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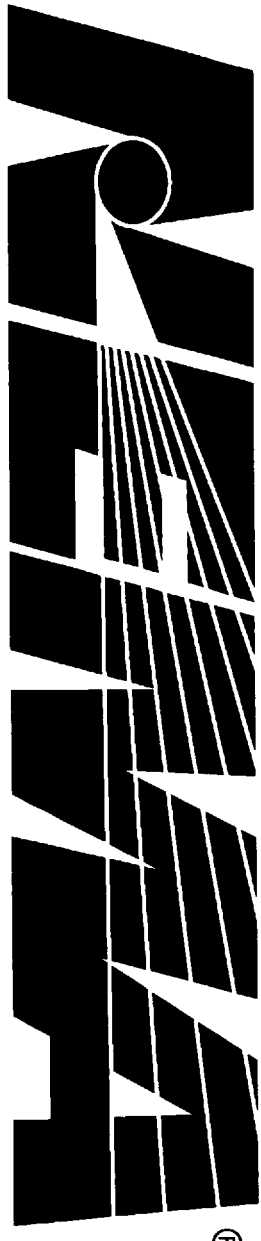
DICOM

Part 4

Service Class Specifications



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Digital Imaging and Communications in Medicine (DICOM)

Part 4: Service Class Specifications

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FOREWORD

The American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee to develop a standard for Digital Imaging and Communications in Medicine (DICOM). This DICOM Standard was developed according to the NEMA procedures.

This standard is developed in liaison with other standardization organizations including CEN TC251 in Europe and JIRA in Japan, with review also by other organizations including IEEE, HL7 and ANSI in the USA.

The DICOM Standard is structured as a multi-part document using the guidelines established in the following document:

— ISO/IEC Directives, 1989 Part 3: Drafting and Presentation of International Standards.

This document is one part of the DICOM Standard which consists of the following parts:

PS 3.1	Introduction and Overview
PS 3.2	Conformance
PS 3.3	Information Object Definitions
PS 3.4	Service Class Specifications
PS 3.5	Data Structures and Encoding
PS 3.6	Data Dictionary
PS 3.7	Message Exchange
PS 3.8	Network Communication Support for Message Exchange
PS 3.9	Point-to-Point Communication Support for Message Exchange
PS 3.10	Media Storage and File Format for Media Interchange
PS 3.11	Media Storage Application Profiles
PS 3.12	Media Formats and Physical Media for Media Interchange
PS 3.13	Print Management Point-to-Point Communication Support
PS 3.14	Grayscale Standard Display Function
PS 3.15	Security Profiles

These parts are related but independent documents. Their development level and approval status may differ. Additional parts may be added to this multi-part standard. PS 3.1 should be used as the base reference for the current parts of this Standard.

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1 SCOPE AND FIELD OF APPLICATION

This Part of the DICOM Standard specifies the set of Service Class Definitions which provide an abstract definition of real-world activities applicable to communication of digital medical information. For each Service Class Definition, this Part specifies:

- the semantic description of the activities of the Service Class Definition
- the group of DIMSE Service operations and notifications applicable to the Service Class Description
- one or more functionally-related Service-Object Pair (SOP) Classes which are supported by the Service Class Definition and may be performed between peer DICOM Application Entities
- the relationship of each Service-Object Pair (SOP) Classes to applicable Information Object Definitions specified in PS 3.3.

For each Service Class Definition, this Part does not specify:

- any necessary information for the semantic description of the IOD
- relationships to associated real-world objects relevant to the IOD
- attributes which describe the characteristics of the IOD

This Part is related to other parts of the DICOM Standard in that:

- Part 3, Information Object Definitions, specifies the set of Information Object Definitions to which the services defined in this Part may be applied
- Part 5, Data Structure and Semantics, defines the data encoding used in the DIMSE Protocol when applied to IODs defined in this Part
- Part 6, Data Dictionary, contains an index by Tag of all IOD Attributes defined in this Part. This index includes the Value Representation and Value Multiplicity for each Attribute
- Part 7, Message Exchange Protocol, defines the DIMSE Services and Protocol which may be applied to IODs defined in this Part.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibilities of applying the most recent editions of the standards indicated below.

ISO/IEC Directives, 1989	Part 3 - Drafting and Presentation of International Standards.
ISO 7498-1 Interconnection-	Information Processing Systems-Open Systems Basic Reference Model
ISO/TR 8509 Interconnection-	Information Processing Systems-Open Systems Service Conventions

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3 DEFINITIONS

For the purposes of this Standard the following definitions apply.

3.1 REFERENCE MODEL DEFINITIONS

This Part of the Standard makes use of the following terms defined in ISO 7498-1:

a. Application Entity
b. Service or Layer Service
c. Application Entity Title

3.2 SERVICE CONVENTIONS DEFINITIONS

This Part of the Standard makes use of the following terms defined in ISO/TR 8509:

a. Primitive

3.3 DICOM INTRODUCTION AND OVERVIEW DEFINITIONS

This Part of the Standard makes use of the following terms defined in PS 3.1:

a. Attribute
b. Command
c. Data Dictionary
d Information Object
e. Message

3.4 DICOM UPPER LAYER SERVICE DEFINITIONS

This Part of the Standard makes use of the following terms defined in PS 3.8:

a. Unique Identifier (UID)
b. DICOM Upper Layer Service

3.5 DICOM MESSAGE EXCHANGE DEFINITIONS

This Part of the Standard makes use of the following terms defined in PS 3.7:

a. DICOM Message Service Element (DIMSE)
b. DIMSE-N Services
c. DIMSE-C Services
d. DIMSE Service Group (DSG)

3.6 DICOM INFORMATION OBJECT DEFINITIONS

This Part of the Standard makes use of the following terms defined in PS 3.3:

a. Attribute Tag
b. Composite IOD
c. DICOM Application Model

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d. DICOM Information Model
e. Information Object Definition
f. Module
g. Normalized IOD

3.7 DICOM CONFORMANCE

This Part of the Standard makes use of the following terms defined in PS 3.2:

a. Standard SOP Class
b. Specialized SOP Class
c. Conformance Statement

3.8 DICOM DATA STRUCTURES AND ENCODING

This Part of the Standard makes use of the following terms defined in PS 3.5:

a. Data Element
b. Data Set

3.9 DICOM SERVICE CLASS DEFINITIONS

The following definitions are commonly used in this Part of the DICOM Standard:

Combined Print Image: a pixel matrix created by superimposing an image and an overlay, the size of which is defined by the smallest rectangle enclosing the superimposed image and overlay.

DICOM Information Model: an Entity-Relationship diagram which is used to model the relationships between the Information Object Definitions representing classes of Real-World Objects defined by the DICOM Application Model.

DICOM Application Model: an Entity-Relationship diagram used to model the relationships between Real-World Objects which are within the area of interest of the DICOM Standard.

Meta Service-Object Pair (SOP) Class: a pre-defined set of SOP Classes that may be associated under a single SOP for the purpose of negotiating the use of the set with a single item.

Preformatted Grayscale Image: an image where all annotation, graphics, and grayscale transformations (up to and including the VOI LUT) expected in the printed image have been burnt in or applied before being sent to the SCP. It is a displayable image where the polarity of the intended display is specified by Photometric Interpretation (0028,0004).

Preformatted Color Image: an image where all annotation, graphics, and color transformations expected in the printed image have been burnt in or applied before being sent to the SCP.

Real-World Activity: that which exists in the real world which pertains to specific area of information processing within the area of interest of the DICOM Standard. Such a Real-World Activity may be represented by one or more computer information metaphors called SOP Classes.

Real-World Object: that which exists in the real world upon which operations may be performed which are within the area of interest of the DICOM Standard. Such a Real-World Object may be represented through a computer information metaphor called a SOP Instance.

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Service Class User: the role played by a DICOM Application Entity (DIMSE-Service-User) which invokes operations and performs notifications on a specific Association.

Service Class Provider: the role played by a DICOM Application Entity (DIMSE-Service-User) which performs operations and invokes notifications on a specific Association.

Service Class: a collection of SOP Classes and/or Meta SOP Classes which are related in that they are described together to accomplish a single application.

Service-Object Pair (SOP) Class: the union of a specific set of DIMSE Services and one related Information Object Definition (as specified by a Service Class Definition) which completely defines a precise context for communication.

Service-Object Pair (SOP) Instance: a concrete occurrence of an Information Object and a communication context.

4 SYMBOLS AND ABBREVIATIONS

The following symbols and abbreviations are used in this Part of the DICOM Standard.

ACR	American College of Radiology
ASCII	American Standard Code for Information Interchange
AE	Application Entity
ANSI	American National Standards Institute
CEN TC251	Comité Européen de Normalisation -Technical Committee 251 - Medical Informatics
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element-Composite
DIMSE-N	DICOM Message Service Element-Normalized
HL7	Health Level 7
IE	Information Entity
IEEE	Institute of Electrical and Electronics Engineers
IOD	Information Object Definition
IS	Information System
ISO	International Standards Organization
JIRA	Japan Industries Association of Radiation Apparatus
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
UID	Unique Identifier

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5 CONVENTIONS

5.1 ENTITY-RELATIONSHIP MODEL

5.1.1 Entity

An entity is used in an Entity-Relationship (E-R) model to represent a Real-World Object, class of Real-World Objects, or DICOM data representation (such as IOD or Module). An entity is depicted as a box within this Part of the DICOM Standard as shown in Figure 5-1.

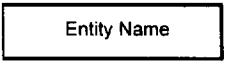

Figure 5-1
ENTITY CONVENTION

5.1.2 Relationship

A relationship, which defines how entities are related, is depicted as a diamond within this Standard as shown in Figure 5-2.

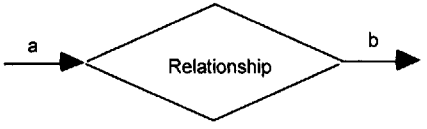

Figure 5-2
RELATIONSHIP CONVENTION

The relationship is read from source to destination entity as indicated by the arrows. The a and b show the source and destination cardinality of the relationship respectively. The following cardinalities are permitted:

a. (a = 1, b = 1)—one source entity is related to one destination entity
b. (a = 1, b = 0-n)—one source entity is related to zero or more destination entities
c. (a = 1, b = 1-n)—one source entity is related to one or more destination entities
d. (a = 1-n, b = 1)—one or more source entities are related to one destination entity
e. (a = 1-n, b = 0-n)—one or more source entities are related to zero or more destination entities
f. (a = 1-n, b = 1-n)—one or more source entities are related to one or more destination entities

In a relationship where (a = 1-n, b = 1-n) the values of the source and destination cardinalities may be different. The value "n" simply denotes one or more.

Note: DICOM has added the use of arrows to the E-R diagramming conventions often used in other literature. This has been done to avoid the possibility of inferring an incorrect relationship which can result from reading a relationship in the reverse order of that intended. For example, a relationship "Cat Catches Mouse" could be read "Mouse Catches

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Cat" if the arrows were not present.

A relationship may be bi-directional (i.e. the relationship is true in both directions). In such a case, the convention used is arrows pointing toward both the source and the destination entities.

5.2 SEQUENCES

Certain tables in this Part of the DICOM Standard denote a Sequence of Items by using the symbol: '>.'

In Annex A, '>' is used to identify a 'Sequence of Modules.' Nested Sequences of Modules are identified by '>>'. In Annex B and Annex C, '>' is used to identify a 'Sequence of Attributes'. See PS 3.5 for the complete specification of how Sequences of Items shall be encoded.

Note: Information Object Definitions (IODs) which include the Sequence of Module construct are often called folders. The use of 'Sequences of Attributes' is not limited to 'Folders.'

5.3 RESPONSE STATUS VALUES

Certain tables in this Part of the DICOM Standard denote an implementation specific response status code by using the symbol: 'xx' as part of the code.

5.4 USAGE SPECIFICATION

The building blocks of SOP Classes are Modules and DIMSE Services. The DIMSE Services associated with a SOP Class may be Mandatory (M) or Optional (U). The usage may be different for the SCU and SCP. The usage is specified as a pair of letters: the former indicating the SCU usage, the latter indicating the SCP usage.

The meaning and behavior of the usage specification for DIMSE Services are:

M/M The SCU shall support the DIMSE Service but is not required to use it on an Association. The SCP shall support the DIMSE Service.

U/M The SCU may support and use the DIMSE Service. The SCP shall support the DIMSE Service.

U/U The SCU may support and use the DIMSE Service. The SCP may support the DIMSE Service. If the SCP does not support the DIMSE Service used by the SCU, it shall return a Failure status.

Modules and their usage in Composite IODs are defined in PS 3.3. Normalized IODs are also constructed from Modules but usage is specified on an attribute basis in this Part of the DICOM Standard. The following usage specification applies to all Attributes of Normalized IODs unless superseded by a usage specification in a particular SOP Class Specification.

The meaning and behavior of the usage specification for Attributes of Normalized IODs are as follows:

1/1 The SCU shall provide a value for the Attribute. If the SCU does not supply a value, the SCP shall return a Failure status ("Missing Attribute," code 0120H). The SCP shall support the Attribute. The SCP shall not support null values (attribute provided with a zero length and no value) for the Attribute.

3/1 The SCU may retrieve or provide a value for the Attribute. The SCP shall support the Attribute. The SCP shall not support null values (attribute provided with a zero length and no value) for the Attribute.

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-/1 The SCU's usage of the Attribute is undefined. The SCP shall support the Attribute. The SCP shall not support null values (attribute provided with a zero length and no value) for the Attribute.

2/2 The SCU shall retrieve or provide a value for the Attribute. The SCU shall always provide the attribute but a null value shall be permitted (attribute provided with a zero length and no value). The SCP shall support the Attribute and permit null values (attribute provided with a zero length and no value) for the Attribute.

3/2 The SCU may retrieve or provide a value for the Attribute. The SCP shall support the Attribute and permit null values (attribute provided with a zero length and no value) for the Attribute.

-/2 The SCU's usage of the Attribute is undefined. The SCP shall support the Attribute and permit null values (attribute provided with a zero length and no value) for the Attribute.

3/3 The SCU may retrieve or provide a value for the Attribute. The SCP may support the Attribute. If the SCP does not support the Attribute and it is requested by the SCU, the SCP shall return a Warning status ("Invalid Attribute value", code 0106H). If the SCP does not support the Attribute and the SCU provides it, the attribute shall be ignored.

If the SCP usage type designation is modified by a "C" (e.g., 3/1C) the specification stated above shall be modified to include the requirement that the SCP shall support the Attribute if the specified condition is met.

6 DICOM INFORMATION MODEL

The DICOM Information Model defines the structure and organization of the information related to the communication of medical images. Figure 6-1 shows the relationships between the major structures of the DICOM Information Model.

6.1 INFORMATION OBJECT DEFINITION

An Information Object Definition (IOD) is an object-oriented abstract data model used to specify information about Real-World Objects. An IOD provides communicating Application Entities with a common view of the information to be exchanged.

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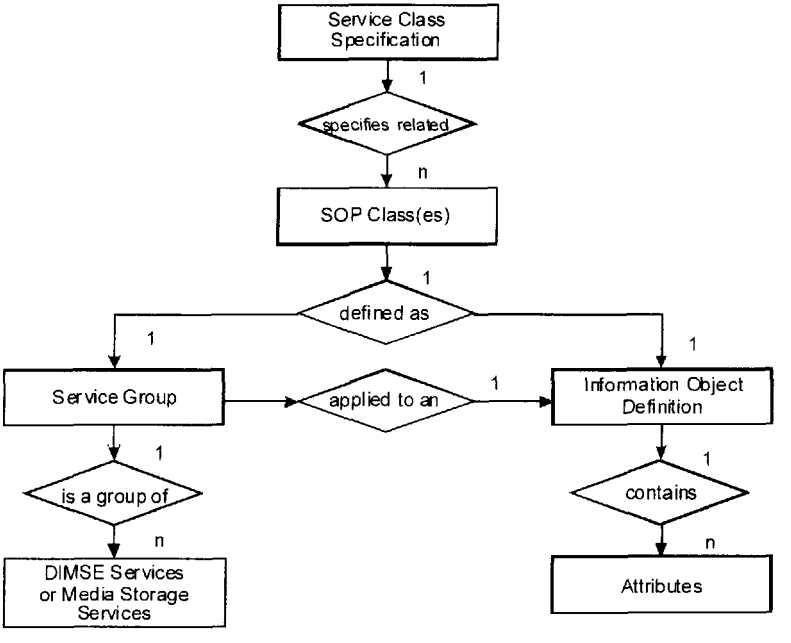

Figure 6-1
MAJOR STRUCTURES OF DICOM INFORMATION MODEL

An IOD does not represent a specific instance of a Real-World Object, but rather a class of Real-World Objects which share the same properties. An IOD used to represent a single class of Real-World Objects is called a Normalized Information Object. An IOD which includes information about related Real-World Objects is called a Composite Information Object.

6.1.1 Composite IOD

A Composite IOD is an Information Object Definition which represents parts of several entities in the DICOM Model of the Real-World. (See PS 3.3.) Such an IOD includes Attributes which are not inherent in the Real-World Object that the IOD represents but rather are inherent in related Real-World Objects.

These related Real-World Objects provide a complete context for the exchanged information. When an instance of a Composite IOD is communicated, this entire context is exchanged between Application Entities. Relationships between Composite IOD Instances shall be conveyed in this contextual information.

Notes: 1. Actual communication of IOD Instances is via SOP Instances.

2. Whenever Composite SOP Instances are in fact related, some of the contextual information is redundant (i.e. the same information about the same Real-World Objects is contained in multiple SOP Instances).

The Composite IODs are specified in PS 3.3.

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6.1.2 Normalized IOD

A Normalized IOD is an Information Object Definition which generally represents a single entity in the DICOM Model of the Real-World.

In this Standard, strict definition of Normalized Object Definitions has not been applied. Application of strict definitions would often result in unnecessary complexity and reduced performance of implementations for several applications.

When an instance of a Normalized IOD is communicated, the context for that instance is not actually exchanged. Instead, the context is provided through the use of pointers to related Normalized IOD Instances.

The Normalized IODs are specified in PS 3.3.

6.2 ATTRIBUTES

The Attributes of an IOD describe the properties of a Real-World Object Instance. Related Attributes are grouped into Modules which represents a higher level of semantics documented in the Module Specifications found in PS 3.3.

Attributes are encoded as Data Elements using the rules, the Value Representation and the Value Multiplicity concepts specified in PS 3.5. For specific Data Elements, the Value Representation and Value Multiplicity of Data Elements are specified in the Data Dictionary in PS 3.6.

6.3 ON-LINE COMMUNICATION AND MEDIA STORAGE SERVICES

For on-line communication the DIMSE Services allow a DICOM Application Entity to invoke an operation or notification across a network or a point-to-point interface. DIMSE Services are defined in PS 3.7.

For media storage interchange, Media Storage Services allow a DICOM Application Entity to invoke media storage related operations.

Media Storage Services are discussed in PS 3.10.

6.3.1 DIMSE-C Services

DIMSE-C Services are services applicable only to a Composite IOD. DIMSE-C provides only operation services.

6.3.2 DIMSE-N Services

DIMSE-N Services are services applicable only to a Normalized IOD. DIMSE-N provides both operation and notification services.

6.4 DIMSE SERVICE GROUP

A DIMSE Service Group specifies one or more operations/notifications defined in PS 3.7 which are applicable to an IOD.

DIMSE Service Groups are defined in this Part of the DICOM Standard, in the specification of a Service-Object Pair Class.

6.5 SERVICE-OBJECT PAIR (SOP) CLASS

A Service-Object Pair (SOP) Class is defined by the union of an IOD and a DIMSE Service Group. The SOP Class definition contains the rules and semantics which may restrict the use of the services in the DIMSE Service Group or the Attributes of the IOD.

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The selection of SOP Classes is used by Application Entities to establish an agreed set of capabilities to support their interaction. This negotiation is performed at Association establishment time as described in PS 3.7. An extended negotiation allows Application Entities to further agree on specific options within a SOP Class.

Note: The SOP Class as defined in the DICOM Information Model is equivalent in ISO/OSI terminology to the Managed Object Class. Readers familiar with object oriented terminology will recognize the SOP Class operations (and notifications) as comprising the methods of an object class.

6.5.1 Normalized and Composite SOP Classes

DICOM defines two types of SOP Classes, Normalized and Composite. Normalized SOP Classes are defined as the union of a Normalized IOD and a set of DIMSE-N Services. Composite SOP Classes are defined as the union of a Composite IOD and a set of DIMSE-C Services.

Note: SOP Class Specifications play a central role for defining DICOM conformance requirements. It allows DICOM Application Entities to select a well-defined application level subset of this Standard to which they may claim conformance. See PS 3.2.

6.6 ASSOCIATION NEGOTIATION

Association establishment is the first phase of communication between peer DICOM compliant Application Entities. The Application Entities shall use Association establishment to negotiate which SOP Classes can be exchanged and how this data will be encoded.

Association Negotiation is defined in PS 3.7.

6.7 SERVICE CLASS SPECIFICATION

A Service Class Specification defines a group of one or more SOP Classes related to a specific function which is to be accomplished by communicating Application Entities. A Service Class Specification also defines rules which allow implementations to state some pre-defined level of conformance to one or more SOP Classes. Applications may conform to SOP Classes as either a Service Class User (SCU) or Service Class Provider (SCP).

Service Class Specifications are defined in this Part of the DICOM Standard.

Note: Such interaction between peer Application Entities work on a 'client/server model.' The SCU acts as the 'client,' while the SCP acts as the 'server'. The SCU/SCP roles are determined during Association establishment.

7 DICOM MODEL OF THE REAL WORLD

The DICOM view of the Real-World which identifies the relevant Real-World Objects and their relationships within the scope of the DICOM Standard is described in the DICOM Model of the Real-World Section of PS 3.3.

This section also describes the DICOM Information Model which identifies the various IODs specified by the DICOM Standard and their relationship.

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Annex A VERIFICATION SERVICE CLASS (Normative)

A.1 OVERVIEW

A.1.1 Scope

The Verification Service Class defines a service which verifies application level communication between peer DICOM AEs. This verification is accomplished on an established Association using the C-ECHO DIMSE-C service.

A.2 SCU/SCP BEHAVIOR

A DICOM AE, supporting the Verification SOP Class SCU role, requests verification of communication to a remote DICOM AE. This request is performed using the C-ECHO request primitive. The remote DICOM AE, supporting the Verification SOP Class SCP role, issues an C-ECHO response primitive. Upon receipt of the C-ECHO confirmation, the SCU determines that verification is complete. See PS 3.7 for the specification of the C-ECHO primitives.

A.3 DIMSE-C SERVICE GROUP

The C-ECHO DIMSE-C service shall be the mechanism used to verify communications between peer DICOM AEs. The C-ECHO service and protocol parameters shall be required as defined in PS 3.7.

A.4 VERIFICATION SOP CLASS

The Verification SOP Class consists of the C-ECHO DIMSE-C service. No associated Information Object Definition is defined. The SOP Class UID shall be "1.2.840.10008.1.1".

No Specialized SOP Classes and/or Meta SOP Classes shall be defined for the Verification SOP Class.

A.5 ASSOCIATION NEGOTIATION

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The following negotiation rules apply to DICOM AEs which support the Verification SOP Class

- The Association-requester (verification SCU role) in the A-ASSOCIATE request shall convey an Abstract Syntax, in a Presentation Context, for the Verification SOP Class. The Abstract Syntax Name shall be equivalent to the Verification SOP Class UID.
- The Association-acceptor (verification SCP role) in the A-ASSOCIATE response shall accept the Abstract Syntax, in a Presentation Context, for the supported Verification SOP Class.

No Application Association Information specific to the Verification SOP Class shall be used.

A.6 CONFORMANCE

A.6.1 Conformance supporting the SCU role

Implementations which conform to the Verification SOP Class SCU role shall meet the:

- C-ECHO service requirements as defined by the DIMSE Service Group, Section A.3

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— Association negotiation rules as defined in Section A.5

A.6.2 Conformance Supporting the SCP Role

Implementations which conform to the Verification SOP Class SCP role shall meet the:

— C-ECHO operation rules as defined by the DIMSE Service Group, Section A.3
— Association negotiation rules as defined in Section A.5

A.6.3 Conformance statement

An implementation may conform to the Verification SOP Class as an SCU, SCP, or both. The Conformance Statement shall be in the format defined in PS 3.2.

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Annex B STORAGE SERVICE CLASS (Normative)

B.1 OVERVIEW

B.1.1 Scope

The Storage Service Class defines an application-level class-of-service which facilitates the simple transfer of images in a manner functionally similar to ACR-NEMA 300-1988. It allows one DICOM AE to send images to another.

B.1.2 Service Definition

Two peer DICOM AEs implement a SOP Class of the Storage Service Class with one serving in the SCU role and one serving in the SCP role. SOP Classes of the Storage Service Class are implemented using the C-STORE DIMSE-C service. C-STORE is described in PS 3.7. A successful completion of the C-STORE has the following semantics:

— Both the SCU and the SCP support the type of information to be stored.
— The information is stored in some medium.
— For some time frame, the information may be accessed.

Note: Support for Storage SOP Classes does not necessarily involve support for SOP Classes of the Query/Retrieve Service Class. How the information may be accessed is implementation dependent. It is required that some access method exists. This method may require an implementation dependent operation at the SCP of the Storage Service Class. The duration of the storage is also implementation dependent, but is described in the Conformance Statement of the SCP. Storage SOP Classes are intended to be used in a variety of environments: e.g. for modalities to transfer images to workstations or archives, for archives to transfer images to workstations or back to modalities, for workstations to transfer processed images to archives, etc.

B.2 BEHAVIOR

This Section discusses the SCU and SCP behavior for SOP Classes of the Storage Service Class. The C-STORE DIMSE-C Service shall be the mechanism used to transfer SOP Instances between peer DICOM AEs as described in PS 3.7.

B.2.1 Behavior of an SCU

The SCU invokes a C-STORE DIMSE Service with a SOP Instance which meets the requirements of the corresponding IOD. The SCU shall recognize the status of the C-STORE service and take appropriate action upon the success or failure of the service.

Notes: 1. The appropriate action is implementation dependent. It is required that the SCU distinguish between successful and failed C-STORE responses. Appropriate action may differ according to application, but are described in the Conformance Statement of the SCU.

2. An SCU that is also an SCU of the Detached Study Management SOP Class is required to meet special requirements for mapping study identification information as specified in Annex F.

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B.2.2 Behavior of an SCP

An SCP of a Storage SOP Class acts as a performing DIMSE-service-user for the C-STORE Service. By performing this service successfully, the SCP indicates that the SOP Instance has been successfully stored.

B.2.3 Statuses

Table B.2-1 defines the specific status code values which might be returned in a C-STORE response. General status code values and fields related to status code values are defined in PS 3.7.

Table B.2-1
C-STORE STATUS

Service Status	Further Meaning	Status Codes	Related Fields
Refused	Out of Resources	A7xx	(0000,0902)
Error	Data Set does not match SOP Class	A9xx	(0000,0901) (0000,0902)
	Cannot understand	Cxxx	(0000,0901) (0000,0902)
Warning	Coercion of Data Elements	B000	(0000,0901) (0000,0902)
	Data Set does not match SOP Class	B007	(0000,0901) (0000,0902)
	Elements Discarded	B006	(0000,0901) (0000,0902)
Success		0000	None

B.3 ASSOCIATION NEGOTIATION

SCPs of Storage SOP Classes operate on SOP Instances specific to the SOP Class. They may use the SOP Class Extended Negotiation Sub-Item defined in PS 3.7. This Sub-Item allows DICOM AEs to exchange application information specific to SOP Class specifications. This is achieved by defining the Service-class-application-information field.

The SOP Class Extended Negotiation Sub-Item negotiation is optional for storage based SOP Classes.

The following negotiation rules apply to all DICOM SOP Classes and Specialized DICOM SOP Classes of the Storage Service Class.

The Association-requester (Storage SCU role) in the A-ASSOCIATE request shall convey:

- one Abstract Syntax, in a Presentation Context, for each supported SOP Class and/or Meta SOP Class of the Storage Service Class
- optionally, one SOP Class Extended Negotiation Sub-Item, for each supported SOP Class and/or Meta SOP Class of the Storage Service Class

The Association-acceptor (Storage SCP role) in the A-ASSOCIATE request shall accept:

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— one Abstract Syntax, in a Presentation Context, for each supported SOP Class and/or Meta SOP Class of the Storage Service Class

— optionally, one SOP Class Extended Negotiation Sub-Item, for each supported SOP Class and/or Meta SOP Class of the Storage Service Class

B.3.1 Extended Negotiation

At the time of Association establishment implementations may exchange information about their respective capabilities, as described in PS 3.7 and PS 3.8. SCUs and SCPs may use the SOP Class Extended Negotiation Sub-Item Structure as described in PS 3.7 to exchange information about the level of conformance and options supported.

Extended negotiation is optional. In the event that either the SCU or the SCP does not support extended negotiation, the defaults shall apply.

B.3.1.1 Service-Class-Application-Information (A-ASSOCIATE-RQ)

The SOP Class Extended Negotiation Sub-item is made of a sequence of mandatory fields as defined by PS 3.7. Table B.3-1 shows the format of the Service-class-application-information field of the SOP Class Extended Negotiation Sub-Item for SOP Classes of the Storage Service Class in the A-ASSOCIATE-RQ.

Table B.3-1
SERVICE-CLASS-APPLICATION-INFORMATION (A-ASSOCIATE-RQ)

Item Bytes	Field Name	Description of Field
1	Level of support	This byte field defines the supported storage level of the Association-requester. It shall be encoded as an unsigned binary integer and shall use one of the following values: 0 - level 0 SCP 1 - level 1 SCP 2 - level 2 SCP 3 - N/A Association-requester is SCU only If extended negotiation is not supported, the default shall have a value of 3.
2	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.
3	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.
4	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.
5	Element Coercion	This byte field defines whether the Association-requester may coerce Data Elements. It shall be encoded as an unsigned binary integer and shall use one of the following values: 0 - does not coerce any Data Element 1 - may coerce Data Elements 2 - N/A - Association-requester is SCU only If extended negotiation is not supported, the default shall have a value of 2.

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6	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.

B.3.1.2 Service-Class-Application-Information (A-ASSOCIATE-AC)

The SOP Class Extended Negotiation Sub-item is made of a sequence of mandatory fields as defined by PS 3.7. Table B.3-2 shows the format of the Service-class-application-information field of the SOP Class Extended Negotiation Sub-Item for SOP Classes of the Storage Service Class in the A-ASSOCIATE-AC.

Table B.3-2
SERVICE-CLASS-APPLICATION-INFORMATION (A-ASSOCIATE-AC)

Item Bytes	Field Name	Description of Field
1	Level of support	This byte field defines the supported storage level of the Association-acceptor. It shall be encoded as an unsigned binary integer and shall use one of the following values: 0 - level 0 SCP 1 - level 1 SCP 2 - level 2 SCP 3 - N/A - Association-acceptor is SCU only If extended negotiation is not supported, no assumptions shall be made by the Association-requester about the capabilities of the Association-acceptor based upon this extended negotiation.
2	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.
3	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.
4	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.
5	Element Coercion	This byte field defines whether the Association-acceptor may coerce Data Elements. It shall be encoded as an unsigned binary integer and shall use one of the following values: 0 - does not coerce any Data Element 1 - may coerce Data Elements 2 - N/A - Association-acceptor is SCU only If extended negotiation is not supported, no assumptions shall be made by the Association-requester about the capabilities of the Association-acceptor based upon this extended negotiation.
6	Reserved	This reserved field shall be sent with a value 00H but not tested to this value when received.

B.4 CONFORMANCE

An implementation which conforms to Storage SOP Classes shall meet the:

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— C-STORE Service requirements as defined in Section B.2
— Association requirements as defined in Section B.3

B.4.1 Conformance as An SCP

Three levels of conformance to the Storage SOP Classes as an SCP may be provided:

— Level 0 (Local). Level 0 conformance indicates that a user defined subset of the Attributes of the image will be stored, and all others will be discarded. This subset of the Attributes shall be defined in the Conformance Statement of the implementor.
— Level 1 (Base). Level 1 conformance indicates that all Type 1 and 2 Attributes defined in the IOD associated with the SOP Class will be stored, and may be accessed. All other elements may be discarded. The SCP may, but is not required to validate that the Attributes of the SOP Instance meets the requirements of the IOD.
— Level 2 (Full). Level 2 conformance indicates that all Type 1, Type 2, and Type 3 Attributes defined in the Information Object Definition associated with the SOP Class will be stored and may be accessed. The SCP may, but is not required to validate that the Attributes of the SOP Instance meet the requirements of the IOD.

At any level of conformance, the SCP of the Storage Service Class may modify the values of certain Attributes in order to coerce the SOP Instance into the Query Model of the SCP. The Attributes which may be modified are the following:

Attribute	Tag
Patient ID	(0010,0020)
Study Instance UID	(0020,000D)
Series Instance UID	(0020,000E)

If an SCP performs such a modification, it shall return a C-STORE response with a status of Warning.

Notes 1. Modification of these Attributes may be necessary if the SCP is also an SCP of a Query/Retrieve SOP Classes. These SOP Classes are described in this Standard. For example, an MR scanner may be implemented to generate Study Instance UIDs for images generated on the MR. When these images are sent to an archive which is HIS/RIS aware, it may choose to change the UID of the study assigned to the study by the PACS. The mechanism by which it performs this coercion is implementation dependent.

2. Other Attributes may be modified/corrected by an SCP of a Storage SOP Class.

B.4.2 Conformance as An SCU

The SCU shall generate only C-STORE requests with SOP Instances which meet the requirements of the IOD associated with the SOP Class.

B.4.3 Conformance Statement Requirements

An implementation may conform to a SOP Class of the Storage Service Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

B.4.3.1 Conformance Statement for An SCU

The following issues shall be documented in the Conformance Statement of any implementation claiming conformance to the Storage SOP Class as an SCU:

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- The behavior of the SCU in the case of a successful C-STORE response status shall be described.
- The behavior of the SCU in each case of an unsuccessful C-STORE response status shall be described.
- The behavior of the SCU in the case of a Warning status received in response to a C-STORE operation.
- Whether extended negotiation is supported.
- The optional elements which may be included in Storage SOP Instances for each IOD supported shall be listed.

B.4.3.2 Conformance Statement for An SCP

The following issues shall be documented in the Conformance Statement of any implementation claiming conformance to the Storage Service Class as an SCP:

- The level of conformance, as defined by Section B.4.1, shall be stated.
- The optional elements which will be discarded (if any) shall be listed for each IOD supported. The Conformance Statement shall document the policies concerning the Attribute Lossy Image Compression (0028,2110).
- The behavior of the SCP in the case of a successful C-STORE operation shall be described. This includes the following:
  - the access method for a stored SOP Instance
  - the duration of the storage
- The meaning of each case of an unsuccessful C-STORE response status shall be described, as well as appropriate recovery action.
- The meaning of each case of a warning C-STORE response status shall be described, as well as appropriate action.
- If the SCP performs coercion on any Attributes, this shall be stated, and the conditions under which it may occur shall be described.

B.4.4 Specialized Conformance

Implementations may provide Specialized SOP Class conformance by providing a proper superset of the SOP Instances to be stored. Implementations providing Specialized SOP Class Conformance to one of the SOP Classes defined in this Annex shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation shall be permitted to conform as a Specialization of the standard SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

B.4.4.1 Specialized SOP Class Identification

Any implementation which specializes the standard SOP Class shall define its specialization as an Allomorphic subclass of the standard SOP Class. As such, the specialization shall have its own unique SOP Class identification.

The Conformance Statement shall include a SOP Class Identification Statement as defined in PS 3.2, declaring a SOP Name and SOP Class UID which identify the Specialized SOP Class. The SOP Name is not guaranteed to be unique (unless the implementor chooses to copyright it) but is provided for informal identification of the SOP Class. The SOP Class UID shall uniquely identify the Specialized SOP Class and conform to the DICOM UID requirements as specified in PS 3.5.

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B.4.4.2 Specialized Information Object Definition

The standard SOP Class may be specialized by supporting additional private Attributes. The SCU Operations Statement shall describe these specializations and be formatted as defined in PS 3.2. Following this statement shall be the list of Attributes which may be sent or stored with SOP Instances.

B.5 STANDARD SOP CLASSES

The SOP Classes in the Storage Service Class identify the Composite IODs to be stored. Table B.5-1 identifies Standard SOP Classes.

Table B.5-1
STANDARD SOP CLASSES

SOP Class Name	SOP Class UID	IOD Specification (defined in PS 3.3)
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	12-lead ECG Waveform
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	General ECG Waveform
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Ambulatory ECG Waveform
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Hemodynamic Waveform

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Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Cardiac Electrophysiology Waveform
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Basic Voice Audio Waveform
Stand-alone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	
Stand-alone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	
Stand-alone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Grayscale Softcopy Presentation State Storage
Standalone PET Curve Storage	1.2.840.10008.5.1.4.1.1.129	
Stored Print Storage	1.2.840.10008.5.1.1.27	
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	DX IOD (see B.5.1.1)
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	DX IOD (see B.5.1.1)
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography IOD (see B.5.1.2)
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography IOD (see B.5.1.2)
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Digital Intra-oral X-Ray IOD (see B.5.1.3)
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Digital Intra-oral X-Ray IOD (see B.5.1.3)
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Basic Text SR
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Enhanced SR
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Comprehensive SR

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B.5.1 Specialization for Standard SOP Classes

B.5.1.1 Digital X-Ray Image Storage SOP Classes

The Digital X-Ray Image Storage - For Presentation SOP Class shall use the DX IOD with an Enumerated Value of FOR PRESENTATION for Presentation Intent Type (0008,0068).

The Digital X-Ray Image Storage - For Processing SOP Class shall use the DX IOD with an Enumerated Value of FOR PROCESSING for Presentation Intent Type (0008,0068).

An SCU or SCP of the Digital X-Ray Image Storage - For Processing SOP Class shall also support the Digital X-Ray Image Storage - For Presentation SOP Class.

Note: The intent of this requirement is to ensure a useful level of interoperability by avoiding the situation where an SCU might support only the Digital X-Ray Image Storage - For Processing SOP Class and an SCP only the Digital X-Ray Image Storage - For Presentation SOP Class, or vice versa. The burden is therefore to support the Digital X-Ray Image Storage - For Presentation SOP Class as a "baseline".

B.5.1.2 Digital Mammography Image Storage SOP Classes

The Digital Mammography Image Storage - For Presentation SOP Class shall use the Digital Mammography IOD with an Enumerated Value of FOR PRESENTATION for Presentation Intent Type (0008,0068).

The Digital Mammography Image Storage - For Processing SOP Class shall use the Digital Mammography IOD with an Enumerated Value of FOR PROCESSING for Presentation Intent Type (0008,0068).

An SCU or SCP of the Digital Mammography Image Storage - For Processing SOP Class shall also support the Digital Mammography Image Storage - For Presentation SOP Class.

B.5.1.3 Digital Intra-oral X-Ray Image Storage SOP Classes

The Digital Intra-oral X-Ray Image Storage - For Presentation SOP Class shall use the Digital Intra-oral X-Ray IOD with an Enumerated Value of FOR PRESENTATION for Presentation Intent Type (0008,0068).

The Digital Intra-oral X-Ray Image Storage - For Processing SOP Class shall use the Digital Intra-oral X-Ray IOD with an Enumerated Value of FOR PROCESSING for Presentation Intent Type (0008,0068).

An SCU or SCP of the Digital Intra-oral X-Ray Image Storage - For Processing SOP Class shall also support the Digital Intra-oral X-Ray Image Storage - For Presentation SOP Class.

B.5.1.4 Grayscale Softcopy Presentation State Storage SOP Class

See Annex N.

B.5.1.5 Structured Reporting Storage SOP Classes

See Annex O.

B.6 RETIRED STANDARD SOP CLASSES

The SOP Classes in Table B.6-1 were defined in previous versions of the DICOM Standard. They are now retired and have been replaced by new standard SOP Classes shown in Table B.5-1.

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Note: Usage of the retired SOP Classes is permitted by DICOM. However, new implementations are strongly encouraged to implement the newer SOP Classes.

Table B.6-1
RETIRED STANDARD SOP CLASSES

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3
X-Ray Angiographic Bi-plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3

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Annex C QUERY/RETRIEVE SERVICE CLASS (Normative)

C.1 OVERVIEW

C.1.1 Scope

The Query/Retrieve Service Class defines an application-level class-of-service which facilitates the simple management of composite object instances in a manner functionally similar to ACR-NEMA 300-1988. The types of queries which are allowed are not complex. This Service Class is not intended to provide a comprehensive generalized database query mechanism such as SQL. Instead, the Query/Retrieve Service Class is focused towards basic composite object instance information queries using a small set of common Key Attributes.

In addition, the Query/Retrieve Service Class provides the ability to retrieve/transfer a well-identified set of composite object instances. The retrieve/transfer capability allows a DICOM AE to retrieve composite object instances from a remote DICOM AE or request the remote DICOM AE to initiate a transfer of composite object instances to another DICOM AE.

Note: Functional similarity to ACR-NEMA 300-1988 facilitates the migration to DICOM.

C.1.2 Conventions

The following conventions are used to define the types of keys used in Query/Retrieve Information Models.

Symbol	Description
U	Unique Key Attribute
R	Required Key Attribute
O	Optional Key Attribute

C.1.3 Query/retrieve Information Model

In order to serve as an SCP of the Query/Retrieve Service Class, a DICOM AE possesses information about the Attributes of a number of stored composite object SOP Instances. This information is organized into a well defined Query/Retrieve Information Model. The Query/Retrieve Information Model may be a standard Query/Retrieve Information Model, as defined in this Annex of the DICOM Standard, or a private Query/Retrieve Information Model, which is defined in the Conformance Statement of the implementor.

Queries and Retrievals are implemented against well defined Information Models. A specific SOP Class of the Query/Retrieve Service Class consists of an Information Model Definition and a DIMSE-C Service Group. In this Service Class, the Information Model plays a role similar to an Information Object Definition (IOD) of most other DICOM Service Classes.

C.1.4 Service Definition

Two peer DICOM AEs implement a SOP Class of the Query/Retrieve Service Class with one serving in the SCU role and one serving in the SCP role. SOP Classes of the Query/Retrieve Service Class are implemented using the DIMSE-C C-FIND, C-MOVE, and C-GET services as defined in PS 3.7.

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Both a baseline and extended behavior is defined for the DIMSE-C C-FIND, C-MOVE, and C-GET services. Baseline behavior specifies a minimum level of conformance for all implementations to facilitate interoperability. Extended behavior enhances the baseline behavior to provide additional features which may be negotiated independently at Association establishment time.

The following descriptions of the DIMSE-C C-FIND, C-MOVE, and C-GET services provide a brief overview of the SCU/SCP semantics:

a) A C-FIND service conveys the following semantics:

— The SCU requests that the SCP perform a match of all the keys specified in the Identifier of the request, against the information it possesses, to the level (E.g. Patient, Study, Series, or Composite object instance) specified in the request.

Note: In this Annex, the term "Identifier" refers to the Identifier service parameter of the C-FIND, C-MOVE, or C-GET service as defined in PS 3.7.

— The SCP generates a C-FIND response for each match with an Identifier containing the values of all key fields and all known Attributes requested. All such responses will contain a status of Pending. A status of Pending indicates that the process of matching is not complete.

— When the process of matching is complete a C-FIND response is sent with a status of Success and no Identifier.

— A Refused or Failed response to a C-FIND request indicates that the SCP is unable to process the request.

— The SCU may cancel the C-FIND service by issuing a C-FIND-CANCEL request at any time during the processing of the C-FIND service. The SCP will interrupt all matching and return a status of Canceled.

b) A C-MOVE service conveys the following semantics:

— The SCU supplies Unique Key values to identify an entity at the level of the retrieval. The SCP of the C-MOVE initiates C-STORE sub-operations for the corresponding storage SOP Instances identified by Unique Key values. These C-STORE sub-operations occur on a different Association than the C-MOVE service. The SCP role of the Query/Retrieve SOP Class and the SCU role of the Storage SOP Class may be performed by different applications which may or may not reside on the same system. Initiation mechanism of C-STORE sub-operations is outside of the scope of DICOM standard.

Note: This does not imply that they use the same AE Title. See C.6.1.2.2.2, C.6.2.2.2.2 and C.6.3.2.2.2 for the requirements to the C-MOVE SCP conformance.

— The SCP may optionally generate responses to the C-MOVE with status equal to Pending during the processing of the C-STORE sub-operations. These C-MOVE responses indicate the number of Remaining C-STORE sub-operations and the number of C-STORE sub-operations returning the status of Success, Warning, and Failed.

— When the number of Remaining C-STORE sub-operations reaches zero, the SCP generates a final response with a status equal to Success, Warning, Failed, or Refused. This response may indicate the number of C-STORE sub-operations returning the status of Success, Warning, and Failed. If the status of a C-STORE sub-operation was Failed a UID List will be returned.

— The SCU may cancel the C-MOVE service by issuing a C-MOVE-CANCEL request at any time during the processing of the C-MOVE. The SCP terminates all incomplete C-STORE

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sub-operations and returns a status of Canceled.

c) A C-GET service conveys the following semantics:

— The SCU supplies Unique Key values to identify an entity at the level of the retrieval. The SCP generates C-STORE sub-operations for the corresponding storage SOP Instances identified by the Unique Key values. These C-STORE sub-operations occur on the same Association as the C-GET service and the SCU/SCP roles will be reversed for the C-STORE.

— The SCP may optionally generate responses to the C-GET with status equal to Pending during the processing of the C-STORE sub-operations. These C-GET responses indicate the number of Remaining C-STORE sub-operations and the number of C-STORE sub-operations returning the status of Success, Warning, and Failed.

— When the number of Remaining C-STORE sub-operations reaches zero, the SCP generates a final response with a status equal to Success, Warning, Failed, or Refused. This response may indicate the number of C-STORE sub-operations returning the status of Success, Warning, and Failed. If the status of a C-STORE sub-operation was Failed a UID List will be returned.

— The SCU may cancel the C-GET service by issuing a C-GET-CANCEL request at any time during the processing of the C-GET. The SCP terminates all incomplete C-STORE sub-operations and returns a status of Canceled.

C.2 QUERY/RETRIEVE INFORMATION MODEL DEFINITION

The Query/Retrieve Information Model is identified by the SOP Class negotiated at Association establishment time. The SOP Class is composed of both an Information Model and a DIMSE-C Service Group.

Note: This SOP Class identifies the class of the Query/Retrieve Information Model (i.e. not the SOP Class of the stored SOP Instances for which the SCP has information)

A Query/Retrieve Information Model may be either a standard Query/Retrieve Information Model or a private Query/Retrieve Information Model. Information Model Definitions for standard SOP Classes of the Query/Retrieve Service Class are defined in this Annex. In order to use a private Query/Retrieve Information Model, a private Query/Retrieve Information Model Definition shall be provided. A Query/Retrieve Information Model Definition contains:

— Entity-Relationship Model Definition

— Key Attributes Definition

C.2.1 Entity-Relationship Model Definition

For any Query/Retrieve Information Model, an Entity-Relationship Model defines a hierarchy of entities, with Attributes defined for each level in the hierarchy (e.g. Patient, Study, Series, Composite object instance)

C.2.2 Attributes Definition

Attributes shall be defined at each level in the Entity-Relationship Model. An Identifier in a C-FIND, C-MOVE, or C-GET command shall contain values to be matched against the Attributes of the Entities in a Query/Retrieve Information Model. For any query, the set of entities for which Attributes are returned, shall be determined by the set of Key Attributes specified in the Identifier which have corresponding matches on entities managed by the SCP associated with the query.

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C.2.2.1 Attribute Types

All Attributes of entities in a Query/Retrieve Information Model shall be either a Unique Key, Required Key, or Optional Key. The term Key Attributes refers to Unique, Required, and Optional Key Attributes.

C.2.2.1.1 Unique Keys

At each level in the Entity-Relationship Model, one Attribute shall be defined as a Unique Key. A single value in a Unique Key Attribute shall uniquely identify a single entity at a given level. That is, two entities at the same level may not have the same Unique Key value.

C-FIND, C-MOVE, and C-GET SCPs shall support existence and matching of all Unique Keys defined by a Query/Retrieve Information Model. All entities managed by C-FIND, C-MOVE, and C-GET SCPs shall have a specific non-zero length Unique Key value.

Unique Keys may be contained in the Identifier of a C-FIND request. Unique Keys shall be contained in the Identifier of C-MOVE and C-GET requests.

C.2.2.1.2 Required Keys

At each level in the Entity-Relationship Model, a set of Attributes shall be defined as Required Keys. Required Keys imply the SCP of a C-FIND shall support matching based on a value contained in a Required Key of the C-FIND request. Multiple entities may have the same value for Required Keys. That is, a distinct value in a Required Key shall not necessarily identify a single entity at the level of the key.

C-FIND SCPs shall support existence and matching of all Required Keys defined by a Query/Retrieve Information Model. If a C-FIND SCP manages an entity with a Required Key of zero length, the value is considered unknown and all matching against the zero length Required Key shall be considered a successful match.

Required Keys may be contained in the Identifier of a C-FIND request. Required Keys shall not be contained in the Identifier of C-MOVE and C-GET requests.

C.2.2.1.3 Optional Keys

At each level in the Entity-Relationship Model, a set of Attributes shall be defined as Optional Keys.

Optional Keys contained in the Identifier of a C-FIND request may have three different types of behavior depending on support for existence and/or matching by the C-FIND SCP. If the C-FIND SCP:

- does not support the existence of the Optional Key, then the Attribute shall not be returned in C-FIND responses
- supports the existence of the Optional Key but does not support matching on the Optional Key, then the Optional Key shall be processed in the same manner as a zero length Required Key. That is, the value specified to be matched for the Optional Key is ignored but a value may be returned by the SCP for this Optional Key.
- supports the existence and matching of the Optional Key, then the Optional Key shall be processed in the same manner as a Required Key.

Notes: 1. C-FIND SCU may not assume an Optional Key with non-zero length will be processed in the same manner as a Required Key. The Conformance Statement of the C-FIND SCP shall list the Optional Keys which are supported.

2. Optional Keys are differentiated from Required Keys in that Optional Keys may or may not be supported for existence and/or matching by C-FIND SCPs. Whereas, Required Keys

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must always be supported by C-FIND SCPs.

Optional Keys may be contained in the Identifier of a C-FIND request. Optional Keys shall not be contained in the Identifier of C-MOVE and C-GET requests.

C.2.2.2 Attribute Matching

The following types of matching may be performed on Key Attributes in the Query/Retrieve Service Class:

- Single Value Matching
- List of UID Matching
- Universal Matching
- Wild Card Matching
- Range Matching
- Sequence Matching

Matching requires special characters (i.e. "*","?","-", and "\") which need not be part of the character repertoire for the VR of the Key Attributes.

The total length of the Key Attribute may exceed the length as specified in the VR in PS 3.5. The Value Multiplicity (VM) may be larger than the VM as specified in PS 3.6 for the Key Attribute.

C.2.2.2.1 Single Value Matching

If the value specified for a Key Attribute in a request is non-zero length and if it is:

a) not a date or time or datetime, contains no wild card characters

b) a date or time or datetime, contains a single date or time or datetime with no "-"

then single value matching shall be performed. Only entities with values which match exactly the value specified in the request shall match. This matching is case-sensitive, except for Attributes with an PN Value Representation (e.g., Patient Name (0010,0010)) in which case it is implementation dependent and shall be specified in the conformance statement.

Notes: 1. This definition implies that dates or times or datetimes are matched by their meaning, not as literal strings. For example:

- the DT "19980128103000.0000" matches "19980128103000"
- the DT "19980128103000GMT" matches "19980128073000GMT-3"
- the TM "2230" matches "223000"
- the TM "223000" matches the deprecated ACR/NEMA 2.0 form "22:30:00"
- the DA "19980128" matches the deprecated ACR/NEMA 2.0 form "1998.01.28"

2. If an application is concerned about how single value matching of dates and times is performed by another application, it may consider using range matching instead, which is always performed by meaning, with both values in the range the same.

C.2.2.2.2 List of UID Matching

A List of UIDs is encoded by using the value multiplicity operator, backslash ("\"), as a delimiter between UIDs. Each item in the list shall contain a single UID value. Each UID in the list contained in the Identifier of the request may generate a match.

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Note: A list of single values is encoded exactly as a VR of UI and a VM of Multiple (see PS 3.5).

C.2.2.2.3 Universal Matching

If the value specified for a Key Attribute in a request is zero length, then all entities shall match this Attribute. An Attribute which contains a Universal Match specification in a C-FIND request provides a mechanism to request the selected Attribute value be returned in corresponding C-FIND responses.

C.2.2.2.4 Wild Card Matching

If the Attribute is not a date, time, signed long, signed short, unsigned short, unsigned long, floating point single, floating point double, other byte string, other word string, unknown, attribute tag, decimal string, integer string, age string or UID and the value specified in the request contains any occurrence of an "*" or a "?", then "*" shall match any sequence of characters (including a zero length value) and "?" shall match any single character. This matching is case sensitive, except for Attributes with an PN Value Representation (e.g., Patient Name (0010,0010)) in which case it is implementation dependent and shall be specified in the conformance statement. See PS 3.5 for Value Representations.

Notes: 1. Wild card matching on a value of "*" is equivalent to universal matching.

2. The wild card matching method specified by DICOM might not be supported by some non-DICOM multi-byte character text processors.

C.2.2.2.5 Range Matching

If the Attribute is a date, then:

a) A string of the form "<date1> - <date2>" shall match all occurrences of dates which fall between <date1> and <date2> inclusive

b) A string of the form "- <date1>" shall match all occurrences of dates prior to and including <date1>

c) A string of the form "<date1> -" shall match all occurrences of <date1> and subsequent dates

If the Attribute is a time, then:

a) A string of the form "<time1> - <time2>" shall match all occurrences of times which fall between <time1> and <time2> inclusive

b) A string of the form "- <time1>" shall match all occurrences of times prior to and including <time1>

c) A string of the form "<time1> -" shall match all occurrences of <time1> and subsequent times

If the Attribute is a datetime, then:

a) A string of the form "<datetime1> - <datetime2>" shall match all moments in time which fall between <datetime1> and <datetime2> inclusive

b) A string of the form "- <datetime1>" shall match all moments in time prior to and including <datetime1>

c) A string of the form "<datetime1> -" shall match all moments in time subsequent to and including <datetime1>

d) The timezone, if present in the Value of the Attribute, shall be taken into account for the purposes of the match.

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Range matching is not defined for types of Attributes other than dates and times.

C.2.2.2.6 Sequence Matching

If a Key Attribute in the Identifier of a C-FIND request needs to be matched against an Attribute structured as a Sequence of Items (Value Representation of Type SQ), the Key Attribute shall be structured as a Sequence of Items with a single Item. This Item may contain zero or more Item Key Attributes. Each Item Key Attribute matching shall be performed on an Item by Item basis. The types of matching defined in Section C.2.2.2 shall be used: Single Value Matching, List of UID Matching, Universal Matching, Wild Card Matching, Range Matching and Sequence Matching (recursive Sequence matching)

If all the Item Key Attributes match, for at least one of the Items of the Attribute against which the match is performed, a successful match is generated. A sequence of matching Items containing only the requested attributes is returned in the corresponding C-FIND responses.

If the Key Attribute in the Identifier of a C-FIND request contains no Key Item Attribute (zero-length Item Tag), then all entities shall match this Attribute. This provides a universal matching like mechanism to request that the selected Key Attribute value (the entire Sequence of Items) be returned in corresponding C-FIND responses.

C.2.2.3 Matching Multiple Values

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

C.3 STANDARD QUERY/RETRIEVE INFORMATION MODELS

Three standard Query/Retrieve Information Models are defined in this Annex. Each Query/Retrieve Information Model is associated with a number of SOP Classes. The following three hierarchical Query/Retrieve Information Models are defined:

- Patient Root
- Study Root
- Patient/Study Only

C.3.1 Patient Root Query/Retrieve Information Model

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

- Patient
- Study
- Series
- Composite object instance

The patient level is the top level and contains Attributes associated with the Patient Information Entity (IE) of the Composite IODs as defined in PS 3.3. Patients IEs are modality independent.

The study level is below the patient level and contains Attributes associated with the Study IE of the Composite IODs as defined in PS 3.3. A study belongs to a single patient. A single patient may have multiple studies. Study IEs are modality independent.

The series level is below the study level and contains Attributes associated with the Series, Frame of Reference and Equipment IEs of the Composite IODs as defined in PS 3.3. A series belongs to a single study. A single study may have multiple series. Series IEs are modality dependent. To

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accommodate this modality dependence, the set of Optional Keys at the series level includes all Attributes defined at the series level from any Composite IOD defined in PS 3.3.

The lowest level is the composite object instance level and contains Attributes associated with the Composite object IE of the Composite IODs as defined in PS 3.3. A composite object instance belongs to a single series. A single series may contain multiple composite object instances. Most composite object IEs are modality dependent. To accommodate this potential modality dependence, the set of Optional Keys at the composite object instance level includes all Attributes defined at the composite object instance level from any CompositeIOD defined in PS 3.3.

C.3.2 Study Root Query/Retrieve Information Model

The Study Root Query/Retrieve Information Model is identical to the Patient Root Query/Retrieve Information Model except the top level is the study level. Attributes of patients are considered to be Attributes of studies.

C.3.3 Patient/Study Only Query/Retrieve Information Model

The Patient/Study Only Query/Retrieve Information Model is identical to the Patient Root except the series and composite object instance levels are not supported.

Note: Even though this model does not include the composite object instance level, composite object instances may be retrieved at the patient and study level (i.e., retrieve all composite object instances for a Patient or Study).

C.3.4 Additional Query/Retrieve Attributes

Some optional attributes which may be used in Query/Retrieve Information Models that are not Attributes of an Information Object Definition and, therefore, are not defined in PS 3.3. These attributes are defined in Table C.3-1.

Table C.3-1
ADDITIONAL QUERY/RETRIEVE ATTRIBUTES

Attribute Name	Tag	Attribute Description
Number of Patient Related Studies	(0020,1200)	The number of studies that match the Patient level Query/Retrieve search criteria
Number of Patient Related Series	(0020,1202)	The number of series that match the Patient level Query/Retrieve search criteria
Number of Patient Related Instances	(0020,1204)	The number of composite object instances that match the Patient level Query/Retrieve search criteria
Number of Study Related Series	(0020,1206)	The number of series that match the Study level Query/Retrieve search criteria
Number of Series Related Instances	(0020,1209)	The number of composite object instances in a Series that match the Series level Query/Retrieve search criteria
Number of Study Related Instances	(0020,1208)	The number of composite object instances that match the Study level Query/Retrieve search criteria

Note: *The use of the word "Images" rather than "composite object instances" is historical, and should not be taken to mean that composite object instances of other than image type are not included in the number.*

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C.4 DIMSE-C SERVICE GROUPS

Three DIMSE-C Services are used in the construction of SOP Classes of the Query/Retrieve Service Class. The following DIMSE-C operations are used:

- C-FIND
- C-MOVE
- C-GET

C.4.1 C-FIND Operation

SCPs of some SOP Classes of the Query/Retrieve Service Class may be capable of processing queries using the C-FIND operation as described in PS 3.7. The C-FIND operation is the mechanism by which queries are performed. Matches against the keys present in the Identifier are returned in C-FIND responses.

C.4.1.1 C-FIND Service Parameters

C.4.1.1.1 SOP Class UID

The SOP Class UID identifies the Query/Retrieve Information Model against which the C-FIND is to be performed. Support for the SOP Class UID is implied by the Abstract Syntax UID of the Presentation Context used by this C-FIND operation.

C.4.1.1.2 Priority

The Priority Attribute defines the requested priority of the C-FIND operation with respect to other DIMSE operations being performed by the same SCP.

Processing of priority requests is not required of SCPs. Whether or not an SCP supports priority processing and the meaning of the different priority levels shall be stated in the Conformance Statement of the SCP.

C.4.1.1.3 Identifier

Both the C-FIND request and response contain an Identifier encoded as a Data Set (see PS 3.5).

C.4.1.1.3.1 Request Identifier Structure

An Identifier in a C-FIND request shall contain:

- Key Attributes values to be matched against the values of storage SOP Instances managed by the SCP.
- Query/Retrieve Level, element (0008,0052) which defines the level of the query.
- Conditionally, the Attribute Specific Character Set (0008,0005). This Attribute is required if expanded or replacement character sets are used.

The Key Attributes and values allowable for the level of the query shall be defined in the SOP Class definition for the Query/Retrieve Information Model.

C.4.1.1.3.2 Response Identifier Structure

The C-FIND response shall not contain Attributes that were not in the request or specified in this section.

An Identifier in a C-FIND response shall contain:

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— Key Attributes with values corresponding to Key Attributes contained in the Identifier of the request.

— Query/Retrieve Level, element (0008,0052) which defines the level of the query. The Query/Retrieve level shall be equal to the level specified in the request.

— Conditionally, the Attribute Specific Character Set (0008,0005). This Attribute is required if expanded or replacement character sets are used.

The C-FIND SCP is required to support either or both the Retrieve AE Title Data Element or the Storage Media File-Set ID/Storage Media File Set UID Data Elements. An Identifier in a C-FIND response shall contain:

— Storage Media File-Set ID (0088,0130) which defines a user or implementation specific human readable Identifier that identifies the Storage Media on which the composite object instance(s) reside. This element pertains to the set of composite object instances available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Composite object instance). This Attribute shall be present if the Retrieve AE Title Data Element is not present. A null value (Data Element length of 0) is valid for all levels except the lowest level in the Information Model as defined by the SOP Class.

— Storage Media File-Set UID (0088,0140) which uniquely identifies the Storage Media on which the composite object instance(s) reside. This element pertains to the set of composite object instances available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Composite object instance). This Attribute shall be present if the Retrieve AE Title Data Element is not present. A null value (Data Element length of 0) is valid for all levels except the lowest level in the Information Model as defined by the SOP Class.

Note: The File-Set concepts are used in PS 3.10.

— Retrieve AE Title (0008,0054) which defines a list of DICOM Application Entity Title(s) that identify the location from which the composite object instance(s) may be retrieved on the network. This element pertains to the set of composite object instances available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Composite object instance). This Attribute shall be present if the Storage Media File-Set ID and Storage Media File-Set UID elements are not present. The Application Entity named in this field shall support either the C-GET or C-MOVE SOP Class of the Query/Retrieve Service Class. A null value (Data Element length of 0) is valid for all levels except the lowest level in the Information Model as defined by the SOP Class.

Notes: 1. For example, a DICOM AE with the AE Title of "A" performs a C-FIND request to a DICOM AE with the AE Title of "B" with the Query/Retrieve level set to "STUDY". DICOM AE "B" determines that the composite object instances for each matching study may be retrieved by itself and sets the Data Element Retrieve AE Title to "B".

2. File-Sets may not be defined at every Query/Retrieve Level. If the SCP supports the File-Set ID/File-Set UID option but does not define these Attributes at the Query/Retrieve Level specified in the C-FIND request it may return these Data Elements with a length of 0 to signify that the value is unknown. An SCU should reissue a C-FIND at a Query/Retrieve Level lower in the hierarchy.

3. The fact that the value of the Key Attribute is unknown to the SCP of the Query/Retrieve Service Class does not imply that it is not present in the underlying Information Object. Thus, a subsequent retrieval may cause a Storage of a SOP Instance which contains the value of the Attribute.

The C-FIND SCP may also, but is not required to, support the Instance Availability (0008,0056) Data Element. This Data Element shall not be included in a C-FIND request. An Identifier in a C-FIND response may contain:

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— Instance Availability (0008,0056) which defines how rapidly composite object instance(s); become available for transmission after a C-MOVE or C-GET retrieval request. This element pertains to the set of composite object instances available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Composite object instance). When some composite instances are less rapidly available than others, the availability of the least rapidly available shall be returned. If this Data Element is not returned, the availability is unknown or unspecified. A null value (Data Element length of 0) is not permitted. The Enumerated Values for this Data Element are:
  — "ONLINE" which means the instances are immediately available,
  — "NEARLINE" which means the instances need to be retrieved from relatively slow media such as optical disk or tape,
  — "OFFLINE" which means the instances need to be retrieved by manual intervention.

C.4.1.1.4 Status

Table C.4-1 defines the specific status code values which might be returned in a C-FIND response. General status code values and fields related to status code values are defined in PS 3.7.

Table C.4-1
C-FIND RESPONSE STATUS VALUES

Service Status	Further Meaning	Status Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied.	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier.	FF01	Identifier

C.4.1.2 C-FIND SCU Behavior

This Section discusses both the baseline and extended behavior of the C-FIND SCU.

C.4.1.2.1 Baseline Behavior of SCU

All C-FIND SCUs shall be capable of generating query requests which meet the requirements of the Hierarchical Search.

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The Identifier contained in a C-FIND request shall contain a single value in the Unique Key Attribute for each level above the Query/Retrieve level. No Required or Optional Keys shall be specified which are associated with levels above the Query/Retrieve level.

The Unique Key Attribute associated with the Query/Retrieve level shall be contained in the C-FIND request and may specify Single Value Matching, Universal Value Matching, or List of UID Matching. In addition, Required and Optional Keys associated with the Query/Retrieve level may be contained in the Identifier.

An SCU conveys the following semantics using the C-FIND request:

— The SCU requests that the SCP perform a match of all keys specified in the Identifier of the request against the information it possesses down to the Query/Retrieve level specified in the request.

Notes: 1. The SCU may not assume the SCP supports any Optional Keys. Hence, Optional Keys serve only to reduce network related overhead when they are supported by the SCP.

2. The SCU must be prepared to filter C-FIND responses when the SCP fails to support an Optional Key specified in the C-FIND request.

— The SCU shall interpret Pending responses to convey the Attributes of a match of an Entity at the level of the query.

— The SCU shall interpret a response with a status equal to Success, Failed or Refused to convey the end of Pending responses.

— The SCU shall interpret a Refused or Failed response to a C-FIND request as an indication that the SCP is unable to process the request.

— The SCU may cancel the C-FIND service by issuing a C-FIND-CANCEL request at any time during the processing of the C-FIND. The SCU shall recognize a status of Canceled to indicate that the C-FIND-CANCEL was successful.

C.4.1.2.2 Extended Behavior of SCU

Extended SCU behavior shall be negotiated at Association establishment time. If an option within the extended behavior is not agreed upon in the negotiation, then only baseline SCU behavior shall be performed with respect to that option. Extended SCU behavior includes all baseline behavior with the following option:

— Relational-queries

C.4.1.2.2.1 Relational-Queries

The C-FIND Service with relational-queries allows any combination of keys at any level in the hierarchy. The Unique Key Attribute associated with the Query/Retrieve level shall be contained in the C-FIND request and may specify Single Value Matching, Universal Value Matching, or List of UID Matching. Support for relational-queries removes the baseline restriction that a Unique Key shall be specified for all levels above the Query/Retrieve level in the C-FIND request.

C.4.1.3 C-FIND SCP Behavior

This Section discusses both the baseline and extended behavior of the C-FIND SCP.

C.4.1.3.1 Baseline behavior of SCP

All C-FIND SCPs shall be capable of processing queries which meet the requirements of the Hierarchical Search.

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An SCP conveys the following semantics with a C-FIND response:

- The SCP is requested to perform a match of all the keys specified in the Identifier of the request, against the information it possesses, to the level specified in the request. Attribute matching is performed using the key values specified in the Identifier of the C-FIND request as defined in Section C.2.
- The SCP generates a C-FIND response for each match using the Hierarchical Search method. All such responses shall contain an Identifier whose Attributes contain values from a single match. All such responses shall contain a status of Pending.
- When all matches have been sent, the SCP generates a C-FIND response which contains a status of Success. A status of Success shall indicate that a response has been sent for each match known to the SCP.
- The SCP shall generate a response with a status of Refused or Failed if it is unable to process the request. A Refused or Failed response shall contain no Identifier.
- If the SCP receives C-FIND-CANCEL indication before it has completed the processing of the matches it shall interrupt the matching process and return a status of Canceled.

C.4.1.3.1.1 Hierarchical Search Method

Starting at the top level in the Query/Retrieve Information Model, continuing until the level specified in the C-FIND request is reached, the following procedures are used to generate matches:

a) If the current level is the level specified in the C-FIND request, then the key match strings contained in the Identifier of the C-FIND request are matched against the values of the Key Attributes for each entity at the current level. For each entity for which the Attributes match all of the specified match strings, construct an Identifier. This Identifier shall contain all of the Unique Keys at higher levels and all of the values of the Attributes for this entity which match those in the C-FIND request. Return a response for each such Identifier. If there are no matching keys, then there are no matches, return a response with a status equal to Success and with no Identifier.

b) Otherwise, if the current level is not the level specified in the C-FIND request and there is an entity matching the Unique Key Attribute value for this level specified in the C-FIND request, perform this procedure at the next level down in the hierarchy.

c) Otherwise there are no matches; return a response with a status equal to Success.

Note: The above description specifies a recursive procedure. It may recur upon itself multiple times as it goes down the hierarchical levels, but at each level it recurs only once.

C.4.1.3.2 Extended Behavior of SCP

Extended SCP behavior shall be negotiated at Association establishment time. If an option within the extended behavior is not agreed upon in the negotiation, then only baseline SCP behavior shall be performed with respect to that option. Extended SCP behavior includes all baseline behavior with the following option:

- Relational-queries

C.4.1.3.2.1 Relational-Queries

The C-FIND Service with relational-queries allows any combination of keys at any level in the hierarchy. At the lowest level, a query using the relational-queries shall contain the Unique Key for that level with either a single value match, a wild card match, or a universal match. Support for relational-queries removes the baseline restriction that a Unique Key shall be specified for all levels above the Query/Retrieve level in the C-FIND request.

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The C-FIND SCP shall perform matching based on all keys specified in the C-FIND request regardless of the Query/Retrieve level.

C.4.1.3.2.2 Relational Search Method

A query using the relational method may contain any combination of keys at any level in the hierarchy. Starting at the top level in the Query/Retrieve Information Model, continuing until the Query/Retrieve level specified in the C-FIND request is reached, the following procedures are used to generate matches:

a) The key match strings contained in the Identifier of the C-FIND request are matched against the values of the Key Attributes for each entity at the current level.

b) If no Key Attribute is specified at the current level and the current level is not the level specified in the C-FIND request, the match shall be performed as if a wild card were specified for the Unique Key Attribute for the current level (i.e. all entities at the current level shall match).

c) If the current level is the level specified in the C-FIND request, then for each matching entity (a matching entity is one for which the Attributes match all of the specified match strings in the Key Attributes), construct an Identifier. This Identifier shall contain all of the Attributes generated by this procedure at higher levels on this recursion path and all of the values of the Key Attributes for this entity which match those in the C-FIND request.

d) Otherwise, if the current level is not the level specified in the C-FIND request, then for each matching entity construct a list of Attributes containing all of the matching Key Attributes and all Attributes which were prepared at the previous level for this entity. Then perform this procedure at the next level down in the hierarchy for each matching entity.

e) Otherwise, if there are no matches, return a response with status equal to Success and no Identifier.

Notes: 1. The above description specifies a recursive procedure. It may recur upon itself multiple times as it goes down the hierarchical levels, and at each level, it may recur multiple times (one for each matching entity). This may result in a large number of Identifiers being generated.

2. It is not required that the above defined procedure be used to generate matches. It is expected that implementations will incorporate different algorithms for performing searches of the databases. For a given query, the set of matches shall be equivalent to that which would be generated by the above procedure.

C.4.2 C-MOVE Operation

SCUs of some SOP Classes of the Query/Retrieve Service Class may generate retrievals using the C-MOVE operation as described in PS 3.7. The C-MOVE operation allows an application entity to instruct another application entity to transfer stored SOP Instances to another application entity using the C-STORE operation. Support for the C-MOVE service shall be agreed upon at Association establishment time by both the SCU and SCP of the C-MOVE in order for a C-MOVE operation to occur over the Association. The C-STORE sub-operations shall always be accomplished over an Association different from the Association which accomplishes the C-MOVE operation. Hence, the SCP of the Query/Retrieve Service Class serves as the SCU of the Storage Service Class.

Note: The application entity which receives the stored SOP Instances may or may not be the originator of the C-MOVE operation.
A C-MOVE request may be performed to any level of the Query/Retrieve Information Model. However, the transfer of stored SOP Instances may not be performed at this level. The level at which the transfer is performed depends upon the SOP Class (See Section C.6).

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C.4.2.1 C-MOVE Service Parameters

C.4.2.1.1 SOP Class UID

The SOP Class UID identifies the Query/Retrieve Information Model against which the C-MOVE is to be performed. Support for the SOP Class UID is implied by the Abstract Syntax UID of the Presentation Context used by this C-MOVE operation.

C.4.2.1.2 Priority

The Priority Attribute defines the requested priority of the C-MOVE operation and corresponding C-STORE sub-operations with respect to other DIMSE operations being performed by the same SCP.

Processing of priority requests is not required of SCPs. Whether or not an SCP supports priority processing, and the meaning of the different priority levels shall be stated in the Conformance Statement of the SCP. The same priority shall be used for all C-STORE sub-operations.

C.4.2.1.3 Move Destination

Move Destination specifies the Application Entity Title of the performer of the C-STORE sub-operations.

C.4.2.1.4 Identifier

The C-MOVE request shall contain an Identifier. The C-MOVE response shall conditionally contain an Identifier as required in C.4.2.1.4.2.

Note: The Identifier is specified as U in the definition of the C-MOVE primitive in PS 3.7 but is specialized for use with this service.

C.4.2.1.4.1 Request Identifier Structure

An Identifier in a C-MOVE request shall contain:

— the Query/Retrieve Level (0008,0052) which defines the level of the retrieval

— Unique Key Attributes which may include Patient ID (0010,0020), Study Instance UIDs (0020,000D), Series Instance UIDs (0020,000E), and the SOP Instance UIDs (0008,0018)

The Unique Keys at each level of the hierarchy and the values allowable for the level of the retrieval shall be defined in the SOP Class definition for the Query/Retrieve Information Model.

Note: In the Baseline behavior, more than one entity may be retrieved if the Query/Retrieve Level is IMAGE, SERIES or STUDY, using List of UID matching, but only Single Value Matching value may be specified for Patient ID (0010,0020).

C.4.2.1.4.2 Response Identifier Structure

The Failed SOP Instance UID List (0008,0058) specifies a list of UIDs of the C-STORE sub-operation SOP Instances for which this C-MOVE operation has failed. An Identifier in a C-MOVE response shall conditionally contain the Failed SOP Instance UID List (0008,0058) based on the C-MOVE response status value. If no C-STORE sub-operation failed, Failed SOP Instance UID List (0008,0058) is absent and therefore no Data Set shall be sent in the C-MOVE response.

The Identifier in a C-MOVE response with a status of:

— Canceled, Failed, Refused, or Warning shall contain the Failed SOP Instance UID List Attribute

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— Pending shall not contain the Failed SOP Instance UID List Attribute (no Data Set)

C.4.2.1.5 Status

Table C.4-2 defines the specific status code values which might be returned in a C-MOVE response. General status code values and fields related to status code values are defined in PS 3.7.

Table C.4-2
C-MOVE RESPONSE STATUS VALUES

Service Status	Further Meaning	Status Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform sub-operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
	Move Destination unknown	A801	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to Process	Cxxx	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures	B000	(0000,1020) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

C.4.2.1.6 Number of Remaining Sub-Operations

Inclusion of the Number of Remaining Sub-operations is conditional based upon the status in the C-MOVE response. The Number of Remaining Sub-operations specifies the number of Remaining C-STORE sub-operations necessary to complete the C-MOVE operation.

The Identifier in a C-MOVE response with a status of:

— Pending shall contain the Number of Remaining Sub-operations Attribute
— Canceled may contain the Number of Remaining Sub-operations Attribute

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— Warning, Failed, Refused, or Successful shall not contain the Number of Remaining Sub-operations Attribute

C.4.2.1.7 Number of Successful Sub-Operations

Inclusion of the Number of Successful Sub-operations is conditional based upon the status in the C-MOVE response. The Number of Successful sub-operations specifies the number of C-STORE sub-operations generated by the requested transfer which have completed successfully.

The Identifier in a C-MOVE response with a status of:

— Pending shall contain the Number of Successful Sub-operations Attribute
— Canceled, Warning, Failed, Refused, or Successful may contain the Number of Successful Sub-operations Attribute

C.4.2.1.8 Number of Failed Sub-Operations

Inclusion of the Number of Failed Sub-operations is conditional based upon the status in the C-MOVE response. The Number of Failed sub-operations specifies the number of C-STORE sub-operations generated by the requested transfer which have Failed.

The Identifier in a C-MOVE response with a status of:

— Pending shall contain the Number of Failed Sub-operations Attribute
— Canceled, Warning, Failed, Refused, or Successful may contain the Number of Failed Sub-operations Attribute

C.4.2.1.9 Number of Warning Sub-Operations

Inclusion of the Number of Warning Sub-operations is conditional based upon the status in the C-MOVE response. The Number of Warning sub-operations specifies the number of C-STORE sub-operations generated by the requested transfer which had a status of warning.

The Identifier in a C-MOVE response with a status of:

— Pending shall contain the Number of Warnings Sub-operations Attribute
— Canceled, Warning, Failed, Refused, or Successful may contain the Number of Warning Sub-operations Attribute

C.4.2.2 C-MOVE SCU Behavior

This Section discusses both the baseline and extended behavior of the C-MOVE SCU.

C.4.2.2.1 Baseline Behavior of SCU

An SCU conveys the following semantics with a C-MOVE request:

— The SCU shall supply a single value in the Unique Key Attribute for each level above the Query/Retrieve level. For the level of retrieve, the SCU shall supply one unique key if the level of retrieve is above the STUDY level and shall supply one UID, or a list of UIDs if a retrieval of several items is desired and the retrieve level is STUDY, SERIES or MAGE. The SCU shall also supply a move destination. The move destination shall be the DICOM Application Entity Title of a DICOM Application Entity capable of serving as the SCP of the Storage Service Class.

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- The SCU shall interpret responses to the C-MOVE with status equal to Pending during the processing of the C-STORE sub-operations. These responses shall indicate the number of Remaining, Successful, Failed, and Warning C-STORE sub-operations.
- The SCU shall interpret responses with a status equal to Success, Warning, Failed, or Refused as final responses. The final response shall indicate the number of Successful C-STORE sub-operations and the number of Failed C-STORE sub-operations resulting from the C-MOVE operation. The SCU shall interpret a status of:
  - Success to indicate that all sub-operations were successful
  - Warning to indicate one or more sub-operations were successful and one or more sub-operations were unsuccessful or had a status of warning, or all sub-operations had a status of warning
  - Failed or Refused to indicate all sub-operations were unsuccessful.
- The SCU may cancel the C-MOVE service by issuing a C-MOVE-CANCEL request at any time during the processing of the C-MOVE. The SCU shall interpret a C-MOVE response with a status of Canceled to indicate the transfer was canceled. The C-MOVE response with a status of Canceled shall contain the number of Successful, Failed, and Warning C-STORE sub-operations. If present, the Remaining sub-operations count shall contain the number of C-STORE sub-operations which were not initiated due to the C-MOVE-CANCEL request.

C.4.2.2.2 Extended Behavior of SCU

Extended SCU behavior shall be negotiated at Association establishment time. If an option within the extended behavior is not agreed upon in the negotiation, then only baseline SCU behavior shall be performed with respect to that option. Extended SCU behavior includes all baseline behavior with the following option:

- Relational-retrieve

C.4.2.2.2.1 Relational-Retrieve

The C-MOVE Service with relational-retrieve removes the restriction that the SCU supply Unique Key values for levels above the Query/Retrieve level to identify an entity at the level of the retrieval. Hence, the Identifier of a C-MOVE request may transfer:

- all composite object instances related to a study by only providing a Study Instance UID (0020,000D)
- all composite object instances related to a series by only providing a Series Instance UID (0020,000E)
- individual composite object instances by only providing a list of SOP Instance UIDs (0008,0018)

C.4.2.3 C-MOVE SCP Behavior

This section discusses both the baseline and extended behavior of the C-MOVE SCP.

C.4.2.3.1 Baseline Behavior of SCP

An SCP conveys the following semantics with a C-MOVE response:

- The SCP shall identify a set of Entities at the level of the transfer based upon the values in the Unique Keys in the Identifier of the C-MOVE request. The SCP shall initiate C-STORE sub-operations for the corresponding storage SOP Instances. These C-STORE sub-operations shall occur on a different Association from the C-MOVE operation. The SCP of the Query/Retrieve Service Class shall serve as an SCU of the Storage Service Class.

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- The SCP shall establish a new Association for the C-STORE sub-operations. A sub-operation is considered Failed if the SCP is unable to negotiate an appropriate presentation context for a given stored SOP Instance.
- The SCP shall initiate C-STORE sub-operations over the new Association for all stored SOP Instances related to the Patient ID, List of Study Instance UIDs, List of Series Instance UIDs, or List of SOP Instance UIDs depending on the Query/Retrieve level specified in the C-MOVE request.
- Optionally, the SCP may generate responses to the C-MOVE with status equal to Pending during the processing of the C-STORE sub-operations. These responses shall indicate the Remaining, Successful, Failed, and Warning C-STORE sub-operations.
- When the number of Remaining sub-operations reaches zero, the SCP shall generate a final response with a status equal to Success, Warning, Failed, or Refused. This response shall indicate the number of Successful sub-operations, the number of Failed sub-operations, and the number of sub-operations with Warning Status. The status contained in the C-MOVE response shall contain:
  - Successful if all sub-operations were successful
  - Warning if one or more sub-operations were successful and one or more sub-operations were unsuccessful or had a warning status
  - Warning if all sub-operations had a warning status
  - Failed or Refused if all sub-operations were unsuccessful
- The SCP may receive a C-MOVE-CANCEL request at any time during the processing of the C-MOVE. The SCP shall interrupt all C-STORE sub-operation processing and return a status of Canceled in the C-MOVE response. The C-MOVE response with a status of Canceled shall contain the number of Successful, Failed, and Warning C-STORE sub-operations. If present, the Remaining sub-operations count shall contain the number of C-STORE sub-operations which were not initiated due to the C-MOVE-CANCEL request.

C.4.2.3.2 Extended Behavior of SCP

Extended SCP behavior shall be negotiated at Association establishment time. If an option within the extended behavior is not agreed upon in the negotiation, then only baseline SCP behavior shall be performed with respect to that option. Extended SCP behavior includes all baseline behavior with the following option:

- Relational-retrieve

C.4.2.3.2.1 Relational-Retrieve

The C-MOVE Service with relational-retrieve removes the restriction that the SCU supply Unique Key values for levels above the Query/Retrieve level to help identify an entity at the level of the retrieval. Hence, the Identifier of a C-MOVE request may specify the transfer of:

- all composite object instances related to a study by only providing a Study Instance UID (0020,000D)
- all composite object instances related to a series by only providing a Series Instance UID (0020,000E)
- individual composite object instances by only providing a list of SOP Instance UIDs (0008,0018)

C.4.3 C-GET Operation

SCUs of some SOP Classes of the Query/Retrieve Service Class may generate retrievals using the C-GET operation as described in PS 3.7. The C-GET operation allows an application entity to

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instruct another application entity to transfer stored SOP Instances to the initiating application entity using the C-STORE operation. Support for the C-GET service shall be agreed upon at Association establishment time by both the SCU and SCP of the C-GET in order for a C-GET operation to occur over the Association. The C-STORE Sub-operations shall be accomplished on the same Association as the C-GET operation. Hence, the SCP of the Query/Retrieve Service Class serves as the SCU of the Storage Service Class.

Note: The application entity which receives the stored SOP Instances is always the originator of the C-GET operation.

A C-GET request may be performed to any level of the Query/Retrieve Information Model. However, the transfer of stored SOP Instances may not be performed at this level. The level at which the transfer is performed depends upon the SOP Class.

C.4.3.1 C-GET Service Parameters

C.4.3.1.1 SOP Class UID

The SOP Class UID identifies the Query/Retrieve Information Model against which the C-GET is to be performed. Support for the SOP Class UID is implied by the Abstract Syntax UID of the Presentation Context used by this C-GET operation.

C.4.3.1.2 Priority

The Priority Attribute defines the requested priority of the C-GET operation and corresponding C-STORE sub-operations with respect to other DIMSE operations being performed by the same SCP.

Processing of priority requests is not required of SCPs. Whether or not an SCP supports priority processing, and the meaning of the different priority levels shall be stated in the Conformance Statement of the SCP. The same priority shall be used for all C-STORE sub-operations.

C.4.3.1.3 Identifier

The C-GET request shall contain an Identifier. The C-GET response shall conditionally contain an Identifier as required in C.4.3.1.3.2.

Note: The Identifier is specified as U in the definition of the C-GET primitive in PS 3.7 but is specialized for use with this service.

C.4.3.1.3.1 Request Identifier Structure

An Identifier in a C-GET request shall contain:

— the Query/Retrieve Level (0008,0052) which defines the level of the retrieval
— Unique Key Attributes which may include Patient ID (0010,0020), Study Instance UIDs (0020,000D) Series Instance UIDs (0020,000E), and SOP Instance UIDs (0008,0018)

The Unique Keys at each level of the hierarchy and the values allowable for the level of the retrieval shall be defined in the SOP Class definition for the Query/Retrieve Information Model.

Note: In the Baseline behavior, more than one entity may be retrieved if the Query/Retrieve Level is IMAGE, SERIES or STUDY, using List of UID matching, but only Single Value Matching value may be specified for Patient ID (0010,0020).

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C.4.3.1.3.2 Response Identifier Structure

The Failed SOP Instance UID List (0008,0058) specifies a list of UIDs of the C-STORE sub-operation SOP Instances for which this C-GET operation has failed. An Identifier in a C-GET response shall conditionally contain the Failed SOP Instance UID List (0008,0058) based on the C-GET response. If no C-STORE sub-operation failed, Failed SOP Instance UID List (0008,0058) is absent and therefore no Data Set shall be sent in the C-GET response.

The Identifier in a C-GET response with a status of:

- Canceled, Failed, Refused, or Warning shall contain the Failed SOP Instance UID List Attribute
- Pending shall not contain the Failed SOP Instance UID List Attribute (no Data Set)

C.4.3.1.4 Status

Table C.4-3 defines the specific status code values which might be returned in a C-GET response. General status code values and fields related to status code values are defined in PS 3.7.

Table C.4-3
C-GET RESPONSE STATUS VALUES

Service Status	Further Meaning	Status Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform sub-operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures or Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warnings	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

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C.4.3.1.5 Number of Remaining Sub-Operations

Inclusion of the Number of Remaining Sub-operations is conditional based upon the status in the C-GET response. The Number of Remaining Sub-operations specifies the number of Remaining C-STORE sub-operations necessary to complete the C-GET operation.

The Identifier in a C-GET response with a status of:

- Pending shall contain the Number of Remaining Sub-operations Attribute
- Canceled may contain the Number of Remaining Sub-operations Attribute
- Warning, Failed, Refused, or Successful shall not contain the Number of Remaining Sub-operations Attribute.

C.4.3.1.6 Number of Successful Sub-Operations

Inclusion of the Number of Successful Sub-operations is conditional based upon the status in the C-GET response. The Number of Successful Sub-operations specifies the number of C-STORE sub-operations generated by the requested transfer which have completed successfully.

The Identifier in a C-GET response with a status of:

- Pending shall contain the Number of Successful Sub-operations Attribute
- Canceled, Warning, Failed, Refused, or Successful may contain the Number of Successful Sub-operations Attribute

C.4.3.1.7 Number of Failed Sub-Operations

Inclusion of the Number of Failed Sub-operations is conditional based upon the status in the C-GET response. The Number of Failed Sub-operations specifies the number of C-STORE sub-operations generated by the requested transfer which have Failed.

The Identifier in a C-GET response with a status of:

- Pending shall contain the Number of Failed Sub-operations Attribute
- Canceled, Warning, Failed, Refused, or Successful may contain the Number of Failed Sub-operations Attribute

C.4.3.1.8 Number of Warning Sub-Operations

Inclusion of the Number of Warning Sub-operations is conditional based upon the status in the C-GET response. The Number of Warning Sub-operations specifies the number of C-STORE sub-operations generated by the requested transfer which had a status of Warning.

The Identifier in a C-GET response with a status of:

- Pending shall contain the Number of Warning Sub-operations Attribute
- Canceled, Warning, Failed, Refused, or Successful may contain the Number of Warning Sub-operations Attribute

C.4.3.2 C-GET SCU Behavior

This Section discusses both the baseline and extended behavior of the C-GET SCU.

C.4.3.2.1 Baseline Behavior of SCU

An SCU conveys the following semantics with a C-GET request:

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- The SCU shall have proposed sufficient presentation contexts at Association establishment time to accommodate expected C-STORE sub-operations which shall occur over the same Association. The SCU of the Query/Retrieve Service Class shall serve as the SCP of the Storage Service Class.
- The SCU shall supply a single value in the Unique Key Attribute for each level above the Query/Retrieve level. For the level of retrieve, the SCU shall supply one unique key if the level of the retrieve is above the STUDY level and shall supply one UID, or a list of UIDs if a retrieval of several items is desired and the retrieve level is STUDY, SERIES or IMAGE.
- The SCU shall interpret C-GET responses with status equal to Pending during the processing of the C-STORE sub-operations. These responses shall indicate the number of Remaining, Successful, Failed, Warning C-STORE sub-operations.
- The SCU shall interpret a C-GET response with a status equal to Success, Warning, Failed, or Refused as a final response. The final response shall indicate the number of Successful sub-operations and the number of Failed C-STORE sub-operations resulting from the C-GET operation. The SCU shall interpret a status of:
  - Success to indicate that all sub-operations were successful
  - Warning to indicate one or more sub-operations were successful and one or more unsuccessful or all sub-operations had a status of warning
  - Failed or Refused to indicate all sub-operations were unsuccessful
- The SCU may cancel the C-GET operation by issuing a C-GET-CANCEL request at any time during the processing of the C-GET request. A C-GET response with a status of Canceled shall indicate to the SCU that the retrieve was canceled. Optionally, the C-GET response with a status of Canceled shall indicate the number of Successful, Failed, and Warning C-STORE sub-operations. If present, the Remaining sub-operations count shall contain the number of C-STORE sub-operations which were not initiated due to the C-GET-CANCEL request.

C.4.3.2.2 Extended Behavior of SCU

Extended SCU behavior shall be negotiated at Association establishment time. If an option within the extended behavior is not agreed upon in the negotiation, then only baseline SCU behavior shall be supported with respect to that option. Extended SCU behavior includes all baseline behavior with the following option:

- Relational-retrieve

C.4.3.2.2.1 Relational-Retrieve

The C-GET Service with relational-retrieve removes the restriction that the SCU supply Unique Key values for levels above the Query/Retrieve level to help identify an entity at the level of the retrieval. Hence, the Identifier of a C-GET request may retrieve:

- all composite object instances related to a study by providing a Study Instance UID (0020,000D)
- all composite object instances related to a series by providing a Series Instance UID (0020,000E)
- individual composite object instances by providing a list of SOP Instance UIDs (0008,0018)

C.4.3.3 C-GET SCP Behavior

This Section discusses both the baseline and extended behavior of the C-GET SCP.

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C.4.3.3.1 Baseline Behavior of SCP

An SCP conveys the following semantics with a C-GET response:

- The SCP shall identify a set of Entities at the level of the retrieval based upon the values in the Unique Keys in the Identifier of the C-GET request. The SCP shall initiate C-STORE sub-operations for the corresponding storage SOP Instances. The SCP of the Query/Retrieve Service Class shall serve as an SCU of the Storage Service Class.
- The SCP shall initiate C-STORE sub-operations over the same Association for all stored SOP Instances related to the Patient ID, List of Study Instance UIDs, List of Series Instance UIDs, or List of SOP Instance UIDs depending on the Query/Retrieve level specified in the C-GET request
- A sub-operation is considered Failed if the SCP is unable to initiate a C-STORE sub-operation because the Query/Retrieve SCU did not offer an appropriate presentation context for a given stored SOP Instance.
- Optionally, the SCP may generate responses to the C-GET with status equal to Pending during the processing of the C-STORE sub-operations. These responses shall indicate the number of Remaining, Successful, Failed, and Warning C-STORE sub-operations.
- When the number of Remaining sub-operations reaches zero, the SCP shall generate a final response with a status equal to Success, Warning, Failed, or Refused. The status contained in the C-GET response shall contain:
  - Success if all sub-operations were successful
  - Warning if one or more sub-operations were successful and one or more sub-operations were unsuccessful or had a status of warning
  - Warning if all sub-operations had a status of Warning
  - Failed or Refused if all sub-operations were unsuccessful
- The SCP may receive a C-GET-CANCEL request at any time during the processing of the C-GET request. The SCP shall interrupt all C-STORE sub-operation processing and return a status of Canceled in the C-GET response. The C-GET response with a status of Canceled shall contain the number of Successful, Failed, and Warning C-STORE sub-operations. If present, the Remaining sub-operations count shall contain the number of C-STORE sub-operations which were not initiated due to the C-GET-CANCEL request.

C.4.3.3.2 Extended Behavior of SCP

Extended SCP behavior shall be negotiated at Association establishment time. If an option within the extended behavior is not agreed upon in the negotiation, then only baseline SCP behavior shall be performed with respect to that option. Extended SCP behavior includes all baseline behavior with the following option:

- Relational-retrieve

C.4.3.3.2.1 Relational-Retrieve

The C-GET Service with relational-retrieve removes the restriction that the SCU supply Unique Key values for levels above the Query/Retrieve level to help identify an entity at the level of the retrieval. Hence, the Identifier of a C-GET request may retrieve:

- all composite object instances related to a study by providing a Study Instance UID
- all composite object instances related to a series by providing a Series Instance UID
- individual composite object instances by providing a list of SOP Instance UIDs

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C.5 ASSOCIATION NEGOTIATION

Association establishment is the first phase of any instance of communication between peer DICOM AEs. AEs supporting DICOM Query/Retrieve SOP Classes utilize Association establishment negotiation by defining the use of Application Association Information. See PS 3.7 for an overview of Association negotiation.

SOP Classes of the Query/Retrieve Service Class, which include query services based on the C-FIND operation, may use SOP Class Extended Negotiation Sub-Item to negotiate options such as Relational-queries.

SOP Classes of the Query/Retrieve Service Class, which include retrieval services based on the C-MOVE and C-GET operations, may use the SOP Class Extended Negotiation Sub-Item to negotiate relational-retrieval.

SOP Classes of the Query/Retrieve Service Class, which include retrieval services based on the C-GET operation, use the SCP/SCU Role Selection Sub-Item to identify the SOP Classes which may be used for retrieval.

C.5.1 Association Negotiation for C-FIND SOP Classes

The following negotiation rules apply to DICOM SOP Classes and Specialized DICOM SOP Classes of the Query/Retrieve Service Class which include the C-FIND operation.

The Association-requester (query SCU role) shall convey in the A-ASSOCIATE request:

- one Abstract Syntax, in a Presentation Context, for each query based SOP Class supported
- optionally, one SOP Class Extended Negotiation Sub-Item, for each query based SOP Class

The Association-acceptor (query SCP role) of an A-ASSOCIATE request shall accept:

- one Abstract Syntax, in a Presentation Context, for each query based SOP Class supported
- optionally, one SOP Class Extended Negotiation Sub-Item, for each query based SOP Class

C.5.1.1 SOP Class Extended Negotiation

The SOP Class Extended Negotiation allows, at Association establishment, peer DICOM AEs to exchange application Association information defined by specific SOP Classes. This is achieved by defining the Service-class-application-information field. The Service-class-application-information field is used to define support for relational-queries.

This negotiation is optional. If absent, the default conditions shall be:

- no relational-query support

The Association-requester, for each SOP Class, may use one SOP Class Extended Negotiation Sub-Item. The SOP Class is identified by the corresponding Abstract Syntax Name (as defined by PS 3.7) followed by the Service-class-application-information field. This field defines:

- relational-query support by the Association-requester

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The Association-acceptor, for each SOP Class Extended Negotiation Sub-Item offered, either accepts the Association-requester proposal by returning the same value (1) or turns down the proposal by returning the value (0)

If the SOP Class Extended Negotiation Sub-Item is not returned by the Association-acceptor then relational-queries are not supported over the Association (default condition).

If the SOP Class Extended Negotiation Sub-Items do not exist in the A-ASSOCIATE indication they shall be omitted in the A-ASSOCIATE response.

C.5.1.1.1 SOP Class Extended Negotiation Sub-Item Structure (A-ASSOCIATE-RQ)

The SOP Class Extended Negotiation Sub-Item consists of a sequence of mandatory fields as defined by PS 3.7. Table C.5-1 defines the Service-class-application-information field for DICOM Query/Retrieve SOP Classes and Specialized DICOM Query/Retrieve SOP Classes which include the C-FIND operation.

Table C.5-1—SOP CLASS EXTENDED NEGOTIATION SUB-ITEM (service-class-application-information field)—A-ASSOCIATE-RQ

Item Bytes	Field Name	Description of Field
1	Relational-queries	This byte field defines relational-query support by the Association-requester. It shall be encoded as an unsigned binary integer and shall use one of the following values 0 - relational queries not supported 1 - relational queries supported

C.5.1.1.2 SOP Class Extended Negotiation Sub-Item Structure (A-ASSOCIATE-AC)

The SOP Class Extended Negotiation Sub-Item is made of a sequence of mandatory fields as defined by PS 3.7. Table C.5-2 defines the Service-class-application-information field for DICOM Query/Retrieve SOP Classes and Specialized DICOM Query/Retrieve SOP Classes which include the C-FIND operation.

Table C.5-2—SOP CLASS EXTENDED NEGOTIATION SUB-ITEM (service-class-application-information field)—A-ASSOCIATE-AC

Item Bytes	Field Name	Description of Field
1	Relational-queries	This byte field defines relational-query support for the Association-acceptor. It shall be encoded as an unsigned binary integer and shall use one of the following values 0 - relational-queries not supported 1 - relational-queries supported

C.5.2 Association Negotiation for C-MOVE SOP Classes

The following negotiation rules apply to DICOM SOP Classes and Specialized DICOM SOP Classes of the Query/Retrieve Service Class which include the C-MOVE operation.

The Association-requester (retrieval SCU role) shall convey in the A-ASSOCIATE request:

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— one Abstract Syntax, in a Presentation Context, for each retrieval based SOP Class supported
— optionally, one SOP Class Extended Negotiation Sub-Item, for each retrieval based SOP Class

The Association-acceptor (retrieval SCP role) of an A-ASSOCIATE request shall accept:

— one Abstract Syntax, in a Presentation Context, for each retrieval based SOP Class supported
— optionally, one SOP Class Extended Negotiation Sub-Item, for each retrieval based SOP Class

C.5.2.1 SOP Class Extended Negotiation

The SOP Class Extended Negotiation allows, at Association establishment, peer DICOM AEs to exchange application Association information defined by specific SOP Classes. This is achieved by defining the Service-class-application-information field. The Service-class-application-information field is used to define support for relational-retrievals.

This negotiation is optional. If absent, the default condition shall be:

— no relational-retrieval support

The Association-requester, for each SOP Class, may use one SOP Class Extended Negotiation Sub-Item. The SOP Class is identified by the corresponding Abstract Syntax Name (as defined by PS 3.7) followed by the Service-class-application-information field. This field defines:

— relational-retrieval support by the Association-requester

The Association-acceptor, for each SOP Class Extended Negotiation Sub-Item offered, either accepts the Association-requester proposal by returning the same value (1) or turns down the proposal by returning the value (0).

If the SOP Class Extended Negotiation Sub-Item is not returned by the Association-acceptor then relational-retrievals are not supported (default condition)

If the SOP Class Extended Negotiation Sub-Items do not exist in the A-ASSOCIATE indication they shall be omitted in the A-ASSOCIATE response.

C.5.2.1.1 SOP Class Extended Negotiation Sub-Item Structure (A-ASSOCIATE-RQ)

The SOP Class Extended Negotiation Sub-Item consists of a sequence of mandatory fields as defined by PS 3.7. Table C.5-3 defines the Service-class-application-information field for DICOM Query/Retrieve SOP Classes and Specialized DICOM Query/Retrieve SOP Classes which include the C-MOVE and C-GET operations.

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Table C.5-3—SOP CLASS EXTENDED NEGOTIATION SUB-ITEM (service-class-application-information field)—A-ASSOCIATE-RQ

Item Bytes	Field Name	Description of Field
1	Relational-retrieval	This byte field defines relational-retrieval support by the Association-requester. It shall be encoded as an unsigned binary integer and shall use one of the following values 0 - relational-retrieval not supported 1 - relational-retrieval supported

C.5.2.1.2 SOP Class Extended Negotiation Sub-Item Structure (A-ASSOCIATE-AC)

The SOP Class Extended Negotiation Sub-Item consists of a sequence of mandatory fields as defined by PS 3.7. Table C 5-4 defines the Service-class-application-information field for DICOM Query/Retrieve SOP Classes and Specialized DICOM Query/Retrieve SOP Classes which include the C-MOVE and C-GET operations.

Table C.5-4—SOP CLASS EXTENDED NEGOTIATION SUB-ITEM (service-class-application-information field)—A-ASSOCIATE-AC

Item Bytes	Field Name	Description of Field
1	Relational-retrieval	This byte field defines relational-retrieval support for the Association-acceptor. It shall be encoded as an unsigned binary integer and shall use one of the following values 0 - relational-retrievals not supported 1 - relational-retrievals supported

C.5.3 Association Negotiation for C-GET SOP Classes

When an SCP performs the C-GET operation it induces a C-STORE operation for the purpose of transmitting composite SOP Instances for Storage. This induced C-STORE operation (called a sub-operation) requires a switch from the C-GET Presentation Context to a Presentation Context that supports the specific C-STOREsub-operation.

The following negotiation rules apply to retrieval based DICOM Query/Retrieve SOP Classes and Specialized DICOM Query/Retrieve SOP Classes which include the C-GET operation.

The Association-requester (retrieve SCU role) in the A-ASSOCIATE request shall convey:

a) C-GET operation support with:
   - one Abstract Syntax, in a Presentation Context, for each SOP Class supported
   - and optionally, one SOP Class Extended Negotiation Sub-Item, for each retrieval based SOP Class

b) Induced Storage sub-operation support where the SOP Class (in the retrieval SCU role) is acting as a Storage SOP Class in the SCP Role. See Figure C.5-1. For each supported Storage SOP Class, the A-ASSOCIATE request contains:
   - one Abstract Syntax in a Presentation Context

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— one SCP/SCU Role Selection Negotiation Sub-item with the SCP-role field set to indicate support of the SCP role. The SCP/SCU Role Selection Negotiation shall be used as defined in PS 3.7.

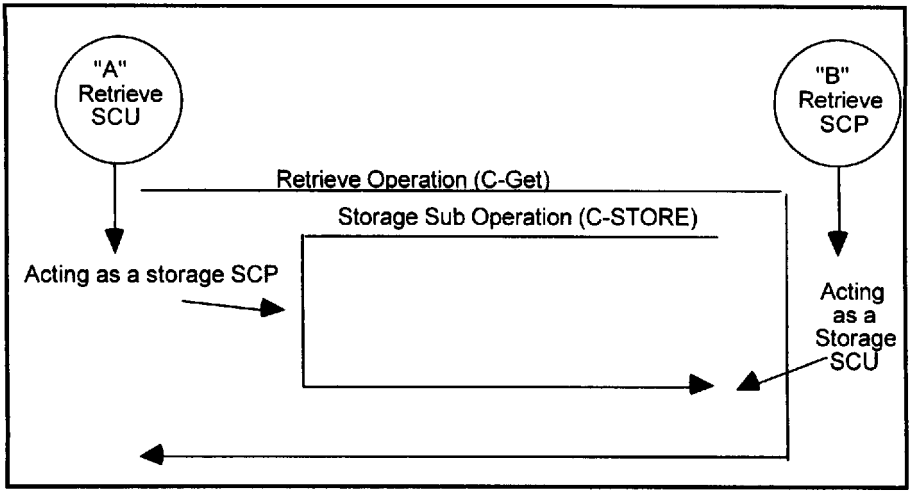

Figure C.5-1
AN EXAMPLE OF THE SUB-OPERATION SCU/SCP ROLES

Note: This negotiation does not place any requirements on the SCU-flag of the SCP/SCU Role Selection Negotiation Sub-Item. It may be set if the Association-requester supports the Storage Service Class in the SCU role.

The Association-acceptor (retrieve SCP role) in the A-ASSOCIATE response shall convey:

a) C-GET operation support with:
   — one Abstract Syntax, in a Presentation Context, for each SOP Class supported
b) Induced Storage sub-operation support where the SOP Class (using the retrieval SCP role) is acting as a Storage SOP Class in the SCU Role. See Figure C.5-1. For each supported Storage SOP Class, the A-ASSOCIATE response contains both:
   — one Abstract Syntax, in a Presentation Context
   — one SCP/SCU Role Selection Negotiation Sub-item with the SCP-role field set to indicate the acceptance of the Association-requester's support of the SCP role. The SCP/SCU Role Selection Negotiation shall be used as defined in PS 3.7.

Note: The negotiation does not place any requirements on the SCU-flag of the SCP/SCU Role Selection Negotiation Sub-Item. It may be set if the Association-acceptor accepts the Storage SCP role. Figure C.5-2 illustrates an example of the retrieve (C-GET) negotiation.

Figure C.5-2 illustrates an example of the retrieve (C-GET) negotiation.

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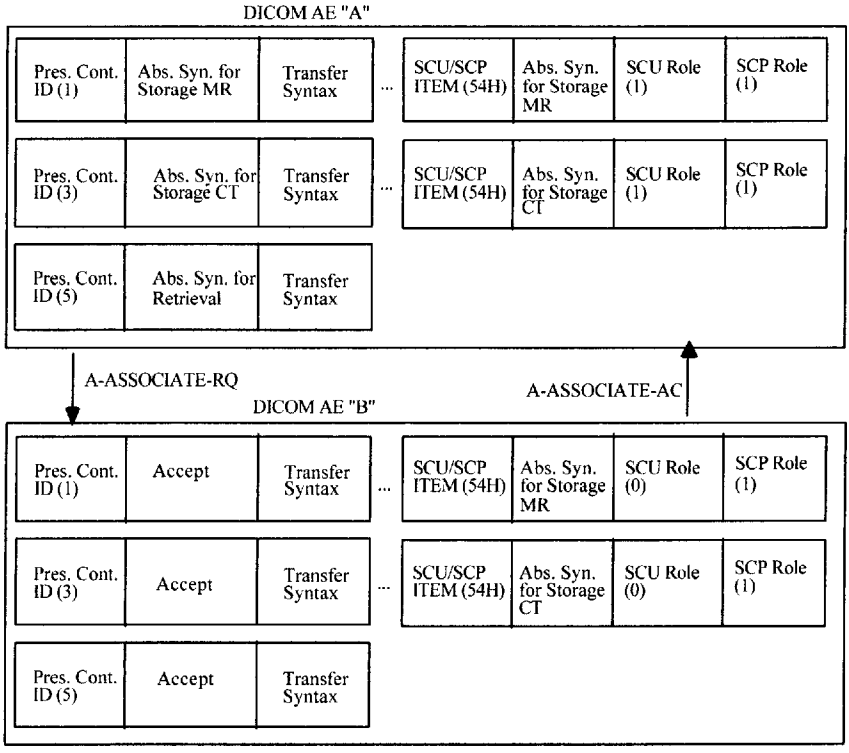
C.5.3.1 SOP Class Extended Negotiation

The SOP Class Extended Negotiation allows, at Association establishment, peer DICOM AEs to exchange application Association information defined by specific SOP Classes.

This is achieved by defining the Service-class-application-information field. The Service-class-application-information field is used to define support for relational-retrievals.



- AE "B" accepts the role of Retrieve SCP
- AE "B" rejects the role of Storage SCP (Does not allow AE "A" to be a Storage SCU)

Figure C.5-2
AN EXAMPLE OF THE RETRIEVE (C-GET) NEGOTIATION

Extended negotiation for SOP Classes based on the retrieval services which include C-GET operations is identical to the negotiation defined for C-MOVE which is defined in Section C.5.2.1 of this Annex.

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Extended negotiation for the SOP Classes of the Storage Service Class (for the C-STORE sub-operation) is defined in Annex B.

C.6 SOP CLASS DEFINITIONS

C.6.1 Patient Root SOP Class Group

In the Patient Root Query/Retrieve Information Model, the information is arranged into four levels which correspond to one of the following four values in element (0008,0052):

Query/Retrieve Level	Value in (0008,0052)
Patient Information	PATIENT
Study Information	STUDY
Series Information	SERIES
Composite object instance Information	IMAGE

Note: The use of the word "Images" rather than "composite object instances" is historical to allow backward compatibility with previous versions of the standard. It should not be taken to mean that composite object instances of other than image type are not included at the level indicated by the value IMAGE.

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C.6.1.1 Patient Root Query/Retrieve Information Model

C.6.1.1.1 E/R Model

The Patient Root Query/Retrieve Information Model may be represented by the entity relationship diagram shown in Figure C.6-1.

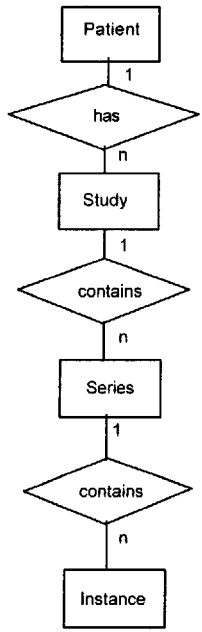

Figure C.6-1
PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM

C.6.1.1.2 Patient Level

Table C.6-1 defines the Attributes at the Patient Query/Retrieve level of the Patient Root Query/Retrieve Information Model.

Notes: 1. A description of the attributes of this Information Model is contained in Section C.3 of this part.

2. Although the Patient ID may not be globally unique, the Study Instance UID is globally unique ensuring that no two studies may be misidentified.

Table C.6-1
PATIENT LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Description	Tag	Type
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	U

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Referenced Patient Sequence	(0008,1120)	O
>Referenced SOP Class UID	(0008,1150)	O
>Referenced SOP Instance UID	(0008,1155)	O
Patient's Birth Date	(0010,0030)	O
Patient's Birth Time	(0010,0032)	O
Patient's Sex	(0010,0040)	O
Other Patient IDs	(0010,1000)	O
Other Patient Names	(0010,1001)	O
Ethnic Group	(0010,2160)	O
Patient Comments	(0010,4000)	O
Number of Patient Related Studies	(0020,1200)	O
Number of Patient Related Series	(0020,1202)	O
Number of Patient Related Instances	(0020,1204)	O

C.6.1.1.3 Study Level

Table C.6-2 defines the keys at the Study Information level of the Patient Root Query/Retrieve Information Model.

Notes: 1. A description of the attributes of this Information Model is contained in Section C.3 of this Part.

2. Although the Patient ID may not be globally unique, the Study Instance UID is globally unique ensuring that no two studies may be mis-identified.

Table C.6-2
STUDY LEVEL KEYS FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U
Modalities in Study	(0008,0061)	O
Referring Physician's Name	(0008,0090)	O
Study Description	(0008,1030)	O
Procedure Code Sequence	(0008,1032)	O
>Code Value	(0008,0100)	O
>Coding Scheme Designator	(0008,0102)	O
>Coding Scheme Version	(0008,0103)	O
>Code Meaning	(0008,0104)	O

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Name of Physician(s) Reading Study	(0008,1060)	O
Admitting Diagnoses Description	(0008,1080)	O
Referenced Study Sequence	(0008,1110)	O
>Referenced SOP Class UID	(0008,1150)	O
>Referenced SOP Instance UID	(0008,1155)	O
Patient's Age	(0010,1010)	O
Patient's Size	(0010,1020)	O
Patient's Weight	(0010,1030)	O
Occupation	(0010,2180)	O
Additional Patient History	(0010,21B0)	O
Other Study Numbers	(0020,1070)	O
Number of Study Related Series	(0020,1206)	O
Number of Study Related Instances	(0020,1208)	O
Interpretation Author	(4008,010C)	O

C.6.1.1.4 Series Level

Table C.6-3 defines the keys at the Series Information level of the Patient Root Query/Retrieve Information Model.

Table C.6-3
SERIES LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Description	Tag	Type
Modality	(0008,0060)	R
Series Number	(0020,0011)	R
Series Instance UID	(0020,000E)	U
Number of Series Related Instances	(0020,1209)	O
All Other Attributes at Series Level		O

Note: The Attribute Number of Series Related Instances is an optional key. It is, however recognized as a broadly needed key and return attribute which SCPs are strongly encouraged to support.

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C.6.1.1.5 Composite object Instance Level

Table C.6-4 defines the keys at the Composite object instance Information level of the Patient Root Query/Retrieve Information Model.

Table C.6-4
COMPOSITE OBJECT INSTANCE LEVEL KEYS FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL

Description	Tag	Type
Instance Number	(0020,0013)	R
Overlay Number	(0020,0022)	O
Curve Number	(0020,0024)	O
LUT Number	(0020,0026)	O
SOP Instance UID	(0008,0018)	U
All Other Attributes at composite object instance Level		O

Notes: Ideally, Overlay Number (0020,0022), Curve Number (0020,0024), LUT Number (0020,0026) and Report Number (0020,00AA) would be of Type R rather than Type O to require an SCP to match on these keys. However for backward compatibility with SCPs that are not aware of the revised model, they remain Type O. An SCP that is aware of the revised model can state in its Conformance Statement that matching on these keys IS performed. Instance Number (0020,0013), if present in non-image objects is the preferred key if present in revised objects.

C.6.1.1.6 Scope of the GET and MOVE Commands and Sub-Operations

A C-MOVE or C-GET request may be performed to any level of the Query/Retrieve Model. However, the transfer of Stored SOP Instances shall always take place at the Composite object instance level. A C-MOVE or C-GET where the Query/Retrieve level is the:

- PATIENT level indicates that all composite object instances related to a Patient shall be transferred.
- STUDY level indicates that all composite object instances related to a Study shall be transferred.
- SERIES level indicates that all composite object instances related to a Series shall be transferred.
- IMAGE level indicates that selected individual composite object instances shall be transferred.

Note: In the Baseline behavior, more than one entity may be retrieved if the Query/Retrieve Level is IMAGE, SERIES or STUDY, using List of UID matching, but only Single Value Matching value may be specified for Patient ID (0010,0020).

C.6.1.2 Conformance Requirements

An implementation may conform to one of the SOP Classes of the Patient Root SOP Class Group as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

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C.6.1.2.1 SCU Conformance

C.6.1.2.1.1 C-FIND SCU Conformance

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group shall support queries against the Query/Retrieve Information Model described in Section C.6.1.1 using the baseline C-FIND SCU Behavior described in Section C.4.1.2.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCU shall state in its Conformance Statement whether it supports Optional Keys. If it supports Optional Keys, then it shall list the Optional Keys which it supports.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCU shall state in its Conformance Statement whether it may generate Relational-queries. If it supports Relational-queries, then it shall also support extended negotiation.

C.6.1.2.1.2 C-MOVE SCU Conformance

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCU shall support transfers against the Query/Retrieve Information Model described in Section C.6.1.1 using the C-MOVE SCU Behavior described in Section C.4.2.2.

C.6.1.2.1.3 C-GET SCU Conformance

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCU shall support retrievals against the Query/Retrieve Information Model described in Section C.6.1.1 using the C-GET SCU Behavior described in Section C.4.3.2.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCU, which generates retrievals using the C-GET operation, shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-GET.

C.6.1.2.2 SCP Conformance

C.6.1.2.2.1 C-FIND SCP Conformance

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group shall support queries against the Query/Retrieve Information Model described in Section C.6.1.1 using the C-FIND SCP Behavior described in Section C.4.1.3.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP shall state in its Conformance Statement whether it supports Optional Keys. If it supports Optional Keys, then it shall list the Optional Keys which it supports.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP shall state in its Conformance Statement whether it supports Relational-queries. If it supports Relational-queries, then it shall also support extended negotiation.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP shall state in its Conformance Statement whether it supports case-insensitive matching for PN VR attributes and list attributes for which this applies.

C.6.1.2.2.2 C-MOVE SCP Conformance

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP shall support transfers against the Query/Retrieve Information Model described in Section C.6.1.1 using the C-MOVE SCP Behavior described in Section C.4.2.3.

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An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP, which generates transfers using the C-MOVE operation shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-MOVE.

C.6.1.2.2.3 C-GET SCP Conformance

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP shall support retrievals against the Query/Retrieve Information Model described in Section C.6.1.1 using the C-GET SCP Behavior described in Section C.4.3.3.

An implementation which conforms to one of the SOP Classes of the Patient Root SOP Class Group as an SCP, which generates retrievals using the C-GET operation, shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-GET.

C.6.1.3 SOP Classes

The SOP Classes in the Patient Root Query SOP Class Group of the Query/Retrieve Service Class identify the Patient Root Query/Retrieve Information Model, and the DIMSE-C operations supported. The following Standard SOP Classes are identified:

SOP Class Name	SOP Class UID
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3

C.6.2 Study Root SOP Class Group

In the Study Root Query/Retrieve Information Model, the information is arranged into three levels which correspond to one of the following three values in element (0008,0052):

Query/Retrieve Level	Value in (0008,0052)
Study Information	STUDY
Series Information	SERIES
Composite object instance Information	IMAGE

Note: The use of the word "Images" rather than "composite object instances" is historical to allow backward compatibility with previous versions of the standard. It should not be taken to mean that composite object instances of other than image type are not included at the level indicated by the value IMAGE.

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C.6.2.1 Study Root Query/Retrieve Information Model

C.6.2.1.1 E/R Model

The Study Root Query/Retrieve Information Model may be represented by the entity relationship diagram shown in Figure C.6-2.

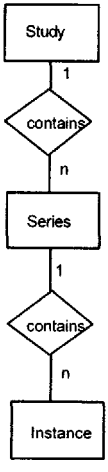

Figure C.6-2
STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM

C.6.2.1.2 Study level

Table C.6-5 defines the keys at the Study Information level of the Study Root Query/Retrieve Information Model.

Notes: 1. A description of the attributes of this Information Model is contained in Section C.3.

2. Although the Patient ID may not be globally unique, the Study Instance UID is globally unique ensuring that no two studies may be mis-identified.

Table C.6-5
STUDY LEVEL KEYS FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	R
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U

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Modalities in Study	(0008,0061)	O
Referring Physician's Name	(0008,0090)	O
Study Description	(0008,1030)	O
Procedure Code Sequence	(0008,1032)	O
>Code Value	(0008,0100)	O
>Coding Scheme Designator	(0008,0102)	O
>Coding Scheme Version	(0008,0103)	O
>Code Meaning	(0008,0104)	O
Name of Physician(s) Reading Study	(0008,1060)	O
Admitting Diagnoses Description	(0008,1080)	O
Referenced Study Sequence	(0008,1110)	O
>Referenced SOP Class UID	(0008,1150)	O
>Referenced SOP Instance UID	(0008,1155)	O
Referenced Patient Sequence	(0008,1120)	O
>Referenced SOP Class UID	(0008,1150)	O
Referenced SOP Instance UID	(0008,1155)	O
Patient's Birth Date	(0010,0030)	O
Patient's Birth Time	(0010,0032)	O
Patient's Sex	(0010,0040)	O
Other Patient IDs	(0010,1000)	O
Other Patient Names	(0010,1001)	O
Patient's Age	(0010,1010)	O
Patient's Size	(0010,1020)	O
Patient's Weight	(0010,1030)	O
Ethnic Group	(0010,2160)	O
Occupation	(0010,2180)	O
Additional Patient History	(0010,21B0)	O
Patient Comments	(0010,4000)	O
Other Study Numbers	(0020,1070)	O
Number of Patient Related Studies	(0020,1200)	O
Number of Patient Related Series	(0020,1202)	O
Number of Patient Related Instances	(0020,1204)	O
Number of Study Related Series	(0020,1206)	O
Number of Study Related Instances	(0020,1208)	O
Interpretation Author	(4008,010C)	O

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Note: The use of the word "Images" rather than "composite object instances" is historical, and should not be taken to mean that composite object instances of other than image type are not included in the number.

C.6.2.1.3 Series Level

Attributes for the Series Level of the Study Root Query/Retrieve Information Model are the same as the Attributes for the Series Level of the Patient Root Query/Retrieve Information Model described in Section C.6.1.1.4.

C.6.2.1.4 Composite object instance Level

Attributes for the Composite object instance Level of the Study Root Query/Retrieve Information Model are the same as the Attributes for the Composite object instance Level of the Patient Root Query/Retrieve Information Model described in Section C.6.1.1.5.

C.6.2.1.5 Scope of The GET and MOVE Commands and Sub-Operations

A C-MOVE or C-GET request may be performed to any level of the Query/Retrieve Model. However, the transfer of Stored SOP Instances shall always take place at the Composite object instance level. A C-MOVE or C-GET where the Query/Retrieve level is the:

- STUDY level indicates that all composite object instances related to a Study shall be transferred
- SERIES level indicates that all composite object instances related to a Series shall be transferred
- IMAGE level indicates that selected individual composite object instances shall be transferred

Note: In the Baseline behavior, more than one entity may be retrieved if the Query/Retrieve Level is IMAGE, SERIES or STUDY, using List of UID matching.

C.6.2.2 Conformance Requirements

An implementation may conform to one of the SOP Classes of the Study Hierarchy SOP Class Group as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

C.6.2.2.1 SCU Conformance

C.6.2.2.1.1 C-FIND SCU Conformance

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group shall support queries against the Query/Retrieve Information Model described in Section C.6.2.1 using the C-FIND SCU behavior described in Section C.4.1.2.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCU shall state in its Conformance Statement whether it supports Optional Keys. If it supports Optional Keys, then it shall list the Optional Keys which it supports.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCU shall be capable of generating queries using the Hierarchical Search. It shall not generate queries using Relational-queries unless the Relational-queries option has been successfully negotiated.

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An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCU shall state in its Conformance Statement whether it may generate Relational-queries. If it supports Relational Search, then it shall also support extended negotiation.

C.6.2.2.1.2 C-MOVE SCU Conformance

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCU shall support transfers against the Query/Retrieve Information Model described in Section C.6.2.1 using the C-MOVE SCU Behavior described in Section C.4.2.2.

C.6.2.2.1.3 C-GET SCU Conformance

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCU shall support retrievals against the Query/Retrieve Information Model described in Section C.6.2.1 using the C-GET SCU Behavior described in Section C.4.3.2.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCU, which generates retrievals using the C-GET operation shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-GET.

C.6.2.2.2 SCP Conformance

C.6.2.2.2.1 C-FIND SCP Conformance

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group shall support queries against the Query/Retrieve Information Model described in Section C.6.2.1 using the C-FIND SCP behavior described in Section C.4.1.3.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP shall state in its Conformance Statement whether it supports Optional Keys. If it supports Optional Keys, then it shall list the Optional Keys which it supports.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP shall state in its Conformance Statement whether it supports Relational Search. If it supports Relational Search, then it shall also support extended negotiation.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP shall state in its Conformance Statement whether it supports case-insensitive matching for PN VR attributes and list attributes for which this applies.

C.6.2.2.2.2 C-MOVE SCP Conformance

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP shall support transfers against the Query/Retrieve Information Model described in Section C.6.2.1 using the C-MOVE SCP Behavior described in Section C.4.2.3.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP, which generates transfers using the C-MOVE operation shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-MOVE.

C.6.2.2.2.3 C-GET SCP Conformance

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP shall support retrievals against the Query/Retrieve Information Model described in Section C.6.2.1 using the C-GET SCP Behavior described in Section C.4.3.3.

An implementation which conforms to one of the SOP Classes of the Study Root SOP Class Group as an SCP, which generates retrievals using the C-GET operation shall state in its Conformance

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Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-GET.

C.6.2.3 SOP Classes

The SOP Classes in the Study Root SOP Class Group of the Query/Retrieve Service Class identify the Study Root Query/Retrieve Information Model, and the DIMSE-C operations supported. The following Standard SOP Classes are identified:

SOP Class Name	SOP Class UID
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3

C.6.3 Patient/Study Only SOP Class Group

In the Patient/Study Only Query/Retrieve Information Model the information is arranged into two levels, which correspond to one of the following values in element (0008,0052):

Query/retrieve level	Value in (0008,0052)
Patient Information	PATIENT
Study Information	STUDY

C.6.3.1 Patient/Study Only Query/Retrieve Information Model

C.6.3.1.1 E/R model

The Patient/Study Only Query/Retrieve Information Model is represented by the entity relationship diagram shown in Figure C.6-3.

C.6.3.1.2 Patient level

Attributes for the Patient Level of the Patient/Study Only Query/Retrieve Information Model are the same as the Attributes for the Patient Level of the Patient Root Query/Retrieve Information Model described in Section C.6.1.1.2.

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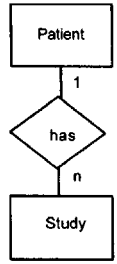

Figure C.6-3
PATIENT/STUDY ONLY QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM

C.6.3.1.3 Study Level

Attributes for the Study Level of the Patient/Study Only Query/Retrieve Information Model are the same as the Attributes for the Study Level of the Patient Root Query/Retrieve Information Model described in Section C.6.1.1.3.

C.6.3.1.4 Scope of GET and MOVE Commands and Sub-Operations

A C-MOVE or C-GET request may be performed to any level of the Query/Retrieve Model. However, the transfer of Stored SOP Instances shall always take place at the Image level. A C-MOVE or C-GET where the Query/Retrieve level is the:

- PATIENT level indicates that all images related to a Patient shall be transferred.
- STUDY level indicates that all images related to a Study shall be transferred.

C.6.3.2 Conformance Requirements

An implementation may conform to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

C.6.3.2.1 SCU Conformance

C.6.3.2.1.1 C-FIND SCU Conformance

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group shall support queries against the Query/Retrieve Information Model described in Section C.6.3.1 using the C-FIND SCU behavior described in Section C.4.1.2.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU shall state in its Conformance Statement whether it supports Optional Keys. If it supports Optional Keys, then it shall list the Optional Keys which are supported.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU shall be capable of generating queries using the Hierarchical Search. It shall not generate queries using Relational Search unless the Relation Option has been successfully negotiated.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU shall state in its Conformance Statement whether it may generate

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Relational Search queries. If it supports Relational Search, then it shall also support extended negotiation.

C.6.3.2.1.2 C-MOVE SCU Conformance

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU shall support transfers against the Query/Retrieve Information Model described in Section C.6.3.1 using the C-MOVE SCU Behavior described in Section C.4.2.2.

C.6.3.2.1.3 C-GET SCU Conformance

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU shall support retrievals against the Query/Retrieve Information Model described in Section C.6.3.1 using the C-GET SCU Behavior described in Section C.4.3.2.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCU, which generates retrievals using the C-GET operation shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-GET.

C.6.3.2.2 SCP Conformance

C.6.3.2.2.1 C-FIND SCP Conformance

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group shall support queries against the Query/Retrieve Information Model described in Section C.6.3.1 using the C-FIND Behavior described in Section C.4.1.3.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP shall state in its Conformance Statement whether it supports Optional Keys. If it supports Optional Keys, then it shall list the Optional Keys which are supported.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP shall state in its Conformance Statement whether it supports Relational Search. If it supports Relational Search, then it shall also support extended negotiation.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP shall state in its Conformance Statement whether it supports case-insensitive matching for PN VR attributes and list attributes for which this applies.

C.6.3.2.2.2 C-MOVE SCP Conformance

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP shall support transfers against the Query/Retrieve Information Model described in Section C.6.3.1 using the C-MOVE SCP Behavior described in Section C.4.2.3.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP, which generates transfers using the C-MOVE operation shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-MOVE.

C.6.3.2.2.3 C-GET SCP Conformance

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP shall support retrievals against the Query/Retrieve Information Model described in Section C.6.3.1 using the C-GET SCP Behavior described in Section C.4.3.3.

An implementation which conforms to one of the SOP Classes of the Patient/Study Only SOP Class Group as an SCP, which generates retrievals using the C-GET operation shall state in its Conformance Statement the Storage Service Class SOP Classes under which it shall support the C-STORE sub-operations generated by the C-GET.

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C.6.3.3 SOP CLASSES

The SOP Classes in the Patient/Study Only SOP Class Group of the Query/Retrieve Service Class identify the Patient/Study Only Query/Retrieve Information Model and the DIMSE-C operations supported. The following Standard SOP Classes are identified:

SOP Class Name	SOP Class UID
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2
Patient/Study Only Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.3.3

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Annex D STUDY CONTENT NOTIFICATION SERVICE CLASS (Normative)

D.1 OVERVIEW

The Study Content Notification Service Class defines an application-level class-of-service which allows one DICOM AE to notify another DICOM AE of the existence, contents and source location of the images of a Study.

Note: An example of usage of this Service Class, is to supplement the Storage Service class to provide the sender of the images of a study an efficient and standardized manner to communicate to the receiver that all the images that belong to the study have been stored.

The reasons for a DICOM AE to communicate this information falls beyond the scope of the Study Content Notification Service Class.

This Service Class allows the notified DICOM AE (SCP) to:

— "verify" if it has all the images that currently make the Study (from the SCU point of view) and return this information to the SCU

— be notified of the "availability" of a study and to perform a number of applications based on the Study Content information. Such applications fall beyond the scope of the Study Content Notification Service Class.

Notes: 1. In a manner similar to the Storage Service Class where the usage of the images stored by the SCP is outside the scope of Service Class definition, the usage of the Study Content information by the notified SCU is not standardized by the Study Content Notification Service Class.

2. If the notified DICOM AE (SCP) determines that it does not have the complete study, it may decide (immediately or at its convenience) to retrieve some of these images from the indicated source location. The study content information provided in the notification includes the knowledge necessary for the notified SCP to perform such a retrieve operation (e.g., C-MOVE) with the Query/Retrieve Service Class. The initiation of such an action falls outside the scope of the Study Content Notification Service Class. If undertaken, the criteria under which it is undertaken should be documented in the Study Notification Service Class SCP Conformance Statement.

The Study Content Notification Service Class consists of a single SOP Class: the Basic Study Content Notification SOP Class. It uses the Basic Study Descriptor IOD which reflects the nested structure of a Study i.e. a simple "study directory." This IOD is defined in PS 3.3. The Study Content Notification Service Class uses the C-STORE DIMSE Service specified in PS 3.7.

D.2 ASSOCIATION NEGOTIATION

The Association negotiation rules as defined in PS 3.7 apply to the SOP Class of this Service Class. No SOP Class specific application information is used.

D.3 CONFORMANCE OVERVIEW

The application-level services addressed by this Service Class definition are specified in a single SOP Class: Basic Study Content Notification SOP Class.

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D.4 BASIC STUDY CONTENT NOTIFICATION SOP CLASS

The Basic Study Content Notification SOP Class conveys only a minimum set of information to identify and retrieve the images of the Study. It keeps the service simple and ensures that it may be used for Studies containing images produced by any modality.

D.4.1 Service Class Provider

The DICOM AE which claims conformance to this SOP Class as an SCP shall receive the Study Content Notification through the use of the DIMSE C-STORE indication used in conjunction with this SOP Class.

The DICOM AE which claims conformance as an SCP to this SOP Class may choose to interpret a subset of the Mandatory and Optional Attributes maintained by the SCU and received by the SCP.

The SCP shall return, via the C-STORE response primitive, the Response Status Code applicable to the associated request. (Table D.4-1 shows response statuses.) Upon receiving the C-STORE indication, the SCP is able to determine if the Study as it is described in the Basic Study Descriptor, exists on its system. This will determine which Response Status Code is returned. This SOP Class places no further requirements on what the SCU shall do as a result of receiving this notification. This behavior shall be documented as part of the SOP Class Conformance Statement.

Table D.4-1
RESPONSE STATUSES

Service Status	Further Meaning	Response Status Codes
Success	Complete Study Content exists on system supporting SCP	0000
Success	Partial Study Content exists on system supporting SCP	0001
Success	None of the Study Content exists on system supporting SCP	0002
Success	It is unknown whether or not study content exists on system supporting SCP	0003
Failed	Failed operation	Cxxx

D.4.2 Service Class User

The DICOM AE which claims conformance as an SCU to this SOP Class shall be capable of issuing the Basic Study Content Notification. It shall be invoked by the SCU through the use of the DIMSE C-STORE request used in conjunction with this SOP Class.

Note: The definition of when an SCU invokes the C-STORE operation is not within the scope of this standard. The Conformance Statement of the SCU specifies the causes of the notification.

The SCU shall include a Data Set with the Attributes as defined in the Basic Study Descriptor IOD in
PS 3.3.

The SCU shall process the C-STORE confirmation and the Response Status Codes. This SOP Class places no further requirements on what the SCU shall do as a result of receiving these

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Response Status Codes. This behavior shall be documented as part of the SOP Class Conformance Statement.

D.4.3 Basic Study Content Notification SOP Class UID

The Basic Study Content Notification SOP Class shall be uniquely identified by the Basic Study Content Notification SOP Class UID which shall have a value "1.2.840.10008.1.9".

D.4.4 Conformance Requirements

The following information shall be provided as part of the Conformance Statement which shall be issued with any implementation claiming conformance to the DICOM Standard.

D.4.4.1 SCU CONFORMANCE REQUIREMENTS

- the reason causing the SCU to issue a C-STORE
- the SCU behavior as a result of receiving Responses Status Codes
- the SCU behavior when supporting Type 2C Attributes [e.g., Retrieve Application Entity Title (0008,0054)] and the conditions for which they are issued as part of a C-STORE.

D.4.4.2 SCP Conformance Requirements

- If the verification that all the images of a study are stored by the SCP DICOM AE is performed, an explicit Response Status Code is returned.
- The SCP behavior as a result of receiving the Study Content Notification information including the actions (corrective if incomplete study, retrieval of images, etc.) taken upon receipt of this information.
- The SCP behavior when supporting Type 2C Attributes [e.g., Retrieve Application Entity Title (0008,0054)] and the conditions for which they are issued as part of a C-STORE.

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Annex E PATIENT MANAGEMENT SERVICE CLASS (Normative)

E.1 OVERVIEW

E.1.1 Scope

The Patient Management Service Class defines an application-level class-of-service that facilitates the creation and tracking of that subset of patient and patient visit information that is required to aid in the management of radiographic studies. The goal of the Patient Management Service Class is to support Application Entities requiring access to information relating to the admission, discharge and transfer of patients for the purpose of obtaining one or more radiographic studies.

Although other Service Classes (e.g. Storage, Retrieval, etc.) partially specify some of the patient information (through the use of the Composite IOD metaphor) the primary focus of such Service Classes is images and not patients. This Service Class can be distinguished from such image-oriented Service Classes in that it focuses on patient information and relationships. There is little functional overlap between the image-oriented Service Classes and this Service Class and it is possible that many implementations will support both this Service Class and one or more image-oriented Service Classes in order to provide a full suite of application functionality.

E.1.2 Patient Management Functional Model

The Patient Management Functional Model is depicted in Figure E.1-1. This model depicts the functional view of the patient management application used by this Service Class. The model is composed of processes (circles) and data flows (arrows). For simplicity, only the most fundamental data flows are shown in the figure.

E.1.2.1 Create Patient

This process takes a pre-admission order for a patient and creates the information necessary to manage the patient. Examples of information associated with the created patient are patient identification and patient name.

E.1.2.2 Schedule Visit

This process takes the created patient information and patient and room availability information and schedules the patient's visit. Examples of information associated with the scheduled visit are scheduled admission date and time and scheduled discharge date and time.

E.1.2.3 Admit Patient

Room availability, patient arrival and scheduled patient information is used by this process to admit a patient. Examples of information associated with the admitted patient are the route of admissions (e.g. emergency, normal) and institution residence (room).

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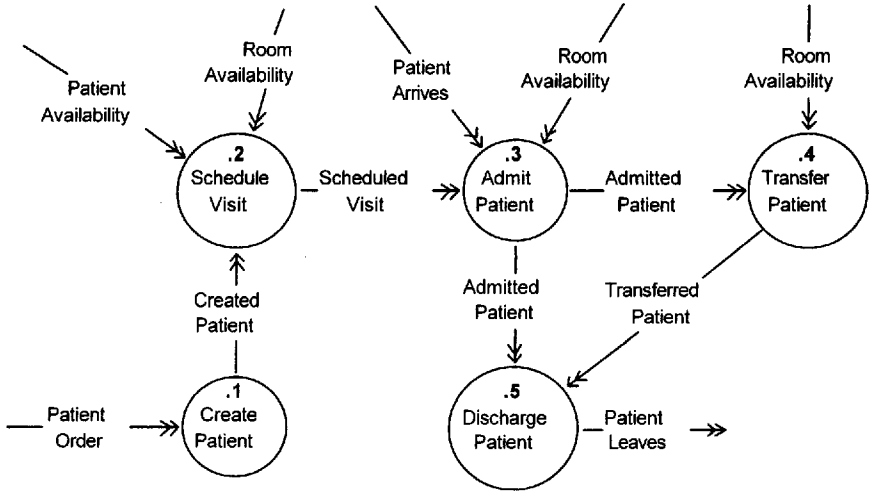

Figure E.1-1
PATIENT MANAGEMENT FUNCTIONAL MODEL

E.1.2.4 Transfer Patient

A transfer may involve changing the patient's long-term institution residence or temporarily assigning the patient to a particular location in the institution. The admitted patient and room availability are inputs to this process. Examples of information associated with the transferred patient are institution residence (long term) and patient location (temporary).

E.1.2.5 Discharge Patient

This process is used to discharge the patient. The output of this process is the discharged patient. Examples of information associated with the discharged patient are patient discharge date and time, and discharge diagnosis.

E.1.3 Patient Management Information Model

The Patient Management Information Model is a view of the data upon which the Patient Management Functional Model acts. The data are modeled through the use of Information Object Definitions (IODs) that are defined in PS 3.3. Two IODs, the Patient and Visit, are used by this Service Class. The Patient IOD specifies macro information about the patient and the Visit IOD specifies information relating to that patient in the context of a specific treatment episode. Reference PS 3.3 for more information on the Patient and Visit IODs.

E.1.4 Patient Management States

The Patient Management Information model defines a finite set of Patient Management states. Table E.1-1 describes the valid Patient Management states. Because of the partition of information between the Patient and Visit IOD, the state information is primarily specified by the Visit IOD.

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Table E.1-1
PATIENT MANAGEMENT STATES

State	Specifying IOD	Description
Created	Patient	Result of completion of Create Patient process
Scheduled	Visit	Patient visit has been scheduled
Admitted	Visit	Result of completion of Admit or Transfer Patient processes
Discharged	Visit	Result of completion of Discharge Patient process

Table E.1-2 defines the set of valid state transitions. For each of the above defined states the valid state resulting from the occurrence of events relating to the functional model is specified. These state transitions are managed by both the Patient and Visit Management SOP Classes.

Table E.1-2
PATIENT MANAGEMENT STATE TRANSITION DIAGRAM

Events	States			
	Created	Scheduled	Admitted	Discharged
Visit Scheduled	Scheduled			
Patient Arrival	Admitted	Admitted		
Patient Transfer	Admitted	Admitted	Admitted	
Patient Discharged	Discharged	Discharged	Discharged	

E.2 CONFORMANCE OVERVIEW

The application-level services addressed by this Service Class Definition are specified via three distinct SOP Classes:

a) Detached Patient Management SOP Class
b) Detached Visit Management SOP Class
c) Detached Patient Management Meta SOP Class

Each SOP Class operates on a subset of the Patient IOD or the Visit IOD and specifies the Attributes, operations, notifications, and behavior applicable to the SOP Class. Conformance of Application Entities shall be defined by selecting one or more of the Patient and Visit Management SOP and Meta SOP Classes. For each SOP Class conformance requirements shall be specified in terms of the Service Class Provider (SCP) and the Service Class User (SCU).

E.2.1 Association Negotiation

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The Association negotiation procedure specified in PS 3.7 shall be used to negotiate the supported SOP Classes or Meta SOP Classes.

Support for the SCP/SCU role selection negotiation is mandatory. The SOP Class Extended Negotiation shall not be supported.

Note: Event notification is a process that logically extends across multiple Associations. SCP implementations should support a local table of SCUs to which event notifications are to be sent.

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E.3 DETACHED PATIENT MANAGEMENT SOP CLASS

The Detached Patient Management SOP Class is intended for those Application Entities requiring transfer of information about a real-world patient and notifications of its changes in state. The SOP Class is termed "Detached" because neither DICOM AE can directly affect the other. A DICOM AE may choose to take some actions based upon a notification or request for information but is in no way required to do so.

Notes: 1. For example, assume that it is important for a PACS review workstation to display the correct patient name for all studies displayed. Assume that a "John Doe" patient is admitted and studies are performed. Later the correct patient name is identified and the patient name is updated in the patient record. Assuming that the HIS is responsible for maintaining data related to patients, the PACS needs to get the new patient name from the HIS. In such a configuration the HIS is the SCP and the PACS is the SCU. When the PACS receives this notification, it may retrieve and update the patient name for all applicable "John Doe" studies or may choose to do nothing.

2. The terms HIS and PACS used in the previous example are provided for clarification purposes only. This document does not define nor constrain the purpose or role of any HIS, RIS, PACS or Acquisition Application Entity conforming to this Service Class Specification.

E.3.1 DIMSE Service Group

Table E.3-1 shows DIMSE-N Services applicable to the Patient IOD under the Detached Patient Management SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Table E.3-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M

E.3.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operation. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following operations.

E.3.2.1 Get Patient Information

This operation allows an SCU to get information about a specific real-world patient which is represented as a Detached Patient Management SOP Instance by a Detached Patient Management SCP. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Detached Patient Management SOP Instance.

E.3.2.1.1 Patient IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attributes maintained by the SCP which the SCU receives via the operations of the SOP Class. The Application Entity which claims conformance as an SCP to the Detached Patient Management SOP Class shall support the subset of the Patient IOD Attributes specified in Table E.3-2.

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Table E.3-2
DETACHED PATIENT MANAGEMENT SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if expanded or replacement character set is used)
Referenced Study Sequence	(0008,1110)	3/2
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Referenced Visit Sequence	(0008,1125)	3/2
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Patient's Name	(0010,0010)	3/2
Patient ID	(0010,0020)	3/2
Patient's Birth Date	(0010,0030)	3/2
Patient's Sex	(0010,0040)	3/2
Referenced Patient Alias SOP Instance UIDs	(0038,0004)	3/2
All Other Attributes		3/3

E.3.2.1.2 Service Class User

The SCU shall specify in the N-GET request primitive the UID of the Detached Patient Management SOP Instance for which Attribute Values are to be returned. The SCU shall be permitted to request that Attribute Values be returned for any Detached Patient Management SOP Class Attribute specified in Section E.3.2.1.1. Additionally, values may be requested for optional Patient IOD Attributes.

The SCU shall specify the list of Managed Patient SOP Class Attributes for which the Attribute Values are to be returned. The encoding rules for this list are specified in the N-GET request primitive specified in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU and shall not be returned by an SCP.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET indication primitive. The SCU may request Attribute values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly

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regardless of whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to interpret accurately the character set used for Attribute values returned, it is recommended that the Attribute value for Specific Character Set (0008,0005) be requested in the N-GET request primitive.

E.3.2.1.3 Service Class Provider

This operation allows the SCU to request from the SCP, selected Attribute Values for a specific Detached Patient Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Detached Patient Management SOP Instance.

The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the associated request. Contingent on the N-GET Response Status, the SCP shall return, via the N-GET Response Primitive, Attribute Values for all requested Attributes maintained by the SCP (see Table E.3-2). The SCP shall not return Data Elements for optional Attributes which are not maintained by the SCP.

E.3.2.1.4 Status Codes

The status values which are specific for this SOP Class and DIMSE Service are defined in Table E.3-3.

See PS 3.7 for response status codes.

Table E.3-3
RESPONSE STATUSES

Service Status	Further Meaning	Response Status Codes
Warning	Requested optional Attributes are not supported	0001

E.3.3 Notifications

The Application Entity which claims conformance as an SCU to this SOP Class shall be permitted to receive the following notification. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following notifications.

E.3.3.1 Receive Patient Event Notification

This notification allows an SCU to receive from the SCP an unsolicited notification of a change in the Detached Patient Management SOP Instance. These notifications shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Patient Management SOP Instance.

The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The SCU shall accept all Attributes included in any notification. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

E.3.3.2 Provide Patient Event Notification

These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in the state of a real-world patient. This notification shall be invoked by the SCP through the use of

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the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Patient Management SOP Instance.

The SCP shall specify in the N-EVENT-REPORT request primitive the UID of the Detached Patient Management SOP Instance for which the event is associated and the Event Type ID. The SCP shall additionally include Attributes related to the event as defined in Table E.3-4.

Note The encoding of Notification Event Information is defined in PS 3.7.

Table E.3-4
PATIENT NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
Patient Created	1	Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)
		Instance Creation Date	(0008,0012)	-/2
		Instance Creation Time	(0008,0013)	-/2
		Instance Creator UID	(0008,0014)	-/2
		Patient 's Name	(0010,0010)	-/2
		Patient ID	(0010,0020)	-/2
		Patient's Birth Date	(0010,0030)	-/2
		Patient's Sex	(0010,0040)	-/2
		All other defined Attributes		-/3
Patient Deleted	2	Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)
		Patient's Name	(0010,0010)	-/2
		Patient ID	(0010,0020)	-/2
Patient Updated	3	Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)
		All updated Attributes		-/1
		Patient's Name	(0010,0010)	-/2
		Patient ID	(0010,0020)	-/2

E.3.3.3 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

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E.3.4 Detached Patient Management SOP Class UID

The Detached Patient Management SOP Class shall be uniquely identified by the Detached Patient Management SOP Class UID which shall have the value "1.2.840.10008.3.1.2.1.1".

E.3.5 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Detached Patient Management SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

E.3.5.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

— operations which it invokes
— notifications which it receives

E.3.5.1.1 Operations

Any optional Attributes for which Attribute values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

E.3.5.1.2 Notifications

All standard event types for which notifications may be processed by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall include an enumerated list of the event types supported:

[- Patient Created;]
[- Patient Updated;]
[- Patient Deleted;]

E.3.5.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the:

— operations which it performs
— notifications which it invokes

E.3.5.2.1 Operations

Any optional Attributes supported by the SCP for which Attribute values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

E.3.5.2.2 Notifications

Any optional Attributes which may be included in Standard notifications to the SCU shall be enumerated in the SCP Notifications Statement. The SCP Notifications Statement shall be formatted as defined in PS 3.2. Following this statement shall be the list of event types and optional Attributes.

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E.4 DETACHED VISIT MANAGEMENT SOP CLASS

The Detached Visit Management SOP Class is intended for those Application Entities requiring transfer of information about a real-world visit and notifications of its changes in state.

Notes: 1. For example, assume that during a patient's visit, it is important for clinicians to have access (at a PACS review workstation) to all old studies which may have been performed on the patient. In order for images to be available at the correct time, the PACS needs to pre-fetch the images prior to the patient's admittance to the institution. Assuming that a HIS is responsible for maintaining data related to patients, the PACS needs to get from the HIS when a patient has been admitted or is scheduled for admission. In such a configuration the HIS is the SCP and the PACS is the SCU. When the PACS receives this notification, it may retrieve the old studies from an archive or choose to take no action.

2. The terms HIS and PACS used in the previous example are provided for clarification purposes only. This document does not define nor constrain the purpose or role of any HIS, RIS, PACS or Acquisition Application Entity conforming to this Service Class Specification.

E.4.1 DIMSE Service Group

DIMSE-N Services in Table E.4-1 are applicable to the Visit IOD under the Detached Visit Management SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Table E.4-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M
N-SET	U/M

E.4.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operations. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following operations.

E.4.2.1 Get Visit Information

This operation allows an SCU to get information about a specific real-world visit which is represented as a Detached Visit Management SOP Instance by a Detached Visit Management SCP. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Detached Visit Management SOP Instance.

E.4.2.1.1 Visit IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attributes maintained by the SCP which the SCU receives via the operations of the SOP Class. The Application Entity which claims conformance as an SCP to the Detached Visit Management SOP Class shall support the subset of the Visit IOD Attributes specified in Table E.4-2.

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Table E.4-2
DETACHED VISIT MANAGEMENT SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set is used)
Referenced Patient Sequence	(0008,1120)	3/1
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Referring Physician's Name	(0008,0090)	3/2
Referenced Study Sequence	(0008,1110)	3/2
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
All other Attributes		3/3

E.4.2.1.2 Service Class User

The SCU shall specify in the N-GET request primitive the UID of the Detached Visit Management SOP Instance for which Attribute Values are to be returned. The SCU shall be permitted to request that Attribute Values be returned for any Detached Visit Management SOP Class Attribute specified in Section E.4.2.1.1. Additionally, values may be requested for optional Visit IOD Attributes.

The SCU shall specify the list of Visit Management SOP Class Attributes for which the Attribute Values are to be returned. The encoding rules for this list are specified in the N-GET request primitive specified in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU and shall not be returned by an SCP.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET indication primitive. The SCU may request Attribute values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly regardless of whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to interpret accurately the character set used for Attribute values returned, it is recommended that the Attribute value for Specific Character Set (0008,0005) be requested in the N-GET request primitive.

E.4.2.1.3 Service Class Provider

This operation allows the SCU to request from the SCP, selected Attribute Values for a specific Detached Visit Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Detached Visit Management SOP Instance.

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The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the associated request. Contingent on the N-GET Response Status, the SCP shall return, via the N-GET Response Primitive, Attribute Values for all requested Attributes maintained by the SCP (see Table E.4-2).

E.4.2.1.4 Status Codes

The status values which are specific for this SOP Class and DIMSE Service are defined as shown in Table E.4-3.

See PS 3.7 for response status codes.

Table E.4-3
RESPONSE STATUSES

Service Status	Further Meaning	Response Status Codes
Warning	Requested optional Attributes are not supported	0001

E.4.2.2 Set Visit Information

This operation allows an SCU to provide information about a specific real-world visit which is represented as a Detached Visit Management SOP Instance by a Detached Visit Management SCP. This operation shall be invoked through the DIMSE N-SET Service used in conjunction with the appropriate Detached Visit Management SOP Instance.

E.4.2.2.1 Visit IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to modify a subset of the Attributes maintained by the SCP. The Application Entity which claims conformance as an SCP to the Detached Visit Management SOP Class shall support the subset of the Visit IOD Attributes specified in Table E.4-4.

The character set used for Attribute values updated using N-SET shall be the same as that used by the SCP.

NOTE—It is recommended that the Attribute value for Specific Character Set (0008,0005) be requested in an N-GET request primitive.

Table E.4-4
DETACHED VISIT MANAGEMENT SOP CLASS N-SET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Visit Status ID	(0038,0008)	3/1
Current Patient Location	(0038,0300)	3/1

E.4.2.2.2 Service Class User

The SCU shall specify in the N-SET Request Primitive the UID of the Detached Visit Management SOP Instance for which Attribute Values are to be provided. The SCU shall be permitted to request that Attribute Values be updated for any Detached Visit Management SOP Class Attribute specified in Section E.4.2.2.1.

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The SCU shall specify the list of Visit Management SOP Class Attributes for which the Attribute Values are to be provided. The encoding rules for this list are specified in the N-SET request primitive specified in PS 3.7.

E.4.2.2.3 Service Class Provider

This operation allows the SCU to request that the SCP update selected Attribute Values for a specific Detached Visit Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-SET Service used in conjunction with the appropriate Detached Visit Management SOP Instance.

The SCP shall return, via the N-SET response primitive, the N-SET Response Status Code applicable to the associated request.

E.4.2.2.4 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

E.4.3 Notifications

The Application Entity which claims conformance as an SCU to this SOP Class shall receive the following notification. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following notifications.

E.4.3.1 Receive Visit Event Notification

This notification allows an SCU to receive from the SCP an unsolicited notification of an event associated with a Detached Visit Management SOP Instance. These notifications shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Visit Management SOP Instance.

The SCU shall return, via the N-EVENT-REPORT Response Primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The SCU shall accept all Attributes included in any notification. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

E.4.3.2 Provide Visit Status Event Notification

These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in state of the visit. This notification shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Visit Management SOP Instance.

The SCP shall specify in the N-EVENT-REPORT request primitive the UID of the Detached Visit Management SOP Instance for which the event is associated and the Event Type ID. The SCP shall additionally include Attributes related to the event as defined in Table E.4-5. Only those Attributes maintained by the SCP may be included in the notification.

Note: The encoding of Notification Event Information is defined in PS 3.7.

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Table E.4-5
VISIT NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU/SCP
Visit Created	1	Specific Character Set	(0008,0005)	-/1C (Required if expanded/replacement character set used)
		Instance Creation Date	(0008,0012)	-/1
		Referenced Patient Sequence	(0008,1120)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Visit Status ID	(0038,0008)	-/1
		Instance Creation Time	(0008,0013)	-/2
		Instance Creator UID	(0008,0014)	-/2
		Admission ID	(0038,0010)	-/2
		All other defined Attributes		-/3
Visit Scheduled	2	Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)
		Referenced Patient Sequence	(0008,1120)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Visit Status ID	(0038,0008)	-/1
		Scheduled Admission Date	(0038,001A)	-/1
		Scheduled Admission Time	(0038,001B)	-/2
		Scheduled Patient Institution Residence	(0038,001E)	-/2
		Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)

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Patient Admitted	3	Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)
		Referenced Patient Sequence	(0008,1120)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Admitting Date	(0038,0020)	-/1
		Visit Status ID	(0038,0008)	-/1
		Referring Physician's Name	(0008,0090)	-/2
		Route of Admissions	(0038,0016)	-/2
		Admitting Time	(0038,0021)	-/2
Patient Transferred	4	Specific Character Set	(0008,0005)	-/1C (Required if expanded/ replacement character set used)
		Referenced Patient Sequence	(0008,1120)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Visit Status ID	(0038,0008)	-/1
		Current Patient Location	(0038,0300)	-/1
		Patient's Institution Residence	(0038,0400)	-/1
		Referenced Patient Sequence	(0008,1120)	-/1
Patient Discharged	5	>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Visit Status ID	(0038,0008)	-/1
		Discharge Time	(0038,0032)	-/2
		Discharge Date	(0038,0030)	-/2
Visit Deleted	6	Admission ID	(0038,0010)	-/2
Visit Updated	7	All updated Attributes		-/1

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E.4.3.3 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

E.4.4 Detached Visit Management SOP Class UID

The Detached Visit Management SOP Class shall be uniquely identified by the Detached Visit Management SOP Class UID which shall have the value "1.2.840.10008.3.1.2.2.1".

E.4.5 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Detached Visit Management SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

E.4.5.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

- operations which it invokes
- notifications which it receives

E.4.5.1.1 Operations

Any optional Attributes for which Attribute values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute values may be provided (using the N-SET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

E.4.5.1.2 Notifications

All standard event types for which notifications may be processed by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall include an enumerated list of the event types supported:

[- Visit Created;]

[- Visit Scheduled;]

[- Patient Admitted;]

[- Patient Transferred;]

[- Patient Discharged;]

[- Visit Updated;]

[- Visit Deleted;]

E.4.5.2 SCP CONFORMANCE

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the:

- operations which it performs
- notifications which it invokes

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E.4.5.2.1 Operations

Any optional Attributes for which Attribute values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute values may be updated (using the N-SET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

E.4.5.2.2 Notifications

Any optional Attributes which may be included in Standard notifications to the SCU shall be enumerated in the SCP Notifications Statement. The SCP Notifications Statement shall be formatted as defined in PS 3.2. Following this statement shall be the list of event types and optional Attributes.

E.5 DETACHED PATIENT MANAGEMENT META SOP CLASS

The Detached Patient Management Meta SOP Class represents the union of the Detached Patient Management SOP Class and the Detached Visit Management SOP Class. It is intended for those Application Entities which conform to both of the aforementioned SOP Classes. All requirements specified for the Detached Patient Management SOP Class and Detached Visit Management SOP Classes shall be met by Application Entities conforming to the Patient Management Meta SOP Class. Please reference Sections E.3 through E.4.5.2.2 for Patient Management Meta SOP Class requirements.

E.5.1 Detached Patient Management Meta SOP Class UID

The Detached Patient Management Meta SOP Class shall be uniquely identified by the Detached Patient Management Meta SOP Class UID which shall have the value "1.2.840.10008.3.1.2.1.4".

E.6 SPECIALIZED SOP CLASS CONFORMANCE

Implementations may provide Specialized SOP Class Conformance by providing a proper superset of the functionality of the Standard SOP Class. Implementations providing Specialized SOP Class Conformance to the one of the SOP Classes defined in this Annex shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

E.6.1 Conformance

An implementation shall be permitted to conform as a Specialization of the standard SOP Class as an SCU, SCP or both. The Conformance statement shall be formatted as defined in PS 3.2.

E.6.2 Specialized SOP Class Identification

Any implementation which specializes the standard SOP Class shall define its specialization as an allomorphic subclass of the standard SOP Class. As such, the specialization shall have its own unique SOP Class identification.

The Conformance Statement shall include a SOP Class Identification Statement as defined in PS 3.2, declaring an SOP Name and SOP Class UID which identify the Specialized SOP Class. The SOP Name is not guaranteed to be unique but is provided for informal identification of the SOP Class. The SOP Class UID shall uniquely identify the Specialized SOP Class and conform to the DICOM UID requirements as specified in PS 3.5.

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E.6.3 SCU Conformance

An implementation which is conformant to the Specialized SOP Class as an SCU shall meet conformance requirements for the:

- operations which it invokes
- notifications which it receives

E.6.3.1 Operations

The standard SOP Class may be specialized by supporting additional standard DIMSE-N operations and/or additional private Attributes. The SCU Operations Statement shall describe these specializations and be formatted as defined in PS 3.2.

Following this statement shall be the list of the:

- standard operations supported by the standard SOP Class which are extended by the addition of Private Attributes
- standard operations and the associated Standard and Private Attributes which are not supported by the standard SOP Class but which are supported by the Specialization

Each additional operation shall be enumerated along with the list of Attributes which it supports.

E.6.3.2 Standard Notifications

Any standard notifications which are processed by the SCU without extension shall be enumerated as specified in Sections E.3.3.2 and E.4.3.2.

E.6.3.3 Extended Notifications

Any private Attributes which may be received in standard notifications in addition to the standard Attributes shall be enumerated in the SCU Notifications Statement.

Additionally, any private event types for which notifications may be requested by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall be formatted as defined in PS 3.2.

Following this statement shall be the list of the:

- Standard Event Types which are extended by the addition of Private Attributes
- Extended Event Types and the associated Standard and Private Attributes

E.6.4 SCP Conformance

An implementation which is conformant to the Specialized SOP Class as an SCP shall meet conformance requirements for the:

- operations which it performs
- notifications which it invokes

E.6.4.1 Operations

The standard SOP Class may be specialized by supporting additional standard DIMSE-N operations and/or additional private Attributes. The SCP Operations Statement shall describe these specializations and be formatted as defined in PS 3.2.

Following this statement shall be the list of the:

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- standard operations supported by the standard SOP Class which are extended by the addition of Private Attributes
- standard operations and the associated standard and private Attributes which are not supported by the standard SOP Class but which are supported by the Specialization

Each additional operation shall be enumerated along with the list of Attributes which it supports.

E.6.4.2 Notifications

Any private Attributes which may be included in standard notifications to the SCU shall be enumerated in the SCP Notifications Statement.

Additionally, any private event types for which notifications may be sent to the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall be formatted as defined in PS 3.2.

Following this statement shall be the list of the:

- Standard Event Types which are extended by the addition of Private Attributes
- Extended Event Types and the associated Standard and Private Attributes

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Annex F STUDY MANAGEMENT SERVICE CLASS (Normative)

F.1 OVERVIEW

F.1.1 Scope

The Study Management Service Class defines an application-level class-of-service which facilitates the creation, scheduling, performance and tracking of imaging studies. Although the primary result from the performance of a study is a group images, there is a host of other information necessary to place the acquired images in the correct context for diagnosis and review. Indeed it is clear that medical professionals do not make diagnoses from a single image but rather from a group of images and related study information taken together.

Although other Service Classes (e.g. Storage, Query/Retrieval, etc.) partially specify some of the study information (through the use of the Composite IOD metaphor) the primary focus of such Service Classes is images and not studies. This Service Class can be distinguished from such image-oriented Service Classes in that this Service Class focuses on study information and how it relates to the acquired images.

The term Study describes one or more Series of images generated as the result of a request for service. A Study is associated with one or more requested procedures. The Series associated with a Study may be generated by multiple imaging modalities.

A Series is a set of related images generated by a single imaging modality. It is necessary to provide a mechanism whereby the set of Series that a modality produces can be correlated to the Study as defined by the request for service which may involve multiple modalities.

A Study Component describes one or more Series generated on a single imaging modality. The Modality Performed Procedure Step SOP Class is an extension of the Study Component SOP Class. The Modality Performed Procedure Step SOP Class contains extensions related to the Modality Worklist Management SOP Class.

In various places and tables in the DICOM Standard, the term "Study Component" is used as a collective name for both the "Study Component Management" and the "Modality Performed Procedure Step". The SOP Classes are distinguished by their SOP Class UIDs.

Note: In the Referenced Study Component Sequence (0008,1111) the Referenced SOP Class UID (0008,1150) can be either the UID of the Study Component Management SOP Class or the UID of the Modality Performed Procedure Step SOP Class. The SOP Instance UIDs will not be the same.

DICOM Composite IODs also relate Series of images to a Study. A Study initially represents an Association of Series from the perspective of a single modality, however, the Composite Study may accumulate Series over time from multiple sources (see the Study Content Notification Service Class described in Annex D).

In an environment that supports both Normalized services and Composite services there is a one too many relationship between a Study Management SOP Instance and the Study that is identified in one or more Composite SOP Instances. It is operationally important to link related Composite and Normalized Study Instances. Figure F.1-1 illustrates the relationship between the Composite and Normalized representations of the Study concept. The Detached Study Management SOP Instance UID that identifies a particular Normalized Study Instance may be used to define the Study

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Instance UID in the related Composite SOP Instances. This same UID is also used in the Referenced Study Sequence Attribute of associated Study Components to link them back to the originally Study.

Because a Composite SOP Instance may contain Series generated by several different pieces of imaging equipment it logically contains multiple Study Components. These Components are optionally tracked in the Composite SOP Instances.

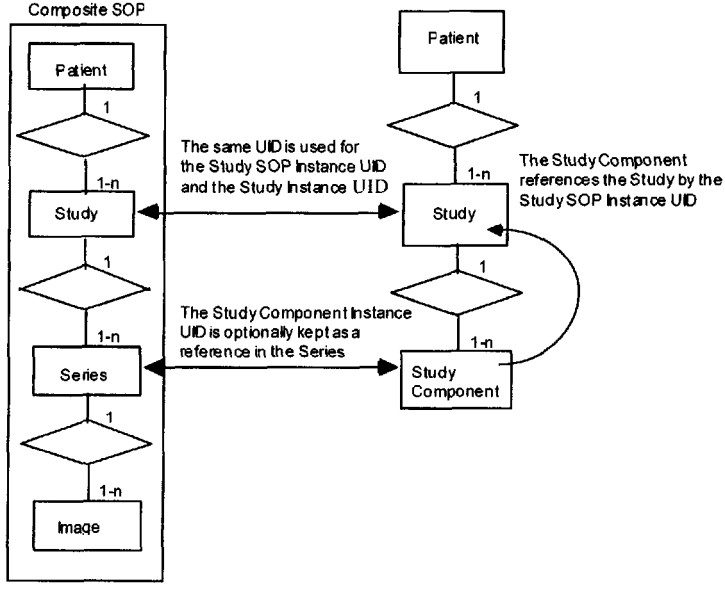

Figure F.1-1
RELATIONSHIP BETWEEN COMPOSITE AND NORMALIZED REPRESENTATIONS OF THE STUDY CONCEPT

The goal of the Study Management Service Class is to support Application Entities requiring access to information relating to the scheduling, acquisition and diagnosis of studies. Applications such as patient preparation, room-scheduling, and billing are outside of the scope of this Service Class.

F.1.2 Study Management Functional Model

The Study Management Functional Model is depicted in Figure F.1-2. The model is composed of processes (circles) and data flows (arrows). For simplicity, only the most fundamental data flows are shown and additional data flows which may occur are not represented in the figure.

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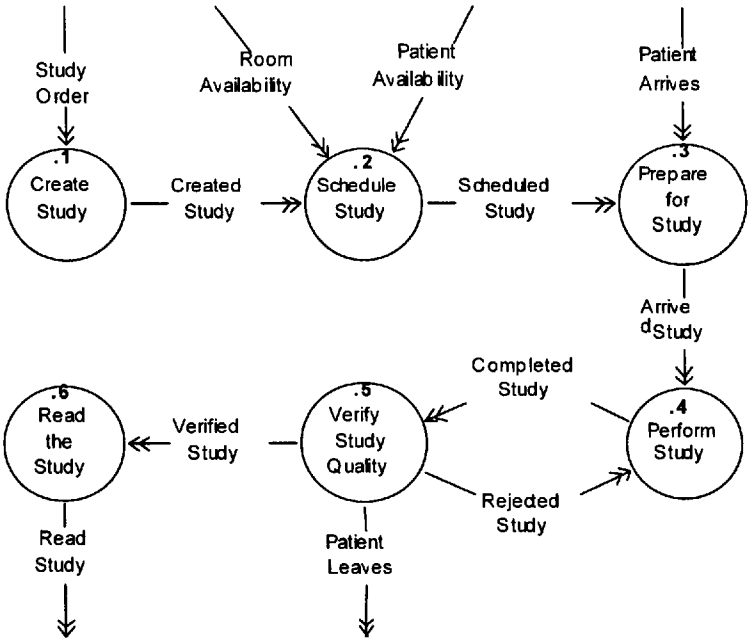

Figure F.1-2
STUDY MANAGEMENT FUNCTIONAL MODEL

F.1.2.1 Create Study

This process takes an order for a study and creates the information necessary to manage the study. Examples of information associated with the created study are study identification and associated patient identification.

F.1.2.2 Schedule Study

Room, patient availability and created study information is used by this process to schedule a study. Examples of information associated with the scheduled study are scheduled date, time, procedure type and location for the study.

F.1.2.3 Prepare for Study

Patient arrival triggers this process. During this process the patient and imaging equipment are prepared for study acquisition. Examples of information associated with the arrived study are arrival date and time.

F.1.2.4 Perform Study

The arrived patient, and the arrived study information are used by this process to perform the study. The output of this process is the completed study. Examples of information associated with the

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completed study are study start date and time, study stop date and time, and associated images acquired.

F.1.2.5 Verify Study Quality

The completed study is verified in this process to ensure that it is of sufficient diagnostic quality. If the study is rejected because of poor diagnostic quality then the Perform Study process is re-initiated. If the study is of sufficient diagnostic quality then the patient is released (may leave) and the verified study is ready for reading. Examples of information associated with the verified study are verified date and time.

F.1.2.6 Read The Study

The verified study is read in this process. Once read, then results reporting may proceed for the study. The management of results reporting, while associated with a specific study, is not an inherent part of the study management process. Reference Annex G for information on the Results Management Service Class which address the results reporting functionality. The read study, which includes information such as read date and time, is used as input to the Results Management Service Class.

F.1.3 Study Management Information Model

The Study Management Information Model is the view of the data upon which the Study Management Functional Model acts. Thus many of the data flows in Figure F.1-2 are specified in the Study Management Information Model.

The data are modeled through the use of Information Object Definitions (IODs) which are defined in PS 3.3. Three IODs, the Study, Study Component and Modality Performed Procedure Step IODs, are used by this Service Class. Reference PS 3.3 for more information on these IODs.

F.1.4 Study Management States

Closely related to the Study Management Information model are the major states in which a study may be. Table F.1-1 describes the valid study states.

The study states are specified by the information of the Study IOD.

In addition to these study states the states for the Modality Performed Procedure Step are defined in Table F.1-3.

Table F.1-1
STUDY MANAGEMENT STATES

State	Description
Created	Result of completion of Create Study process
Scheduled	Result of completion of Schedule Study process
Arrived	Result of completion of Prepare for Study process
Started	Result of initiation of Perform Study process
Completed	Result of completion of Perform Study process
Verified	Result of completion of Verify Study Quality process
Read	Result of completion of Read the Study process

Table F.1-2 defines the valid state transitions for the study. For each of the above defined states the valid state resulting from the occurrence of events relating to the functional model is specified.

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Table F.1-2
STUDY MANAGEMENT STATE TRANSITION DIAGRAM

Events	States						
	Created	**Scheduled**	**Arrived**	**Started**	**Completed**	**Verified**	**Read**
Study Scheduled	Scheduled						
Patient Arrives	Arrived	Arrived					
Study Started	Started	Started	Started				
Study Completed	Completed	Completed	Completed	Completed			
Study Quality OK	Verified	Verified	Verified	Verified	Verified		
Study Quality Rejected	Started	Started	Started	Started	Started		
Read	Read	Read	Read	Read	Read	Read	

F.1.5 Modality Performed Procedure Step Management States

The state information related to the Modality Performed Procedure Step is specified by the Modality Performed Procedure Step IOD in the Attribute Performed Procedure Step Status (0040,0252).

The Performed Procedure Step Object represents only the "performed" segment of the real-world procedure step and not the "scheduled" segment. The number of events is therefore limited; all events are initiated by the modality. The state "DISCONTINUED" means canceled or unsuccessfully terminated, which may happen when the performance of a Procedure Step has been started but cannot be finished by the modality. The modality shall convey this state change to the information system (the SCP), to allow the information system to reschedule or cancel the related Procedure Step. The state "COMPLETED" means that the acquisition of Composite SOP Instances has been successfully completed and the SCU has provided all required attribute values for the Performed Procedure Step.

Table F.1-3 describes the valid Modality Performed Procedure Step states.

Table F.1-3
MODALITY PERFORMED PROCEDURE STEP STATES

State	Description
In Progress	Modality Performed Procedure Step created and execution in progress
Discontinued	Execution of Modality Performed Procedure Step canceled by modality
Completed	Modality Performed Procedure Step completed

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Table F.1-4 defines the valid state transitions for the Performed Procedure Steps. For each of the above defined states the valid state resulting from the occurrence of events is specified. These state transitions are managed by the Modality Performed Procedure Step SOP Class.

Table F.1-4
MODALITY PERFORMED PROCEDURE STEP STATE TRANSITION DIAGRAM

Events	States		
	In Progress	Discontinued	Completed
Performed Procedure Step Discontinued	Discontinued		
Performed Procedure Step Completed	Completed		

F.2 CONFORMANCE OVERVIEW

The application-level services addressed by this Service Class Definition are specified via the following distinct SOP Classes:

a. Detached Study Management SOP Class
b. Study Component Management SOP Class
c. Modality Performed Procedure Step SOP Class
d. Modality Performed Procedure Step Notification SOP Class
e. Modality Performed Procedure Step Retrieve SOP Class

Each SOP Class operates on a subset of the Study IOD, Modality Performed Procedure Step IOD, and Study Component IOD and specifies the Attributes, operations, notifications, and behavior applicable to the SOP Class. Conformance of Application Entities shall be defined by selecting one or more of the Study and Study Component Management SOP and Meta SOP Classes. For each SOP Class conformance requirements shall be specified in terms of the Service Class Provider (SCP) and the Service Class User (SCU).

Note: The example shown in Figure F.2-1 is of usage of the Study Management and Study Component SOP Classes. It illustrates one simple data flow based on these two SOP Classes but is not intended to cover related flows (e.g. Storage of Images, Patient Management , Result Management, etc.). This example (see Figure F.2-1) involves three nodes. Node A (e.g., an image acquisition) system and Node C (e.g., a review system) support the Study SOP and the Study Component SOP Classes as SCUs and Node B (e.g., an information management system) as an SCP.

Node B, notifies Node A that a Study has been scheduled (SOP Instance created internally on Node B as SCP) by issuing an N-EVENT-REPORT Study Notification (1). Using the SOP Instance UID which was communicated in the N-EVENT-REPORT Study Notification (1), Node A may obtain further information by an N-GET Study (2). As a number of images are created on Node A, this node issues an N-CREATE Study Component (3) and relates the created instance to the Study SOP Instance using the Study SOP instance UID which was known from the N-EVENT-REPORT Study Notification (1) received earlier. Node A may later update the status of the Study Component when all necessary images have been created, by using an N-SET Study Component (4).

Based on a change of Study Component Status (internal policies and configuration), Node B decides to issue to Node C an N-EVENT-REPORT Study Notification (5). By using the Study SOP Instance UID, an N-GET Study (6) may be issued to obtain Study information and in particular the current list of Study Component SOP Instance UIDs. By using the SOP Instance UIDs of the Study Components communicated in the N-EVENT-REPORT Study

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Notification (5), an N-GET Study Component (7) may also be issued to obtain information about a specific Study Component (e.g., the Series UIDs/Image UIDs related to the Study Component).

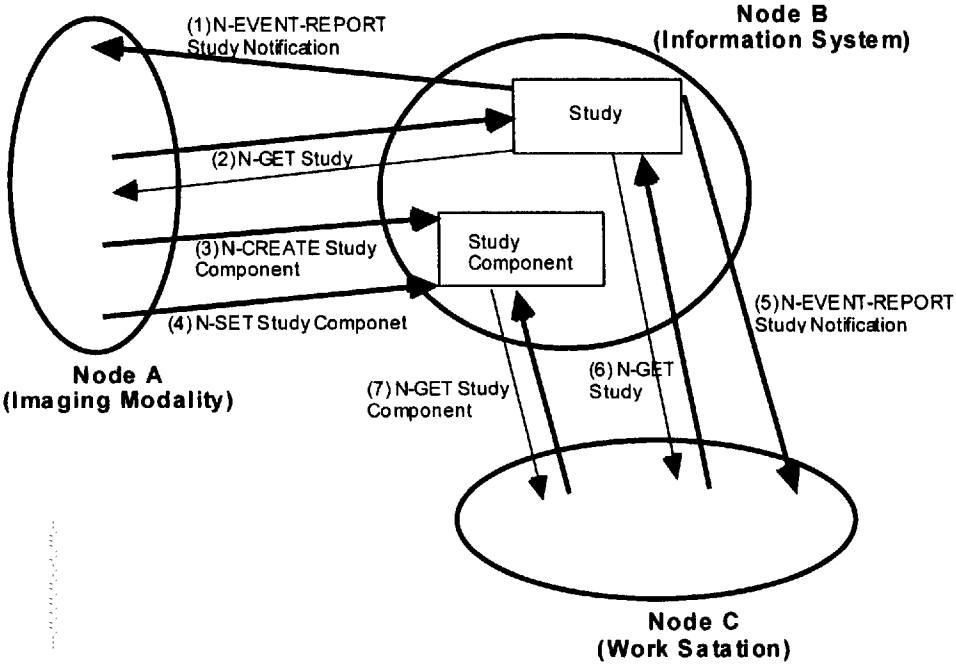

Figure F.2-1 EXAMPLE OF USAGE THE STUDY MANAGEMENT AND STUDY COMPONENT SOP CLASSES

F.2.1 Association Negotiation

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The Association negotiation procedure specified in PS 3.7 shall be used to negotiate the supported SOP Classes or Meta SOP Classes.

Support for the SCP/SCU role selection negotiation is mandatory. The SOP Class Extended Negotiation shall not be supported.

Note: Event notification is a process that logically extends across multiple Associations. SCP implementations should support a local table of SCUs to which event notifications are to be sent.

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F.3 DETACHED STUDY MANAGEMENT SOP CLASS

The Detached Study Management SOP Class is intended for those Application Entities requiring transfer of information about a real-world study and notifications of its changes in state. The SOP Class is termed "Detached" because neither Application Entity can directly affect the other. An Application entity may choose to take some actions based upon a notification or request for information but is in no way required to do so.

Notes: 1. For example, in one configuration, a RIS could be responsible for maintaining data related to studies. In order for the PACS to auto-route (automatically move) newly-acquired images to a review workstation, the PACS needs to know when the study has been completed. In such a configuration the RIS is the SCP and the PACS is the SCU. When the PACS receives this notification, it may retrieve the newly acquired images from the Acquisition Application (modality) or choose to take no action.

2. The terms RIS, PACS and Acquisition Application used in the previous example are provided for clarification purposes only. This document does not define nor constrain the purpose or role of any HIS, RIS, PACS or Acquisition Application Entity conforming to this Service Class Specification.

F.3.1 DIMSE Service Group

Table F.3-1 shows DIMSE-N Services applicable to the Study IOD under the Detached Study Management SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Table F.3-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M
N-SET	U/M

F.3.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operations. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following operations.

F.3.2.1 Get Study Information

This operation allows an SCU to get information about a specific real-world study which is represented as a Detached Study Management SOP Instance by a Detached Study Management SCP. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Detached Study Management SOP Instance.

F.3.2.1.1 Study IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attributes maintained by the SCP which the SCU receives via the operations and notifications of the SOP Class. The Application Entity which claims conformance as an SCP to the Detached Study Management SOP Class shall support the subset of the Study IOD Attributes specified in Table F.3-2.

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Table F.3-2
DETACHED STUDY MANAGEMENT SOP CLASS N-GET ATTRIBUTES

Attribute name	Tag	Requirement type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set is used)
Referenced Study Component Sequence	(0008,1111)	3/1C (Required if a Referenced Study Component exists.)
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Referenced Patient Sequence	(0008,1120)	3/1
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Referenced Visit Sequence	(0008,1125)	3/1
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Accession Number	(0008,0050)	3/2
Referenced Results Sequence	(0008,1100)	3/2
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Study ID	(0020,0010)	3/2
All other Attributes		3/3

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F.3.2.1.2 Service Class User

The SCU shall specify in the N-GET request primitive the UID of the Detached Study Management SOP Instance for which Attribute Values are to be returned. The SCU shall be permitted to request that Attribute Values be returned for any Detached Study Management SOP Class Attribute specified in Section F.3.2. Additionally, Attribute values may be requested for optional Study IOD Attributes.

The SCU shall specify the list of Managed Study SOP Class Attributes for which the Attribute Values are to be returned. The encoding rules for this list are specified in the N-GET request primitive specified in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU and shall not be returned by an SCP.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET indication primitive. The SCU may request Attribute values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly regardless to whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to interpret accurately the character set used for Attribute values returned, it is recommended that the Attribute value for Specific Character Set (0008,0005) be requested in the N-GET Request Primitive when appropriate.

F.3.2.1.3 Service Class Provider

This operation allows the SCU to request from the SCP, selected Attribute Values for a specific Detached Study Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Detached Study Management SOP Instance.

The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the associated request. Contingent on the N-GET Response Status, the SCP shall return, via the N-GET Response Primitive, Attribute Values for all requested Attributes maintained by the SCP (see Table F.3-2).

F.3.2.1.4 Status Codes

The status values which are specific for this SOP Class and DIMSE Service are as shown in Table F.3-3.

See PS 3.7 for response status codes.

Table F.3-3
RESPONSE STATUSES

Service Status	Further Meaning	Response Status Codes
Warning	Requested optional Attributes are not supported	0001

F.3.2.2 Set Study Information

This operation allows an SCU to provide information about a specific real-world study which is represented as a Detached Study Management SOP Instance by a Detached Study Management

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SCP. This operation shall be invoked through the DIMSE N-SET Service used in conjunction with the appropriate Detached Study Management SOP Instance.

F.3.2.2.1 Study IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to modify a subset of the Attributes maintained by the SCP. The Application Entity which claims conformance as an SCP to the Detached Study Management SOP Class shall support the subset of the Study IOD Attributes specified in Table F.3-4.

The character set used for Attribute values updated using N-SET shall be the same as that used by the SCP.

Note: It is recommended that the Attribute value for Specific Character Set (0008,0005) be requested in an N-GET request primitive.

Table F.3-4
DETACHED STUDY MANAGEMENT SOP CLASS N-SET ATTRIBUTES

Attribute name	Tag	Requirement type (SCU/SCP)
Study Date	(0008,0020)	3/1
Study Time	(0008,0030)	3/1
Study Status ID	(0032,000A)	3/1
Study Verified Date	(0032,0032)	3/1
Study Verified Time	(0032,0033)	3/1
Study Completion Date	(0032,1050)	3/1
Study Completion Time	(0032,1051)	3/1
Study Arrival Date	(0032,1040)	3/1
Study Arrival Time	(0032,1041)	3/1

F.3.2.2.2 Service Class User

The SCU shall specify in the N-SET request primitive the UID of the Detached Study Management SOP Instance for which Attribute Values are to be provided. The SCU shall be permitted to request that Attribute Values be updated for any Detached Study Management SOP Class Attribute specified in Section F.3.2.2.1.

The SCU shall specify the list of Study Management SOP Class Attributes for which the Attribute Values are to be provided. The encoding rules for this list are specified in the N-SET request primitive specified in PS 3.7.

F.3.2.2.3 Service Class Provider

This operation allows the SCU to request that the SCP update selected Attribute Values for a specific Detached Study Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-SET Service used in conjunction with the appropriate Detached Study Management SOP Instance.

The SCP shall return, via the N-SET response primitive, the N-SET Response Status Code applicable to the associated request.

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F.3.2.2.4 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

F.3.3 Notifications

The Application Entity which claims conformance as an SCU to this SOP Class shall be permitted to receive the following notifications. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following notifications.

F.3.3.1 Receive Study Status Event Notification

This notification allows an SCU to receive from the SCP an unsolicited notification of a change in the study state (as represented by the value of the Study Status Attribute). These notifications shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Study Management SOP Instance.

The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The SCU shall accept all Attributes included in any notification.

An SCU of Detached Study Management shall utilize the value of the Detached Study Management SOP Instance UID (0000,1000) associated with a Scheduled Study Event as the Study Instance UID (0020,000D) to identify all Image SOP Instances created as part of the scheduled Study.

F.3.3.2 Provide Study Status Event Notification

These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in the study status (as represented by the Study Status Attribute). This notification shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Study Management SOP Instance.

The SCP shall specify in the N-EVENT-REPORT Request Primitive the UID of the Detached Study Management SOP Instance for which the event is associated and the Event Type ID. The SCP shall additionally include Attributes related to the event as defined in Table F.3-5. Only those Attributes maintained by the SCP may be included in the notification.

Note: The encoding of Notification Event Information is defined in PS 3.7.

F.3.3.3 Status Codes

There are no specific status codes for this SOP Class. See PS 3.7 for response status codes.

F.3.4 Detached Study Management SOP Class UID

The Detached Study Management SOP Class shall be uniquely identified by the Detached Study Management SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.1".

F.3.5 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Detached Study Management SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

F.3.5.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

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— operations which it invokes
— notifications which it receives

Table F.3-5
STUDY NOTIFICATION EVENT INFORMATION

Event type name	Event type ID	Attribute	Tag	Req. type SCU/SCP
Study Created	1	Instance Creation Date	(0008,0012)	-/1
		Referenced Patient Sequence	(0008,1120)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Referenced Visit Sequence	(0008,1125)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Instance Creation Time	(0008,0013)	-/2
		Instance Creator UID	(0008,0014)	-/2
		Study Status ID	(0032,000A)	-/2
		All other defined Attributes		-/3
Study Scheduled	2	Specific Character Set	(0008,0005)	-/1C (Required if extended/ replacement character set used)
		Referenced Patient Sequence	(0008,1120)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Referenced Visit Sequence	(0008,1125)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)

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		Scheduled Study Start Date	(0032,1000)	-/1
		Scheduled Study Start Time	(0032,1001)	-/1
		Scheduled Study Location	(0032,1020)	-/2
		Scheduled Study Location Application Entity Title	(0032,1021)	-/2
		Requested Procedure Description	(0032,1060)	-/2
		Requested Procedure Code Sequence	(0032,1064)	-/2
		>Code Value	(0008,0100)	-/1C (Required if sequence is present)
		>Coding Scheme Designator	(0008,0102)	-/1C (Required if sequence is present)
		>Coding Scheme Version	(0008,0103)	-/3
		>Code Meaning	(0008,0104)	-/1C (Required if sequence is present)
Patient Arrived	3	Study Arrival Date	(0032,1040)	-/1
		Study Arrival Time	(0032,1041)	-/1
Study Started	4	Study Date	(0008,0020)	-/1
		Study Time	(0008,0030)	-/1
Study Completed	5	Referenced Study Component Sequence	(0008,1111)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Study Completed Date	(0032,1050)	-/1
		Study Completed Time	(0032,1051)	-/1
Study Verified	6	Referenced Study Component Sequence	(0008,1111)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Study Verified Date	(0032,0032)	-/1
		Study Verified Time	(0032,0033)	-/1

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Study Read	7	Study Read Date	(0032,0034)	-/1
		Study Read Time	(0032,0035)	-/1
Study Deleted	8			
Study Updated	9	All updated Attributes		-/1

F.3.5.1.1 Operations

Any optional Attributes for which Attribute values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute values may be provided (using the N-SET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

F.3.5.1.2 Notifications

All standard event types for which notifications may be requested by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall include an enumerated list of the event types supported:

[- Study Created;]
[- Study Scheduled;]
[- Patient Arrived;]
[- Study Started;]
[- Study Complete;]
[- Study Verified;]
[- Study Read;]
[- Study Updated;]
[- Study Deleted;]

F.3.5.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the:

— operations which it performs
— notifications which it invokes

F.3.5.2.1 Operations

Any optional Attributes for which Attribute values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute values may be updated (using the N-SET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

F.3.5.2.2 Notifications

Any optional Attributes which may be included in Standard notifications to the SCU shall be enumerated in the SCP Notifications Statement. The SCP Notifications Statement shall be

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formatted as defined in PS 3.2. Following this statement shall be the list of event types and optional Attributes.

F.4 STUDY COMPONENT MANAGEMENT SOP CLASS

The Study Component Management SOP Class defines an application-level class-of-service which allows one Application Entity to notify another Application Entity of the existence, contents and source location of a set of Series that are associated with a Study.

Note: An example of usage of this SOP Class is to provide an acquisition device an efficient and standardized manner to communicate to the SCP of Study Management that all the images belonging to the portion of an ordered Study that are under that device's control have been acquired.

A device which acts as an SCP for the DICOM Study Component SOP Class shall also act as an SCP for the Detached Study Management SOP Class. The SCP shall be responsible for synchronizing status information between associated Study Component SOP Instances and Detached Study Management SOP Instances. The rules for status synchronization are determined by local policy and are beyond the scope of the DICOM Standard.

F.4.1 DIMSE Service Group

The DIMSE-N Services shown in Table F.4-1 are applicable to the Study Component IOD under the Study Component Management SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Note: An Application Entity may support the SCU role for Study Component Management in order to obtain information about Study Components created by other Application Entities.

Table F.4-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-SET	U/M
N-GET	U/M

F.4.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operations and the Application Entity which claims conformance as an SCP shall be capable of providing the following operations.

F.4.2.1 Create Study Component Instance

This operation allows an SCU to create an instance of the Study Component SOP and provide information about a specific real-world Study (more specifically the portion of the real-world Study that is under the control of the SCU). This operation shall be invoked through the DIMSE N-CREATE Service.

F.4.2.1.1 Study Component IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to provide a subset of the Attributes maintained by the SCP. The Application Entity which claims

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conformance as an SCP to the Study Component Management SOP Class shall support the subset of the Study Component IOD Attributes specified in Table F.4-2.

Table F.4-2
STUDY COMPONENT MANAGEMENT SOP CLASS N-CREATE ATTRIBUTES

Attribute Name	Tag	Ó
Specific Character Set	(0008,0005)	1C/1C (Required if an extended or replacement character set is used)
Modality	(0008,0060)	1/1
Referenced Study Sequence	(0008,1110)	1/1
>Referenced SOP Class UID	(0008,1150)	1/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	1/1C (Required if sequence is present)
Procedure Code Sequence	(0008,1032)	1/1
>Code Value	(0008,0100)	1/1C (Required if sequence is present)
>Coding Scheme Designator	(0008,0102)	1/1C (Required if sequence is present)
>Coding Scheme Version	(0008,0103)	-/3
>Code Meaning	(0008,0104)	1/1C (Required if sequence is present)
Study Component Status ID	(0032,1055)	1/1
Study Description	(0008,1030)	2/2
Study ID	(0020,0010)	2/2
Referenced Series Sequence	(0008,1115)	2/2
>Series Date	(0008,0021)	2/2C (Required if sequence is present)
>Series Time	(0008,0031)	2/2C (Required if sequence is present)
>Series Instance UID	(0020,000E)	2/2C (Required if sequence is present)
>Retrieve Application Entity Title	(0008,0054)	2C/1C (This Attribute shall be present only if the Images may be retrieved at the SERIES Query/Retrieve Level. See Annex C of this Part.)
>Storage Media File-Set ID	(0088,0130)	2C/1C (This Attribute shall be present only if the Image(s) may be retrieved at the SERIES level using a media storage.)

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>Storage Media File-Set UID	(0088,0140)	2C/1C (This Attribute shall be present only if the Image(s) may be retrieved at the SERIES level using a media storage.)
>Referenced Image Sequence	(0008,1140)	2/2C (Required if sequence is present)
>>Referenced SOP Class UID	(0008,1150)	2/2C (Required if sequence is present)
>>Referenced SOP Instance UID	(0008,1155)	2/2C (Required if sequence is present)
>>Retrieve AE Title	(0008,0054)	2C/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Images may be retrieved at the IMAGE Query /Retrieve Level. See Annex C of this Part.]
>>Storage Media File-Set ID	(0088,0130)	2C/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Image(s) may be retrieved at the IMAGE level using a media storage.]
>>Storage Media File-Set UID	(0088,0140)	2C/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Image(s) may be retrieved at the IMAGE level using a media storage.]
All other Attributes		3/3

F.4.2.1.2 Service Class User

The SCU shall provide Attribute values for Study Component Management SOP Class Attributes specified in Section F.4.2.1.1. Additionally, values may be provided for optional Study Component IOD Attributes that are supported by the SCP. The encoding rules for Study Component Management SOP Class Attributes are specified in the N-CREATE request primitive specification in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU and shall not be returned by an SCP.

The SCU shall be capable of providing all required Attribute values to the SCP in the N-CREATE request primitive. The SCU may provide Attribute values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly regardless of whether the SCP accepts values for those Attributes or not.

The value provided for the Referenced SOP Instance UID of the Referenced Study Sequence (0008,1110) shall be exactly equal to the value of the Study Instance UID (0020,000D) which identifies all images associated with the Study.

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Notes: 1. In order to accurately interpret the character set used for Attribute values provided, it is recommended that the Attribute value for Specific Character Set (0008,0005) be provided in the N-CREATE request primitive.

2. The N-CREATE request primitive requires values for the Referenced Study Sequence in order to permit the created Study Component SOP Instance to be linked to a Detached Study Management SOP Instance. It is assumed that the Study Component SCU received valid values for the Referenced Study Sequence Attribute prior to creating the Study Component SOP Instance. This information may have been provided by the SCP of Detached Study Management in an N-EVENT-REPORT.

3. Two modes of behavior are available to the SCU: values for all Study Component Attributes may be provided with the N-CREATE primitive (including type 2 Attributes) and the Study Component Status ID set to COMPLETED or only values for the type 1 Attributes may be provided, the Study Component Status ID set to CREATED, and at a later time the values for the remaining Attributes provided using the N-SET primitive along with an appropriate update of the Study Component Status ID.

F.4.2.1.3 Service Class Provider

This operation allows the SCU to provide to the SCP selected Attribute values for a specific Study Component Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-CREATE Service used in conjunction with the appropriate Study Component Management SOP Instance.

The SCP shall return, via the N-CREATE response primitive, the N-CREATE Response Status Code applicable to the associated request. Contingent on the N-CREATE Response Status, the SCP shall update the Referenced Study Component Sequence Attribute of the referenced Detached Study Management SOP Instance.

F.4.2.1.4 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

F.4.2.2 Set Study Component Information

This operation allows an SCU to set Attribute Values of an instance of the Study Component SOP and provide information about a specific real-world Study (more specifically the portion of the real-world Study that is under the control of the SCU). This operation shall be invoked through the DIMSE N-SET Service.

F.4.2.2.1 Study Component IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to modify a subset of the Attributes maintained by the SCP. The Application Entity which claims conformance as an SCP to the Study Component Management SOP Class shall support the subset of the Study Component IOD Attributes specified in Table F.4-3.

The character set used for Attribute Values updated using N-SET shall be the same as that used by the SCP.

Note: It is recommended that the Attribute Value for Specific Character Set (0008,0005) be requested in an N-GET request primitive before the N-SET is performed.

Table F.4-3
STUDY COMPONENT MANAGEMENT SOP CLASS N-SET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Study Description	(0008,1030)	3/1

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Procedure Code Sequence	(0008,1032)	3/1
>Code Value	(0008,0100)	3/1C (Required if sequence is present)
>Coding Scheme Designator	(0008,0102)	3/1C (Required if sequence is present)
>Coding Scheme Version	(0008,0103)	3/3
>Code Meaning	(0008,0104)	3/1C (Required if sequence is present)
Study Component Status ID	(0032,1055)	3/1
Study ID	(0020,0010)	3/1
Referenced Series Sequence	(0008,1115)	3/1
>Series Date	(0008,0021)	3/1C (Required if sequence is present)
>Series Time	(0008,0031)	3/1C (Required if sequence is present)
>Series Instance UID	(0020,000E)	3/1C (Required if sequence is present)
>Retrieve AE Title Location	(0008,0054)	3/1C (This Attribute shall be present only if the Images may be retrieved at the SERIES Query/ Retrieve Level. See Annex C of this Part.)
>Storage Media File-Set ID	(0088,0130)	3/1C (This Attribute shall be present only if the Image(s) may be retrieved at the SERIES level using a media storage.)
>Storage Media File-Set UID	(0088,0140)	3/1C (This Attribute shall be present only if the Image(s) may be retrieved at the SERIES level using a media storage.)
>Referenced Image Sequence	(0008,1140)	3/1C (Required if sequence is present)
>>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
>>Retrieve AE Title Location	(0008,0054)	3/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Images may be retrieved at the IMAGE Query/Retrieve Level. See Annex C.]
>>Storage Media File-Set ID	(0088,0130)	3/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Image(s) may be retrieved at the IMAGE level using a media storage.]

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>>Storage Media File-Set UID	(0088,0140)	3/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Image(s) may be retrieved at the IMAGE level using a media storage.]

F.4.2.2.2 Service Class User

The SCU shall specify in the N-SET Request Primitive the UID of the Study Component Management SOP Instance for which Attribute Values are to be provided.

The SCU shall be permitted to request that Attribute Values be updated for any Study Component Management SOP Class Attribute specified in Section F.4.2.2.1. The SCU shall specify the list of Study Component Management SOP Class Attributes for which the Attribute Values are to be provided. The encoding rules for this list are specified in the N-SET request primitive specified in PS 3.7.

F.4.2.2.3 Service Class Provider

This operation allows the SCU to request that the SCP update selected Attribute Values for a specific Study Component Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-SET Service used in conjunction with the appropriate Study Component Management SOP Instance.

The SCP shall return, via the N-SET response primitive, the N-SET Response Status Code applicable to the associated request. Contingent on the N-SET Response Status, the SCP shall update the Referenced Study Component Sequence Attribute of the referenced Detached Study Management SOP Instance.

F.4.2.2.4 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

F.4.2.3 Get Study Component Information

This operation allows an SCU to get information about a specific real-world study which is represented as a Study Component Management SOP Instance by a Study Component Management SCP. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Study Component Management SOP Instance.

Note: An Application Entity may support the SCU role for Study Component Management in order to obtain information about Study Components created by other Application Entities.

F.4.2.3.1 Study Component IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attributes maintained by the SCP which the SCU receives via the operations of the SOP Class. The Application Entity which claims conformance as an SCP to the Study Component Management SOP Class shall support the subset of the Study Component IOD Attributes specified in Table F.4-4.

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Table F.4-4
STUDY COMPONENT MANAGEMENT SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set is used)
Modality	(0008,0060)	3/1
Study Description	(0008,1030)	3/1
Referenced Study Sequence	(0008,1110)	3/1
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Procedure Code Sequence	(0008,1032)	3/1
>Code Value	(0008,0100)	3/1C (Required if sequence is present)
>Coding Scheme Designator	(0008,0102)	3/1C (Required if sequence is present)
>Coding Scheme Version	(0008,0103)	3/3
>Code Meaning	(0008,0104)	3/1C (Required if sequence is present)
Study Component Status ID	(0032,1055)	3/1
Study ID	(0020,0010)	3/2
Referenced Series Sequence	(0008,1115)	3/2
>Series Date	(0008,0021)	3/1C (Required if sequence is present)
>Series Time	(0008,0031)	3/1C (Required if sequence is present)
>Series Instance UID	(0020,000E)	3/1C (Required if sequence is present)
>Retrieve AE Title	(0008,0054)	3/1C (This Attribute shall be present only if the Images may be retrieved at the SERIES Query / Retrieve Level. See Annex C.)
>Storage Media File-Set ID	(0088,0130)	3/1C (This Attribute shall be present only if the Image(s) may be retrieved at the SERIES level using a media storage.)
>Storage Media File-Set UID	(0088,0140)	3/1C (This Attribute shall be present only if the Image(s) may be retrieved at the SERIES level using a media storage.)
>Referenced Image Sequence	(0008,1140)	3/1C (Required if sequence is present)

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>>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
>>Retrieve AE Title	(0008,0054)	3/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Images may be retrieved at the IMAGE Query /Retrieve Level. See Annex C.]
>>Storage Media File-Set ID	(0088,0130)	3/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Image(s) may be retrieved at the IMAGE level using a media storage.]
>>Storage Media File-Set UID	(0088,0140)	3/1C [This Attribute shall be present only if not present in the Referenced Series Sequence (0008,1115) and if the Image(s) may be retrieved at the IMAGE level using a media storage.]
All other Attributes		3/3

F.4.2.3.2 *Service Class User*

The SCU uses the N-GET Service Element to request the SCP to get a Study Component Management SOP Instance. The SCU shall specify the UID of the SOP Instance to be retrieved. The SCU shall be permitted to request that Attribute Values be returned for any Study Component Management SOP Class Attribute specified in Section F.4.2.3.1. Additionally, values may be requested for optional Study Component IOD Attributes.

The SCU shall specify the list of Study Component Management SOP Class Attributes for which the Attribute Values are to be returned. The encoding rules for this list are specified in the N-GET request primitive specified in PS 3.7.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET indication primitive. The SCU may request Attribute Values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly regardless of whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to accurately interpret the character set used for Attribute Values returned, it is recommended that the Attribute Value for Specific Character Set (0008,0005) be requested in the N-GET request primitive.

F.4.2.3.3 Service Class Provider

This operation allows the SCU to request from the SCP selected Attribute Values for a specific Study Component Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Study Component Management SOP Instance.

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The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the associated request. A Failure status code shall indicate that the SCP has not retrieved the SOP Instance. Contingent on the N-GET Response Status, the SCP shall return, via the N-GET Response Primitive, Attribute Values for all requested Attributes maintained by the SCP.

F.4.2.3.4 Status codes

The status values which are specific for this SOP Class and DIMSE Service are defined as shown in Table F.4-5. See PS 3.7 for response status codes.

Table F.4-5
RESPONSE STATUSES

Service status	Further meaning	Response status codes
Warning	Requested optional Attributes are not supported	0001

F.4.3 Study Component Management SOP Class UID

The Study Component Management SOP Class shall be uniquely identified by the Study Component Management SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.2".

F.4.4 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Study Component Management SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

F.4.4.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

- operations which it invokes
- notifications which it receives

F.4.4.1.1 Operations

Any optional Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute Values may be provided (using the N-CREATE Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute Values may be provided (using the N-SET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

F.4.4.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the:

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— operations which it performs
— notifications which it invokes

F.4.4.2.1 Operations

Any optional Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute Values may be updated (using the N-CREATE Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute Values may be updated (using the N-SET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

F.5 STUDY MANAGEMENT META SOP CLASS

The Study Management Meta SOP Class represents the union of the Detached Study Management SOP Class and the Study Component Management SOP Class. It is intended for those Application Entities which conform to both of the aforementioned SOP Classes. All requirements specified for the Detached Study Management SOP Class and Study Component Management SOP Class shall be met by Application Entities conforming to the Study Management Meta SOP Class. Please reference Sections F.3 through F.4.4.2.1 for Study Management Meta SOP Class requirements.

F.5.1 Study Management Meta SOP Class UID

The Study Management Meta SOP Class shall be uniquely identified by the Study Management Meta SOP Class UID which shall have the value "1.2.840.10008.3.1.2.5.5".

F.6 SPECIALIZED SOP CLASS CONFORMANCE

Implementations may provide Specialized SOP Class Conformance by providing a proper superset of the functionality of the Standard SOP Class. Implementations providing Specialized SOP Class Conformance to the Study Management SOP Classes shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

F.6.1 Conformance Type

An implementation shall be permitted to conform to a Specialization of the standard SOP Class as an SCU, SCP or both. The Conformance Type statement shall be formatted as defined in PS 3.2.

F.6.2 Specialized SOP Class Identification

Any implementation which specializes the standard SOP Class shall define its specialization as an Allomorphic subclass of the standard SOP Class. As such, the specialization shall have its own unique SOP Class identification.

The Conformance Statement shall include a SOP Class Identification Statement as defined in PS 3.2, declaring a SOP Name and SOP Class UID which identify the Specialized SOP Class. The SOP Name is not guaranteed to be unique but is provided for informal identification of the SOP Class. The SOP Class UID shall uniquely identify the Specialized SOP Class and conform to the DICOM UID requirements as specified in PS 3.5.

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F.6.3 SCU Conformance

An implementation which is conformant to the Specialized SOP Class as an SCU shall meet conformance requirements for the:

- operations which it invokes
- notifications which it receives

F.6.3.1 Operations

The standard SOP Class may be specialized by supporting additional standard DIMSE-N operations and/or additional private Attributes. The SCU Operations Statement shall describe these specializations and be formatted as defined in PS 3.2.

Following this statement shall be the list of:

- Standard operations supported by the standard SOP Class which are extended by the addition of Private Attributes
- Standard operations and the associated Standard and Private Attributes which are not supported by the standard SOP Class but which are supported by the Specialization

Each additional operation shall be enumerated along with the list of Attributes which it supports.

F.6.3.2 Standard Notifications

Any standard notifications which are received by the SCU without extension shall be enumerated as specified in Section F.3.3.2.

F.6.3.3 Extended Notifications

Any private Attributes which may be received in standard notifications in addition to the standard Attributes shall be enumerated in the SCU Notifications Statement.

Additionally, any private event types for which notifications may be requested by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall be formatted as defined in PS 3.2.

Following this statement shall be the list of:

- Standard Event Types which are extended by the addition of Private Attributes
- Extended Event Types and the associated Standard and Private Attributes

F.6.4 SCP Conformance

An implementation which is conformant to the Specialized SOP Class as an SCP shall meet conformance requirements for the:

- operations which it performs
- notifications which it invokes

F.6.4.1 Operations

The standard SOP Class may be specialized by supporting additional standard DIMSE-N operations and/or additional private Attributes. The SCP Operations Statement shall describe these specializations and be formatted as defined in PS 3.2.

Following this statement shall be the list of:

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— standard operations supported by the standard SOP Class which are extended by the addition of Private Attributes

— standard operations and the associated standard and private Attributes which are not supported by the standard SOP Class but which are supported by the Specialization

Each additional operation shall be enumerated along with the list of Attributes which it supports.

F.6.4.2 Notifications

Any private Attributes which may be included in standard notifications to the SCU shall be enumerated in the SCP Notifications Statement.

Additionally, any private event types for which notifications may be sent to the SCU shall be enumerated in the SCP Notifications Statement. The SCU Notifications Statement shall be formatted as defined in PS 3.2.

Following this statement shall be the list of:

— Standard Event Types which are extended by the addition of Private Attributes

— Extended Event Types and the associated Standard and Private Attributes

F.7 MODALITY PERFORMED PROCEDURE STEP SOP CLASS

F.7.1 DIMSE Service Group

The DIMSE Services shown in Table F.7.1-1 are applicable to the Modality Performed Procedure Step IOD under the Modality Performed Procedure Step SOP Class.

Table F.7.1-1
DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-SET	M/M

The DIMSE Services and Protocols are specified in PS 3.7

F.7.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operations and the Application Entity which claims conformance as an SCP shall be capable of providing the following operations.

F.7.2.1 CREATE Modality Performed Procedure Step SOP Instance

This operation allows an SCU to create an instance of the Modality Performed Procedure Step SOP Class and provide information about a specific real-world Performed Procedure Step that is under control of the SCU. This operation shall be invoked through the DIMSE N-CREATE Service.

Note : The modality should inform the Information System as soon as possible that the performance of the Procedure Step has been started by sending the N-CREATE Service Request. This allows an SCP of the Modality Worklist SOP Class (if supported) to update the Modality Worklist. Some of the attribute values are already known at the beginning of the Procedure Step, they are required to be sent in the N-CREATE command. Other mandatory attributes are known only at the end of the Performed Procedure Step, they are assigned a

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value in the N-SET command.

The same SOP Instance UID is shared by all three Modality Performed Procedure Step SOP Classes. This means that the SOP Instance created and set using the services of the Modality Performed Procedure Step SOP Class can be retrieved using its SOP Instance UID within the service of the Modality Performed Procedure Step Retrieve SOP Class. Changes in its state can be notified by using its SOP Instance UID within the service of the Modality Performed Procedure Step Notification SOP Class. The SOP Class UID specified in the DIMSE N-CREATE and N-SET Services shall be the UID of the Modality Performed Procedure Step SOP Class.

The Modality Performed Procedure Step SOP Instance UID shall not be used to identify a SOP Instance of the Study Component Service Class.

F.7.2.1.1 Modality Performed Procedure Step Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU must provide all Required Attributes as specified in Table F.7.2-1. Optional Attributes maintained by the SCP may be provided as well. The Application Entity which claims conformance as an SCP to this SOP Class shall support the subset of the Modality Performed Procedure Step Attributes specified in Table F.7.2-1.

Table F.7.2-1
MODALITY PERFORMED PROCEDURE STEP SOP CLASS N-CREATE, N-SET AND FINAL STATE ATTRIBUTES

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Requirement Type Final State (See Note 1)
Specific Character Set	(0008,0005)	1C/1C (Required if an extended or replacement character set is used)	Not allowed	
Performed Procedure Step Relationship				
Scheduled Step Attribute Sequence	(0040,0270)	1/1	Not allowed	
>Study Instance UID	(0020,000D)	1/1	Not allowed	
>Referenced Study Sequence	(0008,1110)	2/2	Not allowed	
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	Not allowed	
>Accession Number	(0008,0050)	2/2	Not allowed	

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>Placer Order Number/Imaging Service Request	(0040,2016)	3/3	Not allowed	
>Filler Order Number/Imaging Service Request	(0040,2017)	3/3	Not allowed	
>Requested Procedure ID	(0040,1001)	2/2	Not allowed	
>Requested Procedure Description	(0032,1060)	2/2	Not allowed	
>Scheduled Procedure Step ID	(0040,0009)	2/2	Not allowed	
>Scheduled Procedure Step Description	(0040,0007)	2/2	Not allowed	
>Scheduled Action Item Code Sequence	(0040,0008)	2/2	Not allowed	
>>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Coding Scheme designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Coding Scheme Version	(0008,0103)	3/3	Not allowed	
>>Code Meaning	(0008,0104)	3/3	Not allowed	
Patient's Name	(0010,0010)	2/2	Not allowed	
Patient ID	(0010,0020)	2/2	Not allowed	
Patient's Birth Date	(0010,0030)	2/2	Not allowed	
Patient's Sex	(0010,0040)	2/2	Not allowed	
Referenced Patient Sequence	(0008,1120)	2/2	Not allowed	
>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	Not allowed	
>Referenced Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	Not allowed	
Performed Procedure Step Information				

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Performed Procedure Step ID	(0040,0253)	1/1	Not allowed	
Performed Station AE Title	(0040,0241)	1/1	Not allowed	
Performed Station Name	(0040,0242)	2/2	Not allowed	
Performed Location	(0040,0243)	2/2	Not allowed	
Performed Procedure Step Start Date	(0040,0244)	1/1	Not allowed	
Performed Procedure Step Start Time	(0040,0245)	1/1	Not allowed	
Performed Procedure Step Status	(0040,0252)	1/1	3/1	
Performed Procedure Step Description	(0040,0254)	2/2	3/2	
Performed Procedure Type Description	(0040,0255)	2/2	3/2	
Procedure Code Sequence	(0008,1032)	2/2	3/2	
>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Version	(0008,0103)	3/3	3/3	
>Code Meaning	(0008,0104)	3/3	3/3	
Performed Procedure Step End Date	(0040,0250)	2/2	3/1	1
Performed Procedure Step End Time	(0040,0251)	2/2	3/1	1
Comments on the Performed Procedure Step	(0040,0280)	3/3	3/3	
Image Acquisition Results				
Modality	(0008,0060)	1/1	Not allowed	
Study ID	(0020,0010)	2/2	Not allowed	
Performed Action Item Code Sequence	(0040,0260)	2/2	3/2	

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>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Version	(0008,0103)	3/3	3/3	
>Code Meaning	(0008,0104)	3/3	3/3	
Performed Series Sequence	(0040,0340)	2/2	3/1	1 (See note 2)
>Performing Physician's Name	(0008,1050)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Protocol Name	(0018,1030)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	1
>Operator's Name	(0008,1070)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Series Instance UID	(0020,000E)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	1
>Series Description	(0008,103E)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Retrieve AE Title	(0008,0054)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Referenced Image Sequence	(0008,1140)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	See F.7.2.2.2.

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>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	See F.7.2.2.2.
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>All other attributes from Performed Series Sequence		3/3	3/3	
All other attributes from Radiation Dose Module and Billing and Material Code Module		3/3	3/3	

Notes: 1. The requirement for the final state is that which applies at the time that the Performed Procedure Step Status (0040,0252) is N-SET to a value of COMPLETED or DISCONTINUED, as described in F.7.2.2.2. It is only described if it is different from the SCP requirement for the N-CREATE.

2. The Performed Series Sequence (0040,0340) may not be empty (zero length) at the time that the Performed Procedure Step Status (0040,0252) is N-SET to a value of COMPLETED or DISCONTINUED. In other words a Series must exist for every Performed Procedure Step, though it may contain no Images or Standalone objects, if none were created, as described in F.7.2.2.2.

3. Attributes (0040,1006) Placer Order Number/Procedure and (0040,1007) Filler Order Number/Procedure were previously defined in DICOM. They are now retired (See PS3.3 1998).

4. Attributes (0040,2006) and (0040,2007) were previously defined in DICOM. They are now retired (See PS3.3 1998).

F.7.2.1.2 Service Class User

The SCU shall specify in the N-CREATE request primitive the Class and Instance UIDs of the Modality Performed Procedure Step SOP Instance which is created and for which Attribute Values are to be provided.

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Note: This requirement facilitates the inclusion of relevant Attributes in the Composite SOP Instances generated during the Performed Procedure Step.

The SCU shall provide Attribute values for the Modality Performed Procedure Step SOP Class Attributes as specified in Table F.7.2-1. Additionally, values may be provided for optional Modality Performed Procedure Step IOD Attributes that are supported by the SCP. The encoding rules for Modality Performed Procedure Step Attributes are specified in the N-CREATE request primitive specification in PS 3.7.

The SCU shall be capable of providing all required Attribute values to the SCP in the N-CREATE request primitive. The SCU may provide Attribute values for optional Attributes which are not maintained by the SCP. In such case the SCU shall function properly regardless of whether the SCP accepts values for those Attributes or not.

All Attributes shall be created before they can be set. Sequence Attributes shall be created before they can be filled. Sequence Item Attributes shall not be created at zero length.

Note: Not all the attributes that can be created can be set afterwards (see Table F.7.2-1).

The SCU shall only send the N-CREATE request primitive with the value for the Attribute "Performed Procedure Step Status" (0040,0252) set to "IN PROGRESS".

Note: It is assumed but not required that the SCU (the modality) received the Study Instance UID within the scope of the Basic Worklist Management SOP Class.

F.7.2.1.3 Service Class Provider

The N-CREATE operation allows the SCU to provide to the SCP selected Attribute values for a specific Modality Performed Procedure Step SOP Instance. This operation shall be invoked through the use of the DIMSE N-CREATE Service used in conjunction with the appropriate Modality Performed Procedure Step SOP Instance.

The SCP shall return, via the N-CREATE response primitive, the N-CREATE Response Status Code applicable to the associated request.

The SCP shall accept N-CREATE request primitives only if the value of the attribute "Performed Procedure Step Status" (0040,0252) is "IN PROGRESS". If the Performed Procedure Step Status attribute has another value, the SCP shall set the failure status code "Invalid attribute value" (Code: 0106H) with an Attribute List.

Note: The SCP may update the Referenced Study Component Sequence Attributes in the referenced Study Management SOP Instance, if it exists, and the scheduling information on which the Modality Worklist is based.

F.7.2.1.4 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

F.7.2.2 SET Modality Performed Procedure Step Information

This operation allows an SCU to set Attribute Values of an instance of the Modality Performed Procedure Step SOP Class and provide information about a specific real-world Modality Performed Procedure Step that is under control of the SCU. This operation shall be invoked through the DIMSE N-SET Service.

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F.7.2.2.1 Modality Performed Procedure Step IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to modify a subset of the Attributes maintained by the SCP. The Application Entity which claims conformance as an SCP to this SOP Class shall support the subset of the Modality Performed Procedure Step Attributes specified in Table F.7.2-1.

The character set used for Attribute Values updated using the N-SET shall be the same as that specified by the N-CREATE Request Primitive.

F.7.2.2.2 Service Class User

The SCU shall specify in the N-SET request primitive the UID of the Modality Performed Procedure Step SOP Instance for which it wants to set Attribute Values.

The SCU shall be permitted to set Attribute values for any Modality Performed Procedure Step SOP Class Attribute specified in Table F.7.2-1. The SCU shall specify the list of Modality Performed Procedure Step SOP Class Attributes for which it wants to set the Attribute Values. The SCU shall provide, with one or more N-SET request primitives, the attribute values specified in Table F.7.2-1. The encoding rules for Modality Performed Procedure Step Attributes are specified in the N-SET request primitive specification in PS 3.7. The SCU shall only set Attribute Values which are already created with an N-CREATE request.

The SCU shall not send N-SET request primitives for a Modality Performed Procedure Step SOP Instance after a N-SET request primitive with a value for the attribute "Performed Procedure Step Status" (0040,0252) is "COMPLETED" or "DISCONTINUED" has been sent.

If Sequences are included in a N-SET command, all Items of a Sequence are to be included in the command and not only the Items to be updated.

Once the Modality Performed Procedure Step Status (0040,0252) has been set to "COMPLETED" or "DISCONTINUED" the SCU shall no longer modify the Modality Performed Procedure Step SOP Instance, and shall not create new Composite SOP Instances as part of the same Modality Performed Procedure Step SOP Instance.

Note: A Modality that wishes to continue or resume creating Composite SOP Instances may create a new Modality Performed Procedure Step.

Before or when Modality Performed Procedure Step Status (0040,0252) is set to "COMPLETED" or "DISCONTINUED" the SCU shall have created or set all the Attributes according to the requirements in the Final State column of Table F.7.2-1.

Before or when Modality Performed Procedure Step Status (0040,0252) is set to "COMPLETED" or "DISCONTINUED" the SCU shall have sent to the SCP a list of all Image SOP Instances and all Standalone SOP Instances created during the Procedure Step in Referenced Image Sequence (0008,1140) and Referenced Standalone SOP Instance Sequence (0040,0220) respectively.

Note: The intent is that a completed or discontinued Modality Performed Procedure Step entity will contain a complete list of all the Images and Standalone SOP Instances that were created.

The Modality Performed Procedure Step Status (0040,0252) shall not be set to "COMPLETED" or "DISCONTINUED" if the list contains neither Image references nor Standalone SOP Instance references, unless no such Instances were created.

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F.7.2.2.3 Service Class Provider

The N-SET operation allows the SCU to request that the SCP update selected Attribute values for a specific Modality Performed Procedure Step SOP Instance. This operation shall be invoked through the use of the DIMSE N-SET Service used in conjunction with the appropriate Modality Performed Procedure Step SOP Instance.

The SCP shall return, via the N-SET response primitive, the N-SET Response Status Code applicable to the associated request. Contingent on the N-SET Response Status, the SCP shall update the Referenced Performed Procedure Step Attributes.

The SCP shall accept N-SET request primitives only if the value of the already existing attribute "Performed Procedure Step Status" (0040,0252) is "IN PROGRESS". If the already existing Performed Procedure Step Status attribute has another value, the SCP shall set the failure status code "Processing failure" (Code: 0110H) with a Specific Error Comment (see Section F.7.2.2.4).

The SCP may itself modify any Attributes of the Modality Performed Procedure Step SOP Instance only after the "Performed Procedure Step Status" (0040,0252) has been set to "COMPLETED" or "DISCONTINUED".

Notes: 1. Such coercion of Attributes by the SCP may be necessary to correct, for example, patient identification information or incorrectly selected scheduling information. Such an operation is not permitted to the SCU by the requirements described in Table F.7.2-1, which might create a new Modality Performed Procedure Step SOP Instance to achieve the same objective.

2. Under exceptional circumstances, it may be necessary for the SCP to itself set the Performed Procedure Step Status (0040,0252) to COMPLETED or DISCONTINUED, for example if the Modality has failed. When the Modality recovers, subsequent N-SETs may fail.

F.7.2.2.4 Status Codes

The specific error comment which may be returned as a status code in a N-SET-RSP is defined in Table F.7.2-2. See PS 3.7 for additional response status codes.

Table F.7.2-2
N-SET STATUS

Status	Error Comment	Error ID
0110H	Performed Procedure Step Object may no longer be updated	A710

F.7.3 Modality Performed Procedure Step SOP Class UID

The Modality Performed Procedure Step SOP Class shall be uniquely identified by the Modality Performed Procedure Step SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.3".

F.7.4 Conformance Requirements

Implementations providing conformance to the Modality Performed Procedure Step SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described below.

An implementation may conform to this SOP Class as an SCU or as an SCP. The Conformance Statement shall be in the format defined in Annex A of PS 3.2.

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F.7.4.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the operations which it invokes.

F.7.4.1.1 Operations

Any Attributes for which Attribute Values may be provided (using the N-CREATE Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in Annex A of PS 3.2.

Any Attributes for which Attribute Values may be provided (using the N-SET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in Annex A of PS 3.2.

An implementation which conforms to this SOP Class as an SCU shall specify under which conditions during the performance of the real-world Performed Procedure Step it will create the SOP Class Instance and under which conditions it will set the status value to COMPLETED and DISCONTINUED.

F.7.4.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the operations which it performs.

F.7.4.2.1 Operations

Any Attributes for which Attribute Values may be provided (using the N-CREATE Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in Annex A of PS 3.2.

Any Attributes for which Attribute Values may be updated (using the N-SET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in Annex A of PS 3.2.

The SCP Operations Conformance Statement shall also provide information on the behavior of the SCP (the Information System) at the following occurrences:

- The creation of a new Instance of the Modality Performed Procedure Step SOP Class with the status "IN PROGRESS". The result of that process on the scheduling information and on the attributes values of the Modality Worklist Management SOP Class shall be specified.
- The update of the Attribute "Performed Procedure Step Status", i.e. the change from the state "IN PROGRESS" to "DISCONTINUED" or to "COMPLETED".
- Which Attributes the SCP may coerce after the state has been set to "IN PROGRESS" or "DISCONTINUED" or to "COMPLETED".
- For how long the Modality Performed Procedure Step SOP Instance will persist on the SCP.

F.8 MODALITY PERFORMED PROCEDURE STEP RETRIEVE SOP CLASS

F.8.1 DIMSE Service Group

The DIMSE Services shown in Table F.8.1-1 are applicable to the Modality Performed Procedure Step IOD under the Modality Performed Procedure Step Retrieve SOP Class.

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Table F.8.1-1
DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-GET	M/M

The DIMSE Services and Protocols are specified in PS 3.7. If the Modality Performed Procedure Step Object is no longer available the Request Primitive will be answered with a Failure Status message "No Such Object Instance".

F.8.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operations and the Application Entity which claims conformance as an SCP shall be capable of providing the following operations.

F.8.2.1 GET Performed Procedure Step Information

This operation allows an SCU to get information about a specific real-world Performed Procedure Step which is represented as a Modality Performed Procedure Step Retrieve SOP Instance by a Modality Performed Procedure Step Retrieve SCP. The operation is performed on a Modality Performed Procedure Step IOD. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Modality Performed Procedure Step Retrieve SOP Instance.

The same SOP Instance UID is shared by all three Modality Performed Procedure Step SOP Classes. This means that the SOP Instance created and set using the services of the Modality Performed Procedure Step SOP Class can be retrieved using its SOP Instance UID within the service of the Modality Performed Procedure Step Retrieve SOP Class. Changes in its state can be notified by using its SOP Instance UID within the service of the Modality Performed Procedure Step Notification SOP Class. The SOP Class UID specified in the DIMSE N-GET Service shall be the UID of the Modality Performed Procedure Step Retrieve SOP Class.

The Modality Performed Procedure Retrieve Step SOP Instance UID shall not be used to identify a SOP Instance of the Study Component Service Class.

Note: An Application Entity may support the SCU role of the Modality Performed Procedure Step Retrieve SOP Class in order to obtain information about Performed Procedure Steps created by other Application Entities.

F.8.2.1.1 Modality Performed Procedure Step Retrieve IOD Subset Specifications

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attribute values maintained by the SCP which the SCU receives via the operation of this SOP Class. The Application Entity which claims conformance as an SCP to this Modality Performed Procedure Step Retrieve SOP Class shall support the subset of the Modality Performed Procedure Step Retrieve Attributes specified in Table F.8.2-1.

Table F.8.2-1
MODALITY PERFORMED PROCEDURE STEP RETRIEVE SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set is used)

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Performed Procedure Step Relationship		
Scheduled Step Attributes Sequence	(0040,0270)	3/1
>Study Instance UID	(0020,000D)	-/1
>Referenced Study Sequence	(0008,1110)	-/2
>>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
>Accession Number	(0008,0050)	-/2
>Placer Order Number/Imaging Service Request	(0040,2016)	-/3
>Filler Order Number/Imaging Service Request	(0040,2017)	-/3
>Requested Procedure Description	(0032,1060)	-/2
>Requested Procedure ID	(0040,1001)	-/2
>Scheduled Procedure Step ID	(0040,0009)	-/2
>Scheduled Procedure Step Description	(0040,0007)	-/2
>Scheduled Action Item Code Sequence	(0040,0008)	-/2
>>Code Value	(0008,0100)	-/1C (Required if Sequence Item is present)
>>Coding Scheme designator	(0008,0102)	-/1C (Required if Sequence Item is present)
>>Coding Scheme Version	(0008,0103)	-/3
>>Code Meaning	(0008,0104)	-/3
Patient's Name	(0010,0010)	3/2
Patient ID	(0010,0020)	3/2
Patient's Birth Date	(0010,0032)	3/2
Patient's Sex	(0010,0040)	3/2

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Referenced Patient Sequence	(0008,1120)	3/2
>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>Referenced Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
Performed Procedure Step Information		
Performed Station AE Title	(0040,0241)	3/1
Performed Station Name	(0040,0242)	3/2
Performed Location	(0040,0243	3/2
Performed Procedure Step Start Date	(0040,0244)	3/1
Performed Procedure Step Start Time	(0040,0245)	3/1
Performed Procedure Step ID	(0040,0253)	3/1
Performed Procedure Step Status	(0040,0252)	3/1
Performed Procedure Step End Date	(0040,0250)	3/2
Performed Procedure Step End Time	(0040,0251)	3/2
Performed Procedure Step Description	(0040,0254)	3/2
Performed Procedure Type Description	(0040,0255)	3/2
Procedure Code Sequence	(0008,1032)	3/2
>Code Value	(0008,0100)	-/1C (Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	-/1C (Required if Sequence Item is present)
>Coding Scheme Version	(0008,0103)	-/3
>Code Meaning	(0008,0104)	-/3
Comments on the Performed Procedure Step	(0040,0280)	3/3
Image Acquisition Results		
Performed Series Sequence	(0040,0340)	3/2
>Performing Physician's Name	(0008,1050)	-/2C (Required if Sequence Item is present)
>Protocol Name	(0018,1030)	-/1C

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		(Required if Sequence Item is present)
>Operator's Name	(0008,1070)	-/2C (Required if Sequence Item is present)
>Series Instance UID	(0020,000E)	-/1C (Required if Sequence Item is present)
>Series Description	(0008,103E)	-/2C (Required if Sequence Item is present)
>Retrieve AE Title	(0008,0054)	-/2C (Required Sequence Item is present)
>Referenced Image Sequence	(0008,1140)	-/2C (Required Sequence Item is present)
>>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
>Referenced Standalone SOP Instance Sequence	(0040,0220)	-/2C (Required if Sequence Item is present)
>>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
>All other Attributes from Performed Series Sequence		-/3
Modality	(0008,0060)	3/1
Study ID	(0020,0010)	3/2
Performed Action Item Code Sequence	(0040,0260)	3/2
>Code Value	(0008,0100)	-/1C (Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	-/1C (Required if Sequence Item is present)
>Coding Scheme Version	(0008,0103)	-/3
>Code Meaning	(0008,0104)	-/3
All other attributes from Radiation Dose Module and Billing and Material Code Module		3/3

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Notes: 1. Attributes (0040,1006) Placer Order Number/Procedure and (0040,1007) Filler Order Number/Procedure were previously defined in DICOM. They are now retired (See PS3.3 1998).

2. Attributes (0040,2006) and (0040,2007) were previously defined in DICOM. They are now retired (See PS3.3 1998).

F.8.2.1.2 Service Class User

The SCU uses the N-GET Service Element to request the SCP to get a Modality Performed Procedure Step Retrieve SOP Instance. The SCU shall specify the UID of the SOP Instance to be retrieved, which is a UID of a Modality Performed Procedure Step SOP Instance. The SCU shall be permitted to request that Attribute Values be returned for any Modality Performed Procedure Step Retrieve SOP Class Attribute specified in Table F.8.2-1. Additionally values may be requested for optional Modality Performed Procedure Step IOD Attributes.

The SCU shall specify the list of Modality Performed Procedure Step Retrieve SOP Class Attributes for which values are to be returned. The encoding rules for Modality Performed Procedure Step Attributes are specified in the N-GET request primitive specification in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET indication primitive. The SCU may request Attribute Values for optional Attributes which are not maintained by the SCP. In such a case, the SCU shall function properly regardless of whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to accurately interpret the character set used for the Attribute Values returned, it is recommended that the Attribute Value for the Specific Character Set (0008,0005) be requested in the N-GET request primitive.

F.8.2.1.3 Service Class Provider

The N-GET operation allows the SCU to request from the SCP selected Attribute values for a specific Modality Performed Procedure Step SOP Instance via a Modality Performed Procedure Step Retrieve SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Modality Performed Procedure Step Retrieve SOP Instance which equals the Modality Performed Procedure SOP Instance. The SCP shall retrieve the selected Attribute values from the indicated Modality Performed Procedure Step SOP Instance.

The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the associated request. A Failure Code shall indicate that the SCP has not retrieved the SOP Instance. Contingent on the N-GET Response Status, the SCP shall return, via the N-GET response primitive, Attribute Values for all requested Attributes maintained by the SCP.

F.8.2.1.4 Status Codes

The status values which are specific for this SOP Class and DIMSE Service are defined in Table F.8.2-2. See PS 3.7 for additional response status codes.

Table F.8.2-2
RESPONSE STATUS

Service Status	Further Meaning	Response Status Code

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Warning	Requested optional Attributes are not supported	0001

F.8.3 Modality Performed Procedure Step Retrieve SOP Class UID

The Modality Performed Procedure Step Retrieve SOP Class shall be uniquely identified by the Modality Performed Procedure Step Retrieve SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.4".

F.8.4 Conformance Requirements

Implementations providing conformance to the Modality Performed Procedure Step Retrieve SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described below.

An implementation may conform to this SOP Class as an SCU or as an SCP. The Conformance Statement shall be in the format defined in Annex A of PS 3.2.

F.8.4.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the operations which it invokes.

F.8.4.1.1 Operations

Any Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in Annex A of PS 3.2.

F.8.4.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the operations which it performs.

F.8.4.2.1 Operations

Any Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in Annex A of PS 3.2.

F.9 MODALITY PERFORMED PROCEDURE STEP NOTIFICATION SOP CLASS

The Modality Performed Procedure Step Notification SOP Class is intended for those Application Entities requiring notifications of Modality Performed Procedure Step's changes in state.

An Application Entity may choose to take some actions based upon a notification or request for information but is in no way required to do so.

Notes: 1. For example, in one configuration, an IS could be responsible for maintaining data related to performed procedure steps. A PACS reviewing workstation may need to display the images for any study viewed. In order for the PACS to link the images to the study, a PACS may receive a notification whenever a procedure step has been performed. In such a configuration the IS is the SCP and the PACS is the SCU. When the PACS receives this notification, it may link the images and the performed procedure step to the study within its internal database or may choose to take no action.

2. The terms IS and PACS used in the previous example are provided for clarification purposes only. This document does not define nor constrain the purpose or role of any IS,

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PACS or acquisition Application Entity conforming to this Service Class Specification.

F.9.1 DIMSE service group

Table F.9.1-1 shows the DIMSE-N Services applicable to the Modality Performed Procedure Step IOD under the Modality Performed Procedure Step Notification SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Table F.9.1-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M

F.9.2 Notifications

The Application Entity which claims conformance as an SCU to this SOP Class shall be permitted to receive the following notification. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following notifications.

F.9.2.1 Receive Modality Performed Procedure Step Event Notification

This notification allows an SCU to receive from the SCP an unsolicited notification of a change in a Modality Performed Procedure Step SOP Instance. These notifications shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the related Modality Performed Procedure Step SOP Instance.

The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The SCU shall accept all Attributes included in any notification. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

The same SOP Instance UID is shared by all three Modality Performed Procedure Step SOP Classes. This means that the SOP Instance created and set using the services of the Modality Performed Procedure Step SOP Class can be retrieved using its SOP Instance UID within the service of the Modality Performed Procedure Step Retrieve SOP Class. Changes in its state can be notified by using its SOP Instance UID within the service of the Modality Performed Procedure Step Notification SOP Class. The SOP Class UID specified in the DIMSE N-EVENT-REPORT Service shall be the UID of the Modality Performed Procedure Step Notification SOP Class.

The Modality Performed Procedure Step Notification SOP Instance UID shall not be used to identify a SOP Instance of the Study Component Service Class.

F.9.2.2 Provide Modality Performed Procedure Step Event Notification

These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in the state of a real-world performed procedure step. This notification shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the related Modality Performed Procedure Step SOP Instance.

The SCP shall specify in the N-EVENT-REPORT request primitive the UID of the Modality Performed Procedure Step SOP Instance with which the event is associated and the Event Type ID.

Note: The encoding of Notification Event Information is defined in PS 3.7.

F.9.2.3 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

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F.9.3 Modality Performed Procedure Step Notification SOP Class UID

The Modality Performed Procedure Step Notification SOP Class shall be uniquely identified by the Modality Performed Procedure Step Notification SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.5".

F.9.4 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Modality Performed Procedure Step Notification SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

Table F.9.2-1
PERFORMED PROCEDURE STEP NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
Performed Procedure Step In Progress	1			
Performed Procedure Step Completed	2			
Performed Procedure Step Discontinued	3			
Performed Procedure Step Updated	4			An Update event shall not be used to notify changes in Performed Procedure Step Status (0040,0252).
Performed Procedure Step Deleted	5			

Note: The Notification Event Information contains no Attributes, beyond those defined in PS 3.7. An SCU receiving a Notification and requiring further information may also be an SCU of the Modality Performed Procedure Step Retrieval SOP Class and may use the Affected SOP Instance UID (0000,1000) to perform an N-GET of the Modality Performed Procedure Step SOP Instance.

F.9.4.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

— notifications which it receives

F.9.4.1.1 Notifications

All standard event types for which notifications may be requested by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall include an enumerated list of the event types supported:

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[— Performed Procedure Step In Progress;]

[— Performed Procedure Step Completed;]

[— Performed Procedure Step Discontinued;]

[— Performed Procedure Step Updated;]

[— Performed Procedure Step Deleted;]

F.9.4.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for:

— notifications which it invokes

F.9.4.2.1 Notifications

Any optional Attributes which may be included in Standard notifications to the SCU shall be enumerated in the SCP Notifications Statement. The SCP Notifications Statement shall be formatted as defined in PS 3.2. Following this statement shall be the list of event types and optional Attributes.

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Annex G RESULTS MANAGEMENT SERVICE CLASS (Normative)

G.1 OVERVIEW

G.1.1 Scope

The Results Management Service Class defines an application-level class-of-service which facilitates the creation and tracking of results and associated diagnostic interpretations.

Although other Service Classes (e.g. Storage, Query/Retrieve) partially specify some of the results information (through the use of the Composite IOD metaphor) the primary focus of such Service Classes is images and not results. This Service Class can be distinguished from such image-oriented Service Classes in that this Service Class focuses on results information and how it relates to the acquired images which comprise studies. There is little functional overlap between the image-oriented Service Classes and this Service Class and it is possible that many implementations will support both this Service Class and one or more image-oriented Service Classes in order to provide a full suite of application functionality.

The goal of the Results Management Service Class is to support Application Entities requiring access to information relating to the recording (dictation), transcription, approval and amendment of results for one or more studies. Applications such as billing and insurance are outside of the scope of this Service Class.

G.1.2 Results Management Functional Model

The Results Management Functional Model is depicted in Figure G.1-1. This model primarily depicts the functional view of the results management application used by this Service Class. The model is composed of processes (circles) and data flows (arrows). For simplicity, only the most fundamental data flows are shown and additional data flows which may occur are not represented in the figure.

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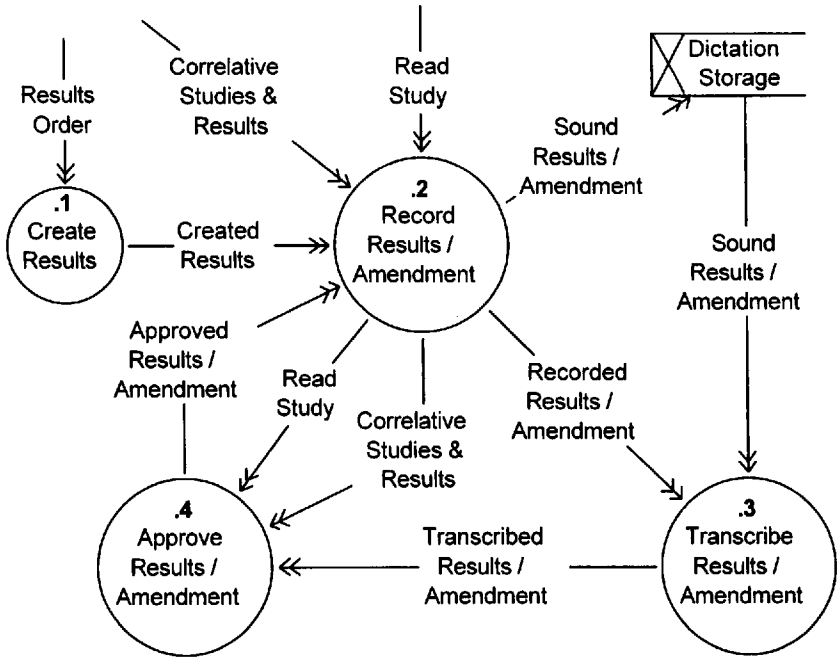

Figure G.1-1
RESULTS MANAGEMENT FUNCTIONAL MODEL

G.1.2.1 Create Results

This process takes an order for results (triggered by examination completion) and creates the information necessary to manage the results. Examples of information associated with the created results are results identification.

G.1.2.2 Record Results

In this process the physician uses the created results information along with the read study and correlative studies and results (from previous patient visits) to record (dictate) the results (diagnosis report) for the read study. Output from this process are the sound results (dictated report) which is sent to dictation storage. The recorded results are also output. Examples of information associated with the recorded results are recorded date an time and the recorder.

G.1.2.3 Transcribe Results

Sound and recorded results information is used by this process to transcribe the results to a textual form. Examples of information associated with the transcribed results are the transcription date and time and the transcriber.

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G.1.2.4 Approve Results

In this process, the transcribed results are reviewed (along with read study and correlative studies and results) for accuracy. Examples of information associated with the approved results are the approval date and time and the approver(s). Note that more than one person may approve a result.

G.1.2.5 Record Amendment

An approved result is amended by this process. Because substantially similar activities are performed when recording an amendment as when recording the initial results, these two processes are represented as a single process in Figure G.1-1. Examples of information associated with the recording of an amendment are recorded date and time and the recorder.

G.1.2.6 Transcribe Amendment

A results amendment is transcribed in this process. Because the same activities are performed when transcribing an amendment as when transcribing the initial results, these two processes are represented as a single process in Figure G.1-1. Examples of information associated with transcribed amendments are the transcription date and time and the transcriber.

G.1.2.7 Approve Amendment

An amended result is approved in this process. Because the same activities are performed when approving an amendment as when approving the initial results, these two processes are represented as a single process in Figure G.1-1. Examples of information associated with the approved amendment are the approval date and time and the approver(s). Note that more than one person may approve an amended report (initial interpretation).

G.1.3 Results Management Information Model

The Results Management Information Model is the view of the data upon which the Results Management Functional Model acts. Thus many of the data flows in Figure G.1-1 are specified in the Results Management Information Model.

The data are modeled through the use of Information Object Definitions (IODs) which are defined in PS 3.3. Two IODs, the Results and Interpretation IODs, are used by this Service Class. The Results IOD specifies the macro information about the results (such as results identifier) and the Interpretation IOD specifies information relating to specific interpretations (report or amendments). The majority of the information used in Figure G.1-1 is specified in the Interpretation IOD. Reference PS 3.3 for more information on the Results and Interpretation IODs.

G.1.4 Results Management States

Closely related to the Results Management Information Model are the major states of the result and its associated interpretations. Table G.1-1 describes the valid Results Management states. Because of the partition of information between the Results and Interpretation IOD, the state information is primarily specified by the Interpretation IOD.

Table G.1-1
RESULTS MANAGEMENT STATES

State	Specifying IOD	Description
Created	Results	Outcome of completion of Create Results process
Recorded	Interpretation	Interpretation has been recorded
Transcribed	Interpretation	Interpretation has been transcribed
Approved	Interpretation	Interpretation has been approved

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Table G.1-2 defines the valid state transitions for the results. For each of the above defined states the valid state resulting from the occurrence of events relating to the functional model is specified. These state transitions are managed by both the Results and Interpretation Management SOP Classes.

Table G.1-2—RESULTS MANAGEMENT STATE TRANSITION DIAGRAM

Events	States			
	Created	**Recorded**	**Transcribed**	**Approved**
Report or Amendment Recorded	Recorded			
Report or Amendment Transcribed	Transcribed	Transcribed		
Report or Amendment Approved	Approved	Approved	Approved	

G.2 CONFORMANCE OVERVIEW

The application-level services addressed by this Service Class Definition are specified via 3 distinct SOP Classes:

a) Detached Results Management SOP Class
b) Detached Interpretation Management SOP Class
c) Detached Results Management Meta SOP Class

Each SOP Class operates on a subset of the Results IOD or the Interpretation IOD and specifies the Attributes, operations, notifications, and behavior applicable to the SOP Class. The conformance requirements are expressed in terms of the Service Class Provider (SCP) and the Service Class User (SCU).

Each SOP Class operates on a subset of the Results IOD or the Interpretation IOD and specifies the Attributes, operations, notifications, and behavior applicable to the SOP Class. Conformance of Application Entities shall be defined by selecting one or more of the Results and Interpretation Management SOP and Meta SOP Classes. For each SOP Class conformance requirements shall be specified in terms of the Service Class Provider (SCP) and the Service Class User (SCU).

G.2.1 Association Negotiation

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The Association negotiation procedure specified in PS 3.7 shall be used to negotiate the supported SOP Classes or Meta SOP Classes.

Support for the SCP/SCU role selection negotiation is mandatory. The SOP Class Extended Negotiation shall not be supported.

Note: Event notification is a process that logically extends across multiple Associations. SCP implementations should support a local table of SCUs to which event notifications are to be sent.

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G.3 DETACHED RESULTS MANAGEMENT SOP CLASS

The Detached Results Management SOP Class is intended for those Application Entities requiring transfer of information about a real-world result and notifications of its changes in state. The SOP Class is termed "Detached" because neither Application Entity can directly affect the other. An Application Entity may choose to take some actions based upon a notification or request for information but is in no way required to do so.

Notes: 1. For example, in one configuration, a RIS could be responsible for maintaining data related to results. A PACS reviewing workstation is required to display the results for any study viewed. In order for the PACS to link the results to the study, a PACS may receive a notification whenever a result has been created. In such a configuration the RIS is the SCP and the PACS is the SCU. When the PACS receives this notification, it may link the results to the study within its internal database or may choose to take no action.

2. The terms RIS and PACS used in the previous example are provided for clarification purposes only. This document does not define nor constrain the purpose or role of any HIS, RIS, PACS or Acquisition Application Entity conforming to this Service Class Specification.

G.3.1 DIMSE service group

Table G.3-1 shows DIMSE-N Services applicable to the Results IOD under the Detached Results Management SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Table G.3-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M

G.3.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted to invoke the following operation. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following operations.

G.3.2.1 Get Results Information

This operation allows an SCU to get information about a specific real-world result which is represented as a Detached Results Management SOP Instance by a Detached Results Management SCP. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Detached Results Management SOP Instance.

G.3.2.1.1 Results IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attributes maintained by the SCP which the SCU receives via the operations of the SOP Class. The Application Entity which claims conformance as an SCP to the Detached Results Management SOP Class shall support the subset of the Results IOD Attributes specified in Table G.3-2.

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Table G.3-2
DETACHED RESULTS MANAGEMENT SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set is used)
Referenced Study Sequence	(0008,1110)	3/1
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Results ID	(4008,0040)	3/2
Referenced Interpretation Sequence	(4008,0050)	3/2
>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Impressions	(4008,0300)	3/2
All other Attributes		3/3

G.3.2.1.2 Service Class User

The SCU shall specify in the N-GET request primitive the UID of the Detached Results Management SOP Instance for which Attribute Values are to be returned. The SCU shall be permitted to request that Attribute Values be returned for any Detached Results Management SOP Class Attribute specified in Section G.3.2.1.1. Additionally, values may be requested for optional Results IOD Attributes which the SCP states (in its Conformance Statement) that it supports.

The SCU shall specify the list of Detached Results Management SOP Class Attributes for which the Attribute Values are to be returned. The encoding rules for this list are specified in the N-GET Request Primitive specified in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU and shall not be returned by an SCP.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET Indication Primitive. The SCU may request Attribute Values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly regardless to whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to accurately interpret the character set used for Attribute Values returned, it is recommended that the Attribute value for Specific Character Set (0008,0005) be requested in the N-GET request primitive.

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G.3.2.1.3 Service Class Provider

This operation allows the SCU to request from the SCP selected Attribute Values for a specific Detached Results Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Detached Results Management SOP Instance.

The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the associated request. Contingent on the N-GET Response Status, the SCP shall return, via the N-GET response primitive, Attribute Values for all requested Attributes maintained by the SCP (see Table G.3-2).

G.3.2.1.4 Status Codes

The status values which are specific for this SOP Class and DIMSE Service are defined as shown in Table G.3-3.

See PS 3.7 for response status codes.

Table G.3-3
RESPONSE STATUSES

Service Status	Further Meaning	Response Status Codes
Warning	Requested optional Attributes are not supported	0001

G.3.3 Notifications

The Application Entity which claims conformance as an SCU to this SOP Class shall be permitted to receive the following notification. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following notifications.

G.3.3.1 Receive Results Event Notification

This notification allows an SCU to receive from the SCP an unsolicited notification of a change in the Detached Results Management SOP Instance. These notifications shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Results Management SOP Instance.

The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The SCU shall accept all Attributes included in any notification. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

G.3.3.2 Provide Results Event Notification

These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in the state of a real-world result. This notification shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Results Management SOP Instance.

The SCP shall specify in the N-EVENT-REPORT request primitive the UID of the Detached Results Management SOP Instance with which the event is associated and the Event Type ID. The SCP shall additionally include Attributes related to the event as defined in Table G.3-4.

Note: The encoding of Notification Event Information is defined in PS 3.7.

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G.3.3.3 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

G.3.4 Detached Results Management SOP Class UID

The Detached Results Management SOP Class shall be uniquely identified by the Detached Results Management SOP Class UID which shall have the value "1.2.840.10008.3.1.2.5.1".

G.3.5 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Detached Results Management SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

Table G.3-4
RESULTS NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
Results Created	1	Specific Character Set	(0008,0005)	-/1C (Required if extended/ replacement character set used)
		Instance Creation Date	(0008,0012)	-/1
		Referenced Study Sequence	(0008,1110)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		Instance Creation Time	(0008,0013)	-/2
		Instance Creator UID	(0008,0014)	-/2
		Results ID	(4008,0040)	-/2
		Referenced Interpretation Sequence	(4008,0050)	-/2
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)
		All other defined Attributes		-/3
Results Deleted	2	Results ID	(4008,0040)	-/2

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Results Updated	3	All updated Attributes		-/1

G.3.5.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

— operations which it invokes

— notifications which it receives

G.3.5.1.1 Operations

Any optional Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

G.3.5.1.2 Notifications

All standard event types for which notifications may be requested by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall include an enumerated list of the event types supported:

[— Results Created;]

[— Results Updated;]

[— Results Deleted;]

G.3.5.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for:

— operations which it performs

— notifications which it invokes

G.3.5.2.1 Operations

Any optional Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

G.3.5.2.2 Notifications

Any optional Attributes which may be included in Standard notifications to the SCU shall be enumerated in the SCP Notifications Statement. The SCP Notifications Statement shall be formatted as defined in PS 3.2. Following this statement shall be the list of event types and optional Attributes.

G.4 DETACHED INTERPRETATION MANAGEMENT SOP CLASS

The Detached Interpretation Management SOP Class is intended for those Application Entities requiring transfer of information about real-world interpretations and notifications of their changes in state.

Notes: 1. For example, in one configuration, a RIS could be responsible for maintaining data related to results interpretations. A PACS reviewing workstation is required to display all approved interpretations for any study viewed. In order for the PACS to link the interpretation to the study, a PACS may receive a notification whenever an interpretation has been

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approved. In such a configuration the RIS is the SCP and the PACS is the SCU. When the PACS receives this notification, it may update its internal database with the received interpretation information or may choose to take no action.

2, The terms RIS and PACS used in the previous example are provided for clarification purposes only. This document does not define nor constrain the purpose or role of any HIS, RIS, PACS or Acquisition Application Entity conforming to this Service Class Specification.

G.4.1 DIMSE Service Group

The DIMSE-N Services shown in Table G.4-1 are applicable to the Interpretation IOD under the Detached Interpretation Management SOP Class.

The DIMSE-N Services and Protocol are specified in PS 3.7.

Table G.4-1
DIMSE-N SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M
N-SET	U/M

G.4.2 Operations

The Application Entity which claims conformance to this SOP Class as an SCU shall be permitted but not required to invoke the following operation. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of Providing the following operations.

G.4.2.1 Get Interpretation Information

This operation allows an SCU to get information about a specific real-world interpretation which is represented as a Detached Interpretation Management SOP Instance by a Detached Interpretation Management SCP. This operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate Detached Interpretation Management SOP Instance.

G.4.2.1.1 Interpretation IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the Attributes maintained by the SCP which the SCU receives via the operations of the SOP Class. The Application Entity which claims conformance as an SCP to the Detached Interpretation Management SOP Class shall support the subset of the Patient IOD Attributes specified in Table G.4-2.

Table G.4-2
DETACHED INTERPRETATION MANAGEMENT SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set used)
Referenced Results Sequence	(0008,1100)	3/1

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>Referenced SOP Class UID	(0008,1150)	3/1C (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	3/1C (Required if sequence is present)
Interpretation Text	(4008,010B)	3/2
Interpretation ID	(4008,0200)	3/2
Interpretation Type ID	(4008,0210)	3/2
Interpretation Status ID	(4008,0212)	3/2
All other Attributes		3/3

G.4.2.1.2 Service Class User

The SCU shall specify in the N-GET request primitive the UID of the Detached Interpretation Management SOP Instance for which Attribute Values are to be returned. The SCU shall be permitted to request that Attribute Values be returned for any Detached Interpretation Management SOP Class Attribute specified in Section G.4.2.1.1. Additionally, values may be requested for optional Patient IOD Attributes which the SCP states (in its Conformance Statement) that it supports.

The SCU shall specify the list of Interpretation Management SOP Class Attributes for which the Attribute Values are to be returned. The encoding rules for this list are specified in the N-GET Request Primitive specified in PS 3.7.

In an N-GET operation, the values of Attributes which are defined within a Sequence of Items shall not be requested by an SCU and shall not be returned by an SCP.

The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to the N-GET indication primitive. The SCU may request Attribute Values for optional Attributes which are not maintained by the SCP. In such a case the SCU shall function properly regardless to whether the SCP returns values for those Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

Note: In order to accurately interpret the character set used for Attribute Values returned, it is recommended that the Attribute Value for Specific Character Set (0008,0005) be requested in the N-GET Request Primitive when appropriate.

G.4.2.1.3 Service Class Provider

This operation allows the SCU to request from the SCP, selected Attribute Values for a specific Detached Interpretation Management SOP Instance. This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the appropriate Detached Interpretation Management SOP Instance.

The SCP shall return, via the N-GET response primitive, the N-GET response status code applicable to the associated request. Contingent on the N-GET response status, the SCP shall return, via the N-GET Response Primitive, Attribute Values for all requested Attributes maintained by the SCP (see Table G.4-2).

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G.4.2.1.4 Status Codes

The status values which are specific for this SOP Class and DIMSE Service are defined as shown in Table G.4-3.

See PS 3.7 for response status codes.

Table G.4-3
RESPONSE STATUSES

Service Status	Further Meaning	Response Status Codes
Warning	Requested optional Attributes are not supported	0001

G.4.2.2 Set Intepretation Information

This operation allows an SCU to provide information about a specific real-world Interpretation which is represented as a Detached Interpretation Management SOP Instance by a Detached Interpretation Management SCP. This operation shall be invoked through the DIMSE N-SET Service used in conjunction with the appropriate Detached Interpretation Management SOP Instance.

G.4.2.2.1 Interpretation IOD Subset Specification

The Application Entity which claims conformance to this SOP Class as an SCU may choose to modify a subset of the Attributes maintained by the SCP. The Application Entity which claims conformance as an SCP to the Detached Interpretation Management SOP Class shall support the subset of the Interpretation IOD Attributes as specified in Table G.4-4.

Table G.4-4
DETACHED INTERPRETATION MANAGEMENT SOP CLASS N-SET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Interpretation Status ID	(4008,0212)	3/1

The character set used for Attribute Values updated using N-SET shall be the same as that used by the SCP.

Note: It is recommended that the Attribute Value for Specific Character Set (0008,0005) be requested in an N-GET request primitive.

G.4.2.2.2 Service Class User

The SCU shall specify in the N-SET Request Primitive the UID of the Detached Interpretation Management SOP Instance for which Attribute Values are to be provided. The SCU shall be permitted to request that Attribute Values be updated for any Detached Interpretation Management SOP Class Attribute specified in Section G.4.2.2.1.

The SCU shall specify the list of Interpretation Management SOP Class Attributes for which the Attribute Values are to be provided. The encoding rules for this list are specified in the N-SET request primitive specified in PS 3.7.

G.4.2.2.3 Service Class Provider

This operation allows the SCU to request that the SCP update selected Attribute Values for a specific Detached Interpretation Management SOP Instance. This operation shall be invoked

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through the use of the DIMSE N-SET Service used in conjunction with the appropriate Detached Interpretation Management SOP Instance.

The SCP shall return, via the N-SET response primitive, the N-SET Response Status Code applicable to the associated request.

G.4.2.2.4 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

G.4.3 Notifications

The Application Entity which claims conformance as an SCU to this SOP Class shall be permitted to receive the following notification. The Application Entity which claims conformance as an SCP to this SOP Class shall be capable of providing the following notification.

G.4.3.1 Receive Interpretation Event Notification

This notification allows an SCU to receive from the SCP an unsolicited notification of an event associated with a Detached Interpretation Management SOP Instance. These notifications shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Interpretation Management SOP Instance.

The SCU shall return, via the N-EVENT-REPORT Response Primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The SCU shall accept all Attributes included in any notification. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

G.4.3.2 Provide Interpretation Status Event Notification

These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in state of the interpretation. This notification shall be invoked by the SCP through the use of the DIMSE N-EVENT-REPORT Service used in conjunction with the appropriate Detached Interpretation Management SOP Instance.

The SCP shall specify in the N-EVENT-REPORT Request Primitive the UID of the Detached Interpretation Management SOP Instance with which the event is associated and the Event Type ID. The SCP shall additionally include Attributes related to the event as defined in Table G.4-5. Only those Attributes maintained by the SCP may be included in the notification.

Note: The encoding of Notification Event Information is defined in PS 3.7.

Table G.4-5
INTERPRETATION NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
Interpretation Created	1	Instance Creation Date	(0008,0012)	-/1
		Referenced Results Sequence	(0008,1100)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1C (Required if sequence is present)
		>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if sequence is present)

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		Instance Creation Time	(0008,0013)	-/2
		Instance Creator UID	(0008,0014)	-/2
		Interpretation Type ID	(4008,0210)	-/2
		Interpretation Status ID	(4008,0212)	-/2
		All other defined Attributes		-/3
Interpretation Recorded	2	Interpretation Recorded Date	(4008,0100)	-/1
		Interpretation Recorded Time	(4008,0101)	-/2
		Interpretation Recorder	(4008,0102)	-/2
		Interpretation Type ID	(4008,0210)	-/2
		Interpretation Status ID	(4008,0212)	-/2
		Reference to Recorded Sound	(4008,0103)	-/3
Interpretation Transcribed	3	Interpretation Transcription Date	(4008,0108)	-/1
		Interpretation Author	(4008,010C)	-/1
		Interpretation Transcription Time	(4008,0109)	-/2
		Interpretation Type ID	(4008,0210)	-/2
		Interpretation Status ID	(4008,0212)	-/2
Interpretation Approved	4	Interpretation Approver	(4008,0111)	-/1
		>Interpretation Approval Dates	(4008,0112)	-/1
		>Interpretation Approval Times	(4008,0113)	-/2
		>Physicians Approving Interpretation	(4008,0114)	-/1
		Interpretation Diagnosis Description	(4008,0115)	-/2
		Interpretation Diagnosis Codes Sequence	(4008,0117)	-/2
		>Code Value	(0008,0100)	-/1C (Required if sequence is present)
		>Coding Scheme Designator	(0008,0102)	-/1C (Required if sequence is present)
		>Coding Scheme Version	(0008,0103)	-/3
		>Code Meaning	(0008,0104)	-/1C (Required if sequence is present)
		Interpretation Status ID	(4008,0212)	-/2
Interpretation Deleted	5			

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Interpretation Updated	6	All updated Attributes		-/1

G.4.3.3 Status Codes

There are no specific status codes. See PS 3.7 for response status codes.

G.4.4 Detached Interpretation Management SOP Class UID

The Detached Interpretation Management SOP Class shall be uniquely identified by the Detached Interpretation Management SOP Class UID which shall have the value "1.2.840.10008.3.1.2.6.1".

G.4.5 Conformance Requirements

Implementations providing Standard SOP Class Conformance to the Detached Interpretation Management SOP Class shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

An implementation may conform to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

G.4.5.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for the:

- operations which it invokes
- notifications which it receives

G.4.5.1.1 Operations

Any optional Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute Values may be provided (using the N-SET Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined in PS 3.2.

G.4.5.1.2 Notifications

All standard event types for which notifications may be requested by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall include an enumerated list of the event types supported:

[—Interpretation Created;]
[—Interpretation Recorded;]
[—Interpretation Transcribed;]
[—Interpretation Approved;]
[—Interpretation Updated;]
[—Interpretation Deleted;]

G.4.5.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the:

- operations which it performs

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— notifications which it invokes

G.4.5.2.1 Operations

Any optional Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

Any optional Attributes for which Attribute Values may be updated (using the N-SET Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined in PS 3.2.

G.4.5.2.2 Notifications

Any optional Attributes which may be included in Standard notifications to the SCU shall be enumerated in the SCP Notifications Statement. The SCP Notifications Statement shall be formatted as defined in PS 3.2. Following this statement shall be the list of event types and optional Attributes.

G.5 DETACHED RESULTS MANAGEMENT META SOP CLASS

The Detached Results Management Meta SOP Class represents the union of the Detached Results Management SOP Class and the Detached Interpretation Management SOP Class. It is intended for those Application Entities which conform to both of the aforementioned SOP Classes. All requirements specified for the Detached Results Management SOP Class and Detached Interpretation Management SOP Classes shall be met by Application Entities conforming to the Results Management Meta SOP Class. Please reference Sections G.3 through G.4.5.2.2 for Results Management Meta SOP Class requirements.

G.5.1 Detached Results Management Meta SOP Class UID

The Detached Results Management Meta SOP Class shall be uniquely identified by the Detached Results Management Meta SOP Class UID which shall have the value "1.2.840.10008.3.1.2.5.4".

G.6 SPECIALIZED SOP CLASS CONFORMANCE

Implementations may provide Specialized SOP Class Conformance by providing a proper superset of the functionality of the Standard SOP Class which is Specialized. Implementations providing Specialized SOP Class Conformance to one of the SOP Classes defined in this Annex shall be conformant as described in the following sections and shall include within their Conformance Statement information as described in the following sections.

G.6.1 Conformance Type

An implementation shall be permitted to conform as a Specialization of the standard SOP Class as an SCU, SCP or both. The Conformance Type statement shall be formatted as defined in PS 3.2.

G.6.2 Specialized SOP Class Identification

Any implementation which specializes the standard SOP Class shall define its specialization as an Allomorphic subclass of the standard SOP Class. As such, the specialization shall have its own unique SOP Class Identification.

The Conformance Statement shall include a SOP Class Identification Statement as defined in PS 3.2, declaring a SOP Name and SOP Class UID which identify the Specialized SOP Class. The SOP Name is not guaranteed to be unique but is provided for informal identification of the SOP Class. The SOP Class UID shall uniquely identify the Specialized SOP Class and conform to the DICOM UID requirements as specified in PS 3.5.

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G.6.3 SCU Conformance

An implementation which is conformant to the Specialized SOP Class as an SCU shall meet conformance requirements for:

- operations which it invokes
- notifications which it receives

G.6.3.1 Operations

The standard SOP Class may be specialized by supporting additional standard DIMSE-N operations and/or additional private Attributes. The SCU Operations Statement shall describe these specializations and be formatted as defined in PS 3.2.

Following this statement shall be the list of:

- standard operations supported by the standard SOP Class which are extended by the addition of Private Attributes
- standard operations and the associated Standard and Private Attributes which are not supported by the standard SOP Class but which are supported by the Specialization

Each additional operation shall be enumerated along with the list of Attributes which it supports.

G.6.3.2 Standard Notifications

Any standard notifications which are requested by the SCU without extension shall be enumerated as specified in Sections G.3.3.2 and G.4.3.2.

G.6.3.3 Extended Notifications

Any private Attributes which may be received in standard notifications in addition to the standard Attributes shall be enumerated in the SCU Notifications Statement.

Additionally, any private event types for which notifications may be received by the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall be formatted as defined in PS 3.2.

Following this statement shall be the list of:

- Standard Event Types which are extended by the addition of Private Attributes
- Extended Event Types and the associated Standard and Private Attributes

G.6.4 SCP Conformance

An implementation which is conformant to the Specialized SOP Class as an SCP shall meet conformance requirements for:

- operations which it performs
- notifications which it invokes

G.6.4.1 Operations

The standard SOP Class may be specialized by supporting additional standard DIMSE-N operations and/or additional private Attributes. The SCP Operations Statement shall describe these specializations and be formatted as defined in PS 3.2.

Following this statement shall be the list of:

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— standard operations supported by the standard SOP Class which are extended by the addition of Private Attributes
— standard operations and the associated standard and private Attributes which are not supported by the standard SOP Class but which are supported by the Specialization

Each additional operation shall be enumerated along with the list of Attributes which it supports.

G.6.4.2 Notifications

Any private Attributes which may be included in standard notifications to the SCU shall be enumerated in the SCP Notifications Statement.

Additionally, any private event types for which notifications may be sent to the SCU shall be enumerated in the SCU Notifications Statement. The SCU Notifications Statement shall be formatted as defined in PS 3.2.

Following this statement shall be the list of:

— Standard Event Types which are extended by the addition of Private Attributes
— Extended Event Types and the associated Standard and Private Attributes

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Annex H PRINT MANAGEMENT SERVICE CLASS (Normative)

H.1 SCOPE

The Print Management Service Class defines an application-level class-of-service which facilitates the printing of images and image related data on a hard copy medium.

Note: The DICOM Print Management Service Class covers the general cases of printing medical images in standardized layouts. An application can obtain more flexible layout, annotation, and formatting either by direct manipulation of the pixel matrices used in DICOM Print Management, or by utilizing page descriptions written in a page description language (such as Postscript or PDF) that are communicated to the printing system using commonly available protocols. These other page descriptions languages are not communicated using DICOM protocols and their use is outside the scope of the DICOM Standard.

H.2 PRINT MANAGEMENT MODEL

H.2.1 Print Management Data Flow Model

H.2.1.1 Global Data Flow Model

The Print Management Data Flow Model (Figure H.2-1) consists of three main processes:

- Film Session Management process
- Queue Management process
- Print process

Note: The Standard uses the word film as a general name for different types of hard copy media (e.g. photographic film, paper).

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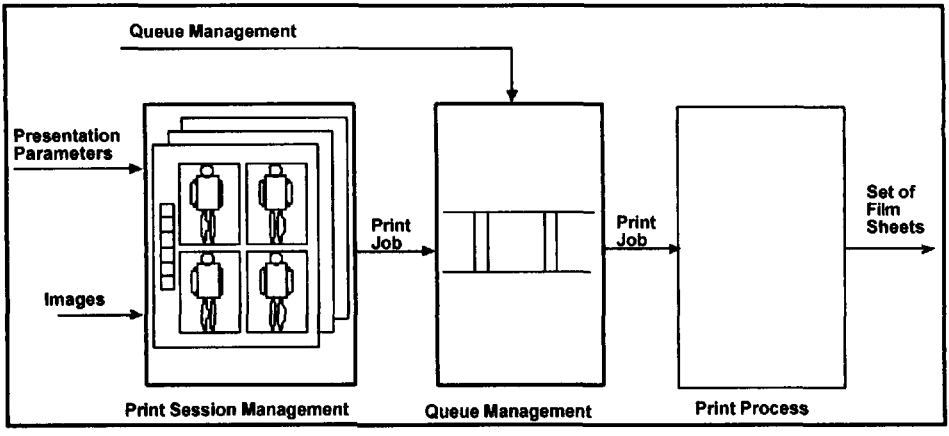

Figure H.2-1
PRINT MANAGEMENT DATA FLOW MODEL

The Film Session Management process is responsible for acquiring all the information which is required to print the film session. The film session is the atomic work package of the Print Management Application and contains one or more films related in a user defined way (e.g., belonging to the same exam, patient) that are originated from one host (e.g., workstation, diagnostic modality) and that are printed on one hard copy printer.

Each film consists of one or more images and zero or more film related annotations. An annotation consists of one or more lines of text.

Each image consists of pixel data and zero or more overlay planes. The user controls the look of the film by assigning values to print parameters.

Print parameters are defined at film session, film, image and annotation levels. The parameter level determines the scope of operation of the print parameters (e.g., print parameters of the image level are valid for the corresponding image).

The inputs of the Film Session Management process are:

- set of images and image related data
- presentation data that describes the visual look of the films

The output of the Film Session Management process is the Print Job, which contains all the information to print the film session.

The Queue Management process manages the various Print Jobs. The user can manipulate the queue content : e.g. delete Print Jobs, prioritize Print Jobs.

The Print process prints a set of films, based on the information in the Print Job. The Print process is implementation specific and its management is beyond the scope of the DICOM standard.

H.2.1.2 Grayscale Transformations

The Print Management Service Class supports two grayscale transformations and spatial transformations that converts an original image into a printed image.

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The sequence of spatial transformations (e.g., magnification and merging of annotation with images) and their relationships with the grayscale transformations are implementation specific and fall beyond the scope of the DICOM Standard.

The sequence of grayscale transformations is important for achieving consistent image quality because of the non-orthogonal nature of the different transformations. Figure H.2-2 describes the sequence of grayscale transformations.

Note: This section previously described Modality LUT and VOI LUT transformations in more detail. Since Referenced Print SOP Classes have been retired, these descriptions no longer apply to the Print Management Service Class. See PS 3.4-1998.

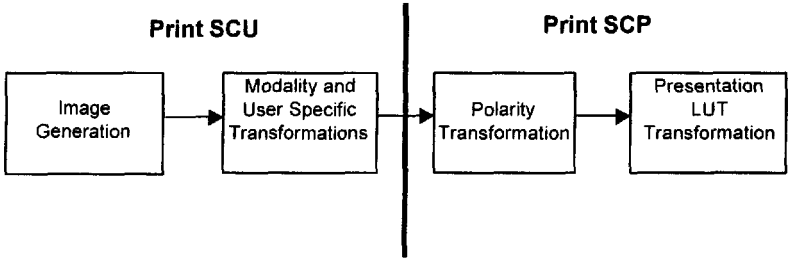

Figure H.2-2
PRINT MANAGEMENT DATA FLOW MODEL

H.2.1.2.1 Modality and User Specific Transformations

Examples of these transformations are Modality LUT, Mask Subtraction, and VOI LUT.

The Modality LUT transforms manufacturer dependent pixel values into pixel values which are meaningful for the modality and which are manufacturer independent.

The VOI LUT transforms the modality pixel values into pixel values which are meaningful for the user or the application. For example it selects of a range of pixel values to be optimized for display, such as soft tissue or bone windows in a CT image.

H.2.1.2.2 Polarity

Polarity specifies whether minimum input pixel values shall be displayed as black or white. If Polarity (2020,0020) is NORMAL then the pixels will be displayed as specified by Photometric Interpretation; if Polarity is REVERSE then the pixels will be displayed with the opposite polarity as specified by Photometric Interpretation.

Polarity (2020,0020) is an Attribute of the Image Box IOD.

H.2.1.2.3 Presentation LUT

The Presentation LUT transforms the polarity pixel values into Presentation Values (P-Values), which are meaningful for display of the images. P-Values are approximately related to human perceptual response. They are intended to facilitate consistent display with common input for both hardcopy and softcopy display devices and be independent of the specific class or characteristics of the display device. It is used to realize image display tailored for specific modalities, applications, and user preferences

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In the Print Management Service Class, the Presentation LUT is part of the Presentation LUT IOD.

Hardcopy devices convert P-Values into optical density for printing. This conversion depends on desired image D-max and D-min. It also depends on expected viewing conditions such as lightbox intensity for transparency films. The conversion to printed density is specified in the Presentation LUT SOP Class.

If the modality desires to natively specify P-Values as its output, it can negotiate for support of the Presentation LUT, but specify a LUT that is an identity function. The identity function informs the display device that no further translation is necessary.

Note: Performing this translation in the printer prevents potential loss of precision (detail) that would occur if this translation were to be performed on many of the existing 8-bit modalities.

H.2.2 Print Management Service Class Structure

The Print Management Service Class Structure is shown in Figure H.2-3.

The Print Management SCU and Print Management SCP are peer DICOM Print Management Application Entities. The Application Entity of the Print Management SCP corresponds with one or more hard copy printers. If the SCP Application Entity corresponds with multiple printers then the SCP Application Entity selects for each Print Job the printer where the Print Job will be printed.

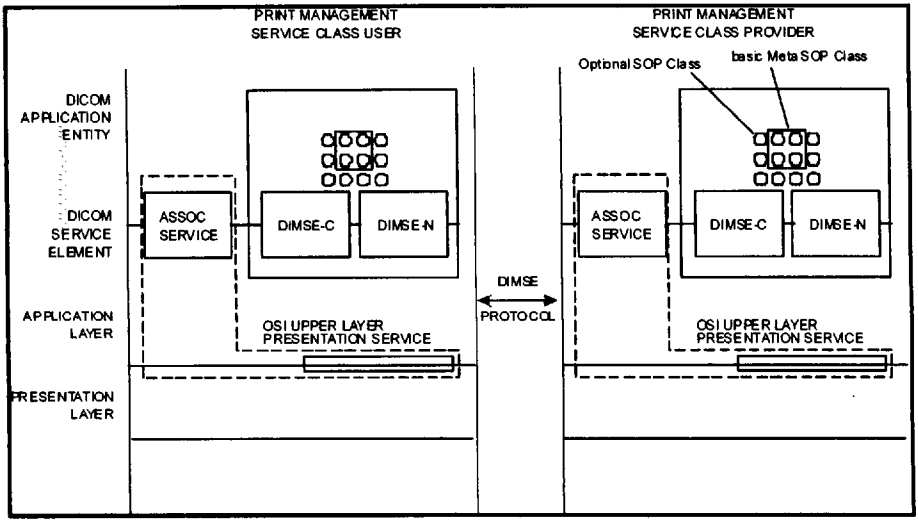

Figure H.2-3
PRINT MANAGEMENT SERVICE CLASS STRUCTURE

The Print Management SCU and Print Management SCP establish an Association by using the Association Services of the OSI Upper Layer Service. During Association establishment, the DICOM Print Management Application Entities negotiate the supported SOP Classes. The negotiation procedure is defined in Section H.5.

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Figure H.2-4 shows alternative configurations for printing images and image related data from one host to multiple printers.

— Configuration 1: one SCU Application Entity corresponds with the host and one SCP Application Entity corresponds with multiple printers. The SCU has no control over the print parameters of each printer and over the print destination of the Print Job.

— Configuration 2: one SCU Application Entity corresponds with the host and one Application Entity SCP corresponds with each printer. The SCU has explicit control over the print parameters of each printer and over the print destination of the Print Job. Each SCP Application Entity has one Association with the SCU Application Entity and is identified by its Application Entity title.

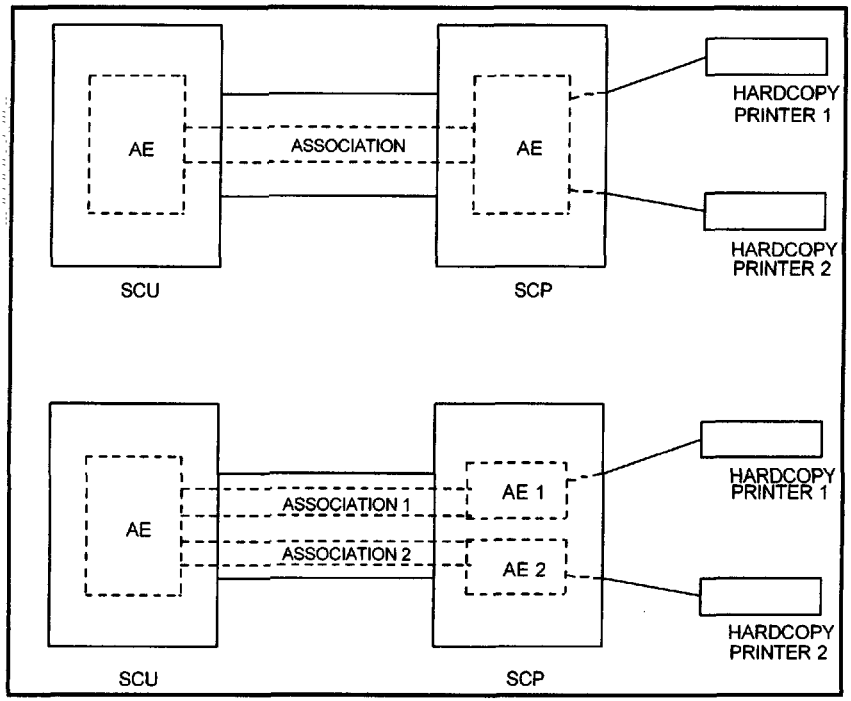

Figure H.2-4
CONFIGURATIONS FOR PRINTING ON MULTIPLE PRINTERS

H.2.3 Print Management SOP Classes

The Print Management SCU controls the Print Process by manipulating the Print Management SOP Classes by means of the DIMSE Services. The Print Management SOP Classes are managed by the Print Management SCP.

The Print Management SOP Classes are classified as follows:

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- Content related SOP Classes: these SOP Classes are an abstraction of the contents of a film (e.g., pixel data, text string). The content related SOP Classes correspond with the Image related SOP Classes, which are described in Section H.4 of this Part.
- Presentation related SOP Classes: these SOP Classes are an abstraction of the presentation of a film (e.g., layout information) and are defined by Normalized IODs and Normalized DIMSE-N Services. The presentation related SOP Classes are defined in Section H.4 of this Part.
- Queue related SOP Classes: these SOP Classes are an abstraction of the print queue and are defined by Normalized IODs and Normalized DIMSE-N Services. The Queue related SOP Classes are defined in Section H.4 of this Part.
- Printer related SOP Classes: these SOP Classes are an abstraction of the printer configuration and status and are defined by Normalized IODs. The Printer SOP Class is defined in Section H.4 of this Part.

H.2.4 Usage Specifications

The building blocks of SOP Classes are Modules and DIMSE Services. The Modules contain related Attributes, which are Mandatory(M) or Optional (U). The usage may be different for the SCU and SCP. The usage is specified as a pair of letters: the former indicating the SCU usage, the latter indicating the SCP usage.

DIMSE Services may be Mandatory (M) or Optional (U) as specified in Section 5.4 of this Part.

The meaning and behavior of the usage specification for Attributes for the Print Management Service Class are:

M/M The SCU shall provide a value for the Attribute. If the SCU does not supply a value, the SCP shall return a Failure status ("Missing Attribute," code 0120H). The SCP shall support at least one value of the Attribute. If the SCP does not support the value specified by the SCU, it shall return a Failure status ("Invalid Attribute Value," code 0106H).

-/M The SCU's usage of the Attribute is undefined. The SCP shall support at least one value of the Attribute.

U/M The SCU may provide a value for the Attribute. If the SCP does not support the value specified by the SCU, it shall return either a Failure status ("Invalid Attribute Value", code 0106H) or return a Warning status ("Attribute Value Out of Range", code 0116H). In the case of Warning status, the SCP will apply the default value as defined in the SCP Conformance Statement.

U/U The SCU may provide a value for the Attribute. If the SCP does not support the value specified by the SCU, but does support the Attribute, it shall return either a Failure status ("Invalid Attribute Value", code 0106H) or a Warning status ("Attribute Value out of Range, code 0116H.). In the case of Warning status, the SCP will apply the default value as defined in the SCP Conformance Statement.

If the SCP does not support the Attribute specified by the SCU, it shall return either a Failure status ("No Such Attribute", code 0105H) or return a Warning status ("Attribute List Error", code 0107H.)). In the case of Warning status, the behavior of the SCP is defined in the SCP Conformance Statement.

If the usage type designation is modified by a "C" (e.g., MC/M) the specification stated above shall be modified to include the requirement that the Attribute shall be supported if the specified condition is met.

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H.2.5 Status Code Categories

For every operation requested on a SOP class of the print management service class, a status code will be returned. These status codes are grouped into success, warning or failure categories.

Note: These status codes categories are defined in PS 3.7:

Success - indicates that the SCP performed the requested operation as requested.

Warning - indicates that the SCP has received the request and will process it. However, immediate processing of the request, or processing in the way specified by the SCU, may not be possible. The SCP expects to be able to complete the request without further action by the SCU across the DICOM interface. The exact behavior of the SCP is described in the Conformance Statement.

Failure - indicates that the SCP is unable to perform the request. The request will not be processed unless it is repeated by the SCU at a later time. The exact behavior of the SCP is described in the Conformance Statement.

H.3 PRINT MANAGEMENT CONFORMANCE

H.3.1 Scope

Print Management conformance is defined in terms of supported Meta SOP Classes, which correspond with the mandatory functionality, and of supported optional SOP Classes, which correspond with additional functionality.

A Meta SOP Class corresponds with a pre-defined group of SOP Classes. The following Print Management Meta SOP Classes are defined:

- Basic Grayscale Print Management Meta SOP Class
- Basic Color Print Management Meta SOP Class
- Pull Stored Print Management Meta SOP Class

All SCUs and SCPs of the Print Management Service Class shall support at least one of the Basic Print Management Meta SOP Classes.

In addition the other Meta SOP Classes or optional SOP Classes may be supported.

The Meta SOP Class level negotiation is used to define a minimum set of print functions; the SOP Class level negotiation is used to define additional functions.

If multiple Meta SOP Classes and one or more optional SOP Classes are negotiated, the SCP shall support all the optional SOP Classes in conjunction with all the Meta SOP Classes.

At association setup, the negotiation process between the Print Management SCU and SCP shall occur for

- one or more of the Meta SOP Classes and zero or more of the optional SOP Classes specified in Section H.3.3.2; or
- one or more of the Printer, Print Job, and Printer Configuration Retrieval SOP Classes.

Note: It is possible for an SCP to support Associations for printing and to also support additional Associations for the sole purpose of exchanging status information about the printer.

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H.3.2 Print Management Meta SOP Classes

H.3.2.1 Description

The Basic Print Management Meta SOP Classes correspond with the minimum functionality that an implementation of the Print Management Service Class shall support. The Basic Print Management Meta SOP Classes support the following mandatory features:

- preformatted grayscale images or preformatted color images; preformatted images are images where annotation, graphics, overlays are burned in
- pre-defined film layouts (image display formats)
- basic presentation parameters on film session, film box and image box level
- basic device management

The optional SOP Classes described in Section H.3.3 may be used with the Basic Print Management Meta SOP Classes.

The Pull Stored Print Management Meta SOP Class is an extension of the Basic Print Management Meta SOP Class. It supports the following mandatory features:

- Film box (page) level printing
- Printing of Hardcopy Grayscale/Color and other Preformatted Images
- Images are send separately from the print parameters
- Print parameters are stored in the Stored Print Storage SOP Instance
- Stored Print Storage SOP Instances and the Image SOP Instances are sent to the printer by the various Storage SOP Classes

The following features are optional for SCUs and SCPs:

- Film box annotation
- Separate image overlays
- Presentation LUT

One use of the Pull Stored Print Management Meta SOP Classes is to make an additional print of images originally printed with one of the Print Management Meta SOP Classes. It allows all the information originally sent to a printer to be sent to the same or another printer. The specific results on the second printer will depend on a number of factors including:

- Printer defaults used for Attributes not specified in the original print process
- Differences in capabilities of the original and subsequent printers

Especially when the subsequent print is made on a different model printer, there probably will be differences in the subsequent prints compared with the original prints. The magnitude of these differences and their acceptability in specific clinical circumstances is beyond the scope of the DICOM Standard.

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H.3.2.2 Meta SOP Class Definitions

H.3.2.2.1 Basic Grayscale Print Management Meta SOP Class

The Meta SOP Class is defined by the following set of supported SOP Classes.

SOP Class Name	Reference	Usage SCU/SCP
Basic Film Session SOP Class	H.4.1	M/M
Basic Film Box SOP Class	H.4.2	M/M
Basic Grayscale Image Box SOP Class	H.4.3.1	M/M
Printer SOP Class	H.4.6	M/M

Note: The image pixel data are part of the Basic Grayscale Image Box SOP Class

The meaning of the Usage SCU/SCP is described in Section H.2.4.

The Basic Grayscale Print Management Meta SOP Class UID has the value "1.2.840.10008.5.1.1.9".

H.3.2.2.2 Basic Color Print Management Meta SOP Class

The Meta SOP Class is defined by the following set of supported SOP Classes.

SOP Class Name	Reference	Usage SCU/SCP
Basic Film Session SOP Class	H.4.1	M/M
Basic Film Box SOP Class	H.4.2	M/M
Basic Color Image Box SOP Class	H.4.3.2	M/M
Printer SOP Class	H.4.6	M/M

Note: The image pixel data are part of the Basic Color Image Box SOP Class

The meaning of the Usage SCU/SCP is described in Section H.2.4.

The Basic Color Print Management Meta SOP Class UID has the value "1.2.840.10008.5.1.1.18".

H.3.2.2.3 Referenced Grayscale Print Management Meta SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

H.3.2.2.4 Referenced Color Print Management Meta SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

H.3.2.2.5 Pull Stored Print Management Meta SOP Class

The Meta SOP Class is defined by the following set of supported SOP Classes.

SOP Class Name	Reference	Usage SCU/SCP
Pull Print Request SOP Class	H.4.9	M/M
Printer SOP Class	H.4.6	M/M

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SCPs shall also support the Hardcopy Grayscale Image Storage SOP Class or the Hardcopy Color Image Storage SOP Class as an SCU. They may support both of these SOP Classes.

SCPs may also support Other Image Storage SOP Classes.

Note: Other Image Storage SOP Classes referenced by the Stored Print IOD describe Preformatted Images. See PS 3.3.

SCPs shall also support the Study Root Query/Retrieve Information Model—MOVE SOP Class as an SCU.

The Pull Stored Print Management Meta SOP Class UID has the value "1.2.840.10008.5.1.1.32".

H.3.3 Optional SOP Classes

H.3.3.1 Description

The optional SOP Classes address functionality beyond that of the Print Management Meta SOP Classes. One or more optional SOP Classes may be used in addition to the Print Management Meta SOP Classes.

The following functionality is supported by the optional SOP Classes:

- annotation (text associated with a sheet of film)
- tracking the printing of the print session
- overlays (text or graphics associated with an image)
- retrieval of printer configuration information
- Presentation LUTs

Use of these optional SOP Classes allows an SCU to provide information to be printed with or on an image without burning the information into the image pixels. If these optional SOP Classes are not supported by both the SCU and SCP, then only the information burnt in to the image pixels before they are sent to the SCP will be printed. If the optional SOP Classes are not supported, the SCU is responsible for burning all expected text or graphics into the image pixels.

H.3.3.2 List of Optional SOP Classes

The following optional SOP Classes may be used in conjunction with the Basic Print Management Meta SOP Classes specified in Section H.3.2.2.

SOP Class Name	Reference	Usage SCU/SCP
Basic Annotation Box SOP Class	H.4.4	U/U
Print Job SOP Class	H.4.5	U/U
Basic Print Image Overlay Box SOP Class	H.4.12	U/U
Presentation LUT SOP Class	H.4.9	U/U
Printer Configuration Retrieval SOP Class	H.4.11	U/U

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Note: Negotiation of the Presentation LUT SOP Class does not imply any behavior in the SCP. Behavior is explicit when the Presentation LUT SOP Class is created and referenced at either the Film Session, Film Box, or Image Box levels.

The following optional SOP Class may be used in conjunction with the Pull Stored Print Management Meta SOP Class specified in Section H.3.2.2.

SOP Class Name	Reference	Usage SCU/SCP
Print Job SOP Class	H.4.5	U/U
Presentation LUT SOP Class	H.4.9	U/U
Printer Configuration Retrieval SOP Class	H.4.11	U/U

Note: Negotiation of the Presentation LUT SOP Class does not imply any behavior in the SCP. Behavior is explicit when the Presentation LUT SOP Class is created and referenced at either the Film Session, Film Box, or Image Box levels.

H.3.4 Conformance statement

The implementation Conformance Statement of these SOP Classes shall follow PS 3.2.

The SCU Conformance Statement shall specify the following items:

- maximum number of supported Associations at the same time
- list of supported SOP Classes and Meta SOP Classes
- for each of the supported SOP and Meta SOP Classes:
  - list of supported optional SOP Class Attributes and DIMSE Service Elements
  - for each supported Attribute (mandatory and optional Attribute), the valid range of values

The SCP Conformance Statement shall specify the following items:

- maximum number of supported Associations at the same time
- list of supported SOP Classes and Meta SOP Classes
- minimum and maximum number of printable pixel matrix per supported film size
- for each of the supported SOP Classes:
  - list of supported optional SOP Class Attributes and DIMSE Service Elements
  - for each supported Attribute (mandatory and optional Attribute):
    - valid range of values
    - default value if no value is supplied by the SCU
    - status code (Failure or Warning) if SCU supplies a value which is out of range
- for each supported DIMSE Service, the SCP behavior for all specific status codes
- description of each supported custom Image Display Format (2010,0010) e.g., position and dimensions of each composing image box, numbering scheme of the image positions
- description of each supported Annotation Display Format ID (2010,0030) e.g., position and dimensions of annotation box, font, number of characters

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- description of each supported configuration table (e.g. identification, content)
- if the SCP supports N-ACTION for the Film Session SOP Class then the SCP shall specify the maximum number of collated films
- in the case of grayscale printers that print color images, the behavior of printing color images
- for Pull Print Request Meta SOP Class SCPs, behavior when Image Overlay, Annotation, and Presentation LUT options are contained in the Stored Print Storage SOP Class
- if cropping of images is supported, the algorithm for removing rows and columns from the image

H.4 PRINT MANAGEMENT SOP CLASS DEFINITIONS

H.4.1 Basic Film Session SOP Class

H.4.1.1 IOD Description

The Basic Film Session IOD describes the presentation parameters which are common for all the films of a film session (e.g. number of films, film destination)

The Basic Film Session SOP Instance refers to one or more Basic Film Box SOP Instances.

H.4.1.2 DIMSE Service Group

The DIMSE Services applicable to the IOD are shown in Table H.4-1.

Table H.4-1
DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-SET	U/M
N-DELETE	U/M
N-ACTION	U/U

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.1.2.1 N-CREATE

The N-CREATE is used to create an instance of the Basic Film Session SOP Class.

H.4.1.2.1.1 Attributes

The Attribute list of the N-CREATE is defined as shown in Table H.4-2.

Table H.4-2
N-CREATE ATTRIBUTE LIST

Attribute Name	Tag	Usage SCU/SCP
Number of Copies	(2000,0010)	U/M
Print Priority	(2000,0020)	U/M

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Medium Type	(2000,0030)	U/M
Film Destination	(2000,0040)	U/M
Film Session Label	(2000,0050)	U/U
Memory Allocation	(2000,0060)	U/U
Owner ID	(2100,0160)	U/U
Proposed Study Sequence	(2130,00A0)	U/U
>Patient's Name	(0010,0010)	U/U
>Patient ID	(0010,0020)	U/U
>Patient's Birth Date	(0010,0030)	U/U
>Patient's Sex	(0010,0040)	U/U
>Patient's Birth Time	(0010,0032)	U/U
>Other Patient ID	(0010,1000)	U/U
>Other Patient Names	(0010,1001)	U/U
>Ethnic Group	(0010,2160)	U/U
>Patient Comments	(0010,4000)	U/U
>Study Instance UID	(0020,000D)	U/U
>Study Date	(0008,0020)	U/U
>Study Time	(0008,0030)	U/U
>Referring Physician's Name	(0008,0090)	U/U
>Study ID	(0020,0010)	U/U
>Accession Number	(0008,0050)	U/U
>Study Description	(0008,1030)	U/U
>Name of Physician(s) Reading Study	(0008,1060)	U/U
>Admitting Diagnoses Description	(0008,1080)	U/U
>Patient's Age	(0010,1010)	U/U
>Patient's Size	(0010,1020)	U/U
>Patient's Weight	(0010,1030)	U/U
>Occupation	(0010,2180)	U/U
>Additional Patient's History	(0010,21B0)	U/U
>Series Number	(0020,0011)	U/U

Notes: 1. The memory allocation Attribute allows the SCU to reserve sufficient memory to store the "working" film session hierarchy as well the "copied" film session hierarchy in the Print Job in order to prevent deadlock situations.

2. Owner ID (2100,0160) is a user option for the Basic Film Session. However, SCUs that also implement the Print Queue Management Service Class are required to supply Owner ID to successfully delete or re-prioritize Print Jobs in the printer queue (see section L.4.2.3.1).

3. Proposed Study Sequence (2130,0040) may be used to identify Stored Print Storage and Hardcopy Image SOP Instances created to store this Film Session

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4. To meet requirements specified in PS 3.3, the Study Instance UID of the Stored Print Storage SOP Instance should be the same as the Study Instance UID in Proposed Study Sequence (2130,0040). New Series Instance and Image Instance UIDs will be supplied by the device that creates the Stored Print Storage SOP Instance.

The meaning of the Usage SCU/SCP is described in Section H.2.4.

Within the film session, the allocated memory is consumed as SOP Instances are created and is freed for reuse as SOP Instances are deleted. All the allocated memory shall be released following termination of the Association or deletion of the Film Session SOP Instance.

H.4.1.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows.

Status	Meaning	Code
Success	Film session successfully created	0000
Warning	Memory allocation not supported	B600

Note: The status code "0106H" (Invalid Attribute Value) indicates that the requested memory allocation can not be provided; the status code "0213H" (Resource limitation) indicates that the requested allocation can temporarily not be provided.

H.4.1.2.1.3 Behavior

The SCU uses the N-CREATE to request the SCP to create a Basic Film Session SOP Instance. The SCU shall initialize Attributes of the SOP Class as specified in Section H.2.4.

The SCP shall create the SOP Instance and shall initialize Attributes of the SOP Class as specified in Section H.2.4.

The SCP shall return the status code of the requested SOP Instance creation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The Basic Film Session SOP Instances shall be created before the Film Box SOP Instances are created.

At any time the SCU/SCP shall only support one Basic Film Session SOP Instance on an Association.

Note: Multiple film sessions may be handled by establishing multiple Associations.

Terminating the Association will effectively perform an N-DELETE on an opened film session. See Note in Section H.4.1.2.3.2.

H.4.1.2.2 N-SET

The N-SET may be used to update an instance of the Basic Film Session SOP Class.

H.4.1.2.2.1 Attributes

All Attributes and usage in Table H.4-2 apply to N-SET.

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H.4.1.2.2.2 Status

The status values which are specific for this SOP Class are defined in H.4.1.2.1.2.

H.4.1.2.2.3 Behavior

The SCU uses the N-SET to request the SCP to update a Basic Film Session SOP Instance. The SCU shall specify the SOP Instance UID to be updated and shall specify the list of Attributes for which the Attribute Values are to be set.

The SCP shall set new values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance update. The meaning of success, warning, and failure status codes is defined in Section H.2.5

H.4.1.2.3 N-DELETE

The N-DELETE is used to delete the complete Basic Film Session SOP Instance hierarchy. As a result, all references to Image SOP Instances within the film session are deleted.

The Basic Film Session SOP Instance hierarchy consists of one Basic Film Session SOP Instance, one or more Basic Film Box SOP Instances, one or more Image Box SOP Instances, zero or more Basic Annotation Box SOP Instances, zero or more Presentation LUT SOP Instances, and zero or more Basic Print Image Overlay Box SOP instances.

Note: The Basic Film Session SOP Instance hierarchy can be visualized as a reversed tree with the Basic Film Session SOP Instance as the root and the Image Box SOP Instances as the leaves.

H.4.1.2.3.1 Status

There are no specific status codes.

H.4.1.2.3.2 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Basic Film Session SOP Instance hierarchy. The SCU shall specify the SOP Instance UID of the Basic Film Session (root).

The SCP shall delete the specified SOP Instance hierarchy.

The SCP shall not delete SOP Instances in the hierarchy as long as there are outstanding references to these SOP Instances

Note: It is beyond the scope of the Standard to specify when the SCP actually deletes SOP Instances with outstanding references. See Note in Section H.4.3.3.2.1.3.

The SCP shall return the status code of the requested SOP Instance deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.1.2.4 N-ACTION

The N-ACTION is used to print the film session; i.e. to print all the films which belong to the film session.

If multiple copies of the film session have been requested, the SCP shall collate the copies. This means that if two copies of four films has been specified, the printed sequence is 12341234.

H.4.1.2.4.1 Attributes

The arguments of the N-ACTION are defined in Table H.4-3.

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The Action Reply argument is encoded as a DICOM Data Set. The Data Set only contains the Attribute Referenced Print Job Sequence (2100,0500) which includes the Referenced SOP Class UID (0008,1150) and the Referenced SOP Instance UID (0008,1155).

If the SCP supports the Print Job SOP Class or Print Queue Management, the Action Reply argument is contained in the N-ACTION response. Otherwise, the Action Reply is not contained in the N-ACTION response.

Table H.4-3
N-ACTION ARGUMENTS

Action Type Name	Action Type ID	Attribute	Tag	Usage SCU/SCP
Print	1	Referenced Print Job Sequence	(2100,0500)	-/MC Required if Print Job SOP is supported
		>Referenced SOP Class UID	(0008,1150)	-/MC Required if Referenced Print Job Sequence (2100,0500) is present
		>Referenced SOP Instance UID	(0008,1155)	-/MC Required if Referenced Print Job Sequence (2100,0500) is present
		>Print Job ID	(2100,0010)	-/MC (Required if Print Queue Management SOP Class is supported)

H.4.1.2.4.2 Status

The status values which are specific for this SOP Class are defined in Table H.4-4.

Table H.4-4
SOP CLASS STATUS VALUES

Status	Meaning	Code
Success	Film belonging to the film session are accepted for printing; if supported, the Print Job SOP Instance is created	0000
Warning	Film session printing (collation) is not supported	B601
	Film Session SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	B602
	Image size is larger than image box size, the image has been demagnified.	B604
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A

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Failure	Film Session SOP Instance hierarchy does not contain Film Box SOP Instances	C600
	Unable to create Print Job SOP Instance; print queue is full	C601
	Image size is larger than image box size	C603
	Combined Print Image size is larger than the Image Box size	C613

Note: Previous versions of the DICOM Standard defined the status code of C604. This code was specified for the case of an image position collision. Since image position collision is not a possible state, the code has been retired.

H.4.1.2.4.3 Behavior

The SCU uses the N-ACTION to request the SCP to print all the films belonging to the identified film session.

The SCP shall make a copy of the "working" Basic Film Session SOP Instance hierarchy, which contains all the information to control the Print Process. Hence the SCU may further update the "working" SOP Instance hierarchy without affecting the result of previous print requests. The execution of the Print Process is monitored by the Print Job SOP Instance (if supported by the SCP) and the Printer SOP Class.

If the SCP supports the Print Job SOP Class then the SCP shall create a Print Job SOP Instance, which contains the copy of the "working" Basic Film Session SOP Instance hierarchy and shall return the Print Job SOP Class/Instance UID pair in the Attribute Referenced Print Job Sequence of the Action Reply argument.

Note: If the SCP supports the Print Job SOP Class, it creates a single Print Job for all the films of the film session.

The SCP shall return the status code of the requested operation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The N-ACTION shall be issued only if the Basic Film Session SOP Instance hierarchy contains at least one Film Box SOP Instance.

H.4.1.3 SOP Class Definition and UID

The Basic Film Session SOP Class UID shall have the value "1.2.840.10008.5.1.1.1".

H.4.2 Basic Film Box SOP Class

H.4.2.1 IOD Description

The Basic Film Box IOD is an abstraction of the presentation of one film of the film session. The Basic Film Box IOD describes the presentation parameters which are common for all images on a given sheet of film.

The Basic Film Box SOP Instance refers to one or more Image Box SOP Instances, zero or more film related Annotation Box SOP Instances, and zero or one Presentation LUT SOP Instance.

H.4.2.2 DIMSE Service Group

Table H.4-5 shows DIMSE Services applicable to the IOD.

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Table H.4-5
DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-ACTION	M/M
N-DELETE	U/M
N-SET	U/U

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.2.2.1 N-CREATE

The N-CREATE is used to create an instance of the Basic Film Box SOP Class.

H.4.2.2.1.1 Attributes

The Attribute list of the N-CREATE is shown in Table H.4-6.

Table H.4-6
N-CREATE ATTRIBUTE LIST

Attribute Name	Tag	Usage SCU/SCP
Image Display Format	(2010,0010)	M/M
Referenced Film Session Sequence	(2010,0500)	M/M
>Referenced SOP Class UID	(0008,1150)	M/M
>Referenced SOP Instance UID	(0008,1155)	M/M
Referenced Image Box Sequence	(2010,0510)	-/M
>Referenced SOP Class UID	(0008,1150)	-/M
>Referenced SOP Instance UID	(0008,1155)	-/M
Referenced Basic Annotation Box Sequence	(2010,0520)	-/MC (Required if optional Anno- tation SOP was negotiated)
>Referenced SOP Class UID	(0008,1150)	-/MC (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	-/MC (Required if sequence is present)
Film Orientation	(2010,0040)	U/M
Film Size ID	(2010,0050)	U/M
Magnification Type	(2010,0060)	U/M
Max Density	(2010,0130)	U/M
Configuration Information	(2010,0150)	U/M

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Referenced Presentation LUT Sequence	(2050,0500)	U/MC (Required if Presentation LUT is supported)
>Referenced SOP Class UID	(0008,1150)	U/MC (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	U/MC) (Required if sequence is present
Annotation Display Format ID	(2010,0030)	U/U
Smoothing Type	(2010,0080)	U/U
Border Density	(2010,0100)	U/U
Empty Image Density	(2010,0110)	U/U
Min Density	(2010,0120)	U/U
Trim	(2010,0140)	U/U
Illumination	(2010,015E)	U/MC (Required if Presentation LUT is supported)
Reflected Ambient Light	(2010,0160)	U/MC (Required if Presentation LUT is supported)
Requested Resolution ID	(2020,0050)	U/U

The meaning of the Usage SCU/SCP is described in Section H.2.4.

If the Illumination (2010,015E) and Reflected Ambient Light (2010,0160) values, respectively termed L_0 and L_a, are not created, the following default values are recommended:

For transmissive film: $L_0 = 2000$ cd/m^2.
$L_a = 10$ cd/m^2.

For reflective media: $L_0 = 150$ cd/m^2.

H.4.2.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows:

Status	Meaning	Code
Success	Film Box successfully created	0000
Warning	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	B605

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Failure	There is an existing Film Box that has not been printed and N-ACTION at the Film Session level is not supported. A new Film Box will not be created when a previous Film Box has not been printed.	C616

H.4.2.2.1.3 Behavior

The SCU uses the N-CREATE to request the SCP to create a Basic Film Box SOP Instance. The SCU shall initialize Attributes of the SOP Class as specified in Section H.2.4.

The SCP shall create the SOP Instance and shall initialize Attributes of the SOP Class as specified in Section H.2.4.

Note: If there exists a Film Box SOP Instance that has not been printed and the SCP does not support N-ACTION on the Film Session, then the SCP should fail the N-CREATE of the new SOP Instance.

Upon the creation of the Basic Film Box SOP Instance, the SCP shall append the SOP Class/Instance UID pair of the created Basic Film Box SOP Instance to the Attribute Referenced Film Box Sequence (2000,0500) of the parent Basic Film Session SOP Instance to link the Basic Film Box SOP Instance to the Basic Film Session SOP Instance.

The SCP shall create Image Box SOP Instances of the appropriate Image Box SOP Class for each image box as defined by the Attribute Image Display Format (2010,0010). The SOP Class of the created Image Box SOP Instance depends on the Meta SOP Class context. For example the Grayscale Image Box SOP Class is related to the Basic Grayscale Print Management Meta SOP Class. The Meta SOP Class context is conveyed by the Presentation Context ID that corresponds with the Meta SOP Class and is defined at Association setup.

The SCP shall append the SOP Class/Instance UID pair of the created Image Box SOP Instance to the Referenced Image Box Sequence Attribute of the parent Basic Film Box SOP Instance to link each Image Box SOP Instance to the Basic Film Box SOP Instance. The SCP returns the list of Image Box SOP Class/Instance UID pairs in the Attribute Referenced Image Box Sequence (2010,0510) of the N-CREATE response message.

If supported, the SCP shall create Basic Annotation Box SOP Instances for each Annotation Box defined by the Attribute Annotation Display Format ID and shall append the SOP Class/Instance UID pair of the created Basic Annotation Box SOP Instance to the Referenced Annotation Box Sequence Attribute of the parent Basic Film Box SOP Instance to link each Basic Annotation Box SOP Instance to the Basic Film Box SOP Instance. The SCP returns the list of Basic Annotation Box SOP Class/Instance UID pairs in the Attribute Referenced Annotation Box Sequence of the N-CREATE response message.

The SCP shall return the status code of the requested SOP Instance creation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.2.2.2 N-SET

The N-SET may be used to update the last created instance of the Basic Film Box SOP Class.

H.4.2.2.2.1 Attributes

The Attributes which may be updated are shown in Table H.4-7.

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Table H.4-7
N-SET ATTRIBUTES

Attribute Name	Tag	Usage SCU/SCP
Magnification Type	(2010,0060)	U/M
Max Density	(2010,0130)	U/M
Configuration Information	(2010,0150)	U/M
Referenced Presentation LUT Sequence	(2050,0500)	U/MC (Required if Presentation LUT is supported)
>Referenced SOP Class UID	(0008,1150)	U/MC (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	U/MC) (Required if sequence is present
Smoothing Type	(2010,0080)	U/U
Border Density	(2010,0100)	U/U
Empty Image Density	(2010,0110)	U/U
Min Density	(2010,0120)	U/U
Trim	(2010,0140)	U/U
Illumination	(2010,015E)	U/MC (Required if Presentation LUT is supported)
Reflected Ambient Light	(2010,0160)	U/MC (Required if Presentation LUT is supported)

The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.2.2.2.2 Status

The status values which are specific for this SOP Class are defined in H.4.2.2.1.2.

H.4.2.2.2.3 Behavior

The SCU uses the N-SET to request the SCP to update a Basic Film Box SOP Instance. The SCU shall only specify the SOP Instance UID of the last created Basic Film Box SOP Instance and shall specify the list of Attributes for which the Attribute Values are to be set.

The SCP shall set new values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance update. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.2.2.3 N-DELETE

The N-DELETE is used to delete the last created Basic Film Box SOP Instance hierarchy. As a result all the information describing the last film is deleted.

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The Basic Film Box SOP Instance hierarchy consists of one Basic Film Box SOP Instance, one or more Image Box SOP Instances, zero or more Basic Annotation Box SOP Instances, zero or more Presentation LUT SOP Instances, and zero or more Basic Print Image Overlay Box SOP instances.

Note: There is no provision in the DICOM Standard to delete previously created Film Box SOP Instances.

H.4.2.2.3.1 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Basic Film Box SOP Instance hierarchy. The SCU shall specify the SOP Instance UID of the last created Basic Film Box (root).

The SCP shall delete the specified SOP Instance hierarchy and shall remove the UID of the deleted Basic Film Box SOP Instance from the list of SOP Instance UIDs of the Film Box UIDs Attribute of the parent Basic Film Session SOP Instance.

The SCP shall return the status code of the requested SOP Instance hierarchy deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The SCP shall not delete SOP Instances in the hierarchy as long as there are outstanding references to these SOP Instances

Note: It is beyond the scope of the Standard to specify when the SCP actually deletes the Image SOP Instances with outstanding references. See Note in Section H.4.3.3.2.1.3.

H.4.2.2.4 N-ACTION

The N-ACTION is used to print one or more copies of the last created instance of the Film Box.

H.4.2.2.4.1 Attributes

The arguments of the N-ACTION are defined as shown in Table H.4-8.

The Action Reply argument is encoded as a DICOM Data Set. The Data Set only contains the Attribute Referenced Print Job Sequence (2100,0500) which includes the Referenced SOP Class UID (0008,1150) and the Referenced SOP Instance UID (0008,1155).

If the SCP supports the Print Job SOP Class or Print Queue Management, the Action Reply argument is contained in the N-ACTION response. Otherwise, the Action Reply is not contained in the N-ACTION response.

Table H.4-8
N-ACTION ARGUMENTS

Action Type Name	Action Type ID	Attribute	Tag	Usage SCU/SCP
Print	1	Referenced Print Job Sequence	(2100,0500)	-/MC Required if Print Job SOP is supported
		>Referenced SOP Class UID	(0008,1150)	-/MC Required if Referenced Print Job Sequence (2100,0500) is present
		>Referenced SOP Instance UID	(0008,1155)	-/MC Required if Referenced Print Job Sequence (2100,0500) is present

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		>Print Job ID	(2100,0010)	-/MC (Required if Print Queue Management SOP Class is supported)

H.4.2.2.4.2 Status

The status values which are specific for this SOP Class are defined as shown in Table H.4-9.

Table H.4-9
STATUS VALUES

Status	Meaning	Code
Success	Film accepted for printing; if supported, the Print Job SOP Instance is created	0000
Warning	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	B603
	Image size is larger than image box size, the image has been demagnified.	B604
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A
Failure	Unable to create Print Job SOP Instance; print queue is full	C602
	Image size is larger than image box size	C603
	Combined Print Image size is larger than the Image Box size	C613

Note: Previous versions of the DICOM Standard defined the status code of C604. This code was specified for the case of an image position collision. Since image position collision is not a possible state, the code has been retired.

H.4.2.2.4.3 Behavior

The SCU uses the N-ACTION to request the SCP to print one or more copies of a single film of the film session. The SCU shall only specify the SOP Instance UID of the last created Basic Film Box SOP Instance.

The SCP shall make a copy of the "working" Basic Film Session SOP Instance and the "working" Basic Film Box SOP Instance hierarchy, which contains all the information to control the Print Process. Hence the SCU may further update the "working" SOP Instances without affecting the result of previous print requests. The execution of the Print Process is monitored by the Print Job SOP Class (if supported by the SCP) and the Printer SOP Class.

If the SCP supports the Print Job SOP Class then the SCP shall create a Print Job SOP Instance, which contains the copy of the "working" Basic Film Session SOP Instance hierarchy and shall return the Print Job SOP Class/Instance UID pair in the Attribute Referenced Print Job Sequence of the Action Reply argument.

The SCP shall return the status code of the requested operation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

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H.4.2.3 SOP Class Definition and UID

The Basic Film Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.2".

H.4.3 Image Box SOP Classes

H.4.3.1 Basic Grayscale Image Box SOP Class

H.4.3.1.1 IOD description

The Basic Image Box IOD is an abstraction of the presentation of an image and image related data in the image area of a film. The Basic Image Box IOD describes the presentation parameters and image pixel data which apply to a single image of a sheet of film.

The Basic Grayscale Image Box SOP Instance is created by the SCP at the time the Basic Film Box SOP Instance is created, based on the value of the Basic Film Box Attribute Image Display Format (2010,0010).

The Basic Grayscale Image Box SOP Instance refers to zero or one Image Overlay Box SOP Instance and zero or one Presentation LUT SOP Instance.

H.4.3.1.2 DIMSE Service Group

The DIMSE Services applicable to the IOD are shown below.

DIMSE Service Element	Usage SCU/SCP
N-SET	M/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

Note: There is no N-CREATE because Instances of the Basic Grayscale Image Box SOP Class are created by the SCP as a result of the N-CREATE of the Film Box SOP Instance.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.3.1.2.1 N-SET

The N-SET may be used to update an instance of the Basic Grayscale Image Box SOP Class.

H.4.3.1.2.1.1 Attributes

The Attributes which may be updated are shown in Table H.4-10.

Table H.4-10
N-SET ATTRIBUTES

Attribute Name	Tag	Usage SCU/SCP
Image Position	(2020,0010)	M/M
Basic Grayscale Image Sequence	(2020,0110)	M/M
>Samples Per Pixel	(0028,0002)	M/M
>Photometric Interpretation	(0028,0004)	M/M
>Rows	(0028,0010)	M/M
>Columns	(0028,0011)	M/M

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>Pixel Aspect Ratio	(0028,0034)	MC/M (Required if the aspect ration is not 1\1))
>Bits Allocated	(0028,0100)	M/M
>Bits Stored	(0028,0101)	M/M
>High Bit	(0028,0102)	M/M
>Pixel Representation	(0028,0103)	M/M
>Pixel Data	(7FE0,0010)	M/M
Polarity	(2020,0020)	U/M
Referenced Image Overlay Box Sequence	(2020,0130)	U/MC (Required if optional Overlay SOP was negotiated)
>Referenced SOP Class UID	(0008,1150)	MC/M (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	MC/M (Required if sequence is present)
Magnification Type	(2010,0060)	U/U
Smoothing Type	(2010,0080)	U/U
Min Density	(2010,0120)	U/U
Max Density	(2010,0130)	U/U
Configuration Information	(2010,0150)	U/U
Requested Image Size	(2020,0030)	U/U
Requested Decimate/Crop Behavior	(2020,0040)	U/U
Referenced Presentation LUT Sequence	(2050,0500)	U/U
> Referenced SOP Class UID	(0008,1150)	U/U
> Referenced SOP Instance UID	(0008,1155)	U/U
Original Image Sequence	(2130,00C0)	U/U
>Study Instance UID	(0020,000D)	MC/M (Required if Sequence is present)
>Series Instance UID	(0020,000E)	MC/M (Required if Sequence is present)
>Patient ID	(0010,0020)	MC/M (Required if Sequence is present and value is known)
>Referenced SOP Class UID	(0008,1150)	MC/M (Required if Sequence is present)
>Referenced SOP Instance UID	(0008,1155)	MC/M (Required if Sequence is present)

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>Referenced Frame Number	(0008,1160)	MC/M (Required if Sequence is present and Original Image is a Multi-frame Image)
>Instance Number	(0020,0013)	MC/M (Required if Sequence is present and value is known)

The meaning of the Usage SCU/SCP is described in Section H.2.4.

The values of Magnification Type (2010,0060) and Smoothing Type (2010,0080) of a particular image box override the values of Magnification Type and Smoothing Type of the film box.

Values for Referenced Presentation LUT Sequence override any Presentation LUT that may have been set at the Basic Film Box. Values for Min/Max Density override any Density values that may have been set at the Basic Film Box.

H.4.3.1.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows.

Status	Meaning	Code
Success	Image successfully stored in Image Box	0000
Warning	Image size larger than image box size, the image has been demagnified.	B604
	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	B605
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609
	Image size or Combined Print Image size is larger than the Image Box size. The Image or Combined Print Image has been decimated to fit.	B60A
Failure	Image size is larger than image box size	C603
	Insufficient memory in printer to store the image	C605
	Combined Print Image size is larger than the Image Box size	C613

H.4.3.1.2.1.3 Behavior

The SCU uses the N-SET to request the SCP to update a Basic Grayscale Image Box SOP Instance. The SCU shall only specify the SOP Instance UID of a Basic Grayscale Image Box belonging to the last created Film Box SOP Instance and shall specify the list of Attributes for which the Attribute Values are to be set.

To instruct the SCP to erase the image in the image position, the SCU shall set a zero length and no value in the Attribute Basic Grayscale Image Sequence (2020,0110).

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The SCP shall set new values for the specified Attributes of the specified SOP Instance.

Note: The image in this N-SET supersedes any image previously set in the Image Box.

The SCP shall return the status code of the requested SOP Instance update. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

If Requested Decimate/Crop Behavior (2020,0040) specifies DECIMATE, Magnification Type (2010,0060) specifies NONE, and the image is too large to fit the Image Box, the SCP shall fail the N-SET.

H.4.3.1.3 SOP Class Definition and UID

The Basic Grayscale Image Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.4".

H.4.3.2 Basic Color Image Box SOP Class

H.4.3.2.1 IOD Description

The Basic Image Box IOD is an abstraction of the presentation of an image and image related data in the image area of a film. The Basic Image Box IOD describes the presentation parameters and image pixel data which apply to a single image of a sheet of film.

The Basic Color Image Box SOP Instance is created by the SCP at the time the Basic Film Box SOP Instance is created, based on the value of the Basic Film Box Attribute Image Display Format (2010,0010).

The Basic Color Image Box SOP Instance refers to zero or one Image Overlay Box SOP Instance.

H.4.3.2.2 DIMSE service group

The following DIMSE Services are applicable to the IOD.

DIMSE Service element	Usage SCU/SCP
N-SET	M/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

Note: There is no N-CREATE because Instances of the Basic Color Image Box SOP Class are created by the SCP as a result of the N-CREATE of the Film Box SOP Instance.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.3.2.2.1 N-SET

The N-SET may be used to update an instance of the Basic Color Image Box SOP Class.

H.4.3.2.2.1.1 Attributes

The Attributes which may be updated are shown in Table H.4-11.

The meaning of the Usage SCU/SCP is described in Section H.2.4.

The values of Magnification Type (2010,0060) and Smoothing Type (2010,0080) of a particular image box override the values of Magnification Type and Smoothing Type of the film box.

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Table H.4-11
N-SET ATTRIBUTES

Attribute Name	Tag	Usage SCU/SCP
Image Position	(2020,0010)	M/M
Basic Color Image Sequence	(2020,0111)	M/M
>Samples Per Pixel	(0028,0002)	M/M
>Photometric Interpretation	(0028,0004)	M/M
>Planar Configuration	(0028,0006)	M/M
>Rows	(0028,0010)	M/M
>Columns	(0028,0011)	M/M
>Pixel Aspect Ratio	(0028,0034)	MC/M (Required if the aspect ration is not 1\1))
>Bits Allocated	(0028,0100)	M/M
>Bits Stored	(0028,0101)	M/M
>High Bit	(0028,0102)	M/M
>Pixel Representation	(0028,0103)	M/M
>Pixel Data	(7FE0,0010)	M/M
Polarity	(2020,0020)	U/M
Referenced Image Overlay Box Sequence	(2020,0130)	U/MC (Required if optional Overlay SOP was negotiated).
>Referenced SOP Class UID	(0008,1150)	MC/M (Required if sequence is present)
>Referenced SOP Instance UID	(0008,1155)	MC/M (Required if sequence is present)
Magnification Type	(2010,0060)	U/U
Smoothing Type	(2010,0080)	U/U
Requested Image Size	(2020,0030)	U/U
Requested Decimate/Crop Behavior	(2020,0040)	U/U
Original Image Sequence	(2130,00C0)	U/U
>Study Instance UID	(0020,000D)	MC/M (Required if Sequence is present)
>Series Instance UID	(0020,000E)	MC/M (Required if Sequence is present)

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>Patient ID	(0010,0020)	MC/M (Required if Sequence is present and value is known)
>Referenced SOP Class UID	(0008,1150)	MC/M (Required if Sequence is present)
>Referenced SOP Instance UID	(0008,1155)	MC/M (Required if Sequence is present)
>Referenced Frame Number	(0008,1160)	MC/M (Required if Sequence is present and Original Image is a Multi-frame Image)
>Instance Number	(0020,0013)	MC/M (Required if Sequence is present and value is known)

H.4.3.2.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows.

Status	Meaning	Code
Warning	Image size larger than image box size, the image has been demagnified.	B604
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609
	Image size or Combined Print Image size is larger than the Image Box size. The Image or Combined Print Image has been decimated to fit.	B60A
Failure	Image size is larger than image box size	C603
	Insufficient memory in printer to store the image	C605
	Combined Print Image size is larger than the Image Box size	C613

H.4.3.2.2.1.3 Behavior

The SCU uses the N-SET to request the SCP to update a Basic Color Image Box SOP Instance. The SCU shall only specify the SOP Instance UID of a Basic Color Image Box belonging to the last created Film Box SOP Instance and shall specify the list of Attributes for which the Attribute Values are to be set.

To instruct the SCP to erase the image in the image position, the SCU shall set a zero length and no value in the Attribute Basic Color Image Sequence (2020,0111).

The SCP shall set new values for the specified Attributes of the specified SOP Instance.

Note: The image in this N-SET supersedes any image previously set in the Image Box.

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The SCP shall return the status code of the requested SOP Instance update. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

If Requested Decimate/Crop Behavior (2020,0040) specifies DECIMATE, Magnification Type (2010,0060) specifies NONE, and the image is too large to fit the Image Box, the SCP shall fail the N-SET.

H.4.3.2.3 SOP Class Definition and UID

The Basic Color Image Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.4.1".

H.4.3.3 Referenced Image Box SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

H.4.4 Basic Annotation Box SOP Class

H.4.4.1 IOD Description

The Basic Annotation Box IOD is an abstraction of the presentation of an annotation (e.g. text string) on a film. The Basic Annotation Box IOD describes the most used text related presentation parameters.

The Basic Annotation Box SOP Instance is created by the SCP at the time the Basic Film Box SOP Instance is created, based on the value of the Attribute Annotation Display Format ID (2010,0030) of the Basic Film Box.

H.4.4.2 DIMSE Service Group

The DIMSE Services which are applicable to the IOD are shown below.

DIMSE Service Element	Usage SCU/SCP
N-SET	U/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

Note: There is no N-CREATE because the Instances of the Basic Annotation Box SOP Class are created by the Film Box SOP Instance.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.4.2.1 N-SET

The N-SET is used to update the Basic Annotation Box SOP Instance.

H.4.4.2.1.1 Attributes

The Attributes which may be updated are shown in Table H.4-13.

Table H.4-13
N-SET ATTRIBUTES

Attribute name	Tag	Usage SCU/SCP
Annotation position	(2030,0010)	M/M
Text String	(2030,0020)	U/M

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The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.4.2.1.2 Status

There are no specific status codes.

H.4.4.2.1.3 Behavior

The SCU uses the N-SET to request the SCP to update a Basic Annotation Box SOP Instance. The SCU shall only specify the SOP Instance UID of the Basic Annotation Box belonging to the last created Film Box SOP Instance and shall specify the list of Attributes for which the Attribute Values are to be set. The SCU may erase the text string by setting a zero length value in the Attribute Text String (2030,0020).

The SCP shall set new values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance update. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.4.3 SOP Class Definition and UID

The Basic Annotation Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.15".

H.4.5 Print Job SOP Class

H.4.5.1 IOD Description

The Print Job IOD is an abstraction of the Print Job transaction and is the basic information entity to monitor the execution of the Print Process. A Print Job contains one film or multiple films, all belonging to the same film session.

The Print Job SOP Class is created by N-ACTION operation of the Film Session SOP Class, Film Box SOP Class, or Pull Print Request SOP Class. The Print Job SOP Instance is deleted after the films are printed or after a failure condition.

H.4.5.2 DIMSE Service Group

The DIMSE Services which are applicable to the IOD are shown below.

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.5.2.1 N-EVENT-REPORT

The N-EVENT-REPORT is used to report execution status changes to the SCU in an asynchronous way.

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H.4.5.2.1.1 Attributes

The arguments of the N-EVENT-REPORT are defined as shown in Table H.4-14.

Note: The encoding of Notification Event Information is defined in PS 3.7.

Table H.4-14
NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Usage SCU/SCP
Pending	1	Execution Status Info	(2100,0030)	U/M
		Print Job ID	(2100,0010)	U/MC (Required if Print Queue Management SOP Class is supported)
		Film Session Label	(2000,0050)	U/U
		Printer Name	(2110,0030)	U/U
Printing	2	Execution Status Info	(2100,0030)	U/M
		Print Job ID	(2100,0010)	U/MC (Required if Print Queue Management SOP Class is supported)
		Film Session Label	(2000,0050)	U/U
		Printer Name	(2110,0030)	U/U
Done	3	Execution Status Info	(2100,0030)	U/M
		Print Job ID	(2100,0010)	U/MC (Required if Print Queue Management SOP Class is supported)
		Film Session Label	(2000,0050)	U/U
		Printer Name	(2110,0030)	U/U
Failure	4	Execution Status Info	(2100,0030)	U/M
		Print Job ID	(2100,0010)	U/MC (Required if Print Queue Management SOP Class is supported)
		Film Session Label	(2000,0050)	U/U
		Printer Name	(2110,0030)	U/U

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H.4.5.2.1.2 Behavior

The SCP uses the N-EVENT-REPORT to inform the SCU about each execution change. The SCP shall only use the N-EVENT-REPORT within the context of the Association in which the Print Job SOP Instance was created.

Note: If SCU wants to monitor the complete execution process of a Print Job, then the SCU should only release the Association after the receipt of the event type Done or Failure.

The SCU shall return the confirmation from the N-EVENT-REPORT operation.

If the Event Type Name = Failure or Pending then the error/pending condition is stored in the Execution Status Info argument. The possible values of the Execution Status Info argument are defined in H.4.5.3.

If the Event Type Name = Failure or Done then the SCP shall delete the Print Job SOP Instance after receiving a confirmation from the SCU.

H.4.5.2.2 N-GET

The N-GET is used to retrieve an instance of the Print Job SOP Class.

H.4.5.2.2.1 Attributes

The Attributes which may be retrieved are shown in Table H.4-15.

Table H.4-15
N-GET ATTRIBUTES

Attribute Name	Tag	Usage SCU/SCP
Execution Status	(2100,0020)	U/M
Execution Status Info	(2100,0030)	U/M
Print Priority	(2000,0020)	U/M
Creation Date	(2100,0040)	U/U
Creation Time	(2100,0050)	U/U
Printer Name	(2110,0030)	U/U
Originator	(2100,0070)	U/U

The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.5.2.2.2 Behavior

The SCU uses the N-GET to request the SCP to get a Print Job SOP Instance. The SCU shall specify the UID of the SOP Instance to be retrieved.

The SCP shall return the values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance retrieval. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.5.3 Execution Status Information

Status Information is defined in PS 3.3. Implementation specific warning and error codes shall be defined in the Conformance Statement.

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H.4.5.4 SOP Class Definition and UID

The Print Job SOP Class UID shall have the value "1.2.840.10008.5.1.1.14".

H.4.6 PRINTER SOP Class

H.4.6.1 IOD Description

The Printer IOD is an abstraction of the hard copy printer and is the basic Information Entity to monitor the status of the printer.

The Printer SOP Instance is created by the SCP during start-up of the hard copy printer and has a well-known SOP Instance UID.

H.4.6.2 DIMSE Service Group

The DIMSE Services which are applicable to the IOD are shown below.

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.6.2.1 N-EVENT-REPORT

The N-EVENT-REPORT is used to report the changes of the printer status in an asynchronous way.

H.4.6.2.1.1 Attributes

The arguments of the N-EVENT-REPORT are defined as shown in Table H.4-16.

Note: The encoding of Notification Event Information is defined in PS 3.7.

Table H.4-16
NOTIFICATION EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Usage SCU/SCP
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U/M
		Film Destination	(2000,0040)	U/U
		Printer Name	(2110,0030)	U/U
Failure	3	Printer Status Info	(2110,0020)	U/M
		Film Destination	(2000,0040)	U/U
		Printer Name	(2110,0030)	U/U

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H.4.6.2.1.2 Behavior

The SCP shall use the N-EVENT-REPORT to inform the SCU about each execution change. The SCP shall send the events to all SCUs with which the SCP has an Association that is using the printer for which the status changes.

The SCU shall return the confirmation of the N-EVENT-REPORT operation.

If the Event Type Name = Warning or Failure then the warning/failure condition is stored in the Printer Status Info argument. The possible values the Printer Status Info argument are defined in H.4.6.3.

H.4.6.2.2 N-GET

The N-GET is used to retrieve an instance of the Printer SOP Class.

H.4.6.2.2.1 Attributes

The Attributes which may be retrieved are shown in Table H.4-17.

Table H.4-17
N-GET ATTRIBUTES

Attribute name	Tag	Usage SCU/SCP
Printer Status	(2110,0010)	U/M
Printer Status Info	(2110,0020)	U/M
Printer Name	(2110,0030)	U/U
Manufacturer	(0008,0070)	U/U
Manufacturer Model Name	(0008,1090)	U/U
Device Serial Number	(0018,1000)	U/U
Software Versions	(0018,1020)	U/U
Date Last Calibration	(0018,1200)	U/U
Last Calibration	(0018,1201)	U/U

The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.6.2.2.2 Behavior

The SCU uses the N-GET to request the SCP to get a Printer SOP Instance. The SCU shall specify the UID of the SOP Instance to be retrieved.

The SCP shall return the values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance retrieval. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.6.3 Printer Status Information

Status Information is defined in PS 3.3. Implementation specific warning and error codes shall be defined in the Conformance Statement.

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H.4.6.4 SOP Class Definition and UID

The Printer SOP Class UID shall have the value "1.2.840.10008.5.1.1.16".

H.4.6.5 Reserved Identifications

The well-known UID of the Printer SOP Instance shall have the value "1.2.840.10008.5.1.1.17".

H.4.7 VOI LUT Box SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

H.4.8 Image Overlay Box SOP Class (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

H.4.9. Presentation LUT SOP Class

H.4.9.1 Information Object Description

The Presentation LUT Information Object is an abstraction of a Presentation LUT (see Section H.2.1.1). The objective of the Presentation LUT is to realize image display tailored for specific modalities, applications, and user preferences. It is used to prepare image pixel data for display on devices that conform to the Grayscale Standard Display Function defined In PS 3.14.

Note: The density range to be printed, Min Density to Max Density, is specified at either the Film Box or the Image Box. As follows from the definition for Min Density and Max Density in PS 3.3, if the requested minimum density is lower than the minimum printer density, or the requested maximum density is greater than the maximum printer density, the printer will use its minimum or maximum density, respectively, when computing the standard response.

The output of the Presentation LUT is Presentation Values (P-Values). P-Values are approximately related to human perceptual response. They are intended to facilitate common input for both hardcopy and softcopy display devices. P-Values are intended to be independent of the specific class or characteristics of the display device.

The Presentation LUT is not intended to alter the appearance of the pixel values, as specified as specified by the Photometric Interpretation (0028,0004) and Polarity (2020,0020).

The Basic Film Box Information Object, the Basic Image Box Information Object and the Referenced Image Box Object reference the Presentation LUT.

If the Configuration Information Attribute (2010,0150) of the Basic Film Box IOD contains information similar to the Presentation LUT, then the Presentation LUT Attributes shall take precedence.

H.4.9.1.1 Mapping of P-Values to Optical Density

The mathematical definition of the Grayscale Standard Display Function and mapping of P-Values to optical density for reflective and transmissive printers is contained in PS 3.14.

H.4.9.2 DIMSE Service Group

The following DIMSE Services are applicable to the association related Presentation LUT Information Object:

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-DELETE	U/M

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The meaning of the Usage SCU/SCP is described in section H.2.4.

This section describes the behavior of the DIMSE Services, which are specific for this Information Object. The general behavior of the DIMSE services is specified in Part 7 of this Standard.

H.4.9.2.1 N-CREATE

The N-CREATE Service Element is used to create an instance of the Presentation LUT SOP Class.

H.4.9.2.1.1 Attributes

The Attribute list of the N-CREATE Service Element is defined as shown in Table H.4-23.

Table H.4-23
N-CREATE ATTRIBUTE LIST

Attribute name	Tag	Usage SCU/SCP
Presentation LUT Sequence	(2050,0010)	MC/M (Required if Presentation LUT Shape (2050,0020) is not present. Not allowed otherwise.)
>LUT Descriptor	(0028,3002)	MC/M (Required if sequence is present. The third value (number of bytes for each LUT entry) shall be 10-16.) Note: The number of bytes that is sent via this LUT will be 2^n, where n is the third value.
>LUT Explanation	(0028,3003)	U/U
>LUT Data	(0028,3006)	MC/M (Required if sequence is present)
Presentation LUT Shape	(2050,0020)	MC/M (Required if Presentation LUT Sequence (2050,0010) is not present. Not allowed otherwise.) SCPs shall support the Enumerated Values IDENTITY and LIN OD

H.4.9.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows:

Status	Meaning	Code
Success	Presentation LUT successfully created	0000
Warning	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	B605

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H.4.9.2.1.3 Behavior

The SCU uses the N-CREATE Service Element to request the SCP to create a Presentation LUT SOP Instance. The SCU shall initialize Attributes of the SOP Class as specified in section H.2.4.

The SCU shall create the Presentation LUT prior to referencing it from the Film Box or the Image Box.

The Presentation LUT persists in the SCP as long as the Association in which it was created is open or an explicit N-DELETE is issued by the SCU.

The SCP shall return the status code of the requested SOP Instance creation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The SCP shall use the Grayscale Standard Display Function as specified in PS 3.14 to convert the output of the Presentation LUT to density for printing. If the SCU specifies values for Illumination (2010,015E) and/or Reflected Ambient Light (2010,0160), these values shall be used instead of the default or configured values of the SCP. If these values are not supplied, the SCP shall use its default or configured values. (See H.4.2.2.1.1 for suggested defaults).

H.4.9.2.2 N-DELETE

The N-DELETE Service Element is used to delete the Presentation LUT SOP Instance.

H.4.9.2.2.1 Status

There are no specific error codes

H.4.9.2.2.2 Behavior

The SCU uses the N-DELETE Service Element to request the SCP to delete the Presentation LUT SOP Instance. The SCU shall specify the Presentation LUT SOP Instance UID.

The SCP shall not delete a Presentation LUT SOP Instance as long as there are outstanding references to it. Otherwise, it shall delete the specified Presentation LUT SOP Instance. The N-DELETE of a Presentation LUT will prevent the SCU from further referencing it. The SCU shall not reference a previously deleted Presentation LUT. The SCP shall return the status code of the requested Presentation LUT SOP Instance deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.9.2.4 SOP Class Definition and UID

The Presentation LUT SOP Class UID is "1.2.840.10008.5.1.1.23".

H.4.10 Pull Print Request SOP Class

H.4.10.1 IOD DESCRIPTION

The Pull Print Request SOP Class is based on the Pull Print Request IOD, which describes all the print parameters to print one or more film pages. The Pull Print Request SOP Instance contains print transaction related information (e.g. priority, number of copies) and a reference to the Stored Print Storage SOP Instance, which contains the print presentation parameters and references to images.

The SCP (printer) is responsible for retrieving all the print parameters and images. The SCU supplies the AE Title of device where the information is stored and the SOP Class and Instance UID of the SOPs to be retrieved.

Note : The normalized Film Session SOP Instance is split into 2 SOP Instances :

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— Stored Print Storage SOP Instance, containing layout information and references to images. The Stored Print Storage SOP Instance contains information which remains invariant during subsequent re-prints (of the same film session). The Stored Print Storage SOP Instance may be archived.

— Pull Print Request SOP Instance, which contains information that may change during subsequent re-prints.

H.4.10.2 DIMSE Service Group

The following DIMSE Services are applicable to the IOD

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-ACTION	M/M
N-DELETE	U/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7

H.4.10.2.1 N-CREATE

The N-CREATE is used to create an instance of the Pull Print Request SOP Class.

H.4.10.2.1.1 Attributes

The Attribute list of the N-CREATE is defined as shown in Table H.4-24.

Table H.4-24
N-CREATE ATTRIBUTE LIST

Attribute Name	Tag	Usage SCU/SCP
Referenced Stored Print Sequence	(2000,0510)	M/M
> Retrieve AE Title	(0008,0054)	M/M
>Referenced SOP Class UID	(0008,1150)	M/M
>Referenced SOP Instance UID	(0008,1155)	M/M
>Study Instance UID	(0020,000D)	M/M
>Series Instance UID	(0020,000E)	M/M
>Patient ID	(0010,0020)	MC/M (Required if value is known.)
Number of Copies	(2000,0010)	U/M
Print Priority	(2000,0020)	U/M
Medium Type	(2000,0030)	U/M
Film Destination	(2000,0040)	U/M
Color Image Printing Flag	(2000,0062)	U/M

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Annotation Flag	(2000,0065)	U/M
Image Overlay Flag	(2000,0067)	U/M
Presentation LUT Flag	(2000,0069)	U/M
Image Box Presentation LUT Flag	(2000,006A)	U/M
Configuration Information	(2010,0150)	U/M
Film Session Label	(2000,0050)	U/U
Memory Allocation	(2000,0060)	U/U
Collation Flag	(2000,0063)	U/U
Illumination	(2010,015E)	U/U
Reflected Ambient Light	(2010,0160)	U/U
Owner ID	(2100,0160)	U/U

Note: The memory allocation Attribute allows the SCU to reserve sufficient memory to store the film page description, including images in order to prevent deadlock situations.

Within the print session, the allocated memory is consumed as SOP Instances are created and is freed for reuse as SOP Instances are deleted. All the allocated memory shall be released following termination of the Association or deletion of the Pull Print Request SOP Instance.

H.4.10.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows.

Status	Meaning	Code
Success	Print Request successfully created	0000
Warning	Memory allocation not supported	B600

Note: The status code "0106H" (Invalid Attribute Value) indicates that the requested memory allocation can not be provided; the status code "0213H" (Resource limitation) indicates that the requested allocation can temporarily not be provided.

H.4.10.2.1.3 Behavior

The SCU uses the N-CREATE to request the SCP to create a Pull Print Request SOP Instance. The SCU shall initialize Attributes of the SOP Instance as specified in Section H.2.4.

The SCP shall create the SOP Instance and shall initialize Attributes of the SOP Class as specified in Section H.2.4.

The Stored Print Storage SOP Instance referenced may contain the optional Attributes Annotation Content Sequence (2130,0050) and/or Image Overlay Box Content Sequence (2130,0060). Use of these optional Attributes allows an SCU to provide information to be printed with or on an image without burning the information into the image pixels. If these optional Attributes are not supported by both the SCU and SCP, then only the information burnt in to the image pixels before they are sent to the SCP will be printed. If the optional Attributes are not supported, the SCU is responsible for burning all expected text or graphics into the image pixels.

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The SCP shall return the status code of the requested SOP Instance creation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

At any time the SCU/SCP shall only support one Pull Print Request SOP Instance on an Association.

Note: Multiple print requests may be handled by establishing multiple Associations.

SCPs unable to collate films shall ignore Collation Flag (2000,0063).

Terminating the Association will effectively perform an N-DELETE on an opened print request. See Note in Section H.4.10.2.3.2.

H.4.10.2.2 N-ACTION

The N-ACTION is initiated by the SCU to request the SCP to retrieve the Stored Print Storage SOP Instance and Image SOP Instances from the specified AE title and to print one or more films, based on the information in the Print Request SOP Instance.

Attributes

The arguments of N-ACTION are defined in Table H.4-25.

Table H.4-25
N-ACTION ARGUMENTS

Action Type Name	Action Type ID	Attribute	Tag	Usage SCU/SCP
PRINT	1	Referenced Print Job Sequence	(2100,0500)	-/MC (Required if Print Job SOP is supported)
		> Referenced SOP Class UID	(0008,1150)	-/MC (Required if Referenced Print Job Sequence is present)
		> Referenced SOP Instance UID	(0008,1155)	-/MC (Required if Referenced Print Job Sequence is present)
		Print Job ID	(2100,0010)	-M/C (Required if Print Queue Management SOP Class is supported)

The Action Reply argument is encoded as a DICOM Data Set. The Data Set only contains the Attribute Referenced Print Job Sequence (2100,0500) which includes the Referenced SOP Class UID (0008,1150) and the Referenced SOP Instance UID (0008,1155).

If the SCP does not support the Print Job SOP Instance, the Action Reply arguments is not contained in the N-ACTION response.

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H.4.10.2.2.2 Status

The status values which are specific for this SOP Class are defined as follows.

SOP CLASS STATUS VALUES

Status	Meaning	Code
Success	Print request, accepted for printing; if supported Print Job SOP Instance is created	0000
Warning	Memory allocation not supported (see H.4.1.2.1.2)	B600
	Film session printing (collation) is not supported	B601
	Film Session does not contain Image Boxes (empty Page)	B602
	Film Box does not contain Image Boxes	B603
	Annotation Box not supported, image printed without annotation.	B604
	Image Overlay Box not supported, image printed without overlay.	B605
	Presentation LUT not supported, image printed without applying any Presentation LUT.	B606
	Presentation LUT not supported at Image Box level, image printed with Film Box Presentation LUT	B608
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A
Failure	Stored Print Storage SOP Instance does not contain Film Boxes	C600
	Unable to create Print Job SOP Instance; print queue is full	C601
	Print queue is full	C602
	Image Size is larger than image box size (by using the specified magnification value)	C603
	Insufficient Memory to store image	C605
	Stored Print Storage SOP Instance not available from Retrieve AE	C607
	Image SOP Instance not available from Retrieve AE	C608
	Failure in retrieving Stored Print Storage SOP Instance	C609
	Failure in retrieving Image SOP Instance	C60A
	Unknown Retrieve AE title	C60B

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Print request rejected because printer cannot handle color images	C60C
Stored Print Storage SOP Instance does not contain Image Boxes (empty page)	C60D
Annotation Box not supported	C60E
Image Overlay Box not supported	C60F
Presentation LUT not supported	C610
Combined Print Image size is larger than the Image Box size	C613
Presentation LUT not supported at Image Box level	C614
Unable to establish an Association with the Retrieve AE	C615

H.4.10.2.2.3 Behavior

The SCU uses N-ACTION to request the SCP to retrieve the Stored Print Storage SOP Instances, the Image SOP Instances and to print the film session.

The SCU shall adhere to the following sequence of actions :

— SCU sends a Pull Print Request SOP Instance to the SCP using N-CREATE Service Element of Pull Print Request SOP Class.

— SCU issues N-ACTION of the Pull Print Request SOP Instance.

The SCP retrieves from the specified Application Entity the requested Stored Print Storage SOP Instance referenced by the Pull Print Request SOP Instance. It then retrieves the requested Image SOP Instances as referenced by the Stored Print Storage SOP Instance. After successful retrieval, the SCP creates a print job that contains the print parameters (of the Stored Print Storage SOP Instance) and images.

The values of Configuration Information (2010,0150), Illumination (2010,015E), and Reflected Ambient Light (2010,0160) contained in the N-CREATE of the Pull Print Request SOP Instance override any corresponding values in the Stored Print Storage SOP Instance.

If supported by the SCP, Referenced Presentation LUT Sequence (2050,0500) in the Stored Print Storage SOP Instance overrides grayscale transformation information contained in Configuration Information (2010,0150) in the Pull Print Request SOP Instance and/or the Stored Print Storage SOP Instance.

The SCP shall return the status code when it has validated the print request information The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The execution of the retrieval process and print process is monitored by the Print Job Instance (if supported) or by the Queue Management SOP Instance (if supported). If the SCP supports Queue Management SOP Class then the SCP shall create a Print Job SOP Instance and an entry in the Print Queue. The SCP shall return the Print Job SOP Class/Instance UID pair in the Action Reply argument.

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H.4.10.2.3 N-DELETE

The N-DELETE is used to delete the Pull Print Request, including the referred Stored Print Storage SOP Instances and Image SOP Instances.

H.4.10.2.3.1 Status

There are no specific status codes

H.4.10.2.3.2 Behavior

The SCU uses N-DELETE to request the SCP to delete the Pull Print Request SOP Instance. The SCU shall specify the SOP Instance UID of the Pull Print Request SOP Instance.

The SCU shall only delete the last created Pull Print Request SOP Instance

The SCP shall delete the specified Pull Print Request SOP Instance, the referenced Stored Print Storage SOP Instance and referenced Image SOP Instances. The SCP shall return the status code.

Note : It is beyond the scope of the standard to specify when the SCP actually deletes the Image SOP Instances. See Note in section H.4.3.3.2.1.3

The SCP shall return the status code of the requested SOP Instance deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5. A Failure status code shall indicate that the SCP has not printed the print request.

A failure code shall indicate that the SCP has not deleted the specified SOP Instance.

H.4.10.4 SOP Class Definition and UID

The Pull Print Request SOP Class UID is "1.2.840.10008.5.1.1.31".

H.4.11 Printer Configuration Retrieval SOP Class

H.4.11.1 IOD Description

The Printer Configuration IOD is an abstraction of the hard copy printer and is the basic Information Entity to retrieve key imaging characteristics of the printer

The Printer Configuration Retrieval SOP Instance is created by the SCP during start-up of the hard copy printer and has a well-known SOP Instance UID.

H.4.11.2 DIMSE Service Group

The DIMSE Services which are applicable to the IOD are shown below.

DIMSE Service Element	Usage SCU/SCP
N-GET	M/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Service which are specific for this IOD. The general behavior of the DIMSE Services is specified in PS 3.7.

H.4.11.2.2 N-GET

The N-GET is used to retrieve an instance of the Printer Configuration Retrieval SOP Class.

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H.4.11.2.2.1 Attributes

The Attributes which are retrieved are shown in Table H.4-26.

Table H.4-26
N-GET ATTRIBUTES

Attribute Name	Tag	Usage SCU/SCP
Printer Configuration Sequence	(2000,001E)	U/M
>SOP Classes Supported	(0008,115A)	-/M
>Maximum Memory Allocation	(2000,0061)	-/M
>Memory Bit Depth	(2000,00A0)	-/M
>Printing Bit Depth	(2000,00A1)	-/M
>Media Installed Sequence	(2000,00A2)	-/M
>>Item Number	(0020,0019)	-/M
>>Medium Type	(2000,0030)	-/M
>>Film Size ID	(2010,0050)	-/M
>>Min Density	(2010,0120)	-/MC Required if Sequence is Present and Min Density is known
>>Max Density	(2010,0130)	-/M
>Other Media Available Sequence	(2000,00A4)	-/M
>>Medium Type	(2000,0030)	-/M
>>Film Size ID	(2010,0050)	-/M
>>Min Density	(2010,0120)	-/MC Required if Sequence is Present and Min Density is known
>>Max Density	(2010,0130)	-/M
>Supported Image Display Formats Sequence	(2000,00A8)	-/M
>>Rows	(0028,0010)	-/MC Required if all Image Boxes in the Display Format have the same number of rows and columns
>>Columns	(0028,0011)	-/MC Required if all Image Boxes in the Display Format have the same number of rows and columns
>>Image Display Format	(2010,0010)	-/M
>>Film Orientation	(2010,0040)	-/M
>>Film Size ID	(2010,0050)	-/M
>>Printer Resolution ID	(2010,0052)	-/M

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>>Printer Pixel Spacing	(2010,0376)	-/M
>>Requested Image Size Flag	(2020,00A0)	-/M
>Default Printer Resolution ID	(2010,0054)	-/M
>Default Magnification Type	(2010,00A6)	-/M
>Other Magnification Types Available	(2010,00A7)	-/M
>Default Smoothing Type	(2010,00A8)	-/M
>Other Smoothing Types Available	(2010,00A9)	-/M
>Configuration Information Description	(2010,0152)	-/M
>Maximum Collated Films	(2010,0154)	-/M
>Decimate/Crop Result	(2020,00A2)	-/M
>Manufacturer	(0008,0070)	-/M
>Manufacturer Model Name	(0008,1090)	-/M
>Printer Name	(2110,0030)	-/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.11.2.2.2 Behavior

The SCU uses the N-GET to request the SCP to get a Printer Configuration Retrieval SOP Instance. The SCU shall specify the UID of the SOP Instance to be retrieved.

The SCP shall return the values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance retrieval.

A Failure status code shall indicate that the SCP has not retrieved the SOP Instance.

H.4.11.3 SOP Class Definition and UID

The Printer Configuration Retrieval SOP Class UID is "1.2.840.10008.5.1.1.16.376".

H.4.11.4 Reserved Identifications

The well-known UID of the Printer Configuration Retrieval SOP Instance is "1.2.840.10008.5.1.1.17.376".

H.4.12 Basic Print Image Overlay Box SOP Class

H.4.12.1 IOD Description

The Basic Print Image Overlay Box IOD is an abstraction of the presentation of an image overlay in an image box. The Basic Print Image Overlay Box is referenced by one or more Basic Image Box IODs. The Basic Image Box IODs may be either color or grayscale. However, there is no provision in the SOP Class for printing the overlay in color.

The following functionality is provided by this SOP Class:

- Overlay data are contained in the SOP Instance
- A single 1-bit overlay is provided
- Overlay rows and columns may be different than image rows and columns
- The overlay or image (but not both) may be magnified before they are superimposed

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— The overlay and image are superimposed to form a Combined Print Image before the image is further processed (e.g. magnification and applying gray scale transformations) for printing.

This SOP Class does not provide a mechanism:

— to print images that would require the Combined Print Image to be cropped to fit the Image Box, or

— to superimpose and print images and overlays that have different pixel aspect ratios.

Note: The Combined Print Image is a pixel matrix created by superimposing an image and overlay, the size of which is defined by the smallest rectangle enclosing the superimposed image and overlay.

H.4.12.2 DIMSE Service Group

Table H.4-27 shows DIMSE Services applicable to the IOD.

Table H.4-27
IOD DIMSE SERVICES

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-SET	U/M
N-DELETE	U/M

The meaning of the Usage SCU/SCP is described in Section H.2.4.

This Section describes the behavior of the DIMSE Services which are specific for this IOD. The general behavior of the DIMSE services is specified in PS 3.7.

H.4.12.2.1 N-CREATE

The N-CREATE is used to create an instance of the Basic Print Image Overlay Box SOP Class.

H.4.12.2.1.1 Attributes

The Attribute list of the N-CREATE is defined in Table H.4-28.

Table H.4-28
N-CREATE and N-SET ATTRIBUTES

Attribute Name	Tag	N-CREATE Usage SCU/SCP	N-SET Usage SCU/SCP
Overlay Pixel Data Sequence	(2040,0020)	M/M	U/M
>Overlay Rows	(6000,0010)	M/M	U/M
>Overlay Columns	(6000,0011)	M/M	U/M
>Overlay Origin	(6000,0050)	M/M	U/M
>Overlay Bits Allocated	(6000,0100)	M/M	U/M
>Overlay Bit Position	(6000,0102)	M/M	U/M
>Overlay Data	(6000,3000)	M/M	U/M

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Overlay or Image Magnification	(2040,0072)	MC/M Required if Magnify to Number of Columns (2040,0074) is present.	MC/M Required if Magnify to Number of Columns (2040,0074) is present.
Magnify to Number of Columns	(2040,0074)	MC/M Required if Overlay or Image Magnification (2040,0072) is present.	MC/M Required if Overlay or Image Magnification (2040,0072) is present.
Overlay Magnification Type	(2040,0060)	U/M	U/M
Overlay Foreground Density	(2040,0080)	U/M	U/M
Overlay Background Density	(2040,0082)	U/M	U/M
Overlay Smoothing Type	(2040,0070)	U/U	U/U

H.4.12.2.1.2 Status

The status value which is specific for this SOP Class is defined as follows.

Status	Meaning	Code
Failure	Combined Print Image requires cropping to fit Image Box. This is not supported in this SOP Class.	C616

H.4.12.2.1.3 Behavior

The SCU uses the N-CREATE to request the SCP to create a Basic Print Image Overlay Box SOP Instance. The SCU shall create an instance of a Basic Print Image Overlay Box prior to referencing it. The SCU shall initialize Attributes of the SOP Class as specified in Section H.2.4.

The SCP shall create the SOP Instance and shall initialize Attributes of the SOP Class as specified in Section H.2.4.

The SCP shall return the status code of the requested SOP Instance creation. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

The SCP shall create the Combined Print Image by magnifying the overlay or image (per Overlay or Image Magnification (2040,0072)) to yield the number of columns in the overlay or image specified by Magnify to Number of Columns (2040,0074) prior to superimposing the image and overlay. The same magnification factor shall be applied to rows and columns of the overlay or image

The overlay and image shall be superimposed before the image is further processed (e.g. *magnification and applying gray scale transformations) for printing. Thus if Overlay Foreground* Density (2040,0080) is specified as WHITE and Polarity is REVERSE, the printed overlay pixels will be black. Any Presentation LUT then applied will produce the same transformation of overlay pixels as it does image pixels.

If the SCP supports cropping of image rows and columns, and cropping of the Combined Print Image would be required for it to fit the Image Box, then failure code C616 shall be returned.

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H.4.12.2.2 N-SET

The N-SET may be used to update an instance of the Basic Print Image Overlay Box SOP Class.

H.4.12.2.2.1 Attributes

The Attributes which may be updated are shown in Table H.4-28.

H.4.12.2.2.2 Status

There are no specific status codes

H.4.12.2.2.3 Behavior

The SCU uses the N-SET to request the SCP to update a Basic Print Image Overlay Box SOP Instance. The SCU shall specify the SOP Instance UID to be updated and shall specify the list of Attributes for which the Attribute values are to be set.

The SCP shall set new values for the specified Attributes of the specified SOP Instance.

The SCP shall return the status code of the requested SOP Instance update. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

H.4.12.2.3 N-DELETE

The N-DELETE is used to delete the Basic Print Image Overlay Box SOP Instance.

H.4.12.2.3.1 Status

There are no specific status codes.

H.4.12.2.3.2 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Basic Print Image Overlay Box SOP Instance. The SCU shall specify the Basic Print Image Overlay Box SOP Instance UID.

If there are no outstanding references to the specified Basic Print Image Overlay Box SOP Instance, the SCP shall delete it. The SCU shall not reference a previously deleted Basic Print Image Overlay Box SOP Instance. The SCP shall not delete the SOP Instance if there are outstanding references to it. The SCP shall return the status code of the requested Basic Print Image Overlay Box SOP Instance deletion. The meaning of success, warning, and failure status codes is defined in Section H.2.5.

Note: If references to the SOP instance exist, the SCP will fail the N-DELETE. The SCU could remove the references using N-SETs of the Image Box and then repeat the N-DELETE of the Basic Print Image Overlay Box SOP Instance.

H.4.12.3 SOP Class Definition and UID

The Basic Print Image Overlay Box SOP Class UID is "1.2.840.10008.5.1.1.24.1".

H.5 ASSOCIATION NEGOTIATION

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The Association negotiation procedure is used to negotiate the supported SOP Classes or Meta SOP Classes. PS 3.7 specifies the Association procedures.

The negotiation procedure is used to negotiate the supported Meta SOP Classes and the supported optional SOP Classes. The SCU and SCP shall support at least one Meta SOP Class UID (e.g.,

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Basic Grayscale Print Management Meta SOP Class) and may support additional optional SOP Classes.

The Print Management Service Class does not support extended negotiation.

The SCU shall specify in the A-ASSOCIATE request one Abstract Syntax, in a Presentation Context, for each supported SOP Class or Meta SOP Class.

If the Association is released or aborted then all the SOP Instances except the Print Job SOP Instance and the Printer SOP Instance are deleted.

Note: Pending Print Jobs will still be printed after the release or abortion of the Association.

H.6 EXAMPLE OF PRINT MANAGEMENT SCU SESSION (Informative)

H.6.1 Simple Example

This example of a Print Management SCU Session is provided for informational purposes only. It illustrates the use of one of the Basic Print Management Meta SOP Classes.

```
A-ASSOCIATE

N-GET (PRINTER SOP Instance)

N-CREATE (Film Session SOP Instance)

for (each film of film session)

{

    N-CREATE (Film Box SOP Instance)

    for (each image of film)

    {

     N-SET (Image Box SOP Instance which encapsulates a PREFORMATTED IMAGE SOP
Instance)

    }

    if (no collation)

    {

     N-ACTION (PRINT, Film Box SOP Instance)

     N-DELETE (Film Box SOP Instance)

    }

}

if (collation)

{

    N-ACTION (PRINT, Film Session SOP Instance)
```


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N-DELETE (Film Session SOP Instance)

}

N-EVENT-REPORT (PRINTER SOP Instance)

A-RELEASE

H.6.2 Advanced Example (Retired)

This section was previously defined in DICOM. It is now retired. See PS 3.4-1998.

H.7 EXAMPLE OF THE PULL PRINT REQUEST META SOP CLASS (Informative)

This example illustrates the relationship of commands of the Pull Print Request Meta SOP Class. Except for command 5, other command Responses are not shown. It assumes that storage of the Stored Print and Image SOP Instances has already occurred. Other combinations of devices are possible, for example, the Host device could also be the Archive device shown in the example.

Multiple Associations between the devices are required and are indicated by Association A, B, etc. Commands 1, 2 and 5 are required to be on the same Association. The time between commands 2 and 5 could be long since the Printer will retrieve and process the Stored Print Storage and Image SOP Instances after receiving the N-ACTION Request (2) and before issuing the N-ACTION Response (5).

Commands 3a and 4a could be on the same Association, but not Association A.

Commands 3b and 4b could be on the same Association only if Commands 3a and 4a are combined into a single C-MOVE Request.

See Annex C for Query/Retrieve SOP Class Specifications

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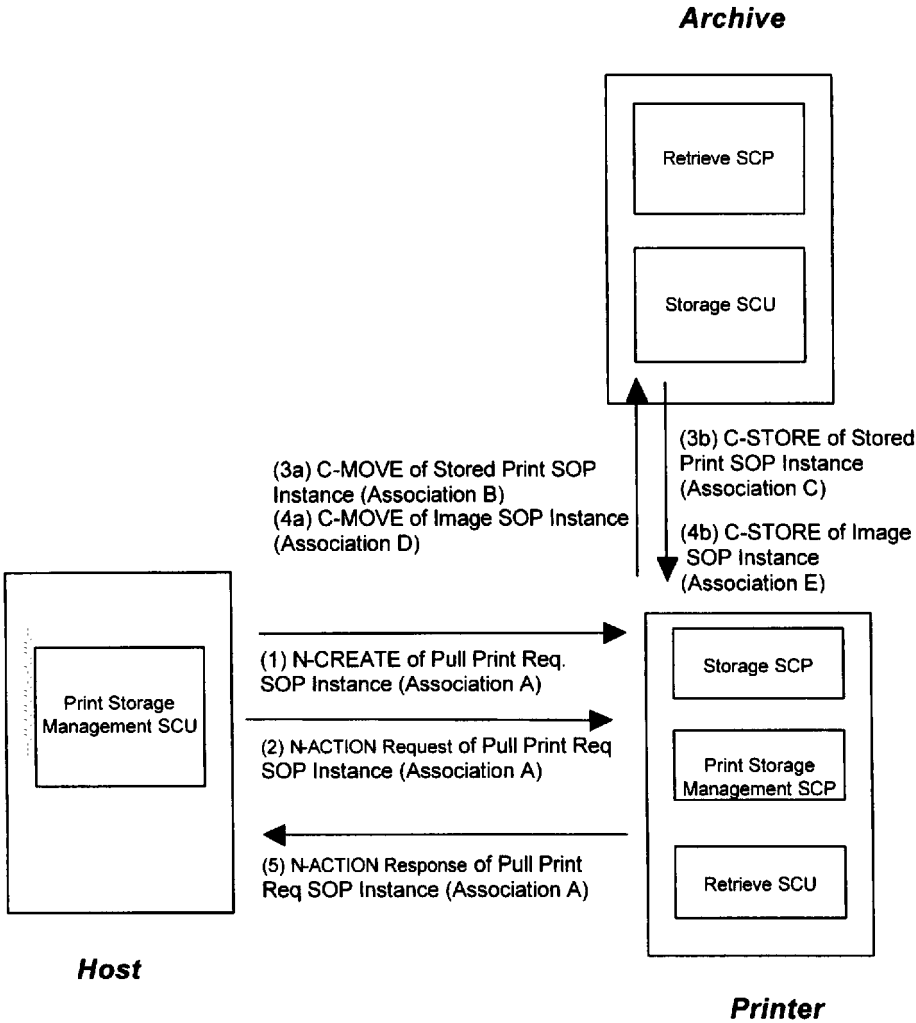

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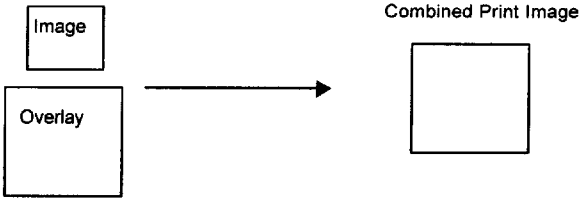
H.8 OVERLAY EXAMPLES (Informative)

These examples are provided for informational purposes only. It illustrates several examples of superimposing overlays and images.

Example 1

Image Rows, Columns	256, 256
Overlay Rows, Columns	512, 512
Overlay or Image Magnification	IMAGE
Magnify to Number of Columns	512
Overlay Origin	1\1

In this case, the image is magnified to have 512 rows and columns before being superimposed with the image. The upper left corner of the overlay is placed on the origin of the image. The Combined Print Image has 512 rows and columns



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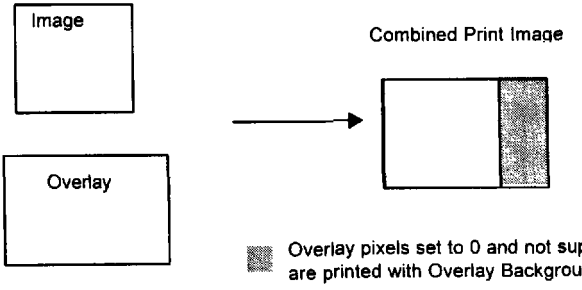
Example 2

Image Rows, Columns	512, 512
Overlay Rows, Columns	512, 599
Overlay or Image Magnification	absent
Magnify to Number of Columns	absent
Overlay Origin	1\1

In this case, neither the overlay or image is magnified before burning into the image. The upper left corner of the overlay is placed on the origin (1\1)of the image. The Combined Print Image has 512 rows and 599 columns



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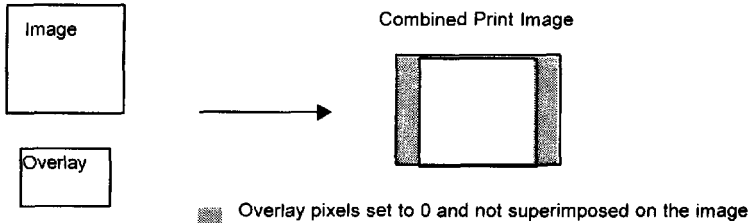
Example 3

Image Rows, Columns	512, 512
Overlay Rows, Columns	256, 300
Overlay or Image Magnification	OVERLAY
Magnify to Number of Columns	600
Overlay Origin	1\-43

In this example, the overlay is magnified to have 512 rows and 600 columns. The overlay and image are superimposed with the overlay origin 44 pixels to the left of the image origin (1\1). The Combined Print Image has 512 rows and 600 columns.



Overlay pixels set to 0 and not superimposed on the image are printed with Overlay Background Density (2040,0082)

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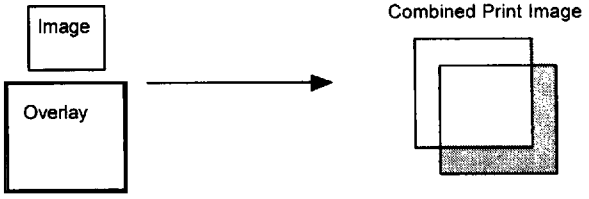
Example 4

Image Rows, Columns	256, 256
Overlay Rows, Columns	512, 512
Overlay or Image Magnification	IMAGE
Magnify to Number of Columns	512
Overlay Origin	100\100

In this case, the image is magnified to have 512 rows and columns before being superimposed with the overlay. The upper left corner of the overlay is placed 99 pixels down and to the right of the image origin. The Combined Print Image has 611 rows and columns.



Overlay pixels set to 0 and not superimposed on the image are printed with Overlay Background Density (2040,0082)

Combined Print Image pixels that are not part of the overlay or image are printed with Overlay Background Density (2040,0082)

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Annex I MEDIA STORAGE SERVICE CLASS (Normative)

I.1 OVERVIEW

I.1.1 Scope

The Media Storage Service Class defines an application-level class-of-service which facilitates the simple transfer of images and associated information between DICOM AEs by means of Storage Media. It supports:

a. The Interchange of images and a wide range of associated information. This is called the Interchange Option of the Media Storage Service Class;

b. The Storage of Images organized in Filming Sessions to ensure in an off-line manner their transfer for hardcopy printing. This is called the Print Option of the Media Storage Service Class;

c. The combined use of the Interchange Option and of the Print Option as introduced in 1 and 2 above.

I.1.2 Service Definition

DICOM AEs implement a SOP Class of the Interchange Option of the Media Storage Service Class by supporting one or more roles among the three roles FSC, FSR or FSU. DICOM AEs implement a SOP Class of the Print Option of the Media Storage Service Class by supporting one or more roles among the two roles FSC or FSU. SOP Classes of the Media Storage Service Class (either Options) are implemented using the Media Storage Operations (M-WRITE, M-READ, M-DELETE, M-INQUIRE FILE-SET and M-INQUIRE FILE). The services provided by these Operations are defined in PS 3.10.

I.2 BEHAVIOR

This Section discusses the FSC, FSR and FSU behavior for SOP Classes of the Media Storage Service Class.

I.2.1 Behavior of an FSC

The FSC shall be able to create a DICOMDIR File containing the Media Storage Directory SOP Class for the created File-set and create zero or more Files belonging to the File-set by invoking M-WRITE Operations with SOP Instances which meet the requirements of the corresponding IOD. It is the responsibility of the FSC to ensure that the M-WRITE results in the creation of a correctly formatted DICOM File. The manner in which this is achieved is beyond the scope of the DICOM Standard.

The FSC shall support the Media Storage Operation M-INQUIRE FILE-SET and may optionally support the M-INQUIRE FILE.

For the Print Option the following specifically applies:

— An FSC requests that a Film Session be printed by an FSU by placing a Film Session Directory Record in a Print Queue Directory Entity and setting the Execution Status (2100,0020) of the Film Session Directory Record to Pending;

— For a Film Session which is requested to be printed, only Film Boxes with an Execution Status (2100,0020) of Pending are requested to be printed.

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I.2.2 Behavior of an FSR

This behavior applies only to the Interchange Option of the Media Storage Service Class. The FSR shall be able to recognize a File-set and the corresponding DICOMDIR containing the Media Storage Directory SOP Class. A valid File-set may contain only a DICOMDIR and no other files. If a File-set contains other files with stored SOP Instance, the FSR shall be capable of invoking M-READ Operations to access the content of the Files of the File-set. The manner in which this is achieved is beyond the scope of the DICOM Standard.

The FSR shall support the Media Storage Operation M-INQUIRE FILE and may optionally support the M-INQUIRE FILE-SET.

I.2.3 Behavior of an FSU

The FSU shall be able to recognize a File-set and the corresponding DICOMDIR containing the Media Storage Directory SOP Class. A valid File-set may contain only a DICOMDIR and no other files. If a File-set contains other files with stored SOP Instances, the FSU shall be capable of invoking M-READ Operations to access the content of the Files of the File-set. The manner in which this is achieved is beyond the scope of the DICOM Standard.

The FSU shall support the Media Storage Operation M-INQUIRE FILE and the M-INQUIRE FILE-SET.

The FSU shall be able to create one or more new Files belonging to the File-set by invoking M-WRITE Operations with SOP Instances which meet the requirements of the corresponding IOD. It is the responsibility of the FSU to ensure that the M-WRITE results in the creation of a correctly formatted DICOM File. The manner in which this is achieved is beyond the scope of the DICOM Standard. The FSU shall be able to update the contents of the DICOMDIR File by using M-DELETE and or M-WRITE Operations.

For the Print Option the following specifically apply:

a) Only Film Sessions with a Film Session Directory Record present in a Print Queue Directory Entity with an Execution Status (2100,0020) of Pending are candidates to be printed;

b) For a Film Session which is candidate for printing, Film Boxes with an Execution Status (2100,0020) of Pending are candidates for being printed;

Note: The behavior of an FSU with respect to Film Sessions and Film Boxes with an Execution Status (2100,0020) of Done, is beyond the scope of the DICOM Standard. They may or may not be printed by the FSU.

c) Following the successful printing of a Film Box, the FSU supporting the Print Option shall change the Execution Status (2100,0020) of the corresponding Film Box Directory Record to Done. Once all the Film Boxes of a Film Session have been successfully printed by the FSU, the Film Session Directory Record Execution Status shall updated to Done. It is beyond the scope of the Print Option of this Service Class to decide whether or not the Film Session, related Film Boxes Directory Records, referenced Film Session, Film Box and Image Box SOP Instances may be deleted from the File-set by the FSU;

d) Following a failure to print one or more Film Boxes from a Film Session, the FSU shall leave the status of the corresponding Film Box Directory Record as Pending. While there are Pending Film Boxes in a Film Session, the Execution Status of the Film session shall remain Pending. It is beyond the scope of the Print Option of this Service Class to decide what recovery action may be taken following the failure of printing a Film Box.

Note: In the case of such failure it is recommended that the Film Session and related Film Box Directory Records as well as referenced Film Session, Film Box and Image Box SOP Instances not be deleted from the File-set by the FSU. The Print Option of this Service Class

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does not include the use of the M-DELETE Operation for Files except for updating the DICOMDIR File. The Interchange Option of the Media Storage Service Class with an FSU Role is intended to be used for such a function.

I.3 CONFORMANCE

I.3.1 Conformance as an FSC

An implementation which conforms to one of the SOP Classes of the Media Storage Service Class:

a) shall meet the requirements specified in Section I.2.1;

b) shall meet the requirements specified in PS 3.10;

c) shall perform M-WRITE Operations according to the SOP Class specification identified by the SOP Class UID in the Meta File Information;

d) shall support the Media Storage Directory SOP Class (stored in the DICOMDIR File). If it supports only the Interchange Option, the directory may contain no Directory Information Module. If it supports the Print Option the directory shall contain a Directory Information Module with appropriate Directory Records (Print Queue, Film Session, Film Box, and Image Box.);

e) may create DICOMDIR Files containing the Media Storage Directory SOP Class with Directory Records making multiple references to a File through an MRDR Directory Records.

I.3.2 Conformance as an FSR

An implementation which conforms to one of the SOP Classes of the Media Storage Service Class with the Interchange Option:

a) shall meet the requirements specified in Section I.2.2;

b) shall meet the requirements specified in PS 3.10;

c) shall perform M-READ Operations according to the SOP Class specification identified by the SOP Class UID in the Meta File Information. M-READ of non-supported SOP Classes shall simply result in ignoring such stored Data Sets;

d) shall read DICOMDIR Files containing the Media Storage Directory SOP Class with Directory Records making multiple references to Files through an MRDR Directory Record.

e) shall read DICOMDIR Files without a Directory Information Module or with a Directory Information Module including Directory Records of a Type not supported by the implementation.

I.3.3 Conformance as an FSU

An implementation which conforms to one of the SOP Classes of the Media Storage Service Class:

a) shall meet the requirements specified in Section I.2.3;

b) shall meet the requirements specified in PS 3.10;

c) shall perform M-READ Operations according to the SOP Class specification identified by the SOP Class UID in the Meta File Information. M-READ of unsupported SOP Classes shall simply result in ignoring such stored Data Sets;

d) shall perform M-WRITE Operations according to the SOP Class specification identified by the SOP Class UID in the Meta File Information;

e) shall support the Media Storage Directory SOP Class (stored in the DICOMDIR File). Directories containing a Directory Information Module shall be updated by an FSU. Directories containing no Directory Information Module shall not be updated by an FSU;

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f) shall read DICOMDIR Files containing the Media Storage Directory SOP Class with Directory Records making multiple references to Files through an MRDR Directory Record;

g) may optionally update DICOMDIR Files containing the Media Storage Directory SOP Class by creating Directory Records, utilizing MRDR Directory Records where multiple references to Files are needed.

h) shall read DICOMDIR Files without a Directory Information Module or with a Directory Information Module including Directory Records of a Type not supported by the implementation.

I.3.4 Conformance Statement Requirements

An implementation of the Media Storage Service Class may support one or more Roles and related Options as specified in Table I.3-1. In addition, the implementation may conform to one or more of the SOP Classes of the Media Storage Service Class defined in Section I.4. The Conformance Statement shall be in the format defined by PS 3.2.

Table I.3-1
Allowed Combinations of Roles and Options

Options	Roles	FSR	FSC	FSU
Interchange Option	With a Directory Information Module	Allowed	Allowed	Allowed Directory shall be updated
	With no Directory Information Module	Allowed	Allowed	Allowed Directory shall not be updated
Print Option	With a Directory Information Module	Not Allowed	Allowed	Allowed Directory shall be updated
	With no Directory Information Module	Not Allowed	Not Allowed	Not Allowed

The following aspects shall be documented in the Conformance Statement of any implementation claiming conformance to one of the Media Storage SOP Classes:

— *the subset of the Basic Directory Information Object Model supported*;
— which of the Service Class Options are supported: Interchange Option or Print Option or both;
— for the Interchange Option, whether the Directory Information Module is present or absent.
— When the Directory Information Module is created or updated (Directory Information Module supported), the optional standard keys which may be included in Directory Records shall be documented. Private Keys and Private Records may also be documented;

I.3.5 Standard Extended, Specialized, and Private Conformance

In addition to Standard Media Storage SOP Classes, implementations may support Standard Extended, Specialized and/or Private SOP Classes as defined by PS 3.2.

For all three types of SOP Classes, implementations shall be permitted to conform as an FSC, FSR, both or as an FSU. The Conformance Statement shall be in the format defined in PS 3.2.

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I.4 MEDIA STORAGE STANDARD SOP CLASSES

The SOP Classes in the Media Storage Service Class identify the Composite and Normalized IODs to be stored. The following Standard SOP Classes are identified in Table I.4-1

Table I.4-1
Media Storage Standard SOP Classes

SOP Class Name	SOP Class UID	IOD Specification
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	IOD defined in PS 3.3
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	IOD defined in PS 3.3
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30	IOD defined in PS3.3
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29	IOD defined in PS3.3
Detached Interpretation Management Storage	1.2.840.10008.3.1.2.6.1	See N-GET Attributes Section G.4.2.1
Detached Patient Management Storage	1.2.840.10008.3.1.2.1.1	See N-GET Attributes Section E.3.2.1
Detached Results Management Storage	1.2.840.10008.3.1.2.5.1	See N-GET Attributes Section G.3.2.1
Detached Study Component Management Storage	1.2.840.10008.3.1.2.3.2	See N-GET Attributes Section F.4.2.1
Detached Study Management Storage	1.2.840.10008.3.1.2.3.1	See N-GET Attributes Section F.3.2.1
Detached Visit Management Storage	1.2.840.10008.3.1.2.2.1	See N-GET Attributes Section E.4.2.1
Media Storage Directory Storage	1.2.840.10008.1.3.10	IOD defined in PS 3.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	IOD defined in PS 3.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	IOD defined in PS 3.3
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	IOD defined in PS 3.3
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	IOD defined in PS 3.3
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	IOD defined in PS 3.3
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	IOD defined in PS 3.3
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	IOD defined in PS 3.3
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	IOD defined in PS 3.3
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	IOD defined in PS 3.3
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	IOD defined in PS 3.3
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	IOD defined in PS 3.3
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	12-lead ECG Waveform

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General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	General ECG Waveform
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Ambulatory ECG Waveform
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Hemodynamic Waveform
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Cardiac Electrophysiology Waveform
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Basic Voice Audio Waveform
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	IOD defined in PS 3.3
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	IOD defined in PS 3.3
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11	IOD defined in PS 3.3
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Grayscale Softcopy Presentation State Storage
Stored Print Storage	1.2.840.10008.5.1.1.27	IOD defined in PS3.3
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	IOD defined in PS 3.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	IOD defined in PS 3.3
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	IOD defined in PS 3.3
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	IOD defined in PS 3.3
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	DX IOD
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	DX IOD
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography IOD
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography IOD
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Digital Intra-oral X-Ray IOD
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Digital Intra-oral X-Ray IOD
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image

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Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Basic Text SR
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Enhanced SR
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Comprehensive SR

Notes: 1. Except for the Media Storage Directory SOP Classes, the above listed Media Storage Standard SOP Classes are assigned the same UID Value as the corresponding network communication SOP Classes. This was done to simplify UID assignment. Although these SOP Classes are based on different Operations, the context of their usage should unambiguously distinguish a Media Storage SOP Class from a Network communication SOP Class.

2. The storage of Normalized Print SOP Instances on media was previously defined in DICOM. They have been retired. See PS 3.4-1998.

I.5 RETIRED STANDARD SOP CLASSES

The SOP Classes in Table I.5-1 were defined in previous versions of the DICOM Standard. They are now retired and have been replaced by new standard SOP Classes shown in Table I.4-1.

Note: Usage of the retired SOP Classes is permitted by DICOM. However, new implementations are strongly encouraged to implement the newer SOP Classes.

Table I.5-1
RETIRED STANDARD SOP CLASSES

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3
X-Ray Angiographic Bi-plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3

I.4.1Specialization for Standard SOP Classes

I.4.1.1 Grayscale Softcopy Presentation State Storage SOP Class

See Annex N.

I.4.1.2 Structured Reporting Storage SOP Classes

See Annex O.

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Annex J STORAGE COMMITMENT SERVICE CLASS (Normative)

J.1 OVERVIEW

J.1.1 Scope

The mechanism currently defined in DICOM for network based storage of SOP Instances, the Storage Service Class, allows a Service Class User (SCU) to transmit images and other information (such as overlays and curves) to a Service Class Provider (SCP). However, the Storage Service Class does not specify that the SCP explicitly take responsibility for the safekeeping of data into account. That is, there is no commitment that the SCP will do more than accept the transmitted SOP Instances. In order to have medical image management in addition to medical image communication, there is a need for a Service Class within DICOM that ensures that there is an explicitly defined commitment to store the SOP Instances.

The Storage Commitment Service Class defines an application-level class-of-service which facilitates this commitment to storage. The Storage Commitment Service Class enables an Application Entity (AE) acting as an SCU to request another Application Entity (AE) acting as an SCP to make the commitment for the safekeeping of the SOP Instances (i.e. that the SOP Instances will be kept for an implementation specific period of time and can be retrieved). The AE where such SOP Instances can later be retrieved may be the SCP where storage commitment was accepted or it may be distinct from that SCP.

The SCP implementation defines how it provides its commitment to storage. Certain SCPs may commit to permanently store the SOP Instances (e.g. an archive system) while other SCPs may commit to provide storage of the SOP Instances for a limited amount of time. The SCP is required to document in its Conformance Statement the nature of its commitment to storage (e.g. duration of storage, retrieve capabilities and latency, capacity).

Once the SCP has accepted the commitment to store the SOP Instances, the SCU may decide that it is appropriate to delete its copies of the SOP Instances. These types of policies are outside the scope of this Standard, however, the SCU is required to document these policies in its Conformance Statement.

J.1.2 Models Overview

The request for storage commitment can be accomplished using one of two basic models: the Push Model and the Pull Model.

The Push model expects an SCU to transmit SOP Instances to an SCP using an appropriate mechanism outside the scope of this Service Class. Storage commitment is then initiated by transmitting a Storage Commitment Request containing references to a set of one or more SOP Instances. Success or failure of storage commitment is subsequently indicated via a notification from the SCP to the SCU.

The Pull model allows an SCU to transmit a Storage Commitment Request containing references to SOP Instances which do not currently reside at the SCP. The SCP must then retrieve the SOP Instances from their current location using a mechanism outside the scope of this Service Class. Success or failure of storage commitment is subsequently indicated via a notification from the SCP to the SCU.

NOTE: As indicated, the mechanisms used to transfer SOP Instances from an SCU to an SCP are outside the scope of this Service Class. However, typical mechanisms are found in the

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Storage Service Class, the Query/Retrieve Service Class, or Media Exchange.

J.2 CONFORMANCE OVERVIEW

The application-level services addressed by this Service Class are specified via 2 distinct SOP Classes:

a) Storage Commitment Push Model SOP Class
b) Storage Commitment Pull Model SOP Class.

An SCP implementation of the Storage Commitment Service Class shall support the Storage Commitment Push Model SOP Class. If an SCP supports the Storage Commitment Pull Model SOP Class, it shall also support the Storage Commitment Push Model SOP Class.

Each SOP Class specifies Attributes, operations, notifications, and behavior applicable to the SOP Class. Conformance of Application Entities shall be defined by selecting one or both of the Storage Commitment SOP Classes. For each SOP Class, conformance requirements shall be specified in terms of the Service Class Provider (SCP) and the Service Class User (SCU).

The Storage Commitment Service Class uses the Storage Commitment IOD as defined in PS 3.3 and the N-ACTION and N-EVENT-REPORT DIMSE Services specified in PS 3.7.

J.2.1 Association Negotiation

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The Association negotiation rules as specified in PS 3.7 shall be used to negotiate the supported SOP Classes.

Support for the SCP/SCU role selection negotiation is mandatory. The SOP Class Extended Negotiation shall not be supported.

An SCP implementation of the Storage Commitment Service Class shall support the Storage Commitment Push Model SOP Class. If an SCP accepts a Presentation Context for the Storage Commitment Pull Model SOP Class, it shall also accept a Presentation Context for the Storage Commitment Push Model SOP Class.

J.3 STORAGE COMMITMENT PUSH MODEL SOP CLASS

The Storage Commitment Push Model SOP Class is intended for those Application Entities requiring storage commitment where the SCU determines the time at which the SOP Instances are transmitted. The SCU transmits the SOP Instances to the SCP using an appropriate mechanism. The request for storage commitment is transmitted to the SCP together with a list of references to one or more SOP Instances. Success or failure of storage commitment is subsequently indicated by a notification from the SCP to the SCU.

J.3.1 DIMSE Service Group

The following DIMSE-N Services are applicable to the Storage Commitment Push Model SOP Class.

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-ACTION	M/M

The DIMSE-N Services and Protocol are specified in PS 3.7.

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J.3.2 Operations

The DICOM AEs which claim conformance to this SOP Class as an SCU shall invoke the N-ACTION operation. The DICOM AEs which claim conformance to this SOP Class as an SCP shall support the N-ACTION operation.

J.3.2.1 Storage Commitment Request

The Storage Commitment Request operation allows an SCU to request an SCP to commit to the safekeeping of a set of SOP Instances. This operation shall be invoked through the N-ACTION primitive.

J.3.2.1.1 Action Information

The DICOM AEs which claim conformance to this SOP Class as an SCU and/or an SCP shall support the Action Types and Action Information as specified in Table J.3-1.

Table J.3-1
STORAGE COMMITMENT REQUEST - ACTION INFORMATION

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Request Storage Commitment	1	Transaction UID	(0008,1195)	1/1
		Storage Media File-Set ID	(0088,0130)	3/3 See Section J.3.2.1.1.1.
		Storage Media File-Set UID	(0088,0140)	3/3 See Section J.3.2.1.1.1.
		Referenced SOP Sequence	(0008,1199)	1/1
		>Referenced SOP Class UID	(0008,1150)	1/1
		>Referenced SOP Instance UID	(0008,1155)	1/1
		>Storage Media File-Set ID	(0088,0130)	3/3 See Section J.3.2.1.1.1.
		>Storage Media File-Set UID	(0088,0140)	3/3 See Section J.3.2.1.1.1.
		Referenced Study Component Sequence	(0008,1111)	1C/1 See Section J.3.2.1.1.2.
		>Referenced SOP Class UID	(0008,1150)	1/1

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		>Referenced SOP Instance UID	(0008,1155)	1/1

J.3.2.1.1.1 Storage Media File Set ID Attributes

If present, the Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0088,0140) shall appear either outside the Referenced SOP Sequence (0008,1199), or within one or more Items within that sequence, but not both. If they appear outside of the sequence, then all of the SOP Instances within the sequence shall be retrievable from the specified Storage Media File-Set. If they appear within an Item of that sequence, then the SOP Instance referenced to by that Item shall be retrievable from the specified Storage Media File-Set.

J.3.2.1.1.2 Referenced Study Component Sequence Attribute

The Referenced Study Component Sequence (0008,1111) Attribute shall be provided if all the SOP Instance(s) referenced within the Referenced SOP Sequence (0008,1199) belong to the same Study Component and represent the complete set of SOP Instances for that Study Component (i.e. if the referenced SOP Instances do not represent the complete Study Component, this Attribute is not sent). Only 1 SOP Class/Instance UID pair may be present in this sequence.

Note: See the Study Management Service Class for more information about the Study Component.

J.3.2.1.2 Service Class User Behavior

The SCU shall use the N-ACTION primitive to request the SCP the safekeeping of a set of SOP Instances. The SOP Instances are referenced in the Action Information as specified in Table J.3-1. The Action Type ID shall be set to 1 specifying the request for storage commitment.

The SCU shall supply the Transaction UID Attribute (0008,1195) to uniquely identify each Storage Commitment Request. The value of the Transaction UID Attribute will be included by the SCP in the Storage Commitment Result (see Section J.3.3.1). Use of the Transaction UID Attribute allows the SCU to match requests and results which may occur over the same or different Associations.

The N-ACTION primitive shall contain the well-known Storage Commitment Push Model SOP Instance UID (defined in Section J.3.5) in its Requested SOP Instance UID parameter.

Note: In the usage described here, there is no explicit creation of a SOP Instance upon which an N-ACTION primitive may operate. Instead, the N-ACTION primitive operates upon a constant well-known SOP Instance. This SOP Instance is conceptually created during startup of each Storage Commitment Service Class SCP Application.

Upon receipt of a successful N-ACTION Response Status Code from the SCP, the SCU now knows that the SCP has received the N-ACTION request. Upon receipt of any other N-ACTION Response Status Code from the SCP, the SCU now knows that the SCP will not process the request and therefore will not commit to the storage of the SOP Instances referenced by the Storage Commitment Request. The actions taken by the SCU upon receiving the status is beyond the scope of this Standard. Upon receipt of a failure status, the Transaction UID is no longer active and shall not be reused for other transactions.

At any time after receipt of the N-ACTION-Response, the SCU may release the association on which it sent the N-ACTION-Request.

Notes: 1. Failure of storage commitment will be signaled via the N-EVENT-REPORT primitive.

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2. In situations where the SOP Instance(s) are transferred via Media Interchange, the Storage Commitment Request may fail because the piece of Media containing the referenced SOP Instance(s) may not yet have been read. Attributes (0088,0130) File-Set ID and (0088,0140) File-Set UID may or may not be present in the case of Media Interchange. They may be provided to facilitate identification of the media containing the transferred SOP Instance(s) by the Storage Commitment SCP.

J.3.2.1.3 Service Class Provider Behavior

Upon receipt of the N-ACTION request, the SCP shall return, via the N-ACTION response primitive, the N-ACTION Response Status Code applicable to the associated request. A success status conveys that the SCP has successfully received the request. A failure status conveys that the SCP is not processing the request.

Notes: 1. Failure of storage commitment will be signaled via the N-EVENT-REPORT primitive.

2. When a Storage Commitment Request is received by an SCP it may immediately assess the list of references for which Storage Commitment is requested and return an N-EVENT-REPORT. In situations where the SOP Instance(s) are transferred via Media Interchange, the N-EVENT-REPORT may fail because the piece of Media containing the referenced SOP Instance(s) may not yet have been read. Attributes (0088,0130) File-Set ID and (0088,0140) File-Set UID may or may not be present in the case of Media Interchange. They may be used to facilitate identification of the media containing the transferred SOP Instance(s) by the Storage Commitment SCP.

J.3.2.1.4 Status Codes

No Service Class specific status values are defined for the N-ACTION Service. See PS 3.7 for general response status codes.

J.3.3 Notifications

The DICOM AEs which claim conformance to this SOP Class as an SCP shall invoke the N-EVENT-REPORT request. The DICOM AEs which claim conformance to this SOP Class as an SCU shall be capable of receiving the N-EVENT-REPORT request.

J.3.3.1 Storage Commitment Result

The Storage Commitment Result notification allows an SCP to inform the SCU whether or not it has accepted storage commitment responsibility for the SOP Instances referenced by a Storage Commitment Request. This notification is also used to convey error information (i.e. storage commitment could not be achieved for one or more of the referenced SOP Instances). This notification shall be invoked through the N-EVENT-REPORT primitive.

J.3.3.1.1 Event Information

The DICOM AEs which claim conformance to this SOP Class as an SCU and/or an SCP shall support the Event Types and Event Information as specified in Table J.3-2.

Table J.3-2
STORAGE COMMITMENT RESULT - EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU/SCP
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	-/1

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		Retrieve AE Title	(0008,0054)	-/3 See Section J.3.3.1.1.1.
		Storage Media File-Set ID	(0088,0130)	-/3 See Section J.3.3.1.1.2.
		Storage Media File-Set UID	(0088,0140)	-/3 See Section J.3.3.1.1.2.
		Referenced SOP Sequence	(0008,1199)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Retrieve AE Title	(0008,0054)	-/3 See Section J.3.3.1.1.1.
		>Storage Media File-Set ID	(0088,0130)	-/3 See Section J.3.3.1.1.2.
		>Storage Media File-Set UID	(0088,0140)	-/3 See Section J.3.3.1.1.2.
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)	-/1
		Retrieve AE Title	(0008,0054)	-/3 See Section J.3.3.1.1.1.
		Storage Media File-Set ID	(0088,0130)	-/3 See Section J.3.3.1.1.2.
		Storage Media File-Set UID	(0088,0140)	-/3 See Section J.3.3.1.1.2.
		Referenced SOP Sequence	(0008,1199)	-/1C This Attribute shall be provided if storage commitment for one or more SOP Instances has been successful
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Retrieve AE Title	(0008,0054)	-/3 See Section J.3.3.1.1.1.

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		>Storage Media File-Set ID	(0088,0130)	-/3 See Section J.3.3.1.1.2.
		>Storage Media File-Set UID	(0088,0140)	-/3 See Section J.3.3.1.1.2.
		Failed SOP Sequence	(0008,1198)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Failure Reason	(0008,1197)	-/1

J.3.3.1.1.1 Retrieve AE Title Attribute

If present, the Retrieve AE Title (0008,0054) shall appear either outside the Referenced SOP Sequence (0008,1199), or within one or more Items within that sequence, but not both. If they appear outside of the sequence, then all of the SOP Instances within the sequence shall be retrievable from the specified Retrieve AE Title. If they appear within an Item of that sequence, then the SOP Instance referenced to by that Item shall be retrievable from the specified Retrieve AE Title.

J.3.3.1.1.2 Storage Media File Set ID Attributes

If present, the Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0088,0140) shall appear either outside the Referenced SOP Sequence (0008,1199), or within one or more Items within that sequence, but not both. If they appear outside of the sequence, then all of the SOP Instances within the sequence shall be retrievable from the specified Storage Media File-Set. If they appear within an Item of that sequence, then the SOP Instance referenced to by that Item shall be retrievable from the specified Storage Media File-Set.

J.3.3.1.2 Service Class Provider Behavior

If the SCP determines that it has successfully completed storage commitment for all the SOP Instances referenced by a Storage Commitment Request, the SCP shall issue an N-EVENT-REPORT with the Event Type ID set to 1 (storage commitment request successful). This event shall include references to the successfully stored SOP Instances. The SCP shall store the referenced SOP Instances in accordance with Level 2 as defined in the Storage Service Class (i.e. all Attributes, including Private Attributes). The Storage Service Class is defined in PS 3.4. After the N-EVENT-REPORT has been sent, the Transaction UID is no longer active and shall not be reused for other transactions.

If it is determined that storage commitment could not be achieved for one or more referenced SOP Instances, the SCP shall issue an N-EVENT-REPORT with the Event Type ID set to 2 (storage commitment request complete - failure exists) conveying that the SCP does not commit to store all SOP Instances. This event shall include references to the failed SOP Instances together with references to those SOP Instances which have been successfully stored. For each failed SOP Instance the reason for failure shall be described by the Failure Reason Attribute. After the N-EVENT-REPORT has been sent, the Transaction UID is no longer active and shall not be reused for other transactions.

The complete set of SOP Instances referenced by the Referenced SOP Sequence (0008,1150) Attribute, in the initiating N-ACTION, shall be present in both Event Types.

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The N-EVENT-REPORT shall include the same Transaction UID Attribute (0008,1195) value as contained in the initiating N-ACTION.

An SCP shall be capable of issuing the N-EVENT-REPORT on a different association than the one on which the N-ACTION operation was performed.

Notes: 1. The SCP may attempt to issue the N-EVENT-REPORT on the same Association, but this operation may fail because the SCU is free to release at any time the Association on which it sent the N-ACTION-Request. As DICOM defaults the association requestor to the SCU role, the SCP (i.e. the association requester) negotiates an SCP role using the SCU/SCP role negotiation (see PS 3.7).

2. The optional Attributes Retrieve AE Title (0008,0054), Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0088,0140) within the Event Information allows an SCP to indicate the location where it has stored SOP Instances for safekeeping. For example, the SCP could relay SOP Instances to a third Application Entity using this Service Class. In which case it can use the Retrieve AE Title Attribute to indicate the real location of the data. Another example is if the SCP stores data on media, it can indicate this using the Storage Media File-Set ID and UID Attributes.

J.3.3.1.3 Service Class User Behavior

An SCU shall be capable of receiving an N-EVENT-REPORT on a different association than the one on which the N-ACTION operation was performed.

Note: To receive this N-EVENT-REPORT, the SCU accepts an association where the SCP role is proposed by the Storage Commitment SCP acting as an association requestor.

The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The actions taken by the SCU upon receiving the N-EVENT-REPORT are beyond the scope of this Standard but are stated in its Conformance Statement.

Note: In the case where the SCP indicates that it cannot achieve storage commitment for some SOP Instances, the SCU might, for example, re-send the failed SOP Instances to the SCP (via the Storage Service Class) and then re-transmit the N-ACTION request. However, this behavior is beyond the scope of this Standard.

J.3.3.1.4 Status Codes

No Service Class specific status values are defined for the N-EVENT-REPORT Service. See PS 3.7 for general response status codes.

Note: This Section refers to status codes returned by the N-EVENT-REPORT response primitive. The Failure Reason Attribute returned in the Storage Commitment Result - Event Information (see PS 3.3) are described in the Storage Commitment IOD.

J.3.4 Storage Commitment Push Model SOP Class UID

The Storage Commitment Push Model SOP Class shall be uniquely identified by the Storage Commitment Push Model SOP Class UID which shall have the value "1.2.840.10008.1.20.1".

J.3.5 Storage Commitment Push Model Reserved Identification

The well-known UID of the Storage Commitment Push Model SOP Instance shall have the value "1.2.840.10008.1.20.1.1".

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J.3.6 Conformance Requirements

Implementations claiming Standard SOP Class Conformance to the Storage Commitment Push Model SOP Class shall be conformant as described in this Section and shall include within their Conformance Statement information as described in this Section and sub-Sections.

An implementation may claim conformance to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

J.3.6.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for

- the operations and actions which it invokes
- the notifications which it receives.

The mechanisms used by the SCU to transfer SOP Instances to the SCP shall be documented.

J.3.6.1.1 Operations

The SCU shall document in the SCU Operations Statement the actions and behavior which cause the SCU to generate an N-ACTION primitive (Storage Commitment Request).

The SCU shall specify the SOP Class UIDs for which it may request storage commitment.

The SCU shall specify if it supports the Referenced Study Component Sequence Attribute.

The SCU shall specify the duration of applicability of the Transaction UID. This may be specified as a time limit or a policy which defines the end of a transaction (e.g. how long will the SCU wait for a N-EVENT-REPORT).

The SCU shall specify if it supports the optional Storage Media File-Set ID & UID Attributes in the N-ACTION. If these Attributes are supported, the SCU shall also specify which Storage Media Application Profiles are supported.

The SCU Operations Statement shall be formatted as defined in PS 3.2

J.3.6.1.2 Notifications.

The SCU shall document in the SCU Notifications Statement the behavior and actions taken by the SCU upon receiving an N-EVENT-REPORT primitive (Storage Commitment Result).

The SCU shall specify the behavior and actions performed when a success status is received (i.e. if and when local SOP Instances copies are deleted).

The SCU shall specify the behavior and actions performed when a failure status is received (i.e. recovery mechanisms, etc.).

The SCU Notifications Statement shall be formatted as defined in PS 3.2

J.3.6.2 SCP Conformance.

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for

- the operations and actions which it performs
- the notifications which it generates.

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J.3.6.2.1 Operations

The SCP shall document in the SCP Operations Statement the behavior and actions of the SCP upon receiving the N-ACTION primitive (Storage Commitment Request).

The SCP shall specify parameters indicating the level of storage commitment, such as:

- under what conditions the SCP would delete SOP Instances
- persistence of storage
- capacity
- volatility
- other pertinent information

The SCP shall specify the mechanisms and characteristics of retrieval of stored SOP Instances, such as:

- supported query/retrieve services
- latency
- other pertinent information

The SCP shall specify if it supports the optional Storage Media File-Set ID & UID Attributes in the N-ACTION. If these Attributes are supported, the SCP shall also specify which Storage Media Application Profiles are supported.

The SCP Operations Statement shall be formatted as defined in PS 3.2

J.3.6.2.2 Notifications

The SCP shall document in the SCP Notifications Statement the behavior and actions which cause the SCP to generate an N-EVENT-REPORT primitive (Storage Commitment Result).

The SCP shall specify if it supports the optional Storage Media File-Set ID & UID Attributes in the N-EVENT-REPORT and describe the policies for how the Media is used. The SCP shall also specify which Storage Media Application Profiles are supported.

The SCP shall specify if it supports the optional Retrieve AE Title (0008,0054) Attribute in the N-EVENT-REPORT and describe the policies for how it is used.

The SCP Notifications Statement shall be formatted as defined in PS 3.2

J.4 STORAGE COMMITMENT PULL MODEL SOP CLASS

The Storage Commitment Pull Model SOP Class is intended for those Application Entities requiring storage commitment where the SCP determines the time at which SOP Instances are transmitted. The SOP Instances to be held for safekeeping are referenced in a Storage Commitment Request transmitted to the SCP. The SCP shall then retrieve the SOP Instances from the appropriate location. Success or failure of storage commitment is subsequently indicated by a notification from the SCP to the SCU.

J.4.1 DIMSE Service Group

The following DIMSE-N Services are applicable to the Storage Commitment Pull Model SOP Class.

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DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-ACTION	M/M

The DIMSE-N Services and Protocol are specified in PS 3.7.

J.4.2 Operations

The DICOM AEs which claim conformance to this SOP Class as an SCU shall invoke the N-ACTION operation. The DICOM AEs which claim conformance to this SOP Class as an SCP shall support the N-ACTION operation.

J.4.2.1 Storage Commitment Request

The Storage Commitment Request operation allows an SCU to request an SCP to commit to the safekeeping of a set of SOP Instances. This operation shall be invoked through the N-ACTION primitive.

J.4.2.1.1 Action Information

The DICOM AEs which claim conformance to this SOP Class as an SCU and/or an SCP shall support the Action Types and Action Information as specified in Table J.4-1.

Table J.4-1
STORAGE COMMITMENT REQUEST - ACTION INFORMATION

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Request Storage Commitment	1	Transaction UID	(0008,1195)	1/1
		Retrieve AE Title	(0008,0054)	1C/1 See J.4.2.1.1.1.
		Referenced SOP Sequence	(0008,1199)	1/1
		>Referenced SOP Class UID	(0008,1150)	1/1
		>Referenced SOP Instance UID	(0008,1155)	1/1
		>Retrieve AE Title	(0008,0054)	1C/1 See J.4.2.1.1.1.
		Referenced Study Component Sequence	(0008,1111)	1C/1 See J.4.2.1.1.2.
		>Referenced SOP Class UID	(0008,1150)	1/1
		>Referenced SOP Instance UID	(0008,1155)	1/1

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J.4.2.1.1.1 Retrieve AE Title Attribute

The Retrieve AE Title (0008,0054) shall appear either outside the Referenced SOP Sequence (0008,1199), or within one or more Items within that sequence, but not both. If they appear outside of the sequence, then all of the SOP Instances within the sequence shall be retrievable from the specified Retrieve AE Title. If they appear within an Item of that sequence, then the SOP Instance referenced to by that Item shall be retrievable from the specified Retrieve AE Title.

J.4.2.1.1.2 Referenced Study Component Sequence Attribute

The Referenced Study Component Sequence (0008,1111) Attribute shall be provided if all the SOP Instance(s) referenced within the Referenced SOP Sequence (0008,1199) belong to the same Study Component and represent the complete set of SOP Instances for that Study Component (i.e. if the referenced SOP Instances do not represent the complete Study Component, this Attribute is not sent). Only 1 SOP Class/Instance UID pair may be present in this sequence.

J.4.2.1.2 Service Class User Behavior

The SCU shall use the N-ACTION primitive to request the SCP provide storage commitment for a set of SOP Instances. The SOP Instances are referenced in the Action Information as specified in Table J.4-1. The Action Type ID shall be set to 1 specifying the request for storage commitment.

The SCU shall supply the Transaction UID Attribute (0008,1195) to uniquely identify each Storage Commitment Request. The value of the Transaction UID Attribute will be included by the SCP in the Storage Commitment Result (see Section J.4.3.1). Use of the Transaction UID Attribute allows the SCU to match requests and results which may occur over the same or different Associations.

The N-ACTION primitive shall contain the well-known Storage Commitment Pull Model SOP Instance UID (defined in Section J.4.5) in its Requested SOP Instance UID parameter.

Note: In the usage described here, there is no explicit creation of a SOP Instance upon which an N-ACTION primitive may operate. Instead, the N-ACTION primitive operates upon a constant well-known SOP Instance. This SOP Instance is conceptually created during startup of each Storage Commitment Service Class SCP Application.

Upon receipt of a successful N-ACTION Response Status Code from the SCP, the SCU now knows that the SCP is processing the N-ACTION request. Upon receipt of any other N-ACTION Response Status Code from the SCP, the SCU now knows that the SCP will not process the request and therefore will not attempt to retrieve the SOP Instances referenced by the Storage Commitment Request. The actions taken by the SCU upon receiving the status is beyond the scope of this Standard. Upon receipt of a failure status, the Transaction UID is no longer active and shall not be reused for other transactions.

Note: Failure storage commitment will be signaled via the N-EVENT-REPORT primitive.

J.4.2.1.3 Service Class Provider Behavior

Upon receipt of the N-ACTION request, the SCP shall return, via the N-ACTION response primitive, the N-ACTION Response Status Code applicable to the associated request. A success status conveys that the SCP has successfully received the request. A failure status conveys that the SCP is not processing the request.

If a success status has been returned in the N-ACTION Response Status Code, the SCP shall then attempt to retrieve the SOP Instances referenced in the Storage Commitment Request (see Table J.4-1). The mechanisms used by the SCP to retrieve SOP Instances are outside the scope of this Service Class but are documented in its Conformance Statement. However, in the case that network based retrieval is used, the SCP shall use a separate Association for retrieving SOP Instances.

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Notes: 1. Failure of storage commitment will be signaled via the N-EVENT-REPORT primitive.

2. As indicated, the actual mechanism used by the SCP to retrieve SOP Instances is outside the scope of this Service Class. However, typical mechanisms are found in the Query/Retrieve Service Class. The Application Entity serving as the SCP of the Query/Retrieve Service Class need not necessarily be the same as the SCU of the Storage Commitment Service Class. This allows scenarios in which storage commitment is initiated by a third party.

J.4.2.1.4 Status Codes

No Service Class specific status values are defined for the N-ACTION Service. See PS 3.7 for response codes.

J.4.3 Notifications

The DICOM AEs which claim conformance to this SOP Class as an SCP shall invoke the N-EVENT-REPORT request. The DICOM AEs which claim conformance to this SOP Class as an SCU shall support the N-EVENT-REPORT request.

J.4.3.1 Storage Commitment Result

The Storage Commitment Result notification allows an SCP to inform the SCU whether or not it has accepted storage commitment responsibility for the SOP Instances referenced by a Storage Commitment Request. This notification is also used to convey error information (i.e. storage commitment could not be achieved for one or more of the referenced SOP Instances). This notification shall be invoked through the N-EVENT-REPORT primitive.

J.4.3.1.1 Event Information

The DICOM AEs which claim conformance to this SOP Class as an SCU and/or an SCP shall support the Event Types and Event Information as specified in Table J.4-2.

Table J.4-2
STORAGE COMMITMENT RESULT - EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU/SCP
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	-/1
		Retrieve AE Title	(0008,0054)	-/3 See J.4.3.1.1.1.
		Storage Media File-Set ID	(0088,0130)	-/3 See J.4.3.1.1.2.
		Storage Media File-Set UID	(0088,0140)	-/3 See J.4.3.1.1.2.
		Referenced SOP Sequence	(0008,1199)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1

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		>Retrieve AE Title	(0008,0054)	-/3 See J.4.3.1.1.1.
		>Storage Media File-Set ID	(0088,0130)	-/3 See J.4.3.1.1.2.
		>Storage Media File-Set UID	(0088,0140)	-/3 See J.4.3.1.1.2.
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)	-/1
		Retrieve AE Title	(0008,0054)	-/3 See J.4.3.1.1.1.
		Storage Media File-Set ID	(0088,0130)	-/3 See J.4.3.1.1.2.
		Storage Media File-Set UID	(0088,0140)	-/3 See J.4.3.1.1.2.
		Referenced SOP Sequence	(0008,1199)	-/1C This Attribute shall be provided if storage commitment for one or more of the SOP Instances has been successful
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Retrieve AE Title	(0008,0054)	-/3 See J.4.3.1.1.1.
		>Storage Media File-Set ID	(0088,0130)	-/3 See J.4.3.1.1.2.
		>Storage Media File-Set UID	(0088,0140)	-/3 See J.4.3.1.1.2.
		Failed SOP Sequence	(0008,1198)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Failure Reason	(0008,1197)	-/1

J.4.3.1.1.1 Retrieve AE Title Attribute

If present, the Retrieve AE Title (0008,0054) shall appear either outside the Referenced SOP Sequence (0008,1199), or within one or more Items within that sequence, but not both. If they appear outside of the sequence, then all of the SOP Instances within the sequence shall be

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retrievable from the specified Retrieve AE Title. If they appear within an Item of that sequence, then the SOP Instance referenced to by that Item shall be retrievable from the specified Retrieve AE Title.

J.4.3.1.1.2 Storage Media File Set ID Attributes

If present, the Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0088,0140) shall appear either outside the Referenced SOP Sequence (0008,1199), or within one or more Items within that sequence, but not both. If they appear outside of the sequence, then all of the SOP Instances within the sequence shall be retrievable from the specified Storage Media File-Set. If they appear within an Item of that sequence, then the SOP Instance referenced to by that Item shall be retrievable from the specified Storage Media File-Set.

J.4.3.1.2 Service Class Provider Behavior

If the SCP determines that it has successfully completed storage commitment for all the SOP Instances referenced by a Storage Commitment Request, the SCP shall issue an N-EVENT-REPORT with the Event Type ID set to 1 (storage commitment request successful). This event shall include references to the successfully stored SOP Instances. The SCP shall store the referenced SOP Instances in accordance with Level 2 as defined in the Storage Service Class (i.e. all Attributes, including Private Attributes). The Storage Service Class is defined in Annex B of this Part. After the N-EVENT-REPORT has been sent, the Transaction UID is no longer active and shall not be reused for other transactions.

If it is determined that storage commitment could not be achieved for one or more referenced SOP Instances, the SCP shall issue an N-EVENT-REPORT with the Event Type ID set to 2 (storage commitment request complete - failure exists) conveying that the SCP does not commit to store all SOP Instances. This event shall include references to the failed SOP Instances together with references to those SOP Instances which have been successfully stored. For each failed SOP Instance the reason for failure shall be described by the Failure Reason Attribute. After the N-EVENT-REPORT has been sent, the Transaction UID is no longer active and shall not be reused for other transactions.

The complete set of SOP Instances referenced by the Referenced SOP Sequence (0008,1150) Attribute, in the initiating N-ACTION, shall be present in both Event Types.

The N-EVENT-REPORT shall include the same Transaction UID Attribute (0008,1195) value as contained in the initiating N-ACTION.

The N-EVENT-REPORT may occur on a different Association than the N-ACTION operation.

Note: The optional Attributes Retrieve AE Title (0008,0054), Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0088,0140) within the Event Information allows an SCP to indicate the location where it has stored SOP Instances for safekeeping. For example, the SCP could relay SOP Instances to a third Application Entity using this Service Class. In which case it can use the Retrieve AE Title Attribute to indicate the real location of the data. Another example is if the SCP stores data on media, it can indicate this using the Storage Media File-Set ID and UID Attributes.

J.4.3.1.3 Service Class User Behavior

The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. The actions taken by the SCU upon receiving the N-EVENT-REPORT are beyond the scope of this Standard but are stated in its Conformance Statement.

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J.4.3.1.4 Status Codes

No Service Class specific status values are defined for the N-EVENT-REPORT Service. See PS 3.7 for general response status codes.

Note: This Section refers to status codes returned by the N-EVENT-REPORT response primitive. The Failure Reason Attribute returned in the Storage Commitment Result - Event Information (see Table J.4-2) are described in the Storage Commitment IOD.

J.4.4 Storage Commitment Pull Model SOP Class UID

The Storage Commitment Pull Model SOP Class shall be uniquely identified by the Storage Commitment Pull Model SOP Class UID which shall have the value "1.2.840.10008.1.20.2".

J.4.5 Storage Commitment Pull Model Reserved Identification

The well-known UID of the Storage Commitment Pull Model SOP Instance shall have the value "1.2.840.10008.1.20.2.1".

J.4.6 Conformance Requirements

Implementations claiming Standard SOP Class Conformance to the Storage Commitment Pull Model SOP Class shall be conformant as described in this Section and shall include within their Conformance Statement information as described in this Sections and its Sub-Sections.

An implementation may claim conformance to this SOP Class as an SCU, SCP or both. The Conformance Statement shall be in the format defined in PS 3.2.

J.4.6.1 SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for

- the operations and actions which it invokes
- the notifications which it receives.

J.4.6.1.1 Operations

The SCU shall document in the SCU Operations Statement the actions and behavior which cause the SCU to generate an N-ACTION primitive (Storage Commitment Request).

The SCU shall specify the SOP Class UIDs for which it may request storage commitment.

The SCU shall specify if it supports the Referenced Study Component Sequence Attribute.

The SCU shall specify the duration of applicability of the Transaction UID. This may be specified as a time limit or a policy which defines the end of a transaction (e.g. how long will the SCU wait for a N-EVENT-REPORT).

The SCU Operations Statement shall be formatted as defined in PS 3.2.

J.4.6.1.2 Notifications

The SCU shall document in the SCU Notifications Statement the behavior and actions taken by the SCU upon receiving an N-EVENT-REPORT primitive (Storage Commitment Result).

The SCU shall specify the behavior and actions performed when a success status is received (i.e. if and when local SOP Instances copies are deleted).

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The SCU shall specify the behavior and actions performed when a failure status is received (i.e. recovery mechanisms, etc.).

The SCU Notifications Statement shall be formatted as defined in PS 3.2.

J.4.6.2 SCP Conformance

An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for

- the operations and actions which it performs
- the notifications which it generates.

J.4.6.2.1 Operations

The SCP shall document in the SCP Operations Statement the behavior and actions of the SCP upon receiving the N-ACTION primitive (Storage Commitment Request).

The SCP shall specify the mechanisms used to retrieve SOP Instances.

The SCP shall specify parameters indicating the level of storage commitment, such as:

- under what conditions the SCP would delete SOP Instances
- persistence of storage
- capacity
- volatility
- other pertinent information

The SCP shall specify the mechanisms and characteristics of retrieval of stored SOP Instances, such as:

- supported query/retrieve services
- latency
- other pertinent information

The SCP Operations Statement shall be formatted as defined in PS 3.2.

J.4.6.2.2 Notifications

The SCP shall document in the SCP Notifications Statement the behavior and actions which cause the SCP to generate an N-EVENT-REPORT primitive (Storage Commitment Result).

The SCP shall specify if it supports the optional Attributes Storage Media File-Set ID (0088,0130) and Storage Media File-Set UID (0088,0140) in the N-EVENT-REPORT. If these Attributes are supported, the SCP shall also specify which Storage Media Application Profiles are supported.

The SCP Notifications Statement shall be formatted as defined in PS 3.2.

J.5 STORAGE COMMITMENT EXAMPLES (Informative)

This Section and its sub-sections contain examples of ways in which the Storage Commitment Service Class could be used. This is not meant to be an exhaustive set of scenarios but rather a set of examples.

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J.5.1 Push Model Example

Figure J.5-1 is an example of the use of the Storage Commitment Push Model SOP Class.

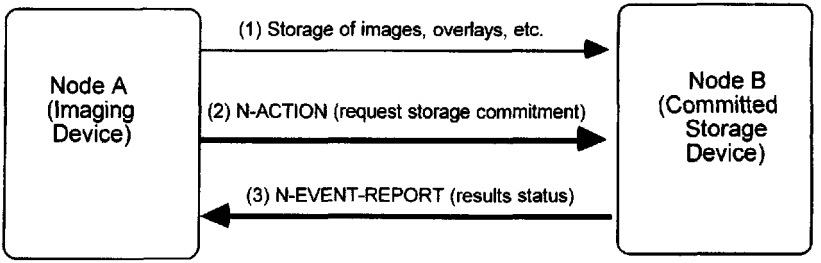

Figure J.5-1
EXAMPLE OF STORAGE COMMITMENT PUSH MODEL SOP CLASS

Node A (an SCU) uses the services of the Storage Service Class to transmit one or more SOP Instances to Node B (1). Node A then issues an N-ACTION to Node B (an SCP) containing a list of references to SOP Instances, requesting that the SCP take responsibility for storage commitment of the SOP Instances (2). If the SCP has determined that all SOP Instances exist and that it has successfully completed storage commitment for the set of SOP Instances, it issues an N-EVENT-REPORT with the status successful (3) and a list of the stored SOP Instances. Node A now knows that Node B has accepted the commitment to store the SOP Instances. Node A might decide that it is now appropriate for it to delete its copies of the SOP Instances. The N-EVENT-REPORT may or may not occur on the same Association as the N-ACTION.

If the SCP determines that committed storage can for some reason not be provided for one or more SOP Instances referenced by the N-ACTION request, then instead of reporting success it would issue an N-EVENT-REPORT with a status of completed - failures exists. With the EVENT-REPORT it would include a list of the SOP Instances that were successfully stored and also a list of the SOP Instances for which storage failed.

J.5.2 Pull Model Example

Figure J.5-2 is an example of the use of the Storage Commitment Pull Model SOP Class. It presents one possible data flow between two Nodes (other configurations can also be used, including those in which the requester of Storage Commitment and the device from which the images are retrieved are distinct).

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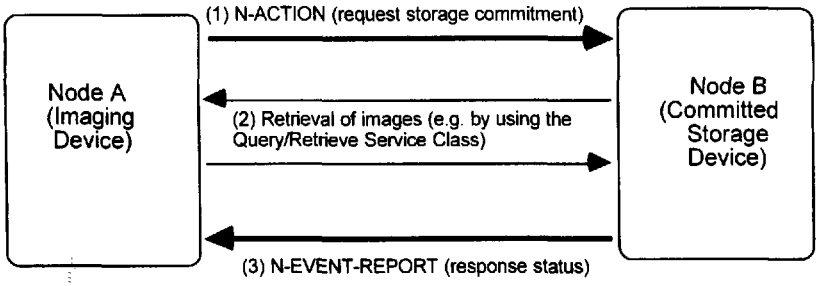

Figure J.5-2
EXAMPLE OF STORAGE COMMITMENT PULL MODEL SOP CLASS

Node A, an SCU of the Storage Commitment Pull Model SOP Class, informs Node B, an SCP, of its wish for commitment to storage by issuing an N-ACTION containing a list of references to SOP Instances (1). Node B subsequently uses the services of the Query/Retrieve Service Class to retrieve SOP Instances from Node A (2). If the SCP has determined that all SOP Instances specified in the Storage Commitment Request have been successfully retrieved and that it has successfully completed storage commitment, it issues an N-EVENT-REPORT with a status of success (3) and a list of the stored SOP Instances. Node A now knows that Node B has stored the SOP Instances. Node A might decide that it is now appropriate for it to delete its copies of the SOP Instances.

If the SCP determines that storage commitment can for some reason not be provided for one or more SOP Instances referenced by the N-ACTION request then instead of reporting success it would issue an N-EVENT-REPORT with a status of completed - failures exists. With the EVENT-REPORT it would include a list of the SOP Instances that were successfully stored and also a list of the SOP Instances for which storage failed.

J.5.3 Remote Storage of Data by the SCP

Figure J.5-3 explains the use of the Retrieve AE Title and applies to both the push and the pull model. Using either the push or the pull model a set of SOP Instances will be transferred from the SCU to the SCP. The SCP may decide to store the data locally or, alternatively, may decide to store the data at a remote location. This example illustrates how to handle the latter case.

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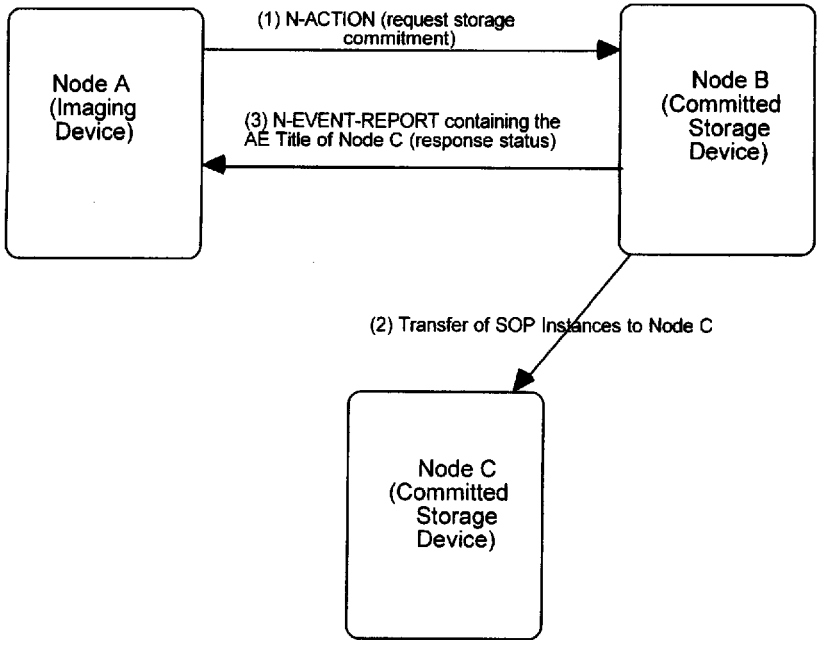

Figure J.5-3
EXAMPLE OF REMOTE STORAGE OF SOP INSTANCES

Node A, an SCU of either the Storage Commitment Pull Model or Push Model SOP Class, informs Node B, an SCP of the corresponding SOP Class, of its wish for storage commitment by issuing an N-ACTION containing a list of references to SOP Instances (1). Depending on the SOP Class in question the SOP Instances will either already have been transferred from Node A to Node B (Push Model) or will be transferred as a result of the N-ACTION (Pull Model) (2). If the SCP has determined that storage commitment has been achieved for all SOP Instances at Node C specified in the original Storage Commitment Request (from Node A), it issues an N-EVENT-REPORT (3) like in the previous examples. However, to inform the SCU about the address of the location at which the data will be stored, the SCP includes in the N-EVENT-REPORT the Application Entity Title of Node C.

The Retrieve AE Title can be included in the N-EVENT-REPORT at two different levels. If all the SOP Instances in question were stored at Node C, a single Retrieve AE Title could be used for the whole data set. However, the SCP could also choose not to store all the SOP Instances at the same location. In this case the Retrieve AE Title Attribute must be provided at the level of each single SOP Instance in the Referenced SOP Instance Sequence.

This example also applies to the situation where the SCP decides to store the SOP Instances on Storage Media. Instead of providing the Retrieve AE Title, the SCP will then provide a pair of Storage Media File-Set ID and UID.

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J.5.4 Storage Commitment in Conjunction with Use of Storage Media

Figure J.5-4 is an example of how to use the Push Model with Storage Media to perform the actual transfer of the SOP Instances.

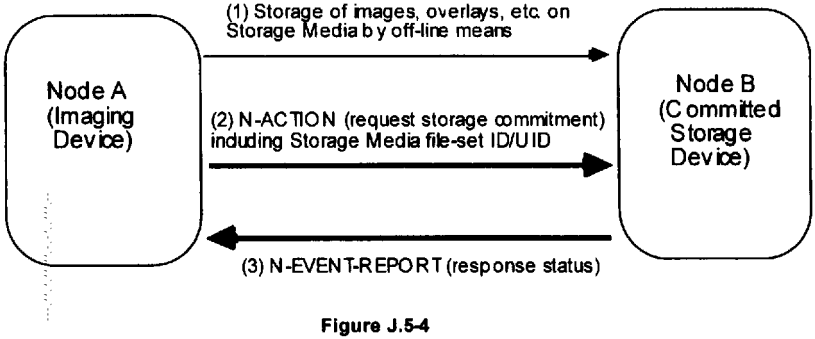

Figure J.5-4
EXAMPLE OF STORAGE COMMITMENT IN CONJUNCTION WITH STORAGE MEDIA

Node A (an SCU) starts out by transferring the SOP Instances for which committed storage is required to Node B (an SCP) by off-line means on some kind of Storage Media (1). When the data is believed to have arrived at Node B, Node A can issue an N-ACTION to Node B containing a list of references to the SOP Instances contained on the Storage Media, requesting that the SCP perform storage commitment of these SOP Instances (2). If the SCP has determined that all the referenced SOP Instances exist (they may already have been loaded into the system or they may still reside on the Storage Media) and that it has successfully completed storage commitment for the SOP Instances, it issues an N-EVENT-REPORT with the status successful (3) and a list of the stored SOP Instances like in the previous examples.

If the Storage Media has not yet arrived or if the SCP determines that committed storage can for some other reason not be provided for one or more SOP Instances referenced by the N-ACTION request it would issue an N-EVENT-REPORT with a status of completed - failures exists. With the EVENT-REPORT it would include a list of the SOP Instances that were successfully stored and also a list of the SOP Instances for which storage failed. The SCP is not required to wait for the Storage Media to arrive (however it may chose to wait) but is free to reject the Storage Commitment request immediately. If so, the SCU may decide to reissue another N-ACTION at a later point in time.

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Annex K BASIC WORKLIST MANAGEMENT SERVICE (Normative)

K.1 OVERVIEW

K.1.1 Scope

The Basic Worklist Management Service Class defines an application-level class-of-service which facilitates the access to worklists.

A worklist is the structure to present information related to a particular set of tasks. It specifies particular details for each task. The information supports the selection of the task to be performed first, and supports the performance of that task.

Note: One example is the worklist used to present information about scheduled imaging procedures at an imaging modality and to the operator of that modality. Another example is the worklist presented at a radiological reporting station to indicate which studies have been performed and are waiting to be reported.

This supplement defines a service for communicating such worklists. The following are characteristics for this Service Class:

— The worklist has to be queried by the Application Entity (AE) associated with the application on which, or by which, the tasks included in the worklist have to be performed. In this query, a number of search keys can be used, defined for each particular worklist SOP class.

— The worklist consists of worklist items, each item is related to one task. A worklist item contains Attributes from different objects related to the task.

Notes: 1. This Service Class is not intended to provide a comprehensive generalized database query mechanism such as SQL. Instead, the Basic Worklist Management Service Class is focused towards basic queries using a small set of common Key Attributes used as Matching Keys or Return Attributes. Basic Worklist Information Models are not hierarchical.

2. Basic Worklist Information Models always consist of one query level, which may consist of one or more entities. There is no distinction between hierarchical and relational use of C-Find in the Basic Worklist Management Service Class.

K.1.2 Conventions

Key Attributes serve two purposes, they may be used as : Matching Key Attributes and Return Key Attributes. Matching Key Attributes may be used for matching (criteria to be used in the C-FIND request to determine whether an entity matches the query). Return Key Attributes may be used to specify desired return Attributes (what elements in addition to the Matching Key Attributes have to be returned in the C-FIND response).

Note: Matching Keys are typically used in an SQL 'where' clause. Return Keys are typically u sed in an SQL 'select' clause to convey the Attribute values.

Matching Key Attributes may be of Type "required" (R) or "optional" (O). Return Key Attributes may be of Type 1, 1C, 2, 2C, 3 as defined in PS 3.5.

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K.1.3 Worklist Information Model

In order to serve as a Service Class Provider (SCP) of the Basic Worklist Service Class, a DICOM Application Entity (AE) possesses information about the Attributes of a number of managed worklist entries. This information is organized into Worklist Information Models.

Worklists are implemented against well defined Information Models. A specific SOP Class of the Basic Worklist Service Class consists of an informative Overview, an Information Model Definition and a DIMSE-C Service Group. In this Service Class, the Information Model plays a role similar to an Information Object Definition (IOD) of most other DICOM Service Classes.

K.1.4 Service Definition

Two peer DICOM AEs implement a SOP Class of the Basic Worklist Service Class with one serving in the SCU role and one serving in the SCP role. SOP Classes of the Basic Worklist Service Class are implemented using the DIMSE-C C-FIND service as defined in PS 3.7.

Only a baseline behavior of the DIMSE-C C-FIND is used in the Service Class.

The following description of the DIMSE-C C-FIND service provides a brief overview of the SCU/SCP semantics.

A C-FIND service conveys the following semantics:

- The SCU requests that the SCP perform a match for the Matching Keys and return values for the Return Keys which have been specified in the Identifier of the request, against the information that the SCP possesses, to the objects specified in the SOP Class.

Note: In this Annex, the term "Identifier" refers to the Identifier service parameter of the C-FIND service as defined in PS 3.7.

- The SCP generates a C-FIND response for each match with an Identifier containing the values of all Matching Key Attributes and all known Return Key Attributes requested. Each response contains one worklist item. All such responses will contain a status of Pending. A status of Pending indicates that the process of matching is not complete.
- When the process of matching is complete a C-FIND response is sent with a status of Success and no Identifier.
- A Refused or Failed response to a C-FIND request indicates that the SCP is unable to process the request.
- The SCU may cancel the C-FIND service by issuing a C-CANCEL-FIND request at any time during the processing of the C-FIND service. The SCP will interrupt all matching and return a status of Canceled.

Note: The SCU needs to be prepared to receive C-FIND responses sent by the SCP until the SCP finally processed the C-CANCEL-FIND request.

K.2 WORKLIST INFORMATION MODEL DEFINITION

The Worklist Information Model is identified by the SOP Class negotiated at Association establishment time. The SOP Class is composed of both an Information Model and a DIMSE-C Service Group.

Information Model Definitions for standard SOP Classes of the Worklist Service Class are defined in this Annex. A Worklist Information Model Definition contains:

- an Entity-Relationship Model Definition
- a Key Attributes Definition;

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K.2.1 Entity-Relationship Model Definition

Basic Worklist Information Models consist of a single level, that includes all Matching Key Attributes and all Return Key Attributes, which may be sent from the SCU to the SCP in the request and whose values are expected to be returned from the SCP to the SCU in each of the responses (or worklist items). The Matching Key Attribute values in the request specify the worklist items that are to be returned in the responses. All Key Attributes (the Matching Key Attributes and the Return Key Attributes) in the request determine which Attribute values are returned in the responses for that worklist.

A Worklist Item has a one-to-one relationship with the real-world object defining the root for the Basic Worklist Information Model. In addition the worklist item is related to a number of other objects from the real-world model. Each of these real-world objects is represented by a hierarchy of entities organized in an (internal) Entity-Relationship Model.

K.2.2 Attributes Definition

Attributes are defined for each entity in the internal Entity-Relationship Model. An Identifier in a C-FIND request shall contain values to be matched against the Attributes of the Entities in a Worklist Information Model. For any worklist request, the set of entities for which Attributes are returned, shall be determined by the set of Matching and Return Key Attributes specified in the Identifier.

K.2.2.1 Attribute Types

All Attributes of entities in a Worklist Information Model shall be specified both as a Matching Key Attribute (either required or optional) and as a Return Key Attribute.

K.2.2.1.1 Matching Key Attributes

The Matching Key Attributes are Keys, which select worklist items to be included in a requested Worklist.

K.2.2.1.1.1 Required Matching Key Attributes

A Basic Worklist Management SCP shall support matching based on values of all Required Matching Key Attributes of the C-FIND request. Multiple entities may match a given value for a Required Key.

If an SCP manages an entity with an unknown Attribute value (i.e. zero length), the unknown value shall fail to match any Matching Key value.

Notes: 1. Even though there is no means to perform matching on such entities, they may be queried as a Return Key Attribute using a C-FIND request with a zero length value (universal match) or by a single wildcard (wildcard match).

2. An SCU may choose to supply any subset of Required Matching Key Attributes.

K.2.2.1.1.2 Optional Matching Key Attributes

In the Worklist Information Model, a set of Attributes may be defined as Optional Matching Key Attributes. Optional Matching Key Attributes contained in the Identifier of a C-FIND request may induce two different types of behavior depending on support for matching by the SCP. If the SCP

- does not support matching on the Optional Matching Key Attribute, then the Optional Matching Key Attribute shall be ignored for matching but shall be processed in the same manner as a Return Key Attribute.
- supports matching of the Optional Matching Key Attribute, then the Optional Matching Key Attribute shall be processed in the same manner as a Required Matching Key.

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Notes: 1. The Conformance Statement of the SCP lists the Optional Matching Key Attributes which are supported for matching.

2. An SCU can not expect the SCP to support a match on an Optional Matching Key.

K.2.2.1.2 Return Key Attributes

The values of Return Key Attributes to be retrieved with the Worklist are specified with zero-length (universal matching) in the C-FIND request. SCPs shall support Return Key Attributes defined by a Worklist Information Model according to the Data Element Type (1, 1C, 2, 2C, 3) as defined in PS 3.5.

Every Matching Key Attribute shall also be considered as a Return Key Attribute. Therefore the C-FIND response shall contain in addition to the values of the requested Return Key Attributes the values of the requested Matching Key Attributes.

Notes: 1 The Conformance Statement of the SCP lists the Return Key Attributes of Type 3, which are supported.

2. An SCU may choose to supply any subset of Return Key Attributes.

3. An SCU can not expect to receive any Type 3 Return Key Attributes.

K.2.2.2 Attribute Matching

The following types of matching, which are defined by the Query/Retrieve Service Class in PS 3.4 may be performed on Matching Key Attributes in the Basic Worklist Service Class. Different Matching Key Attributes may be subject for different matching types. The Worklist Information Model defines the type of matching for each Required Matching Key Attribute. The Conformance Statement of the SCP shall define the type of matching for each Optional Matching Key Attribute.

— Single Value Matching
— List of UID Matching
— Wild Card Matching
— Range Matching
— Sequence Matching

The following type of matching, which is defined by the Query/Retrieve Service Class in Annex C of this Part shall be performed on Return Key Attributes in the Basic Worklist Service Class.

— Universal Matching

K.2.2.3 Matching Multiple Values

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

K.3 WORKLIST INFORMATION MODEL

Each Worklist Information Model is associated with one SOP Class. The following Worklist Information Model is defined:

— Modality Worklist Information Model

K.4 DIMSE-C SERVICE GROUP

One DIMSE-C Service is used in the construction of SOP Classes of the Basic Worklist Management Service Class. The following DIMSE-C operation is used.

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— C-FIND

K.4.1 C-FIND Operation

SCPs of some SOP Classes of the Basic Worklist Management Service Class are capable of processing queries using the C-FIND operation as described in PS 3.7. The C-FIND operation is the mechanism by which queries are performed. Matches against the keys present in the Identifier are returned in C-FIND responses.

K.4.1.1 C-FIND Service Parameters

K.4.1.1.1 SOP Class UID

The SOP Class UID identifies the Worklist Information Model against which the C-FIND is to be performed. Support for the SOP Class UID is implied by the Abstract Syntax UID of the Presentation Context used by this C-FIND operation.

K.4.1.1.2 Priority

The Priority Attribute defines the requested priority of the C-FIND operation with respect to other DIMSE operations being performed by the same SCP.

Processing of priority requests is not required of SCPs. Whether or not an SCP supports priority processing and the meaning of the different priority levels shall be stated in the Conformance Statement of the SCP.

K.4.1.1.3 Identifier

Both the C-FIND request and response contain an Identifier encoded as a Data Set (see PS 3.5).

K.4.1.1.3.1 Request Identifier Structure

An Identifier in a C-FIND request shall contain

— Key Attributes values to be matched against the values of Attributes specified in that SOP Class.

The Key Attributes and values allowable for the query shall be defined in the SOP Class definition for the corresponding Worklist Information Model.

K.4.1.1.3.2 Response Identifier Structure

An Identifier in a C-FIND response shall contain:

— Key Attributes with values corresponding to Key Attributes contained in the Identifier of the request (Key Attributes as defined in K.2.2.1.)

K.4.1.1.4 Status

Table K.4.-1 defines the status code values which might be returned in a C-FIND response. Fields related to status code values are defined in PS 3.7.

Table K.4-1
C-FIND RESPONSE STATUS VALUES

Service Status	Further Meaning	Status Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)

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Failed	Identifier Does Not Match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied.	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.	FF01	Identifier

Note: Status Codes are returned in DIMSE response messages (See PS 3.7). The code values stated in column "Status Codes" are returned in Status Command Element (0000,0900).

K.4.1.2 C-FIND SCU Behavior

All C-FIND SCUs shall be capable of generating query requests which meet the requirements of the "Worklist" Search Method (see K.4.1.3.1).

Required Keys, and Optional Keys associated with the Worklist may be contained in the Identifier.

An SCU conveys the following semantics using the C-FIND requests and responses:

- The SCU requests that the SCP perform a match of all keys specified in the Identifier of the request against the information it possesses of the Worklist specified in the request.
- The SCU shall interpret Pending responses to convey the Attributes of a match of an Entity.
- The SCU shall interpret a response with a status equal to Success, Failed, Refused or Cancel to convey the end of Pending responses.
- The SCU shall interpret a Refused or Failed response to a C-FIND request as an indication that the SCP is unable to process the request.
- The SCU may cancel the C-FIND service by issuing a C-FIND-CANCEL request at any time during the processing of the C-FIND. The SCU shall recognize a status of Cancel to indicate that the C-FIND-CANCEL was successful.

K.4.1.3 C-FIND SCP Behavior

All C-FIND SCPs shall be capable of processing queries which meet the requirements of the "Worklist" Search (see K.4.1.3.1).

An SCP conveys the following semantics using the C-FIND requests and responses:

- The SCP is requested to perform a match of all the keys specified in the Identifier of the request, against the information it possesses. Attribute matching is performed using the key values specified in the Identifier of the C-FIND request as defined in Section K.2.

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— The SCP generates a C-FIND response for each match using the "Worklist" Search method. All such responses shall contain an Identifier whose Attributes contain values from a single match. All such responses shall contain a status of Pending.

— When all matches have been sent, the SCP generates a C-FIND response which contains a status of Success. A status of Success shall indicate that a response has been sent for each match known to the SCP.

Note: No ID is contained in a response with a status of Success. For a complete definition, see PS 3.7.

— The SCP shall generate a response with a status of Refused or Failed if it is unable to process the request. A Refused or Failed response shall contain no Identifier.

— If the SCP receives C-FIND-CANCEL indication before it has completed the processing of the matches it shall interrupt the matching process and return a status of Cancel.

K.4.1.3.1 "Worklist" Search Method

The following procedure is used to generate matches.

The key match strings contained in the Identifier of the C-FIND request are matched against the values of the Key Attributes for each worklist entity. For each entity for which the Attributes match all of the specified match strings, construct an Identifier. This Identifier shall contain all of the values of the Attributes for this entity which match those in the C-FIND request. Return a response for each such Identifier. If there are no matching keys, then there are no matches, return a response with a status equal to Success and with no Identifier.

K.5 ASSOCIATION NEGOTIATION

Association establishment is the first phase of any instance of communication between peer DICOM AEs. The Association negotiation procedure specified in PS 3.7 shall be used to negotiate the supported SOP Classes or Meta SOP Classes.

Support for the SCP/SCU role selection negotiation is optional. The SOP Class Extended Negotiation shall not be supported.

K.6 SOP CLASS DEFINITIONS

K.6.1 Modality Worklist SOP Class

K.6.1.1 Modality Worklist SOP Class Overview

The Modality Worklist SOP class defined within the Basic Worklist Management Service Class defines an application-level class of service which facilitates the communication of information to the imaging modality about Scheduled Procedure Steps, and entities related to the Scheduled Procedure Steps. As will be detailed below, part of the information carried by the worklist mechanism is intended to be used by the imaging modality itself, but much of the information is intended to be presented to the modality operator.

This worklist is structured according to Scheduled Procedure Steps. A procedure step is a unit of service in the context of a requested imaging procedure.

The Modality Worklist SOP class supports the following requirements:

— Verify patient (e.g. download patient demographic information from IS to Modality, to verify that the person to be examined is the intended subject).

— Select a Scheduled Procedure Step from the IS (e.g. download procedure step information from the IS to the Modality). The Modality Worklist SOP Class supports two alternatives

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for the realization of this requirement, supporting different organization methods of the department:

- The Modality may obtain the list of Scheduled Procedure Steps from the IS. Display of the list and selection from the list is done at the Modality.
- The list is displayed and selection is performed on the IS. This implies, that the information is obtained by the Modality just before the Scheduled Procedure Step starts.

— Prepare the performance of a Scheduled Procedure Step.

— Couple DICOM images unambiguously with related information from the IS (e.g. patient demographics, procedure description, ID data structure from the IS, contextual IS information).

— Capture all the attributes from the IS, that are mandatory to be inserted into the DICOM Image Object

The Modality Worklist SOP Class is not intended to provide access to all IS information and services which may be of interest to a Modality operator or attending physician. Its primary focus is the efficient operation of the image acquisition equipment. DICOM SOP Classes such as the existing Detached Patient Management SOP Class and non-DICOM Services which fall beyond the scope of the Modality Worklist SOP Class may be needed.

The Modality Worklist SOP Class does not support the transmission of information from the Modality to the information system.

K.6.1.2 Modality Worklist Information Model

K.6.1.2.1 E/R Model

In response to a given C-FIND request, the SCP might have to send several C-FIND responses, (i.e. one C-FIND response per matching worklist item). Each worklist item focuses on one Scheduled Procedure Step and the related information. The E-R diagram presented in Figure K.6-1 depicts the content of one C-FIND request, that is:

— the matching Scheduled Procedure Step, the Requested Procedure to which the Scheduled Procedure Step contributes, the Imaging Service Request in which the associated Requested Procedure is ordered, any associated Visit, and the Patient who is to be the subject of the Procedure.

Therefore, for a given C-FIND request, a given Scheduled Procedure Step will appear in only one of the resulting C-FIND responses. Obviously, information about the Requested Procedure, Imaging Service Request, Visit and Patient may be mentioned in several of these C-FIND responses.

The Modality Worklist Information Model is represented by the Entity Relationship diagram shown in figure K.6 -1.

Note: The entities appearing in messages related to the Modality Worklist SOP Class are required to comply to the Modality Worklist model. However, DICOM does not define the internal structure of the database.

The entry point of the Modality Worklist is the Scheduled Procedure Step entity.

The attributes of a Scheduled Procedure Step Worklist can be found in the following Modules in PS 3.3.

— Patient Relationship Module

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- Patient Identification Module
- Patient Demographic Module
- Patient Medical Module
- Visit Relationship Module
- Visit Identification Module
- Visit Status Module
- Visit Admission Module
- Scheduled Procedure Step Module
- Requested Procedure Module
- Imaging Service Request Module

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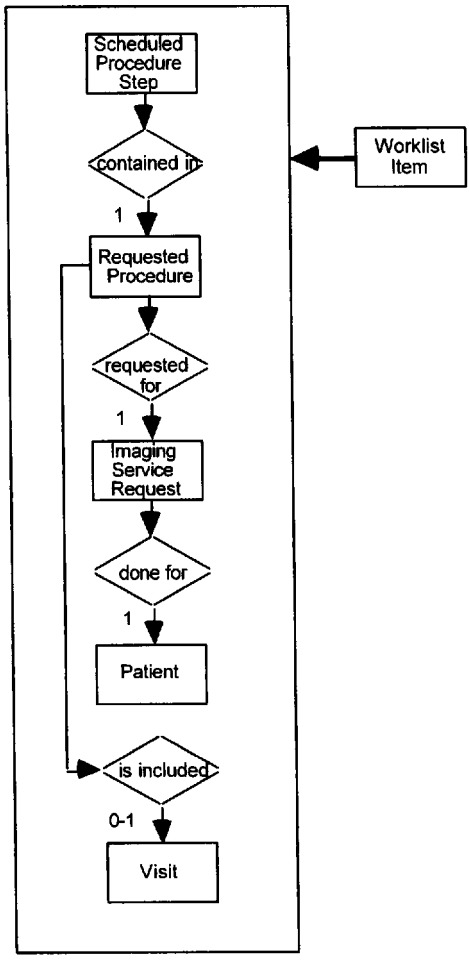

Figure K.6-1
MODALITY WORKLIST INFORMATION MODEL E/R DIAGRAM

K.6.1.2.2 Modality Worklist Attributes

Table K.6-1 defines the Attributes of the Modality Worklist Information Model:

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Table K.6-1
ATTRIBUTES FOR THE MODALITY WORKLIST INFORMATION MODEL

Description / Module	Tag	Matching Key Type	Return Key Type	Remark/Matching Type
SOP Common				
Specific Character Set	(0008,0005)	O	1C	This attribute is required if expanded or replacement character sets are used.
Scheduled Procedure Step				
Scheduled Procedure Step Sequence	(0040,0100)	R	1	The Attributes of the Scheduled Procedure Step shall only be retrieved with Sequence Matching. The Scheduled Procedure Step Sequence shall contain only a single Item.
>Scheduled Station AE Title	(0040,0001)	R	1	The Scheduled station AE title shall be retrieved with Single Value Matching only.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	Scheduled Step Start Date shall be retrieved with Single Value Matching or Range Matching. See remark under Scheduled Procedure Step Start Time (0040,0003).
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	Scheduled Step Start Time shall be retrieved with Single Value Matching or Range Matching. Scheduled Step Start Date and Scheduled Step Start Time are subject to Range Matching. If both keys are specified for Range Matching, e.g. the date range July 5 to July 7 and the time range 10am to 6pm specifies the time period starting on July 5, 10am until July 7, 6pm. Note: If the Information System does not provide scheduling for individual Procedure Steps, it may use the closest scheduling information it possesses (e.g. Procedures are subject to scheduling instead of Procedure Steps).
>Modality	(0008,0060)	R	1	The Modality shall be retrieved with Single Value Matching.

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>Scheduled Performing Physician's Name	(0040,0006)	R	2	Scheduled Performing Physician's Name shall be retrieved with Single Value Matching or Wild Card Matching.
>Scheduled Procedure Step Description	(0040,0007)	O	1C	Either the Scheduled Procedure Step Description (0040,0005) or the Scheduled Action Item Code Sequence (0040,0008) or both shall be supported by the SCP.
>Scheduled Station Name	(0040,0010)	O	2	
>Scheduled Procedure Step Location	(0040,0011)	O	2	
>Scheduled Action Item Code Sequence	(0040,0008)	O	1C	Either the Scheduled Procedure Step Description (0040,0005) or the Scheduled Action Item Code Sequence (0040,0008) or both shall be supported by the SCP. The Scheduled Action Item Code Sequence contains one or more Action Items.
>>Code Value	(0008,0100)	O	1C	Required if a Sequence Item is present.
>>Coding Scheme Version	(0008,0103)	O	3	
>>Coding Scheme Designator	(0008,0102)	O	1C	Required if a Sequence Item is present.
>>Code Meaning	(0008,0104)	O	3	
>Pre-Medication	(0040,0012)	O	2C	Required if Pre-Medication is to be applied to that Scheduled Procedure Step.
>Scheduled Procedure Step ID	(0040,0009)	O	1	
>Requested Contrast Agent	(0032,1070)	O	2C	Required if Contrast Media is to be applied to that Scheduled Procedure Step.
>Scheduled Procedure Step Status	(0040,0020)	O	3	
>All other Attributes from the Scheduled Procedure Step Module		O	3	
Requested Procedure				
Requested Procedure ID	(0040,1001)	O	1	
Requested Procedure Description	(0032,1060)	O	1C	The Requested Procedure Description (0032,1060) or the Requested Procedure Code Sequence (0032,1064) or both shall be supported by the SCP.

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Requested Procedure Code Sequence	(0032,1064)	O	1C	The Requested Procedure Description (0032,1060) or the Requested Procedure Code Sequence (0032,1064) or both shall be supported by the SCP. The Requested Procedure Code Sequence shall contain only a single Item.
>Code Value	(0008,0100)	O	1C	Required if a Sequence Item is present.
>Coding Scheme Designator	(0008,0102)	O	1C	Required if a Sequence Item is present.
>Coding Scheme Version	(0008,0103)	O	3	
>Code Meaning	(0008,0104)	O	3	
Study Instance UID	(0020,000D)	O	1	
Referenced Study Sequence	(0008,1110)	O	2	
>Referenced SOP Class UID	(0008,1150)	O	1C	Required if a Sequence Item is present.
>Referenced SOP Instance UID	(0008,1155)	O	1C	Required if a Sequence Item is present.
Requested Procedure Priority	(0040,1003)	O	2	
Patient Transport Arrangements	(0040,1004)	O	2	
All other Attributes from the Requested Procedure Module		O	3	
Imaging Service Request				
Accession Number	(0008,0050)	O	2	
Requesting Physician	(0032,1032)	O	2	
Referring Physician's Name	(0008,0090)	O	2	
All other Attributes from the Imaging Service Request Module		O	3	
Visit Identification				
Admission ID	(0038,0010)	O	2	
All other Attributes from the Visit Identification Module		O	3	
Visit Status				
Current Patient Location	(0038,0300)	O	2	
All other Attributes from the Visit Status Module		O	3	

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Visit Relationship				
Referenced Patient Sequence	(0008,1120)	O	2	
>Referenced SOP Class UID	(0008,1150)	O	2	
>Referenced SOP Instance UID	(0008,1155)	O	2	
All other Attributes from the Visit Relationship Module		O	3	
Visit Admission				
All Attributes from the Visit Admission Module		O	3	
Patient Relationship				
All Attributes from the Patient Relationship Module		O	3	
Patient Identification				
Patient's Name	(0010,0010)	R	1	Patient Name shall be retrieved with Single Value Matching or Wild Card Matching.
Patient ID	(0010,0020)	R	1	Patient ID shall be retrieved with Single Value Matching.
All other Attributes from the Patient Identification Module		O	3	
Patient Demographic				
Patients Birth Date	(0010,0030)	O	2	
Patient's Sex	(0010,0040)	O	2	
Patient's Weight	(0010,1030)	O	2	
Confidentiality constraint on patient data	(0040,3001)	O	2	
All other Attributes from the Patient Demographic Module		O	3	
Patient Medical				
Patient State	(0038,0500)	O	2	
Pregnancy Status	(0010,21C0)	O	2	
Medical Alerts	(0010,2000)	O	2	
Contrast Allergies	(0010,2110)	O	2	
Special Needs	(0038,0050)	O	2	
All other Attributes from the Patient Medical Module		O	3	

Notes: 1. Just like Series and Image Entities specified in the Query/Retrieve Service Class either an SCU or an SCP may support optional Matching Key Attributes and/or Type 3 Return Key

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Attributes which are not included in the Worklist Information Model (i.e. standard or private attributes). This is considered a Standard Extended SOP Class (see PS 3.2).

2. Each Module contains a Comment Attribute. This may be used to transmit non-structured information, which may be displayed to the operator of the Modality.

K.6.1.3 Conformance Requirements

An implementation may conform to the Modality Worklist SOP Class as an SCU or an SCP. The Conformance Statement shall be in the format defined in PS 3.2.

K.6.1.3.1 SCU Conformance

An implementation which conforms to the Modality Worklist SOP Class shall support queries against the Worklist Information Model described in Section K.6.1.2 of this Annex using the baseline C-FIND SCU Behavior described in Section K.4.1.2 of this Part.

An implementation which conforms to the Modality Worklist SOP Class as an SCU shall state in its Conformance Statement whether it requests matching on Optional Matching Key Attributes. If it requests Type 3 Return Key Attributes, then it shall list these Optional Return Key Attributes.

K.6.1.3.2 SCP Conformance

An implementation which conforms to the Modality Worklist SOP Class shall support queries against the Worklist Information Model described in Section K.6.2.1 of this Annex using the C-FIND SCP Behavior described in Section K.4.1.3 of this Part.

An implementation which conforms to the Modality Worklist SOP Class as an SCP shall state in its Conformance Statement whether it supports matching on Optional Matching Key Attributes. If it supports Type 3 Return Key Attributes, then it shall list the Optional Return Key Attributes which it supports.

An implementation which conforms to the Modality Worklist SOP Class as an SCP shall state in its Conformance Statement whether it supports case-insensitive matching for PN VR attributes and list attributes for which this applies.

K.6.1.4 SOP Class

The Modality Worklist SOP Class in the Basic Worklist Service Class identify the Modality Worklist Information Model, and the DIMSE-C operations supported. The following Standard SOP Class is identified:

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

K.7 EXAMPLES FOR THE USAGE OF THE MODALITY WORKLIST (Informative)

These typical examples of Modality Worklists are provided for informational purposes only.

— A Worklist consisting of Scheduled Procedure Step entities that have been scheduled for a certain time period (e.g. "August 9, 1995"), and for a certain Scheduled Station AE title (namely the modality, where the Scheduled Procedure Step is going to be performed). See Figure K.7-1.

— A Worklist consisting of the Scheduled Procedure Step entities that have been scheduled for a certain time period (e.g. "August 9, 1995"), and for a certain Modality type (e.g. CT

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machines). This is a scenario, where scheduling is related to a pool of modality resources, and not for a single resource.

— A Worklist consisting of the Scheduled Procedure Step entities that have been scheduled for a certain time period (e.g. "August 9, 1995"), and for a certain Scheduled Performing Physician. This is a scenario, where scheduling is related to human resources and not for equipment resources.

— A Worklist consisting of a single Scheduled Procedure Step entity that has been scheduled for a specific Patient. In this scenario, the selection of the Scheduled Procedure Step was done beforehand at the modality. *The rationale to retrieve this specific worklist is to convey* the most accurate and up-to-date information from the IS, right before the Procedure Step is performed.

The Modality Worklist SOP Class User may retrieve additional Attributes. This may be achieved by Services outside the scope of the Modality Worklist SOP Class.

Additional Attributes may be retrieved using N-GET services on the appropriate Service Class Providers, e.g. on the Detached Patient Management Service Class to retrieve additional patient Attributes.

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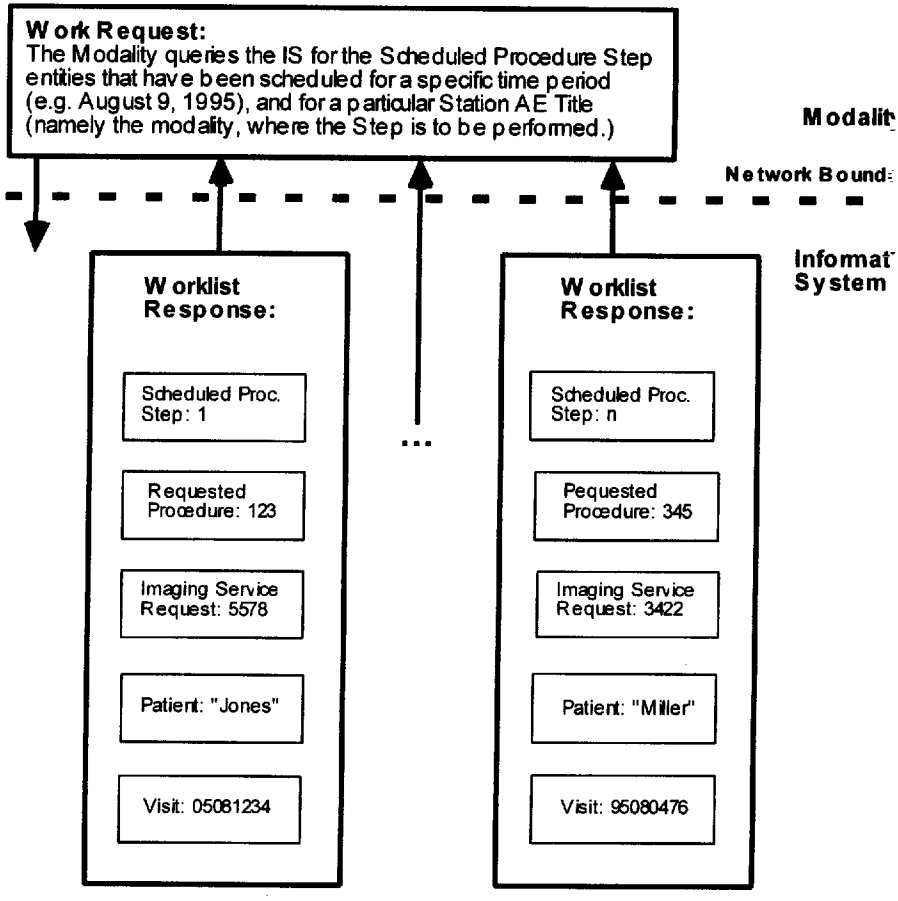

Figure K.7-1
MODALITY WORKLIST MESSAGE FLOW EXAMPLE

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Annex L QUEUE MANAGEMENT SERVICE CLASS (Normative)

L.1 SCOPE

The Queue Management Service Class defines an application-level class-of-service which facilitates the management of queues in a network. The Queue Management Service Class covers the following functions:

- request and monitor the content of a queue
- manipulate the content of a queue (e.g. prioritize jobs, delete queue entry)

The Queue Management Service Class covers a set of application specific queues (e.g. printer queue) which all share a similar behavior.

L.2 ASSOCIATION NEGOTIATION

The Queue Management Service Class uses an association which may be the same or different from the association that controls the corresponding server (e.g. Print Management SCP).

Note: There is a 1-to-1 relation between the Queue Management Service Class Provider and the corresponding server (e.g. Print Management SCP).

The association negotiation procedure is used to negotiate the supported SOP Classes. PS 3.7 specifies the association procedure.

The Queue Management Service Class does not support extended negotiation.

The release of an association shall not have any effect on the contents of the queue.

L.3 CONFORMANCE STATEMENT

A Conformance Statement for the implementation of this SOP Classes shall follow PS 3.2.

The SCU Conformance Statement shall specify the following items:

- the maximum number of supported associations at the same time
- a list of supported SOP Classes
- for each of the supported SOP Classes, a list of supported optional SOP Class Attributes and DIMSE Service Elements
- for each supported N-EVENT-REPORT Service Element, a list of supported Event Type IDs
- for each supported N-ACTION Service Element, a list of supported Action Type IDs
- for each supported mandatory and optional Attribute, the valid range of values

The SCP Conformance Statement shall specify the following items:

- the maximum number of supported associations at the same time
- a list of supported SOP Classes
- whether restoration of the queue occurs at power-on: yes or no

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- the behavior of N-ACTION Service Element (whether the priority of a job can be changed or whether the job can be deleted while the job is being processed)
- for each of the supported SOP Classes, a list of supported optional SOP Class Attributes and DIMSE Service Elements
- for each supported N-EVENT-REPORT Service Element, a list of supported Event Type IDs
- for each supported N-ACTION Service Element, a list of supported Action Type IDs
- for each supported mandatory and optional Attribute:
  - the valid range of values
  - the default value if no value is supplied by the SCU
- the status code (FAILURE or WARNING) if a SCU supplies a value which out of range
- for each supported DIMSE service, the SCP behavior for all specific status codes

L.4 PRINT QUEUE MANAGEMENT SOP CLASS DEFINITION

The Print Queue Management SOP Class allows SCUs to:

- monitor the status of the print queue
- obtain information about all the jobs in the queue
- delete and change the priority of jobs for which it knows the Owner ID

The Print Job SOP Class shall be supported by SCPs in conjunction with this SOP Class.

Note: SCUs may choose to not support the Print Job SOP Class. If they do not, they will not receive notification of the Print Job UID and the Print Job ID when the job is submitted to the queue.

L.4.1 Information Object Description

The Print Queue IOD is an abstraction of a queue of one printer or of a group of printers. The Print Queue IOD is related to the Printer IOD, which describes the printer or the group of printers.

The Print Queue Management SOP Instance is created by the SCP during start-up of the device managing the queue and has a well-known SOP Instance UID.

The Print Queue IOD describes the content and status of the queue. It contains a list of queue entries. A queue entry is an abstraction of the Print Job transaction and is the basic information entity to monitor the execution of the print process. A Print Job contains one film or multiple films, all belonging to the same Film Session.

Print jobs are added to the queue by the SCP as a result of the SCU's N-ACTION on a Film Session or Film Box. Print jobs may be removed from the queue by the SCP when they are successfully printed or successfully deleted as a result of the SCU's N-ACTION=DELETE.

It is not a requirement that the SCP maintain a record and report failed and completed jobs. However, it may choose to maintain and report on these Print Jobs for some time after the Print Jobs have been completed or failed.

L.4.2 DIMSE Service Group

The DIMSE Services applicable to the IOD are shown in Table L.4-1.

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Table L.4-1
DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-GET	U/M
N-ACTION	U/M

The meaning of the Usage SCU/SCP is described in section H.2.4.

This section describes the behavior of the DIMSE Services, which are specific for this Information Object. The general behavior of the DIMSE services is specified in PS 3.7.

L.4.2.1 N-EVENT-REPORT

The N-EVENT-REPORT Service Element is used to report execution status changes to the SCU in an asynchronous way.

L.4.2.1.1 Attributes

The arguments of the N-EVENT-REPORT Service Element are defined in table L.4-2.

Table L.4-2
N-EVENT-REPORT ATTRIBUTES

Event type Name	Event type ID	Description	Attribute	Tag	Usage SCU/ SCP
HALTED	1	Queue operation is halted	-	-	U/M
FULL	2	Queue is full	-	-	U/M
NORMAL	3	Queue is operational	-	-	U/M

The Notification Event Information Attributes are encoded as a data set.

PS 3.2 allows the return of any standard Attribute of the SOP Class that is the subject of an N-EVENT REPORT whether or not the Attribute is listed in the N-EVENT REPORT Attributes Table. In the case of N-EVENT REPORT for the Print Queue Management SOP Class, SCPs shall not return Owner ID (2100,0160) regardless of whether the SCU requested it or not.

Note: The reason SCPs are not to return Owner ID is to minimize the chance of non-authorized entities deleting or re-prioritizing Print Jobs in the print queue.

L.4.2.1.2 Behavior

The SCP shall use the N-EVENT-REPORT Service Element to inform the SCU about a change of the queue status.

The SCP shall only use the N-EVENT-REPORT Service Element within the context of an Association that supports the Print Queue SOP Instance

Notes 1. In the case the Print Queue SOP Instance is supported by multiple associations at the same time, then the Event Type may be multi-casted over these active associations.

2. The ability of the SCP to establish an Association to convey the N-EVENT-REPORT is not supported.

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3. An SCU may choose to support both the Print Queue Management SOP Class and the Print Job SOP Class. If both SOP Classes are supported and the Association(s) on which the SCU and the SCP are communicating, are open, the SCU could receive two N-EVENT REPORTs when a change in the queue status occurs. One will indicate the change to the specific Print Job submitted by the SCU. The other will indicate the change the to Print Queue.

The SCU shall return the confirmation from the N-EVENT-REPORT operation.

L.4.2.2 N-GET

The N-GET Service Element is used to retrieve an instance of the Print Queue Management SOP Class.

L.4.2.2.1 Attributes

The arguments of the N-GET Service Element are defined in table L.4-3.

Table L.4-3
N-GET ATTRIBUTES

Attribute Name	Tag	Usage SCU/SCP
Queue Status	(2120,0010)	U/M
Print Job Description Sequence	(2120,0050)	U/MC (Required if one or more Print Jobs are in the queue)
>Print Job ID	(2100,0010)	U/MC (Required if the sequence is present)
>Execution Status	(2100,0020)	U/MC (Required if the sequence is present)
>Execution Status Info	(2100,0030)	U/MC (Required if the sequence is present)
>Creation Date	(2100,0040)	U/U
>Creation Time	(2100,0050)	U/U
>Print Priority	(2000,0020)	U/MC (Required if the sequence is present)
>Origin AE	(2100,0070)	U/U
>Destination AE	(2100,0140)	U/U
>Printer Name	(2110,0030)	U/MC (Required if the sequence is present)
>Film Destination	(2000,0040)	U/U
>Film Session Label	(2000,0050)	U/U
>Medium Type	(2000,0030)	U/U
>Number Of Films	(2100,0170)	U/U
>Referenced Print Job Sequence	(2120,0070)	U/MC (Required if the sequence is present)
>>Referenced SOP Class UID	(0008,1150)	U/MC (Required if the sequence is present)

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>>Referenced SOP Instance UID	(0008,1155)	U/MC (Required if the sequence is present)

The meaning of the Usage SCU/SCP is described in section H.2.4.

Note: Attribute Print Job ID (2100,0010) identifies the print job. It is supplied by the print management SCP and contained in the Action Reply to the N-ACTION that caused the print job to be entered into the print queue.

PS 3.2 allows the return of any standard Attribute of the SOP Class that is the subject of an N-GET whether or not the Attribute is listed in the N-GET Attributes Table. In the case of N-GET for the Print Queue Management SOP Class, SCPs shall not return Owner ID (2100,0160) regardless of whether the SCU requested it or not.

Note: The reason SCPs are not to return Owner ID is to minimize the chance of non-authorized entities deleting or re-prioritizing Print Jobs in the print queue.

L.4.2.2.2 Status Info

Status Information is defined in PS 3.3. Implementation specific warning and error codes shall be defined in the Conformance Statement.

L.4.2.2.3 Behavior

The SCU uses the N-GET Service Element to request the SCP to get a Print Queue SOP Instance. The SCU shall specify the well-known UID of the Print Queue SOP Instance.

The SCP shall return the values for the specified Attributes of the specified SOP Instance as defined in Table L.4-3.

The SCP shall return the status code of the requested SOP Instance retrieval.

A Queue Status value of FULL indicates that new jobs cannot be accepted at this time, but that jobs in the queue are being processed and new jobs will be accepted at a later time without human intervention.

A Queue Status value of HALTED indicates that no new jobs are being accepted for some other reason, for instance printer service. Existing jobs may or may not be processed and reprioritizing and deletion of jobs may or may not be accepted by the SCP.

A Failure status code shall indicate that the SCP has not retrieved the SOP Instance.

L.4.2.3 N-ACTION

The N-ACTION Service Element is used to manipulate the queue content.

L.4.2.3.1 Attributes

The arguments of the N-ACTION Service Element are defined in table L.4-4.

Table L.4-4
N-ACTION ATTRIBUTES

Action type Name	Action type ID	Description	Attribute	Tag	Usage SCU/SCP
PRIORITIZE	1	Change priority of queue entry	Print Job ID	(2100,0010)	M/M

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			Print Priority	(2000,0020)	M/M
			Owner ID	(2100,0160)	M/M
DELETE	2	Delete queue entry	Print Job ID	(2100,0010)	M/M
			Owner ID	(2100,0160)	M/M

Note: Owner ID (2100,0160) is user option for the Basic Film Session (see section H.4.1.2.1). However, SCUs, who implement the Print Queue Management SOP Class are required to supply Owner ID to successfully delete or re-prioritize Print Jobs in the printer queue.

The ACTION INFORMATION arguments and ACTION REPLY arguments are encoded as a DICOM data set.

L.4.2.3.2 Status

The status values which are specific for this SOP Class are defined as follows:

Status	Meaning	Code
Success	Operation successfully completed	0000
Failure	Print queue is halted (no new jobs are being accepted, N-ACTIONs may or may not be processed by the SCP)	C651
	Mismatch of owner IDs	C652
	Action failed because the job was in process	C653

L.4.2.3.3 Behavior

The SCU may use the N-ACTION Service Element to request the SCP to perform actions on one print job of the queue, associated to a particular printer.

Note: The Standard does not specify whether the SCP must be capable of deleting or re-prioritizing jobs that are in process. This is specified in the SCP Conformance Statement.

The SCP shall only perform the requested operation if the Owner ID in N-ACTION Attribute corresponds with the Owner ID of the corresponding print job; otherwise the SCP shall reject the operation.

In the case of a successful N-ACTION=DELETE, the Print Job shall not be printed.

In the case of a successful N-ACTION=PRIORITIZE, the Print Job shall be printed in the order that would have occurred if a new Print Job with the new priority had been entered into the queue at the time the SCP processed the N-ACTION=PRIORITIZE.

The SCP shall return the status code of the requested operation. A Failure status code indicates that the requested operation has not been completed by the SCP.

L.4.3 SOP Class Definition and UID

The Print Queue Management SOP Class UID is "1.2.840.10008.5.1.1.26".

L.4.4 Reserved Identification

The well-known UID of the Print Queue SOP Instance is "1.2.840.10008.5.1.1.25".

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ANNEX M : HANDLING OF IDENTIFYING PARAMETERS (Informative)

M.1 PURPOSE OF THIS ANNEX

The DICOM Standard was published in 1993 and addresses medical images communication between medical modalities, workstations and other medical devices as well as data exchange between medical devices and the Information System (IS). DICOM defines SOP Instances with Patient, Visit and Study information managed by the Information System and allows to communicate the Attribute values of these objects.

Since the publication of the DICOM Standard great effort has been made to harmonize the Information Model of the DICOM Standard with the models of other relevant standards, especially with the HL7 model and the CEN TC 251 WG3 PT 022 model. The result of these effort is a better understanding of the various practical situations in hospitals and an adaptation of the model to these situations. In the discussion of models, the definition of Information Entities and their Identifying Parameters play a very important role.

The purpose of this Informative Annex is to show which identifying parameters may be included in Image SOP Instances and their related Modality Performed Procedure Step (MPPS) SOP Instance. Different scenarios are elucidated to describe varying levels of integration of the Modality with the Information System, as well as situations in which a connection is temporarily unavailable.

Note: In this Annex, "Image SOP Instance" is used as a collective term for all Composite Image Storage SOP Instances, as well as Standalone Overlay, LUT, and Curve Storage SOP Instances, etc.

The scenarios described here are informative and do not constitute a normative section of the DICOM Standard.

M.2 INTEGRATED ENVIRONMENT

"Integrated" means in this context that the Acquisition Modality is connected to an Information System or Systems that may be an SCP of the Modality Worklist SOP Class or an SCP of the Modality Performed Procedure Step SOP Class or both. In the following description only the behavior of "Modalities" is mentioned, it goes without saying that the IS must conform to the same SOP Classes.

The Modality receives identifying parameters by querying the Modality Worklist SCP and generates other Attribute values during image generation. It is desirable that these identifying parameters be included in the Image SOP Instances as well as in the MPPS object in a consistent manner. In the case of a Modality that is integrated but unable to receive or send identifying parameters, e.g. link down, emergency case, the Modality may behave as if it were not integrated.

The Study Instance UID is a crucial Attribute that is used to relate Image SOP Instances (whose Study is identified by their Study Instance UID), the Modality PPS SOP Instance which contains it as a reference, and the actual or conceptual Requested Procedure (i.e. Study) and related Imaging Service Request in the IS. An IS that manages an actual or conceptual Detached Study Management entity is expected to be able to relate this Study Instance UID to the SOP Instance UID of the Detached Study Management SOP Instance, whether or not the Study Instance UID is provided by the IS or generated by the modality.

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M.2.1 Modality Conforms to Modality Worklist and MPPS SOP Classes

The modality may:

- N-CREATE a MPPS SOP Instance and include its SOP Instance UID in the Image SOP Instances within the Referenced Study Component Sequence Attribute.
- Copy the following Attribute values from the Modality Worklist information into the Image SOP Instances and into the related MPPS SOP Instance:
  - Study Instance UID
  - Referenced Study Sequence
  - Accession Number
  - Requested Procedure ID
  - Scheduled Procedure Step ID
  - Scheduled Procedure Step Description
  - Scheduled Action Item Code Sequence
- Create the following Attribute value and include it into the Image SOP Instances and the related MPPS SOP Instance:
  - Performed Procedure Step ID
- Include the following Attribute values that may be generated during image acquisition, if supported, into the Image SOP Instances and the related MPPS SOP Instance:
  - Performed Procedure Step Start Date
  - Performed Procedure Step Start Time
  - Performed Procedure Step Description
  - Study ID

M.2.2 Modality Conforms only to the Modality Worklist SOP Class

The modality may:

- In the absence of the ability to N-CREATE a MPPS SOP Instance, generate a MPPS SOP Instance UID and include it into the Referenced Study Component Sequence Attribute of the Image SOP Instances. A system that later N-CREATEs a MPPS SOP Instance may use this UID extracted from the related Image SOP Instances.
- Copy the following Attribute values from the Modality Worklist information into the Image SOP Instances:
  - Study Instance UID
  - Referenced Study Sequence
  - Accession Number
  - Requested Procedure ID
  - Scheduled Procedure Step ID
  - Scheduled Procedure Step Description
  - Scheduled Action Item Code Sequence
- Create the following Attribute value and include it into the Image SOP Instances:
  - Performed Procedure Step ID

  A system that later N-CREATEs a MPPS SOP Instance may use this Attribute value extracted from the related Image SOP Instances.
- Include the following Attribute values that may be generated during image acquisition, if supported, into the Image SOP Instances:

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- Performed Procedure Step Start Date
- Performed Procedure Step Start Time
- Performed Procedure Step Description
- Study ID

A system that later N-CREATEs a MPPS SOP Instance may use these Attribute values extracted from the related Image SOP Instances.

M.2.3 Modality Conforms only to the MPPS SOP Class

The modality may:

- N-CREATE a MPPS SOP Instance and include its SOP Instance UID in the Image SOP Instances within the Referenced Study Component Sequence Attribute.
- Create the following Attribute values and include them in the Image SOP Instances and the related MPPS SOP Instance:
  - Study Instance UID (see also section M.6)
  - Performed Procedure Step ID
- Copy the following Attribute values, if available to the Modality, into the Image SOP Instances and into the related MPPS SOP Instance:
  - Accession Number
  - Patient ID
  - Patient's Name
  - Patient's Birth Date
  - Patient's Sex

  If sufficient identifying information is included, it will allow the Image SOP Instances and the MPPS SOP Instance to be later related to the Requested Procedure and the actual or conceptual Detached Study Management entity.
- Include the following Attribute values that may be generated during image acquisition, if supported, into the Image SOP Instances and the related MPPS SOP Instance:
  - Performed Procedure Step Start Date
  - Performed Procedure Step Start Time
  - Performed Procedure Step Description
  - Study ID

M.3 NON-INTEGRATED ENVIRONMENT

"Non-Integrated" means in this context that the Acquisition Modality is not connected to an Information System Systems, does not receive Attribute values from an SCP of the Modality Worklist SOP Class, and cannot create a Performed Procedure Step SOP Instance.

The modality may:

- In the absence of the ability to N-CREATE a MPPS SOP Instance, generate a MPPS SOP Instance UID and include it into the Referenced Study Component Sequence Attribute of the Image SOP Instances. A system that later N-CREATEs a MPPS SOP Instance may use this UID extracted from the related Image SOP Instances.
- Create the following Attribute values and include them in the Image SOP Instances:
  - Study Instance UID (see also section M.6)
  - Performed Procedure Step ID

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A system that later N-CREATEs a MPPS SOP Instance may use these Attribute values extracted from the related Image SOP Instances.

- Copy the following Attribute values, if available to the Modality, into the Image SOP Instances:
  - Accession Number
  - Patient ID
  - Patient's Name
  - Patient's Birth Date
  - Patient's Sex

  If sufficient identifying information is be included, it will allow the Image SOP Instances to be later related to the Requested Procedure and the actual or conceptual Detached Study Management entity.
- Include the following Attribute values that may be generated during image acquisition, if supported, into the Image SOP Instances:
  - Performed Procedure Step Start Date
  - Performed Procedure Step Start Time
  - Performed Procedure Step Description
  - Study ID

  A system that later N-CREATEs a MPPS SOP Instance may use these Attribute values extracted from the related Image SOP Instances.

M.4 ONE MPPS IS CREATED IN RESPONSE TO TWO OR MORE REQUESTED PROCEDURES

In the MPPS SOP Instance, all the specific Attributes of a Scheduled Procedure Step or Steps are included in the Scheduled Step Attributes Sequence. In the Image SOP Instances, these Attributes may be included in the Request Attributes Sequence. This is an optional Sequence in order not to change the definition of existing SOP Classes by adding new required Attributes or changing the meaning of existing Attributes.

Both Sequences may have more than one Item if more than one Requested Procedure results in a single Performed Procedure Step.

Because of the definitions of existing Attributes in existing Image SOP Classes, the following solutions are a compromise. The first one chooses or creates a value for the single valued Attributes Study Instance UID and Accession Number. The second one completely replicates the Image data with different values for the Attributes Study Instance UID and Accession Number.

M.4.1 Choose or Create a Value for Study Instance UID and Accession Number

The modality may:

- In the Image SOP Instances:
  - create a Request Attributes Sequence containing two or more Items each containing the following Attributes:
    - Requested Procedure ID
    - Scheduled Procedure Step ID
    - Scheduled Procedure Step Description
    - Scheduled Action Item Code Sequence
  - create a Referenced Study Sequence containing two or more Items sufficient to contain the Study SOP Instance UID values from the Modality Worklist for both Requested Procedures

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- select one value from the Modality Worklist or generate a new value for:
  - Study Instance UID (see also M.6)
- select one value from the Modality Worklist or generate a new value or assign an empty value for:
  - Accession Number

- In the MPPS SOP Instance:
  - create a Scheduled Step Attributes Sequence containing two or more Items each containing the following Attributes:
    - Study Instance UID
    - Referenced Study Sequence
    - Accession Number
    - Requested Procedure ID
    - Scheduled Procedure Step ID
    - *Scheduled Procedure Step Description*
    - Scheduled Action Item Code Sequence
  - include the following Attribute value that may be generated during image acquisition, if supported:
    - Procedure Code Sequence
- In both the Image SOP Instances and the MPPS SOP Instance
  - create a Performed Procedure Step ID
  - include the following Attribute values that may be generated during image acquisition, if supported:
    - *Performed Procedure Step Start Date*
    - Performed Procedure Step Start Time
    - Performed Procedure Step Description
    - Study ID

M.4.2 Replicate the Image IOD

An alternative method is to replicate the entire Image SOP Instance with a new SOP Instance UID, and assign each Image IOD it's own identifying Attributes. In this case, each of the Study Instance UID and the Accession Number values can be used in their own Image SOP Instance.

Both Image SOP Instances may reference a single MPPS SOP Instance (via the MPPS SOP Instance UID in the Referenced Study Component Sequence).

Each individual Image SOP Instance may reference it's own related Study SOP Instance, if it exists (via the Referenced Study Sequence). This Study SOP Instance has a one to one relationship with the corresponding Requested Procedure.

If an MPPS SOP Instance is created, it may reference both related Study SOP Instances.

The modality may:

- For all Series in the MPPS, replicate the entire Series of Images using new Series Instance UIDs
- Create replicated Image SOP Instances with different SOP Instance UIDs that use the new Series Instance UIDs, for each of the two or more Requested Procedures

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- In each of the Image SOP Instances, using values from the corresponding Requested Procedure:
  - create a Request Attributes Sequence containing an Item containing the following Attributes:
    - Requested Procedure ID
    - Scheduled Procedure Step ID
    - Scheduled Procedure Step Description
    - Scheduled Action Item Code Sequence
  - copy from the Modality Worklist:
    - Study Instance UID
    - Accession Number
  - create a Referenced Study Sequence containing an Item containing the following Attribute:
    - Study SOP Instance in the Referenced Study Sequence from the Worklist
- In the MPPS SOP Instance (if supported):
  - create a Scheduled Step Attributes Sequence containing two or more Items each containing the following Attributes:
    - Study Instance UID
    - Referenced Study Sequence
    - Accession Number
    - Requested Procedure ID
    - Scheduled Procedure Step ID
    - Scheduled Procedure Step Description
    - Scheduled Action Item Code Sequence
  - include the following Attribute value that may be generated during image acquisition, if supported:
    - Procedure Code Sequence
- In both the Image SOP Instances and the MPPS SOP Instance (if supported):
  - create a Performed Procedure Step ID
  - Include the following Attribute values that may be generated during image acquisition, if supported:
    - Performed Procedure Step Start Date
    - Performed Procedure Step Start Time
    - Performed Procedure Step Description
    - Study ID

M.5 MPPS SOP INSTANCE CREATED BY ANOTHER SYSTEM (NOT THE MODALITY)

If for some reason the Modality was unable to create the MPPS SOP Instance, another system may wish to perform this service. This system must make sure that the created PPS SOP Instance is consistent with the related Image SOP Instances.

Depending on the availability and correctness of values for the Attributes in the Image SOP Instances, these values may be copied into the MPPS SOP Instance, or they may have to be coerced, e.g. if they are not consistent with corresponding values available from the IS.

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For example, if the MPPS SOP Instance UID is already available in the Image SOP Instance (in the Referenced Study Component Sequence), it may be utilized to N-CREATE the MPPS SOP Instance. If not available, a new MPPS SOP Instance UID may be generated and used to N-CREATE the MPPS SOP Instance. In this case there may be no MPPS SOP Instance UID in the Referenced Study Component Sequence in the corresponding Image SOP Instances. An update of the Image SOP Instances will restore the consistency, but this is not required.

M.6 MAPPING OF STUDY INSTANCE UIDS TO THE STUDY SOP INSTANCE UID

If modalities are not integrated with an Information System that is an SCP of the Modality Worklist SOP Class, they are not able to receive an IS generated Study Instance UID, and therefore they must create their own Study Instance UIDs.

The MPPS is a way of conveying back to an IS the Study Instance UID generated by the Modality in such a case.

Integration of a Performed Procedure Step (and the corresponding Image SOP Instances) with the Study or Imaging Service Request to which it corresponds is a management function of the IS. Even with all the normal identifying Attributes present and consistent, it may not always be possible to perform such matching in a completely automatic fashion.

COMPARISON OF CORRESPONDING ATTRIBUTES OF MODALITY WORKLIST INFORMATION MODEL, IMAGE AND STANDALONE IODS AND MODALITY PERFORMED PROCEDURE STEP IOD

Modality Worklist [Return Key Type] (e)	Images and Standalone IOD [Type]	MPPS IOD [SCU/SCP Type]
----	----	Scheduled Step Attributes Sequence [1/1] (c)
Study Instance UID [1]	Study Instance UID [1]	>Study Instance UID [1/1]
Referenced Study Sequence [2] (d)	Referenced Study Sequence [3] (c)	>Referenced Study Sequence [2/2] (f)
Accession Number [2]	Accession Number [2]	>Accession Number [2/2]
—	Request Attributes Sequence [3] (a,c)	----
Requested Procedure ID [1]	>Requested Procedure ID [1C]	>Requested Procedure ID [2/2]
Scheduled Procedure Step ID [1]	>Scheduled Procedure Step ID [1C]	>Scheduled Procedure Step ID [2/2]
Scheduled Procedure Step Description [1C]	>Scheduled Procedure Step Description [3]	>Scheduled Procedure Step Description [2/2]
Scheduled Action Item Code Sequence [1C]	>Scheduled Action Item Code Sequence [3]	Performed Action Items Code Sequence [2/2]
----	Study ID [2]	Study ID [2/2]
----	Performed Procedure Step ID [3] (b)	Performed Procedure Step ID [1/1]
----	Performed Procedure Step Start Date [3] (b)	Performed Procedure Step Start Date [1/1]
----	Performed Procedure Step Start Time [3] (b)	Performed Procedure Step Start Time [1/1]
----	Performed Procedure Step Description [3]	Performed Procedure Step Description [2/2]

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Requested Procedure Description [1C]		
Requested Procedure Code Sequence [1C]	—	Procedure Code Sequence [2/2]
—	Referenced Study Component Sequence [3] (d)	—
—	>Referenced SOP Class UID [1C]	SOP Class UID [1/1]
—	>Referenced SOP Instance UID [1C]	SOP Instance UID [1/1]
—	Protocol Name [3]	Protocol Name [1/1]

(a) Recommended if the Modality conforms as a SCU to the Modality Worklist SOP Class and Modality Performed Procedure Step

(b) Recommended if the Modality conforms as a SCU to the Modality Performed Procedure Step SOP Class

(c) Sequence may have one or more Items

(d) Sequence may have only one Item

(e) Worklist may have one or more Items related to one Modality Performed Procedure Step

(f) Referenced Study Sequence may have only one item. If more Study Sequences are related to the Modality Performed Procedure Step, additional Scheduled Step Attribute Sequence items must be created.

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Annex N GRAYSCALE SOFTCOPY PRESENTATION STATE STORAGE SOP CLASS (Normative)

N.1. OVERVIEW

N.1.1 SCOPE

The Grayscale Softcopy Presentation State Storage SOP Class extends the functionality of the Storage Service class (defined in Annex B) to add the ability to convey an intended presentation state or record an existing presentation state. The SOP Class specifies information and behavior that may be used to present (display) images that are referenced from within the SOP Class.

It includes capabilities for specifying:

a. the output grayscale space in P-Values
b. grayscale contrast transformations including modality and VOI LUT
c. mask subtraction for multi-frame images
d. selection of the area of the image to display and whether to rotate or flip it
e. image and display relative annotations, including graphics, text and overlays

The softcopy presentation state refers to the grayscale image transformations that are to be applied in an explicitly defined manner to convert the stored image pixel data values in a Composite Image Storage Instance to presentation values (P-Values) when an image is displayed on a softcopy device. The P-Values are in a device independent perceptually linear space that is formally defined in PS 3.14 Grayscale Standard Display Function.

The Grayscale Softcopy Presentation State Storage SOP Class may be used to store a single state per image, or a common state to be shared by multiple selected images. All images to which the state applies must be a part of the same study that the stored state is a part of, and be of the same Composite Image Storage SOP Class.

How an SCU of this SOP Class records or generates this state is beyond the scope of the standard.

Note: For example, an acquisition device may acquire, reconstruct and store to a workstation or archive images that are later examined by an operator for the purpose of quality assurance or printing. At that time a selected grayscale transformation (such as a window level/width operation) may be applied by the operator, and that activity captured and saved as a Grayscale Softcopy Presentation State Storage SOP Instance to the same workstation or archive, from which it is subsequently available for use by another user. Another workstation may retrieve the state for later use. Alternatively, an automated algorithm may derive a state from analysis of image statistics, body part examined, or other characteristics.

How an SCP of this SOP Class chooses between multiple states that may apply to an image is beyond the scope of this standard, other than to state that a claim of conformance as an SCP of this SOP Class implies that the SCP shall make the presentation state available to the user of the device, and if selected by the user, shall apply all the transformations stored in the state in the manner in which they are defined in the standard.

Notes: 1. For example, an acquisition device may automatically store appropriate presentation states for series of images as they are reconstructed that represent adequate defaults. A

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user or algorithm may subsequently determine a more appropriate presentation state that more effectively displays the contents of an image, or record some annotation related directly to the image, and record that as another presentation state for an image. An application subsequently may display the image by automatically choosing to use the more recently saved or more specific presentation state, or may use the more general default presentation state for all images but notify the user that alternative presentation states are available.

2. Choice of the same presentation state to display an image on two devices claiming conformance to these SOP Classes implies through the definition of the P-Value space that the displayed image on both devices will be perceptually similar within the limits defined in PS 3.14 Grayscale Standard Display Function, regardless of the actual capabilities of the display systems.

N.2 GRAYSCALE TRANSFORMATION SEQUENCE

The Grayscale Softcopy Presentation State Storage SOP Class supports a sequence of grayscale transformations that completely define the conversion of a stored image into a displayed image.

The sequence of grayscale transformations from stored pixel values into the Grayscale Standard Display Function P-Values is explicitly defined in a conceptual model. The actual sequence implemented may differ but must result in the same appearance. Figure N.2-1 describes this sequence of grayscale transformations.

Notes: 1. Even though a Composite Image Storage SOP Class may not include some modules that are part of the described grayscale transformations, the Grayscale Softcopy Presentation State Storage SOP Class does include them. For example, the CT Image Storage SOP Class includes Rescale Slope and Intercept in the CT Image Module, but does not include the Modality LUT Module, and hence is restricted to the description of linear transformations. A saved presentation state that refers to a CT Image Storage SOP Instance may include a Modality LUT, and hence may apply a non-linear transformation. This is a feature of the extended functionality of the Grayscale Softcopy Presentation State Storage SOP Class.

2. For the shutter, annotation and spatial transformations, the order in which they are applied relative to the other transformations should not result in a different appearance. The one exception is when a spatial transformation is applied that involves magnification implemented with interpolation. In this case, whether the interpolation is performed before or after the contrast transformations (such as VOI LUT) may result in a slightly different appearance. It is not considered necessary to constrain this sequence more precisely.

The grayscale transformations defined in the Grayscale Softcopy Presentation State Storage SOP Class replace those that may be defined in the Referenced Image SOP Instance. If a particular transformation is absent in the Grayscale Softcopy Presentation State Storage SOP Class, then it shall be assumed to be an identity transformation, and any equivalent transformation, if present, in the Referenced Image SOP Instance shall NOT be used instead.

Photometric Interpretation (0028,0004) in the Referenced Image SOP Instance shall be ignored, since its effect is defined by the application of the grayscale transformations.

Note: These requirements are in order to achieve complete definition of the entire grayscale transformation in the Grayscale Softcopy Presentation State Storage SOP Class, and not to depend on the content of the Referenced Image SOP Instance, which may change.

The Referenced Image Storage SOP Instance may also contain bit-mapped overlays and curves. The Grayscale Softcopy Presentation State Storage SOP Class specifies a mechanism for turning these on or off (i.e. displaying them or not).

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The presentation related Attributes of the Grayscale Softcopy Presentation State Storage SOP Class are immutable. They shall never be modified or updated; only a derived SOP Instance with a new SOP Instance UID may be created to represent a different presentation.

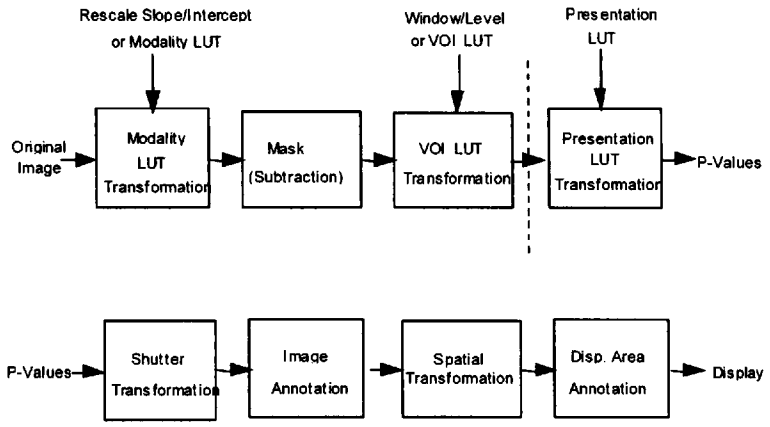

Figure N.2-1
Grayscale Image Transformation Model

N.2.1 Modality LUT

The Modality LUT transformation transforms the manufacturer dependent pixel values into pixel values which are meaningful for the modality and which are manufacturer independent (e.g., Hounsfield number for CT modalities, Optical Density for film digitizers). These may represent physical units or be dimensionless. The Modality LUT in the Presentation State is modality dependent and is analogous to the same module in an Image .

Note: In some cases, such as the CT Image Storage SOP Class, the same conceptual step as the Modality LUT is specified in another form, for example as Rescale Slope and Rescale Intercept Attributes in the CT Image Module, though the Modality LUT Module is not part of the CT Image IOD.

In the case of a linear transformation, the Modality LUT is described by the Rescale Slope (0028,1053) and Rescale Intercept (0028,1052). In the case of a non-linear transformation, the Modality LUT is described by the Modality LUT Sequence. The rules for application of the Modality LUT are defined in PS 3.3 Modality LUT Module.

If the Modality LUT or equivalent Attributes are part of both the Image and the Presentation State, then the Presentation State Modality LUT shall be used instead of the Image Modality LUT or equivalent Attributes in the Image. If the Modality LUT is not present in the Presentation State it shall be assumed to be an identity transformation. Any Modality LUT or equivalent Attributes in the Image shall not be used.

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N.2.2 Mask

The mask transformation may be applied in the case of multi-frame images for which other frames at a fixed frame position or time interval relative to the current frame may be subtracted from the current frame. Multiple mask frames may be averaged, and sub-pixel shifted before subtraction.

This transformation uses the Mask Module as used in the X-Ray Angiography Image Storage SOP Class, though it may be applied to any Image Storage SOP Instance that contains a multi-frame image.

In the case of X-Ray images, the subtraction is specified to take place in a space logarithmic to X-Ray intensity. If the stored pixel values are not already in such a space, an implementation defined transformation to such a space must be performed prior to subtraction. If a Modality LUT Module is present as well as a Mask Module, then the Modality LUT shall specify a transformation into such a logarithmic space, otherwise it shall not be present (even though a Modality LUT may be present in the referenced image(s) which shall be ignored).

Notes: 1. In the case of an XA or XRF image, if the Pixel Intensity Relationship (0028,1040) in the image is LOG, then even though a Modality LUT would be present in the image (to map pixel values back to linear to X-Ray intensity), no Modality LUT would be present in the presentation state (i.e. the Modality LUT would be an identity transformation) since log values are required for subtraction. See PS 3.3 C.8.7.1.1.2.

2. In the case of an XA or XRF image, if the Pixel Intensity Relationship (0028,1040) is LIN, then no Modality LUT would be present in the image, but a Modality LUT would need to be present in the presentation state since log values are required for subtraction.

3. In the case of an XA or XRF image, if the Pixel Intensity Relationship (0028,1040) in the image is DISP, then even though a Modality LUT may or may not be present in the image (to map pixel values back to linear to X-Ray intensity), a different Modality LUT would be present in the presentation state if the creator of the presentation state could create a transformation from DISP pixel values to a logarithmic space for subtraction, or the Modality LUT in the presentation state would be an identity transformation if the DISP pixel values were known to already be log values required for subtraction.

The result will be a signed value with a bit length one longer than the source frames.

When there is no difference between corresponding pixel values, the subtracted image pixel will have a value of 0.

If a pixel in the current frame has a greater value than in the mask frame, then the resulting frame shall have a positive value. If it has a lesser value, then the resulting frame shall have a negative value.

N.2.3 VOI LUT

The value of interest (VOI) LUT transformation transforms the modality pixel values into pixel values which are meaningful for the user or the application.

Note: Photometric Interpretation (0028,0004) is ignored, since its effect is defined by the application of the grayscale transformations.

The Softcopy VOI LUT Module in the Presentation State is analogous to the VOI LUT Module in an Image.

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In the case of a linear transformation, the VOI LUT is described by the Window Center (0028,1050) and Window Width (0028,1051). In the case of a non-linear transformation, the VOI LUT is described by the VOI LUT Sequence. The rules for application of the VOI LUT are defined in PS 3.3 Softcopy VOI LUT Module.

The VOI LUT may have sections with negative slope.

Note: In the Basic Print Service Class a VOI LUT may not have negative slope.

If a VOI LUT is part of both the Image and the Presentation State then the Presentation State VOI LUT shall be used instead of the Image VOI LUT. If a VOI LUT (that applies to the Image) is not present in the Presentation State , it shall be assumed to be an identity transformation. Any VOI LUT or equivalent values in the Image shall not be used.

N.2.4 Presentation LUT

The Presentation LUT transformation transforms the pixel values into P-Values, a device independent perceptually linear space as defined in PS 3.14 Grayscale Display Function Standard. It may be an identity function if the output of the VOI LUT transformation is in P-Values.

Note: If the Presentation LUT and VOI LUT step are identity transformations, and the Mask Module is absent, then the output of the Modality LUT must be, by definition, P-Values.

No output space other than P-Values is defined for the Grayscale Softcopy Presentation State Storage SOP Classes.

In the case of a linear transformation, the Presentation LUT is described by the Presentation LUT Shape (2050,0020). In the case of a non-linear transformation, the Presentation LUT is described by the Presentation LUT Sequence. The rules for application of the Presentation LUT are defined in PS 3.3 Softcopy Presentation LUT Module.

Notes: 1. Since the grayscale transformation pipeline fully defines all transformations applied to the stored pixel values in the referenced image object, the value of Photometric Interpretation (0028,0004) in the referenced image object is ignored and overridden. This implies that either the creator of the presentation state chose a pipeline that reflects the Photometric Interpretation (0028,0004) , or chose to ignore or override the Photometric Interpretation, and invert the image relative to what is specified by Photometric Interpretation. If the Modality LUT and VOI LUT do not have a negative slope, one can achieve the effect of inversion of the polarity of an image by choosing Presentation LUT Shape of IDENTITY or INVERSE that displays the minimum pixel value as white rather than black in the case of a Photometric Interpretation of MONOCHROME2, or black rather than white in the case of a Photometric Interpretation of MONOCHROME1. If Presentation LUT Data is sent, then one can invert the order of the entries in the LUT table to achieve inversion of polarity.

2. The minimum P-Value (zero) always commands that the lowest intensity be displayed.

3. No separate Polarity transformation is defined.

A Softcopy Presentation LUT Module is always present in a Presentation State. If a Presentation LUT is present in the Image then the Presentation State Presentation LUT shall be used instead of the Image Presentation LUT.

N.2.5 Shutter

The Shutter transformation provides the ability to exclude the perimeter outside a region of an image. A gray level may be specified to replace the area under the shutter.

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One form of this transformation uses the Display Shutter Module as used in the X-Ray Angiography Image Storage SOP Class, though it may be applied to any Image Storage SOP Instance, including single frame images.

Another form uses a bit-mapped overlay to indicate arbitrary areas of the image that should be excluded from display by replacement with a specified gray level, as described in the Bitmap Display Shutter Module.

Notes: 1. Since annotations follow the shutter operation in the pipeline, annotations in shuttered regions are not obscured and are visible.

2. Any shutter present in the referenced image object is ignored (i.e. not applied).

N.2.6 Pre-Spatial Transformation Annotation

The Pre-Spatial Transformation Annotation transformation includes the application of bit-mapped overlays as defined in the Overlay Plane Module, and free unformatted text or vector graphics as described in the Graphic Annotation Module that are defined in the image pixel space (as opposed to the displayed area space).

N.2.7 Spatial Transformation

Some modalities may not deliver the image in the desired rotation and need to specify a rotation into the desired position for presentation. This transformation, specified in the Spatial Transformation Module, includes a rotation of 90, 180, 270 degrees clockwise followed by a horizontal flip (L <--> R). Rotation by an arbitrary angle is not supported.

In addition, selection of a region of the image pixel space to be displayed is specified in the Displayed Area Module. This may have the effect of magnifying (or minifying) that region depending on what physical size the display is instructed to render the selected region. If so, the method of interpolation (or sub-sampling) is implementation dependent.

Note: In particular the number of displayed pixels may be different from the number of image pixels as a result of:

- minification (e.g. 1 display pixel for 4 image pixels),
- magnification (4 display pixels for each image pixel),
- interpolation (display pixels derived from values other than those in the image pixels), and
- sub-sampling.

N.2.8 Post-Spatial Transformation Annotation

The Post-Spatial Transformation Annotation transformation includes the application of free unformatted text or vector graphics as described in the Graphic Annotation Module that are defined in the displayed area space (as opposed to the image pixel space).

This implies that the displayed area space is defined as being the image after all Spatial Transformations have been applied.

These annotations are rendered in the displayed space, though they may be anchored to points in either the displayed area or image pixel space.

N.3 BEHAVIOR OF AN SCP

In addition to the behavior for the Storage Service Class specified in B.2.2 Behavior of an SCP, the following additional requirements are specified for the Grayscale Softcopy Presentation State Storage SOP Class:

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— a display device acting as an SCP of this SOP Class shall make all mandatory presentation attributes available for application to the referenced images at the discretion of the display device user, for all Image Storage SOP Classes defined in the Conformance Statement for which the Grayscale Softcopy Presentation State Storage SOP Class is supported.

N.4 CONFORMANCE

In addition to the Conformance Statement requirements for the Storage Service Class specified in B.4.3, the following additional requirements are specified for the Grayscale Softcopy Presentation State Storage SOP Class:

N.4.1 Conformance Statement for An SCU

The following issues shall be documented in the Conformance Statement of any implementation claiming conformance to the Grayscale Softcopy Presentation State Storage SOP Class as an SCU:

— For an SCU of a Grayscale Softcopy Presentation State Storage SOP Class that is creating a SOP Instance of the Class, the manner in which presentation related attributes are derived from a displayed image, operator intervention or defaults, and how they are included in the IOD.

— For an SCU of a Grayscale Softcopy Presentation State Storage SOP Class, the Image Storage SOP Classes that are also supported by the SCU and which may be referenced by instances of the Grayscale Softcopy Presentation State Storage SOP Class.

N.4.2 Conformance Statement for An SCP

The following issues shall be documented in the Conformance Statement of any implementation claiming conformance to the Grayscale Softcopy Presentation State Storage SOP Class as an SCP:

— For an SCP of a Grayscale Softcopy Presentation State Storage SOP Class that is displaying an image referred to by a SOP Instance of the Class, the manner in which presentation related attributes are used to influence the display of an image.

— For an SCP of a Grayscale Softcopy Presentation State Storage SOP Class, the Image Storage SOP Classes that are also supported by the SCP and which may be referenced by instances of the Grayscale Softcopy Presentation State Storage SOP Class.

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Annex O STRUCTURED REPORTING STORAGE SOP CLASSES (Normative)

O.1 OVERVIEW

The Structured Reporting Storage SOP Classes extend the functionality of the Storage Service class (defined in Annex B) to extend the SCP behavior and conformance requirements.

O.2 BEHAVIOR OF AN SCP

An SCP intending to display or otherwise render a Structured Report shall convey its full meaning in an unambiguous manner.

For a device, that is both an SCU and an SCP of these Storage SOP Classes, in addition to the behavior for the Storage Service Class specified in B.2.2, the following additional requirements are specified for Structured Reporting Storage SOP Classes:

— an SCP of this SOP Class shall support Level 2 Conformance as defined in Section B.4.1.

Note: This requirement means that all Type 1, Type 2, and Type 3 Attributes defined in the Information Object Definition associated with the SOP Class will be stored and may be accessed.

O.3 MODIFICATION OF SR DOCUMENT CONTENT

A device that is an SR Storage SOP Class SCU may modify information in a SOP Instance which it has previously sent or received. When this SOP Instance is modified and sent to an SCP, it shall be assigned a new SOP Instance UID if any of the following conditions are met:

- addition, removal or update of any attribute within the SR Document General Module or SR Document Content Module;
- modification of the Series Instance UID (0020,000E);
- modification of the Study Instance UID (0020,000D).

O.4 CONFORMANCE

In addition to the Conformance Statement requirements for the Storage Service Class specified in B.4.3, the following additional requirements are specified for Structured Reporting Storage SOP Classes:

O.4.1 Conformance Statement for an SCU

The following shall be documented in the Conformance Statement of any implementation claiming conformance to the Structured Reporting Storage SOP Classes as an SCU:

— The Image or other composite object Storage SOP Classes that are also supported by the SCU and which may be referenced by instances of Structured Reporting Storage SOP Class.

— The range of Value Types and Relationship Types that are supported by the SCU.

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— The conditions under which a new SOP Instance UID is generated for an existing SR Document.

O.4.2 Conformance Statement for an SCP

The following shall be documented in the Conformance Statement of any implementation claiming conformance to the Structured Reporting Storage SOP Class as an SCP:

— For an SCP of a Structured Reporting Storage SOP Class that is displaying or otherwise rendering the structured report contained in a SOP Instance of the Class, the general form in which the structured report related attributes are rendered.

— For an SCP of a Structured Reporting Storage SOP Class, the Image or other composite object Storage SOP Classes that are also supported by the SCP and which may be referenced by instances of the Structured Reporting Storage SOP Class, and whether or not they will be displayed or otherwise rendered.

— For an SCP of a Structured Reporting Storage SOP Class that is displaying or otherwise rendering an image or other composite object referred to by a SOP Instance of the Class, the manner in which the structured report related attributes (such as spatial coordinates and referenced presentation states) are used to influence the display of the image or object.

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Annex P INDEX TO ATTRIBUTE TAGS AND UIDs (Informative)

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