Digital Imaging and Communications in Medicine (DICOM)

Supplement 17: Modality Performed Procedure Step

CONTENTS

Foreword

ACR (the American College of Radiology) and NEMA (the National Electrical Manufacturers Association) formed a joint committee to develop a Standard for Digital Imaging and Communications in Medicine. This DICOM Standard was developed according to the NEMA Procedures. The ACC (American College of Cardiology) has decided to join this standardization effort with a particular interest in the definition of Digital Media Storage Standards.

This Supplement to the Standard was developed in liaison with other Standard Organizations including CEN TC 251 WG 4 in Europe and JIRA in Japan, with review also by other organizations including 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 a Supplement to the DICOM Standard. It is an extension to PS 3.3, PS 3.4 and PS 3.6 of the published DICOM Standard. The published Parts are:

PS 3.1 —   Introduction and Overview

PS 3.2 —   Conformance

PS 3.3 —   Information Object definitions

PS 3.4 —   Service Class Specifications

PS 3.5 —   Data Structures and Encoding

PS 3.6 —   Data Dictionary

PS 3.7 —   Message Exchange

PS 3.8 —   Network Communication Support for Message Exchange

PS 3.9 —   Point-to-Point Communication Support for Message Exchange

PS 3.10 —   Media Storage and File Format for Data Interchange

PS 3.11 —   Media Storage Application Profiles

PS 3.12 —   Media Formats and Physical Media for Data Interchange

PS 3.13 —   Print Management Point-to Point Communication Support

These Parts are independent but related documents.

Note: This Supplement is influenced by the ISIS (Information System - Imaging System) Model. The ISIS Model is being developed by the American College of Radiology, National Electrical Manufacturers Association, The Collage of American Pathologists Image Exchange Committee (CAP-IEC), CEN/TC 251 WG 4, and Health Level 7 (HL7) as a Real World Model for the domain of the Information System - Imaging System interface. This Supplement uses only the subset of the ISIS Model that contains Objects relevant to the Performed Procedure Step.

Scope and Field of Application

This Supplement of the DICOM Standard defines three SOP Classes related to the performance of a procedure step that acquires images, collectively referred to as the "Modality Performed Procedure Step SOP Classes": the "Modality Performed Procedure Step SOP Class" , the "Modality Performed Procedure Step Retrieve SOP Class and the "Modality Performed Procedure Step Notification SOP Class". These SOP Classes facilitate the transmission of information related to a Performed Procedure Step from a Modality to an Information System (IS) and from the IS to other systems (typically workstations). The details for carrying out the Procedure Step are defined by the attribute values of the Scheduled Procedure Step included in the Modality Worklist SOP Class. Besides the Modality Performed Procedure Step, there may be other Procedure Steps, e.g.:

— Reporting Performed Procedure Step
— Performed Image Processing Step

These Procedure Steps are not covered by this document. The Modality Performed Procedure Step SOP Classes are an extension of the Study Component Management SOP Class. The Modality Performed Procedure Step SOP Classes have been introduced in order to facilitate the use of the Modality Worklist Management SOP Class, to introduce terminology related to the Extended DICOM real-world model and to fully exploit a bi-directional Modality to Information System connection. In various sections of the DICOM Standard, the term "Study Component" is used as an collective name for both the "Study Component" and the "Modality Performed Procedure Step".

The Modality Performed Procedure Step SOP Classes specify what information a modality should send back to the Information System (IS). There are many reasons to send information back to the Information System. The IS needs this data to update its scheduling information, and the creation of a Modality Performed Procedure Step SOP Instance indicates to the IS that the Procedure Step has been started. The IS does not store the images but stores information related to the Modality Performed Procedure Step. This information may include such different categories of data as organizational and medical details of the performance of the Procedure, radiation dose values, billing data and material management data. Furthermore, the IS may use the status values of the Modality Performed Procedure Step to support applications like patient tracking or scheduling of reporting.

The attributes of these SOP Classes may be stored in the Information System and made available to other systems or further processed in the Information System (Dose Values, Billing and Material Management Information). However, there are many different Information Systems using different sets of attributes, and there is not a predominant standard defining the required attributes for Information Systems. These SOP Classes are not intended to enforce a harmonization of all Information Systems in hospitals, therefore many attributes are optional for both the SCU and the SCP. By using only the minimal set of mandatory attributes it is possible for a large number of Information Systems to conform as a SCPs to these SOP Classes. At the same time, using the optional attributes, the Standard offers a way to transmit attribute values useful to more advanced Information Systems.

The details for carrying out a Modality Performed Procedure Step have been entered by users of the Information System and transmitted from the Information System to a modality via the Modality Worklist Management SOP Class. However, this data may change during the execution of the Procedure Step. The actual time may be different from the requested time and, for medical reasons, an operator or physician may decide that the Performed Procedure Step should be carried out differently than requested.

It is important to send the information about what procedure steps were actually performed to the Information System, though the information conveyed with the Imaging Service Request may still be of interest. Accordingly these SOP Classes facilitate the communication of the following information:

— the relations between this Information Entity and other IEs within the DICOM model, i.e. references to other SOP Classes and Information Entities;

— the identification of the images produced by this Modality Performed Procedure Step;

— organizational and medical information acquired during the performance of the Procedure Step, which may or may not differ from the requested (scheduled) information;

— radiation dose values to which the patient was exposed during the performance of this Procedure Step and information related to the dose values;

— billing and material management information which may be communicated within this SOP Class, though the use to which this information is put is beyond the scope of this Standard.

The Modality Performed Procedure Step SOP Classes are related to the Modality Worklist Management SOP Class. The scheduling information in the IS should be updated based on information sent back within the scope of the Modality Performed Procedure Step SOP Classes. It is assumed (but not required) that the Information System is able to use feed-back from the modality, i. e. that both SCPs, of the Modality Worklist Management SOP Class SCP and of the Modality Performed Procedure Step SOP Classes, are supported by the Information System.

Status information of the Modality Performed Procedure Step may be pushed asynchronously to other AEs on the network using the N-EVENT reports of the Modality Performed Procedure Step Notification SOP Class.

Additional information about the Modality Performed Procedure Step may be retrieved by using the N-GET Service of the Modality Performed Procedure Step Retrieve SOP Class.

This Supplement includes a number of Addenda to existing Parts of DICOM:

1.   Part 3 Addenda (Additions to Annex B and Annex C, Section C.4)

2.   Part 4 Addenda (Addition to Annex F)

3.   Part 6 Addenda (Addition to Section 6)

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NEMA Standards Publication PS 3.3 - 1996

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Digital Imaging and Communications in Medicine (DICOM)

8   *Addendum Part 3: Modality Performed Procedure Step Information Object Definitions*

Part 3 Additions

2   **Item 1: Amend Part 3.3 section 7 "DICOM Model of the Real World" with the following text. The changed text is underlined. Figure 7-1 is not modified, and Figures 7-2 and 7-3 have**
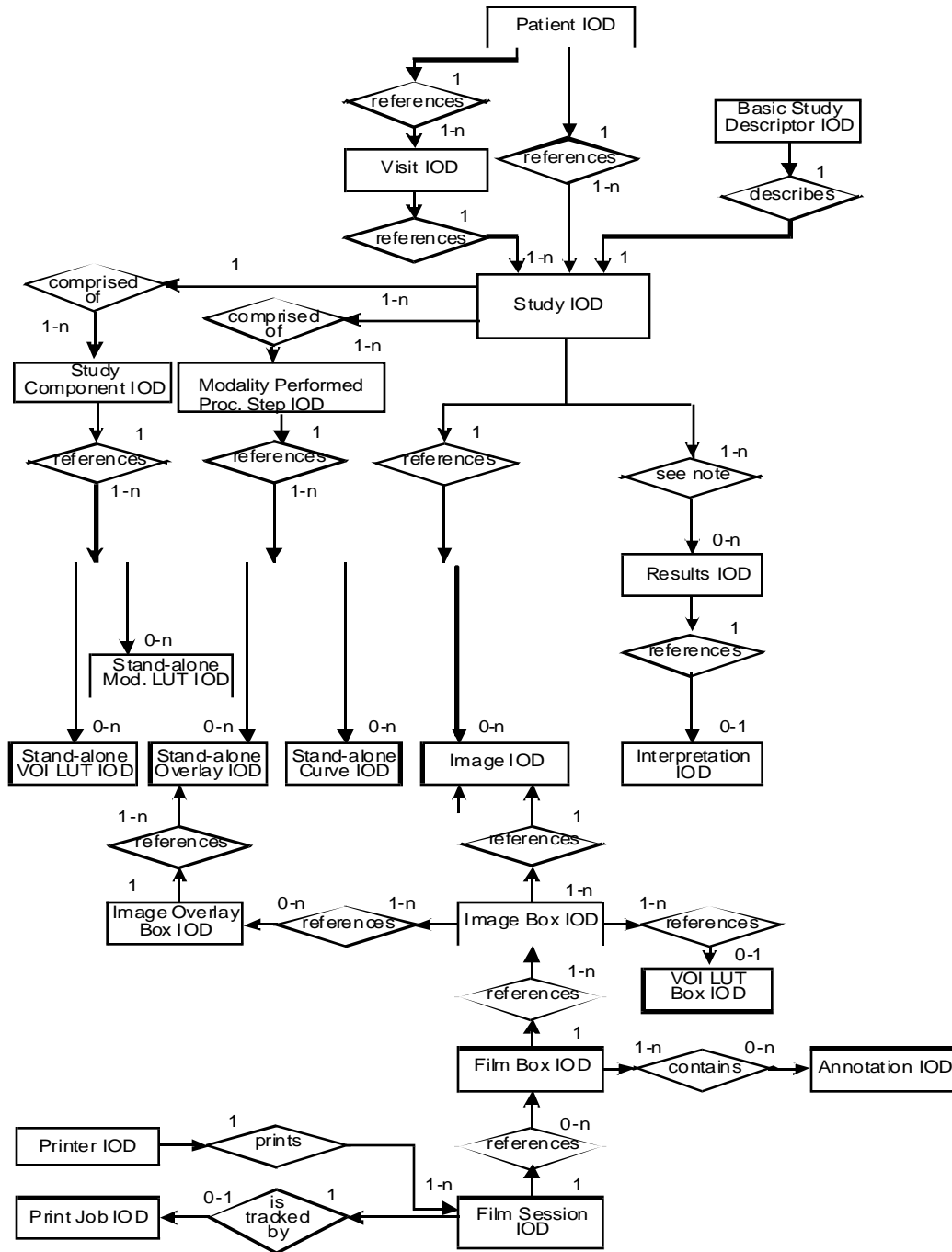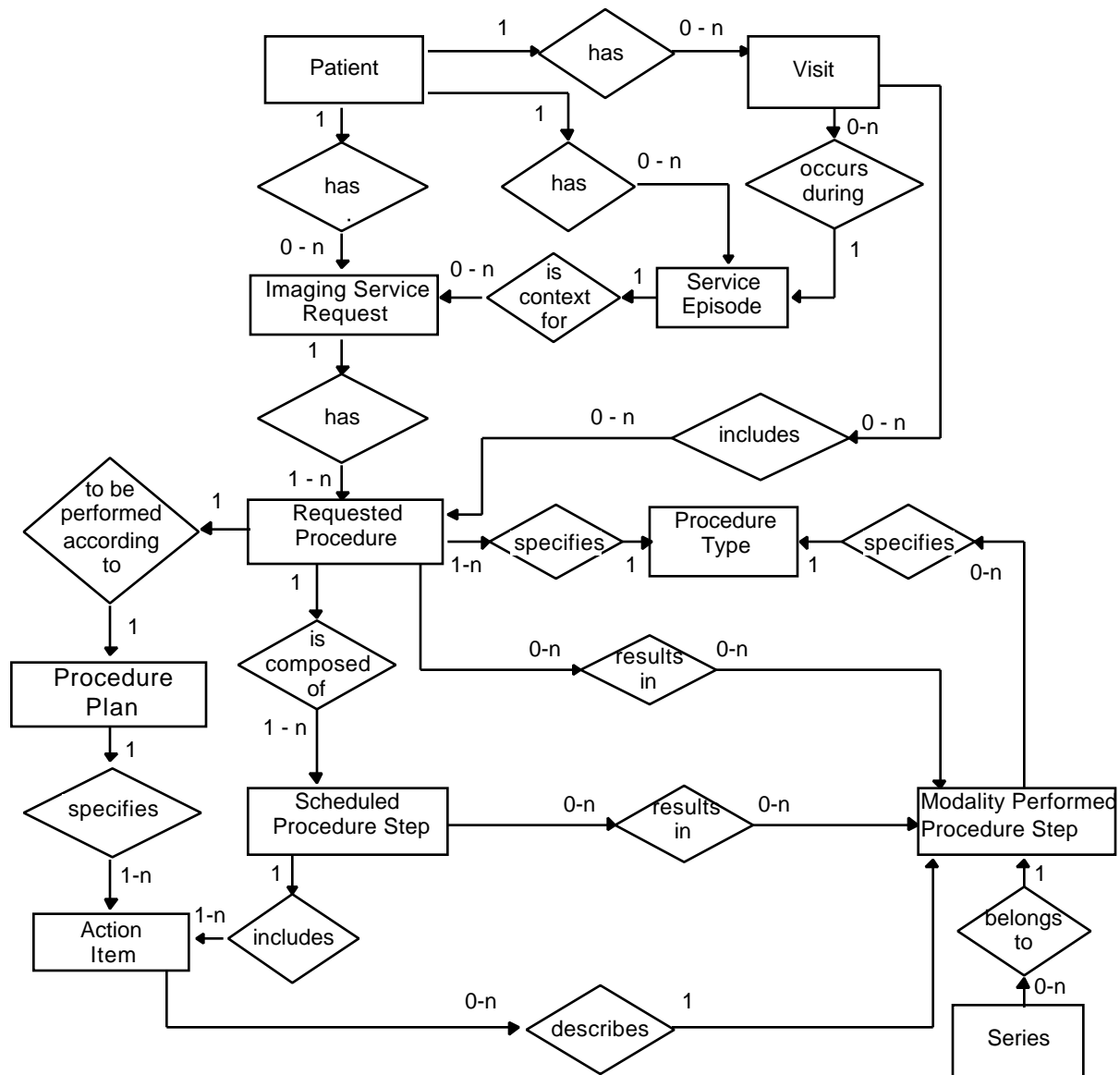4   **the Modality Performed Procedure Step IOD included.**

Figure 7-2
DICOM INFORMATION MODEL

Figure 7-3.
2
MODEL OF THE REAL WORLD FOR THE PURPOSE OF MODALITY-IS INTERFACE

7.3   Extension of the DICOM model of the real-world

2   For the purpose ~~of the Modality Worklist SOP Class in~~ of the Basic Worklist Management Service Class and the Modality Performed Procedure Step SOP Classes an enhancement of the original DICOM Model of the Real-
4   World is made, as depicted in Figure 7-3.

Annex G discusses the relationship of this extension to the original DICOM model of the real world.

6   ~~This subset of the real-world model covers the requirements for the Modality Worklist SOP Class in the Basic Worklist Management Service Class.~~

8   Figure 7-3 is an abstract description of the real world objects invoked in the Modality-IS Interface. It is not to be seen as a database scheme for an implementation.

10   Note: Part of the real world model depicted in Figure 7.3 is influenced by the ISIS (Information System - Imaging System) Model. The ISIS Model is being developed by the ~~American College of Radiology, National Electrical~~
12   ~~Manufacturers Association, ACR-NEMA~~ DICOM Committee, the College of American Pathologists Image Exchange Committee (CAP-IEC), CEN/TC251/WG4/PT4-020: Modality-Information System Interface Project
14   Team, and Health Level Seven (HL7) as the Real World Model for the domain of the Information System - Imaging System interface. The ISIS model is a common mapping of CEN/TC251/WG3/PT-022,
16   CEN/TC251/WG4/PT-020, HL7, CAP-IEC, and ACR-NEMA DICOM Real-World-Models. The semantics of the objects and their attributes in this Standard are described in the ISIS model. This supplement uses only the
18   subset of the ISIS Model that contains objects relevant to the Worklist. The ISIS Model ensures consistency with PT3-022, CAP-IEC, and HL7.

20

7.3.1.6   SCHEDULED PROCEDURE STEP

22   A Scheduled Procedure Step is an arbitrarily defined scheduled unit of service, that is specified by the Procedure Plan for a Requested Procedure. A Scheduled Procedure Step prescribes one or more Action
24   Items (events). A Scheduled Procedure Step involves equipment (e.g. imaging Modality equipment, anesthesia equipment, surgical equipment, transportation equipment), human resources, consumable
26   supplies, location, and time (e.g. start time, stop time, duration). While in the context of imaging services the scheduling of a Procedure Step might include only a general designation of imaging Modality that could be
28   satisfied by multiple pieces of the same equipment type, the performance of one instance of a Scheduled Procedure Step involves one and only one piece of imaging Modality equipment.

30   The performance of a Scheduled Procedure Step may result in the creation of zero or more Modality Performed Procedure Step instances.

32   Notes: 1. The Procedure Step entity is provided to support management of the logistical aspects of procedures (e.g. materials management, human resources, scheduling). The full definition of the contents of Procedure Steps
34   and their constituent action items (events) is implementation dependent and is beyond the scope of this Standard. A single Action Item (event) contained within a given Scheduled Procedure Step might or might not
36   be able to be scheduled in a given facility.

         2. A Scheduled Procedure Step may contribute to more than one Requested Procedure (e.g. a Scheduled
38   Procedure Step requiring an intravenous iodine contrast injection might be shared by an intravenous pyelogram and a CT examination). However, for billing purposes an instance of a Scheduled Procedure Step is
40   typically considered to be a part of only one Requested Procedure.

         3. Typically each Scheduled Procedure Step contains at least one Action Item (event) of a magnitude that
42   would justify an entry in the medical record.

7.3.1.9   MODALITY PERFORMED PROCEDURE STEP

A Performed Procedure Step is an arbitrarily defined unit of service that has actually been performed (not just scheduled). Logically it corresponds to a Scheduled Procedure Step, but real-world conditions may dictate that what is actually performed does not correspond exactly with what was requested or scheduled.

> Note: For example, two or more Scheduled Procedure Steps, Requested Procedures or Imaging Service Requests may have been generated by different Referring Physicians but may be satisfied be a single Performed Procedure Step at the discretion of a Performing Physician or Operator. Alternatively, a single Scheduled Procedure Step may need to be satisfied by multiple Performed Procedure Steps on different types or instances of equipment, due to clinical need or failure conditions, or over extended periods of time.

It contains information describing the type of procedure actually performed.

A Requested Procedure results in the creation of zero or more Performed Procedure Steps.

A Scheduled Procedure Step results in the creation of zero or more Performed Procedure Steps.

The Performed Procedure Step contains information about it's state (e.g. in progress, discontinued or completed).

A Modality Performed Procedure Step is a Performed Procedure Step that results from the acquisition of images from a Patient or other Imaging Subject on a Modality.

It contains information describing the performance of a step of an imaging procedure, including data about the performance of the procedure itself, radiation dose values to which the patient has been exposed if ionizing radiation is in use, and data for billing and material management.

The Modality Performed Procedure Step contains references to zero or more Series of Images and other Composite SOP Instances that may be created as part of the procedure step. A particular Series is part of only one Modality Performed Procedure Step.

Item 2: Insert the following sections in Part 3, Annex B

B.17   MODALITY PERFORMED PROCEDURE STEP INFORMATION OBJECTS DEFINITION

B.17.1   IOD Description

A "Modality Performed Procedure Step Information Object Definition" is an abstraction of the information that describes the activities, conditions and results of an imaging procedure performed on a modality. It contains information about the Modality Performed Procedure Step (MPPS) and its relations to other Information Entities of the DICOM real-world model as introduced in PS 3.3.

A Modality Performed Procedure Step is related to the actual imaging procedure carried out at the modality. Other types of Performed Procedure Steps, e.g. reporting or image processing, are not covered by the Modality Performed Procedure Step IOD. The information gathered includes data about the performance of the procedure itself, radiation dose values to which the patient has been exposed, and data for billing and material management. The Modality Performed Procedure Step IOD includes general PPS modules and image acquisition specific ones, such as Image Acquisition Results, Radiation Dose and Billing and Material Management.

B.17.2   IOD Modules

2 Table B.17.2-1 lists the modules which make up the Modality Performed Procedure Step IOD.

Table B.17.2-1
4 **MODALITY PERFORMED PROCEDURE STEP IOD MODULES**

Module	Reference	Module Description
SOP Common	C.12.1	Contains SOP common information
Performed Procedure Step Relationship	C.4.13	References the related SOPs and IEs.
Performed Procedure Step Information	C.4.14	Includes identifying and status information as well as place and time
Image Acquisition Results	C.4.15	Identifies Series, Images, Standalone LUTs, Overlays and Curves related to this PPS and specific image acquisition conditions.
Radiation Dose	C.4.16	Contains radiation dose information related to this Performed Procedure Step.
Billing and Material Management Codes	C.4.17	Contains codes for billing and material management.

6   Notes: The Radiation Dose Module (C.4.16) does not have meaning if the modality does not generate ionizing radiation or if the generator does not provide the area dose product.

8 **Item 3: Insert the following sub-sections in Part 3, Annex C, Section C.4**

C.4.13   Performed Procedure Step Relationship

10 Table C.4.13-1 specifies the Attributes used to reference other SOP Classes and other Information Entities of the DICOM real-world model as defined in PS 3.3 Section 7.3.1.6.

12 **Table C.4.13-1**
PERFORMED PROCEDURE STEP RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	Attribute Description
Patient's Name	(0010,0010)	Patient's full legal name.
Patient ID	(0010,0020)	Primary hospital identification number or code for the patient.
Patient's Birth Date	(0010,0030)	Date of birth of the named patient
Patient's Sex	(0010,0040)	Sex of the named Patient. Enumerated Values: M = male F = female O = other
Referenced Patient Sequence	(0008,1120)	Uniquely identifies the Patient SOP Instance.

>Referenced SOP Class UID	(0008,1150)	Uniquely identifies the referenced SOP Class
>Referenced SOP Instance UID	(0008,1155)	Uniquely identifies the referenced SOP Instance
Scheduled Step Attribute Sequence	(0040,0270)	Sequence containing attributes that are related to the scheduling of the Procedure Step. The Sequence may have one or more Items.
>Study Instance UID	(0020,000D)	Unique identifier for the Study
>Referenced Study Sequence	(0008,1110)	Uniquely identifies the Study SOP Instance associated with this Scheduled Procedure Step. This Sequence shall have only one Item.
>>Referenced SOP Class UID	(0008,1150)	Uniquely identifies the SOP Class.
>>Referenced SOP Instance UID	(0008,1155)	Uniquely identifies the SOP Instance.
>Accession Number	(0008,0050)	A departmental IS generated number which identifies the order for the Study.
>Placer Order Number/Imaging Service Request	(0040,2006)	The order number assigned to the Imaging Service Request by the party placing the order.
>Filler Order Number/Imaging Service Request	(0040,2007)	The order number assigned to the Imaging Service Request by the party filling the order.
>Requested Procedure ID	(0040,1001)	Identifier of the related Requested Procedure
>Requested Procedure Description	(0032,1060)	Institution-generated administrative description or classification of Requested Procedure.
>Placer Order Number/Procedure	(0040,1006)	The order number assigned to the Requested Procedure by the party placing the order.
>Filler Order Number/Procedure	(0040,1007)	The order number assigned to the Requested Procedure by the party filling the order.
>Scheduled Procedure Step ID	(0040,0009)	Identifier of the related Scheduled Procedure Step
>Scheduled Procedure Step Description	(0040,0007)	Institution-generated description or classification of the Scheduled Procedure Step to be performed.
>Scheduled Action Item Code Sequence	(0040,0008)	Sequence describing the Scheduled Action Item(s) following a specific coding scheme. This sequence contains one or more Action Items.
>>Code Value	(0008,0100)	The code value (defined by the coding scheme) that represents the type of Scheduled Action Item.
>>Coding Scheme designator	(0008,0102)	The code from table D-2 designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104).
>>Code Meaning	(0008,0104)	The Scheduled Procedure Step that is represented by the Code Value (0008,0100).

Note: The patient information is included in order to relate the Modality Performed Procedure Step SOP Instance to
2   the Study Management SOP Instance and other associated IODs in case the SCU (the modality) is unable to
            obtain or use the Study Instance UID created by the Information System.
4

C.4.14   Performed Procedure Step Information

6 Table C.4.14-1 defines the general attributes which may be used by all specific Procedure Steps.

Table C.4.14-1
8 **PERFORMED PROCEDURE STEP INFORMATION MODULE ATTRIBUTES**

Attribute Name	Tag	Attribute Description
Performed Station AE Title	(0040,0241)	AE title of the modality on which the Performed Procedure Step was performed.
Performed Station Name	(0040,0242)	An institution defined name for the modality on which the Performed Procedure Step was performed.
Performed Location	(0040,0243)	Description of the location at which the Performed Procedure Step was performed
Performed Procedure Step Start Date	(0040,0244)	Date on which the Performed Procedure Step started.
Performed Procedure Step Start Time	(0040,0245)	Time at which the Performed Procedure Step started.
Performed Procedure Step ID	(0040,0253)	User or equipment generated identifier of that part of a Procedure that has been carried out within this step.
Performed Procedure Step End Date	(0040,0250)	Date on which the Performed Procedure Step ended.
Performed Procedure Step End Time	(0040,0251)	Time at which the Performed Procedure Step ended.
Performed Procedure Step Status	(0040,0252)	Contains the state of the Performed Procedure Step. Enumerated Values: IN PROGRESS = Started but not complete DISCONTINUED = Canceled or unsuccessfully terminated COMPLETED = Successfully completed
Performed Procedure Step Description	(0040,0254)	Institution-generated description or classification of the Procedure Step that was performed.
Comments on the Performed Procedure Step	(0040,0280)	User-defined comments on the Performed Procedure Step.
Performed Procedure Type Description	(0040,0255)	A description of the type of procedure performed.
Procedure Code Sequence	(0008,1032)	A sequence that conveys the (single) type of procedure performed.
>Code Value	(0008,0100)	The code value (defined by the coding scheme) that

		represents the procedure performed.
>Coding Scheme Designator	(0008,0102)	The code from table D-2 designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104).
>Code Meaning	(0008,0104)	The procedure performed that is represented by the Code Value (0008,0100)

C.4.15   Image Acquisition Results

Table C.4.15-1 specifies attributes that describe the acquisition of images during the performance of the Procedure Step and that provide references to the Series, Images and Standalone SOP Instances associated with this Modality Performed Procedure Step.

Table C.4.15-1
IMAGE ACQUISITION RESULTS MODULE ATTRIBUTES

Attribute Name	Tag	Attribute Description
Modality	(0008,0060)	Type of equipment that originally acquired the data used to create the images associated with this Modality Performed Procedure Step. See C.7.3.1.1.1 for Defined Terms.
Study ID	(0020,0010)	User or equipment generated Study Identifier
Performed Action Item Sequence	(0040,0260)	Sequence describing the Action Items performed for this Procedure Step. This sequence may have zero or more Items.
>Code Value	(0008,0100)	The code value (defined by the coding scheme) that represents the type of Performed Action Item.
>Coding Scheme Designator	(0008,0102)	The code from Annex D designating the coding scheme that maps the Code Value onto the Code Meaning.
>Code Meaning	(0008,0104)	The Action Item that is represented by the Code Value.
Performed Series Sequence	(0040,0340)	Attributes of the Series that comprise this Modality Performed Procedure Step. The Sequence may have zero or more Items.
>Performing Physician's Name	(0008,1050)	Name of the physician administering this Series.
>Operator's Name	(0008,1070)	Name of the operator who performed this Series.
>Protocol Name	(0018,1030)	User-defined description of the conditions under which the Series was performed.
>Series Instance UID	(0020,000E)	Unique Identifier of the Series.
>Series Description	(0008,103E)	User provided description of the Series
>Retrieve AE Title	(0008,0054)	Title of the DICOM Application Entity where the Images and Standalone SOP Instances in this Series may be retrieved on the network.

		Note: This duration for which this location remains valid is unspecified.
>Referenced Image Sequence	(0008,1140)	A Sequence that provides reference to one or more sets of Image SOP Class/SOP Instance pairs. The sequence may have zero or more Items.
>>Referenced SOP Class UID	(0008,1150)	Uniquely identifies the referenced SOP Class.
>>Referenced SOP Instance UID	(0008,1155)	Uniquely identifies the referenced SOP Instance.
>Referenced Standalone SOP Instance Sequence	(0040,0220)	Uniquely identifies Standalone IODs such as LUTs, Curves or Overlays related to these images. The sequence may have zero or more Items.
>>Referenced SOP Class UID	(0008,1150)	Uniquely identifies the referenced SOP Class.
>>Referenced SOP Instance UID	(0008,1155)	Uniquely identifies the referenced SOP Instance.

2   Note: The term "Standalone IOD" is used as a generic name for all IODs other than images that conform to the DICOM Composite IOD Information Model, such as Curves, Overlays, LUTs.

4

C.4.16   Radiation Dose

6   Table C.4.16-1 defines the Attributes that may be used to communicate information related to radiation dose values. The attributes are intended to enable the Information System to store Patient exposure to ionizing
8   radiation for legal purposes. Though these attributes are not intended to be used to accurately calculate volume dose distribution, they may serve for some quality control purposes.

10   This module provides a means to communicate radiation dose values but DICOM does not define any requirements for the accuracy of these values, which may be defined in other professional, national or international
12   standards.

The scope of the attributes contained in this module covers the entire acquisition that comprises the Modality
14   Performed Procedure Step. Attributes that relate to single images, such as mAs or kVP, may be included in the Image IODs. It is beyond the scope of DICOM to define what attributes may be required to calculate or estimate area
16   dose product values.

Table C.4.16-1
18   **RADIATION DOSE MODULE ATTRIBUTES**

Attribute Name	Tag	Attribute Description
Anatomic Structure, Space or Region Sequence	(0008,2229)	Anatomic structure, space or region that has been exposed to ionizing radiation. The sequence may have zero or one Items.
>Code Value	(0008,0100)	The code value that represents the anatomic region.
>Coding Scheme Designator	(0008,0102)	The code value from Part 3 Annex D designating the coding scheme for anatomic regions that maps the Code Values onto the Code Meaning.

>Code Meaning	(0008,0104)	The anatomic region that is represented by the Code Value.
Total Time of Fluoroscopy	(0040,0300)	Total duration of X-Ray exposure during fluoroscopy in seconds (pedal time) during this Performed Procedure Step.
Total Number of Exposures	(0040,0301)	Total number of exposures made during this Performed Procedure Step. The number includes non-digital and digital exposures.
Distance Source to Detector (SID)	(0018,1110)	Distance in mm from the source to detector center; SID: Source Image Distance.
Distance Source to Entrance	(0040,0306)	Distance in mm from the source to the surface of the patient closest to the source during this Performed Procedure Step. Note: This may be an estimated value based on assumptions about the patient's body size and habitus.
Entrance Dose	(0040,0302)	Average entrance dose value measured in dGy at the surface of the patient during this Performed Procedure Step. Note: This may be an estimated value based on assumptions about the patient's body size and habitus.
Exposed Area	(0040,0303)	Typical dimension of the exposed area at the detector plane. If Rectangular: row dimension followed by column; if Round: diameter. Measured in mm. Note: This may be an estimated value based on assumptions about the patient's body size and habitus.
Image Area Dose Product	(0018,115E)	Total area-dose-product to which the patient was exposed, accumulated over the complete Performed Procedure Step and measured in dGy*cm*cm, including fluoroscopy. Notes: 1. The sum of the Image Area Dose Product of all images of a Series or a Study may not result in the actual area dose product to which the patient was exposed. 2. This may be an estimated value based on assumptions about the patient's body size and habitus.
Comments on Radiation Dose	(0040,0310)	User-defined comments on any special conditions related to radiation dose encountered during this Performed Procedure Step.

Notes: 1. The Anatomic Region may be deduced from attribute values available within the Modality Worklist Manage-
2   ment SOP Class, such as Reason for Service Request, Reasons for Requested Procedure, Scheduled Proce-
                  dure Step Description and Scheduled Action Item Code Sequence.

4   2. The Image Area Dose Product should take into account collimator position and filters, and the value for the
                  Exposed Area should also take into account collimator position. If the equipment does not provide the
6   Entrance Dose, it may be calculated using Area Dose Product, Exposed Area, SID and an assumed body
                  thickness.

8   3. The Distance Source to Detector (0018,1110) and Exposed Area (0040,0303) are only meaningful if they
                  remain constant for all acquisitions during this Performed Procedure Step.

10

C.4.17   Billing and Material Management Codes

12   The Attributes defined in Table C.4.17-1 provide a means to transmit billing and material management codes
     from a modality to an Information System. It is beyond the scope of this Standard to define all the required
14   coding schemes and the relevant codes.

Table C.4.17-1
16   **BILLING AND MATERIAL MANAGEMENT CODE MODULE ATTRIBUTES**

Attribute name	Tag	Attribute Description
Billing Procedure Step Sequence	(0040,0320)	Contains billing codes for the Procedure Type performed within the Procedure Step. The sequence may have zero or more Items.
>Code Value	(0008,0100)	A code value (defined by the coding scheme) that represents information for billing.
>Coding Scheme Designator	(0008,0102)	A designator for a coding scheme used for billing that maps the Code Values onto the Code Meaning.
>Code Meaning	(0008,0104)	Text description of the billing procedure represented by Code Value (0008,0100).
Film Consumption Sequence	(0040,0321)	Information about the film consumption for this Performed Procedure Step. The sequence may have zero or more Items.
>Number of Films	(2100,0170)	Number of films actually printed.
>Medium Type	(2000,0030)	Type(s) of medium on which images were printed. For Defined Terms see Table C.13-1.
>Film Size ID	(2010,0050	Size(s) of film on which images were printed. For Defined Terms see Table C.13-3.
Billing Supplies and Devices Sequence	(0040,0324)	Chemicals, supplies and devices for billing used in the Performed Procedure Step. The sequence may have one or more Items.
>Billing Item Sequence	(0040,0296)	Code values of chemicals, supplies or devices required for billing. The sequence may have zero or one Items.
>>Code Value	(0008,0100)	The code value (defined by the coding scheme) that represents the chemicals or devices.

>>Coding Scheme Designator	(0008,0102)	The identification of a hospital-selected coding scheme.
>>Code Meaning	(0008,0104)	Text description of the chemical or device represented by Code Value (0008,0100).
>Quantity Sequence	(0040,0293)	Sequence containing the quantity of used chemicals or devices. The sequence may have zero or one Items.
>>Quantity	(0040,0294)	Numerical quantity value.
>>Measuring Units Sequence	(0040,0295)	Unit of measurement. The sequence may have zero or one Items.
>>>Code Value	(0008,0100)	A code value (defined by the coding scheme) that represents information for the unit of measurement.
>>>Coding Scheme Designator	(0008,0102)	The code from PS 3.3 Annex D designating the coding scheme applied.
>>>Code Meaning	(0008,0104)	Text description of the unit of measurement represented by Code Value (0008,0100).

2 **C.7.2.1   General Study Module**

Item 4: Modify Table C.7-2 in Part 3, Annex C:

4

Attribute Name	Tag	Type	Attribute Description
Referenced Study Sequence	(0008,1110)	3	A sequence which provides reference to a Study SOP Class/Instance pair. ~~Only a single reference is allowed.~~ The sequence may have zero or more Items. ~~Encoded as~~ sequence of items: (0008,1150) and (0008,1155)

6 **C.7.3.1   General Series Module**

Item 5: Extend and modify Table C.7-4 in Part 3, Annex C with the following attributes and
8 **notes:**

Attribute Name	Tag	Type	Attribute Description
Request Attributes Sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items.

>Requested Procedure ID	(0040,1001)	1C	Identifier which identifies the Requested Procedure in the Imaging Service Request. Required if Sequence Item is present.
>Scheduled Procedure Step ID	(0040,0009)	1C	Identifier which identifies the Scheduled Procedure Step. Required if Sequence Item is present.
>Scheduled Procedure Step Description	(0040,0007)	3	Institution-generated description or classification of the Scheduled Procedure Step to be performed.
>Scheduled Action Item Code Sequence	(0040,0008)	3	Sequence describing the Scheduled Action Item(s) following a specific coding scheme. This sequence contains one or more Action Items.
>>Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the type of Scheduled Action Item. Required if Sequence Item is present.
>>Coding Scheme Designator	(0008,0102)	1C	The code from table D-2 designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). Required if Sequence Item is present.
>>Code Meaning	(0008,0104)	3	The Scheduled Procedure Step that is represented by the Code Value (0008,0100).
Performed Procedure Step ID	(0040,0253)	3	Identification of that part of a Procedure that has been carried out within this step.
Performed Procedure Step Start Date	(0040,0244)	3	Date on which the Performed Procedure Step started.
Performed Procedure Step Start Time	(0040,0245)	3	Time on which the Performed Procedure Step started.
Performed Procedure Step Description	(0040,0254)	3	Institution-generated description or classification of the Procedure Step that was performed.
Referenced Study Component Sequence	(0008,1111)	3	Uniquely identifies the Study Component SOP Instance or Modality Performed Procedure Step SOP Instance to which the Series is related. The Sequence shall have zero or one Item.

2   Note: 1. If the Modality Performed Procedure Step SOP Class is supported as an SCU by a Storage SCU, the SCU is strongly encouraged to support the attribute Referenced Study Component Sequence (0008,1111). This

4   attribute references the Modality Performed Procedure Step SOP Instance, and extraction of this Attribute from an image may allow retrieval of the Modality Performed Procedure Step SOP Instance.

2. If the Modality does not conform to the Modality Performed Procedure Step SOP Class, it is still advisable to include the attributes Performed Procedure Step Start Date (0040,0244), Performed Procedure Step Start Time (0040,0245) and Performed Procedure Step Description (0040,0254) into the Image IODs.

2

Item 6: Replace Part 3.3 Annex G "Integration of Modality Worklist in the Original DICOM Standard (Informative) with the following text. The whole section is repeated here for clarity. The changed text is underlined. Figures G-1 and G-2 have the Modality Performed Procedure Step IOD included.

Annex G   Integration of Modality Worklist and Modality Performed Procedure Step in the Original DICOM Standard (Informative)

DICOM was published in 1993 and effectively addresses image communication for a number of modalities and Image Management functions for a significant part of the field of medical imaging. Since then, many additional medical imaging specialties have contributed to the extension of the DICOM Standard and developed additional Image Object Definitions. Furthermore, there have been discussions about the harmonization of the DICOM Real-World domain model with other standardization bodies. This effort has resulted in a number of extensions to the DICOM Standard. The integration of the Modality Worklist and Modality Performed Procedure Step addresses an important part of the domain area that was not included initially in the DICOM Standard. At the same time, the Modality Worklist and Modality Performed Procedure Step integration makes a steps in the direction of harmonization with other standardization bodies (CEN TC 251, HL7, etc.).

The purpose of this ANNEX is to show how the original DICOM Standard relates to the extension for Modality Worklist Management and Modality Performed Procedure Step. The two included figures outline the void filled by the Modality Worklist Management and Modality Performed Procedure Step specification, and the relationship between the original DICOM Data Model and the extended model.
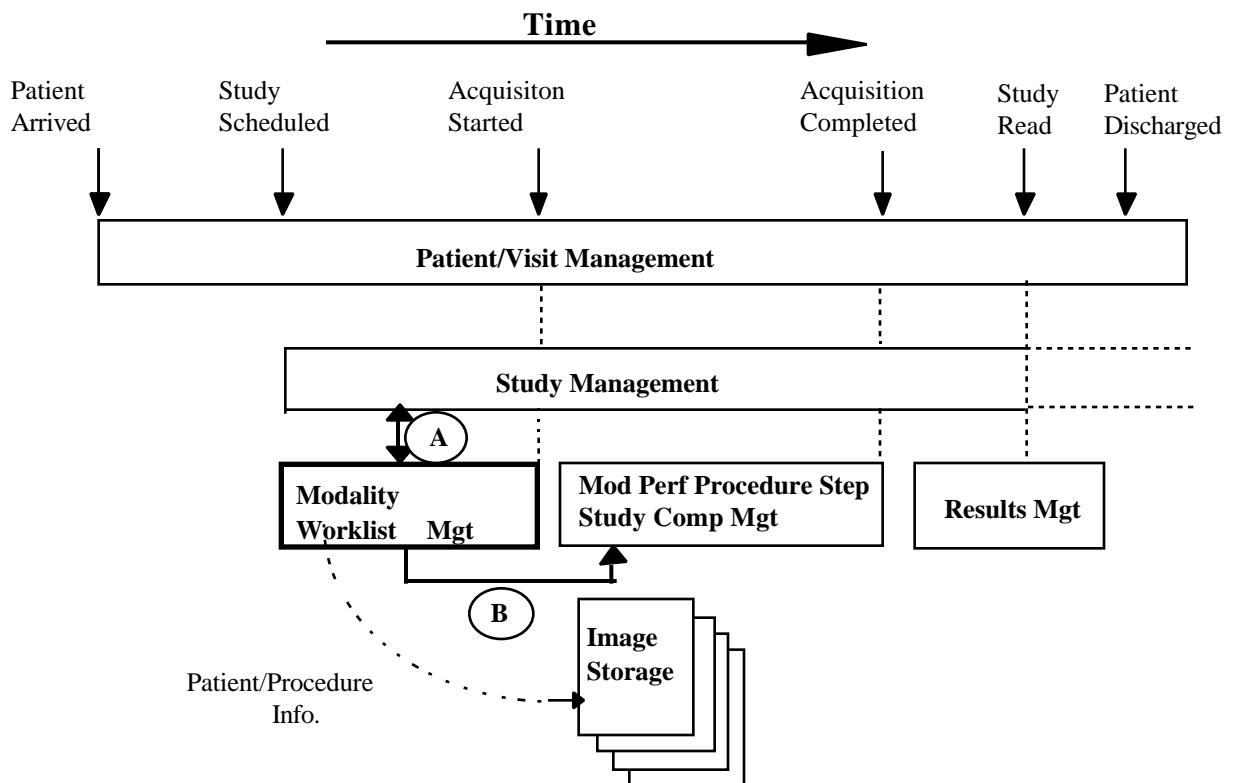
2   **Figure G-1: Functional View - Modality Worklist <u>and Modality Performed Procedure Step</u> Management in the Context of DICOM Service Classes**

4   The management of a patient starts when the patient enters a physical facility (e.g. a hospital, a clinic, a imaging center) or even before that time. The DICOM Patient Management SOP Class provides many of the functions
6   that are of interest to imaging departments. Figure ~~X-1~~<u>G-1</u> is an example where one presumes that an order for a procedure has been issued for a patient. The order for an imaging procedure results in the creation of a
8   Study Instance within the DICOM Study Management SOP Class. At the same time (A) the Modality Worklist Management SOP Class enables a modality operator to request the scheduling information for the ordered
10   procedures. A worklist can be constructed based on the scheduling information. The handling of the requested imaging procedure in DICOM Study Management and in DICOM Worklist Management are closely
12   related. The worklist also conveys patient/study demographic information that can be incorporated into the images.

14   Worklist Management is completed once the ~~scheduled~~ imaging procedure has started <u>and the Scheduled Procedure Step has been removed from the Worklist, possibly in response to the Modality Performed</u>
16   <u>Procedure Step</u> (B). However, Study Management continues throughout all stages of the Study, including interpretation. The actual procedure performed (based on the request) and information about the images
18   produced are conveyed by the DICOM Study Component SOP Class <u>or the Modality Performed Procedure SOP Classes.</u>
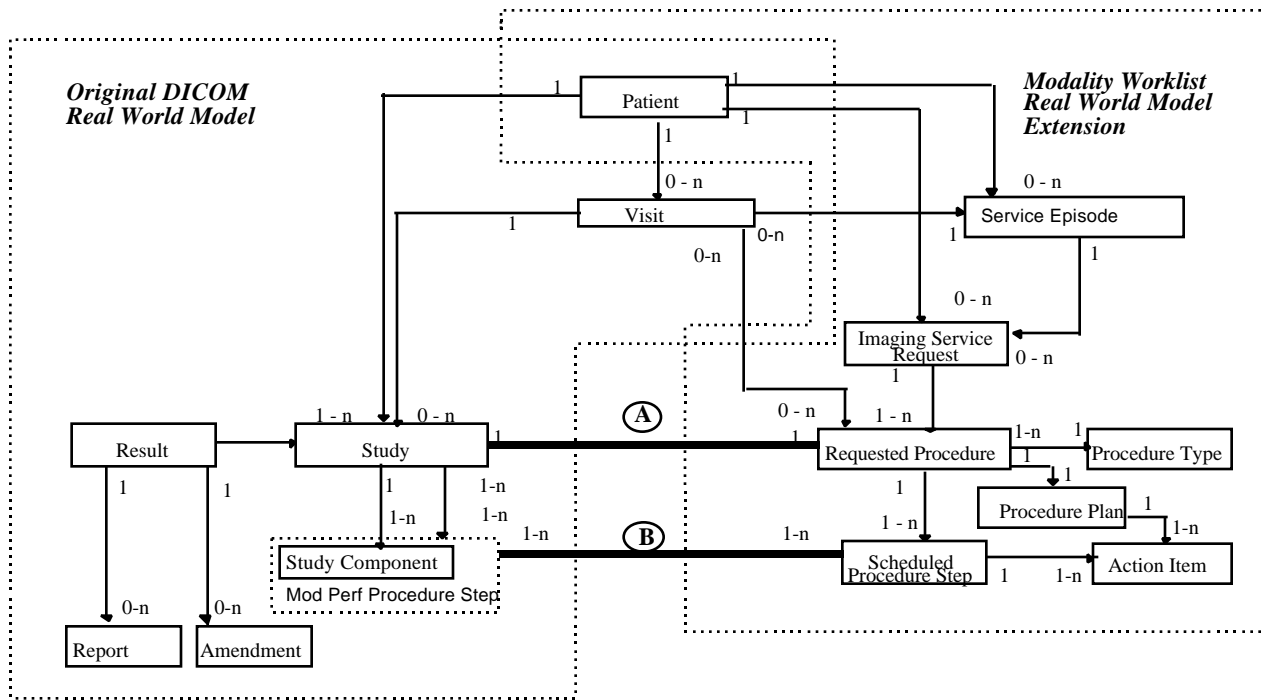
2   **Figure G-2: Relationship of the Original Model and the Extensions for Modality Worklist
and Modality Performed Procedure Step Management**

4   Figure G-2 shows the relationship between the original DICOM Real-World model and the extensions of this
Real-World model required to support the Modality Worklist and the Modality Performed Procedure Step. The
6   new parts of the model add entities that are needed to request, and to schedule, and describe the
performance of imaging procedures, a concepts that is were not supported in the original model. The entities
8   required for representing the Worklist form a natural extension of the original DICOM Real-World model.

Common to both the original model and the extended model is the Patient entity. The Service Episode is an
10   administrative concept that has been shown in the extended model in order to pave the way for future
adaptation to a common model supported by other standardization groups including HL7, CEN TC 251 WG 3,
12   CAP-IEC, etc. The Visit is in the original model but not shown in the extended model because it is a part of the
Service Episode.

14   There is a 1 to 1 relationship between a Requested Procedure and the DICOM Study (A). A DICOM Study is
the result of a single Requested Procedure. A Requested Procedure can result in only one Study.

16   A 1 to 1 n:m relationship exists between a Scheduled Procedure Step and a Modality Performed Procedure
Step (B). The concept of a Modality Performed Procedure Step is a superset of the Study Component
18   concept contained in the original DICOM model. There is no means to relate previously Scheduled Procedure
Steps using Study Component information. This may be a candidate for future extensions of the Study
20   Component into the more general concept of Performed Procedure Step. The Modality Performed Procedure
Step SOP Classes provide a means to relate Modality Performed Procedure Steps to Scheduled Procedure
22   Steps.

2

NEMA Standards Publication PS 3.4 - 1996

4

Digital Imaging and Communications in Medicine (DICOM)

6   *Addendum Part 4: Modality Performed Procedure Step SOP Class Specifications*

Part 4 Additions and Changes

2 **F.X   ADDITIONS AND CHANGES TO ANNEX F**

Item 7: Modify the text of Annex F Section F.1.1 Scope
---

4   Replace the 5th paragraph by the following text:

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

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

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

---
16 **Item 8: Modify the text of Annex F Section F.1.3 Study Management Information Model**

        Replace the second paragraph with the following text:

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

Item 9: Replace text in Annex F Section F.1.4 Study Management States
---

22   Modified text:

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

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

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

Item 10: Add the following section after Annex F Section F.1.4 Study Management States
---

F.1.5   Modality Performed Procedure Step Management States

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

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

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

Table F.1-3
14   **MODALITY PERFORMED PROCEDURE STEP STATES**

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

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

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

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

22 **Item 11: Modify the text of the first paragraph of Section F.2 Conformance Overview in Annex F**

24   Modified text:

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

a. Detached Study Management SOP Class

b. Study Component Management SOP Class

c. Modality Performed Procedure Step SOP Class

d. Modality Performed Procedure Step Notification SOP Class

e. Modality Performed Procedure Step Retrieve SOP Class

Item 12: Modify the text of the first sentence of the second paragraph of Section F.2 Conformance Overview in Annex F

Modified text

Each SOP Class operates on a subset of the Study IOD, Modality Performed Procedure Step IOD and Study
Component IOD and specifies the Attributes, operations, notifications, and behavior applicable to the SOP
Class.

Item 13: Add the following sections into Annex F

F.7   MODALITY PERFORMED PROCEDURE STEP SOP CLASS

F.7.1 DIMSE Service Group

The DIMSE Services shown in Table F.7.1-1 are applicable to the Modality Performed Procedure Step IOD under
the Modality Performed Procedure Step SOP Class.

Table F.7.1-1
DIMSE SERVICE GROUP

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-SET	M/M

The DIMSE Services and Protocols are specified in PS 3.7

F.7.2 Operations

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

F.7.2.1   CREATE Modality Performed Procedure Step SOP Instance

2   This operation allows an SCU to create an instance of the Modality Performed Procedure Step SOP Class and provide information about a specific real-world Performed Procedure Step that is under control of the SCU. This
4   operation shall be invoked through the DIMSE N-CREATE Service.

     Note :   The modality should inform the Information System as soon as possible that the performance of the Procedure
6   Step has been started by sending the N-CREATE Service Request. This allows an SCP of the Modality
              Worklist SOP Class (if supported) to update the Modality Worklist. Some of the attribute values are already
8   known at the beginning of the Procedure Step, they are required to be sent in the N-CREATE command. Other
              mandatory attributes are known only at the end of the Performed Procedure Step, they are assigned a value
10   in the N-SET command.

12   The same SOP Instance UID is shared by all three Modality Performed Procedure Step SOP Classes. This means that the SOP Instance created and set using the services of the Modality Performed Procedure Step
14   SOP Class can be retrieved using its SOP Instance UID within the service of the Modality Performed Procedure Step Retrieve SOP Class. Changes in its state can be notified by using its SOP Instance UID within the service
16   of the Modality Performed Procedure Step Notification SOP Class. The SOP Class UID specified in the DIMSE N-CREATE and N-SET Services shall be the UID of the Modality Performed Procedure Step SOP Class.

18   The Modality Performed Procedure Step SOP Instance UID shall not be used to identify a SOP Instance of the Study Component Service Class.

20   ### F.7.2.1.1   Modality Performed Procedure Step Subset Specification

   The Application Entity which claims conformance to this SOP Class as an SCU must provide all Required Attributes
22   as specified in Table F.7.2-1. Optional Attributes maintained by the SCP may be provided as well. The Application Entity which claims conformance as an SCP to this SOP Class shall support the subset of the Modality Performed
24   Procedure Step Attributes specified in Table F.7.2-1.

Table F.7.2-1
26   **MODALITY PERFORMED PROCEDURE STEP SOP CLASS N-CREATE, N-SET AND FINAL STATE ATTRIBUTES**

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Requirement Type Final State (See Note 1)
Specific Character Set	(0008,0005)	1C/1C (Required if an extended or replacement character set is used)	Not allowed	
Performed Procedure Step Relationship				
Scheduled Step Attribute Sequence	(0040,0270)	1/1	Not allowed	
>Study Instance UID	(0020,000D)	1/1	Not allowed	

>Referenced Study Sequence	(0008,1110)	2/2	Not allowed	
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	Not allowed	
>Accession Number	(0008,0050)	2/2	Not allowed	
>Placer Order Number/Imaging Service Request	(0040,2006)	3/3	Not allowed	
>Filler Order Number/Imaging Service Request	(0040,2007)	3/3	Not allowed	
>Requested Procedure ID	(0040,1001)	2/2	Not allowed	
>Requested Procedure Description	(0032,1060)	2/2	Not allowed	
>Placer Order Number/Procedure	(0040,1006)	3/3	Not allowed	
>Filler Order Number/Procedure	(0040,1007)	3/3	Not allowed	
>Scheduled Procedure Step ID	(0040,0009)	2/2	Not allowed	
>Scheduled Procedure Step Description	(0040,0007)	2/2	Not allowed	
>Scheduled Action Item Code Sequence	(0040,0008)	2/2	Not allowed	
>>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Coding Scheme designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	Not allowed	

>>Code Meaning	(0008,0104)	3/3	Not allowed	
Patient's Name	(0010,0010)	2/2	Not allowed	
Patient ID	(0010,0020)	2/2	Not allowed	
Patient's Birth Date	(0010,0032)	2/2	Not allowed	
Patient's Sex	(0010,0040)	2/2	Not allowed	
Referenced Patient Sequence	(0008,1120)	2/2	Not allowed	
>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	Not allowed	
>Referenced Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	Not allowed	
Performed Procedure Step Information				
Performed Procedure Step ID	(0040,0253)	1/1	Not allowed	
Performed Station AE Title	(0040,0241)	1/1	Not allowed	
Performed Station Name	(0040,0242)	2/2	Not allowed	
Performed Location	(0040,0243)	2/2	Not allowed	
Performed Procedure Step Start Date	(0040,0244)	1/1	Not allowed	
Performed Procedure Step Start Time	(0040,0245)	1/1	Not allowed	
Performed Procedure Step Status	(0040,0252)	1/1	3/1	
Performed Procedure Step Description	(0040,0254)	2/2	3/2	
Performed Procedure Type Description	(0040,0255)	2/2	3/2	
Procedure Code Sequence	(0008,1032)	2/2	3/2	
>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	

>Coding Scheme Designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Code Meaning	(0008,0104)	3/3	3/3	
Performed Procedure Step End Date	(0040,0250)	2/2	3/1	1
Performed Procedure Step End Time	(0040,0251)	2/2	3/1	1
Image Acquisition Results				
Modality	(0008,0060)	1/1	Not allowed	
Study ID	(0020,0010)	2/2	Not allowed	
Performed Action Item Code Sequence	(0040,0260)	2/2	3/2	
>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Code Meaning	(0008,0104)	3/3	3/3	
Performed Series Sequence	(0040,0340)	2/2	3/1	1 (See note 2)
>Performing Physician's Name	(0008,1050)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Protocol Name	(0018,1030)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	1
>Operator's Name	(0008,1070)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2

>Series Instance UID	(0020,000E)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	1
>Series Description	(0008,103E)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Retrieve AE Title	(0008,0054)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Referenced Image Sequence	(0008,1140)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	See F.7.2.2.2.
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	See F.7.2.2.2.
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>All other attributes from Performed Series Sequence		3/3	3/3	

All other attributes from Radiation Dose Module and Billing and Material Code Module		3/3	3/3	

Notes: 1. The requirement for the final state is that which applies at the time that the Performed Procedure Step Status (0040,0252) is N-SET to a value of COMPLETED or DISCONTINUED, as described in F.7.2.2.2. It is only described if it is different from the SCP requirement for the N-CREATE.

2. The Performed Series Sequence (0040,0340) may not be empty (zero length) at the time that the Performed Procedure Step Status (0040,0252) is N-SET to a value of COMPLETED or DISCONTINUED. In other words a Series must exist for every Performed Procedure Step, though it may contain no Images or Standalone objects, if none were created, as described in F.7.2.2.2.

F.7.2.1.2   Service Class User

The SCU shall specify in the N-CREATE request primitive the Class and Instance UIDs of the Modality Performed Procedure Step SOP Instance which is created and for which Attribute Values are to be provided.

Note: This requirement facilitates the inclusion of relevant Attributes in the Composite SOP Instances generated during the Performed Procedure Step.

The SCU shall provide Attribute values for the Modality Performed Procedure Step SOP Class Attributes as specified in Table F.7.2-1. Additionally, values may be provided for optional Modality Performed Procedure Step IOD Attributes that are supported by the SCP. The encoding rules for Modality Performed Procedure Step Attributes are specified in the N-CREATE request primitive specification in PS 3.7.

The SCU shall be capable of providing all required Attribute values to the SCP in the N-CREATE request primitive. The SCU may provide Attribute values for optional Attributes which are not maintained by the SCP. In such case the SCU shall function properly regardless of whether the SCP accepts values for those Attributes or not.

All Attributes shall be created before they can be set. Sequence Attributes shall be created before they can be filled. Sequence Item Attributes shall not be created at zero length.

Note: Not all the attributes that can be created can be set afterwards (see Table F.7.2-1).

The SCU shall only send the N-CREATE request primitive with the value for the Attribute "Performed Procedure Step Status" (0040,0252) set to "IN PROGRESS".

Note: It is assumed but not required that the SCU (the modality) received the Study Instance UID within the scope of the Basic Worklist Management SOP Class.

F.7.2.1.3   Service Class Provider

The N-CREATE operation allows the SCU to provide to the SCP selected Attribute values for a specific Modality Performed Procedure Step SOP Instance. This operation shall be invoked through the use of the DIMSE N-CREATE Service used in conjunction with the appropriate Modality Performed Procedure Step SOP Instance.

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

The SCP shall accept N-CREATE request primitives only if the value of the attribute "Performed Procedure
4 Step Status" (0040,0252) is "IN PROGRESS". If the Performed Procedure Step Status attribute has another
value, the SCP shall set the failure status code "Invalid attribute value" (Code: 0106H) with an Attribute List.

6   Note: The SCP may update the Referenced Study Component Sequence Attributes in the referenced Study
Management SOP Instance, if it exists, and the scheduling information on which the Modality Worklist is
8   based.

10 **F.7.2.1.4   Status Codes**

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

12 **F.7.2.2   SET Modality Performed Procedure Step Information**

This operation allows an SCU to set Attribute Values of an instance of the Modality Performed Procedure Step
14 SOP Class and provide information about a specific real-world Modality Performed Procedure Step that is
under control of the SCU. This operation shall be invoked through the DIMSE N-SET Service.

16 **F.7.2.2.1   Modality Performed Procedure Step IOD Subset Specification**

The Application Entity which claims conformance to this SOP Class as an SCU may choose to modify a subset
18 of the Attributes maintained by the SCP. The Application Entity which claims conformance as an SCP to this
SOP Class shall support the subset of the Modality Performed Procedure Step Attributes specified in Table
20 F.7.2-1.

The character set used for Attribute Values updated using the N-SET shall be the same as that specified by the
22 N-CREATE Request Primitive.

F.7.2.2.2   Service Class User

24 The SCU shall specify in the N-SET request primitive the UID of the Modality Performed Procedure Step SOP
Instance for which it wants to set Attribute Values.

26 The SCU shall be permitted to set Attribute values for any Modality Performed Procedure Step SOP Class
Attribute specified in Table F.7.2-1. The SCU shall specify the list of Modality Performed Procedure Step SOP
28 Class Attributes for which it wants to set the Attribute Values. The SCU shall provide, with one or more N-SET
request primitives, the attribute values specified in Table F.7.2-1. The encoding rules for Modality Performed
30 Procedure Step Attributes are specified in the N-SET request primitive specification in PS 3.7. The SCU shall
only set Attribute Values which are already created with an N-CREATE request.

32 The SCU shall not send N-SET request primitives for a Modality Performed Procedure Step SOP Instance after
a N-SET request primitive with a value for the attribute "Performed Procedure Step Status" (0040,0252) is
34 "COMPLETED" or "DISCONTINUED" has been sent.

If Sequences are included in a N-SET command, all Items of a Sequence are to be included in the command
36 and not only the Items to be updated.

Once the Modality Performed Procedure Step Status (0040,0252) has been set to "COMPLETED" or
38 "DISCONTINUED" the SCU shall no longer modify the Modality Performed Procedure Step SOP Instance, and

shall not create new Composite SOP Instances as part of the same Modality Performed Procedure Step SOP
2 Instance.

Note: A Modality that wishes to continue or resume creating Composite SOP Instances may create a new Modality
4   Performed Procedure Step.

6 Before or when Modality Performed Procedure Step Status (0040,0252) is set to "COMPLETED" or
"DISCONTINUED" the SCU shall have created or set all the Attributes according to the requirements in the Final
8 State column of Table F.7.2-1.

Before or when Modality Performed Procedure Step Status (0040,0252) is set to "COMPLETED" or
10 "DISCONTINUED" the SCU shall have sent to the SCP a list of all Image SOP Instances and all Standalone SOP
Instances created during the Procedure Step in Referenced Image Sequence (0008,1140) and Referenced
12 Standalone SOP Instance Sequence (0040,0220) respectively.

Note: The intent is that a completed or discontinued Modality Performed Procedure Step entity will contain a
14   complete list of all the Images and Standalone SOP Instances that were created.

16 The Modality Performed Procedure Step Status (0040,0252) shall not be set to "COMPLETED" or
"DISCONTINUED" if the list contains neither Image references nor Standalone SOP Instance references, unless
18 no such Instances were created.

F.7.2.2.3   Service Class Provider

20 The N-SET operation allows the SCU to request that the SCP update selected Attribute values for a specific
Modality Performed Procedure Step SOP Instance. This operation shall be invoked through the use of the
22 DIMSE N-SET Service used in conjunction with the appropriate Modality Performed Procedure Step SOP
Instance.

24 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
26 Performed Procedure Step Attributes.

The SCP shall accept N-SET request primitives only if the value of the already existing attribute "Performed
28 Procedure Step Status" (0040,0252) is "IN PROGRESS". If the already existing Performed Procedure Step
Status attribute has another value, the SCP shall set the failure status code "Processing failure" (Code: 0110H)
30 with a Specific Error Comment (see Section F.7.2.2.4).

The SCP may itself modify any Attributes of the Modality Performed Procedure Step SOP Instance only after
32 the "Performed Procedure Step Status" (0040,0252) has been set to "COMPLETED" or "DISCONTINUED".

Notes: 1. Such coercion of Attributes by the SCP may be necessary to correct, for example, patient identification
34   information or incorrectly selected scheduling information. Such an operation is not permitted to the SCU by
          the requirements described in Table F.7.2-1, which might create a new Modality Performed Procedure Step
36   SOP Instance to achieve the same objective.

          2. Under exceptional circumstances, it may be necessary for the SCP to itself set the Performed Procedure
38   Step Status (0040,0252) to COMPLETED or DISCONTINUED, for example if the Modality has failed. When the
          Modality recovers, subsequent N-SETs may fail.
40

F.7.2.2.4   Status Codes

2   The specific error comment which may be returned as a status code in a N-SET-RSP is defined in Table F.7.2-2. See PS 3.7 for additional response status codes.

4   **Table F.7.2-2**
                                         N-SET STATUS

Status	Error Comment	Error ID
0110H	Performed Procedure Step Object may no longer be updated	A710

6

F.7.3 Modality Performed Procedure Step SOP Class UID

8   The Modality Performed Procedure Step SOP Class shall be uniquely identified by the Modality Performed Procedure Step SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.3".

10 ### F.7.4 Conformance Requirements

Implementations providing conformance to the Modality Performed Procedure Step SOP Class shall be
12 conformant as described in the following sections and shall include within their Conformance Statement information as described below.

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

16 ### F.7.4.1   SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for
18 the operations which it invokes.

F.7.4.1.1   Operations

20 Any Attributes for which Attribute Values may be provided (using the N-CREATE Service) by the SCU shall be enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined
22 in Annex A of PS 3.2.

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

26 An implementation which conforms to this SOP Class as an SCU shall specify under which conditions during the performance of the real-world Performed Procedure Step it will create the SOP Class Instance and under
28 which conditions it will set the status value to COMPLETED and DISCONTINUED.

F.7.4.2   SCP Conformance

30 An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for the operations which it performs.

F.7.4.2.1   Operations

2 Any Attributes for which Attribute Values may be provided (using the N-CREATE Service) by the SCU shall be enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined
4 in Annex A of PS 3.2.

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

8 The SCP Operations Conformance Statement shall also provide information on the behavior of the SCP (the Information System) at the following occurrences:

10   —   The creation of a new Instance of the Modality Performed Procedure Step SOP Class with the status "IN PROGRESS". The result of that process on the scheduling information and on the
12   attributes values of the Modality Worklist Management SOP Class shall be specified.
          —   The update of the Attribute "Performed Procedure Step Status", i.e. the change from the state "IN
14   PROGRESS" to "DISCONTINUED" or to "COMPLETED".
          —   Which Attributes the SCP may coerce after the state has been set to "IN PROGRESS" or
16   "DISCONTINUED" or to "COMPLETED".
          —   For how long the Modality Performed Procedure Step SOP Instance will persist on the SCP.

F.8   MODALITY PERFORMED PROCEDURE STEP RETRIEVE SOP CLASS

2 ### F.8.1 DIMSE Service Group

The DIMSE Services shown in Table F.8.1-1 are applicable to the Modality Performed Procedure Step IOD under
4 the Modality Performed Procedure Step Retrieve SOP Class.

Table F.8.1-1
6 **DIMSE SERVICE GROUP**

DIMSE Service Element	Usage SCU/SCP
N-GET	M/M

8 The DIMSE Services and Protocols are specified in PS 3.7. If the Modality Performed Procedure Step Object is no
longer available the Request Primitive will be answered with a Failure Status message "No Such Object Instance".

10 ### F.8.2 Operations

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

14 ### F.8.2.1   GET Performed Procedure Step Information

This operation allows an SCU to get information about a specific real-world Performed Procedure Step which is
16 represented as a Modality Performed Procedure Step Retrieve SOP Instance by a Modality Performed
Procedure Step Retrieve SCP. The operation is performed on a Modality Performed Procedure Step IOD. This
18 operation shall be invoked through the DIMSE N-GET Service used in conjunction with the appropriate
Modality Performed Procedure Step Retrieve SOP Instance.

20 The same SOP Instance UID is shared by all three Modality Performed Procedure Step SOP Classes. This
means that the SOP Instance created and set using the services of the Modality Performed Procedure Step
22 SOP Class can be retrieved using its SOP Instance UID within the service of the Modality Performed Procedure
Step Retrieve SOP Class. Changes in its state can be notified by using its SOP Instance UID within the service
24 of the Modality Performed Procedure Step Notification SOP Class. The SOP Class UID specified in the DIMSE
N-GET Service shall be the UID of the Modality Performed Procedure Step Retrieve SOP Class.

26 The Modality Performed Procedure Retrieve Step SOP Instance UID shall not be used to identify a SOP
Instance of the Study Component Service Class.

28 Note: An Application Entity may support the SCU role of the Modality Performed Procedure Step Retrieve SOP Class
in order to obtain information about Performed Procedure Steps created by other Application Entities.
30

F.8.2.1.1   Modality Performed Procedure Step Retrieve IOD Subset Specifications

32 The Application Entity which claims conformance to this SOP Class as an SCU may choose to interpret the
Attribute values maintained by the SCP which the SCU receives via the operation of this SOP Class. The
34 Application Entity which claims conformance as an SCP to this Modality Performed Procedure Step Retrieve
SOP Class shall support the subset of the Modality Performed Procedure Step Retrieve Attributes specified in
36 Table F.8.2-1.

Table F.8.2-1

MODALITY PERFORMED PROCEDURE STEP RETRIEVE SOP CLASS N-GET ATTRIBUTES

Attribute Name	Tag	Requirement Type (SCU/SCP)
Specific Character Set	(0008,0005)	3/1C (Required if an extended or replacement character set is used)
Performed Procedure Step Relationship		
Scheduled Step Attributes Sequence	(0040,0270)	3/1
>Study Instance UID	(0020,000D)	-/1
>Referenced Study Sequence	(0008,1110)	-/2
>>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
>Accession Number	(0008,0050)	-/2
>Placer Order Number/Imaging Service Request	(0040,2006)	-/3
>Filler Order Number/Imaging Service Request	(0040,2007)	-/3
>Requested Procedure Description	(0032,1060)	-/2
>Placer Order Number/Procedure	(0040,1006)	-/3
>Filler Order Number/Procedure	(0040,1007)	-/3
>Requested Procedure ID	(0040,1001)	-/2
>Scheduled Procedure Step ID	(0040,0009)	-/2
>Scheduled Procedure Step Description	(0040,0007)	-/2
>Scheduled Action Item Code Sequence	(0040,0008)	-/2

>>Code Value	(0008,0100)	-/1C
		(Required if Sequence Item is present)
>>Coding Scheme designator	(0008,0102)	-/1C
		(Required if Sequence Item is present)
>>Code Meaning	(0008,0104)	-/3
Patient's Name	(0010,0010)	3/2
Patient ID	(0010,0020)	3/2
Patient's Birth Date	(0010,0032)	3/2
Patient's Sex	(0010,0040)	3/2
Referenced Patient Sequence	(0008,1120)	3/2
>Referenced SOP Class UID	(0008,1150)	-/1C
		(Required if Sequence Item is present)
>Referenced Instance UID	(0008,1155)	-/1C
		(Required if Sequence Item is present)
Performed Procedure Step Information		
Performed Station AE Title	(0040,0241)	3/1
Performed Station Name	(0040,0242)	3/2
Performed Location	(0040,0243	3/2
Performed Procedure Step Start Date	(0040,0244)	3/1
Performed Procedure Step Start Time	(0040,0245)	3/1
Performed Procedure Step ID	(0040,0253)	3/1
Performed Procedure Step Status	(0040,0252)	3/1
Performed Procedure Step End Date	(0040,0250)	3/2
Performed Procedure Step End Time	(0040,0251)	3/2
Performed Procedure Step Description	(0040,0254	3/2
Performed Procedure Type Description	(0040,0255)	3/2
Procedure Code Sequence	(0008,1032)	3/2
>Code Value	(0008,0100)	-/1C

		(Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	-/1C (Required if Sequence Item is present)
>Code Meaning	(0008,0104)	-/3
Image Acquisition Results		
Performed Series Sequence	(0040,0340)	3/2
>Performing Physician's Name	(0008,1050)	-/2C (Required if Sequence Item is present)
>Protocol Name	(0018,1030)	-/1C (Required if Sequence Item is present)
>Operator's Name	(0008,1070)	-/2C (Required if Sequence Item is present)
>Series Instance UID	(0020,000E)	-/1C (Required if Sequence Item is present)
>Series Description	(0008,103E)	-/2C (Required if Sequence Item is present)
>Retrieve AE Title	(0008,0054)	-/2C (Required Sequence Item is present)
>Referenced Image Sequence	(0008,1140)	-/2C (Required Sequence Item is present)
>>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
>Referenced Standalone SOP Instance Sequence	(0040,0220)	-/2C (Required if Sequence Item is present)
>>Referenced SOP Class UID	(0008,1150)	-/1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	-/1C (Required if Sequence Item is present)
>All other Attributes from Performed Series Sequence		-/3
Modality	(0008,0060)	3/1

Study ID	(0020,0010)	3/2
Performed Action Item Code Sequence	(0040,0260)	3/2
>Code Value	(0008,0100)	-/1C (Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	-/1C (Required if Sequence Item is present)
>Code Meaning	(0008,0104)	-/3
All other attributes from Radiation Dose Module and Billing and Material Code Module		3/3

2   **F.8.2.1.2   Service Class User**

The SCU uses the N-GET Service Element to request the SCP to get a Modality Performed Procedure Step
4   Retrieve SOP Instance. The SCU shall specify the UID of the SOP Instance to be retrieved, which is a UID of a
Modality Performed Procedure Step SOP Instance. The SCU shall be permitted to request that Attribute
6   Values be returned for any Modality Performed Procedure Step Retrieve SOP Class Attribute specified in
Table F.8.2-1. Additionally values may be requested for optional Modality Performed Procedure Step IOD
8   Attributes.

The SCU shall specify the list of Modality Performed Procedure Step Retrieve SOP Class Attributes for which
10   values are to be returned. The encoding rules for Modality Performed Procedure Step Attributes are specified
in the N-GET request primitive specification in PS 3.7.

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

14   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
16   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
18   shall do as a result of receiving this information.

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

22

F.8.2.1.3   Service Class Provider

24   The N-GET operation allows the SCU to request from the SCP selected Attribute values for a specific Modality
Performed Procedure Step SOP Instance via a Modality Performed Procedure Step Retrieve SOP Instance.
26   This operation shall be invoked through the use of the DIMSE N-GET Service used in conjunction with the
appropriate Modality Performed Procedure Step Retrieve SOP Instance which equals the Modality Performed

Procedure SOP Instance. The SCP shall retrieve the selected Attribute values from the indicated Modality
2   Performed Procedure Step SOP Instance.

The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to the
4   associated request. A Failure Code shall indicate that the SCP has not retrieved the SOP Instance. Contingent
on the N-GET Response Status, the SCP shall return, via the N-GET response primitive, Attribute Values for all
6   requested Attributes maintained by the SCP.

F.8.2.1.4   Status Codes
8   The status values which are specific for this SOP Class and DIMSE Service are defined in Table F.8.2-2. See
PS 3.7 for additional response status codes.

10   **Table F.8.2-2**
                                 RESPONSE STATUS'S

Service Status	Further Meaning	Response Status Code
Warning	Requested optional At-tributes are not supported	0001

12

F.8.3 Modality Performed Procedure Step Retrieve SOP Class UID
14   The Modality Performed Procedure Step Retrieve SOP Class shall be uniquely identified by the Modality
Performed Procedure Step Retrieve SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.4".

16   ### F.8.4 Conformance Requirements

Implementations providing conformance to the Modality Performed Procedure Step Retrieve SOP Class shall
18   be conformant as described in the following sections and shall include within their Conformance Statement
information as described below.

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

22   ### F.8.4.1   SCU Conformance

An implementation which is conformant to this SOP Class as an SCU shall meet conformance requirements for
24   the operations which it invokes.

F.8.4.1.1   Operations
26   Any Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be
enumerated in the SCU Operations Statement. The SCU Operations Statement shall be formatted as defined
28   in Annex A of PS 3.2.

F.8.4.2   SCP Conformance
30   An implementation which is conformant to this SOP Class as an SCP shall meet conformance requirements for
the operations which it performs.

F.8.4.2.1   Operations

2   Any Attributes for which Attribute Values may be requested (using the N-GET Service) by the SCU shall be
     enumerated in the SCP Operations Statement. The SCP Operations Statement shall be formatted as defined
4   in Annex A of PS 3.2.

F.9   MODALITY PERFORMED PROCEDURE STEP NOTIFICATION SOP CLASS

2 The Modality Performed Procedure Step Notification SOP Class is intended for those Application Entities requiring notifications of Modality Performed Procedure Step's changes in state.

4 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.

6   Notes: 1. For example, in one configuration, an IS could be responsible for maintaining data related to performed
              procedure steps. A PACS reviewing workstation may need to display the images for any study viewed. In
8   order for the PACS to link the images to the study, a PACS may receive a notification whenever a procedure
              step has been performed. In such a configuration the IS is the SCP and the PACS is the SCU. When the
10   PACS receives this notification, it may link the images and the performed procedure step to the study within
              its internal database or may choose to take no action.
12   2. The terms IS and PACS used in the previous example are provided for clarification purposes only. This
              document does not define nor constrain the purpose or role of any IS, PACS or acquisition Application Entity
14   conforming to this Service Class Specification.

F.9.1   DIMSE service group

16 Table F.9.1-1 shows the DIMSE-N Services applicable to the Modality Performed Procedure Step IOD under
18 the Modality Performed Procedure Step Notification SOP Class.

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

20   **Table F.9.1-1**
                          DIMSE-N SERVICE GROUP

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

22

F.9.2 Notifications

24 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
26 capable of providing the following notifications.

F.9.2.1   Receive Modality Performed Procedure Step Event Notification

28 This notification allows an SCU to receive from the SCP an unsolicited notification of a change in a Modality Performed Procedure Step SOP Instance. These notifications shall be invoked by the SCP through the use
30 of the DIMSE N-EVENT-REPORT Service used in conjunction with the related Modality Performed Procedure Step SOP Instance.

32 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
34 notification. This Service Class Specification places no requirements on what the SCU shall do as a result of receiving this information.

36 The same SOP Instance UID is shared by all three Modality Performed Procedure Step SOP Classes. This means that the SOP Instance created and set using the services of the Modality Performed Procedure Step

SOP Class can be retrieved using its SOP Instance UID within the service of the Modality Performed Procedure
2 Step Retrieve SOP Class. Changes in its state can be notified by using its SOP Instance UID within the service
of the Modality Performed Procedure Step Notification SOP Class. The SOP Class UID specified in the DIMSE
4 N-EVENT-REPORT Service shall be the UID of the Modality Performed Procedure Step Notification SOP Class.

The Modality Performed Procedure Step Notification SOP Instance UID shall not be used to identify a SOP
6 Instance of the Study Component Service Class.

F.9.2.2   Provide Modality Performed Procedure Step Event Notification

8 These notifications allow an SCU to receive from the SCP an unsolicited notification of a change in the state of
a real-world performed procedure step. This notification shall be invoked by the SCP through the use of the
10 DIMSE N-EVENT-REPORT Service used in conjunction with the related Modality Performed Procedure Step
SOP Instance.

12 The SCP shall specify in the N-EVENT-REPORT request primitive the UID of the Modality Performed
Procedure Step SOP Instance with which the event is associated and the Event Type ID.

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

16 ### F.9.2.3   Status Codes

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

18 ### F.9.3 Modality Performed Procedure Step Notification SOP Class UID

The Modality Performed Procedure Step Notification SOP Class shall be uniquely identified by the Modality
20 Performed Procedure Step Notification SOP Class UID which shall have the value "1.2.840.10008.3.1.2.3.5".

F.9.4 Conformance Requirements

22 Implementations providing Standard SOP Class Conformance to the Modality Performed Procedure Step
Notification SOP Class shall be conformant as described in the following sections and shall include within their
24 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
26 be in the format defined in PS 3.2.

Table F.9.2-1
28 **PERFORMED PROCEDURE STEP NOTIFICATION EVENT INFORMATION**

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
Performed Procedure Step In Progress	1			
Performed Procedure Step Completed	2			
Performed Procedure Step Discontinued	3			

Performed Procedure Step Updated	4			An Update event shall not be used to notify changes in Performed Procedure Step Status (0040,0252).
Performed Procedure Step Deleted	5			

2   Note: The Notification Event Information contains no Attributes, beyond those defined in PS 3.7. An SCU receiving a
              Notification and requiring further information may also be an SCU of the Modality Performed Procedure Step
4   Retrieval SOP Class and may use the Affected SOP Instance UID (0000,1000) to perform an N-GET of the
              Modality Performed Procedure Step SOP Instance.

6

F.9.4.1   SCU Conformance

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

10   —   notifications which it receives

F.9.4.1.1   Notifications

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

16   [—   Performed Procedure Step In Progress;]

          [—   Performed Procedure Step Completed;]

18   [—   Performed Procedure Step Discontinued;]

          [—   Performed Procedure Step Updated;]

20   [—   Performed Procedure Step Deleted;]

F.9.4.2   SCP Conformance

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

24   —   notifications which it invokes

F.9.4.2.1   Notifications

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

Item 14: Add the following Informative Annex Y to Part 4:

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2 # ANNEX Y (Informative): Handling of Identifying Parameters

Y.1   PURPOSE OF THIS ANNEX

4 The DICOM Standard was published in 1993 and addresses medical images communication between medical modalities, workstations and other medical devices as well as data exchange between medical devices and the
6 Information System (IS). DICOM defines SOP Instances with Patient, Visit and Study information managed by the Information System and allows to communicate the attribute values of these objects.

8 Since the publication of the DICOM Standard great effort has been made to harmonize the Information Model of the DICOM Standard with the models of other relevant standards, especially with the HL7 model and the
10 CEN TC 251 WG3 PT 022 model. The result of these effort is a better understanding of the various practical situations in hospitals and an adaptation of the model to these situations. In the discussion of models, the
12 definition of Information Entities and their Identifying Parameters play a very important role.

The purpose of this Informative Annex is to show which identifying parameters may be included in Image SOP
14 Instances and their related Modality Performed Procedure Step (MPPS) SOP Instance. Different scenarios are elucidated to describe varying levels of integration of the Modality with the Information System, as well as
16 situations in which a connection is temporarily unavailable.

Note: In this annex, "Image SOP Instance" is used as a collective term for all Composite Image Storage SOP
18   Instances, as well as Standalone Overlay, LUT, and Curve Storage SOP Instances, etc.

20 The scenarios described here are informative and do not constitute a normative section of the Standard.

Y.2   INTEGRATED ENVIRONMENT

22 "Integrated" means in this context that the Acquisition Modality is connected to an Information System or Systems that may be an SCP of the Modality Worklist SOP Class or an SCP of the Modality Performed
24 Procedure Step SOP Class or both. In the following description only the behavior of "Modalities" is mentioned, it goes without saying that the IS must conform to the same SOP Classes.

26 The Modality receives identifying parameters by querying the Modality Worklist SCP and generates other attribute values during image generation. It is desirable that these identifying parameters be included in the
28 Image SOP Instances as well as in the MPPS object in a consistent manner. In the case of a Modality that is integrated but unable to receive or send identifying parameters, e.g. link down, emergency case, the Modality
30 may behave as if it were not integrated.

The Study Instance UID is a crucial Attribute that is used to relate Image SOP Instances (whose Study is
32 identified by their Study Instance UID), the Modality PPS SOP Instance which contains it as a reference, and the actual or conceptual Requested Procedure (i.e. Study) and related Imaging Service Request in the IS. An
34 IS that manages an actual or conceptual Detached Study Management entity is expected to be able to relate this Study Instance UID to the SOP Instance UID of the Detached Study Management SOP Instance, whether
36 or not the Study Instance UID is provided by the IS or generated by the modality.

Y.2.1 Modality Conforms to Modality Worklist and MPPS SOP Classes

2   The modality may:

• N_ CREATE a MPPS SOP Instance and include its SOP Instance UID in the Image SOP Instances within
4   the Referenced Study Component Sequence attribute.

• Copy the following Attribute values from the Modality Worklist information into the Image SOP Instances and
6   into the related MPPS SOP Instance:

   • Study Instance UID

8   • Referenced Study Sequence

   • Accession Number

10   • Requested Procedure ID

   • Scheduled Procedure Step ID

12   • Scheduled Procedure Step Description

   • Scheduled Action Item Code Sequence

14 • Create the following Attribute value and include it into the Image SOP Instances and the related MPPS SOP
     Instance:

16   • Performed Procedure Step ID

• Include the following Attribute values that may be generated during image acquisition, if supported, into the
18   Image SOP Instances and the related MPPS SOP Instance:

   • Performed Procedure Step Start Date

20   • Performed Procedure Step Start Time

   • Performed Procedure Step Description

22   • Study ID

Y2.2   Modality Conforms only to the Modality Worklist SOP Class

24   The modality may:

• In the absence of the ability to N-CREATE a MPPS SOP Instance, generate a MPPS SOP Instance UID and
26   include it into the Referenced Study Component Sequence attribute of the Image SOP Instances. A
     system that later N-CREATEs a MPPS SOP Instance may use this UID extracted from the related Image
28   SOP Instances.

• Copy the following Attribute values from the Modality Worklist information into the Image SOP Instances:

30   • Study Instance UID

- • Referenced Study Sequence

2   • Accession Number

- • Requested Procedure ID

4   • Scheduled Procedure Step ID

- • Scheduled Procedure Step Description

6   • Scheduled Action Item Code Sequence

- • Create the following Attribute value and include it into the Image SOP Instances:

8   • Performed Procedure Step ID

A system that later N-CREATEs a MPPS SOP Instance may use this Attribute value extracted from the
10 related Image SOP Instances.

- • Include the following Attribute values that may be generated during image acquisition, if supported, into the
12 Image SOP Instances:

- • Performed Procedure Step Start Date

14   • Performed Procedure Step Start Time

- • Performed Procedure Step Description

16   • Study ID

A system that later N-CREATEs a MPPS SOP Instance may use these Attribute values extracted from the
18 related Image SOP Instances.

Y2.3   Modality Conforms only to the MPPS SOP Class

20 The modality may:

- • N_ CREATE a MPPS SOP Instance and include its SOP Instance UID in the Image SOP Instances within
22 the Referenced Study Component Sequence attribute.

- • Create the following Attribute values and include them in the Image SOP Instances and the related MPPS
24 SOP Instance:

- • Study Instance UID (see also section Y.6)

26   • Performed Procedure Step ID

- • Copy the following Attribute values, if available to the Modality, into the Image SOP Instances and into the
28 related MPPS SOP Instance:

- • Accession Number

30   • Patient ID

- • Patient's Name

2 - • Patient's Birth Date

- • Patient's Sex

4   If sufficient identifying information is be included, it will allow the Image SOP Instances and the MPPS SOP
    Instance to be later related to the Requested Procedure and the actual or conceptual Detached Study
6   Management entity.

- • Include the following Attribute values that may be generated during image acquisition, if supported, into the
8   Image SOP Instances and the related MPPS SOP Instance:

- • Performed Procedure Step Start Date

10 - • Performed Procedure Step Start Time

- • Performed Procedure Step Description

12 - • Study ID

Y.3   NON-INTEGRATED ENVIRONMENT

14   "Non-Integrated" means in this context that the Acquisition Modality is not connected to an Information System
     Systems, does not receive Attribute values from an SCP of the Modality Worklist SOP Class, and cannot create
16   a Performed Procedure Step SOP Instance.

     The modality may:

18 - • In the absence of the ability to N-CREATE a MPPS SOP Instance, generate a MPPS SOP Instance UID and
     include it into the Referenced Study Component Sequence attribute of the Image SOP Instances. A
20   system that later N-CREATEs a MPPS SOP Instance may use this UID extracted from the related Image
     SOP Instances.

22 - • Create the following Attribute values and include them in the Image SOP Instances:

- • Study Instance UID (see also section Y.6)

24 - • Performed Procedure Step ID

     A system that later N-CREATEs a MPPS SOP Instance may use these Attribute values extracted from the
26   related Image SOP Instances.

- • Copy the following Attribute values, if available to the Modality, into the Image SOP Instances:

28 - • Accession Number

- • Patient ID

30 - • Patient's Name

- • Patient's Birth Date

• Patient's Sex

2   If sufficient identifying information is be included, it will allow the Image SOP Instances to be later related to the Requested Procedure and the actual or conceptual Detached Study Management entity.

4   • Include the following Attribute values that may be generated during image acquisition, if supported, into the Image SOP Instances:

6   • Performed Procedure Step Start Date

        • Performed Procedure Step Start Time

8   • Performed Procedure Step Description

        • Study ID

10   A system that later N-CREATEs a MPPS SOP Instance may use these Attribute values extracted from the related Image SOP Instances.

12   **Y.4   ONE MPPS IS CREATED IN RESPONSE TO TWO OR MORE REQUESTED PROCEDURES**

14   In the MPPS SOP Instance, all the specific attributes of a Scheduled Procedure Step or Steps are included in the Scheduled Step Attributes Sequence. In the Image SOP Instances, these attributes may be included in

16   the Request Attributes Sequence. This is an optional Sequence in order not to change the definition of existing SOP Classes by adding new required Attributes or changing the meaning of existing Attributes.

18   Both Sequences may have more than one Item if more than one Requested Procedure results in a single Performed Procedure Step.

20   Because of the definitions of existing Attributes in existing Image SOP Classes, the following solutions are a compromise. The first one chooses or creates a value for the single valued Attributes Study Instance UID and

22   Accession Number. The second one completely replicates the Image data with different values for the Attributes Study Instance UID and Accession Number.

24   **Y.4.1 Choose or create a value for Study Instance UID and Accession Number**

The modality may:

26   • In the Image SOP Instances:

        • create a Request Attributes Sequence containing two or more Items each containing the following
28   Attributes:

            • Requested Procedure ID

30   • Scheduled Procedure Step ID

            • Scheduled Procedure Step Description

32   • Scheduled Action Item Code Sequence

- • create a Referenced Study Sequence containing two or more Items sufficient to contain the Study
  SOP Instance UID values from the Modality Worklist for both Requested Procedures

- • select one value from the Modality Worklist or generate a new value for:

  - • Study Instance UID (see also Y.6)

- • select one value from the Modality Worklist or generate a new value or assign an empty value for:

  - • Accession Number

- • In the MPPS SOP Instance:

  - • create a Scheduled Step Attributes Sequence containing two or more Items each containing the
    following Attributes:

    - • Study Instance UID

    - • Referenced Study Sequence

    - • Accession Number

    - • Requested Procedure ID

    - • Scheduled Procedure Step ID

    - • Scheduled Procedure Step Description

    - • Scheduled Action Item Code Sequence

  - • include the following Attribute value that may be generated during image acquisition, if supported:

    - • Procedure Code Sequence

- • In both the Image SOP Instances and the MPPS SOP Instance

  - • create a Performed Procedure Step ID

  - • include the following Attribute values that may be generated during image acquisition, if supported:

    - • Performed Procedure Step Start Date

    - • Performed Procedure Step Start Time

    - • Performed Procedure Step Description

    - • Study ID

Y.4.2 Replicate the Image IOD

An alternative method is to replicate the entire Image SOP Instance with a new SOP Instance UID, and assign
each Image IOD it's own identifying attributes. In this case, each of the Study Instance UID and the Accession
Number values can be used in their own Image SOP Instance.

Both Image SOP Instances may reference a single MPPS SOP Instance (via the MPPS SOP Instance UID in
2   the Referenced Study Component Sequence).

Each individual Image SOP Instance may reference it's own related Study SOP Instance, if it exists (via the
4   Referenced Study Sequence). This Study SOP Instance has a one to one relationship with the corresponding
Requested Procedure.

6   If an MPPS SOP Instance is created, it may reference both related Study SOP Instances.

The modality may:

8   • For all Series in the MPPS, replicate the entire Series of Images using new Series Instance UIDs

• Create replicated Image SOP Instances with different SOP Instance UIDs that use the new Series Instance
10   UIDs, for each of the two or more Requested Procedures

• In each of the Image SOP Instances, using values from the corresponding Requested Procedure:

12   • create a Request Attributes Sequence containing an Item containing the following Attributes:

• Requested Procedure ID

14   • Scheduled Procedure Step ID

• Scheduled Procedure Step Description

16   • Scheduled Action Item Code Sequence

• copy from the Modality Worklist:

18   • Study Instance UID

• Accession Number

20   • create a Referenced Study Sequence containing an Item containing the following Attribute:

• Study SOP Instance in the Referenced Study Sequence from the Worklist

22   • In the MPPS SOP Instance (if supported):

• create a Scheduled Step Attributes Sequence containing two or more Items each containing the
24   following Attributes:

• Study Instance UID

26   • Referenced Study Sequence

• Accession Number

28   • Requested Procedure ID

• Scheduled Procedure Step ID

- • Scheduled Procedure Step Description

2
- • Scheduled Action Item Code Sequence

- • include the following Attribute value that may be generated during image acquisition, if supported:

4
- • Procedure Code Sequence

- • In both the Image SOP Instances and the MPPS SOP Instance (if supported):

6
- • create a Performed Procedure Step ID

- • Include the following Attribute values that may be generated during image acquisition, if supported:

8
- • Performed Procedure Step Start Date

- • Performed Procedure Step Start Time

10
- • Performed Procedure Step Description

- • Study ID

12 **Y.5   MPPS SOP INSTANCE CREATED BY ANOTHER SYSTEM (NOT THE MODALITY)**

If for some reason the Modality was unable to create the MPPS SOP Instance, another system may wish to
14 perform this service. This system must make sure that the created PPS SOP Instance is consistent with the
related Image SOP Instances.

16 Depending on the availability and correctness of values for the Attributes in the Image SOP Instances, these
values may be copied into the MPPS SOP Instance, or they may have to be coerced, e.g. if they are not
18 consistent with corresponding values available from the IS.

For example, if the MPPS SOP Instance UID is already available in the Image SOP Instance (in the Referenced
20 Study Component Sequence), it may be utilized to N-CREATE the MPPS SOP Instance. If not available, a new
MPPS SOP Instance UID may be generated and used to N-CREATE the MPPS SOP Instance. In this case
22 there may be no MPPS SOP Instance UID in the Referenced Study Component Sequence in the
corresponding Image SOP Instances. An update of the Image SOP Instances will restore the consistency, but
24 this is not required.

Y.6   MAPPING OF STUDY INSTANCE UIDS TO THE STUDY SOP INSTANCE UID

26 If modalities are not integrated with an Information System that is an SCP of the Modality Worklist SOP Class,
they are not able to receive an IS generated Study Instance UID, and therefore they must create their own
28 Study Instance UIDs.

The MPPS is a way of conveying back to an IS the Study Instance UID generated by the Modality in such a
30 case.

Integration of a Performed Procedure Step (and the corresponding Image SOP Instances) with the Study or
32 Imaging Service Request to which it corresponds is a management function of the IS. Even with all the normal
identifying Attributes present and consistent, it may not always be possible to perform such matching in a
34 completely automatic fashion.

Comparison of Corresponding Attributes of Modality Worklist Information Model, Image and Standalone IODs and Modality Performed Procedure Step IOD

Modality Worklist [Return Key Type] [e]	Images and Standalone IOD [Type]	MPPS IOD [SCU/SCP Type]
----	----	Scheduled Step Attributes Sequence [1/1] [c]
Study Instance UID [1]	Study Instance UID [1]	>Study Instance UID [1/1]
Referenced Study Sequence [2] [d]	Referenced Study Sequence [3] [c]	>Referenced Study Sequence [2/2] [f]
Accession Number [2]	Accession Number [2]	>Accession Number [2/2]
----	*Request Attributes Sequence [3]* [a,c]	----
Requested Procedure ID [1]	*>Requested Procedure ID [1C]*	>Requested Procedure ID [2/2]
Scheduled Procedure Step ID [1]	*>Scheduled Procedure Step ID [1C]*	>Scheduled Procedure Step ID [2/2]
Scheduled Procedure Step Description [1C]	*>Scheduled Procedure Step Description [3]*	>Scheduled Procedure Step Description [2/2]
Scheduled Action Item Code Sequence [1C]	*>Scheduled Action Item Code Sequence [3]*	Performed Action Items Code Sequence [2/2]
----	Study ID [2]	Study ID [2/2]
----	*Performed Procedure Step ID [3]* [b]	Performed Procedure Step ID [1/1]
----	*Performed Procedure Step Start Date [3]* [b]	Performed Procedure Step Start Date [1/1]
----	*Performed Procedure Step Start Time [3]* [b]	Performed Procedure Step Start Time [1/1]
----	*Performed Procedure Step Description [3]*	Performed Procedure Step Description [2/2]
Requested Procedure Description [1C]		
Requested Procedure Code Sequence [1C]	----	Procedure Code Sequence [2/2]
----	Referenced Study Component Sequence [3] [d]d)	----
----	>Referenced SOP Class UID [1C]	SOP Class UID [1/1]
----	>Referenced SOP Instance UID [1C]	SOP Instance UID [1/1]
----	Protocol Name [3]	Protocol Name [1/1]

    a.   recommended if the Modality conforms as a SCU to the Modality Worklist SOP Class and Modality Performed Procedure Step

2   b.   recommended if the Modality conforms as a SCU to the Modality Performed Procedure Step SOP Class

    c.   Sequence may have one or more Items

4   d.   Sequence may have only one Item

    e.   Worklist may have one or more Items related to one Modality Performed Procedure Step

6   f.   Referenced Study Sequence may have only one item. If more Study Sequences are related to the Modality Performed Procedure Step, additional Scheduled Step Attribute Sequence items must be created.

2 **NEMA Standards Publication PS 3.6 - 1996**

4 *Digital Imaging and Communications in Medicine (DICOM)*

Addendum Part 6: Modality Performed Procedure Step Data Dictionary

6

Part 6 Addendum

2 **Item 15: Add the following Data Elements to Part 6 Section 6:**

4 | Tag | Name | VR | VM |
|-----|------|-----|-----|
| 6 (0008,2229) | Anatomic Structure, Space or Region Sequence | SQ | 1 |
| (0040,0220) | Referenced Standalone SOP Instance Sequence | SQ | 1 |
| 8 (0040,0241) | Performed Station AE Title | AE | 1 |
| (0040,0242) | Performed Station Name | SH | 1 |
| 10 (0040,0243) | Performed Location | SH | 1 |
| (0040,0244) | Performed Procedure Step Start Date | DA | 1 |
| 12 (0040,0245) | Performed Procedure Step Start Time | TM | 1 |
| (0040,0250) | Performed Procedure Step End Date | DA | 1 |
| 14 (0040,0251) | Performed Procedure Step End Time | TM | 1 |
| (0040,0252) | Performed Procedure Step Status | CS | 1 |
| 16 (0040,0253) | Performed Procedure Step ID | CS | 1 |
| (0040,0254) | Performed Procedure Step Description | LO | 1 |
| 18 (0040,0255) | Performed Procedure Type Description | LO | 1 |
| (0040,0260) | Performed Action Item Sequence | SQ | 1 |
| 20 (0040,0270) | Scheduled Step Attributes Sequence | SQ | 1 |
| (0040,0275) | Request Attributes Sequence | SQ | 1 |
| 22 (0040,0280) | Comments on the Performed Procedure Steps | ST | 1 |
| (0040,0293) | Quantity Sequence | SQ | 1 |
| 24 (0040,0294) | Quantity | DS | 1 |

	(0040,0295)	Measuring Units Sequence	SQ	1
2	(0040,0296)	Billing Item Sequence	SQ	1
	(0040,0300)	Total Time of Fluoroscopy	US	1
4	(0040,0301)	Total Number of Exposures	US	1
	(0040,0302)	Entrance Dose	US	1
6	(0040,0303)	Exposed Area	US	1-2
	(0040,0306)	Distance Source to Entrance	DS	1
8	(0040,0310)	Comments on Radiation Dose	ST	1
	(0040,0320)	Billing Procedure Step Sequence	SQ	1
10	(0040,0321)	Film Consumption Sequence	SQ	1
	(0040,0324)	Billing Supplies and Devices Sequence	SQ	1
12	(0040,0330)	Referenced Procedure Step Sequence	SQ	1
	(0040,0340)	Performed Series Sequence	SQ	1

Item 16: Add the following UIDs to Part 6 Annex A:

2

UID Value	UID Name	UID Type	Part
1.2.840.10008.3.1.2.3.3	Modality Performed Procedure Step SOP Class	SOP Class	PS 3.4
1.2.840.10008.3.1.2.3.4	Modality Performed Procedure Step Retrieve SOP Class	SOP Class	PS 3.4
1.2.840.10008.3.1.2.3.5	Modality Performed Procedure Step Notification SOP Class	SOP Class	PS 3.4