOM Query/Retrieve SCP for data retrieval, the Q/R AE also implements the SCU role of the Storage SOP Classes for the SOP Instances move sub-operations.

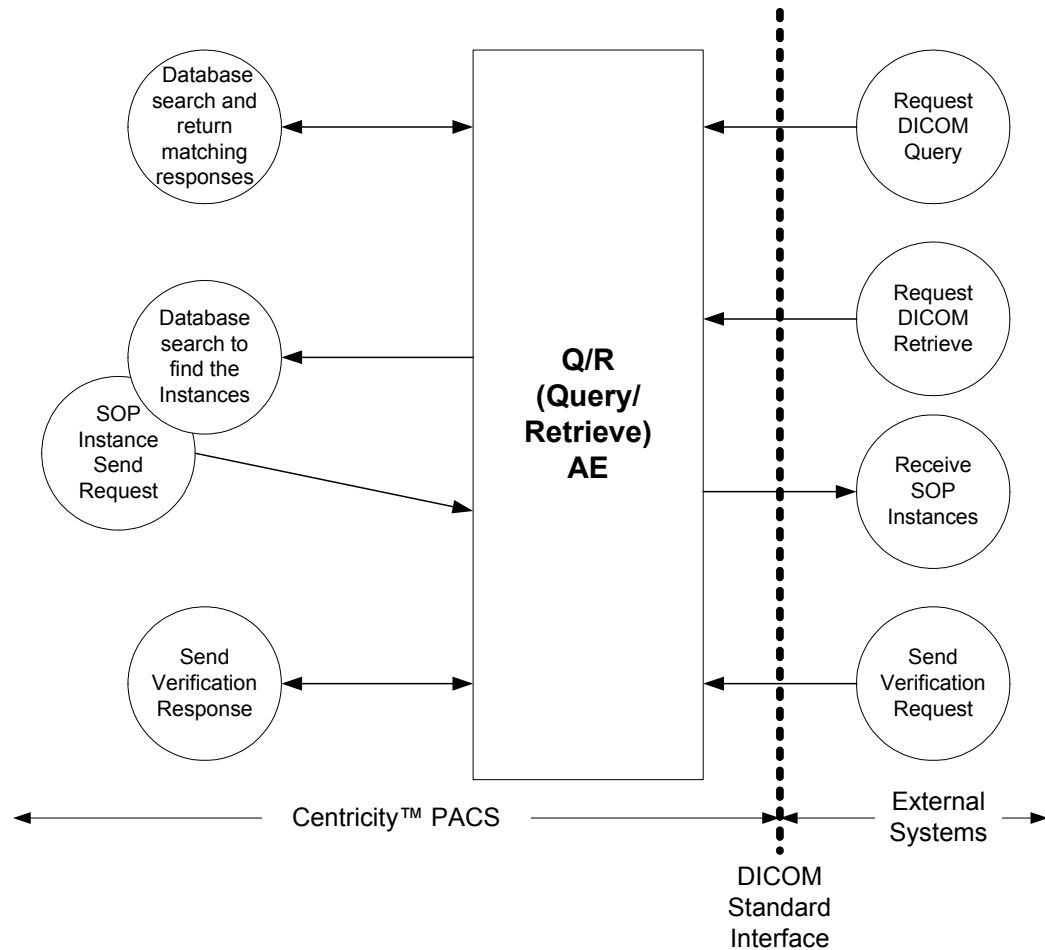


FIGURE 2-4. DATA FLOW DIAGRAM OF Q/R AE

There is no real-world activity required for the Q/R AE to respond to incoming DICOM associations for DICOM Query and Retrieve. The Q/R AE is always waiting for an incoming association and will automatically respond to a DICOM Verification request.

After receiving DICOM Query request, the Q/R AE will start the following local real-world activities:

1. Search for the requested data attributes on the Patient / Study / Series / SOP Instance levels in the Centricity™ database, as specified in the Query request and using the matching criteria specified in the Query request.
2. Return all matching responses.

After receiving DICOM Retrieve request, the Q/R AE will start the following local real-world activities:

1. Search for the SOP Instances records on the Patient / Study / Series / SOP Instance level in the Centricity™ database, as specified in the Retrieve request and using the matching criteria specified in the Retrieve request.
2. Locate the data files of the found SOP Instances in the Centricity™ storage sub-system. Fetch the data from the long-term archiving sub-system if necessary.

If the data files can be located, initiate a separate DICOM association to send these files to the destination AE as specified in the received Retrieve request.

## 2.2.2 Functional Definitions of AEs

The DICOM Application Entities of Centricity™ PACS initiate or receive the DICOM associations to support a number of application functions for the PACS system.

### 2.2.2.1 Storage AE

The Storage AE supports the following application-level functions:

- Receive SOP instances from a remote DICOM AE.
- Relate each received instance to an ordered / scheduled study in the Centricity™ PACS database by matching the Patient / Study information in the instance's data set to the information of the database.
- If no matching can be found, create a new (unordered) study by directly using the Patient / Study information in the received data set and relate the SOP instance to the created study.

**Note:**

When relating a SOP Instance to an ordered study, the Storage AE may alter the values of some data elements using the values of the counterpart data fields of the matched study in the Centricity™ database. In addition, the SOP Instances may be also changed by the Patient / Study update information received from RIS or entered by the Centricity™ Exam Manager operator. Centricity™ PACS does not create a new SOP Instance for these data changes. A later DICOM Query or Retrieve request from remote AE will receive the SOP Instance with some data elements changed, or may not find the submitted SOP Instance if the changed data elements are used as the searching keys. A list of the data elements that may undergo data coercion is given in Section 4.2.3. Data coercion is performed for data correction purpose.

- Store the Patient, Study, Series, and SOP Instance relationship permanently in the Centricity™ PACS database.
- Store the SOP instances in the PACS storage system, for use within Centricity™ PACS and for long-term archiving.

**Note:**

Centricity™ PACS will properly save and archive all SOP Instances successfully received via the Storage AE. However, Centricity™ PACS cannot guarantee that all received SOP Instances can be properly displayed and printed. Section 4.2.4 lists the detailed application-level functions that Centricity™ PACS is able to support for the successfully received SOP Instances.

- Receive a DICOM Storage Commitment Request from a remote AE.

- Create a job (transaction) and add it in the Centricity™ PACS Storage Commitment Queue. The job is identified by the transaction UID in the received request and associated with a timer of a configurable time-out value (see Section 2.6.5).
- Poll the Storage Commitment Queue for a job, which is either completed or time-out.
- Send Storage Commitment Result to remote AE.
- Respond to a DICOM Verification (Echo) request from a remote AE.

#### 2.2.2.2 Send AE

The Send AE supports the following application-level function:

- Send the SOP Instances of a study maintained in Centricity™ PACS to a remote AE.

**Note:** Due to the data coercion, the SOP Instances sent to a remote AE may be different from the originally received SOP Instances in certain data elements. See Section 4.2.3 for possible data corrections in Centricity™ PACS.

#### 2.2.2.3 Q/R AE

The Q/R AE supports the following application-level functions:

- Receive a DICOM Query request at Patient / Study / Series / SOP Instance levels from a remote AE.
- Search for the data attributes in the Centricity™ database that match the requested matching keys
- Respond to the remote AE by returning all matched data sets

**Note:** Due to the data coercion, the values of certain returned keys in the Query responses may be different from the values of the corresponding data element in the SOP Instances originally sent the Storage AE. See Section 4.2.3 for possible data corrections in Centricity™ PACS.

- Receive a DICOM Retrieve request at Patient / Study / Series / SOP Instance levels from a remote AE
- Find the requested SOP Instances in Centricity™ PACS, against both the on-line storage subsystem and the long-term archiving subsystem.
- Send the matched and found SOP Instances to the specified destination AE.

**Note:** Due to the data coercion, the SOP Instances moved to a remote AE may be different from the originally received SOP Instances in certain data elements. See Section 4.2.3 for possible data corrections in Centricity™ PACS.

- Respond to a DICOM Verification (Echo) request from a remote AE.

### 2.2.3 Sequencing of Real-World Activities

Not applicable.

## 2.3 STANDARD SPECIFICATION

### 2.3.1 Send AE

The Send AE provides the Standard Conformance to the following DICOM Standard SOP Classes and Private SOP Classes as an SCU:

TABLE 2-1. SCU CONFORMANCE LIST OF SOP CLASSES FOR SEND AE

SOP Class Name	SOP Class UID	SOP Class Type
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Standard
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Standard
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Standard
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Standard
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Standard
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Standard
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Standard
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Standard
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Standard
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Standard
Digital Mammography X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.2	Standard
Digital Mammography X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Standard
Digital X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.1	Standard
Digital X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Standard
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Standard
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Standard
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Standard
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Standard
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Standard
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Standard
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Standard
X-Ray Angiographic Bi-plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Standard
GE Private 3D Model Storage	1.2.840.113619.4.26	Private
GE Advance (PET) Raw Data Storage	1.2.840.113619.4.30	Private
GEPACS PRIVATE IMS INFO Storage	2.16.840.1.113709.1.5.1	Private



### 2.3.2 Storage AE

The Storage AE provides the Standard Conformance to the following DICOM Standard SOP Classes and Private SOP Classes as an SCP:

TABLE 2-2. SCP CONFORMANCE LIST OF SOP CLASSES FOR STORAGE AE

SOP Class Name	SOP Class UID	SOP Class Type
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Standard
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Standard
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Standard
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Standard
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Standard
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Standard
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Standard
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Standard
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Standard
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Standard
Digital Mammography X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.2	Standard
Digital Mammography X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.2.1	Standard
Digital X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.1	Standard
Digital X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.1.1	Standard
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Standard
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Standard
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	Standard
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	Standard
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Standard
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Standard
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Standard
X-Ray Angiographic Bi-plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	Standard
GE Private 3D Model Storage	1.2.840.113619.4.26	Private
GE Advance (PET) Raw Data Storage	1.2.840.113619.4.30	Private
GEPACS PRIVATE IMS_INFO Storage	2.16.840.1.113709.1.5.1	Private
Storage Commitment Push Model	1.2.840.10008.1.20.1	Standard
Verification (Echo)	1.2.840.10008.1.1	Standard

### 2.3.3 Q/R AE

The Q/R AE provide the Standard Conformance to the following DICOM Standard SOP Classes as SCP:

**TABLE 2-3. SCP CONFORMANCE LIST OF SOP CLASSES FOR Q/R AE**

SOP Class Name	SOP Class UID
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2
Verification (Echo)	1.2.840.10008.1.1

The Q/R AE provides Standard Conformance to the DICOM Standard SOP Classes listed in Table 2-1 as SCU for the C-STORE sub-operation initiated in a C-MOVE context.

### 2.3.4 Association Establishment Policies

This section describes the common behaviors of the all AEs of the DICOM Server with respect to the DICOM network association establishment. Specific behaviors of each individual AE will be described in Sections 2.3.5 and 2.3.6.

#### 2.3.4.1 General

The DICOM Application Context Name (ACN), which is always proposed by the DICOM Server, is

Name	UID
DICOM Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length of PDU negotiation is included in all association establishment requests. The Maximum Length of PDU proposed for all associations initiated by the DICOM Server is configurable (see Section 2.6.7) up to

Maximum Length of PDU	28,672 Bytes
-----------------------	--------------

The number given above (28,672 bytes) is also the Maximum Length of PDU in all DICOM associations that the DICOM Server can accept.

The DICOM Server does not support SOP class Extended Negotiation in any DICOM associations its AEs accept.

The Storage AE of the DICOM Server will propose (SCU/SCP) Role Selection Negotiation in a DICOM association it initiates for sending the Storage Commitment Result.

Other AEs of the DICOM Server will not propose (SCU/SCP) Role Selection Negotiation in any DICOM associations they initiate.

The user information items sent by the AEs of the DICOM Server are:

- Maximum Length of PDU
- Implementation Class UID
- Implementation Version Name

**2.3.4.2 Number of Associations**

The DICOM Server is able to initiate and accept multiple DICOM associations at a time to perform DIMSE service elements. The maximum number of simultaneous DICOM associations that can be initiated and accepted are configurable for the DICOM Server, but not for separate AEs (see Section 2.6.2).

Table 2-4 shows how the relationship between the separate AEs and the maximum number of simultaneous DICOM associations that the DICOM Server can support. The numbers in Table 2-4 are the default values.

**TABLE 2-4. THE DEFAULT MAXIMUM NUMBER OF SIMULTANEOUS ASSOCIATIONS SUPPORTED BY THE AEs OF THE DICOM SERVER**

AE	Association Purpose	Default Maximum Number of Associations	
		Initiation	Acceptance
Send AE	Send SOP Instances	2	—
Storage AE	Send Storage Commitment Result	1	—
Storage AE	Receive SOP Instances and Storage Commitment Requests	—	See Note
Q/R AE	Receive (Service) Query or Retrieve Requests	—	See Note
Q/R AE	Sub-ops for sending SOP Instances (for Retrieve Requests)	See Note	—

Note: There can be a total of 20 outstanding associations for these areas combined.

As shown in Table 2-4, by default, the DICOM Server is able to initiate totally two simultaneous associations for sending the SOP Instances. This includes execution of the Image Send commands issued by the Centricity™ PACS system or users. For the Storage Commitment Result, the Storage AE will always initiate one single association.

By default, the DICOM Server is able to support a maximum 20 simultaneous associations for receiving SOP Instances and Storage Commitment Requests, as well as for servicing Query and Retrieve requests. This includes all additional associations required for sending SOP Instances as the store sub-operations resulting from servicing a DICOM Retrieve request. The DICOM Server does not restrict the number of maximum simultaneous associations individually for the separate services and serves the incoming associations on a first-come-first-serve basis, until the configured maximum number is reached.

**Note:** Centricity™ PACS supports multiple instances of the DICOM Server running simultaneously. If the number of simultaneous associations supported by a single DICOM Server is not sufficient, multiple Centricity™ DAS subsystems can be configured.

#### 2.3.4.3 Asynchronous Nature

None of the DICOM Server AE's support asynchronous operations. All operations will be performed synchronously.

#### 2.3.4.4 Implementation Identifying Information

All AEs of the DICOM Server provide the same Implementation Class UID, which is:

Implementation Class UID	2.16.840.1.113709.1.1.1
--------------------------	-------------------------

All AEs of the DICOM Server provide the same Implementation Version Name, which is:

Implementation Version Name	CENTRICITY_1.0
-----------------------------	----------------

#### 2.3.4.5 Timers

##### 2.3.4.5.1 Association Timers

The DICOM Server supports an association timer for an association that the DICOM Server plays the role of association initiator.

The association timer starts when the association request is sent, and stops when the association is established.

##### 2.3.4.5.2 Operation Inactivity Timer

The DICOM Server supports an operation inactivity timer in each association.

For the role of association initiator, the operation inactivity timer re-starts every time a DIMSE service request has been issued.

For the role of association acceptor, the operation inactivity timer re-starts every time a DIMSE service response has been sent.

#### 2.3.5 Association Initiation Policies

All AEs of the DICOM Server can be configured to initiate association establishment only to remote AEs defined in a Remote AE list for the initiation of DICOM associations. The Remote AEs are specified with the Remote AE Titles as well as the network presentation addresses in the remote AE lists configured for the DICOM Server (see Section 2.6.1).

The calling AE Titles can be configured for each AE of the DICOM Server.

#### 2.3.5.1 Real-World Activity: Send SOP Instance(s) to Remote AE

The Send AE will perform a C-STORE operation to support this real-world activity.

A list of remote AE can be configured, so that the Send AE will initiate associations only to these AEs for sending SOP Instances. This includes the C-STORE sub-operation association initiation within a C-MOVE association. This configuration capability allows the user control of the valid DICOM Retrieve destinations.

For the DICOM Conformance Statement of this operation, please refer to Section 3.1 (page 3–27).

#### 2.3.5.2 Real-World Activity: Send Storage Commitment Result to Remote AE

The Storage AE will perform N-EVENT-REPORT operation to support this real-world activity.

The Storage AE will initiate associations only to remote AE, which previously requested a DICOM Storage Commitment transaction.

For the DICOM Conformance Statement of this operation, please refer to Section 6.2 (page 6–54).

### 2.3.6 Association Acceptance Policies

Each AE of the DICOM Server accepts incoming association requests on their dedicated TCP port numbers as defined in the configuration file (see Section 2.6.1). They will accept an association, if at least one proposed Presentation Context is acceptable.

The DICOM Server can be configured to accept one or several particular transfer syntaxes for the same Abstract Syntax, if a remote AE offers multiple Presentation Contexts per association. The default value is that the DICOM Server will only accept one transfer syntax for a particular Abstract Syntax.

All AEs of the DICOM Server can be configured to accept association requests only from specific remote AEs defined in a Remote AE list (see Section 2.6.1). The remote AEs are specified with the AE Titles as well as with the network presentation addresses in the Remote AE list, configured for the DICOM Server (see Section 2.6.1). This behavior of the DICOM Server helps the user to control the remote AE's access for data archiving, Storage Commitment, Query/Retrieve services of Centricity™ PACS.

The called AE Titles can be configured for each AE of the DICOM Server.

The DICOM Server will check both the calling and called AE Titles for the acceptance of an incoming association.

Association requests can be rejected with the following status codes and reasons:

TABLE 2-5. ASSOCIATION REJECT STATUS CODES AND REASONS

Result	Source	Reason	Description
Rejected (transient)	UL service-provider	Temporary congestion	Resource limitation: process creation failed, memory allocation failed, etc.
Rejected (transient)	UL service-provider	Centricity™ PACS internal service down	Database network connection down, image storage network connection down, etc.
Rejected (permanent)	UL service-user	Application Context Name not supported	Incorrect (unknown) Application Context Name
Rejected (permanent)	UL service-user	Calling AE Title unknown or not supported	The calling AE Title is not included in the configuration list, or the calling AE is not supported by the called AE Title.
Rejected (permanent)	UL service-user	Called AE Title unknown or not supported	The called AE Title is unknown to the DICOM Server, or the calling AE is not supported by the called AE Title.

**2.3.6.1 Real-World Activity: Receive DICOM SOP Instances from Remote AE**

The Storage AE supports the C-STORE operation for this service.

For the DICOM Conformance Statement of this service, please refer to Section 4.1 (page 4–31).

**2.3.6.2 Real-World Activity: Storage Commitment Request from Remote AE**

The Storage AE supports the N-ACTION operation for this service.

For the DICOM Conformance Statement of this service, please refer to Section 6.1 (page 6–52).

**2.3.6.3 Real-World Activity: DICOM Query Request from Remote AE**

The Q/R AE supports the C-FIND operation for this service.

For the DICOM Conformance Statement of this service, please refer to Section 5.1 (page 5–44).

**2.3.6.4 Real-World Activity: DICOM Retrieve Request from Remote AE**

The Q/R AE supports the C-MOVE operation for this service. In addition, the Q/R AE will perform a sub-operation C-STORE to transmit the requested SOP Instances.

For the DICOM Conformance Statement of this service, please refer to Section 5.2 (page 5–49).

**2.3.6.5 Real-World Activity: DICOM Verification (Echo) Request from Remote AE**

Both the Storage AE and the Q/R AE support the C-ECHO operation for this service.

For the DICOM Conformance Statement of this service, please refer to Section 4.1 (page 4–31) and Section 5.1 (page 5–44).

## **2.4 COMMUNICATION PROFILES**

### **2.4.1 Supported Communication Stacks**

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

### **2.4.2 TCP/IP Stack**

TCP/IP Network Communication is supported as specified in DICOM PS 3.8.

#### **2.4.2.1 Physical Media Support**

The GE AEs are unconstrained to the physical medium over which TCP/IP message traffic is carried. Various network interfaces are supported, including but not limited to: 10-BaseT Ethernet, 100-BaseT Ethernet, 1000-BaseT Ethernet and ATM OC-3.

The physical media supported depends on network cabling and interfaces equipment available at the Centricity™ PACS installation site and interface equipment commercially available.

An equipment list and configuration information for the physical media supported is available upon request.

### **2.4.3 OSI Stack**

Not supported.

### **2.4.4 Point-to-Point Stack**

Not supported.

## **2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS**

### **2.5.1 Extension / Specialization SOP Classes**

The DICOM Server supports the extensions to the DICOM Standard Storage SOP Classes as listed in Table 2-1 and Table 2-2. Private or standard extended data elements will be accepted for storage and archiving, and supported for SOP Instance sending and retrieve.

The DICOM Server does not support any Specialization SOP Classes.

### **2.5.2 Privatized SOP Classes**

The DICOM Server supports the following Private SOP Classes:

SOP CLASS NAME	SOP CLASS UID
GE Private 3D Model Storage	1.2.840.113619.4.26
GE Advance (PET) Raw Data Storage	1.2.840.113619.4.30
GEPACS_PRIVATE_IMS_INFO Storage	2.16.840.1.113709.1.5.1

This Private SOP Class has been applied exclusively for the data exchange between two Centricity™ PACS installation sites. Therefore, the definition of the GEPACS\_PRIVATE\_IMS\_INFO IOD is not published in this Conformance Statement document. It is expected that other vendors' applications will ignore all Presentation Contexts proposed for the GEPACS\_PRIVATE\_IMS\_INFO Storage SOP Class.

### 2.5.3 Privatized Transfer Syntax

The DICOM Server supports the following Private Transfer Syntax:

TRANSFER SYNTAX NAME	UID
COMPRESS_EXPRESS	2.16.840.1.113709.1.2.2

This Private Transfer Syntax has been applied for the DICOM Server to propose and accept the Presentation Contexts for all DICOM Standards Storage SOP Classes that the DICOM Server supports (see Sections 3 and 4). It uses Explicit VR and Big Endian format for the data set encoding, and the GE proprietary CompressXpress™ and TruRez™ image compression algorithms for the pixel data compression. No pixel data encapsulation is applied.

It is expected that other vendors' applications will ignore all Presentation Contexts proposed with the COMPRESS\_EXPRESS Transfer Syntax.

## 2.6 CONFIGURATION

The exact method for configuring each configurable item is specified in other Centricity™ PACS documentation. The following sections only describe some items that are configurable.

### 2.6.1 AE Title/Presentation Address Mapping

#### 2.6.1.1 Local AE Title

- AE Titles of the Storage AE for receiving SOP Instances and Storage Commitment Requests
- AE Titles of the Storage AE for sending Storage Commitment Results
- AE Titles of the Send AE for sending SOP Instances
- AE Titles of the Q/R AE for serving the DICOM Query and Retrieve request
- AE Titles of the Q/R AE for sending SOP Instances in response to C-MOVE operation



#### 2.6.1.2 Remote AE Title

- AE Titles of the remote AEs that the DICOM Server will interact with, for receiving and sending SOP Instances, serving Storage Commitment Requests and Query/Retrieve requests.

#### 2.6.1.3 AE Title / Presentation Address Mapping

A local mechanism is provided to configure an AE Title / Presentation Address mapping table. This table contains the following data items for each AE entry:

- AE Title
- AE Name
- TCP/IP addresses
- TCP Port Number

#### 2.6.2 Maximum Simultaneous Associations

The maximum number of simultaneous associations that the Send AE and Storage AE (for Storage Commitment result) can initiate, is configurable. The default value is 3.

The maximum number of simultaneous associations that the Storage AE can accept and that the Q/R AE can initiate or accept, is configurable. The default value is 20.

#### 2.6.3 AE Title / Accepted Association Mapping

A local mechanism is provided to configure:

- A list of remote AEs that are permitted to send SOP Instances and to request Storage Commitment to the Storage AE.
- A list of remote AEs that are permitted to query Patient / Study / Series / SOP Instances information and to retrieve SOP Instances from Q/R AE.

#### 2.6.4 AE Title / Association Initiation Mapping

A local mechanism is provided to configure:

- A list of remote AEs, to which the Storage AE and the Q/R AE can initiate an association to send the SOP Instances.

#### 2.6.5 Server Time-out

Association time-out

Association operation inactivity time-out

Storage Commitment job time-out

#### 2.6.6 Message Validation

The Storage AE can validate incoming DICOM messages to see if the messages conform to the DICOM Standards. A configuration option turns this checking on or off.

### **2.6.7 Maximum PDU Size Accepted**

The Maximum Length of PDU negotiated by the DICOM Server is configurable up to the maximum value of 28,672 bytes.

## **2.7 SUPPORT FOR EXTENDED CHARACTER SETS**

The DICOM Server supports the following character sets:

- ISO-IR-6 (ISO 646), ASCII Graphic Character Set
- ISO-IR-100 (ISO 8859-1), 96-Character Graphic Character Set. Right-hand Part of Latin Alphabet.
- ISO-IR-13, Japanese Katakana Character Set
- ISO-IR-14, Japanese Version of ISO 646 for Roman Characters
- ISO-IR-87, Japanese Character Set
- ISO-IR-149, Korean Graphic Character Set
- ISO-IR-165, CCITT Chinese Set

In some Application Entities of the DICOM Server, restrictions may apply to the extended character sets, see sub-sections “Extended Character Sets” in Sections 3 to 6 for the Extended Character Sets support scopes for each Application Entity.

## **2.8 CODES AND CONTROLLED TERMINOLOGY**

The product uses no coded terminology.

## **2.9 SECURITY PROFILES**

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

It is assumed that the product is used within a secured environment. It is assumed that a secured environment 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.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN)).

### 3. DICOM STORAGE SERVICE CLASS (SCU ROLE) CONFORMANCE STATEMENT

This section describes the Conformance Statement for the data sending functions supported in Centricity™ PACS. They are implemented in the Send AE as the SCU role of the DICOM Storage SOP Classes.

#### 3.1 SEND STORAGE SOP INSTANCE TO REMOTE AE

The Send AE initiates a DICOM association for sending DICOM Storage SOP instances to a remote AE by performing the C-STORE operations.

The Send AE is able to initiate multiple DICOM associations to remote AEs simultaneously. The maximum number of concurrent associations that the Send AE can initiate for sending the SOP Instances, is configurable (see Section 2.6.2 and Table 2-4).

##### 3.1.1 Associated Real-World Activities

The Send AE will initiate a DICOM association for sending one or several SOP instances to a remote AE in response to the following real-world activities:

1. A user initiated a DICOM Send command for a specified study with a specified destination AE on the Centricity™ Workstation.
2. The Centricity™ PACS has been configured to send a study to a specified destination AE when the study's status changes to a specified value, and this condition occurs.

##### 3.1.2 Proposed Presentation Contexts

Table 3-1 shows the transfer syntaxes that the Send AE uses to propose the Presentation Contexts.

**TABLE 3-1. TRANSFER SYNTAXES USED IN PRESENTATION CONTEXTS PROPOSED BY SEND AE**

<b>Transfer Syntax Table</b>		
<b>List Name</b>	<b>Name List</b>	<b>UID List</b>
Transfer Syntax List 1	COMPRESS EXPRESS	2.16.840.1.113709.1.2.2
	Explicit VR Big Endian	1.2.840.10008.1.2.2
	Explicit VR Little Endian	1.2.840.10008.1.2.1
	Implicit VR Little Endian	1.2.840.10008.1.2
Transfer Syntax List 2	Explicit VR Big Endian	1.2.840.10008.1.2.2
	Explicit VR Little Endian	1.2.840.10008.1.2.1
	Implicit VR Little Endian	1.2.840.10008.1.2
Transfer Syntax List 3	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50

The transfer syntaxes are grouped in three lists. In each Presentation Context, one list of the transfer syntaxes is proposed.

Table 3-2 shows the Presentation Contexts proposed by the Send AE after the real-world activity “Send DICOM Instance” (refer to Figure 2-3) has been performed.

**TABLE 3-2. PROPOSED PRESENTATION CONTEXTS FOR SEND AE**

<b>Presentation Context Table</b>				
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>	<b>Role</b>	<b>Extended Negotiation</b>
<b>SOP Class</b>	<b>UID</b>			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Transfer Syntax List 1	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2		SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4		SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7		SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20		SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1		SCU	None
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1		SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1		SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2		SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1		SCU	None
Digital Mammography X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.2		SCU	None
Digital Mammography X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.2.1		SCU	None
Digital X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.1		SCU	None
Digital X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.1.1		SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128		SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Transfer Syntax List 3	SCU	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2		SCU	None
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3		SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4		SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6		SCU	None
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3		SCU	None
X-Ray Angiographic Bi-plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3		SCU	None
GE Private 3D Model Storage	1.2.840.113619.4.26	SCU	None	

GE Advance (PET) Raw Data Storage	1.2.840.113619.4.30		SCU	None
GEPACS_PRIVATE_IMS_I NFO Storage	2.16.840.1.113709.1.5.1	Transfer Syntax List 2	SCU	None

As shown in Table 3-2, the first 24 SOP Classes listed in the table can use any of the Transfer Syntaxes included in Transfer Syntax List 1 or Transfer Syntax List 3. The last SOP class listed in Table 3-2 can use only the Transfer Syntaxes included in Transfer Syntax List 2.

As shown in Table 3-2, the Send AE will propose two Presentation Contexts for some Abstract Syntaxes; one using Transfer Syntax List 1 and the second using Transfer Syntax List 3. This behavior is configurable. The DICOM Server can be configured only to propose transfer syntaxes in one list, if desired.

In order to send a SOP Instance, the Send AE requires that the transfer syntax of the SOP Instance match one of the transfer syntaxes that the SCP selected for the accepted Presentation Context. If no transfer syntaxes match, the Send AE will be not able to send the SOP Instance.

### 3.1.2.1 SOP Specific Conformance Statement for All Storage SOP Classes

The Send AE provides standard conformance to the DICOM Standard Storage Service Class as SCU for all storage SOP classes listed in Table 3-2.

The Send AE will invoke DIMSE C-STORE service element to perform the SOP Instance Send operation.

All optional elements, which exist in the Storage SOP Instance, will be sent. The existence of optional elements depends on the equipment sending images to Centricity™ PACS.

All private elements, which exist in the Storage SOP Instance, will be sent. The existence of private elements depends on the equipment sending images to Centricity™ PACS.

Non-DICOM images stored on Centricity™ PACS will be converted to a DICOM Secondary Capture SOP Class, and transmitted by performing the C-STORE operation.

The Send AE does not use the C-STORE priority attribute.

**Note:** As pointed out previously, SOP Instances sent to the remote AE may have undergone correction / modification in certain data elements. A list of the data elements that may undergo data coercion is given in Section 4.2.3.

The implementation of the Send AE can perform multiple C-STORE operations over one single association. The Send AE will propose all Presentation Contexts as the list of SOP Instances to be sent dictates, and send all SOP Instances as long as the required Presentation Contexts are accepted.

Upon receiving a C-STORE-RSP containing a “Success” status, the Send AE will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE-RSP containing a “Refused” status, the Send AE will terminate the association. The remaining SOP Instances are not transmitted.

Upon receiving a C-STORE-RSP which contains either an “Error” or Warning” status, the Send AE will consider the current request to be failed, but will continue to attempt to send the remaining SOP Instances on the same association.

If any of the timers (see Section 2.3.4.5) expires, the connection is closed and the operation in progress is considered failed.

In any case, the SOP Instances sent are always retained in Centricity™ PACS.

### **3.1.3 Extended Character Sets**

The DICOM Server may perform a data coercion in a SOP Instance sent out, in order to update the data set with the information maintained in the Centricity™ database. The Patient's Name (0010,0010) may be multi-valued to include Ideographic and Phonetic name groups in addition to Alphabetic Name. This will be done if the receiving AE has been configured to intend to receive these additional names and these are available in Centricity™ database. While the Alphabetic Name is always encoded with the ISO-IR-100 character set, the Ideographic and Phonetic Names can be encoded with other dual-byte character sets as listed in Section 2.7. In the current release, the DICOM Server will not add text information encoded with extended character sets into other data elements.

See Centricity™ service documentation for the peer AE configuration method.

## 4. DICOM STORAGE SERVICE CLASS (SCP ROLE) CONFORMANCE STATEMENT

This section describes the Conformance Statement for the data receiving functions supported in Centricity™ PACS. They are implemented in the Storage AE as the SCP role of the DICOM Storage SOP Classes.

### 4.1 RECEIVE STORAGE SOP INSTANCE FROM REMOTE AE

The Storage AE constantly listens for incoming associations to receive DICOM Storage SOP instances from a remote AE.

The Storage AE is able to serve multiple DICOM associations simultaneously. The maximum number of concurrent associations that the Storage AE can accept for receiving the SOP Instances, is configurable (see Section 2.6.2 and Table 2-4).

#### 4.1.1 Associated Real-World Activities

The following real-world activities are associated with the Receive Storage SOP Instance operation (refer to Figure 2-2):

1. A physician orders a study for the patient at RIS. At the time the study is ordered, the RIS sends the study order and patient information to Centricity™ PACS, which subsequently creates an ordered study and expects to receive SOP Instances associated with this study.
2. The patient arrives in the Radiology department for the study. Either the modality is able to query the Modality Worklist from the Centricity™ PACS Broker or from a RIS or some other system, or a technologist manually enters the patient / study information into the modality. The technologist then performs the study on the patient.
3. Based on the patient / study information, the modality generates the DICOM Storage SOP instances as the results of the study and sends these to the Storage AE of Centricity™ PACS.
4. The Storage AE matches the DICOM objects received from the modality to an ordered study in the database. This is referred to as Study Profiling, see Section 4.2.1.

#### 4.1.2 Acceptable Presentation Contexts

Table 4-1 shows the Presentation Contexts acceptable for the Storage AE for receiving DICOM Storage SOP Instances.

TABLE 4-1. ACCEPTABLE PRESENTATION CONTEXTS FOR STORAGE AE

Presentation Context Table							
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation		
SOP Class	UID	Name List	UID List				
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	COMPRESS_EXPRESS	2.16.840.1.113709.1.2.2	SCP	None		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2			SCP	None		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4			SCP	None		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7			SCP	None		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20			SCP	None		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None		
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1			SCP	None		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1			SCP	None		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2			SCP	None		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1			SCP	None		
Digital Mammography X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.2			SCP	None		
Digital Mammography X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.2.1			Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Digital X-Ray Image Storage (for presentation)	1.2.840.10008.5.1.4.1.1.1.1					SCP	None
Digital X-Ray Image Storage (for processing)	1.2.840.10008.5.1.4.1.1.1.1.1					SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128					SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None		
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2			SCP	None		
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3			SCP	None		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4			SCP	None		
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6			SCP	None		
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCP	None		
X-Ray Angiographic Bi-plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3			SCP	None		
GE Private 3D Model Storage	1.2.840.113619.4.26			SCP	None		
GE Advance (PET) Raw Data Storage	1.2.840.113619.4.30			SCP	None		



Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	SCP/SCU Role Selection
Verification (Echo)	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
GEPACS_PRIVATE_IMS_I NFO Storage	2.16.840.1.113709.1.5.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

**4.1.2.1.1.1 Presentation Context Acceptance Criterion**

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

**4.1.2.1.1.2 Transfer Syntax Selection Policies**

The two “Transfer Syntax” columns in Table 4-1 list all transfer syntaxes that the Storage AE can accept for the DICOM Presentation Contexts proposed for the specified Abstract Syntaxes.

As shown in Table 4-1, the first 24 SOP Classes listed in the table can use any of five different Transfer Syntaxes (COMPRESS\_EXPRESS, Explicit VR Big Endian, Explicit VR Little Endian, Implicit VR Little Endian or JPEG Baseline (Process 1)). The last three SOP classes listed in Table 4-1 can use any of three different Transfer Syntaxes (Explicit VR Big Endian, Explicit VR Little Endian or Implicit VR Little Endian).

The DICOM Server can be configured to accept one or several or all of these transfer syntaxes, for each Abstract Syntax, according to the transfer syntax selection rules specified in Section 2.3.6.

If several transfer syntaxes are present in a Presentation Context, the Storage AE will select a transfer syntax in the order as listed in Table 4-1.

**4.1.2.2 SOP Specific Conformance Statement for Verification Service Class**

The Storage AE provides standard conformance to the DICOM Verification Service Class as SCP.

**4.1.2.3 SOP Specific Conformance Statement for Storage Commitment SOP Class**

The Storage AE also accepts Presentation Context for the DICOM Storage Commitment Push Model SOP Class. For the Conformance Statement for this behavior, the reader is referred to Section 6.1.

**4.1.2.4 SOP Specific Conformance Statement for All Storage SOP Classes**

The Storage AE provides standard conformance to the DICOM Storage Service Class as SCP.

No specialized Storage SOP Classes can be accepted.

**4.1.2.4.1 General Behavior for all Storage SOP Classes**

The SCP conforms to the DICOM Storage SOP Classes at Level 2 (full) as specified in DICOM PS 3.4, Appendix B.4.1. No elements are discarded.

All private data elements (including Unknown VR data element) will be accepted and stored as is.

The SCP will match the received Storage SOP instances to patients and studies in the Centricity™ PACS database via Study Profiling procedure. The Study Profiling behavior of the SCP depends on the called AE Title that the remote AE selected to request the association. See Sections 4.2.1 and 4.2.2.

**Note:** The Study Profiling procedure can cause changes of certain data elements in the SOP Instances. Centricity™ PACS does not regenerate a new SOP instance for the data coercion. A remote AE may receive the same SOP instance with certain data elements changed at a later time. A list of data elements that may be corrected, as well as the correction reasons, are given in Section 4.2.3.

The Study Profiling procedure has been designed to optimize its performance when a remote AE sends all SOP Instances of a study in one association (regardless of the image order in series and the series order in study). This is, however, not a required condition. The SCP is able to handle any form and any order of SOP Instances transmission either in one single association or in multiple association. But the performance of the SCP (because the AE operation is synchronized with the Study Profiling procedure) will not be optimum.

As part of the Study Profiling procedure, the Storage AE can change the status of study for the last received image to “verified” when the calling AE (SCU) closes an association. This behavior is controlled by the called AE Title selected by the remote AE. See Section 4.2.2 for more information.

**Note:** When a study is “verified” in Centricity™ PACS, it cannot receive any more images and the study can be read by a radiologist. The SOP Instances sent to a “verified” study (including additional new images or re-transmission of old images) will be either rejected or placed to a newly created study, depending on the called AE Title of the Storage AE receiving the instances (Section 4.2.2)

The SCP can validate the received SOP Instances against the DICOM Standards for data integrity. This feature can be configured as turned-on or -off (see Section 2.6.6)

The SCP will ignore the value of the C-STORE priority attribute.

If the SCP accepts a received SOP Instance for storage, the instance is stored in the file format as specified in DICOM PS 3.10, with the Explicit VR Big Endian transfer syntax. The SCP will store all unknown data elements as “unknown VR (UN)”. Therefore, besides the data change / correction mentioned above, certain data elements may be recomputed for the sake of the data storage, like group length, sequence length, etc.

If any of timers (see Section 2.3.4.5) expires, the connection is closed and the operation in progress is considered failed.

The SCP will abort the association with an A-ABORT when processing of Store Requests cannot be completed because the Centricity™ PACS storage or database subsystem is not functioning (see Section 4.1.2.4.4).

#### 4.1.2.4.2 Storage of SOP Instance Data Elements in Database

After having matched a SOP instance to the Patient / Study in the Centricity™ PACS database via the Study Profiling procedure (see Sections 4.2.1 and 4.2.2), certain data elements of the Storage SOP instance are saved in the database. The data elements saved in the Centricity™ database may be subject to data coercion due to the Study Profiling procedure or Patient / Study update either by information received from RIS or manually performed by the Centricity™ Exam Manager operator.

In addition, some data fields of Centricity™ database have a smaller size than the size specified in the DICOM Standard. Any data values exceeding the field size of the database will be truncated.

**TABLE 4-2. DATA ELEMENTS MAY BE TRUNCATED IN THE DATABASE**

<b>Data Element</b>	<b>DICOM Size</b>	<b>Database Size</b>	<b>Behavior</b>
Patient ID	64 Char	32 Char	The characters exceeding the size allowed by the database will be truncated. No warning returned to the SCU.
Patient's Name*	64 Char	40 Char	The Patient's Name will be first converted to the database format (see Section 4.2.1) and then truncated if the size exceeds the size allowed by the database. No warning returned to the SCU.

\*: This restriction applies to the Alphabetic Name group if the Patient's Name data element in a received data set is multi-valued. An UTF-8 text string up to 255 bytes in the Centricity™ database is supported for both the Ideographic and Phonetic Name groups. This guarantees that these name groups are not truncated.

#### 4.1.2.4.3 SOP Instance Storage and Abnormal Association Termination

##### 4.1.2.4.3.1 SOP Instance Storage by SCP

It is possible for the Storage SCP (Storage AE) to fail in a manner where the cached data is unrecoverable, such as a power failure. The Storage SCU (remote AE) should use the following rules to decide if the transmitted SOP Instances have been stored safely in Centricity™ PACS:

- If the Storage SCU requested association release (A-RELEASE) and received A-RELEASE response from the Storage SCP, all successfully transmitted SOP Instances (messages) in the association have been stored in the Centricity™ on-line storage system persistently.
- If the Storage SCU issues an association abort (A-ABORT) or receives a provider-initiated abort (A-P-ABORT), the success or failure of the Storage SCP to retain any object sent on the association is undefined.
- If an association is terminated because of any network operation failure or time-out, the success or failure of the Storage SCP to retain any object sent on the association is undefined.

The Storage SCU (remote AE) is strongly recommended to use the DICOM Storage Commitment service to verify the permanent storage status of the submitted SOP instances (see Section 6).

##### 4.1.2.4.4 C-STORE Response Status

The Storage SCP will return the following status codes in C-STORE-RSP message:

TABLE 4-3. STATUS CODES RETURNED IN C-STORE-RSP

Service Status	Status Code	Further Meaning	Status Code Sending Explanation	Related Fields Sent Back to SCU
Success	0000	Image Accepted	Image successfully profiled to a Study object in the Centricity™ database.	None
Refused	A700	Out of Resources	Processing of Store Requests cannot be completed because the Centricity™ PACS storage or database subsystem is not functioning.	None
Error	A900	Data Set does not match SOP Class	The following generally required data elements are either missing or do not match the SOP Class: <ul style="list-style-type: none"> <li>• SOP Instance UID</li> <li>• SOP Class UID</li> <li>• Study Instance UID</li> <li>• Series Instance UID</li> </ul>	None
	C000	Cannot Understand	The processing of Store Requests cannot be completed due to the failure of Study Profiling (e.g., no match found and the called AE Title is unable to create a new Patient / Study).	None

If a status code of Refused or Error is returned in a C-STORE-RSP, the success or failure of the SCP to retain the SOP Instance transmitted in the corresponding C-STORE-RQ is undefined.

### 4.1.3 Extended Character Sets

The use of extended character sets is fully supported. A received SOP Instance can be stored, archived and retrieved with all text information encoded with any supported character sets.

When adding the text information from the received data set to the Centricity™ database, however, only the Patient's Name data element is supported for all character sets listed in Section 2.7. Other text information will not be added to the database if they are encoded with any character set other than ISO-IR-6 or ISO-IR-100 (but these text strings still remain in the data sets, which are stored and archived).

## 4.2 IMPORTANT REMARKS TO STORAGE AE (SCP ROLE)

### 4.2.1 Study Profiling

The Storage AE will perform the Study Profiling process for each received Storage SOP Instance, in order to relate it to an ordered study object in the Centricity™ database. The process is performed by matching the Patient / Study level data elements in the data set of the SOP instance to the Patient / Study object existing in the database.

**Note:** A comprehensive description of the Study Profiling process is beyond the scope of this document. See product documents of Centricity™ PACS for more information.

#### 4.2.1.1 Data Elements Applied for Patient / Study Matching

Table 4-4 lists the data elements of a SOP instance used to match it to a study (of a patient) in the Centricity™ PACS database.

**TABLE 4-4. DATA ELEMENTS USED IN STUDY PROFILING**

Attribute Name	Tag
Patient's Name	(0010,0010)
Patient ID	(0010,0020)
Patient's Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Accession Number	(0008,0050)
Study Instance UID	(0020,000D)
Study ID	(0020,0010)
Study Date	(0008,0020)
Study Time	(0008,0030)
Modality	(0008,0060)

Not all of these data elements are always used for a Study Profiling process. The Storage AE supports a number of separate AE Titles, which choose a subset of these data elements for a particular Study Profiling algorithm. Section 4.2.2 gives these AE Titles along with other properties of a Study Profiling process, like the ability of creating a new study if a matching to the existing studies failed.

#### 4.2.1.2 Extended Character Sets in Patient's Name Text Encoding

If the Patient's Name data element in a received data set is multi-valued, only the Alphabetic Name group is applied for the patient / study matching. Other name groups are ignored for the data matching purpose. If the Alphabetic Name is absent but other name groups exist, the data set is treated as if the Patient Name is a null length value in terms of patient / study matching.

If the Alphabetic Name is provided with character set ISO-IR-13, a transliteration process is applied to convert it into the representation of ISO-IR-6. The transliteration is performed according to the Table-II specification in the Japanese Dictionaries.

#### 4.2.1.3 Patient's Name Format Conversion

Before the data elements of a SOP instance are used to search for or create data in the Centricity™ PACS Database, Patient's Names supplied by the calling AE (Storage SCU) are first converted to upper case. They are then translated from DICOM format to the normal format used in reading worklists. For example, the DICOM formatted name "Last^First^Middle^Prefix^Suffix" becomes "LAST, FIRST MIDDLE PREFIX SUFFIX".

Notice that a comma has been added between the first and last names specified in the DICOM format. If a complete DICOM name comes in with no separators (^), then no comma is added to the name. In

this case, the DICOM formatted name "Last First Middle Prefix Suffix" becomes "LAST FIRST MIDDLE PREFIX SUFFIX".

**Note:** The Person Name Conversion is performed only in the Centricity™ database. This does not affect the format of the person name in the DICOM data set of the SOP Instances stored and archived in the Centricity™ PACS.

In the Centricity™ database, a Patient's Name complex is separated with the Last Name and the Rest Name including First Name, Middle Name, Prefix and Suffix, and the comma ',' is used as delimiter.

As described in Section 4.1.2.4.2, the Patient's Name string will be truncated if it exceeds the allowed size (refer to Table 4-2).

#### 4.2.1.4 Verified and Canceled Study

If a study matched by the Study Profiling process has a (PACS internal) status "verified" or "canceled", no more SOP Instances can be added to it. This will cause the Storage AE either to reject the received SOP Instance, or to create a new (unordered) study to host the SOP Instance, depending on the capability of the called AE Title, see Section 4.2.2.

The solution for this problem is to "un-verify" the study if it is "verified", or to recover the study if it is "canceled", prior to sending the SOP Instances to the study. See Centricity™ PACS product documents for more information about these operations.

#### 4.2.2 Behavior of AE Title Selected by SCU

A number of AE Titles can be configured for the Storage AE to support different algorithms for the Study Profiling of the received SOP Instances.

The Centricity™ PACS system allows selection of the following elements to configure a Study Profiling algorithm (a Storage AE Title):

- A number of DICOM data elements listed in Table 4-4.
- The database fields that the DICOM data elements should be mapped to.
- A comparison operation used to match the DICOM data elements to the database fields, e.g., simple match, wildcard matching, etc.

The specified Storage AE Title will use the defined algorithm to perform the Study Profiling process for all images sent to it.

In addition to specify the matching elements for the Study Profiling algorithm, the following features can be defined for the specific Storage AEs, too:

1. Patient / Exam Creation Ability. If the matching defined the Study Profiling algorithm failed or the matched exam is already “verified”, a new patient and / or (unordered) study can be created in the Centricity™ database to host these unmatched images. Disabling the Patient / Exam Creation ability causes the images to be rejected if the matching failed. If this ability is enabled, the Storage AE will use the data elements in the DICOM header of the received images to create the patient and / or exam objects.
2. Automatic Study Verification. The automatic study verification refers to the ability to change the status of a study to “verified” after successful completion of one DICOM association, if the study receives one or several SOP instances in the association. The study states are defined interior the Centricity™ PACS system. When a study is “verified” in the Centricity™ PACS database, no more Storage SOP instances may be placed into the study.

Using different Study Profiling algorithms via different AE Titles is mainly to help coping with different behaviors of the imaging modalities to get the patient / study data entered and therefore to include these data items in the generated SOP instances.

The ability of configuring the specific Storage AE Titles refers to the Dynamic Profiling function of Centricity™ PACS. See Centricity™ PACS Product Documentation for more information.

### 4.2.3 Coercion of Data Elements

Centricity™ PACS supports an interface to customer HIS/RIS systems or use Centricity™ Exam Manager to perform necessary RIS functions. The RIS information is always assumed by Centricity™ PACS (either a real RIS or Centricity™ Exam Manager) to contain more accurate Patient and Study data than the data received from the acquisition systems via DICOM Composite SOP Instances. Therefore, the RIS information is always used to correct any data entry errors. This data error correction is propagated to all DICOM Storage SOP Instances maintained in Centricity™ PACS.

Another reason causing the change of the data elements in the SOP Instances is the Study Profiling. As long as a SOP Instance is matched to an existing study in the Centricity™ database, all data attributes of the study (as well as its upper-associated Patient) are propagated to the SOP Instance. This is because the Storage AE more trusts the “RIS data”.

Also the Study Instance UID, Series Instance UID and SOP Instance UID can be changed, if they conflict with the UID values already used in the Centricity™ database to identify another (Study, Series or SOP Instance) object.

Table 4-5 lists all data elements of the SOP Instances that may undergo a data correction in Centricity™ PACS. They can be different from the original values when a remote AE retrieves them from the Q/R AE of the DICOM Server.

TABLE 4-5. DATA ELEMENT COERCION OF THE SOP INSTANCES

Attribute Name	Tag	Change Reason
Patient ID	(0010,0020)	SOP Instance is associated to another patient, or wrong Patient ID is included in the data set
Patient's Name*	(0010,0010)	Wrong data in data set. Most likely manual input.
Patient's Birth Date	(0010,0030)	Wrong data in data set. Most likely manual input.
Patient's Sex	(0010,0040)	Wrong data in data set. Most likely manual input.
Other Patient IDs	(0010,1000)	Data corrected or supplemented
Study Instance UID**	(0020,000D)	SOP Instance is associated to another study
Accession Number	(0008,0050)	Wrong data in data set. Most likely manual input.
Study Date	(0008,0020)	Study with multiple steps performed on different device, Centricity™ PACS takes the earliest study date / time.
Study Time	(0008,0030)	See above.
Referring Physician's Name	(0008,0090)	Wrong data in data set. Most likely manual input.
Study Description	(0008,1030)	Study with multiple steps performed on different device, Centricity™ PACS can only take one.
Requested Procedure ID	(0040,1001)	Data corrected or supplemented
Series Instance UID**	(0020,000E)	Bad Series Instance UID in the data set
Series Number	(0020,0011)	User specific reasons.
SOP Instance UID**	(0008,0018)	Bad SOP Instance UID in the data set
Instance Number	(0020,0013)	User specific reasons.
Number of Images in Acquisition	(0020,1002)	User specific reasons.

\*: Patient's Name may be multi-valued and encoded with extended character set. See Section 3.1.3.

\*\* : If these UID values are changed, the original UID values are saved in the data set as private tags. See Appendix B.

#### 4.2.4 Supported Uses of SOP Instances

Usually, Centricity™ PACS is applied in the radiology practice for image data management, storage, archiving, display, print, and distribution.

The DICOM Conformance Statement information specifies which DICOM Storage SOP Classes are supported by the Centricity™ DICOM Server as an SCP, i.e., they can be received by Centricity™ PACS. This does not automatically confirm that all SOP Instances can be displayed or printed or processed in a certain application.

This section gives the information of the supported uses of the received SOP Instances in Centricity™ PACS.

##### 4.2.4.1 Data Storage

Centricity™ PACS will store all successfully received SOP Instances in its on-line storage subsystem.



#### 4.2.4.2 Data Archiving

Centricity™ PACS will archive all successfully received SOP Instances in its long-term archiving subsystem. The storage duration in the long-term archiving subsystem is permanent.

**Note:** Although a permanent storage function is always provided for the received SOP Instances, a remote AE is strongly recommended to use the DICOM Storage Commitment Push Model SOP class to verify the archiving status of the submitted SOP Instances.

#### 4.2.4.3 Information Query and Data Retrieval

Centricity™ PACS supports a remote AE to query the information and to retrieve the data sets of all stored and archived SOP Instances, using the DICOM Query/Retrieve SOP Classes.

Centricity™ PACS performs an information query always against the data maintained in the database.

Centricity™ PACS performs a data retrieval always against both the on-line storage subsystems and the long-term archiving subsystems.

**Note:** A remote AE may be unable to query and retrieve the SOP Instances using the original values in certain matching keys as sent to Centricity™ PACS previously, because of the data coercion. See Section 4.2.3.

#### 4.2.4.4 Data Display

Centricity™ Workstation and Centricity™ WEB Clients are able to display an image SOP Instance if it meets the conditions specified in Table 4-6.

TABLE 4-6. CONDITIONS FOR IMAGE SOP INSTANCE DISPLAY

Name	Tag	Description
Modality Code	(0008,0060)	The image SOP Instance must contain one of the following Modality Code values: <ul style="list-style-type: none"> <li>•CR</li> <li>•CT</li> <li>•MR</li> <li>•RG</li> <li>•DS</li> <li>•DF</li> <li>•XA</li> <li>•RF</li> <li>•DX</li> <li>•PT</li> <li>•US</li> <li>•NM</li> <li>•MG*</li> </ul>
Photometric Interpretation	(0028,0004)	The image SOP Instance must contain one of the following Photometric Interpretation values: <ul style="list-style-type: none"> <li>•MONOCHROME1</li> <li>•MONOCHROME2</li> <li>•RGB</li> <li>•YBR_FULL**</li> <li>•YBR_FULL_422**</li> </ul>

\*: Centricity™ PACS supports the display of Digital Mammograms (Modality Code: MG) only for secondary review purposes (not for primary diagnosis).

\*\* : Centricity™ WEB Clients are able to display the YBR\_FULL and YBR\_FULL\_422 color images only if these are sent to the Centricity™ PACS using the DICOM JPEG Baseline (Process 1) Transfer Syntax.

Centricity™ PACS is unable to display any non-Image SOP Instance, e.g., curves.

#### 4.2.4.5 DICOM Data Element List

Centricity™ Workstation and Centricity™ WEB Clients are able to display a list of data elements in an image SOP Instance. All data elements with a group number less than 0x7FE0 can be listed.

Text information encoded with any character sets listed in Section 2.7 can be displayed, provided that the Centricity™ Workstation or Centricity™ WEB Clients platform is appropriately configured. For the requirements for the platform configuration, see Centricity™ PACS documentation.

#### 4.2.4.6 Data Print

Centricity™ Print Server is able to print an image SOP Instance if it meets the conditions specified in Table 4-7.

TABLE 4-7. CONDITIONS FOR IMAGE SOP INSTANCE PRINT

Name	Tag	Description
Modality Code	(0008,0060)	The image SOP Instance must contain one of the following Modality Code values: <ul style="list-style-type: none"> <li>•CR</li> <li>•CT</li> <li>•MR</li> <li>•RG</li> <li>•DS</li> <li>•DF</li> <li>•XA</li> <li>•RF</li> <li>•DX</li> <li>•PT</li> <li>•US</li> <li>•NM</li> <li>•MG</li> </ul>
Photometric Interpretation	(0028,0004)	The image SOP Instance must contain one of the following Photometric Interpretation values: <ul style="list-style-type: none"> <li>•MONOCHROME1</li> <li>•MONOCHROME2</li> <li>•RGB*</li> <li>•YBR_FULL*</li> <li>•YBR_FULL_422*</li> </ul>

*\*: The color images are converted to a grayscale representation by extracting the brightness component and printed on a grayscale printer. Centricity™ PACS does not support color printers.*

Centricity™ PACS is unable to print any non-image SOP Instance, e.g., curves.

## 5. DICOM QUERY/RETRIEVE SERVICE CLASS (SCP ROLE) CONFORMANCE STATEMENT

This section describes the Conformance Statement for information query and data retrieval functions supported in Centricity™ PACS. They are implemented in the Q/R AE as the SCP role of the DICOM Query/Retrieve SOP Classes.

### 5.1 DICOM QUERY REQUEST FROM REMOTE AE

The Q/R AE constantly listens for incoming associations in order to service a DICOM Query request from a remote AE.

The Q/R AE is able to accept multiple DICOM associations simultaneously. The maximum number of concurrent associations that the Q/R AE can accept for serving DICOM Query requests is configurable (see Section 2.6.2 and Table 2-4).

#### 5.1.1 Associated Real-World Activities

The following real-world activities are associated with the C-FIND service element (response role) (refer to Figure 2-4):

1. Search for patients, studies, series, or SOP instances in the Centricity™ PACS database.
2. Send the found data sets in C-FIND responses to the remote AE.

#### 5.1.2 Acceptable Presentation Contexts

Table 5-1 shows the Presentation Contexts acceptable by the Q/R AE.

TABLE 5-1. ACCEPTABLE PRESENTATION CONTEXTS FOR Q/R AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	UID	Name List	UID List		
Patient Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Study Root Q/R Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1			SCP	None
Patient Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Study Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Verification (Echo)	1.2.840.10008.1.1			SCP	None

#### 5.1.2.1.1.1 Presentation Context Acceptance Criterion

The Q/R AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

#### 5.1.2.1.1.2 Transfer Syntax Selection Policies

The two “Transfer Syntax” columns in Table 5-1 list all transfer syntaxes that the Q/R AE can accept for the DICOM Presentation Contexts proposed for the specified Abstract Syntaxes.

The five SOP classes listed in Table 5-1 can use any of three different Transfer Syntaxes (i.e. Explicit VR Big Endian, Explicit VR Little Endian or Implicit VR Little Endian).

The DICOM Server can be configured to accept one or several or all of these transfer syntaxes, for each Abstract Syntax, according to the transfer syntax selection rules specified in Section 2.3.6.

If several transfer syntaxes are present in a Presentation Context, the Q/R AE will select a transfer syntax in the order as listed in Table 5-1.

#### 5.1.2.2 SOP Specific Conformance Statement for Verification Service Class

The Q/R AE provides standard conformance to the DICOM Verification Service Class as a SCP.

#### 5.1.2.3 SOP Specific Conformance Statement for Query/Retrieve Information Model – FIND SOP Classes

The Q/R AE provides standard conformance to the DICOM Query/Retrieve Information Model – FIND SOP Classes as a SCP.

##### 5.1.2.3.1 General Behavior

The SCP uses the DIMSE service element C-FIND to serve a DICOM Query from a remote AE as follows:

1. The Q/R AE supports a DICOM Query at all levels of Patient / Study / Series / SOP Instance as specified in the supported DICOM Query/Retrieve Information Models (Table 5-1), and return the found data sets in C-FIND response.
2. The Q/R AE only uses the keys of supported type matching (see Sections 5.1.2.3.4 and 5.1.2.3.5) to perform the database search. Values in keys of type Returned will be ignored and will be filled in with data found from the database.
3. Any unsupported key (not included in Sections 5.1.2.3.4 and 5.1.2.3.5) will be ignored. No corresponding data element will be returned at all.
4. Sequence matching is supported by the Q/R AE.
5. Range matching is supported for the Date and Time keys (see Section 5.1.2.3.3)
6. The Q/R AE only supports hierarchical query. No relational query is supported.
7. The Q/R AE searches for the data set using the matching keys specified in the C-FIND request against the Centricity™ database.

8. The Q/R AE does not provide any value for the data element Storage Media File-Set ID. At the moment, the Centricity™ PACS system does not support any DICOM Media Storage SOP class.
9. The Q/R AE will ignore the data element Priority in a DICOM Query request.

**Note:** Due to the data coercion of the SOP Instances as described in Section 4.2.3, the return data elements can be different from the values in the DICOM Storage SOP Instances originally sent to the Storage AE.

#### 5.1.2.3.2 Data Query to Centricity™ PACS Database

When a query specifies a searching key for a person name, the Q/R AE will perform an automatic data conversion. The Q/R AE converts the DICOM person name format to the person name format used in the Centricity™ database as specified in Section 4.2.1.3, and forces a case-insensitive search in the database.

The Q/R AE reserves the right to reject any query which would cause extremely large compute or I/O intensive operations during the search such as a query matching all studies in the database.

In general, the Q/R AE will always return a limited number of responses to a Q/R SCU, if the submitted query may potentially generate a large number of matches in the database. The maximum number of returned query responses is configurable.

#### 5.1.2.3.3 Matching Operations

##### 5.1.2.3.3.1 Date and Time Keys Matching Operations

The Q/R AE supports a DICOM Query request using any matching operations in a date or time matching key specified in the DICOM PS 3.4, as listed in Table 5-2.

**TABLE 5-2. DATE AND TIME MATCHING OPERATIONS**

Specification	Key Value Description
NONE	No key or no key value was specified
EQ	<value> ; match all occurrences of value
GE	<value>- ; match all occurrences of value and subsequent values
LE	-<value> ; match all occurrences of prior to and including value
RANGE	<value1>-<value2> ; match all occurrences between value1 and value2 inclusive.

Because Centricity™ PACS saves the date and time values in one single field in the database, an arbitrarily independent search for the date and time keys in a DICOM Query request cannot be supported. For a combination of the date and time matching keys, the Q/R AE will interpret the performed date and time joint matching as indicated in Table 5-3.

**TABLE 5-3. DATE AND TIME JOINT MATCHING OPERATIONS PERFORMED BY THE SCP**

<b>Date Specification</b> (See Table 5-2)	<b>Time Specification</b> (See Table 5-2)	<b>Operation Performed</b>
NONE	NONE, EQ, GE, LE, RANGE	Search not qualified by date and time (ignored)
EQ, GE, LE, RANGE	NONE	Search using date specification
EQ	EQ, GE, LE, RANGE	Search using specified date and time
GE, LE, RANGE	EQ, GE, LE, RANGE	Search using date specification only

**5.1.2.3.3.2 Other Keys Matching Operations**

The Q/R AE supports single value matching for all keys of a supported type “Matching”, see Section 5.1.2.3.4.

The Q/R AE supports wild card matching for all text valued keys of a supported type “Matching”, see Section 5.1.2.3.4.

The Q/R AE supports UID list matching for all UID keys of a supported type “Matching”, see Section 5.1.2.3.4.

**5.1.2.3.4 Patient Root Information Model Definition**

This section specifies the use of the DICOM Patient Root Query/Retrieve Information Model for matching keys and returned keys supported in a DICOM Query request.

Sections 5.1.2.3.4.1 through 5.1.2.3.4.4 define what attributes are supported for query. Table 5-4 specifies the usage definitions for each attribute.

**TABLE 5-4. QUERY KEY USAGE**

<b>Usage</b>	<b>Description of Term</b>
Matching	Matching is supported, and values for it are returned
Partial Matching	Partial matching is supported. Explanations will be given on a per key basis.
Returned	If the attribute is sent in the request, then if a value exists in the database it will be returned. No matching is performed

**5.1.2.3.4.1 Patient Level - Key Attributes Supported**

Patient Level Key Attributes are specified in Table 5-5.

TABLE 5-5. PATIENT LEVEL KEY ATTRIBUTES

Description	Tag	Usage
Patient's Name*	(0010,0010)	Matching
Patient ID	(0010,0020)	Matching
Patient's Birth Date	(0010,0030)	Returned
Patient's Sex	(0010,0040)	Returned
Other Patient IDs	(0010,1000)	Returned
Ethnic Group	(0010,2160)	Returned

\*: The Q/R AE accepts a multi-valued Patient's Name data element as a matching key, if the Alphabetic Name is fully qualified. If the Alphabetic Name is partially qualified, only a single-valued Patient's Name element can be used as a matching key.

5.1.2.3.4.2 Study Level - Key Attributes Supported

Study Level Key Attributes are specified in Table 5-6.

TABLE 5-6. STUDY LEVEL KEY ATTRIBUTES

Description	Tag	Usage
Study Instance UID	(0020,000D)	Matching
Accession Number	(0008,0050)	Matching
Study ID	(0020,0010)	Matching
Study Date	(0008,0020)	Matching See Section 5.1.2.3.3
Study Time	(0008,0030)	Partial Support See Section 5.1.2.3.3
Referring Physician's Name	(0008,0090)	Returned
Study Description	(0008,1030)	Returned
Procedure Code Sequence	(0008,1032)	Matching
>Code Value	(0008,0100)	Matching
>Coding Scheme Designator	(0008,0102)	Matching
>Code Meaning	(0008,0104)	Matching

5.1.2.3.4.3 Series Level - Key Attributes Supported

Series Level Key Attributes are specified in Table 5-7.



TABLE 5-7. SERIES LEVEL KEY ATTRIBUTES

Description	Tag	Usage
Modality	(0008,0060)	Matching
Series Number	(0020,0011)	Matching
Series Instance UID	(0020,000E)	Matching
Series Description	(0008,103E)	Returned
Body Part Examined	(0018,0015)	Matching

5.1.2.3.4.4 SOP Instance Level - Key Attributes Supported

SOP Instance Level Key Attributes are specified in Table 5-8.

TABLE 5-8. SOP INSTANCE LEVEL KEY ATTRIBUTES

Description	Tag	Usage
Instance Number	(0020,0013)	Matching
SOP Instance UID	(0008,0018)	Matching

5.1.2.3.5 Study Root Information Model Definition

The Study Level Key Attributes supported are the same as those listed in Section 5.1.2.3.4.1 and Section 5.1.2.3.4.2.

The Series Level Key Attributes supported are the same as those listed in Section 5.1.2.3.4.3.

The SOP Instance Level Key Attributes supported are the same as those listed in Section 5.1.2.3.4.4.

5.1.3 Extended Character Sets

The Q/R AE may include a multi-valued Patient's Name element in the query responses, if the query requesting AE has been configured to intend to receive the multi-valued names and these are available in Centricity™ database. While the Alphabetic Name is always encoded with the ISO-IR-100 character set, the Ideographic and Phonetic Names can be encoded with other dual-byte character sets as listed in Section 2.7. In the current release, the Q/R AE will not include text information encoded with extended character sets in any other data elements of the query responses.

See Centricity™ service documentation for the peer AE configuration method.

5.2 DICOM RETRIEVE REQUEST FROM REMOTE AE

The Q/R AE constantly listens for incoming associations to serve a DIMSE C-MOVE operation issued from a remote AE.

The Q/R AE accepts associations for finding the SOP Instances and sends the found SOP Instances to the destination AE specified in the C-MOVE operation, as Query/Retrieve SCP.

The Q/R AE initiates associations in response to requests to move images, as DICOM Storage SCU.

The Q/R AE is able to accept multiple DICOM associations simultaneously. The maximum number of concurrent associations that the Q/R AE can accept for serving DICOM Retrieve requests, is configurable.

### 5.2.1 Associated Real-World Activities

The following real-world activities are associated with the C-MOVE service element (response role) (refer to Figure 2-4):

1. Search for the information of the requested SOP Instances in the Centricity™ database and gain the access to the data files of the SOP Instances.
2. Send found SOP Instances to the specified remote AE specified in the DICOM Retrieve request, if the data files are accessible.
3. Send C-MOVE-RSP to the calling remote AE.

### 5.2.2 Acceptable Presentation Contexts

See Table 5-1 in Section 5.1.2.

#### 5.2.2.1.1.1 Presentation Context Acceptance Criterion

The Q/R AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

#### 5.2.2.1.1.2 Transfer Syntax Selection Policies

The two “Transfer Syntax” columns in Table 5-1 list all transfer syntaxes that the Q/R AE can accept for the DICOM Presentation Contexts proposed for the specified Abstract Syntaxes.

The five SOP classes listed in Table 5-1 can use any of three different Transfer Syntaxes (i.e. Explicit VR Big Endian, Explicit VR Little Endian or Implicit VR Little Endian).

The DICOM Server can be configured to accept one or several or all of these transfer syntaxes, for each Abstract Syntax, according to the transfer syntax selection rules specified in Section 2.3.3.

If several transfer syntaxes are present in a Presentation Context, the Q/R AE will select a transfer syntax in the order as listed in Table 5-1.

#### 5.2.2.2 SOP Specific Conformance Statement for Query/Retrieve Information Model – MOVE SOP Classes

The Q/R AE provides standard conformance to the DICOM Query/Retrieve Information Model – MOVE SOP Classes as SCP.

1. The Q/R AE searches for the requested SOP Instances in Centricity™ database as specified by the Unique Key values in C-MOVE-RQ. If no requested SOP instances can be found then the Q/R

AE will return C-MOVE-RSP to the calling AE with a status Success. The response will equal zero for the number of completed, failed, and warning sub-operations.

2. All SOP Instances requested in a C-MOVE-RQ will be sent to the destination AE over a single association. The Q/R AE sends a C-MOVE-RSP with the Pending status to the SCU periodically with a configurable time interval.
3. A C-MOVE-RSP will contain the number remaining, completed, failed, and warning C-STORE sub-operations.
4. The Q/R AE will ignore the data element Priority, if it is included in the C-MOVE request.

### 5.2.3 Proposed Presentation Contexts

The Q/R AE initiates a DICOM association to the data move destination AE to perform the DIMSE C-STORE operation for sending the found SOP Instances.

The Q/R provides the exact same Conformance Statement for this DICOM Storage SCU Role as described in Section 3.1.

**Note:** Due to the data coercion of the SOP Instances as described in Section 4.2.3, the retrieved SOP Instances can contain certain data elements with different values from the SOP Instances sent to Centricity™ PACS originally.

### 5.2.4 Extended Character Sets

The Q/R AE may perform a data coercion in a SOP Instance sent to the data retrieval requesting AE, in order to update the data set with the information maintained in the Centricity™ database. The Patient's Name (0010,0010) may be multi-valued to include Ideographic and Phonetic name groups in addition to Alphabetic Name. This will be done if the receiving AE has been configured to intend to receive these additional names and these are available in Centricity™ database. While the Alphabetic Name is always encoded with ISO-IR-100 character set, the Ideographic and Phonetic Names can be encoded with other dual-byte character sets as listed in Section 2.7. In the current release, the DICOM Server will not add text information encoded with extended character sets into other data elements.

See Centricity™ service documentation for the peer AE configuration method.

## 6. DICOM STORAGE COMMITMENT SERVICE CLASS (SCP ROLE) CONFORMANCE STATEMENT

This section describes the Conformance Statement for the storage commitment functions supported in Centricity™ PACS. They are implemented in the Storage AE as the SCP role of the DICOM Storage Commitment SOP Classes. The Storage AE's SCP implementation of the Storage Commitment Service Class supports the Storage Commitment Push Model SOP Class.

### 6.1 RECEIVE STORAGE COMMITMENT REQUEST FROM REMOTE AE

The Storage AE constantly listens for incoming associations in order to receive a Storage Commitment Request (as well as DICOM Storage SOP Instances) from a remote AE.

The Storage AE is able to accept a Presentation Context for the Storage Commitment Push Model SOP Class either in a dedicated association, or in a single association together with Presentation Contexts for DICOM Storage SOP Classes. The behavior of the Storage AE with respect to the Storage Commitment service is the same in the both cases.

The Storage AE is able to serve multiple DICOM associations simultaneously. The maximum number of the concurrent associations that the Storage AE can accept is configurable (see Section 2.6.2 and Table 2-4).

#### 6.1.1 Associated Real-World Activities

The following real-world activities are associated with the Receive Storage Commitment Request operation (refer to Figure 2-2):

1. The Storage AE places a job (transaction) in the Centricity™ Storage Commitment Queue. The job includes all SOP instances requested for Storage Commitment, as well as the calling DICOM AE Title. For each job, a timer is started when it is added to the Storage Commitment Queue.
2. The Storage AE constantly polls the queue for a job which response can be sent back to the original requester.

**Note:** Other components of Centricity™ PACS will process the Storage Commitment Queue and update the status of the jobs (pending or completed or failed or time-out). This is beyond the scope of this Conformance Statement document.

#### 6.1.2 Acceptable Presentation Contexts

See Table 4-1 in Section 4.1.2.

##### 6.1.2.1.1 Presentation Context Acceptance Criterion

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

#### 6.1.2.1.1.2 Transfer Syntax Selection Policies

The two “Transfer Syntax” columns in Table 4-1 list all transfer syntaxes that the Storage AE can accept for the DICOM Presentation Contexts proposed for the Abstract Syntax DICOM Storage Commitment Push Model SOP Class. The three transfer syntaxes are: Explicit VR Big Endian, Explicit VR Little Endian and Implicit VR Little Endian.

The DICOM Server can be configured to accept one or several or all of these transfer syntaxes, for each Abstract Syntax, according to the transfer syntax selection rules specified in Section 2.3.6.

If several transfer syntaxes are present in a Presentation Context, the Storage AE will select a transfer syntax in the order as listed in Table 4-1.

#### 6.1.2.2 SOP Specific Conformance Statement for Storage Commitment Push Model SOP Class

The Storage AE provides standard conformance to the DICOM Storage Commitment Service as an SCP. The Storage AE uses the DIMSE service element N-ACTION to receive a Storage Commitment Request.

The Storage AE supports the data elements listed in Table 6-1 as part of the data set in a received N-ACTION request.

**TABLE 6-1. DATA ELEMENTS SUPPORTED IN STORAGE COMMITMENT REQUEST**

<b>Data Element</b>	<b>Tag</b>	<b>Description</b>
Transaction UID	(0008,1195)	UID to identify this request
Referenced SOP Sequence	(0008,1199)	A list of SOP instances to be requested for Storage Commitment
> Referenced SOP Class UID	(0008,1150)	SOP Class UID of the instance
> Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the instance

The Storage AE will ignore the data elements listed in Table 6-2 if they are included in a Storage Commitment Request.

**TABLE 6-2. DATA ELEMENTS IGNORED IN STORAGE COMMITMENT REQUEST**

Data Element	Tag	Description
Storage Media File-Set ID	(0088,0130)	The DICOM File-Set from which all SOP instances can be retrieved.
Storage Media File-Set UID	(0088,0140)	Uniquely identifies a Storage Media on which this SOP instance resides.
> Storage Media File-Set ID	(0088,0130)	The DICOM File-Set from which all SOP instances can be retrieved.
> Storage Media File-Set UID	(0088,0140)	Uniquely identifies a Storage Media on which this SOP instance resides.
Referenced Performed Procedure Step Sequence (formerly known as Referenced Study Component Sequence)	(0008,1111)	The Study Component that contains all SOP instances listed in the referenced SOP sequence.

The Storage AE will accept a Storage Commitment Request for both referenced SOP Instances already received (known objects) and not yet received at this moment (unknown objects). If the unknown objects are received and archived successfully at a later time (before the Storage Commitment jog timer expires), a success response will be sent to the requester.

The Storage AE will return a Success Status Code in N-ACTION-RSP to indicate that the Storage Commitment transaction is received successfully and queued in Centricity™ PACS for processing. A Storage Commitment Result will be sent to the remote AE via N-EVENT-REPORT operation.

The Storage AE will return a Failure Status Code in N-ACTION-RSP to indicate that the receipt of the Storage Commitment transaction failed or the transaction cannot be processed. No Storage Commitment Result will be sent to the remote AE.

**6.1.2.3 N-ACTION Response Status**

The Storage AE will return the standard status codes in N-ACTION-RSP message as specified in DICOM PS 3.7.

**6.2 SEND STORAGE COMMITMENT RESULT TO REMOTE AE**

The Storage AE initiates a DICOM association to send a DICOM Storage Commitment Result notification to a remote AE, in response to a previously received Storage Commitment Request.

The Storage AE will always initiate a new DICOM association to send the Storage Commitment Result. It will never send a Storage Commitment Result in the same DICOM association in which a DICOM Storage Commitment Request was received.

The Storage AE will always initiate one single DICOM association for sending the Storage Commitment Result simultaneously. Multiple Storage Commitment Results will be sent subsequently.

**6.2.1 Associated Real-World Activity**

The following real-world activity will cause the Storage AE to initiate a DICOM association for sending a DICOM Storage Commitment Result:

1. The Storage AE periodically polls the Centricity™ Storage Commitment Queue and gets a job, which is pending, completed, or timed-out.

**6.2.2 Proposed Presentation Contexts**

The Storage AE will propose the Presentation Context listed in Table 6-3 for sending a Storage Commitment Result to a remote AE.

**TABLE 6-3. PROPOSED PRESENTATION CONTEXTS FOR STORAGE AE AND STORAGE COMMITMENT RESULT**

<b>Presentation Context Table</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>SOP Class</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	SCU/SCP Role Selection
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Implicit VR Little Endian	1.2.840.10008.1.2		

The columns “Transfer Syntax” in Table 6-3 list all transfer syntaxes that the Storage AE can propose for the Abstract Syntax Storage Commitment Push Model SOP Class. The DICOM Server can be configured to propose the Presentation Contexts with one or several or all of these transfer syntaxes.

The Storage AE will propose SCU/SCP Role Selection negotiation for the Presentation Contexts of the Storage Commitment Push Model SOP Class.

**6.2.2.1 SOP Specific Conformance Statement for Storage Commitment Push Model SOP Class**

The Storage AE will invoke the N-EVENT-REPORT operation in a newly created association to send the Storage Commitment Result to the remote AE in response to a previously received Storage Commitment Request.

The Storage AE can send one or more Storage Commitment Results over a single association.

The Storage AE always initiates a separate, dedicated association to send Storage Commitment Results. It will never send Storage Commitment Results over the same association that a Storage Commitment Request was received on.

The Storage AE does not support the optional Storage Media File-Set ID and Storage Media File-Set UID in the Storage Commitment Result. The Storage AE does not support the optional Retrieve AE Title Attribute in the Storage Commitment Result.

**6.2.2.1.1 Storage Commitment Result - Success**

The Storage AE will use the Event Type ID value 1 (Storage Commitment Request Successful) to send a Success Storage Commitment Result, and include the data elements listed in Table 6-4 in the data part of N-EVENT-REPORT-RQ.

**TABLE 6-4. DATA ELEMENTS INCLUDED IN SUCCESS STORAGE COMMITMENT RESULT**

Data Element	Tag	Description
Transaction UID	(0008,1195)	UID to identify this Storage Commitment transaction.
Referenced SOP Sequence	(0008,1199)	A list of SOP instances to be committed for long-term archiving in Centricity™ PACS. This sequence should match the requested sequence in the corresponding Storage Commitment Request.
> Referenced SOP Class UID	(0008,1150)	SOP Class UID of the instance
> Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the instance

Centricity™ PACS guarantees the long-term archiving of the committed SOP Instances. A remote AE can retrieve the SOP Instance from Centricity™ PACS via the Q/R AE of the DICOM Server.

**Note:** Due to the data coercion of the SOP Instances as described in Section 4.2.3, the SOP Instance UID of an object may be altered. In this case, Centricity™ PACS is unable to send a success response to the Storage Commitment Request, even if the altered object has been successfully archived.

**6.2.2.1.2 Storage Commitment Result - Failure**

The Storage AE will use the Event Type ID value 2 (Storage Commitment Request Complete – Failure Exists) to send a Failure Storage Commitment Result and include the data elements listed in Table 6-5 in the data part of N-EVENT-REPORT-RQ.



**TABLE 6-5. DATA ELEMENTS INCLUDED IN FAILURE STORAGE COMMITMENT RESULT**

<b>Data Element</b>	<b>Tag</b>	<b>Description</b>
Transaction UID	(0008,1195)	UID to identify this Storage Commitment transaction.
Referenced SOP Sequence	(0008,1199)	A list of SOP instances that are successfully committed for long-term archiving in Centricity™ PACS
> Referenced SOP Class UID	(0008,1150)	SOP Class UID of the instance
> Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the instance
Failed SOP Sequence	(0008,1198)	A list of SOP instances that are NOT committed for long-term archiving in Centricity™ PACS
> Referenced SOP Class UID	(0008,1150)	SOP Class UID of the instance
> Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the instance
> Failure Reason	(0008,1197)	Reason that the SOP Instance is not committed for long-term archiving.

The Storage AE only supports the Failure Reasons listed in Table 6-6 and will return one of these reasons in the Failure Storage Commitment Result.

**TABLE 6-6. FAILURE CODES SUPPORTED BY THE STORAGE AE**

<b>Failure Code</b>	<b>Failure Reason</b>	<b>Description</b>
0110H	Processing Failure	Requested SOP Instances are failed for archiving or the PACS installation site is designated not to archive data permanently.
0112H	No such object instance	Requested SOP Instances cannot be found in the Centricity™ database (still not yet received when the job timer expired).
0213H	Resource Limitation	Requested SOP Instances cannot be archived because of the lack of resources (archiving media, etc.).

## **7. CENTRICITY™ PACS DICOM CONFORMANCE STATEMENT FOR PRINT SERVICE**

### **7.1 INTRODUCTION**

Centricity™ PACS implements a DICOM Print Server (denoted DPS for short in this section) for the PACS users to print the images to a connected DICOM Printer SCP application. This Conformance Statement is completely independent of the other Conformance Statement specified in Sections 2 through 6 of this document.

### **7.2 IMPLEMENTATION MODEL**

The DPS creates one single DICOM Application Entity to support the print service.

Multiple DPS instances can run in one Centricity™ PACS installation.

#### **7.2.1 Application Data Flow Diagrams**

The DPS AE implements the SCU role of the DICOM Basic Grayscale Print Management Meta SOP Class.

With this SCU role, the DPS AE is able to retrieve the printer information, to accept printer status event report and to print images.

The real-world activity that triggers the DPS AE to start an association for image print is an image print request issued by the Centricity™ Workstation user. However, the print job is performed in an asynchronous way, from the point of view of the Workstation user.

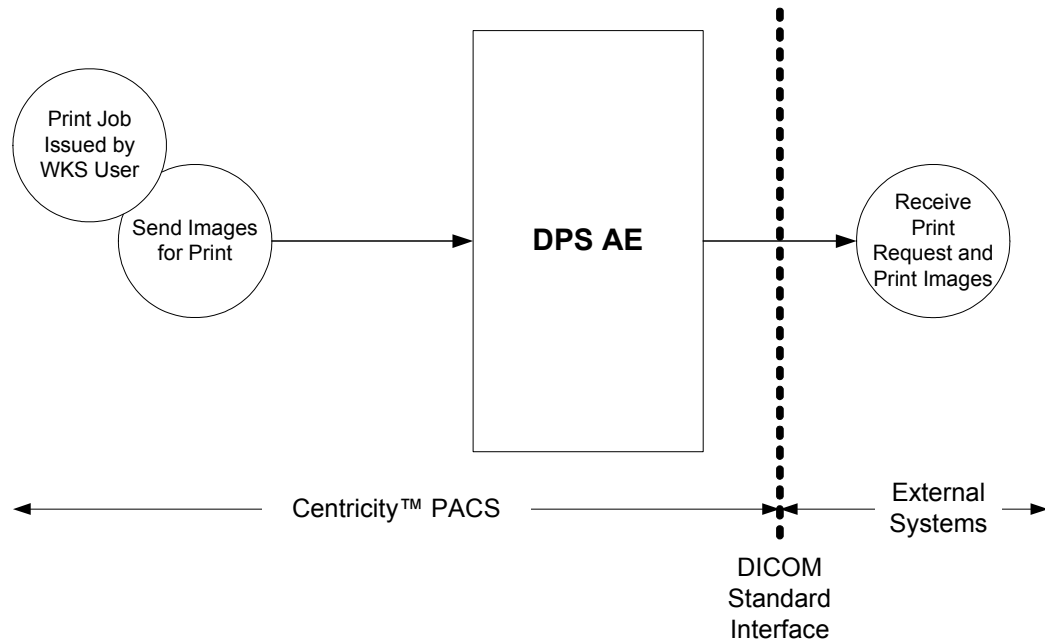


FIGURE 7-1. DATA FLOW DIAGRAM OF DICOM PRINT SERVER (DPS) AE

When starting a print job, the DPS AE attempts to send all images specified in the job to the DICOM Print SCP application for printing. The job will be removed, which indicates a successful completion of the job, only after all images are sent.

**Note:** With each print job performed, the DPS AE successfully sends all images as well as print formatting information specified in the job to the DICOM Print SCP application for printing. However, the DPS AE cannot guarantee that these images are printed. The user should check the DICOM Conformance Statement of the Print SCP application for the specified actions after a successful completion of a DICOM association.

## 7.2.2 Functional Definitions of AEs

The DPS AE supports the following application-level functions:

- Format a film sheet by filling the images into the film sheet according to the print format requested in the print job.
- Burn all (text and graphic) overlays into the image pixel data matrix.
- Perform all densitometric transforms to the image pixel data matrix as specified in the print job.
- Perform all spatial transforms to the image pixel data matrix as specified in the print job.
- Send the image pixel data matrix to the DICOM Print SCP application for print.

### 7.3 STANDARD SPECIFICATION

The DPS AE provides the Standard Conformance to the DICOM Basic Grayscale Print Management Meta SOP Class, which includes the SOP Classes listed in Table 7-1.

TABLE 7-1. SCU CONFORMANCE LIST OF SOP CLASSES FOR DICOM PRINT SERVER (DPS) AE

SOP Class Name	SOP Class UID
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Printer	1.2.840.10008.5.1.1.16

#### 7.3.1 Association Establishment Policies

The DPS AE initiates a network association to a DICOM Print SCP application for performing a print job, which may include one or several images.

##### 7.3.1.1 General

The DICOM Application Context Name (ACN), which is always proposed by the DPS AE, is

Name	UID
DICOM Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length of PDU negotiation is included in an association establishment request. The Maximum Length of PDU proposed for all associations initiated by the DPS AE is configurable (see Section 2.6.7) up to

Maximum Length of PDU	28,672 Bytes
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The DPS AE does not propose SOP class Extended Negotiation in any DICOM association it initiates.

The DPS AE does not propose (SCU/SCP) Role Selection Negotiation in any DICOM association it initiates. The default role always applies; the DPS AE plays the SCU role because it initiates an association.

The user information items sent by the DPS AE include:

- Maximum Length of PDU
- Implementation Class UID
- Implementation Version Name

### 7.3.1.2 Number of Associations

The DPS AE is able to initiate multiple associations to different Print SCP Application Entities at a time to perform DIMSE service elements. The maximum number of simultaneous DICOM associations that can be initiated, is determined by the total number of the remote DICOM Print SCP Application Entities known to the DPS AE.

To each remote DICOM Print SCP Application Entity, the DPS will not initiate another association before the currently operating association is completed.

### 7.3.1.3 Asynchronous Nature

The DPS AE does not support asynchronous operations. All operations will be performed synchronously.

### 7.3.1.4 Implementation Identifying Information

The DPS AE provides the Implementation Class UID, which is:

Implementation Class UID	1.2.840.113619.6.94
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The DPS AE provides the Implementation Version Name, which is:

Implementation Version Name	CENTRICITY_1.0
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### 7.3.1.5 Timers

#### 7.3.1.5.1 Association Timers

The DPS AE supports an association timer, which starts when the association request is sent, and stops when the association is established.

#### 7.3.1.5.2 Operation Inactivity Timer

The DPS AE supports an operation inactivity timer, which re-starts every time a DIMSE service request has been issued.

### 7.3.2 Real-World Activity: Print Job

The DPS AE keeps polling the print job queue of the Centricity™ PACS system. If one print job is retrieved, it initiates an association to the DICOM Print SCP application specified in the job, as long as there is no association currently running with the requested DICOM Print SCP application.

If another job is currently being printed, then the print job waits until the other print job is completed, and then the job is printed.

**Note:** If several printers are served with one DICOM Print Server, which is able to support only one DICOM Application Entity, the DPS AE can operate only one association with the DICOM Print Server simultaneously.

**7.3.2.1 Associated Read-World Activity**

A Centricity™ Workstation user selects one or several or all images from an exam, and issues a print command. The user also specifies the film format as well as the printer that should perform the print job. Refer to Figure 7-1.

**7.3.2.2 Proposed Presentation Contexts**

The DPS AE will propose the Presentation Context listed in Table 7-2 to request a print service to a remote AE.

**TABLE 7-2. PROPOSED PRESENTATION CONTEXTS FOR DPS AE AND PRINT IMAGES**

<b>Presentation Context Table</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>SOP Class</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.1.1.9	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Implicit VR Little Endian	1.2.840.10008.1.2		

The Basic Grayscale Print Management Meta SOP class listed in Table 7-2 can use any of three different Transfer Syntaxes (i.e. Explicit VR Big Endian, Explicit VR Little Endian or Implicit VR Little Endian).

The columns “Transfer Syntax” in Table 7-2 list all transfer syntaxes that the DPS AE can propose for the Abstract Syntax Basic Grayscale Print Management Meta SOP Class. The DPS AE can be configured to propose the Presentation Contexts with one or several or all of these transfer syntaxes.

If multiple transfer syntaxes are chosen to be proposed in the Presentation Context, they are included in the order displayed in Table 7-2.

**7.3.2.2.1 SOP Specific Conformance for Printer SOP Class**

After a successful association negotiation, the DPS AE issues an N-GET-RQ message in order to retrieve the contents of the well-known Printer SOP Instance (SOP Instance UID is 1.2.840.10008.1.1.17).

The attributes list that the DPS AE requests is specified in Table 7-3.

TABLE 7-3. ATTRIBUTE LIST REQUESTED BY DPS AE IN N-GET OPERATION

Data Element	Tag	Description
Printer Status	(2110,0010)	Printer device status
Printer Status Info	(2110,0020)	Additional information about printer device
Printer Name	(2110,0030)	Printer name
Manufacturer	(0008,0070)	Manufacturer of the printer
Manufacturer's Model Name	(0008,1090)	Manufacturer's model name of the printer
Device Serial Number	(0018,1000)	Manufacturer's serial number of the printer
Software Version	(0018,1020)	Manufacturer's designation of software version of the printer
Date of Last Calibration	(0018,1200)	Date when the printer was last calibrated.
Time of Last Calibration	(0018,1201)	Time when the printer was last calibrated.

If the N-GET-RQ fails, the DPS AE will release the association and terminate the print job.

The DPS AE accepts N-EVENT-REPORT-RQ from the well-known Printer SOP instance at any time of the lifecycle of the print association.

The DPS will release the association if the Printer Status Info attribute contains one of the following values in either N-GET-RSP or N-EVENT-REPORT-RQ messages received from the called AE:

- "RECEIVER FULL"
- "NO RECEIVE MGZ"
- "PRINTER INIT"
- "SUPPLY EMPTY"
- "NO SUPPLY MGZ"
- "FILM JAM"

In these conditions, the DPS AE assumes that the called AE is not in a normal operating state to continue any print job sent to it. It is also assumed that a manual intervention is required, to correct this condition.

The DPS AE accepts an N-EVENT-REPORT-RSP including any standard event attributes and acknowledges the receipt of the message immediately by sending an N-EVENT-REPORT-RSP message to the well-known Printer SOP instance.

**7.3.2.2.2 SOP Specific Conformance for Basic Film Session SOP Class**

After a successful check of the Printer attributes (see Section 7.3.2.2.1), the DPS AE creates a Basic Film Session by invoking N-CREATE-RQ message. The data attributes listed in Table 7-4 are provided in the N-CREATE-RQ message.

TABLE 7-4. ATTRIBUTE LIST OF N-CREATE-RQ FOR CREATION OF BASIC FILM SESSION

Data Element	Tag	Value Sent by DPS AE
Number of Copies	(2000,0010)	Number of copies requested. The DPS AE sends value one (1) or two (2).
Print Priority	(2000,0020)	The default value sent by the DPS AE is MEDIUM. Three values can be sent: <ul style="list-style-type: none"> <li>• LOW</li> <li>• MEDIUM</li> <li>• HIGH</li> </ul> These are configured by the DPS user.
Medium Type	(2000,0030)	The default value sent by the DPS AE is CURRENT. Four values can be sent: <ul style="list-style-type: none"> <li>• CURRENT</li> <li>• PAPER</li> <li>• CLEAR_FILM</li> <li>• BLUE_FILM</li> </ul> These are configured by the DPS user.
Film Destination	(2000,0040)	The default value sent by the DPS AE is CURRENT. Three values can be sent: <ul style="list-style-type: none"> <li>• CURRENT</li> <li>• MAGAZINE</li> <li>• PROCESSOR</li> </ul> These are configured by the DPS user.
Film Session Label	(2000,0050)	DICOM_PRINT
Memory Allocation	(2000,0060)	0

The DPS AE waits for receiving an N-CREATE-RSP message from the called AE as response to the Basic Film Session creation request. According to the received N-CREATE-RSP message, the DPS AE behaves as following:

1. If the creation of the Basic Film Session fails, the DPS AE releases the association and terminates the print job.
2. If the creation of the Basic Film Session succeeds, the DPS AE continues to create all film box instances for the print job. After completion of the print job, the DPS AE deletes the Basic Film Session instance by invoking an N-DELETE-RQ message.
3. Except the N-DELETE-RQ message after completion of the entire print job, the DPS AE does not send any message to the created Basic Film Session instance. In particular, the DPS AE never executes the print job at the Basic Film Session level by invoking an N-ACTION-RQ message to the Basic Film Session instance.

**7.3.2.2.3 SOP Specific Conformance for Basic Film Box SOP Class**

After successful creation of a Basic Film Session instance, the DPS AE creates one Basic Film Box to the Basic Film Session instance. The attributes listed in Table 7-5 will be provided in the N-CREATE-RQ message.



TABLE 7-5. ATTRIBUTE LIST OF N-CREATE-RQ FOR CREATION OF BASIC FILM BOX

Data Element	Tag	Value Sent by DPS AE
Image Display Format	(2010,0010)	STANDARD\C,R $1 \leq C \leq 4$ $1 \leq R \leq 6$
Referenced Film Session Sequence	(2010,0500)	
> Referenced SOP Class UID	(0008,1150)	1.2.840.10008.5.1.1.1
> Referenced SOP Instance UID	(0008,1155)	UID returned by the called AE
Film Orientation	(2010,0040)	PORTRAIT
Film Size ID	(2010,0050)	One of the following values: <ul style="list-style-type: none"> <li>• 8IN×10IN</li> <li>• 10IN×12IN</li> <li>• 10IN×14IN</li> <li>• 11IN×14IN</li> <li>• 14IN×14IN</li> <li>• 14IN×17IN</li> <li>• 24CM×24CM</li> <li>• 24CM×30CM</li> </ul> These are configured by the DPS user.
Magnification Type	(2010,0060)	The default value sent by the DPS AE is CUBIC. Four values can be sent: <ul style="list-style-type: none"> <li>• CUBIC</li> <li>• REPLICATE</li> <li>• BILINEAR</li> <li>• NONE</li> </ul> These are configured by the DPS user.
Maximum Density	(2010,0130)	The default value sent by the DPS AE is 264. Other values can be if configured by the DPS user. The maximum value can be sent is 400.
Configuration Information	(2010,0150)	A user-defined value can be sent. This value is configured according to the Conformance Statement of the called AE.
Border Density	(2010,0100)	The default value sent by the DPS AE is BLACK. Two values can be sent: <ul style="list-style-type: none"> <li>• BLACK</li> <li>• WHITE</li> </ul> These are configured by the DPS user.
Empty Image Density	(2010,0110)	The default value sent by the DPS AE is BLACK. Two values can be sent: <ul style="list-style-type: none"> <li>• BLACK</li> <li>• WHITE</li> </ul> These are configured by the DPS user.
Minimum Density	(2010,0120)	0

Trim	(2010,0140)	The default value sent by the DPS AE is YES. Two values can be sent: <ul style="list-style-type: none"> <li>• YES</li> <li>• NO</li> </ul> These are configured by the DPS user.
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In the N-CREATE-RSP message sent to the DPS AE from the called AE, the DPS AE expects to receive a set of created Basic Grayscale Image Box instances. The number of the Basic Grayscale Image Box instances should match to the Image Display Format attribute sent to the called AE.

According to the received N-CREATE-RSP message, the DPS AE behaves as following:

1. If the creation of the Basic Film Box fails, the DPS AE releases the association and terminates the print job.
2. If the creation of the Basic Film Box succeeds, the DPS AE fills the created Image Boxes in the film box by sending the pixel data and other descriptive information (see Section 7.3.2.2.4). After successfully completion of setting all image boxes, the DPS AE invokes an N-ACTION-RQ message to the Basic Film Box to print the film sheet. Finally, the DPS AE deletes the Basic Film Box instance by sending an N-DELETE-RQ message to the called AE.
3. If not all images have printed, the DPS AE will create another Basic Film Box instance and repeat the operations in the last step to print the rest images.

**7.3.2.2.4 SOP Specific Conformance for Basic Grayscale Image Box SOP Class**

For each Basic Grayscale Image Box created in the Basic Film Box (see Section 7.3.2.2.3), the DPS AE issues a single N-SET-RQ message if an image should be printed in that Basic Grayscale Image Box. No N-SET-RQ message is sent if a Basic Grayscale Image Box should be blank (no image is printed at this location on the film sheet).

The data attributes listed in Table 7-6 are provided in the N-SET-RQ message.

TABLE 7-6. ATTRIBUTE LIST OF N-SET-RQ FOR FILLING IN IMAGE BOX

Data Element	Tag	Value Sent by DPS AE
Image Position	(2020,0010)	An ordinal number of the image in the specified display format.
Basic Grayscale Image Sequence	(2020,0110)	
> Samples per Pixel	(0028,0002)	1
> Photometric Interpretation	(0028,0004)	MONOCHROME2
> Rows	(0028,0010)	Number of rows of the pixel matrix
> Columns	(0028,0011)	Number of columns of the pixel matrix
> Pixel Aspect Ratio	(0028,0034)	This data element is sent if its value is not one (1).
> Bits Allocated	(0028,0100)	16 or 8
> Bits Stored	(0028,0101)	12 or 8
> High Bit	(0028,0102)	11 or 7
> Pixel Representation	(0028,0103)	0
> Pixel Data	(7FE0,0010)	Pixel data stream
Requested Image Size	(2020,0030)	Requested image width in mm. The DPS AE sends this data element only if the user requested a true-size image print.

## 7.4 COMMUNICATION PROFILES

### 7.4.1 Supported Communication Stacks

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

### 7.4.2 TCP/IP Stack

TCP/IP Network Communication is supported as specified in DICOM PS 3.8.

#### 7.4.2.1 Physical Media Support

The GE AEs are unconstrained to the physical medium over which TCP/IP message traffic is carried. Various network interfaces are supported, including but not limited to: 10-BaseT Ethernet, 100-BaseT Ethernet, 1000-BaseT Ethernet and ATM OC-3.

The physical media supported depends on network cabling and interfaces equipment available at the Centricity™ PACS installation site and interface equipment commercially available.

An equipment list and configuration information for the physical media supported is available upon request.

### 7.4.3 OSI Stack

Not supported.

#### 7.4.4 Point-to-Point Stack

Not supported.

### 7.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

None.

### 7.6 CONFIGURATION

The exact method for configuring each configurable item is specified in other Centricity™ PACS documentation. The following sections only describe some items that are configurable.

#### 7.6.1 AE Title

The DPS AE Title can be configured by the user. If multiple DPS systems are used in the same Centricity™ PACS installation, they can be configured with different AE Titles.

#### 7.6.2 DPS Time-out

Association time-out

Association operation inactivity time-out

### 7.7 SUPPORT FOR EXTENDED CHARACTER SETS

The DICOM Server supports the following character sets:

- ISO-IR-6 (ISO 646)

### 7.8 CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

### 7.9 SECURITY PROFILES

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

It is assumed that the product is used within a secured environment. It is assumed that a secured environment 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.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN)).

## 8. APPENDIX A: IMAGE THUMBNAILS ADDED TO DICOM IMAGES

The DICOM standard specifies an Icon Image Sequence. However, this sequence does not support JPEG compressed icons, icon bit depths greater than 8, or true color (RGB) icons. The GE Private Image Thumbnail Sequence is an enhancement that incorporates this additional functionality.

### 8.1 IMAGE THUMBNAIL

Centricity™ PACS will create a thumbnail for each DICOM Image SOP Instance of the following Photometric Interpretation values:

- MONOCHROME1
- MONOCHROME2
- RGB

The thumbnail is derived from the original pixel data by downscaling the image size to  $128 \times 128$  pixels or less, and added to the original SOP Instance with a private sequence data element in the DICOM Image SOP Instance.

One thumbnail is created per DICOM image. For a multi-frame image, only one thumbnail is created from the center frame. The number of the frame, which is used for the thumbnail creation, is included in the Image SOP Instance (see Section 8.3).

In Centricity™ PACS, the thumbnails are used by the Centricity™ Web display application for image navigation when browsing through a set of images. With the information published in this Appendix, a DICOM application receiving the images from Centricity™ PACS can also explore the thumbnail data encoded in the Image SOP Instances.

### 8.2 IMAGE THUMBNAIL COMPRESSION

The thumbnail is compressed with either 8-bit or 12-bit JPEG lossy compression format, depending on the stored pixel depth of the original images.

For all Image SOP Instances with the data element “Bits Stored” equal to or less than 8, the thumbnail image is stored one byte per pixel and compressed by JPEG 8-bit lossy compression.

For all Image SOP Instances with the data element “Bits Stored” equal to or less than 12, the thumbnail image is stored two bytes per pixel and compressed by JPEG 12-bit lossy compression.

For all Image SOP Instances with the data element “Bits Stored” greater than 12, the pixel data of the thumbnail image is first shifted to fit into the 12-bit scope and then stored two bytes per pixel. The thumbnail is compressed by JPEG 12-bit lossy compression. The number of bits shifted is saved in the GE Private Image Thumbnail Sequence, as specified in Section 8.3.

All thumbnails are represented in the unsigned format (either one byte or two bytes (12-bit) integer). If an Image SOP Instance contains a signed pixel data element, the thumbnail pixel data will be offset to

the unsigned scope. The offset added is saved in the GE Private Image Thumbnail Sequence, as specified in the next section.

### 8.3 IMAGE THUMBNAIL ENCODING

Centricity™ PACS adds a private sequence data element (GE Private Image Thumbnail Sequence) to an Image SOP Instance for the thumbnail encoding. There is no change to the existing data attributes of the SOP Instance.

The GE Private Image Thumbnail Sequence is specified in Table 8-1.

**TABLE 8-1. SPECIFICATION OF GE PRIVATE IMAGE THUMBNAIL SEQUENCE**

Data Element	Tag	VR	VM	Description
Private Creator ID	(0009,00xx)	LO	1	“GEIIS”. Reserve Element Numbers 0000-00FF of group 0009 in the SOP Instance.
GE Private Image Thumbnail Sequence	(0009,xx10)	SQ	1	Always only one item present
> Samples per Pixel	(0028,0002)	US	1	Copy from the original SOP Instance
> Photometric Interpretation	(0028,0004)	CS	1	Thumbnail Photometric Interpretation. Enumerated Values: <ul style="list-style-type: none"> <li>• MONOCHROME1</li> <li>• MONOCHROME2</li> <li>• RGB</li> </ul>
> Planar Configuration	(0028,0006)	US	1	Thumbnail Planar Configuration. Always 0, if present.
> Number of Frames	(0028,0008)	IS	1	Copy from the original SOP Instance. The thumbnail itself is always single frame.
> Rows	(0028,0010)	US	1	Thumbnail Rows of Image Matrix ≤ 128.
> Columns	(0028,0011)	US	1	Thumbnail Columns of Image Matrix ≤ 128.
> Bits Allocated	(0028,0100)	US	1	Copy from the original SOP Instance
> Bits Stored	(0028,0101)	US	1	Copy from the original SOP Instance. If this value is 8 or less, the thumbnail JPEG stream is 8-bit compressed, otherwise, it is 12-bit compressed.
> High Bit	(0028,0102)	US	1	Copy from the original SOP Instance
> Pixel Representation	(0028,0103)	US	1	Copy from the original SOP Instance
> Largest Image Pixel Value	(0028,0107)	US/SS	1	Copy from the original SOP Instance
> Pixel Padding Value	(0028,0120)	US/SS	1	Copy from the original SOP Instance
> Window Center	(0028,1050)	DS	1-n	Copy from the original SOP Instance
> Window Width	(0028,1051)	DS	1-n	Copy from the original SOP Instance
> Rescale Intercept	(0028,1052)	DS	1	Copy from the original SOP Instance

> Rescale Slope	(0028,1053)	DS	1	Copy from the original SOP Instance
> Private Creator ID	(0029,0010)	LO	1	“GEIIS”. Reserve Element Numbers 1000-10FF of group 0029 in this item.
> Shift Count	(0029,1010)	UL	1	The number of bits the pixel values were shifted down, in order to get them into the 12-bit range before JPEG compression.
> Offset	(0029,1012)	UL	1	Value added to pixel values to convert them from signed to unsigned values before JPEG compression.
> Actual Frame Number	(0029,1014)	UL	1	Actual frame number of image the thumbnail was generated from. For multi-frame images, this should represent the center frame. Only one thumbnail is created for the entire multi-frame image.
> Private Creator ID	(7FD1,0010)	LO	1	“GEIIS”. Reserve Element Numbers 1000-10FF of group 7FD1 in this item.
> GE IIS Compression Type	(7FD1,1010)	UL	1	Centricity™ PACS internally used data compression code. Always 26 for thumbnail.
> Pixel Data	(7FE0,0010)	OB	1	8-bit or 12-bit JPEG lossy compressed thumbnail image pixel data stream.

Where: xx = 00 to FF

The GE Private Image Thumbnail Sequence includes a number of standard data elements directly copied from the original Image SOP Instance, to which the sequence is added. These data elements are marked as *Copy from the original SOP Instance* in Table 8-1. These data elements provide the original pixel data context from which the thumbnail has been derived. Note that they do not contain the values specific to the thumbnail.

The GE Private Image Thumbnail Sequence uses a number of standard data elements to describe the properties of the thumbnail pixel data. Note that these data elements in this sequence really contain the values specific to the thumbnail, but not to the original image pixel data.

## 9. APPENDIX B: PRIVATE DATA ELEMENTS OF ORIGINAL UID VALUES

When Centricity™ PACS changes the values of Study Instance UID, Series Instance UID and/or SOP Instance UID, the original UID values are saved as private data elements in the same data set, as shown in Table 9-1.

**TABLE 9-1. PRIVATE DATA ELEMENTS FOR ORIGINAL UID VALUES**

Data Element	Tag	VR	VM	Description
Private Creator ID	(0907,00xx)	LO	1	“GEIIS”. Reserve Element Numbers 0000-00FF of group 0907 in the SOP Instance.
Original Study Instance UID	(0907,xx10)	UI	1	The value of the original Study Instance UID, which has been changed into the current value in (0020,000D).
Original Series Instance UID	(0907,xx20)	UI	1	The value of the original Series Instance UID, which has been changed into the current value in (0020,000E).
Original SOP Instance UID	(0907,xx30)	UI	1	The value of the original SOP Instance UID, which has been changed into the current value in (0008,0018).

Where: xx = 00 to FF

Centricity™ PACS changes the UID values for resolving any conflict of the UID values in the received data set to the UID values maintained in the Centricity™ database.

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