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Digital Imaging and Communications in Medicine (DICOM)

Part 4: Service Class Specifications

NEMA

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Digital Imaging and Communications in Medicine (DICOM)
Part 4: Service Class Specifications

Approved by:
The American College of Radiology

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ACR-NEMA

Digital Imaging and Communications in Medicine
Part 4: Service Class Specifications

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

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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Digital Imaging and Communications in Medicine
Part 4: Service Class Specifications

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	Information Processing Systems-Open Systems Interconnection-Basic Reference Model
ISO/TR 8509	Information Processing Systems-Open Systems Interconnection-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)

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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
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:

3.9.1 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.

3.9.2 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.

3.9.3 Meta service-object pair (SOP) class: a predefined 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.

3.9.4 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.

3.9.5 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.

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

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

3.9.8 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.

3.9.9 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.

3.9.10 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.

4.1 ACR American College of Radiology

4.2 ASCII American Standard Code for Information Interchange

4.3 AE Application Entity

4.4 ANSI American National Standards Institute

4.5 CEN TC251 Comité Européen de Normalisation -Technical Committee 251 - Medical Informatics

4.6 DICOM Digital Imaging and Communications in Medicine

4.7 DIMSE DICOM Message Service Element

4.8 DIMSE-C DICOM Message Service Element-Composite

4.9 DIMSE-N DICOM Message Service Element-Normalized

4.10 HL7 Health Level 7

4.11 IE Information Entity

4.12 IEEE Institute of Electrical and Electronics Engineers

4.13 IOD Information Object Definition

4.14 ISO International Standards Organization

4.15 JIRA Japanese Industry Radiology Apparatus

4.16 NEMA National Electrical Manufacturers Association

4.17 OSI Open Systems Interconnection

4.18 SCP Service Class Provider

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4.19 SCU Service Class User

4.20 SOP Service-Object Pair

4.21 UID Unique Identifier

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.

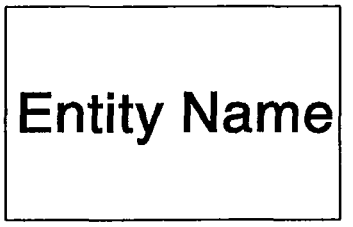

Figure 5-1—Entity convention

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.

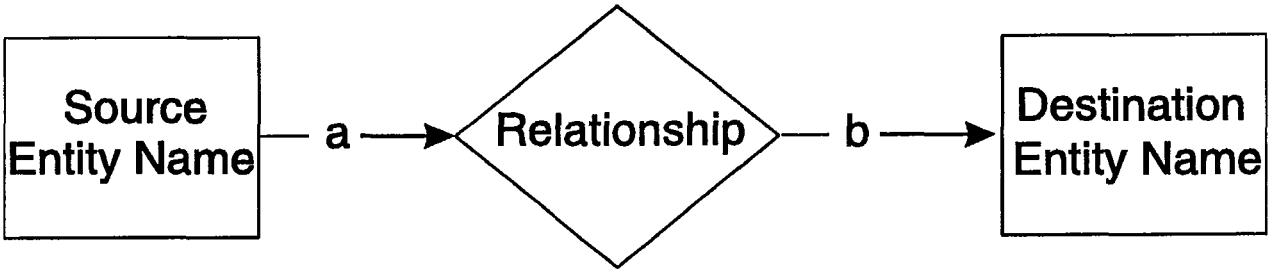

Figure 5-2—Relationship convention

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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 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.

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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.

-/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.

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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.

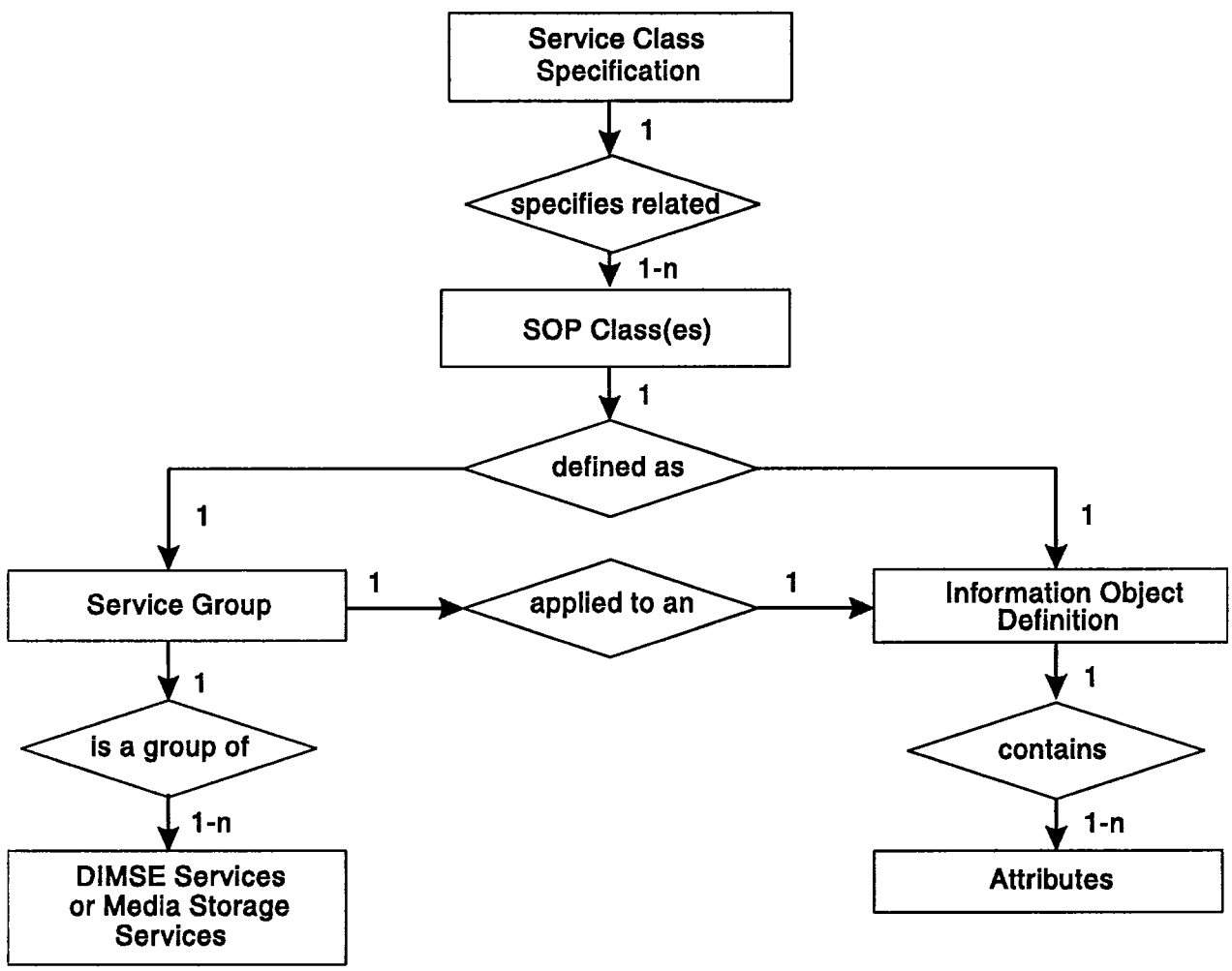

Figure 6-1—Major structures of DICOM information model

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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 Figure 7-1.) 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 Annex A of PS 3.3.

6.1.2 NORMALIZED IOD

A Normalized IOD is an Information Object Definition which represents a single entity in the DICOM Model of the Real-World. Such an IOD includes Attributes which are only inherent in the Real-World Object that the IOD represents.

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 Annex B of 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 Annex C 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.

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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.

NOTE— These 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.

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 Part 7 of the DICOM Standard. 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.

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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

Figure 7-1 depicts the DICOM view of the Real-World which identifies the relevant Real-World Objects and their relationships within the scope of the DICOM Standard. It provides a common framework to ensures consistency between the various Information Objects defined by the DICOM Standard.

7.1 *DICOM information model*

From the DICOM Model of the real world, the DICOM Information Model is derived. The DICOM Information Model presented by Figure 7-2 identifies the various IODs specified by the DICOM Standard and their relationship. There is not always a one-to-one correspondence between DICOM Information Object Definitions and Real-World Objects. For example a Composite IOD contains Attributes of multiple Real-World Objects such as series, equipment, frame of reference, study and patient.

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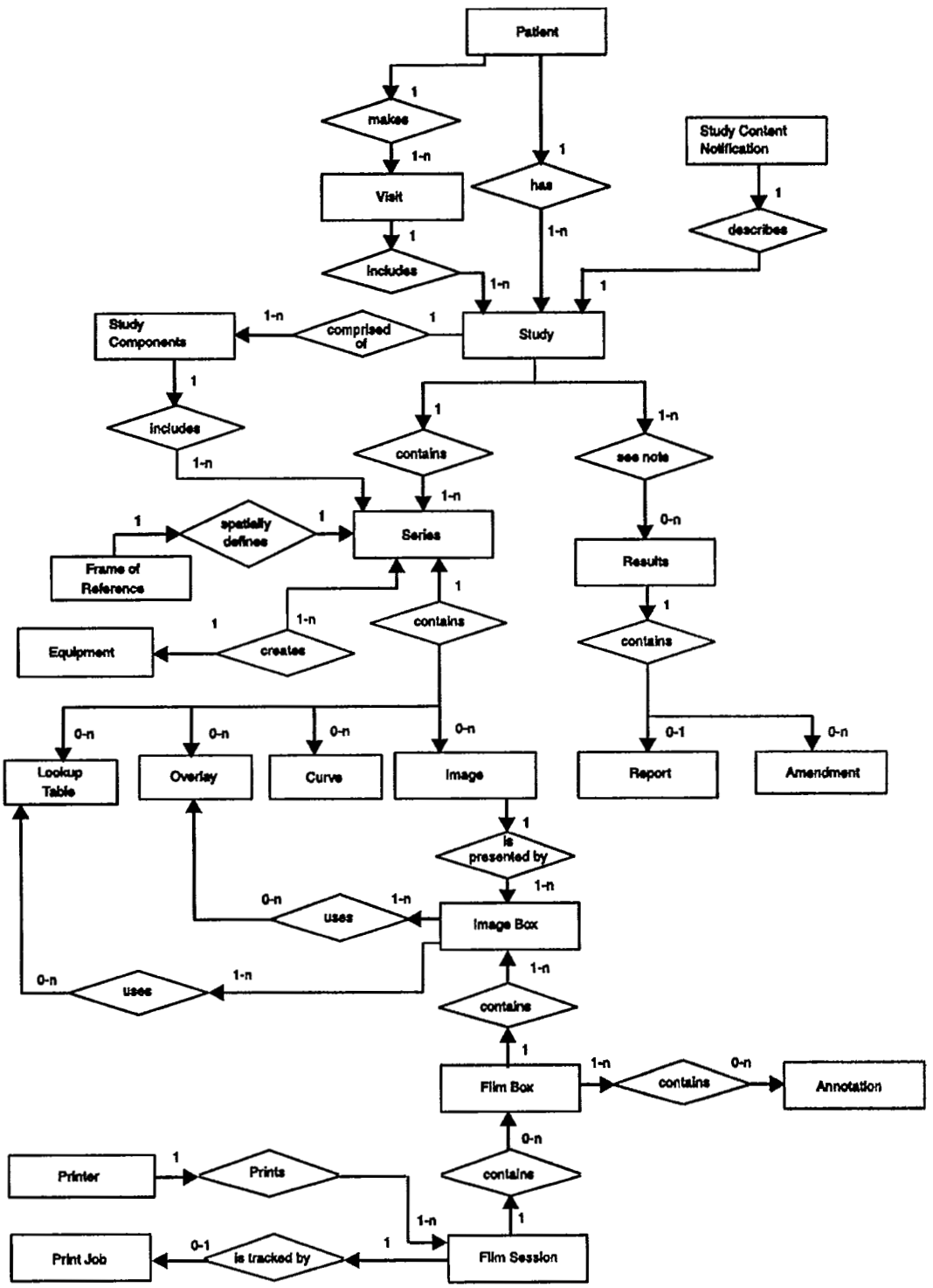

NOTE— The relationship between study and result is complex, involving other Real-World Objects (e.g. the interpreting physician). This Standard does not model these objects.

Figure 7-1—DICOM model of the real-world

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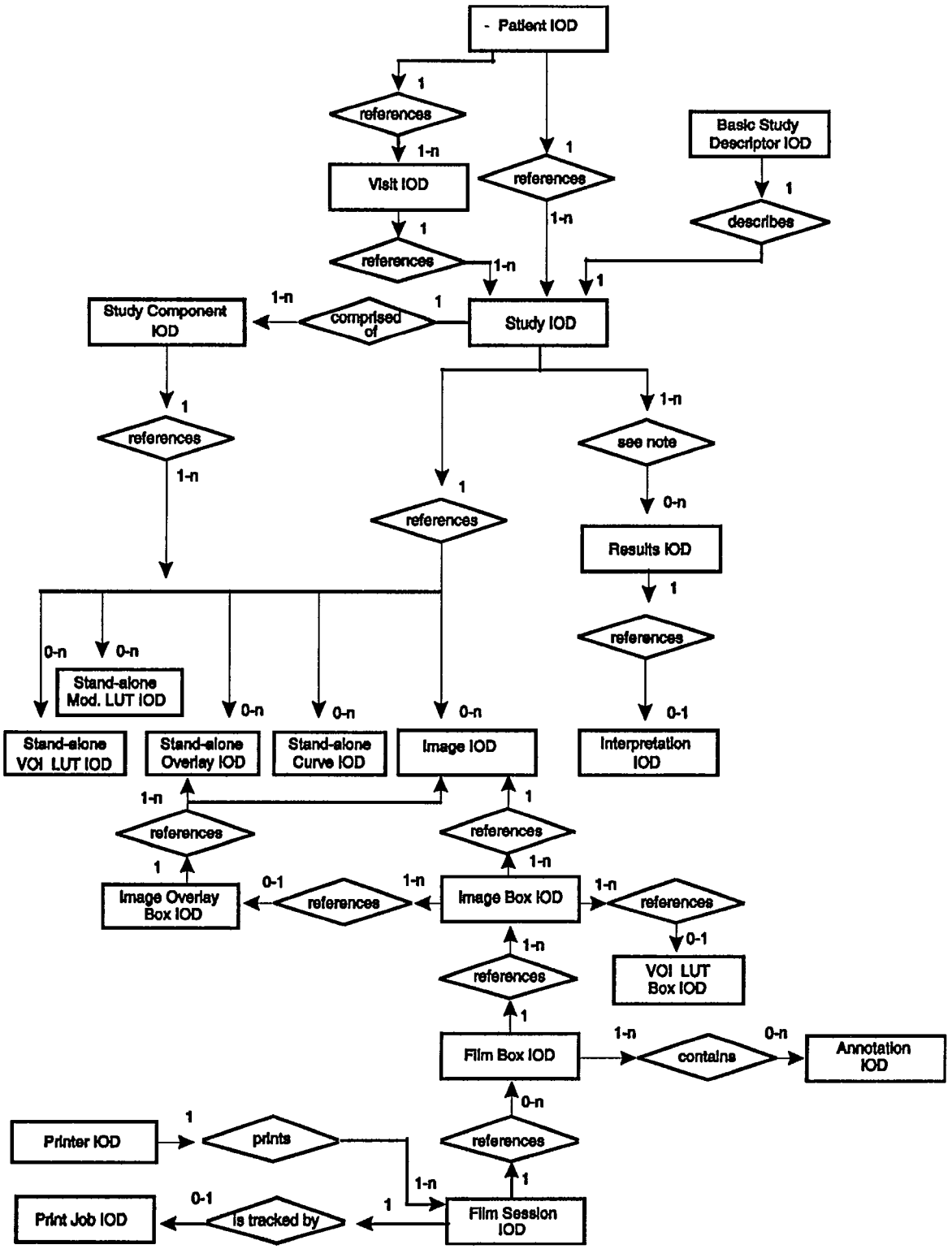

NOTE—The entities shown correspond to IODs defined in PS3.3.

Figure 7-2—DICOM information model

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Annex A
(Normative)
Verification service class

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.

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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

— 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 Annex A of PS 3.2.

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Annex B
(Normative)
Storage service class

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 lists all values which may be returned as a status code in a C-STORE-RSP.

Table B.2-1—C-STORE status

Service Status	Further Meaning	Protocol 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.

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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:

— 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.

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.

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

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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:

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

— Association requirements as defined in Section B.3

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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 Annex A of PS 3.2.

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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:

— 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 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.

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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 Annex A of 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 Annex A of 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.

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 Annex A of 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.

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Table B.5-1—Standard SOP classes

SOP Class Name	SOP Class UID
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
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Stand-alone Overlay Storage	1.2.840.10008.5.1.4.1.1.8
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Stand-alone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10
Stand-alone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11

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Annex C
(Normative)
Query/retrieve service class

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 images 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 image 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 images. The retrieve/transfer capability allows a DICOM AE to retrieve images from a remote DICOM AE or request the remote DICOM AE to initiate a transfer of images 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 image 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.

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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.

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 Image) 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 of the Query/Retrieve SOP Class serves as the SCU of the Storage SOP Class.

— 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 suboperations and the number of C-STORE suboperations 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

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the number of C-STORE suboperations returning the status of Success, Warning, and Failed. If the status of a C-STORE suboperation 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 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 suboperations and the number of C-STORE suboperations 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 suboperations returning the status of Success, Warning, and Failed. If the status of a C-STORE suboperation 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

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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, Image).

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.

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:

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— 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. A 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 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

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, contains no wild card characters

b) a date or time, contains a single date or time 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.

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 long, floating point single, floating point double, other byte string, other word string, attribute tag, decimal string, integer 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. See PS 3.5 for Value Representations.

NOTE— Wildcard matching on a value of "*" is equivalent to universal matching.

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

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

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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 are 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

— Image

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The patient level is the top level and contains Attributes associated with the Patient Information Entity (IE) of the Image 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 Image 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 Image 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 accommodate this modality dependence, the set of Optional Keys at the series level includes all Attributes defined at the series level from any Image IOD defined in PS 3.3.

The lowest level is the image level and contains Attributes associated with the Image IE of the Image IODs as defined in PS 3.3. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent. To accommodate this modality dependence, the set of Optional Keys at the image level includes all Attributes defined at the image level from any Image IOD 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 image levels are not supported.

NOTE— **Even though this model does not include the image level, images may be retrieved at the patient and study level (i.e., retrieve all images 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.

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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 Images	(0020,1204)	The number of images 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 Study Related Images	(0020,1208)	The number of images that match the Study level Query/Retrieve search criteria

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.

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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

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

An Identifier in a C-FIND response shall contain:

— 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.

The C-FIND SCP is required to support either 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 image(s) reside. This element pertains to the set of images available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Image). 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 image(s) reside. This element pertains to the set of images available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Image). 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.

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— Retrieve AE Title (0008,0054) which defines a list of DICOM Application Entity Title(s) that identify the location from which the image(s) may be retrieved on the network. This element pertains to the set of images available at the Query/Retrieve Level specified in the Identifier of the C-FIND request (e.g. Patient, Study, Series, Image). 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 images 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.

C.4.1.1.4 Status

Table C.4-1 defines the status values which may be returned in a C-FIND response. Fields related to status code values are defined in PS 3.7.

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.

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.

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Table C.4-1—C-FIND response status values

Service Status	Further Meaning	Protocol 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

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.

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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.

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:

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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.

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

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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).

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.

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C.4.2.1.2 Priority

The Priority Attribute defines the requested priority of the C-MOVE operation and corresponding C-STORE suboperations 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

Both the C-MOVE request and response contain an Identifier.

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 UID (0020,000D), Series Instance UID (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.

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

— 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 status values which may be returned in a C-MOVE response. Fields related to status code values are defined in PS 3.7.

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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) (0000,1021) (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)

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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

— 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

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— 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 at least one UID and may supply a list of UIDs if a retrieval of several items is desired. 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.

— 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 suboperations.

— 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

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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 images related to a study by only providing a Study Instance UID (0020,000D)

— all images related to a series by only providing a Series Instance UID (0020,000E)

— individual images 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.

— 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, Study Instance UID, Series Instance UID, 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

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— 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 images related to a study by only providing a Study Instance UID (0020,000D)

— all images related to a series by only providing a Series Instance UID (0020,000E)

— individual images 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 Part 7 of the DICOM Standard. The C-GET operation allows an application entity to 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.

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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

Both the C-GET request and response contain an Identifier.

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 UID (0020,000D) Series Instance UID (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.

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)

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C.4.3.1.4 Status

Table C.4-3 defines the status values which may be returned in a C-GET response. 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)

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.

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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

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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:

- 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 at least one UID and may supply a list of UIDs if a retrieval of several items is desired.

- 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

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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 images related to a study by providing a Study Instance UID (0020,000D)
- all images related to a series by providing a Series Instance UID (0020,000E)
- individual images 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.

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, Study Instance UID, Series Instance UID, 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

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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 images related to a study by providing a Study Instance UID

— all images related to a series by providing a Series Instance UID

— individual images by providing a list of SOP Instance UIDs

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.

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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

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.

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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:

— 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

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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.

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.

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 image 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-STORE sub-operation.

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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

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

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

— 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.

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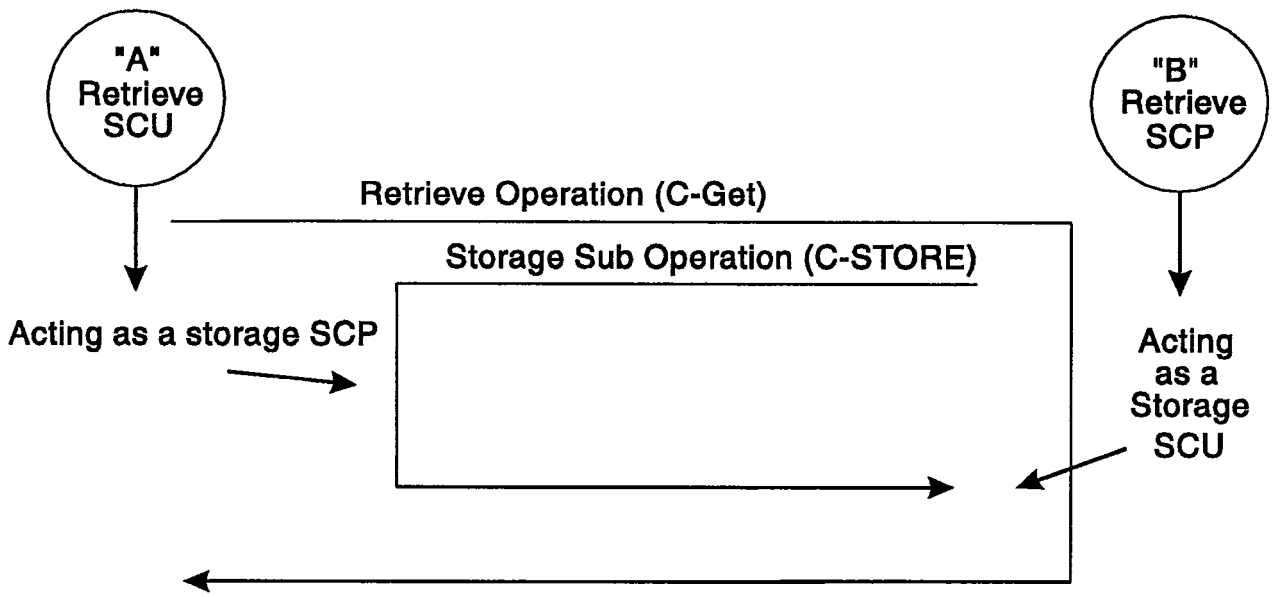

Figure C.5-1—An example of the sub-operation SCU/SCP roles

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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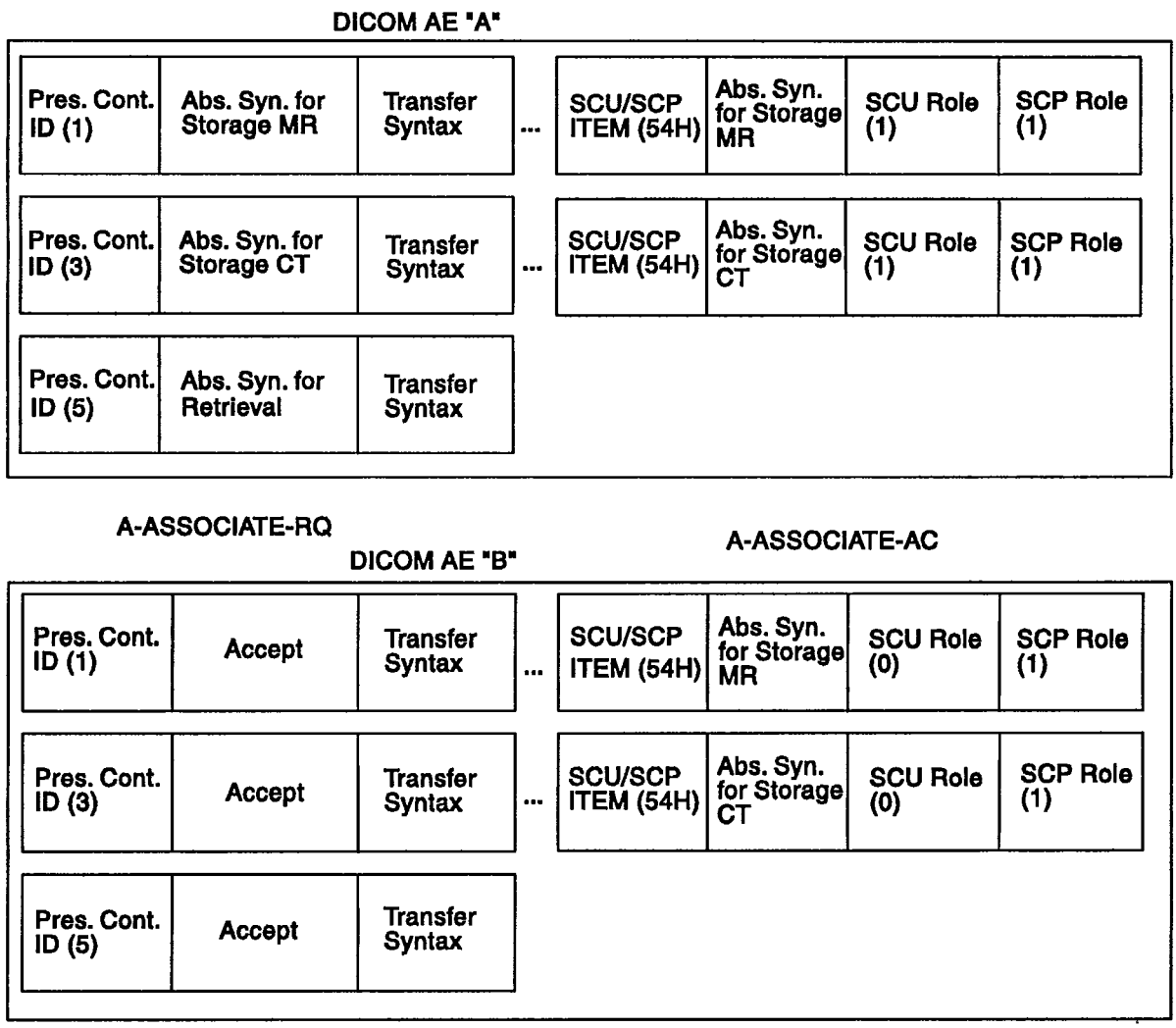
C.5.3.1 SOP CLASS EXTENDED NEGOTIATION

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 (Dose 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.

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

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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
Image Information	IMAGE

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.

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.

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.

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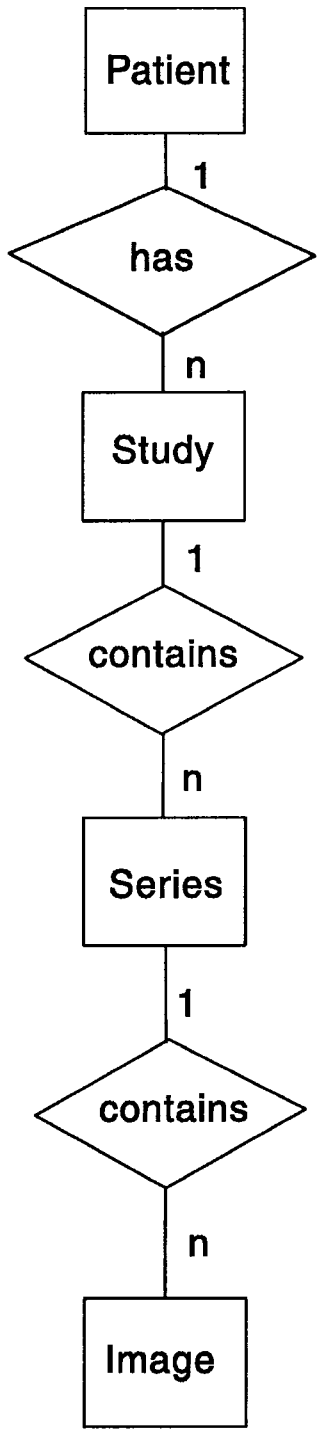

Figure C.6-1—Patient root query/retrieve information model E/R diagram

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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
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 Images	(0020,1204)	O

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.

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.

C.6.1.1.5 Image level

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

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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
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
>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
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 Images	(0020,1208)	O
Interpretation Author	(4008,010C)	O

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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
All Other Attributes at Series Level		O

Table C.6-4—Image level keys for the patient root query/retrieve information model

Description	Tag	Type
Image Number	(0020,0013)	R
SOP Instance UID	(0008,0018)	U
All Other Attributes at Image Level		O

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 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.

— SERIES level indicates that all images related to a Series shall be transferred.

— IMAGE level indicates that selected individual images shall be transferred.

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 Annex A of 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.

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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.

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

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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
Image Information	IMAGE

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.

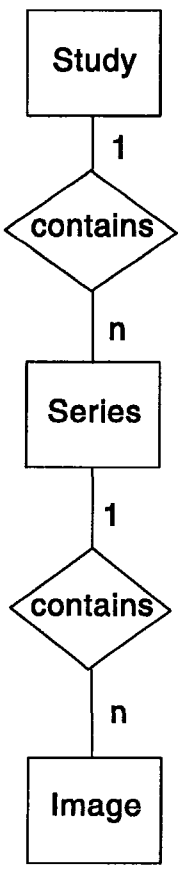

Figure C.6-2—Study root query/retrieve information model E/R diagram

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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.

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
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
>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

Table C.6-5 continued on next page

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Table C.6-5 continued

>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 Images	(0020,1204)	O
Number of Study Related Series	(0020,1206)	O
Number of Study Related Images	(0020,1208)	O
Interpretation Author	(4008,010C)	O

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 misidentified.

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.

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C.6.2.1.4 Image level

Attributes for the Image Level of the Study Root Query/Retrieve Information Model are the same as the Attributes for the Image 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 Image level. A C-MOVE or C-GET where the Query/Retrieve level is the:

— STUDY level indicates that all images related to a Study shall be transferred

— SERIES level indicates that all images related to a Series shall be transferred

— IMAGE level indicates that selected individual images shall be transferred

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 Annex A of 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.

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.

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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.

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 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.6.2.3 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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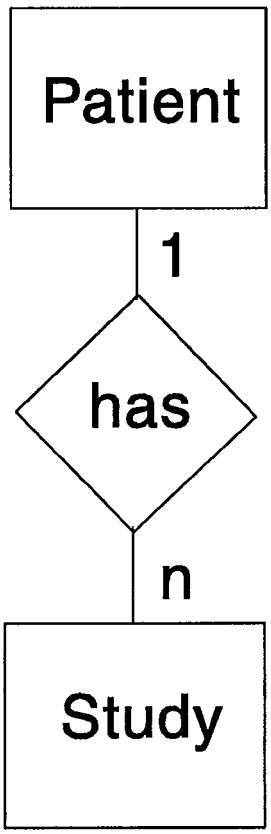

Figure C.6-3—Patient/study only query/retrieve information model E/R diagram

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.

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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 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.

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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.

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
(Normative)
Study content notification service class

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.

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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.

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

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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 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
(Normative)
Patient management service class

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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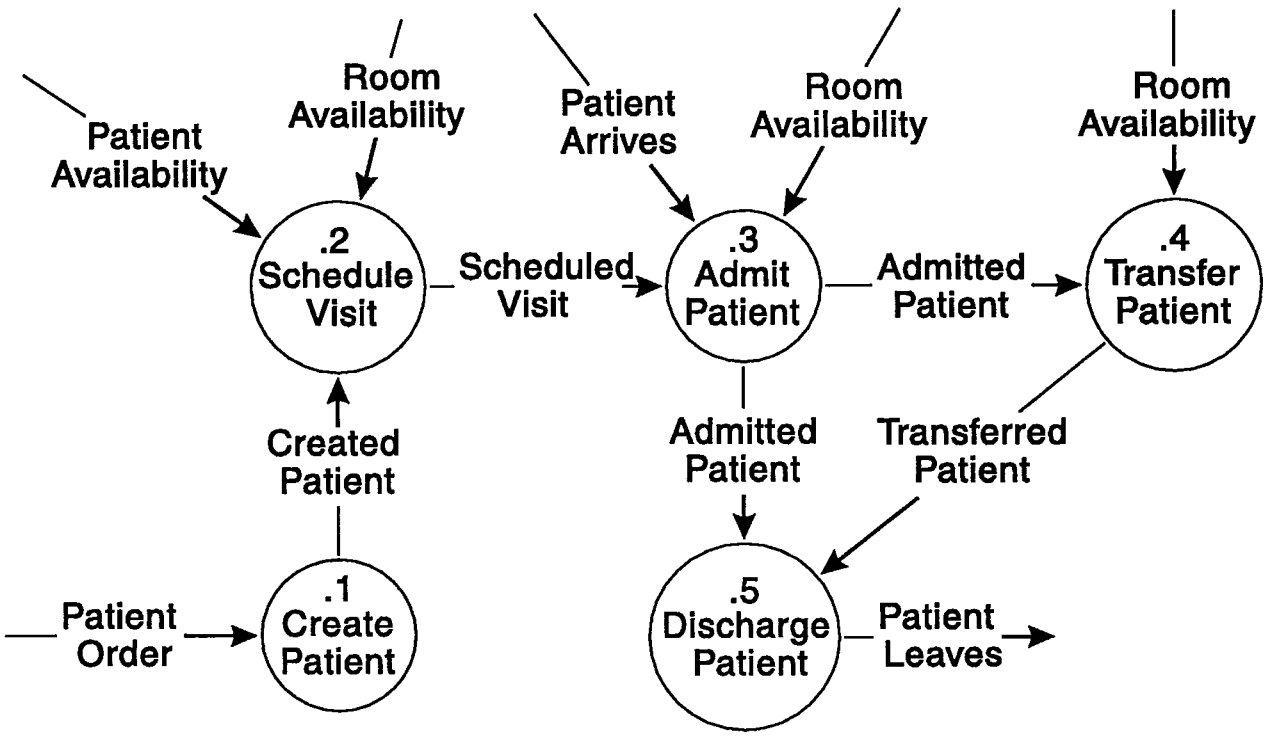

Figure E.1-1—Patient management functional model

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.

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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.

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	

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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.

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.

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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.

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 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.

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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

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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.

Table E.3-3—Response statuses

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

See PS 3.7 for response status codes.

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

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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.

E.3.3.3 STATUS CODES

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

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 Annex A of 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 Annex A of 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;]

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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
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

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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 Annex A of 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 Annex A of PS 3.2. Following this statement shall be the list of event types and optional Attributes.

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.

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.

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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.4.2.1 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.

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.

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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.4.2.1.3 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.

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.

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Table E.4-3—Response statuses

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

See PS 3.7 for response status codes.

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.

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

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.

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.

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.

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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	Req. 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)

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Table E.4-5 continued

Visit Scheduled (continued)	2	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
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

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Table E.4-5 continued

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
Patient Discharged	5	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
		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 Annex A of 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 Annex A of 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 Annex A of 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;]

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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

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 Annex A of 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 Annex A of 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 Annex A of 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.

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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 Annex A of 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 Annex A of 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.

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 Annex A of 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.

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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 Annex A of 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 Annex A of 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.6.4.2 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 Annex A of PS 3.2.

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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
(Normative)
Study management service class

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 utilizing a single procedure. One or more Study Components may be related to a Study.

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 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.

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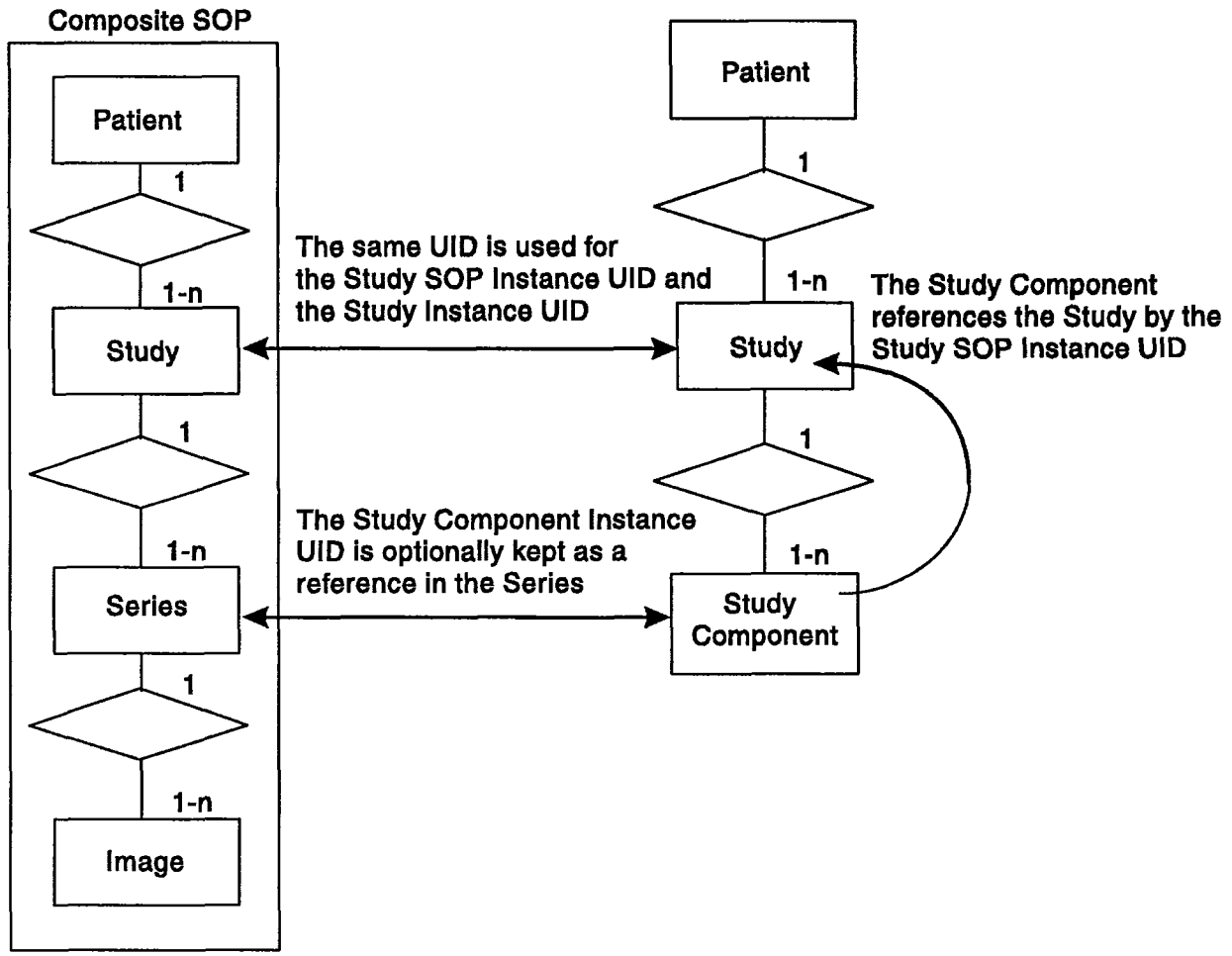

Figure F.1-1—Relationship between composite and normalized representations of the study concept

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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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.

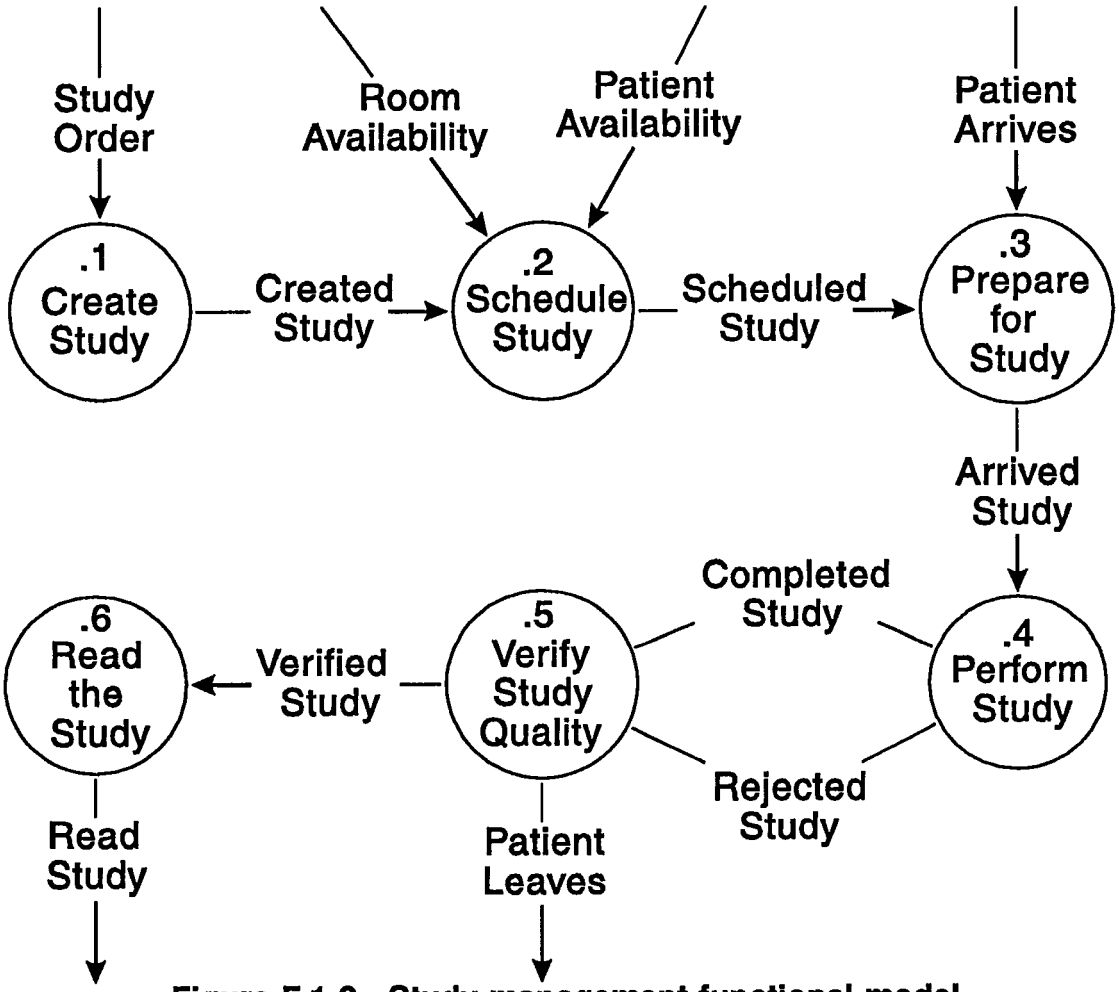

Figure F.1-2—Study management functional model

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.

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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 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. One IOD, the Study IOD, is used by this Service Class. Reference Part 3 of the DICOM Standard for more information on the Study IOD.

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. Because this Service Class uses only the Study IOD, all state information is specified by that IOD.

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.

F.2 Conformance overview

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

a) Detached Study Management SOP Class

b) Study Component Management SOP Class

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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—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	

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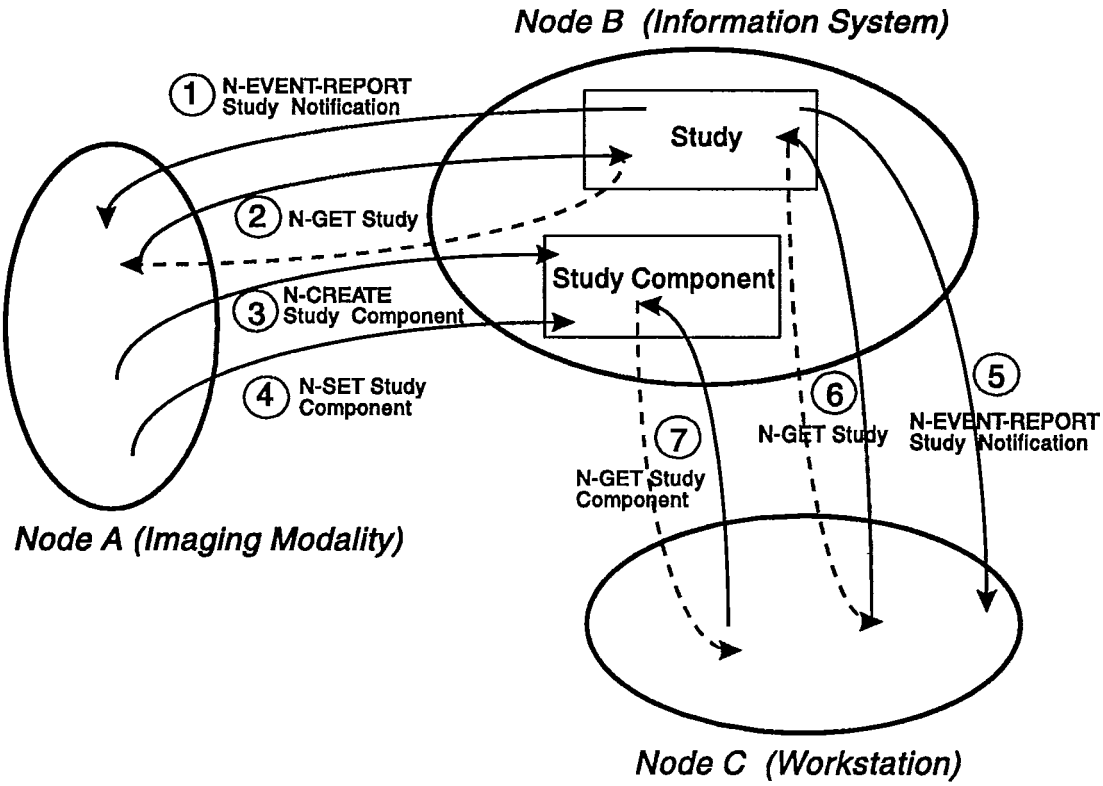

Figure F.2-1—Example of usage the study management and study component SOP classes

Each SOP Class operates on a subset of the Study 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).

NOTES— 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 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).

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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.

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.

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

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

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.

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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.

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.

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)	3/1
>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 Patient Sequence	(0008,1120)	3/1

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Table F.3-2 continued

>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

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.

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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.

Table F.3-3—Response statuses

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

See PS 3.7 for response status codes.

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 SCP. This operation shall be invoked through the DIMSE N-SET Service used in conjunction with the appropriate Detached Study Management SOP Instance.

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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.

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.

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

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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.

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.

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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 Annex A of 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:

— 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)

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Table F.3-5 continued

Study Created Continued	1	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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Table F.3-5 continued

Study Scheduled continued	2	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)
		>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)

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Table F.3-5 continued

Study Completed continued	5	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
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 Annex A of 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 Annex A of 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;]

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[- 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 Annex A of 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 Annex A of 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 formatted as defined in Annex A of 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 Standard.

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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.

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

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.

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 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.

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.

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Table F.4-2—Study component management SOP class N-CREATE attributes

Atttribute Name	Tag	Requirement Type (SCU/SCP)
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)
>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)

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Table F.4-2 continued

>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.)
>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.]

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Table F.4-2 continued

>>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

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.

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.

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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.

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.

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F.4.2.2.4 Status codes

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

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
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)
>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.)

Table continued on next page

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Table F.4-3 continued

>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.]
>>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.4.2.3 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.

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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.

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.

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.

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."

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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)
>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)

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Table F.4-4 continued

>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)
>>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

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Table F.4-5—Response statuses

Service status	Further meaning	Response status codes
Warning	Requested optional Attributes are not supported	0001

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 Annex A of 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 Annex A of 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 Annex A of 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 Annex A of 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:

— operations which it performs

— notifications which it invokes

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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 Annex A of 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 Annex A of 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 Annex A of 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 Annex A of 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 Annex A of 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 Annex A of 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 Annex A of 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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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 Annex A of 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.6.4.2 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 Annex A of 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 G
(Normative)
Results management service class

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.

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 and time and the recorder.

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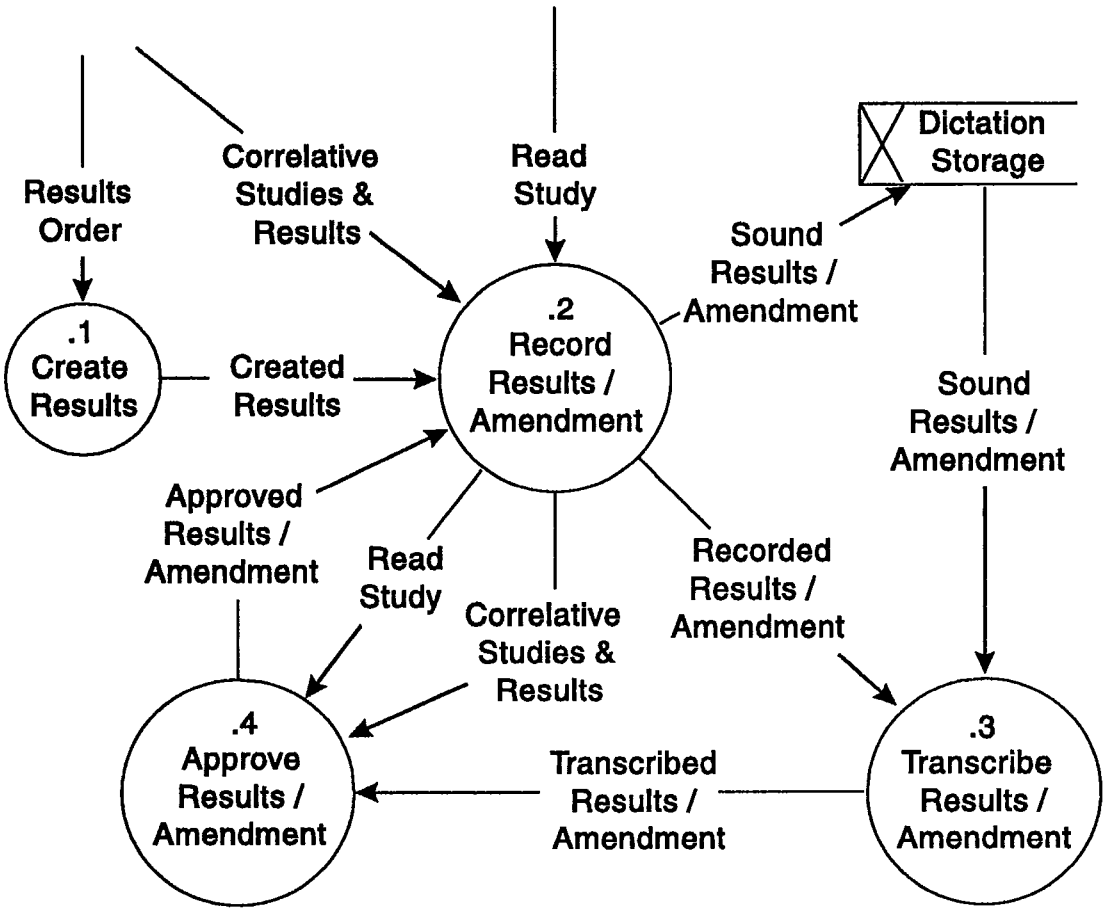

Figure G.1-1—Results management functional model

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.

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.

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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.

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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.

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.

Table G.3-1—DIMSE-N service group

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

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

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.

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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.

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

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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 Part 7 of the DICOM Standard.

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.

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.

Table G.3-3—Response statuses

Service status	Further meaning	Response status codes
Warning	Requested optional Attributes are not supported	0001

See PS 3.7 for response status codes.

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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.

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 Annex A of PS 3.2.

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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)

Table continued on next page

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Table G.3-4 continued

Results Created continued	1	All other defined Attributes		-/3
Results Deleted	2	Results ID	(4008,0040)	-/2
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 Annex A of 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 Annex A of PS 3.2.

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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 Annex A of 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 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.

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

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

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.

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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
>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

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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).

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.

Table G.4-3—Response statuses

Service status	Further meaning	Response status codes
Warning	Requested optional Attributes are not supported	0001

See PS 3.7 for response status codes.

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G.4.2.2 SET INTERPRETATION 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 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.

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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.

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."

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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)
		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

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Table G.4-5 continued

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)
		>Code Meaning	(0008,0104)	-/1C (Required if sequence is present)
		Interpretation Status ID	(4008,0212)	-/2

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Table G.4-5 continued

Interpretation Deleted	5			
Interpretation Updated	6	All updated Attributes		-/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 Annex A of 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 Annex A of 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 Annex A of 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;]

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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

— 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 Annex A of 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 Annex A of 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 Annex A of 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.

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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 Annex A of 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 Annex A of 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.

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 Annex A of 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.

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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 Annex A of 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 Annex A of 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.6.4.2 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 Annex A of PS 3.2.

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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
(Normative)
Print management service class

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.

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).

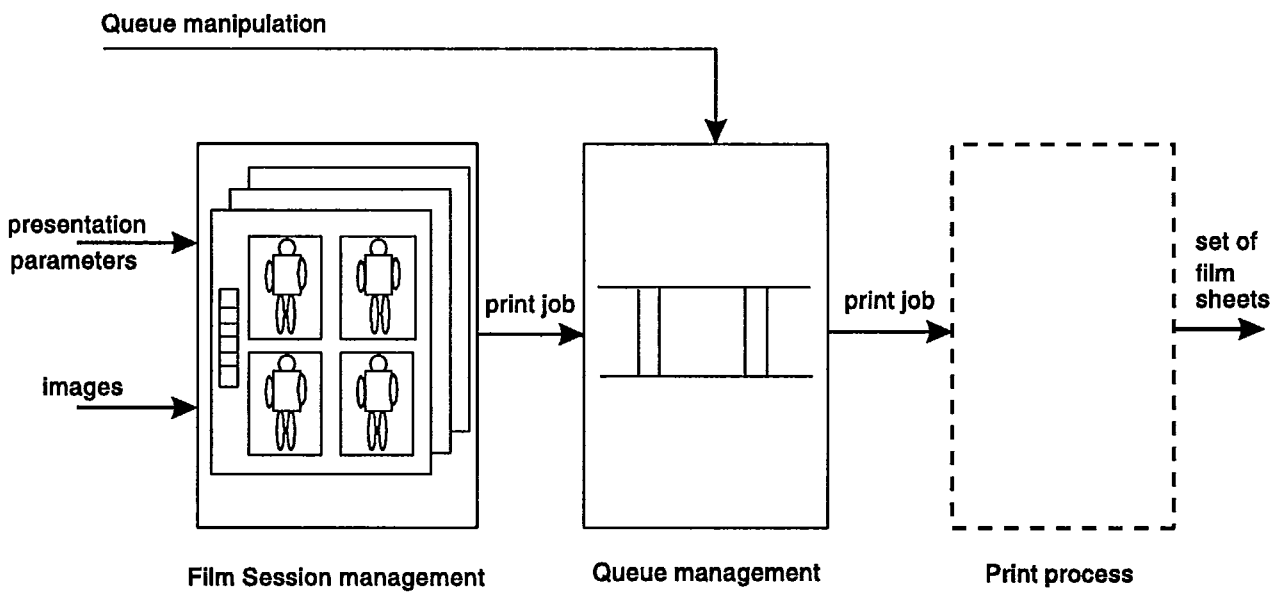

Figure H.2-1—Print management data flow model

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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 a sequence of grayscale transformations and spatial transformations that converts an original image into a printed image.

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.

The following types of grayscale transformations are defined:

— 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, OD for film digitizers). The Modality LUT is modality dependent and is part of the 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 module.

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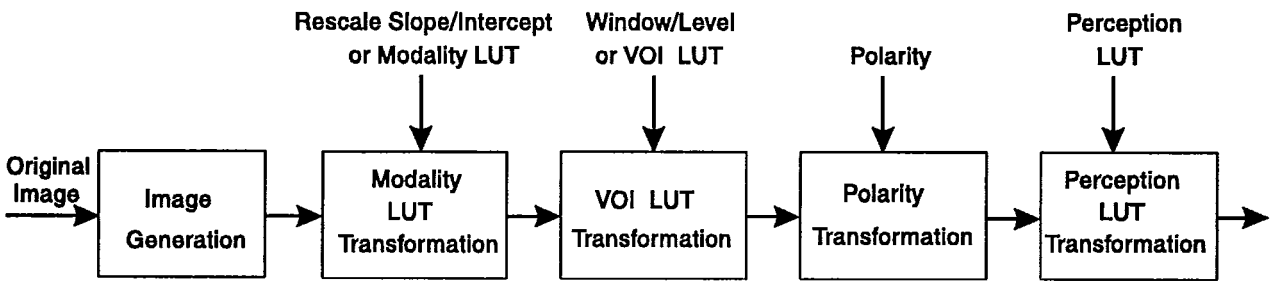

Figure H.2-2—Print management data flow model

— Value of interest (VOI) LUT transformation: transforms the modality pixel values into pixel values which are meaningful for the user or the application. The semantics of the VOI pixel values are defined by the Photometric Interpretation (0028,0004) (see PS 3.3): if the Photometric Interpretation is MONOCHROME1 then a minimum VOI pixel value will be displayed as white; if the Photometric Interpretation is MONOCHROME2 then a minimum VOI pixel value will be displayed as black. The VOI LUT is either part of the Image IOD or part of the Image Box IOD. In the case of a linear transformation, the VOI LUT Box 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 module (as part of the Image IOD) or by the VOI LUT Box IOD (referenced by the Image Box IOD). The VOI LUT shall not have any sections with negative slope. If the VOI LUT is part of both the Image IOD and the Image Box IOD then the Image Box related VOI LUT shall have precedence over the Image related VOI LUT.

— Polarity transformation: specifies whether minimum VOI pixel values shall be displayed as black or white. If Polarity (2020,0020) is NORMAL then the VOI pixels will be displayed as specified by Photometric Interpretation; if Polarity is REVERSE then the VOI pixels will be displayed with the opposite polarity as specified by Photometric Interpretation. Polarity (2020,0020) is an Attribute of the Image Box IOD.

— Perception LUT transformation: transforms the polarity pixel values into optical density related values which are optimal for human perception. The Perception LUT depends on the type of display (e.g. soft copy, hard copy). The Perception LUT is not addressed by this version of the DICOM Standard.

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.

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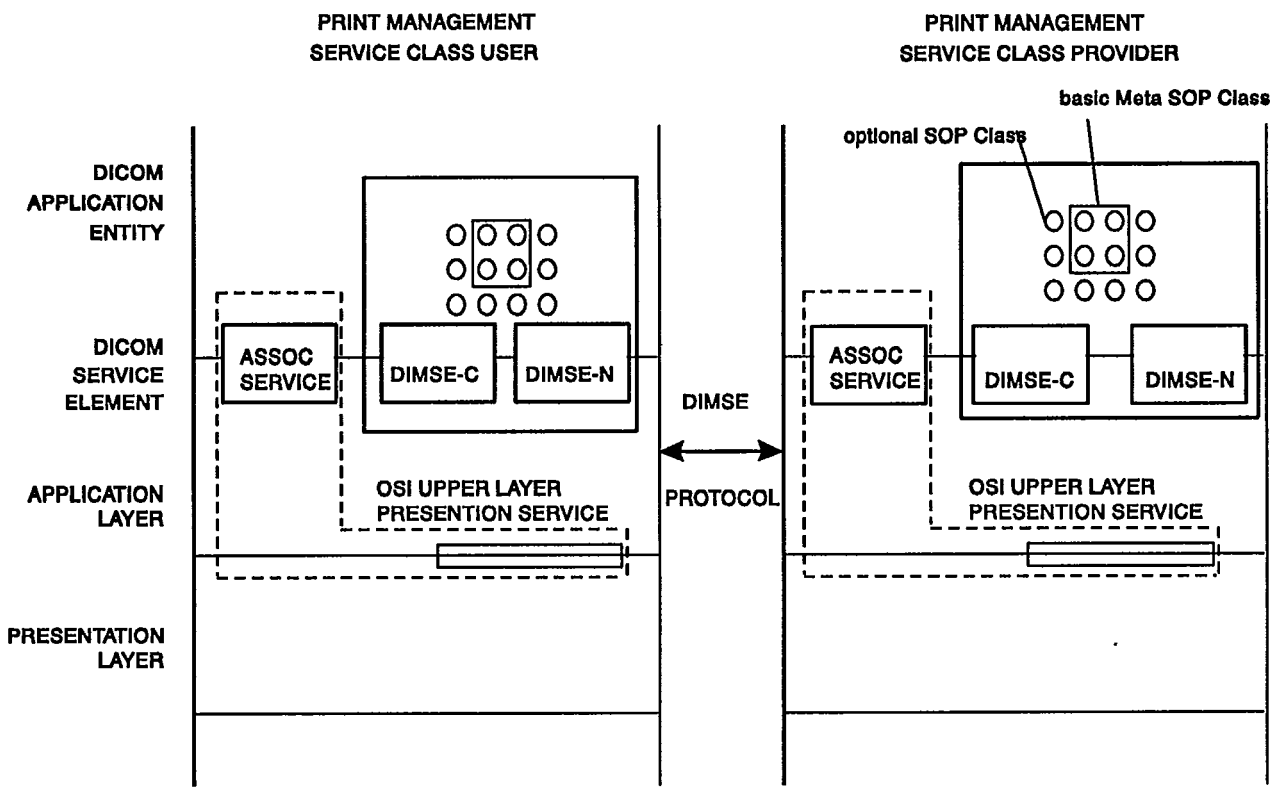

Figure H.2-3—Print management service class structure

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.

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.

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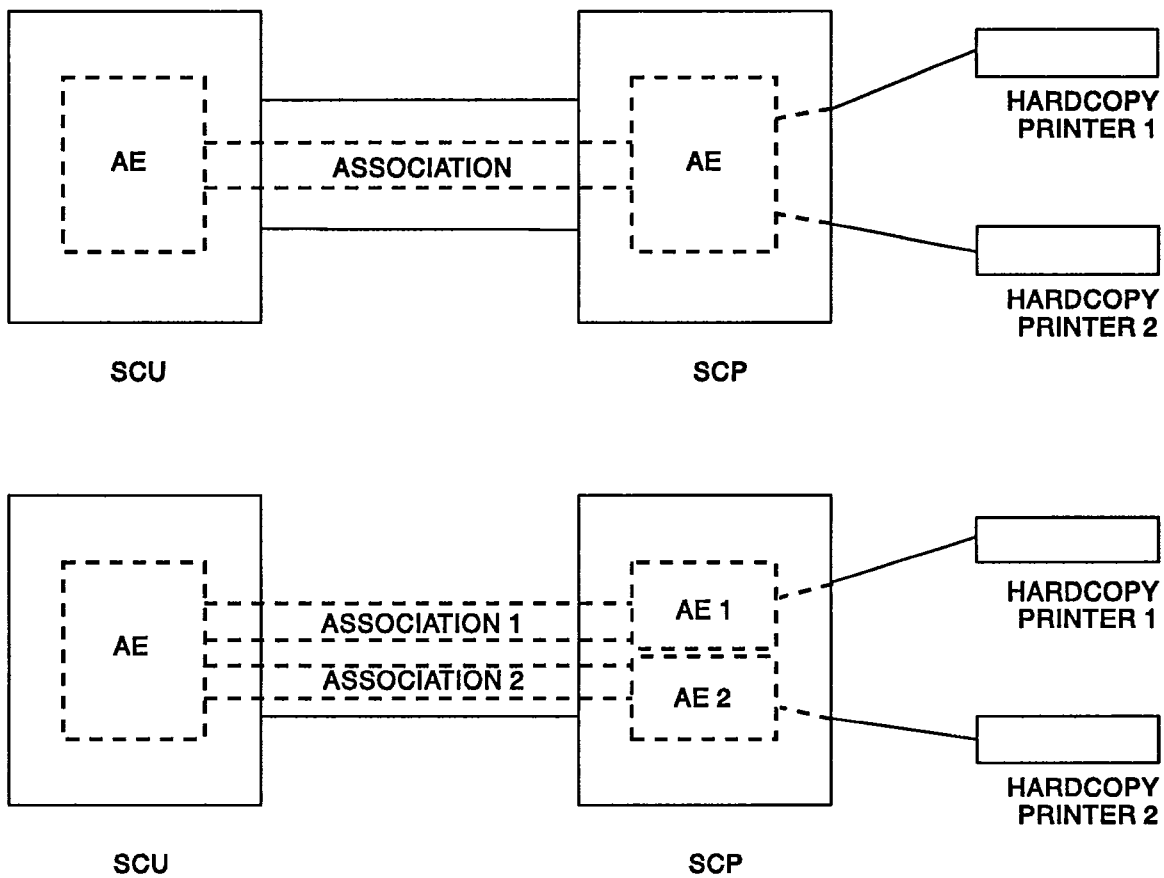

Figure H.2-4—Configurations for printing on multiple printers

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:

— 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.

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— 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 or return a WARNING status ("Invalid Attribute Value," code 0106H). 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 or a WARNING status ("Invalid Attribute Value," code 0106H). 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 or return a WARNING status ("No such Attribute," code 0105H). 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.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 predefined group of SOP Classes. The following Print Management Meta SOP Class Instances are defined:

— Basic Grayscale Print Management Meta SOP Class

— Basic Color Print Management Meta SOP Class

— Referenced Grayscale Print Management Meta SOP Class

— Referenced Color Print Management Meta SOP Class

Any implementation of the Print Management Service Class is required to support at least one of the Basic Print Management Meta SOP Classes. In addition the SCU/SCP may support optional Meta SOP and SOP Classes.

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.

At Association setup, the negotiation process between the Print Management SCU and SCP shall occur at the Meta SOP Class level. In addition, optional SOPs may be negotiated. 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.

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

— predefined film layouts (image display formats)

— basic presentation parameters on film session, film box and image box level

— basic device management

NOTE— The functionality of the Basic Print Management Meta SOP Class corresponds with the print functionality of the ACR-NEMA 2.0 Standard.

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The Referenced Print Management Meta SOP Classes provide additional functionality to support printing of modality specific images. This includes applying Lookup Tables to the image pixel data.

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

The Meta SOP Class is defined by the following set of supported SOP Classes.

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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
Referenced Image Box SOP Class	H.4.3.3	M/M
Printer SOP Class	H.4.6	M/M
VOI LUT Box SOP Class	H.4.7	U/M

One or more Image Storage SOP Classes which support grayscale images shall be supported by both the SCU and the SCP in conjunction with this Meta SOP Class.

The meaning of the Usage SCU/SCP is described in Section H.2.4.

The Referenced Grayscale Print Management Meta SOP Class UID has the value "1.2.840.10008.5.1.1.9.1."

H.3.2.2.4 Referenced 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
Referenced Image Box SOP Class	H.4.3.3	M/M
Printer SOP Class	H.4.6	M/M

One or more Image Storage SOP Classes which support color images shall be supported by both the SCU and the SCP in conjunction with this Meta SOP Class.

The meaning of the Usage SCU/SCP is described in Section H.2.4.

The Referenced Color Print Management Meta SOP Class UID has the value "1.2.840.10008.5.1.1.18.1."

H.3.3 *Optional SOP classes*

H.3.3.1 DESCRIPTION

The optional SOP Classes address functionality beyond the Print Management Meta SOP Classes. One or more optional SOP Classes may be used in addition to the Print Management Meta SOP Class.

The following functionality is supported by the optional SOP Classes:

— annotation
— tracking the printing of the print session
— overlays

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H.3.3.2 LIST OF OPTIONAL SOP CLASSES

The following optional SOP Classes may be used in conjunction with any of the 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
Image Overlay Box SOP Class	H.4.8	U/U

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
- list of supported optional SOP Class Attributes and DIMSE Service Elements

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

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.

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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
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

NOTE— 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.

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. A Failure status code shall indicate that the SCP has not created the SOP Instance.

A Warning status code shall indicate that the SCP has created the SOP Instance but the SCU has no control over the memory allocation scheme.

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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.

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 of the Film Session SOP Class may be updated.

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.

A SUCCESS status code indicates that the SCP has updated the specified Attributes of the SOP Instance. A FAILURE status code indicates that the SCP has not updated the SOP Instance. A WARNING status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

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 the information describing the film session is deleted.

The Basic Film Session SOP Instance hierarchy shall consist of one Basic Film Session SOP Instance, one or more Basic Film Box SOP Instances, one or more Image Box SOP Instances, and zero or more Basic Annotation 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.

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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 return the status code of the requested SOP Instance hierarchy deletion.

The SCP shall not delete Image SOP Instances or VOI LUT Box SOP Instances 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 or VOI LUT Box SOP Instances.

A Failure status code shall indicate that the SCP has not deleted the specified SOP Instance hierarchy.

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.

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 Class, the Action Reply argument is not contained in the N-ACTION response.

H.4.1.2.4.2 Status

The status values which are specific for this SOP Class are defined in Table H.4-4.

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.

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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

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
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 position collision : multiple images assigned to single image position	C604
	Image size is larger than image box size (by using the specified magnification value)	C603

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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.

A Warning status code shall indicate that the SCP is not capable of printing the film session in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

A Failure status code shall indicate that the SCP has not printed the film session.

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, and zero or more film related Annotation Box SOP Instances.

H.4.2.2 DIMSE SERVICE GROUP

Table H.4-5 shows DIMSE Services applicable to the IOD.

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.

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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.

The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.2.2.1.2 Status

There are no specific status codes.

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.

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.

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The SCP shall return the status code of the requested SOP Instance creation.

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 Annotation 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
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

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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.

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
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

The meaning of the Usage SCU/SCP is described in Section H.2.4.

H.4.2.2.2.2 Status

There are no specific status codes.

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.

A Failure status code shall indicate that the SCP has not updated the SOP Instance. A WARNING status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

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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.

The Basic Film Box SOP Instance hierarchy shall consist of one Basic Film Box SOP Instance, one or more Image Box SOP Instances, and zero or more Basic Annotation 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 SCP shall not delete Image SOP Instances or VOI LUT Box SOP Instances 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 or VOI LUT Box SOP Instances.

H.4.2.2.4 N-ACTION

The N-ACTION is used to print one or more copies of a single film of the film session.

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 does not support the Print Job SOP Class, the Action Reply argument is not contained in the N-ACTION response.

H.4.2.2.4.2 Status

The status values which are specific for this SOP Class are defined as shown in Table H.4-8.

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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

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
Failure	Unable to create Print Job SOP Instance; print queue is full	C602
	Image position collision : multiple images assigned to single image position	C604
	Image size is larger than image box size (by using the specified magnification value)	C603

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.

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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.

A Warning status code shall indicate that the SCP is not capable of printing the film in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

A Failure status code shall indicate that the SCP has not printed the film session.

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.

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.

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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.

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.

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
Failure	Insufficient memory in printer to store the image	C605

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 Preformatted Grayscale Image Sequence (2020,0110).

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.

A Failure status code shall indicate that the SCP has not updated the SOP Instance. A WARNING status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

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."

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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.

Table H.4-10—N-SET attributes

Attribute name	Tag	Usage SCU/SCP
Image Position	(2020,0010)	M/M
Preformatted 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
>Pixel Aspect Ratio	(0028,0034)	M/M
>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 Overlay Sequence	(0008,1130)	U/MC (Required if optional Overlay SOP was negotiated)
>SOP Class UID	(0008,1150)	MC/M (Required if sequence is present)
>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

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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.

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
Failure	Insufficient memory in printer to store the image	C605

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Table H.4-11—N-SET attributes

Attribute name	Tag	Usage SCU/SCP
Image Position	(2020,0010)	M/M
Preformatted 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)	M/M
>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 Overlay Sequence	(0008,1130)	U/MC (Required if optional Overlay SOP was negotiated.
>SOP Class UID	(0008,1150)	MC/M (Required if sequence is present)
>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

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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 Preformatted Color Image Sequence (2020,0111).

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.

A Failure status code shall indicate that the SCP has not updated the SOP Instance. A Warning status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

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

H.4.3.3.1 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 Referenced 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 Referenced Image Box SOP Instance refers to zero or one Image SOP Instance, zero or one VOI LUT Box SOP Instance, and zero or one Image Overlay Box SOP Instance.

H.4.3.3.2 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 Referenced 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.

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H.4.3.3.2.1 N-SET

The N-SET may be used to update an instance of the Referenced Image Box SOP Class.

H.4.3.3.2.1.1 Attributes

The Attributes which may be updated are shown in Table H.4-12.

Table H.4-12—N-SET attributes

Attribute name	Tag	Usage SCU/SCP
Image Position	(2020,0010)	M/M
Referenced Image Sequence	(0008,1140)	M/M
>Referenced SOP Class UID	(0008,1150)	M/M
>Referenced SOP Instance UID	(0008,1155)	M/M
>Referenced Frame Number	(0008,1160)	MC/M (Required if the Referenced SOP Class UID (0008,1150) references a multi-frame image)
Polarity	(2020,0020)	U/M
Referenced VOI LUT Box Sequence	(2020,0140)	U/M
>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 Overlay Sequence	(0008,1130)	U/MC (Required if optional Overlay SOP was negotiated)
>Referenced SOP Class UID	(0008,1150)	MC/M (Required if sequence is present)

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Table H.4-12 continued

>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 SOP Class UID (0008,1150) references a multi-frame overlay)
Magnification Type	(2010,0060)	U/U
Smoothing Type	(2010,0080)	U/U
Requested Image Size	(2020,0030)	U/U

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.

H.4.3.3.2.1.2 Status

The status values which are specific for this SOP Class are defined as follows.

Status	**Meaning**	**Code**
Failure	Insufficient memory in printer to store the image	C605
	More than one VOI LUT Box contained in the image	C606

H.4.3.3.2.1.3 Behavior

The SCU uses the N-SET to request the SCP to update a Referenced Image Box SOP Instance. The SCU shall only specify the SOP Instance UID of a Referenced 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.

The Referenced Image, VOI LUT Box, and Overlay Sequences specified shall refer to an Image IOD, VOI LUT Box, or Standalone Overlay IOD that has been previously stored on the SCP.

If the image box references a VOI LUT Box and the referenced image also contains one or more VOI LUTs, the VOI LUT referenced by the image box shall be applied to the image and the VOI LUTs contained in the image shall be ignored by the SCP.

If the image box does not reference a VOI LUT Box and the referenced image contains more than one VOI LUT, the SCP shall return a status code of Failure.

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If the Image Overlay Box is not specified then any overlay planes contained in the image are OR'd and printed with the image in a transparent way.

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 Referenced Image Sequence (0008,1140).

The SCU shall offer and the SCP shall accept Image SOP Classes only on the same Association as the one supporting Print Management.

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.

A Failure status code shall indicate that the SCP has not updated the SOP Instance. A Warning status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

H.4.3.3.3 SOP class definition and UID

The Referenced Image Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.4.2."

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.

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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

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.

A Failure status code shall indicate that the SCP has not updated the SOP Instance. A Warning status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

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.

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The Print Job SOP Class is created by N-ACTION operation of the Film Session SOP Class or the Film Box 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.

H.4.5.2.1.1 Attributes

The arguments of the N-EVENT-REPORT are defined as shown in Table H.4-14.

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.

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H.4.5.2.2.1 Attributes

The Attributes which may be retrieved are shown in Table H.4-15.

The meaning of the Usage SCU/SCP is described in Section H.2.4.

Table H.4-14—Notification event information

Event type name	Event	Attribute	Tag	Usage
PENDING	1	Printer Name	(2110,0030)	U/U
		Film Session Label	(2000,0050)	U/U
		Execution Status Info	(2100,0030)	U/M
PRINTING	2	Printer Name	(2110,0030)	U/U
		Film Session Label	(2000,0050)	U/U
		Execution Status Info	(2100,0030)	U/M
DONE	3	Printer Name	(2110,0030)	U/U
		Film Session Label	(2000,0050)	U/U
		Execution Status Info	(2100,0030)	U/M
FAILURE	4	Printer Name	(2110,0030)	U/U
		Film Session Label	(2000,0050)	U/U
		Execution Status Info	(2100,0030)	U/M

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

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

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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.

A Failure status code shall indicate that the SCP has not retrieved the SOP Instance.

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.

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.

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Table H.4-16—Notification event information

Event type name	Event	Attribute	Tag	Usage
NORMAL	1			
WARNING	2	Printer Name	(2110,0030)	U/U
		Printer Status Info	(2110,0020)	U/M
FAILURE	3	Printer Name	(2110,0030)	U/U
		Printer Status Info	(2110,0020)	U/M

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

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.

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.

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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 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.4.6.3 PRINTER STATUS INFORMATION

Status Information is defined in PS 3.3. Implementation specific warning and error codes shall be defined in the Conformance Statement.

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*

H.4.7.1 IOD DESCRIPTION

The VOI LUT Box IOD is an abstraction of a Value Of Interest look-up table (see Section H.2.1.2). The VOI LUT Box transforms the modality pixel values into pixel values which are meaningful for the user or the application. The VOI LUT Box pixel values are proportional to luminance. The VOI LUT Box shall not have any sections with negative slope. The VOI LUT Box transformations are only meaningful for grayscale images.

In the case of a linear transformation, the VOI LUT Box is described by the Window Center (0028,1050) and Window Width (0028,1051).

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If the VOI LUT Box is not specified then a linear VOI is used.

The VOI LUT Box is referenced by the Image Box IOD.

H.4.7.2 DIMSE SERVICE GROUP

Table H.4-18 shows DIMSE Services applicable to the IOD.

Table H.4-18—DIMSE service group

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.4.7.2.1 N-CREATE

The N-CREATE is used to create an instance of the VOI LUT Box SOP Class.

H.4.7.2.1.1 Attributes

The Attribute list of the N-CREATE is defined in Table H.4-19. The Usage specified in the table shall override the Type specification in the Module Attributes Table in PS 3.3.

H.4.7.2.1.2 Status

There are no specific status codes.

H.4.7.2.1.3 Behavior

The SCU uses the N-CREATE to request the SCP to create a VOI LUT 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.

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Table H.4-19—N-CREATE attributes

Attribute name	Tag	Usage SCU/SCP
VOI LUT Box Sequence	(0028,3010)	U/M
> LUT Descriptor	(0028,3002)	MC/M (Required if sequence is present)
>LUT Explanation	(0028,3003)	U/U
>LUT Data	(0028,3006)	MC/M (Required if sequence is present)
Window Center	(0028,1050)	U/M
Window Width	(0028,1051)	U/M
Window Center & Width Explanation	(0028,1055)	U/M

Upon the creation of the VOI LUT Box SOP Instance, the SCP shall append the SOP Class/Instance UID of the created VOI LUT Box SOP Instance to the Referenced VOI Sequence Attribute of the parent Image Box SOP Instance to link the VOI LUT Box SOP Instance to the Image Box SOP Instance.

The SCP shall return the status code of the requested SOP Instance creation.

H.4.7.2.2 N-SET

The N-SET may be used to update an instance of the VOI LUT Box SOP Class.

H.4.7.2.2.1 Attributes

All Attributes of the VOI LUT Box SOP Class may be updated.

H.4.7.2.2.2 Status

There are no specific status codes.

H.4.7.2.2.3 Behavior

The SCU uses the N-SET to request the SCP to update a VOI LUT 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.

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A SUCCESS status code indicates that the SCP has updated the specified Attributes of the SOP Instance. A FAILURE status code indicates that the SCP has not updated the SOP Instance. A Warning status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

H.4.7.2.3 N-DELETE

The N-DELETE is used to delete the VOI LUT Box SOP Instance.

H.4.7.2.3.1 Status

There are no specific status codes.

H.4.7.2.3.2 Behavior

The SCU uses the N-DELETE to request the SCP to delete the VOI LUT Box SOP Instance. The SCU shall specify the VOI LUT Box SOP Instance UID.

The SCP shall delete the specified VOI LUT Box SOP Instance. The SCP shall return the status code of the requested VOI LUT Box SOP Instance deletion.

A Failure status code shall indicate that the SCP has not deleted the specified VOI LUT Box SOP Instance.

H.4.7.3 SOP CLASS DEFINITION AND UID

The VOI LUT Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.22."

H.4.8 *Image overlay box SOP class*

H.4.8.1 IOD DESCRIPTION

The Image Overlay Box IOD is an abstraction of the presentation of an image overlay in an image box. The Image Overlay Box is referenced by the Image Box IOD.

H.4.8.2 DIMSE SERVICE GROUP

Table H.4-20 shows DIMSE Services applicable to the IOD.

Table H.4-20—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.

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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.4.8.2.1 N-CREATE

The N-CREATE is used to create an instance of the Image Overlay Box SOP Class.

H.4.8.2.1.1 Attributes

The Attribute list of the N-CREATE is defined in Table H.4-21.

Table H.4-21—N-CREATE attributes

Attribute name	Tag	Usage SCU/SCP
Referenced Image Box Sequence	(2040,0500)	M/M
>Referenced SOP Class UID	(0008,1150)	M/M
>Referenced SOP Instance UID	(0008,1155)	M/M
Referenced Overlay Plane Sequence	(2040,0010)	U/M
>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 Overlay Plane Groups	(2040,0011)	MC/M (Required if sequence is present)
Overlay Magnification Type	(2040,0060)	U/U
Overlay Smoothing Type	(2040,0070)	U/U
Overlay Foreground Density	(2040,0080)	U/U
Overlay Mode	(2040,0090)	U/U
Threshold Density	(2040,0100)	U/U

H.4.8.2.1.2 Status

There are no specific status codes.

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H.4.8.2.1.3 Behavior

The SCU uses the N-CREATE to request the SCP to create an Image Overlay 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.

Upon the creation of the Image Overlay Box SOP Instance, the SCP shall append the SOP Class/Instance UID of the created Image Overlay Box SOP Instance to the Referenced Image Overlay Box Sequence Attribute of the parent Image Box SOP Instance to link the Image Overlay Box SOP Instance to the Image Box SOP Instance.

The SCP shall return the status code of the requested SOP Instance creation.

H.4.8.2.2 N-SET

The N-SET may be used to update an instance of the Image Overlay Box SOP Class.

H.4.8.2.2.1 Attributes

The Attributes which may be updated are shown in Table H.4-22.

Table H.4-22—N-SET attributes

Attribute name	Tag	Usage SCU/SCP
Referenced Overlay Plane Sequence	(2040,0010)	U/M
>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 Overlay Plane Groups	(2040,0011)	MC/M (Required if sequence is present)
Overlay Magnification Type	(2040,0060)	U/U
Overlay Smoothing Type	(2040,0070)	U/U
Overlay Foreground Density	(2040,0080)	U/U
Overlay Mode	(2040,0090)	U/U
Threshold Density	(2040,0100)	U/U

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H.4.8.2.2.2 Status

There are no specific status codes.

H.4.8.2.2.3 Behavior

The SCU uses the N-SET to request the SCP to update an 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.

A Success status code indicates that the SCP has updated the specified Attributes of the SOP Instance. A FAILURE status code indicates that the SCP has not updated the SOP Instance. A Warning status shall indicate that the SCP is not capable of performing the operation in the specified way. The exact behavior of the SCP is described in the Conformance Statement.

H.4.8.2.3 N-DELETE

The N-DELETE is used to delete the Image Overlay Box SOP Instance.

H.4.8.2.3.1 Status

There are no specific status codes.

H.4.8.2.3.2 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Image Overlay Box SOP Instance. The SCU shall specify the Image Overlay Box SOP Instance UID.

The SCP shall delete the specified Image Overlay Box SOP Instance. The SCP shall return the status code of the requested Image Overlay Box SOP Instance deletion.

A Failure status code shall indicate that the SCP has not deleted the specified Image Overlay Box SOP Instance.

H.4.8.3 SOP CLASS DEFINITION AND UID

The Image Overlay Box SOP Class UID shall have the value "1.2.840.10008.5.1.1.24."

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., Basic Monochrome Print Management Meta SOP Class) and may support additional optional SOP Classes.

The Print Management Service Class does not support extended negotiation.

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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

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)
    N-DELETE (Film Session SOP Instance)

}

N-EVENT-REPORT (PRINTER SOP Instance)

A-RELEASE
```

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H.6.2 *Advanced example*

This example of a Print Management SCU Session is provided for informational purposes only. It illustrates the use of the Referenced Grayscale Print Management Meta SOP Class with the optional Print Job SOP Class option.

```
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)
    {
       C-STORE (IMAGE SOP Instance)

       N-CREATE (VOI LUT Box SOP Instance)

       N-SET (Image Box SOP Instance with references to IMAGE SOP Instance and VOI LUT Box
       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)
    N-DELETE (Film Session SOP Instance)

}

N-EVENT-REPORT (Print Job SOP Instance)

N-EVENT-REPORT (PRINTER SOP Instance)

A-RELEASE
```

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Annex I
(Informative)
Index to attribute tags

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The purpose of NEMA standards, their classification, and status are set forth in certain clauses of the NEMA *Standardization Policies and Procedures* manual and are referenced below:

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National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for their particular needs. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

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A standard of the National Electrical Manufacturers Association defines a product, process, or procedure with reference to one or more of the following: nomenclature, composition, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Standardization Policies and Procedures, p. 1)

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Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the Standards Publication may be capable of otherwise equivalent performance.

(Standardization Policies and Procedures, p. 6)

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National Electrical Manufacturers Association Standards are of three classes, which have received the affirmative vote of at least two-thirds of the Subdivision votes cast in the affirmative or negative:

1. NEMA Standard, which relates to a product, process, or procedure commercially standardized and subject to repetitive manufacture.
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development.
3. Adoptive Standard, which is adopted in whole or in part from the standards of another organization, either domestic, regional, or international.

(Standardization Policies and Procedures, pp. 5)

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(Standardization Policies and Procedures, pp. 5)

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