

Digital Imaging and Communications in Medicine (DICOM)

Supplement 96: Unified Worklist and Procedure Step

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110

Scope and Field of Application

111 This Supplement introduces a Unified Worklist and Procedure Step Service Class by adding a Unified
112 Procedure Step IOD and four associated SOP Classes to interact with it; one for pushing items onto a
113 worklist, one for pulling items off of a worklist and updating them, one for monitoring a worklist item and
114 one for transmitting status events.

115 The Unified Procedure Step (UPS) combines the details of a procedure step as planned, and the details of
116 how it was actually performed, allowing them to be managed in a single object instance.

117 The **UPS Push SOP Class** allows SCU systems to:

- 118 • create (push) a new worklist item (i.e. instance) on a worklist
- 119 • submit a cancellation request for a worklist item

120 The **UPS Pull SOP Class** allows SCU systems to:

- 121 • query a worklist for matching items
- 122 • take responsibility for performing a worklist item
- 123 • add/modify progress/status/result details for the worklist item
- 124 • finalize a controlled worklist item as Completed or Canceled.

125 The **UPS Watch SOP Class** allows SCU systems to:

- 126 • query for worklist items of interest
- 127 • subscribe/unsubscribe for event notifications of changes to a given worklist item
- 128 • subscribe/unsubscribe for event notifications of all worklist items
- 129 • get details for a given worklist item
- 130 • submit a cancellation request for a given worklist item

131 The **UPS Event SOP Class** allows SCU systems to:

- 132 • receive event notifications of changes to a worklist item

133 By implementing combinations of these four SOP Classes (See Appendix Z in Part 17) systems can
134 support a wide variety of use cases including Push workflow, Pull workflow and monitoring.

135

136 The following paragraphs discuss gaps in existing DICOM SOP Classes that support worklists.

137 The ability to query a worklist for work items containing the details and context of a task, aka “Pull
138 Workflow”, has proved to be one of the most successful services in DICOM. The Modality Worklist SOP
139 Class is implemented by the vast majority of modality systems in the market, however it is limited in some
140 ways to modality tasks. The Modality Performed Procedure Step SOP Class closes the loop by allowing
141 feedback on the status, progress and results of a work item.

142 The General Purpose Worklist Management SOP Class and the General Purpose Performed Procedure
143 Step SOP Class introduced similar capabilities to non-modality systems; however aspects of these SOP
144 Classes, such as managing scheduled and performed workitems separately and permitting an N:M
145 relationship between them, can make management of the state and the relationships of the workitems
146 difficult for the SCP. Further, since DICOM did not specify this behavior, it raises the possibility of
147 incompatible implementations.

148 Neither of the above approaches support “Push Workflow”, where the worklist manager pushes task
149 assignments to the performing system, or where a third “scheduling” system pushes new tasks onto the
150 worklist manager. Reporting, radiation therapy planning, CAD system scheduling, image post-processing
151 and some modality scenarios all have applications for such a Push Workflow. HL7 order messaging is a
152 form of Push Workflow. A mechanism permitting Push Workflow as well as Pull Workflow would be a
153 useful feature.

154 Some implementations have used dataflow to mimic a form of implicit Push Workflow. Data is pushed or
155 otherwise made available to an application, from which the application infers that it should perform some
156 work. In some scenarios, the application can make an accurate educated guess about what needs to be
157 done based on the presence and type of data, however, it is missing the additional context information
158 and/or processing parameters that would be present in an explicit workitem. Similarly, progress and
159 completion of the work must be inferred by the appearance of some form of output, rather than being
160 explicitly recorded. It can also be difficult for the application to know when it has received the full set of
161 input objects.

162 The Unified Procedure Step (UPS) Service Class simplifies the state machine and relationships by
163 merging the request information (worklist), the status information, and the results information into a single
164 normalized object. In DICOM terms, the Scheduled Procedure Step and the Performed Procedure Step
165 are merged into one IOD that combines modules derived from the General Purpose Worklist Management
166 IOD and the General Purpose Performed Procedure Step IOD. This forces a 1:1 relationship between
167 these elements, simplifying management.

168 Examples of uses include:

169 a. CAD Processing Push Workflow

170
171 Tasks may be pushed to particular machines along with a copy of the data to be processed and
172 possibly specific parameters. The system managing the reading worklist may subscribe to monitor
173 the progress/completion of the CAD processing to know when the study is ready for reading by the
174 human observer.

175 b. “3D Lab” Pull Workflow

176
177 Tasks to prepare 3D views of acquired studies are pushed (perhaps by the RIS upon scheduling;
178 perhaps by the modality upon completion of the acquisition; perhaps by the PACS upon receipt of
179 the acquired images) onto a 3D Lab worklist. One of several 3D workstations pulls the workitem
180 off the worklist, retrieves the identified images and performs the requested 3D view generation.
181 Again, the system managing the reading worklist would get subscribed to monitor completion to
182 know when the views, and the study, are ready for reading.

183 c. Radiation Therapy Dose Calculation Push Workflow

184
185 Users schedule tasks to a shared dose calculation server system and need to track progress.
186 Pushing the tasks avoids problems with a pull workflow such as the server having to continually
187 poll worklists on (a large number of) possible clients; needing to configure the server to know

188 about all the clients; reporting results to a user who might be at several locations; and associating
189 the results with clients automatically.

190 d. Radiation Therapy Pull workflow

191 A Treatment Delivery System or other auxiliary device such as a Patient Positioning System
192 performs a workflow query on a Treatment Management System, and selects one or more of the
193 returned workitems, performing them in sequence. The Treatment Management System is
194 typically responsible for scheduling the procedure steps itself (rather than receiving them from
195 another system via UPS push).
196

197 e. Mammography Workflow

198 Mammography frequently makes use of CAD as a post-processing step as described in example
199 a) above. It would also benefit from the Radiologist being able to order additional views or retakes
200 from the reporting station. This could be done using UPS Push to the modality; or UPS Push to
201 the RIS and UPS Pull from the modality; or UPS Push to the RIS and some mirroring mechanism
202 (not specified here) where the RIS creates a new Modality Worklist item based on the new UPS.
203 Mammography reporting workflow often involves dual-reads/overreads and the resulting
204 reconciliation of differences that might benefit from UPS workflow patterns such as chaining or
205 handoffs (see below).
206

207 f. Task Hand-offs

208 After starting a task, a user may find that the job is more appropriate for someone else (for
209 example a complex interpretation could be “forwarded” to a specialist). A new task could be
210 added to the worklist, perhaps specifically identified for another person. The original requestor
211 could be subscribed to monitor the subsequent task and the original performer could also
212 subscribe to monitor that the new task gets done, and perhaps review the result as a learning
213 exercise.
214

215 g. Task Subcontracting

216 When a primary task is pushed onto the worklist of a departmental manager, it might then create
217 several subtasks necessary to complete the primary task and put the subtasks on the appropriate
218 worklists or push the subtasks directly to the appropriate performing system.
219

220 h. Task Chaining

221 Each system in a department, upon completing a task, might push the logical follow-on task onto
222 the worklist of the next system in the chain. A supervisory system might globally subscribe to each
223 of the working systems to keep tabs on all activity, and perhaps manage any exceptions.
224

225 i. BPEL Leaf Node (Complex Business Logic System)

226 An organization may implement a system for managing complex business logic (decomposing the
227 complex business logic into separate decision elements and simple performing elements). The
228 Business Process Execution Language (BPEL) is an example of a standard defining one such
229 system. DICOM equipment might act as “leaf” nodes that are scheduled and controlled by such a
230 system. The Unified Procedure Step provides mechanisms for such a business management
231 system to communicate step details to the performing DICOM device and monitor progress and
232 results.
233

234 Cases where there are N:M relationships can often be reduced to 1:1 tasks to be performed by the
235 devices.

236 Appendix Z in Part 17 (below) discusses some of the above issues and examples in more detail, however
 237 defining specific business logic for mapping complex tasks to one or more simpler ones, deciding when
 238 something should be put on a worklist, tracking availability of task inputs, etc. is beyond the scope of this
 239 supplement.

240

Part 2 Addendum

Add new FT SOP Class UIDs to overview table. (FZ values were never added to the standard)

Table A.1-2
 UID VALUES

UID Value	UID NAME	Category
...		
<u>1.2.840.10008.5.1.4.34.6.1</u>	<u>Unified Procedure Step – Push SOP Class</u>	<u>Workflow Management</u>
<u>1.2.840.10008.5.1.4.34.6.2</u>	<u>Unified Procedure Step – Watch SOP Class</u>	<u>Workflow Management</u>
<u>1.2.840.10008.5.1.4.34.6.3</u>	<u>Unified Procedure Step – Pull SOP Class</u>	<u>Workflow Management</u>
<u>1.2.840.10008.5.1.4.34.6.4</u>	<u>Unified Procedure Step – Event SOP Class</u>	<u>Workflow Management</u>

245

Part 3

Modify section 6.3.1 as follows:

6.3.1 DIMSE-C SERVICES

250 DIMSE-C Services are services applicable only to a Composite IOD, **except for C-FIND which may apply to both normalized and composite instances**. DIMSE-C Services provide only operation services.

Add the following at the end of section 7

7.X EXTENSION OF THE DICOM MODEL OF THE REAL-WORLD FOR THE UNIFIED PROCEDURE STEP (UPS)

255 The DICOM Model of the Real-World is extended with the addition of a Unified Procedure Step object whose relationship to existing DICOM Real World objects is shown in Figure 7.X.a.

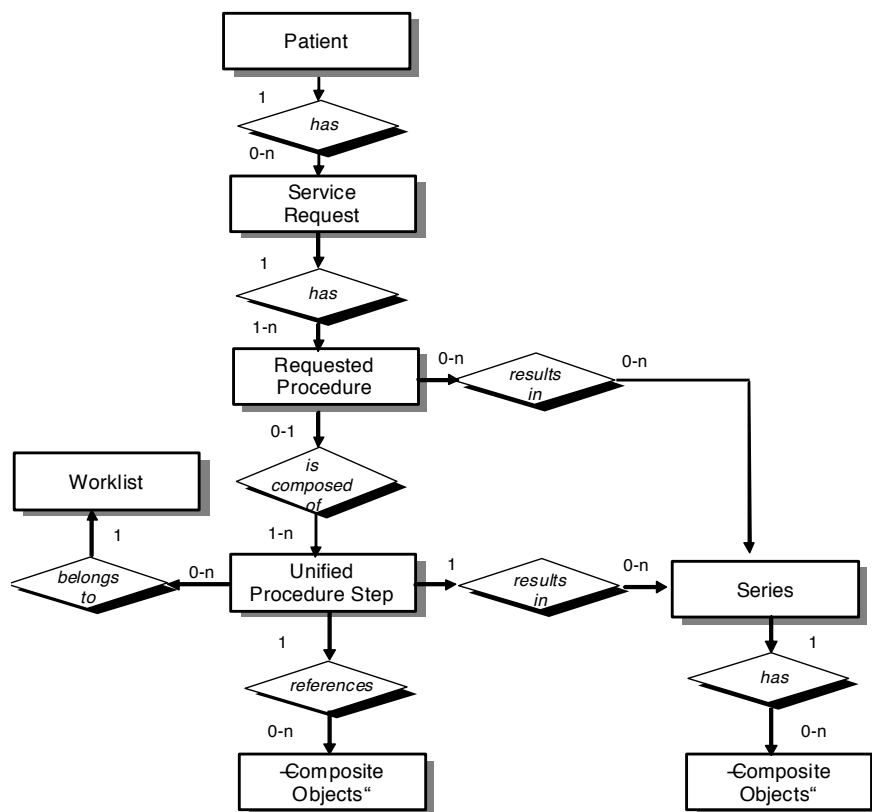


Figure 7.X.a DICOM Model of the Real World – Unified Procedure Step

7.X.1 Unified Procedure Step

A Unified Procedure Step (UPS) represents an arbitrary unit of service. Unified Procedure Steps are generally scheduled in response to a Requested Procedure, although a UPS may be triggered by other events, such as a scheduled calibration, completion of prior work in a pipeline, etc.

The Unified Procedure Step (UPS) unifies the details of the procedure step that has been requested, the progress details during performance, and the details of the procedure step actually performed. The details can describe the specific service activity, the subject and/or data acted on, the originator and context of the request, the human/equipment/application resources involved, the priority, date, time and location of the activity, and references to resulting output data.

Normally the details about the activity as performed correspond to the details of the activity as requested, however real-world conditions may dictate that what is actually performed does not correspond exactly with what was requested or scheduled.

7.X.2 Worklist

A Worklist is an arbitrary collection of Unified Procedure Steps that share a common worklist label.

Add the second table shown here (10-3b) to Section 10.3. (Table 10-3 is shown here for reference)

10.3 IMAGE SOP INSTANCE REFERENCE MACRO

Table 10-3

IMAGE SOP INSTANCE REFERENCE MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
<i>Include 'SOP Instance Reference Macro' Table 10-11</i>			
Referenced Frame Number	(0008,1160)	1C	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.
Referenced Segment Number	(0062,000B)	1C	Identifies the Segment Number to which the reference applies. Required if the Referenced SOP Instance is a Segmentation and the reference does not apply to all segments and Referenced Frame Number (0008,1160) is not present.

The Referenced Instances and Access Macro (Table 10-3b) contains identifiers and access details for a collection of instances. It is intended to provide sufficient information to retrieve the referenced instances.

Table 10-3b

REFERENCED INSTANCES AND ACCESS MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Type of Instances	(0040,E020)	1	<p>Type of object instances referenced.</p> <p>Defined Terms:</p> <p><u>DICOM</u></p> <p><u>CDA</u></p>
Study Instance UID	(0020,000D)	1C	<p>Unique identifier for the Study.</p> <p>Required if Type of Instances (0040,E020) is DICOM</p>
Series Instance UID	(0020,000E)	1C	<p>Unique identifier for the Series that is part of the Study identified in Study Instance UID (0020,000D), if present, and contains the referenced object instance(s).</p> <p>Required if Type of Instances (0040,E020) is DICOM</p>
Referenced SOP Sequence	(0008,1199)	1	<p>References to object instances.</p> <p>One or more Items shall be included in this sequence</p>
>Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.
>Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.
>HL7 Instance Identifier	(0040,E001)	1C	<p>Instance Identifier of the encapsulated HL7 Structured Document, encoded as a UID (OID or UUID), concatenated with a caret (“^”) and Extension value (if Extension is present in Instance Identifier).</p> <p>Required if Type of Instances (0040,E020) is CDA.</p>
>Referenced Frame Number	(0008,1160)	1C	<p>Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1.</p> <p>Note: This Attribute may be multi-valued.</p> <p>Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.</p>
>Referenced Segment Number	(0062,000B)	1C	<p>Identifies the Segment Number to which the reference applies. Required if the Referenced SOP Instance is a Segmentation and the reference does not apply to all segments and Referenced Frame Number (0008,1160) is not present.</p>

<u>DICOM Retrieval Sequence</u>	<u>(0040,E021)</u>	<u>1C</u>	<p><u>Details for retrieving instances via the DICOM Retrieve Service.</u></p> <p><u>Required if Media Retrieval Sequence (0040,E022), WADO Retrieval Sequence (0040,E023), and XDS Retrieval Sequence (0040,E024) are not present. May be present otherwise.</u></p> <p><u>This sequence shall only identify sources known to have instances referenced in Referenced SOP Sequence (0008,1199).</u></p> <p><u>One or more Items shall be included in this sequence.</u></p>
<u>>Retrieve AE Title</u>	<u>(0008,0054)</u>	<u>1</u>	<p><u>Title of a DICOM Application Entity where the referenced instance(s) may be retrieved on the network.</u></p>
<u>Media Retrieval Sequence</u>	<u>(0040,E022)</u>	<u>1C</u>	<p><u>Details for retrieving instances from Media.</u></p> <p><u>Required if DICOM Retrieval Sequence (0040,E021), WADO Retrieval Sequence (0040,E023), and XDS Retrieval Sequence (0040,E024) are not present. May be present otherwise.</u></p> <p><u>This sequence shall only identify media known to have instances referenced in Referenced SOP Sequence (0008,1199).</u></p> <p><u>One or more Items shall be included in this sequence.</u></p>
<u>>Storage Media File-Set ID</u>	<u>(0088,0130)</u>	<u>2</u>	<p><u>The user or implementation specific human readable identifier that identifies the Storage Media on which the referenced instance(s) reside.</u></p>
<u>>Storage Media File-Set UID</u>	<u>(0088,0140)</u>	<u>1</u>	<p><u>Uniquely identifies the Storage Media on which the referenced instance(s) reside.</u></p>
<u>WADO Retrieval Sequence</u>	<u>(0040,E023)</u>	<u>1C</u>	<p><u>Details for retrieving instances available as Uniform Resources via WADO.</u></p> <p><u>Note: This sequence addresses use of the <u>URI-based Web Access to DICOM Objects. Retrieval via the Web Services-based WADO-WS is addressed in the XDS Retrieval Sequence (0040,E024).</u></u></p> <p><u>Required if DICOM Retrieval Sequence (0040,E021), Media Retrieval Sequence (0040,E022), and XDS Retrieval Sequence (0040,E024) are not present. May be present otherwise.</u></p> <p><u>One or more Items shall be included in this sequence.</u></p>

<u>>Retrieve URI</u>	<u>(0040,E010)</u>	<u>1</u>	<u>Retrieval access path to the referenced instance(s). Includes fully specified scheme, authority, path, and query in accordance with RFC 2396.</u>
<u>XDS Retrieval Sequence</u>	<u>(0040,E024)</u>	<u>1C</u>	<u>Details for retrieving instances using WADO-WS or IHE XDS transactions.</u> <u>Note: This sequence addresses use of the Web Services-based WADO-WS. Retrieval via the URI-based Web Access to DICOM Objects is addressed in the WADO Retrieval Sequence (0040,E023).</u> <u>Required if DICOM Retrieval Sequence (0040,E021), Media Retrieval Sequence (0040,E022), and WADO Retrieval Sequence (0040,E023) are not present. May be present otherwise.</u> <u>This sequence shall only identify repositories known to have instances referenced in Referenced SOP Sequence (0008,1199).</u> <u>One or more Items shall be included in this sequence.</u>
<u>>Repository Unique ID</u>	<u>(0040,E030)</u>	<u>1</u>	<u>Uniquely identifies a Repository from which the referenced instances can be retrieved.</u>
<u>>Home Community ID</u>	<u>(0040,E031)</u>	<u>3</u>	<u>Uniquely identifies a Community to which requests for the referenced instances can be directed.</u>

Add Section B.X Unified Procedure Step IOD

B.X UNIFIED PROCEDURE STEP INFORMATION OBJECT DEFINITION

B.X.1 IOD Description

285 A Unified Procedure Step (UPS) describes the details of a procedure step that has been scheduled, the progress details during performance, and the details of the procedure step actually performed in response.

B.X.2 IOD Modules

Table B.X.2-1 lists the modules that make up the Unified Procedure Step IOD.

**Table B.X.2-1
UNIFIED PROCEDURE STEP IOD MODULES**

290

Module	Reference	Module Description
SOP Common	C.12.1	Contains SOP common information
Unified Procedure Step Relationship Module	C.X.4	References the related SOPs and IEs
Unified Procedure Step	C.X.2	Describes the UPS task to be performed including

Scheduled Procedure Information		information about place, time, priority and input data
Unified Procedure Step Progress Information	C.X.1	Describes the progress of a UPS task
Unified Procedure Step Performed Procedure Information	C.X.3	Describes the work performed including information about status, place, time and result data

Add Section C.X Unified Procedure Step Modules

C.X UNIFIED PROCEDURE STEP SPECIFIC MODULES

295 The following Sections specify Modules used for Unified Procedure Steps.

C.X.1 Unified Procedure Step Progress Information Module

Table C.X.1-1 specifies the Attributes that describe the progress of a Unified Procedure Step (UPS).

**Table C.X.1-1
Unified Procedure Step Progress Information Module Attributes**

Attribute Name	Tag	Attribute Description
Procedure Step State	(0074,1000)	State of the Procedure Step. Enumerated Values: SCHEDULED IN PROGRESS CANCELED COMPLETED See PS3.4 for details on Unified Procedure Step states.
Progress Information Sequence	(0074,1002)	Information about work progress for the Procedure Step. Zero or one Item shall be included in this sequence.
>Procedure Step Progress	(0074,1004)	A numerical indicator of progress expressed as percentage complete. Note: This is primarily for status rendering (e.g. progress bar). The percentage is not necessarily an accurate indication of total time.
>Procedure Step Progress Description	(0074,1006)	A textual description of progress. Note: For example, it might contain "Annealing complete".
>Procedure Step Communications URI	(0074,1008)	Contact Information to communicate with performers of the Procedure Step.

Attribute Name	Tag	Attribute Description
Sequence		Zero or more Items shall be included in this sequence.
>>Contact URI	(0074,100a)	URI to communicate with performer of the procedure in progress. Any URI (telephone number, URL, etc.) is permitted.
>>Contact Display Name	(0074,100c)	Name of the person, department or organization to contact for more information about the performance of the Procedure Step.
>Procedure Step Cancellation DateTime	(0040,4052)	Date and Time at which the procedure step was discontinued.
>Reason For Cancellation	(0074,1238)	A textual description of the reason a procedure step was discontinued.
>Procedure Step Discontinuation Reason Code Sequence	(0074,100e)	Coded Reason(s) for Discontinuing the Procedure Step. Zero or more items shall be included in this sequence.
>>Include 'Code Sequence Macro' Table 8.8-1		Defined Context ID is 9300.

300

C.X.2 Unified Procedure Step Scheduled Procedure Information Module

Table C.X.2-1 specifies the Attributes that describe the Unified Procedure Step (UPS) to be performed. The UPS may or may not be scheduled for a specific time or device, or may simply represent a piece of work that is intended to be performed.

305

**Table C.X.2-1
Unified Procedure Step Scheduled Procedure Information Module Attributes**

Attribute Name	Tag	Attribute Description
Scheduled Procedure Step Priority	(0074,1200)	Priority of the scheduled Procedure Step Enumerated Values are: HIGH: used to indicate an urgent or emergent work item, equivalent to a STAT request. MEDIUM: used to indicate a work item that has a priority less than HIGH and higher than LOW. It can be used to further stratify work items. LOW: used to indicate a routine or non-urgent work item.
Scheduled Procedure Step Modification Date and Time	(0040,4010)	Date and time when the Scheduled Procedure Information was last modified or first created (whichever is most recent). Note: This attribute should be automatically updated by the worklist management system whenever any modification is made to Scheduled Procedure Information Module attributes of a Unified Procedure Step.
Worklist Label	(0074,1202)	A label identifying the worklist to which the

Attribute Name	Tag	Attribute Description
		Procedure Step instance belongs.
Procedure Step Label	(0074,1204)	A label describing the task of the Procedure Step in text appropriate for displaying in the user selection interface.
Comments on the Scheduled Procedure Step	(0040,0400)	User-defined comments on the scheduled Procedure Step.
Scheduled Station Name Code Sequence	(0040,4025)	Identifying names within the enterprise of the equipment for which the Procedure Step is scheduled. The names conveyed in the Code Value (0008,0100) may be the same as the AE Titles, but do not have to be. Zero or more Items shall be included in this sequence.
<i>>Include Code Sequence Macro Table 8.8-1</i>		<i>No Baseline Context ID is defined.</i>
Scheduled Station Class Code Sequence	(0040,4026)	Classes of the equipment for which the Procedure Step is scheduled. Zero or more Items shall be included in this sequence.
<i>>Include Code Sequence Macro Table 8.8-1</i>		<i>No Baseline Context ID is defined.</i>
Scheduled Station Geographic Location Code Sequence	(0040,4027)	Geographic locations of the equipment for which the Procedure Step is scheduled. Zero or more Items shall be included in this sequence.
<i>>Include Code Sequence Macro Table 8.8-1</i>		<i>No Baseline Context ID is defined.</i>
Scheduled Human Performers Sequence	(0040,4034)	Human performers that are scheduled to be involved or responsible for performing the Procedure Step. Zero or more Items shall be included in this sequence.
>Human Performer Code Sequence	(0040,4009)	Human performer that is involved or responsible for performing the Procedure Step. Only a single Item shall be permitted in this sequence.
<i>>>Include Code Sequence Macro Table 8.8-1</i>		<i>No Baseline Context ID is defined.</i>
>Human Performer's Name	(0040,4037)	Name of the human performer.
>Human Performer's Organization	(0040,4036)	Organization to which the human performer is accountable for the activities in the Procedure Step.
Scheduled Procedure Step Start Date Time	(0040,4005)	Date and time at which the Procedure Step is scheduled to start.
Expected Completion Date Time	(0040,4011)	Date and time at which the Procedure Step is expected to be completed.
Scheduled Workitem Code	(0040,4018)	Coded description of the Procedure Step.

Attribute Name	Tag	Attribute Description
Sequence		Only a single Item shall be permitted in this sequence.
>Include Code Sequence Macro Table 8.8-1		<p><i>Baseline Context ID is CID 9231</i></p> <p><i>Note: This CID has generic workitems. An implementation may choose to define more specific, detailed workitems.</i></p>
Scheduled Processing Parameters Sequence	(0074,1210)	<p>Processing parameters to be used by the performing system when carrying out the Procedure Step.</p> <p>Zero or more Items shall be included in this sequence.</p>
>Include Content Item Macro Table 10-2		<p><i>The Content Item shall not have a Value Type (0040,A040) of CONTAINER.</i></p> <p><i>Note: The CONTAINER limitation prevents encoding SR Trees.</i></p>
Input Readiness State	(0040,4041)	<p>Readiness state of the Input Information Sequence (0040,4021) and the referenced instances.</p> <p>Enumerated values are:</p> <p style="padding-left: 40px;">INCOMPLETE</p> <p style="padding-left: 40px;">UNAVAILABLE</p> <p style="padding-left: 40px;">READY</p> <p>INCOMPLETE means the Input Information Sequence is not yet complete and additional instance references might be added.</p> <p>UNAVAILABLE means the Input Information Sequence is complete but one or more of the referenced instances might not yet be available from the referenced source(s).</p> <p>READY means that the Input Information Sequence is complete and the referenced instances are available from the referenced sources.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1) If the Procedure Step does not require input information, the Input Readiness State may be READY when the Input Information Sequence is empty. 2) There is no guarantee that the referenced instances will still be available at the referenced location when retrieval is attempted. 3) There is no requirement to confirm the presence of referenced media prior to setting the Input Readiness State to

Attribute Name	Tag	Attribute Description
		READY.
Input Information Sequence	(0040,4021)	References to information objects needed to perform the scheduled Procedure Step. Referencing unencapsulated HL7 documents is described further in C.12.1.1.6. See also Input Readiness State (0040,4041). Zero or more Items shall be included in this sequence.
<i>>Include ' Referenced Instances and Access Macro' Table 10-3b</i>		
Study Instance UID	(0020,000D)	Unique Study identification that shall be used for the created Composite SOP Instances resulting from this Unified Procedure Step.

C.X.3 Unified Procedure Step Performed Procedure Information Module

310 Table C.X.3-1 specifies the Attributes that describe the performance and results of a Unified Procedure Step (UPS).

**Table C.X.3-1
Unified Procedure Step Performed Procedure Information Module Attributes**

Attribute Name	Tag	Attribute Description
Unified Procedure Step Performed Procedure Sequence	(0074,1216)	Details of the Procedure Step as performed. Zero or one item shall be included in this sequence.
>Actual Human Performers Sequence	(0040,4035)	Human performers that are/were actually involved or responsible for performing the Procedure Step. Zero or more Items shall be included in this sequence. Note: Initially this list will be empty. Items may be added to the list at or after the status transition of the Procedure Step State (0074,1000) to "IN PROGRESS"
>>Human Performer Code Sequence	(0040,4009)	Human performer that is involved or responsible for performing the Procedure Step. Only a single Item shall be permitted in this sequence.
<i>>>>Include Code Sequence Macro Table 8.8-1</i>		No Baseline Context ID is defined.
>>Human Performer's Name	(0040,4037)	Name of the human performer.
>>Human Performer's Organization	(0040,4036)	Organization to which the human performer is accountable for the activities in the Procedure Step.

>Performed Station Name Code Sequence	(0040,4028)	Names within the enterprise of the equipment that performed the Procedure Step. This name may be the same as the AE Title, but does not have to be. Zero or more Items shall be included in this sequence.
>>Include Code Sequence Macro Table 8.8-1		<i>No Baseline Context ID is defined.</i>
>Performed Station Class Code Sequence	(0040,4029)	Classes of the equipment that created the Procedure Step. Zero or more Items shall be included in this sequence.
>>Include Code Sequence Macro Table 8.8-1		<i>No Baseline Context ID is defined.</i>
>Performed Station Geographic Location Code Sequence	(0040,4030)	Geographic locations of the equipment that created Procedure Step. Zero or more Items shall be included in this sequence.
>>Include Code Sequence Macro Table 8.8-1		<i>No Baseline Context ID is defined.</i>
>Performed Procedure Step Start DateTime	(0040,4050)	Date and Time at which the Procedure Step started.
>Performed Procedure Step Description	(0040,0254)	Institution-generated description or classification of the Procedure Step that was performed.
>Performed Workitem Code Sequence	(0040,4019)	A sequence that conveys the type of procedure performed. Zero or more items shall be present in this sequence.
>>Include Code Sequence Macro Table 8.8-1		<i>Baseline Context ID is CID 9231</i> Note: This CID has generic workitems. An implementation may choose to define more specific, detailed workitems.
>Performed Processing Parameters Sequence	(0074,1212)	Parameters used to perform the procedure. Zero or more items shall be present in this sequence
>>Include Content Item Macro Table 10-2		<i>The Content Item shall not have a Value Type (0040,A040) of CONTAINER.</i> Note: The CONTAINER limitation prevents including SR Trees.
>Performed Procedure Step End DateTime	(0040,4051)	Date and Time at which the Procedure Step ended.

>Output Information Sequence	(0040,4033)	<p>References to information created as part of the Procedure Step.</p> <p>Referencing unencapsulated HL7 documents is described further in C.12.1.1.6.</p> <p>Zero or more Items shall be included in this sequence.</p>
>>Include 'Referenced Instances and Access Macro' Table 10-3b		

C.X.4 Unified Procedure Step Relationship Module

315 Table C.X.4-1 specifies the Attributes that describe the relationship of a Unified Procedure Step (UPS).

**Table C.X.4-1
Unified 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. See C.X.4.1
<i>Include Issuer of Patient ID Macro Table 10-18</i>		
Other Patient IDs Sequence	(0010,1002)	Identification numbers or codes used to identify the patient, which may or may not be human readable, and may or may not have been obtained from an implanted or attached device such as an RFID or barcode. Zero or more Items shall be included in this sequence.
>Patient ID	(0010,0020)	An identification number or code used to identify the patient.
<i>>Include Issuer of Patient ID Macro Table 10-18</i>		
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
Admission ID	(0038,0010)	Identification number of the visit as assigned by the healthcare provider
Issuer of Admission ID Sequence	(0038,0014)	Identifier of the Assigning Authority that issued the Admission ID. Only a single Item shall be permitted in this sequence.
<i>>Include HL7v2 Hierarchic Designator Macro</i>		

<i>Table 10-17</i>		
Admitting Diagnoses Description	(0008,1080)	Description of admitting diagnosis (diagnoses) for the patient.
Admitting Diagnoses Code Sequence	(0008,1084)	Coded admitting diagnosis (diagnoses) for the patient. One or more Items shall be included in this Sequence.
<i>>Include 'Code Sequence Macro' Table 8.8-1</i>		<i>No Baseline Context ID is defined.</i>
Referenced Request Sequence	(0040,A370)	Requested Procedures to which the Procedure Step contributes. Zero or more Items shall be included in the sequence.
<i>>Study Instance UID</i>	(0020,000D)	Unique identifier for the Study.
<i>>Accession Number</i>	(0008,0050)	An identifier of the order for the Study.
<i>>Issuer of Accession Number Sequence</i>	(0008,0051)	Identifier of the Assigning Authority that issued the Accession Number. Only a single Item shall be permitted in this sequence.
<i>>>Include HL7v2 Hierarchic Designator Macro Table 10-17</i>		
<i>>Requested Procedure Code Sequence</i>	(0032,1064)	Procedure Type of the Requested Procedure. Zero or one Item shall be included in this sequence.
<i>>>Include Code Sequence Macro Table 8.8-1</i>		<i>No Baseline Context ID is defined.</i>
<i>>Placer Order Number / Imaging Service Request</i>	(0040,2016)	The order number assigned to the Service Request by the party placing the order.
<i>>Order Placer Identifier Sequence</i>	(0040,0026)	Identifier of the Assigning Authority that issued the Placer Order Number. Only a single Item shall be permitted in this sequence.
<i>>>Include HL7v2 Hierarchic Designator Macro Table 10-17</i>		
<i>>Filler Order Number / Imaging Service Request</i>	(0040,2017)	The order number assigned to the Service Request by the party filling the order.
<i>>Order Filler Identifier Sequence</i>	(0040,0027)	Identifier of the Assigning Authority that issued the Filler Order Number. Only a single Item shall be permitted in this sequence.
<i>>>Include HL7v2 Hierarchic Designator Macro Table 10-17</i>		
<i>>Requested Procedure ID</i>	(0040,1001)	Identifier of the related Requested Procedure.
<i>>Requested Procedure Description</i>	(0032,1060)	Institution-generated description or classification of the Requested Procedure.

>>Reason for the Requested Procedure	(0040,1002)	Reason for requesting this procedure.
> Reason for Requested Procedure Code Sequence	(0040,100A)	Coded reason for requesting this procedure. Zero or more Items shall be included in the sequence.
>>Include 'Code Sequence Macro' Table 8.8-1		No Baseline Context ID is defined.
>Requested Procedure Comments	(0040,1400)	User-defined comments on the Requested Procedure.
>Confidentiality Code	(0040,1008)	Confidentiality Constraints on the Requested Procedure by the party filling the order.
>Names of Intended Recipients of Results	(0040,1010)	Names of the physicians, who are intended recipients of results.
>Imaging Service Request Comments	(0040,2400)	User-defined comments on the Service Request.
>Requesting Physician	(0032,1032)	Physician who requested the Service Request.
>Requesting Service	(0032,1033)	Institutional department where the request initiated.
>Issue Date of Imaging Service Request	(0040,2004)	Date on which the Service Request was issued by the requester.
>Issue Time of Imaging Service Request	(0040,2005)	Time at which the Service Request was issued by the requester.
>Referring Physician's Name	(0008,0090)	The physician who referred the Patient to the physician or service issuing the Service Request. Note: This is generally the recipient of any report generated by the Service Request.
Replaced Procedure Step Sequence	(0074,1224)	Canceled procedure step(s) which are replaced by this procedure step. Zero or more Items shall be included in the sequence.
>Include 'SOP Instance Reference Macro' Table 10-11		

C.X.4.1 Patient Identification

320 For workitems which have a patient as the subject or context, the Patient ID, Issuer of Patient ID, Patient's Name, Patient's Sex and Patient's Birth Date shall have appropriate values.

For workitems which have an identifiable subject that is not a patient, for example a phantom to be scanned or a display to be calibrated, the Patient ID shall be filled with an acceptable pseudo-patient value.

325 Note: For an object with a hospital asset control number or a manufacturer's serial number, that number might be used as the Patient ID. The Issuer of Patient ID would identify the hospital asset control system or the device manufacturer. Alternatively, it is conceivable that a Patient ID could be generated by the ADT or the local John Doe procedure (to avoid conflicting with an ID assigned to a real patient).
The Patient Name might be set to CT^Phantom or ReadingRoom1Display.

330

Part 4

Add Annex UUU

Annex UUU UNIFIED PROCEDURE STEP SERVICE AND SOP CLASSES (Normative)

335 UUU.1 OVERVIEW

This Annex defines the Service and SOP Classes associated with a Unified Worklist and Procedure Step.

The Unified Procedure Step Service Class provides for management of simple worklists, including creating new worklist items, querying the worklist, and communicating progress and results.

340 A worklist is a list of Unified Procedure Step (UPS) instances. Each UPS instance unifies the worklist details for a single requested procedure step together with the result details of the corresponding performed procedure step. There is a one to one relationship between the procedure step request and the procedure step performed.

345 Unified Procedure Step instances may be used to represent a variety of scheduled tasks such as: Image Processing, Quality Control, Computer Aided Detection, Interpretation, Transcription, Report Verification, or Printing.

The UPS instance can contain details of the requested task such as when it is scheduled to be performed or Workitem Codes describing the requested actions. The UPS may also contain details of the input information the performer needs to do the task and the output the performer produced, such as: Current Images, Prior Images, Reports, Films, Presentation States, or Audio recordings.

350 The Unified Worklist and Procedure Step Service Class includes four SOP Classes associated with UPS instances. The SOP Class UID for any UPS Instance always specifies the UPS Push SOP Class. The separate SOP Classes facilitate better negotiation and logical implementation groups of functionality.

355 The UPS Push SOP Class allows an SCU to instruct the SCP to create a new UPS instance, effectively letting a system push a new work item onto the SCP's worklist. It is important to note that the SCP could be a Worklist Manager that maintains the worklist for other systems that will perform the work, or the SCP could be a performing system itself which manages an internal worklist.

360 The UPS Pull SOP Class allows an SCU to query a Worklist Manager (the SCP) for matching UPS instances, and instruct the SCP to update the status and contents of selected items (UPS instances). The SCU effectively pulls work instructions from the worklist. As work progresses, the SCU records details of the activities performed and the results created in the UPS instance.

The UPS Watch SOP Class allows an SCU to subscribe for status update events and retrieve the details of work items (UPS instances) managed by the SCP.

The UPS Event SOP Class allows an SCP to provide the actual status update events for work items it manages to relevant (i.e. subscribed) SCUs.

365 **UUU.1.1 Unified Procedure Step States**

Figure UUU.1.1-1, Table UUU.1.1-1 and Table UUU.1.1-2 specify how changes in the state of a Unified Procedure Step shall be managed.

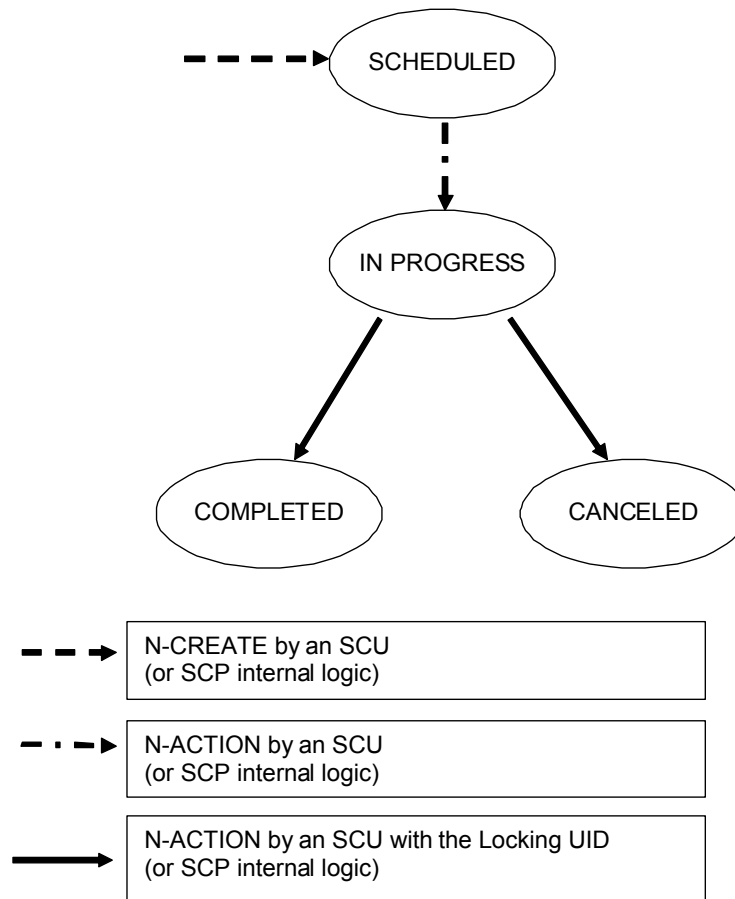


Figure UUU.1.1-1 Unified Procedure Step State Diagram

370 The following interactions represent an example sequence of events and state transitions. Observe that the DIMSE Services described here operate on the same IOD. The multiple UPS SOP Classes thus act in a coordinated manner as specified in this Annex.

To create a UPS, an SCU uses an N-CREATE to push a UPS onto the SCP’s worklist. The SCP responds to such requests by creating a Unified Procedure Step (UPS) with an initial state of SCHEDULED.

375 **Note:** All UPS Instances are instances of the UPS Push SOP Class, although the other three SOP Classes (UPS Pull, UPS Watch and UPS Event) may also operate on the Instance.

380 To subscribe to receive N-EVENT-REPORTs for a UPS, or to unsubscribe to stop receiving N-EVENT-REPORTS, an SCU uses an N-ACTION request. The SCU may be the system that created the UPS as a Push SCU, or may be some other system with a reason to track the progress and results of a scheduled step.

To inform interested systems of the state of a UPS or the SCP itself, an SCP issues N-EVENT-REPORTs to SCUs that have subscribed.

To find a UPS of interest, an SCU uses a C-FIND to query the SCP for relevant UPS instances.

385 To “claim” and start work on a UPS, an SCU (which will be referred to here as the “Performing SCU”) uses an N-ACTION Change State request to set the UPS state to IN PROGRESS and provide a transaction UID (which will be referred to here as the Locking UID). For a SCHEDULED UPS, the SCP responds by changing the UPS state to IN PROGRESS and recording the transaction UID for future use. For a UPS with other status, the SCP rejects the request.

390 The SCP does not permit the status of a SCHEDULED UPS to be set to COMPLETED or CANCELED without first being set to IN PROGRESS.

To modify details of the performed procedure, the Performing SCU uses an N-SET request to the SCP (providing the Locking UID for the UPS). N-SET requests on an IN PROGRESS UPS where the Locking UID in the N-SET dataset does not match the Locking UID in the UPS are rejected by the SCP.

395 To modify the status of the procedure step, the Performing SCU uses an N-ACTION Change State request to the SCP (providing the Locking UID for the UPS). N-ACTION Change State requests where the Locking UID in the N-ACTION dataset does not match the Locking UID in the UPS are rejected by the SCP.

400 The Locking UID effectively limits control of the state of an IN PROGRESS UPS to only the SCP and the Performing SCU. The SCP does not check whether IP addresses, AE-Titles, or parameters other than the Locking UID match to determine if the SCU has permission.

When the Performing SCU completes work on the UPS, it N-SETS any values necessary to meet the Final State requirements in Table UUU.2.5-3, then uses an N-ACTION request (providing the Locking UID for the UPS during both steps) for the SCP to change the UPS state to COMPLETED.

405 When the Performing SCU abandons work on an incomplete UPS, it N-SETS any values necessary to meet the Final State requirements in Table UUU.2.5-3, then uses an N-ACTION request (providing the Locking UID for the UPS) for the SCP to change the UPS state to CANCELED.

To request cancellation of a UPS, non-performing SCUs use an N-ACTION Request Cancel (See PS 3.17 Z.4 and Z.5 for example cases).

- 410
- If the UPS is still in the SCHEDULED state, the SCP first changes the UPS state to IN PROGRESS, and then to CANCELED, issuing the appropriate N-EVENT-REPORTS.
 - If the UPS is already IN PROGRESS and the SCP is itself performing the UPS, it may, at its own discretion, choose to cancel the UPS as described in the previous paragraph.
 - If the UPS is already IN PROGRESS and the SCP is not the performer, it does not change the UPS state to CANCELED, but rather responds by issuing an N-EVENT-REPORT of the cancellation request to all subscribed SCUs. If the Performing SCU is listening to N-EVENT-REPORTs it may, at its own discretion, choose to cancel the UPS as described above.
- 415

Table UUU.1.1-1 describes the valid UPS states

**Table UUU.1.1-1
UNIFIED PROCEDURE STEP (UPS) STATES**

State	Description
SCHEDULED	The UPS is scheduled to be performed.
IN PROGRESS	The UPS has been claimed and a Locking UID has been set. Performance of the UPS has likely started.

CANCELED	The UPS has been permanently stopped before or during performance of the step. This may be due to voluntary or involuntary action by a human or machine. Any further UPS-driven work required to complete the scheduled task must be performed by scheduling another (different) UPS.
COMPLETED	The UPS has been completed.

420

COMPLETED and CANCELED are “Final States” that involve specific requirements on the UPS as described in UUU.2.5.1.1.

425 Table UUU.1.1-2 describes the valid state transitions (a row in the table defines what should happen in response to a certain event for each initial state). Details on how the Operations listed in the table should be carried out are described in section UUU.2.

**Table UUU.1.1-2
UNIFIED PROCEDURE STEP STATE TRANSITION TABLE**

Events	States				
	<i>null</i>	SCHEDULED	IN PROGRESS	COMPLETED	CANCELED
N-CREATE received for this SOP Instance UID	Create SOP Instance with empty transaction UID, Change State to SCHEDULED	error 0111	error 0111	error 0111	error 0111
N-ACTION to Change State to IN PROGRESS with correct transaction UID	error C307	Report state change, Record transaction UID, Change State to IN PROGRESS	error C302	error C300	error C300
N-ACTION to Change State to IN PROGRESS without correct transaction UID	error C307	error C301	error C301	error C301	error C301
N-ACTION to Change State to SCHEDULED	error C307	error C303	error C303	error C303	error C303
N-ACTION to Change State to COMPLETED, with correct transaction UID	error C307	error C310	If Final State Requirements met, (Report state change, Change State to COMPLETED); Else C304	warning B306	error C300

Events	States				
	<i>null</i>	SCHEDULED	IN PROGRESS	COMPLETED	CANCELED
N-ACTION to Change State to COMPLETED, without correct transaction UID	error C307	error C301	error C301	error C301	error C301
N-ACTION to Request Cancel	error C307	Report state change to IN-PROGRESS, Report state change to CANCELED, Change State to CANCELED	Report that an Application Entity requested a cancel.	error C311	warning B304
N-ACTION to Change State to CANCELED, with correct transaction UID	error C307	error C310	If Final State Requirements met, (Report state change, Change State to CANCELED); Else C304.	error C300	warning B304
N-ACTION to Change State to CANCELED, without correct transaction UID	error C307	error C301	error C301	error C301	error C301

430 **UUU.2 DIMSE SERVICE GROUPS**

The DIMSE Services shown in Table UUU.2-1, UUU.2-2, UUU.2-3 and UUU.2-4 are applicable to the Unified Procedure Step (UPS) IOD under the UPS Push, UPS Pull, UPS Watch and UPS Event SOP Classes respectively.

**Table UUU.2-1
DIMSE SERVICE GROUP – UPS Push**

435

DIMSE Service Element	Usage SCU/SCP
N-CREATE	M/M
N-ACTION – Request UPS Cancel	M/M

**Table UUU.2-2
DIMSE SERVICE GROUP – UPS Pull**

DIMSE Service Element	Usage SCU/SCP
C-FIND	M/M
N-GET	M/M
N-SET	M/M

N-ACTION –Change UPS State	M/M
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440

**Table UUU.2-3
DIMSE SERVICE GROUP – UPS Watch**

DIMSE Service Element	SCU/SCP
N-ACTION – Un/Subscribe	M/M
N-GET	M/M
C-FIND	U/M
N-ACTION – Request UPS Cancel	U/M

**Table UUU.2-4
DIMSE SERVICE GROUP – UPS Event**

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

445

UUU.2.1 Change UPS State (N-ACTION)

This operation allows an SCU to ask the SCP to change the state of a Unified Procedure Step (UPS) instance. This operation shall be invoked by the SCU through the DIMSE N-ACTION Service.

UUU.2.1.1 Action Information

450 DICOM AEs that claim conformance to the UPS Pull SOP Class as an SCU and/or an SCP shall support the Action Types and Action Information as specified in Table UUU.2.1-1.

**Table UUU.2.1-1
Change UPS State – ACTION INFORMATION**

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Change UPS State	1	Procedure Step State	(0074,1000)	1/1
		Transaction UID	(0008,1195)	1/1

455 **UUU.2.1.2 Service Class User Behavior**

An SCU uses N-ACTION to ask the SCP to change the state of a UPS Instance as shown in Figure UUU.1.1-1. Since all UPSs are created as instances of the UPS Push SOP Class, the Requested SOP Class UID (0000,0003) in the N-ACTION request shall be the UID of the UPS Push SOP Class. See UUU.3.1 for further details.

460 To take control of a SCHEDULED UPS, an SCU shall generate a Transaction UID and submit a state change to IN PROGRESS including the Transaction UID in the submission. The SCU shall record and use the Transaction UID in future N-ACTION and N-SET requests for that UPS instance.

Notes: 1. The performing SCU may wish to record the Transaction UID in non-volatile storage. This would allow the SCU to retain control over the UPS after recovering from a crash.

465 2. If two SCUs try to take control of a UPS, the second SCU will get an error since the first SCU established the correct Transaction UID, so the Transaction UID provided by the second SCU is incorrect.

Upon completion of an IN PROGRESS UPS it controls, an SCU shall submit a state change to
470 COMPLETED and include the Transaction UID for the UPS instance.

To cancel an IN PROGRESS UPS for which it has the Transaction UID, an SCU shall submit a state change to CANCELED and include the Transaction UID for the UPS instance.

Notes: 1. Prior to submitting the state change to CANCELED, the performing SCU can N-SET the values of Reason For Cancellation, Procedure Step Discontinuation Reason Code Sequence, Contact Display Name or Contact URI to provide information to observing SCUs about the context of the cancellation.
475 2. To request cancellation of an IN PROGRESS UPS for which it does not have the Transaction UID, an SCU uses the Request UPS Cancel action as described in UUU.2.2, rather than a Change UPS State action.

Prior to submitting a state change to COMPLETED or CANCELED for a UPS instance it controls, the SCU
480 shall perform any N-SETs necessary for the UPS to meet Final State requirements as described in section UUU.2.5.1.1.

At any time after receipt of the N-ACTION-Response, the SCU may release the association on which it sent the N-ACTION-Request.

UUU.2.1.3 Service Class Provider Behavior

485 The SCP shall perform the submitted state change for the identified UPS instance by setting the Procedure Step State (0074,1000) to the requested value, or shall report the appropriate failure response code.

Upon successfully changing the state of a UPS instance to IN PROGRESS, the SCP shall record the Transaction UID provided by the SCU in the Transaction UID (0008,1195) of the UPS instance.

Upon completion of the N-ACTION request, the SCP shall return, via the N-ACTION response primitive,
490 the N-ACTION Status Code applicable to the associated request as shown in Table UUU.2.1-2.

The SCP shall only perform legal state changes as described in Table UUU.1.1-2.

The SCP shall refuse requests to change the state of an IN PROGRESS UPS unless the Transaction UID of the UPS instance is provided in the N-ACTION request.

The SCP shall refuse requests to change the state of an IN PROGRESS UPS to COMPLETED or
495 CANCELED if the Final State requirements described in Table UUU.2.5-3 have not been met.

After the state of the UPS instance has been changed to COMPLETED or CANCELED, the SCP shall not delete the instance until all deletion locks have been removed.

Note: See UUU.2.3.2 for a description of how SCUs place and remove deletion locks and see PS 3.17 Z.1 Reliable Watchers and Deletion Locks for further discussion.

500 The SCP may also modify the Procedure Step State (0074,1000) of a UPS instance independently of an N-ACTION request, e.g., if the SCP is performing the procedure step itself, or if it has been determined that the performing SCU has been disabled.

Note: If the SCP is not performing the procedure step, this should be done with caution.

Upon successfully changing the state of a UPS instance, the SCP shall carry out the appropriate N-EVENT-REPORT behavior as described in UUU.2.4.3 if it supports the UPS Event SOP Class as an SCP.
505

Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7 and PS 3.15). PS 3.7 provides a “Refused: Not Authorized” error code. Further requiring or documenting authentication and/or authorization features from the SCU or SCP is beyond the scope of this SOP Class.

UUU.2.1.4 Status Codes

510 The status values which are specific for this DIMSE operation are defined in Table UUU.2.1-2.

**Table UUU.2.1-2
STATUS VALUES**

Status	Meaning	Code
Success	The requested state change was performed	0000
Warning	The UPS is already in the requested state of CANCELED	B304
	The UPS is already in the requested state of COMPLETED	B306
Failure	Refused: The UPS may no longer be updated	C300
	Refused: The correct Transaction UID was not provided	C301
	Refused: The UPS is already IN PROGRESS	C302
	Refused: The UPS may only become SCHEDULED via N-CREATE, not N-SET or N-ACTION	C303
	Refused: The UPS has not met final state requirements for the requested state change	C304
	Specified SOP Instance UID does not exist or is not a UPS Instance managed by this SCP	C307
	Refused: The UPS is not yet in the “IN PROGRESS” state	C310

UUU.2.2 Request UPS Cancel (N-ACTION)

515 This operation allows an SCU which does not control a given Unified Procedure Step (UPS) instance to request to the SCP that the instance be canceled. This operation shall be invoked by the SCU through the DIMSE N-ACTION Service.

UUU.2.2.1 Action Information

520 DICOM AEs that claim conformance to the UPS Push SOP Class as an SCU or an SCP shall support the Action Types and Action Information as specified in Table UUU.2.2-1. DICOM AEs that claim conformance to the UPS Watch SOP Class as an SCP or claim conformance to the UPS Watch SOP Class as an SCU and choose to implement Request UPS Cancel shall support the Action Types and Action Information as specified in Table UUU.2.2-1.

**Table UUU.2.2-1
Request UPS Cancel – ACTION INFORMATION**

525

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Request UPS Cancel	2	Reason For Cancellation	(0074,1238)	3/1
		Procedure Step Discontinuation Reason Code Sequence	(0074,100e)	3/1

	>Code Value	(0008,0100)	1/1
	>Coding Scheme Designator	(0008,0102)	1/1
	>Coding Scheme Version	(0008,0103)	1C/1C Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously
	>Code Meaning	(0008,0104)	1/1
	Contact URI	(0074,100a)	3/1
	Contact Display Name	(0074,100c)	3/1

UUU.2.2.2 Service Class User Behavior

An SCU uses N-ACTION to request to the SCP that the state of a UPS Instance be changed to CANCELED as shown in Figure UUU.1.1-1. Since all UPSs are created as instances of the UPS Push SOP Class, the Requested SOP Class UID (0000,0003) in the N-ACTION request shall be the UID of the UPS Push SOP Class. See UUU.3.1 for further details.

The SCU may include a Reason For Cancellation and/or a proposed Procedure Step Discontinuation Reason Code Sequence.

The SCU may also provide a Contact Display Name and/or a Contact URI for the person with whom the cancel request may be discussed.

Note: An N-ACTION Status Code indicating success means that the Request was accepted, not that the UPS has been canceled. The system performing the UPS is not obliged to honor the request to cancel and in some scenarios, may not even receive notification of the request. See UUU.2.4.

At any time after receipt of the N-ACTION-Response, the SCU may release the association on which it sent the N-ACTION-Request.

To cancel an IN PROGRESS UPS which the SCU is itself performing, the SCU shall instead use the Change UPS State action as described in UUU.2.1.

UUU.2.2.3 Service Class Provider Behavior

The SCP shall send appropriate "UPS Cancel Requested" N-EVENT-REPORT messages, as described in UUU.2.4.3 or shall report the appropriate failure response code.

Note: If provided, the Reason For Cancellation, a proposed Procedure Step Discontinuation Reason Code Sequence, a Contact Display Name and a Contact URI of someone responsible for the Cancel request might be useful in deciding to cancel the UPS or might be displayed to an operator so they can make contact for the purpose of clarifying or confirming the Cancel request. If the SCP is the performer and chooses to actually Cancel the UPS, it may at its own discretion set the Procedure Step Discontinuation Reason Code Sequence in the UPS instance based on the corresponding values provided.

If the Procedure Step State (0074,1000) of the UPS instance is still SCHEDULED, the SCP shall change the Procedure Step State, as described in UUU.2.1.3, first to IN PROGRESS and then to CANCELED, ensuring that the Final State requirements, described in section UUU.2.5.1.1, are met.

If the Procedure Step State (0074,1000) of the UPS instance is IN PROGRESS, and the SCP is itself the performer of the UPS, the SCP may, at its own discretion, choose to cancel the UPS as described in UUU.2.1.3.

560 If the SCP is the performer of the UPS and chooses not to cancel, or if there is no possibility that the performing SCU will be informed of the cancel request (e.g. the subscription list for the UPS is empty, or the SCP has determined that the performing SCU has been disabled), the SCP may return a failure.

Upon completion of the N-ACTION request, the SCP shall return, via the N-ACTION response primitive, the N-ACTION Status Code applicable to the associated request as shown in Table UUU.2.2-2.

565 Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7 and PS 3.15). PS 3.7 provides a “Refused: Not Authorized” error code. Further requiring or documenting authentication and/or authorization features from the SCU or SCP is beyond the scope of this SOP Class.

UUU.2.2.4 Status Codes

The status values which are specific for this DIMSE operation are defined in Table UUU.2.2-2.

570

**Table UUU.2.2-2
STATUS VALUES**

Status	Meaning	Code
Success	The cancel request is acknowledged	0000
Warning	The UPS is already in the requested state of CANCELED	B304
Failure	Refused: The UPS is already COMPLETED	C311
	Refused: Performer chooses not to cancel	C313
	Specified SOP Instance UID does not exist or is not a UPS Instance managed by this SCP	C307
	Refused: The performer cannot be contacted	C312

UUU.2.3 Subscribe/Unsubscribe to Receive UPS Event Reports (N-ACTION)

575 This operation allows an SCU to subscribe with an SCP in order to receive N-EVENT-REPORTS of subsequent changes to the state of a UPS instance, or to unsubscribe in order to no longer receive such N-EVENT-REPORTS. This operation shall be invoked by the SCU through the DIMSE N-ACTION Service.

UUU.2.3.1 Action Information

DICOM AEs that claim conformance to the UPS Watch SOP Class as an SCU and/or an SCP shall support the Action Types and Action Information as specified in Table UUU.2.3-1.

580

**Table UUU.2.3-1
Subscribe/Unsubscribe to Receive UPS Event Reports – ACTION INFORMATION**

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Subscribe to Receive UPS Event Reports	3	Receiving AE	(0074,1234)	1/1
		Deletion Lock	(0074,1230)	1/1
Unsubscribe from Receiving UPS Event	4	Receiving AE	(0074,1234)	1/1

Reports				
Suspend Global Subscription	5	Receiving AE	(0074,1234)	1/1

Each AE may be in one of three UPS Subscription States for each existing UPS Instance: Not Subscribed, Subscribed with Deletion Lock, or Subscribed w/o Deletion Lock. The UPS Subscription State determines whether N-EVENT-REPORTs relating to a UPS Instance will be sent to the AE.

Each AE may also be in one of three Global Subscription States for a given SCP: No Global Subscription, Globally Subscribed with Deletion Lock, Globally Subscribed w/o Deletion Lock. The Global Subscription State mainly determines the initial UPS Subscription State for an AE and new UPS Instances created by the SCP. Changes to the Global Subscription State can also change the UPS Subscription State for existing UPS Instances as described in Table UUU.2.3-2.

The three Subscription actions in Table UUU.2.3-1 are used to manage the UPS Subscription State and Global Subscription State of an AE.

Table UUU.2.3-2 describes the UPS Subscription State transitions of an AE for a given UPS Instance. Each row in the table defines what should happen in response to a Subscription Action, or a UPS creation event, given the initial state. The table also shows when an initial event message should be sent to the AE describing the "Current UPS State".

Note: In general, instance specific instructions take precedence over global instructions. The exception is the Unsubscribe Globally instruction, which removes all subscriptions, global and specific. To simply stop globally subscribing to new instances without removing specific subscriptions, use the Suspend Global Subscription message.

Most actions affect only the UPS Subscription State of a single UPS Instance. However, Global actions potentially affect all existing UPS Instances managed by the SCP and this is indicated in the following table by "All". For example, in the "AE Subscribes Globally with Lock" row, the content of the "Not Subscribed" cell means that in addition to setting the Global Subscription State for the AE to "Global Subscription with Lock", all existing UPS Instances whose UPS Subscription State for the Receiving AE is "Not Subscribed" will each have their UPS Subscription State changed to "Subscribed with Lock" and an event will be sent to the Receiving AE for each Instance.

**Table UUU.2.3-2
UPS SUBSCRIPTION STATE TRANSITION TABLE**

Events	States (for a specific UPS and AE)			
	<i>null</i>	Not Subscribed	Subscribed with Lock	Subscribed w/o Lock
A UPS is Created when the AE Global Subscription State is "No Global Subscription"	Go to Not Subscribed	N/A	N/A	N/A
A UPS is Created when the AE Global Subscription State is "Global Subscription with Lock"	Go to Subscribed with Lock; Send initial event	N/A	N/A	N/A

	States (for a specific UPS and AE)			
Events	<i>null</i>	Not Subscribed	Subscribed with Lock	Subscribed w/o Lock
A UPS is Created when the AE Global Subscription State is "Global Subscription w/o Lock"	Go to Subscribed w/o Lock; Send initial event	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
AE Subscribes Globally with Lock	<i>N/A</i>	<i>AE Global State is now "Global Sub. with Lock";</i> All Go to Subscribed with Lock; All Send initial event	<i>AE Global State is now "Global Sub. with Lock";</i> No UPS state change;	<i>AE Global State is now "Global Sub. with Lock";</i> No UPS state change;
AE Subscribes Globally w/o Lock	<i>N/A</i>	<i>AE Global State is now "Global Sub. w/o Lock";</i> All Go to Subscribed w/o Lock;	<i>AE Global State is now "Global Sub. w/o Lock";</i> No UPS state change;	<i>AE Global State is now "Global Sub. w/o Lock";</i> No UPS state change;
AE Subscribes to Specific UPS with Lock	<i>N/A</i>	Go to Subscribed with Lock; Send initial event	No UPS state change; Send initial event	Go to Subscribed with Lock; Send initial event
AE Subscribes to Specific UPS without Lock	<i>N/A</i>	Go to Subscribed w/o Lock; Send initial event	Go to Subscribed w/o Lock; Send initial event	No UPS state change; Send initial event
AE Unsubscribes from Specific UPS	<i>N/A</i>	No UPS state change	Go to Not Subscribed	Go to Not Subscribed
AE Unsubscribes Globally	<i>N/A</i>	<i>AE Global State is now "No Global Subscription";</i> No UPS state change;	<i>AE Global State is now "No Global Subscription";</i> All Go to Not Subscribed;	<i>AE Global State is now "No Global Subscription";</i> All Go to Not Subscribed;
AE Suspends Global Subscription	<i>N/A</i>	<i>AE Global State is now "No Global Subscription";</i> No UPS state change;	<i>AE Global State is now "No Global Subscription";</i> No UPS state change;	<i>AE Global State is now "No Global Subscription";</i> No UPS state change;

See PS 3.17 Z.1 Reliable Watchers and Deletion Locks for further discussion of deletion locks.

UUU.2.3.2 Service Class User Behavior

The SCU subscribing to track the progress and results of the scheduled procedure step may be the system that created the UPS as an SCU of the UPS Push SOP Class, or it may be some other interested
615 observer.

An SCU shall use the N-ACTION primitive to request the SCP to subscribe an AE (usually the requesting SCU) to receive event reports relating to UPS instances managed by the SCP. Since all UPSs are created as instances of the UPS Push SOP Class, the Requested SOP Class UID (0000,0003) in the N-ACTION request shall be the UID of the UPS Push SOP Class. See UUU.3.1 for further details.

620 An SCU shall also use the N-ACTION primitive to request the SCP to unsubscribe an AE to stop receiving event reports relating to UPS instances managed by the SCP. Action Information is specified in Table UUU.2.3-1. The SCU shall always provide the AE-TITLE which is to receive (or stop receiving) the N-EVENT-REPORTs.

To subscribe for events relating to *a single specific UPS instance* managed by the SCP, the SCU shall use
625 Action Type ID 3 (Subscribe to Receive UPS Event Reports) and provide the SOP Instance UID of the specific UPS instance in the N-ACTION primitive request. The SCU shall indicate a need for the UPS instance to persist after its state has changed to COMPLETED or CANCELED by setting the value of the Deletion Lock to TRUE. Otherwise the SCU shall set the value of the Deletion Lock to FALSE.

To unsubscribe for events relating to *a single specific UPS instance* managed by the SCP, the SCU shall
630 use Action Type ID 4 (Unsubscribe from Receiving UPS Event Reports) and provide the SOP Instance UID of the specific UPS instance in the N-ACTION primitive request.

To subscribe for events relating to *all current and subsequently created UPS instances* managed by the SCP, the SCU shall use Action Type ID 3 (Subscribe to Receive UPS Event Reports) and provide the well-known UID 1.2.840.10008.5.1.4.34.5 in the N-ACTION primitive request. The SCU shall indicate a need
635 for UPS instances to persist after their states have changed to COMPLETED or CANCELED by setting the value of the Deletion Lock to TRUE. Otherwise the SCU shall set the value of the Deletion Lock to FALSE.

Note: This "global subscription" is useful for SCUs that wish to monitor all activities without having to issue regular C-FINDs to identify new UPS instances.

To unsubscribe for events relating to *all current UPS instances* managed by the SCP and also stop being
640 subscribed to subsequently created UPS instances, the SCU shall use Action Type ID 4 (Unsubscribe from Receiving UPS Event Reports) and provide the well-known UID 1.2.840.10008.5.1.4.34.5 in the N-ACTION primitive request.

Note: This "global unsubscription" is useful for SCUs that wish to stop monitoring all activities and release all deletion locks (if any) placed for this subscriber.

645 To just stop being subscribed to subsequently created UPS instances, but still continue to receive events for currently subscribed instances managed by the SCP, the SCU shall use Action Type ID 5 (Suspend Global Subscription) and provide the well-known UID 1.2.840.10008.5.1.4.34.5 in the N-ACTION primitive request.

For each UPS instance on which the SCU has placed a deletion lock, either explicitly on the specific
650 instance or implicitly via a global subscription with lock, the SCU shall remove the deletion lock once any needed final state information for the instance has been obtained. The deletion lock may be removed either by unsubscribing or by subscribing with the value of the Deletion Lock set to FALSE.

Note: The SCP will retain COMPLETED or CANCELED UPS Instances until all deletion locks have been released. Failure by SCUs to release the deletion lock may cause problems for the SCP. SCU's which

655 do not have a significant need for the final state information, or who cannot dependably remove deletion locks should not use deletion locks.

The successful N-ACTION Response Status Code indicates that the SCP has received the N-ACTION request and the Subscription State for the AE has been successfully modified.

660 Note: When subscribing to a specific instance, the SCU can also expect to receive an initial N-EVENT-REPORT containing the current state of the UPS instance. When subscribing globally with the Deletion Lock set to TRUE, the SCU can expect to receive initial N-EVENT-REPORTs for every instance currently managed by the SCP. Initial N-EVENT-REPORTs for newly created instances, received as a result of a global subscription, will appear as transitions to the SCHEDULED state.

665 A warning N-ACTION Response Status Code of “Deletion Lock not granted”, indicates that the AE subscription requested by the SCU was successful, but the deletion lock has not been set.

A failure N-ACTION Response Status Code indicates that the subscription state change requested will not be processed and no subscription states have been changed. The action taken by the SCU upon
670 receiving this status is beyond the scope of this Standard.

At any time after receipt of the N-ACTION-Response, the SCU may release the association on which it sent the N-ACTION-Request.

UUU.2.3.3 Service Class Provider Behavior

675 Upon receipt of the N-ACTION request, the SCP shall attempt to update the Global Subscription State and/or UPS Subscription State of the specified AE with respect to the specified SOP Instance UID as described in Table UUU.2.3-2 and then return, via the N-ACTION response primitive, the appropriate N-ACTION Response Status Code.

680 A success status conveys that the Global Subscription State and/or UPS Subscription State for the AE specified in Receiving AE (0074,1234) was successfully modified by the SCP. The AE-TITLE in Receiving AE (0074,1234) may be different than the AE-TITLE used by the SCU for the association negotiation. The SCP shall use the AE-TITLE specified in Receiving AE (0074,1234). This allows systems to subscribe other systems they know would be interested in events for a certain UPS.

For all UPS instances managed by the SCP, the SCP shall send N-EVENT-REPORTS (as described in UUU.2.4.3) to AEs that have a UPS Subscription State of “Subscribed with Lock” or “Subscribed w/o Lock”.

685 Upon successfully processing a subscription action, the SCP shall send initial UPS State Report N-EVENT-REPORTs, as indicated in Table UUU.2.3-2, providing the current status of the UPS Instance to the Receiving AE.

690 The SCP may also refuse both specific and global Subscription requests by returning a failure N-ACTION Response Status Code for “Refused: Not Authorized” if the refusal depends on permissions related to the tasks or the requestor, or “Refused: SCP does not support Event Reports” if the SCP does not support sending the events. The SCP must document in its conformance statement if it might refuse Subscription requests.

695 The SCP may remove existing Deletion Locks by changing the UPS Subscription State for the AE from “Subscribed with Lock” to “Subscribed w/o Lock” and/or by changing the Global Subscription State for an AE from “Global Subscription with Lock” to “Global Subscription w/o Lock”. This is intended to allow the SCP to deal with SCU malfunctions. The SCP must document in its conformance statement if it might remove a Deletion Lock.

700 The SCP may also refuse the Deletion Lock portion of a specific or global Subscription request. For example, a request to modify the UPS Subscription State for the AE to “Subscribed with Lock” would instead result in a UPS Subscription State of “Subscribed w/o Lock” and a Warning status (see Table UUU.2.3-3) returned to the requesting SCU. This is intended to deal with Security and related policy restrictions. The SCP must document in its conformance statement if it might refuse a Deletion Lock.

705 Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7 and PS 3.15). PS 3.7 provides a “Refused: Not Authorized” error code. Further requiring or documenting authentication and/or authorization features from the SCU or SCP is beyond the scope of this SOP Class.

UUU.2.3.4 Status Codes

The status values which are specific for this DIMSE operation are defined in Table UUU.2.3-3.

**Table UUU.2.3-3
STATUS VALUES**

Status	Meaning	Code
Success	The requested change of subscription state was performed	0000
Warning	Deletion Lock not granted.	B301
Failure	Specified SOP Instance UID does not exist or is not a UPS Instance managed by this SCP	C307
	Receiving AE-TITLE is Unknown to this SCP	C308
	Refused: Specified action not appropriate for specified instance	C314
	Refused: SCP does not support Event Reports	C315

710

UUU.2.4 Report a Change in UPS Status (N-EVENT-REPORT)

This operation allows an SCP to notify an SCU of a change in state of a UPS instance or a change in state of the SCP itself. This operation shall be invoked by the SCP through the DIMSE N-EVENT-REPORT Service.

715 **UUU.2.4.1 Event Report Information**

DICOM AEs that claim conformance to the UPS Event SOP Class as an SCU and/or an SCP shall support the Event Type IDs and Event Report Attributes as specified in Table UUU.2.4-1.

**Table UUU.2.4-1
Report a Change in UPS Status - EVENT REPORT INFORMATION**

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
UPS State Report	1	Procedure Step State	(0074,1000)	-/1
		Input Readiness State	(0040,4041)	-/1
		Reason For Cancellation	(0074,1238)	-/3
		Procedure Step Discontinuation Reason Code Sequence	(0074,100e)	-/3
		>Code Value	(0008,0100)	-/1
		>Coding Scheme Designator	(0008,0102)	-/1

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
		>Coding Scheme Version	(0008,0103)	-/1C Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously
		>Code Meaning	(0008,0104)	-/1
UPS Cancel Requested	2	Requesting AE	(0074,1236)	-/1
		Reason For Cancellation	(0074,1238)	-/1C Required if provided in the triggering N-ACTION
		Procedure Step Discontinuation Reason Code Sequence	(0074,100e)	-/1C Required if provided in the triggering N-ACTION
		>Code Value	(0008,0100)	-/1
		>Coding Scheme Designator	(0008,0102)	-/1
		>Coding Scheme Version	(0008,0103)	-/1C Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously
		>Code Meaning	(0008,0104)	-/1
		Contact URI	(0074,100a)	-/1C Required if provided in the triggering N-ACTION
		Contact Display Name	(0074,100c)	-/1C Required if provided in the triggering N-ACTION
UPS Progress Report	3	Progress Information Sequence	(0074,1002)	-/1
		>Procedure Step Progress	(0074,1004)	-/3
		>Procedure Step Progress	(0074,1006)	-/3

Event Type Name	Event Type ID	Attribute	Tag	Req. Type SCU/SCP
		Description		
		>Procedure Step Communications URI Sequence	(0074,1008)	-/3
		>>Contact URI	(0074,100a)	-/1
		>>Contact Display Name	(0074,100c)	-/3
SCP Status Change	4	SCP Status	(0074,1242)	-/1
		Subscription List Status	(0074,1244)	-/1
		Unified Procedure Step List Status	(0074,1246)	-/1

720

Note: The meanings of the Progress Information attribute values in the context of a specific task are undefined, and the values may be obsolete when the UPS has moved to the COMPLETED or CANCELED state.

UUU.2.4.2 Service Class User Behavior

725 The SCU shall return, via the N-EVENT-REPORT response primitive, the N-EVENT-REPORT Response Status Code applicable to the associated request. See PS 3.7 for general response status codes.

The SCU shall accept all Attributes included in any notification. No requirements are placed on what the SCU will do as a result of receiving this information.

730 Note: An SCU may receive N-EVENT-REPORTs with an Event Type ID of 1 (UPS State Report) either due to a state change to the UPS, or in response to initial subscription to the UPS (possibly when the UPS is initially created). See UUU.2.3.3.

If an SCU performing a UPS receives an N-EVENT-REPORT for that instance with an Event Type ID of 2 (UPS Cancel Requested), then this SCU may, at its own discretion, choose to cancel the UPS as described in UUU.2.1.2.

735 Notes: 1. A UPS Cancel Requested notification includes the AE of the Requesting SCU which could be useful to the performing SCU in deciding the significance/authority of the Cancel Request.
2. The Reason For Cancellation, a proposed Procedure Step Discontinuation Reason Code Sequence, a Contact Display Name and a Contact URI of someone responsible for the Cancel Request may also be provided in the notification. Some performing SCUs might find this information useful in deciding to
740 cancel the UPS or might provide the information to an operator so they can make contact for the purpose of clarifying or confirming the Cancel Request. If the performing SCU chooses to Cancel the UPS, it may at its own discretion set the Procedure Step Discontinuation Reason Code Sequence in the UPS instance based on the corresponding values provided.

745 An SCU that wishes to start/stop receiving N-EVENT-REPORTs about UPS instances may subscribe/unsubscribe as described in UUU.2.3.2.

If an SCU receives an N-EVENT-REPORT with an Event Type ID of 4 (SCP Status Change), it is not required to act on that information, however the SCU may want to consider actions such as: re-subscribing if the subscription list has been Cold Started, verifying (and recreating if necessary) scheduled UPSs if the
750 UPS list has been Cold Started, etc.

Note: An SCU may receive SCP State Change Events from any SCP with which it is currently subscribed either globally or for any specific UPS.

UUU.2.4.3 Service Class Provider Behavior

755 The SCP shall specify in the N-EVENT-REPORT Request Primitive the Event Type ID and the UID of the UPS Instance with which the event is associated. Since all UPSs are created as instances of the UPS Push SOP Class, the Affected SOP Class UID (0000,0002) in the N-EVENT-REPORT request shall be the UID of the UPS Push SOP Class. See UUU.3.1 for further details. The SCP shall additionally include Attributes related to the event as defined in Table UUU.2.4-1.

760 Each time the SCP completes a Subscribe to Receive UPS Event Reports Action (See UUU.2.3.1) for a specific UPS instance, the SCP shall send to the Receiving AE a UPS State Report Event and provide the current value of the Procedure Step State (0074,1000) and Input Readiness State (0040,4041) attributes for the UPS instance.

765 Each time the SCP completes a Subscribe to Receive UPS Event Reports Action (See UUU.2.3.1) for the well-known UID 1.2.840.10008.5.1.4.34.5 with the value of the Deletion Lock set to TRUE (i.e. a Global Subscription with Lock), the SCP shall send to the Receiving AE a UPS State Report Event for every UPS Instance managed by the SCP and provide the current value of the Procedure Step State (0074,1000) and Input Readiness State (0040,4041) attributes.

770 Each time the SCP creates a new UPS instance, the SCP shall send a UPS State Report Event, indicating a change of status to SCHEDULED and the initial value of and Input Readiness State (0040,4041), to all AEs with a Global Subscription State of "Global Subscription with Lock" or "Global Subscription w/o Lock". (See UUU.2.3)

In the following text "Subscribed SCUs" means all AEs where the UPS Subscription State of the UPS Instance in question is "Subscribed with Lock" or "Subscribed w/o Lock". (See UUU.2.3).

775 Each time the SCP changes the Procedure Step State (0074,1000) attribute for a UPS instance, the SCP shall send a UPS State Report Event to subscribed SCUs.

Each time the SCP changes the Input Readiness State (0040,4041) attribute for a UPS instance, the SCP shall send a UPS State Report Event to subscribed SCUs.

780 Each time the SCP receives an N-ACTION with an Action Type ID of 2 (Request UPS Cancel), the SCP shall send a UPS Cancel Requested Event to subscribed SCUs. The SCP shall include the AE Title of the triggering N-ACTION SCU in the Requesting AE attribute. The SCP shall include the Reason For Cancellation, Contact Display Name and Contact URI attributes if they were provided in the triggering N-ACTION.

785 Each time the SCP updates the Procedure Step Progress (0074,1004), the Procedure Step Progress Description (0074,1006), or the contents of the Procedure Step Communications URI Sequence (0074,1008) for a UPS instance, the SCP shall send a UPS Progress Event, with the current contents of the Progress Information Sequence (0074,1002), to subscribed SCUs.

790 Each time the SCP is restarted, the SCP shall send an SCP Status Change Event. The SCP, if it knows it is going down, may send an additional SCP Status Change Event before it is shut down. Since the subscription lists may be incomplete or missing in the event of a restart, the SCP shall maintain a fallback list of AEs (for example as a configuration file, or from an LDAP server). The SCP shall send the SCP Status Change Events to:

- all AEs on the fallback list and,

- 795
- all AEs with a Global Subscription State of “Global Subscription with Lock” or “Global Subscription w/o Lock” and,
 - all AEs with a UPS Subscription State of “Subscribed with Lock” or “Subscribed w/o Lock” for any UPS Instance managed by the SCP

Note: The SCP may choose to not send duplicate messages to an AE.

800 The value of SCP Status (0074,1242) shall be RESTARTED if the SCP is sending this message due to being restarted and GOING DOWN if the SCP will be shut down soon.

Note: SCPs that report they are GOING DOWN might stop accepting new interactions from SCUs until after they have restarted.

805 When SCP Status (0074,1242) is RESTARTED, the value of Subscription List Status (0074,1244) shall be WARM START if the SCP preserved the Subscription List to the best of its knowledge, and COLD STARTED if the SCP has not preserved the Subscription List.

When SCP Status (0074,1242) is RESTARTED, the value of Unified Procedure Step List Status (0074,1246) shall be WARM START if the SCP preserved the UPS List to the best of its knowledge, and COLD START if the SCP has not preserved the UPS List.

810 If the SCP is unable to successfully complete an N-EVENT-REPORT to any given SCU, the SCP has no obligation to queue or retry, and it should not imply any effect on the subscription list or deletion locks.

UUU.2.4.4 Status Codes

No Service Class specific status values are defined for the N-EVENT-REPORT Service. See PS 3.7 for general response status codes.

815 UUU.2.5 Create a Unified Procedure Step (N-CREATE)

This operation allows an SCU to instruct an SCP to create a Unified Procedure Step. This operation shall be invoked by the SCU through the DIMSE N-CREATE Service.

UUU.2.5.1 Unified Procedure Step Attribute Specification

820 An Application Entity that claims conformance to the UPS Push SOP Class as an SCU shall provide all Required Attributes as specified in Table UUU.2.5-3. Additional Attributes defined by the UPS IOD may be provided as well.

An Application Entity that claims conformance to the UPS Push SOP Class as an SCP shall support all required Attributes as specified in Table UUU.2.5-3. Additional Attributes defined by the UPS IOD may be supported as well.

825 UUU.2.5.1.1 UPS Final State Requirements

COMPLETED and CANCELED are Final States for a UPS instance. The attributes and values of the UPS instance must meet certain requirements before it may be placed in either of the Final States.

Note: A UPS instance is in the SCHEDULED state when created. See UUU.1.1 for rules governing state transitions.

830

Attributes shall be valued as indicated by the Final State Codes in the Final State Column of Table UUU.2.5-3 before the Procedure Step State (0074,1000) may be set to COMPLETED or CANCELED (i.e. Final State).

835 Performing systems are encouraged to ensure that the values for all attributes reasonably reflect what was done and the Final State of the UPS. This may include blanking attributes which are permitted to be empty and for which no reasonable value can be determined. The UPS contents should make it clear whether the step was completed, what work was done, what results were produced and whether the results are usable. See PS 3.17 Section Z.7 for a discussion of methods to convey things like partial completion.

840 Note: The SCU may choose not to distribute, or otherwise make available, some or all instances created during the procedure step and referenced in the Output Information Sequence (0040,4033).

**Table UUU.2.5-1
Final State Codes**

Final State Code	Meaning
R	The UPS State shall not be set to COMPLETED or CANCELED if this attribute does not have a value.
RC	The UPS State shall not be set to COMPLETED or CANCELED if the condition is met and this attribute does not have a value.
P	The UPS State shall not be set to COMPLETED if this attribute does not have a value, but may be set to CANCELED.
X	The UPS State shall not be set to CANCELED if this attribute does not have a value, but may be set to COMPLETED.
O	The UPS State may be set to either COMPLETED or CANCELED if this attribute does not have a value.

UUU.2.5.1.2 UPS Macros

846 To reduce the size and complexity of table UUU.2.5-3, a macro notation is used.

848 For example, in table UUU.2.5-3, a table entry specifying “Include Code Sequence Macro Table UUU.2.5-2a” should be interpreted as including
 849 the following table of text as a substitution. The nesting level for the sequence inclusion is indicated by the nesting level on the reference to the
 850 macro. Where the matching key type requirement is “*” it should be replaced with the matching key type requirement of the sequence attribute
 851 that incorporates this macro.

852 For code sequences that have requirements for N-CREATE, N-SET, N-GET, or C-FIND behavior that differ from the Macro, the code sequence
 853 contents are explicitly listed in the Table rather than specifying inclusion of the Macro.

854

**Table UUU.2.5-2a
 UPS Code Sequence Macro**

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Code Value	(0008,0100)	1/1	1/1		-/1	*	1	Code Value shall be retrieved with Single Value Matching.
Coding Scheme Designator	(0008,0102)	1/1	1/1		-/1	*	1	Coding Scheme Designator shall be retrieved with Single Value Matching.
Coding Scheme Version	(0008,0103)	1C/1C	1C/1C		-/1	-	1	Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously.
Code Meaning	(0008,0104)	1/1	1/1		-/1	-	1	Code Meaning shall not be used as Matching Key.

856

**Table UUU.2.5-2b
 UPS Content Item Macro**

858

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
----------------	-----	------------------------------------	---------------------------------	----------------	---------------------------------	----------------------	-----------------------	--------------------------

Value Type	(0040,A040)	1/1	1/1		-/1	*	1	The type of the value encoded in this name-value Item. Enumerated Value: DATETIME DATE TIME PNAME UIDREF TEXT CODE NUMERIC
Concept Name Code Sequence	(0040,A043)	1/1	1/1		-/1	*	1	Coded concept name of this name-value Item.
<i>>Include 'UPS Code Sequence Macro' Table UUU.2.5-2a</i>								<i>No Baseline Context ID is defined.</i>
DateTime	(0040,A120)	1C/1C	1/1		-/1	*	1	Datetime value for this name-value Item. Required if Value Type (0040,A040) is DATETIME.
Date	(0040,A121)	1C/1C	1/1		-/1	*	1	Date value for this name-value Item. Required if Value Type (0040,A040) is DATE.
Time	(0040,A122)	1C/1C	1/1		-/1	*	1	Time value for this name-value Item. Required if Value Type (0040,A040) is TIME.
Person Name	(0040,A123)	1C/1C	1/1		-/1	*	1	Person name value for this name-value Item. Required if Value Type (0040,A040) is PNAME.

UID	(0040,A124)	1C/1C	1/1		-/1	*	1	UID value for this name-value Item. Required if Value Type (0040,A040) is UIDREF.
Text Value	(0040,A160)	1C/1C	1/1		-/1	*	1	Text value for this name-value Item. Required if Value Type (0040,A040) is TEXT.
Concept Code Sequence	(0040,A168)	1C/1C	1/1		-/1	*	1	Coded concept value of this name-value Item. Required if Value Type (0040,A040) is CODE.
>Include 'UPS Code Sequence Macro' Table UUU.2.5-2a								No Baseline Context ID is defined.
Numeric Value	(0040,A30A)	1C/1C	1/1		-/1	*	1	Numeric value for this name-value Item. Required if Value Type (0040,A040) is NUMERIC.
Measurement Units Code Sequence	(0040,08EA)	1C/1C	1/1		-/1	*	1	Units of measurement for a numeric value in this name-value Item. Required if Value Type (0040,A040) is NUMERIC.
>Include 'UPS Code Sequence Macro' Table UUU.2.5-2a								Baseline Context ID 82

860

**Table UUU.2.5-2c
Referenced Instances and Access Macro**

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Type of Instances	(0040,E020)	1/1	1/1		-/1	O	1	
Study Instance UID	(0020,000D)	1C/1	1C/1		-/1	O	1	Required if Type of Instances (0040,E020) is DICOM

Series Instance UID	(0020,000E)	1C/1	1C/1		-/1	O	1	Required if Type of Instances (0040,E020) is DICOM
Referenced SOP Sequence	(0008,1199)	1/1	1/1		-/1	O	1	
>Referenced SOP Class UID	(0008,1150)	1/1	1/1		-/1	*	1	
>Referenced SOP Instance UID	(0008,1155)	1/1	1/1		-/1	*	1	
>HL7 Instance Identifier	(0040,E001)	1C/1	1C/1		-/1	*	1	Required if Type of Instances (0040,E020) is CDA.
>Referenced Frame Number	(0008,1160)	1C/1	1C/1		-/2	*	1	Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames, and Referenced Segment Number (0062,000B) is not present.
>Referenced Segment Number	(0062,000B)	1C/1	1C/1		-/2	*	1	Required if the Referenced SOP Instance is a Segmentation and the reference does not apply to all segments and Referenced Frame Number (0008,1160) is not present.
DICOM Retrieval Sequence	(0040,E021)	1C/1	1C/1		-/1	O	1C	Required if Media Retrieval Sequence (0040,E022), WADO Retrieval Sequence (0040,E023), and XDS Retrieval Sequence (0040,E024) are not present. May be present otherwise.
>Retrieve AE Title	(0008,0054)	1/1	1/1		-/1	*	1	

Media Retrieval Sequence	(0040,E022)	1C/1	1C/1		-/1	O	1C	Required if DICOM Retrieval Sequence (0040,E021), WADO Retrieval Sequence (0040,E023), and XDS Retrieval Sequence (0040,E024) are not present. May be present otherwise.
>Storage Media File-Set ID	(0088,0130)	2/2	2/2		-/2	*	2	
>Storage Media File-Set UID	(0088,0140)	1/1	1/1		-/1	*	1	
WADO Retrieval Sequence	(0040,E023)	1C/1	1C/1		-/1	O	1C	Required if DICOM Retrieval Sequence (0040,E021), Media Retrieval Sequence (0040,E022), and XDS Retrieval Sequence (0040,E024) are not present. May be present otherwise.
>Retrieve Location UID	(0040,E011)	1/1	1/1		-/1	*	1	
>Retrieve URI	(0040,E010)	1/1	1/1		-/1	*	1	
XDS Retrieval Sequence	(0040,E024)	1C	1C/1		-/1	O	1C	Required if DICOM Retrieval Sequence (0040,E021), Media Retrieval Sequence (0040,E022), and WADO Retrieval Sequence (0040,E023) are not present. May be present otherwise.
>Repository Unique ID	(0040,E030)	1	1/1		-/1	*	1	
>Home Community ID	(0040,E031)	3/2	3/2		3/2	*	2	

862

Table UUU.2.5-2d
HL7v2 Hierarchic Designator Macro

864

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
----------------	-----	------------------------------------	---------------------------------	----------------	---------------------------------	----------------------	-----------------------	--------------------------

Local Namespace Entity ID	(0040,0031)	1C/1	Not Allowed		-/1	*	1C	Creation required if Universal Entity ID (0040,0032) is not present; may be present otherwise. Return Key required if set.
Universal Entity ID	(0040,0032)	1C/1	Not Allowed		-/1	*	1C	Creation required if Local Namespace Entity ID (0040,0031) is not present; may be present otherwise. Return Key required if set.
Universal Entity ID Type	(0040,0033)	1C/1	Not Allowed		-/1	*	1C	Creation required if Universal Entity ID (0040,0032) is present. Return Key required if set.
Local Namespace Entity ID	(0040,0031)	1C/1	Not Allowed		-/1	*	1C	Creation required if Universal Entity ID (0040,0032) is not present; may be present otherwise. Return Key required if set.

866

Table UUU.25-2e
Issuer of Patient ID Macro

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Issuer of Patient ID	(0010,0021)	2/2	Not allowed	O	3/2	R	2	
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	2/2	Not allowed	O	3/2	O	2	
>Universal Entity ID	(0040,0032)	2/2	Not allowed	O	3/2	O	2	
>Universal Entity ID Type	(0040,0033)	1C/1	Not allowed	O	3/2	O	1C	Required if Universal Entity ID (0040,0032) is present in this item with a value.
>Identifier Type Code	(0040,0035)	2/2	Not allowed	O	3/2	O	2	

>Assigning Facility Sequence	(0040,0036)	2/2	Not allowed	O	3/2	O	2	The Attributes of the Assigning Facility Sequence shall only be retrieved with Sequence Matching.
>>Include HL7v2 Hierarchic Designator Macro Table UUU.2.5-2d								
>Assigning Jurisdiction Code Sequence	(0040,0039)	2/2	Not allowed	O	3/2	O	2	The Attributes of the Assigning Jurisdiction Code Sequence shall only be retrieved with Sequence Matching.
>>Include Code Sequence Macro Table UUU.2.5-2a								Baseline CID 5001 for country codes.
>Assigning Agency or Department Code Sequence	(0040,003A)	2/2	Not allowed	O	3/2	O	2	The Attributes of the Assigning Agency or Department Code Sequence shall only be retrieved with Sequence Matching.
>>Include Code Sequence Macro Table UUU.2.5-2a								No Baseline Context Group.

868

**Table UUU.2.5-2f
SOP Instance Reference Macro**

870

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Referenced SOP Class UID	(0008,1150)	1/1	1/1		-/1	*	1	Code Value shall be retrieved with Single Value Matching.
Referenced SOP Instance UID	(0008,1155)	1/1	1/1		-/1	*	1	Coding Scheme Designator shall be retrieved with Single Value Matching.

872

UUU.2.5.1.3 UPS Attribute Service Requirements

874 This table combines the attribute requirements for multiple DIMSE services (N-CREATE, N-SET, N-GET, C-FIND) to facilitate consistency between the requirements.

876 See PS 3.4 Section 5.4 for the meaning of the requirement codes used in the N-CREATE, N-SET, N-GET and Return Key columns in the following table.

878 See PS 3.4 C.1.2 for the meaning of the requirement codes used in the Match Key column in the following table.

See Table UUU.2.5-1 for the meaning of the requirement codes used in the Final State column of the following table.

880

**Table UUU.2.5-3
UPS SOP CLASS N-CREATE/N-SET/N-GET/C-FIND ATTRIBUTES**

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Transaction UID	(0008,1195)	2/2 Shall be empty	(See UUU.2.6.3)	O	Not allowed	-	-	Cannot be queried.
SOP Common Module								
Specific Character Set	(0008,0005)	1C/1C	1C/1C	RC	3/1	-	1C	Required if extended or replacement character set is used
SOP Class UID	(0008,0016)	Shall be set to 1.2.840.10008.5.1.4.34.6.1 by SCP	Not allowed	R	Not allowed	O	1	Uniquely identifies the SOP Class of the Unified Procedure Step. See Section UUU.3.1 for further explanation.

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
SOP Instance UID	(0008,0018)	Not allowed. SOP Instance is conveyed in the Affected SOP Instance UID (0000,1000)	Not allowed. SOP Instance is conveyed in the Requested SOP Instance UID (0000,1001)	R	Not allowed. SOP Instance is conveyed in the Requested SOP Instance UID (0000,1001)	U	1	Uniquely identifies the SOP Instance of the UPS. See Section K.6.2.2.3 for further explanation. SOP Instance UID shall be retrieved with Single Value Matching.
All other Attributes from the SOP Common Module		3/3	3/3	O	3/3	-	-	
Unified Procedure Step Scheduled Procedure Information Module								
Scheduled Procedure Step Priority	(0074,1200)	1/1	3/1	R	3/1	R	1	Scheduled Procedure Step Priority shall be retrieved with Single Value Matching.
Scheduled Procedure Step Modification Date and Time	(0040,4010)	2/1 SCP shall use time of CREATE rather than any value provided	-/1 SCP will use time of SET	R	3/1	O	3	Scheduled Procedure Step Modification Date and Time shall be retrieved with Single Value Matching or Range Matching.

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Procedure Step Label	(0074,1204)	1/1	3/1	O	3/1	R	1	
Worklist Label	(0074,1202)	2/1 If a value is not provided by the SCU, the SCP shall fill in the Worklist Label, e.g. using a default value or by assigning the UPS instance to a logical worklist.	3/1	O	3/1	R	1	
Scheduled Processing Parameters Sequence	(0074,1210)	2/2	3/2	O	3/2	-	2	
<i>>Include Content Item Macro Table UUU.2.5-2b</i>								
Scheduled Station Name Code Sequence	(0040,4025)	2/2	3/2	O	3/2	R	2	The Attributes of the Scheduled Station Name Code Sequence shall only be retrieved with Sequence Matching. Note: In Push Scenario, the SCP-Performer has to create empty but could self fill later.
<i>>Include Code Sequence Macro Table UUU.2.5-2a</i>								

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Scheduled Station Class Code Sequence	(0040,4026)	2/2	3/2	O	3/2	R	2	The Attributes of the Scheduled Station Class Code Sequence shall only be retrieved with Sequence Matching.
<i>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
Scheduled Station Geographic Location Code Sequence	(0040,4027)	2/2	3/2	O	3/2	R	2	The Attributes of the Scheduled Station Geographic Location Code Sequence shall only be retrieved with Sequence Matching.
<i>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
Scheduled Human Performers Sequence	(0040,4034)	2C/2C	3/2	O	3/2	R	2	The Attributes of the Scheduled Human Performers Sequence shall only be retrieved with Sequence Matching. Required if a Human Performer is specified.

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
>Human Performer Code Sequence	(0040,4009)	1/1	1/1	O	-/1	R	1	The Attributes of the Scheduled Human Performers Code Sequence shall only be retrieved with Sequence Matching.
<i>>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
>Human Performer's Name	(0040,4037)	1/1	1/1	O	-/1	O	3	
>Human Performer's Organization	(0040,4036)	1/1	1/1	O	-/1	O	3	
Scheduled Procedure Step Start Date and Time	(0040,4005)	1/1	3/1	R	3/1	R	1	Scheduled Procedure Step Start Date and Time shall be retrieved with Single Value Matching or Range Matching.
Expected Completion Date and Time	(0040,4011)	3/1	3/1	O	3/1	R	3	Expected Completion Date and Time shall be retrieved with Single Value Matching or Range Matching.

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Scheduled Workitem Code Sequence	(0040,4018)	2/2	3/1	O	3/1	R	2	The Attributes of the Scheduled Workitem Code Sequence shall only be retrieved with Sequence Matching.
<i>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
Comments on the Scheduled Procedure Step	(0040,0400)	2/2	3/1	O	3/1	O	3	
Input Readiness State	(0040,4041)	1/1	3/1	R	3/1	R	1	Input Readiness State shall be retrieved with Single Value Matching.
Input Information Sequence	(0040,4021)	2/2	3/2	O	3/2	O	2	The Attributes of the Input Information Sequence shall only be retrieved with Sequence Matching.
<i>>Include Referenced Instances and Access Macro Table UUU.2.5-2c</i>								

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Study Instance UID	(0020,000D)	1C/2	3/2	O	3/2	O	2	Required if the Workitem is expected to result in the creation of any DICOM Composite Instances whose IOD contains the Study IE. There may be situations where the performer does not use the Study Instance UID suggested by the Scheduler.
All other Attributes from the Unified Procedure Step Scheduled Procedure Information Module		3/3	3/3	O	3/3	-	-	
Unified Procedure Step Relationship Module								
Patient's Name	(0010,0010)	2/2	Not allowed	O	3/2	R	2	

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Patient ID	(0010,0020)	1C/2	Not allowed	O	3/2	R	2	Required if the subject of the workitem requires identification or if the workitem is expected to result in the creation of objects that identify the subject. See PS 3.3 C.X.4.1
<i>Include Issuer of Patient ID Macro Table UUU.2.5-2e</i>								
Other Patient IDs Sequence	(0010,1002)	2/2	3/3	O	3/2	O	2	
>Patient ID	(0010,0020)	1/1	1/1	O	-/1	O	1	
<i>Include Issuer of Patient ID Macro Table UUU.2.5-2e</i>								
Patient's Birth Date	(0010,0030)	2/2	Not allowed	O	3/2	R	2	
Patient's Sex	(0010,0040)	2/2	Not allowed	O	3/2	R	2	
Admission ID	(0038,0010)	2/2	Not allowed	O	3/2	R	2	
Issuer of Admission ID Sequence	(0038,0014)	2/2	Not allowed	O	3/2	R	2	
<i>>Include HL7v2 Hierarchic Designator Macro Table UUU.2.5-2d</i>								
Admitting Diagnoses Description	(0008,1080)	2/2	Not allowed	O	3/2	O	2	

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Admitting Diagnoses Code Sequence	(0008,1084)	2/2	Not allowed	O	3/2	O	2	The Attributes of the Admitting Diagnoses Code Sequence shall only be retrieved with Sequence Matching.
<i>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
Referenced Request Sequence	(0040,A370)	2/2	Not allowed	O	3/2	O	2	Could be "changed" while SCHEDULED by canceling and re- creating with the "correct" values.
>Study Instance UID	(0020,000D)	1/1	Not allowed	O	-/1	O	1	
>Accession Number	(0008,0050)	2/2	Not allowed	O	-/2	R	2	
>Issuer of Accession Number Sequence	(0008,0051)	2/2	Not allowed	O	-/2	R	2	The Issuer of Accession Number Sequence shall only be retrieved with Sequence Matching.
<i>>>Include HL7v2 Hierarchic Designator Macro Table UUU.2.5-2d</i>								
>Placer Order Number/Imaging Service Request	(0040,2016)	3/1	Not allowed	O	-/1	O	1C	Required if set.

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
>Order Placer Identifier Sequence	(0040,0026)	2/2	Not allowed	O	-/2	O	2	The Order Placer Identifier Sequence shall only be retrieved with Sequence Matching.
<i>>>Include HL7v2 Hierarchic Designator Macro Table UUU.2.5-2d</i>								
>Filler Order Number/Imaging Service Request	(0040,2017)	3/1	Not allowed	O	-/1	O	1C	Required if set.
>Order Filler Identifier Sequence	(0040,0027)	2/2	Not allowed	O	-/2	O	2	The Order Filler Identifier Sequence shall only be retrieved with Sequence Matching.
<i>>>Include HL7v2 Hierarchic Designator Macro Table UUU.2.5-2d</i>								
>Requested Procedure ID	(0040,1001)	2/2	Not allowed	O	-/2	R	2	
>Requested Procedure Description	(0032,1060)	2/2	Not allowed	O	-/2	O	2	
>Requested Procedure Code Sequence	(0032,1064)	2/2	Not allowed	O	-/2	O	2	
<i>>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
>Reason for the Requested Procedure	(0040,1002)	3/3	3/3	O	-/3	-	-	

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
> Reason for Requested Procedure Code Sequence	(0040,100A)	3/3	3/3	O	-/3	-	-	
<i>>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
>Requested Procedure Comments	(0040,1400)	3/3	3/3	O	-/3	O	1C	Required if set.
>Confidentiality Code	(0040,1008)	3/3	3/3	O	-/3	O	3	
>Names of Intended Recipients of Results	(0040,1010)	3/3	3/3	O	-/3	O	3	
>Imaging Service Request Comments	(0040,2400)	3/3	3/3	O	-/3	O	3	
>Requesting Physician	(0032,1032)	3/3	3/3	O	-/3	O	3	
>Requesting Service	(0032,1033)	3/1	3/1	O	-/3	R	3	
>Issue Date of Imaging Service Request	(0040,2004)	3/3	3/3	O	-/3	O	3	
>Issue Time of Imaging Service Request	(0040,2005)	3/3	3/3	O	-/3	O	3	
>Referring Physician's Name	(0008,0090)	3/3	3/3	O	-/3	O	3	

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Replaced Procedure Step Sequence	(0074,1224)	1C/1C	Not allowed	O	3/2	R	3	Required if the UPS replaces another Procedure Step.
<i>>Include 'SOP Instance Reference Macro' Table UUU.2.5-2f</i>								
Patient Medical Module								
Medical Alerts	(0010,2000)	3/2	3/2	O	3/2	O	2C	Required if present.
Pregnancy Status	(0010,21C0)	3/2	3/2	O	3/2	O	2C	Required if present.
Special Needs	(0038,0050)	3/2	3/2	O	3/2	O	2C	Required if present.
All other Attributes from the Patient Medical Module		3/3	3/3	O	3/3	O	3	
Unified Procedure Step Progress Information Module								
Procedure Step State	(0074,1000)	1/1 Shall be created with a value of "SCHEDULED"	Not Allowed. Use N-ACTION	R	3/1	R	1	Procedure Step State shall be retrieved with Single Value Matching
Progress Information Sequence	(0074,1002)	2/2 Shall be empty	3/2	X	3/2		2	
>Procedure Step Progress	(0074,1004)	Not Allowed	3/1	O	-/1	-	-	

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
>Procedure Step Progress Description	(0074,1006)	Not Allowed	3/1	O	-/1	-	-	
>Procedure Step Communications URI Sequence	(0074,1008)	Not Allowed	3/1	O	-/1	-	-	
>>Contact URI	(0074,100a)	Not Allowed	1/1	O	-/1	-	-	
>>Contact Display Name	(0074,100c)	Not Allowed	3/1	O	-/1	-	-	
Procedure Step Cancellation DateTime	(0040,4052)	Not Allowed	3/1	X	-/1	-	-	If changing the UPS State (0074,1000) to CANCELED and this attribute has no value, the SCP shall fill it with the current datetime.
>Reason For Cancellation	(0074,1238)	Not Allowed	3/1	O	-/1	-	-	
>Procedure Step Discontinuation Reason Code Sequence	(0074,100e)	Not Allowed	3/1	X	-/1			
>>Include Code Sequence Macro Table UUU.2.5-2a								
Unified Procedure Step Performed Procedure Information Module								

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
Unified Procedure Step Performed Procedure Sequence	(0074,1216)	2/2 Shall be created empty	3/2	P	3/2	-	-	The Attributes of the UPS Performed Procedure Sequence shall only be retrieved with Sequence Matching. Note: Since this attribute may be created empty and has a Final State requirement of X, a UPS in the SCHEDULED state may be canceled with two N-ACTIONS (IN PROGRESS then CANCELED) and no N-SETS.
>Actual Human Performers Sequence	(0040,4035)	Not Allowed	3/1	RC	-/1	O	1C	Shall be provided if known. Return Key required if set. The Attributes of the Actual Human Performers Sequence shall only be retrieved with Sequence Matching.
>>Human Performer Code Sequence	(0040,4009)	Not Allowed	3/1	RC	-/1	-	-	Shall be provided if known.

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
>>>Include Code Sequence Macro Table UUU.2.5-2a								
>>Human Performer's Name	(0040,4037)	Not Allowed	3/1	RC	-/1	-	-	Shall be provided if known
>>Human Performer's Organization	(0040,4036)	Not Allowed	3/1	O	-/1	-	-	
>Performed Station Name Code Sequence	(0040,4028)	Not Allowed	3/2	P	-/2	O	3	
>>Include Code Sequence Macro Table UUU.2.5-2a								
>Performed Station Class Code Sequence	(0040,4029)	Not Allowed	3/2	O	-/2	-	-	
>>Include Code Sequence Macro Table UUU.2.5-2a								
>Performed Station Geographic Location Code Sequence	(0040,4030)	Not Allowed	3/2	O	-/2	-	-	
>>Include Code Sequence Macro Table UUU.2.5-2a								
>Performed Procedure Step Start DateTime	(0040,0244)	Not Allowed	3/1	P	-/1	-	-	
>Performed Procedure Step Description	(0040,0254)	Not Allowed	3/1	O	-/1	-	-	
>Comments on the Performed Procedure Step	(0040,0280)	Not Allowed	3/1	O	-/1	-	-	

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Final State	Req. Type N-GET (SCU/SCP)	Match Key Type	Return Key Type	Remark/ Matching Type
>Performed Workitem Code Sequence	(0040,4019)	Not Allowed	3/1	P	-/1	-	-	
<i>>>Include Code Sequence Macro Table UUU.2.5-2a</i>								
>Performed Processing Parameters Sequence	(0074,1212)	Not Allowed	3/1	O	-/1	-	-	
<i>>>Include Content Item Macro Table UUU.2.5-2b</i>								
>Performed Procedure Step End DateTime	(0040,0250)	Not Allowed	3/1	P	-/1	O	1C	Required if set.
>Output Information Sequence	(0040,4033)	Not Allowed	2/2	P	-/2	-	-	If there are no relevant output objects, then this sequence may have no items.
<i>>Include Referenced Instances and Access Macro Table UUU.2.5-2c</i>								

882 **UUU.2.5.2 Service Class User Behavior**

An SCU uses N-CREATE to request the SCP schedule a new UPS.

884 The SCU shall specify in the N-CREATE request primitive the UPS Push SOP Class UID and the SOP Instance UID for the UPS which is to be created and for which Attribute Values are to be provided. See
886 UUU.3.1 for further discussion of UPS SOP Class UIDs.

888 The SCU shall provide Attribute values in the N-CREATE request primitive for all required UPS Attributes as specified in Table UUU.2.5-3. Additionally, values may be provided for optional Attributes as specified in Table UUU.2.5-3.

890 The SCU shall specify a value of "SCHEDULED" for the attribute Procedure Step State (0074,1000) in the N-CREATE request primitive.

892 **UUU.2.5.3 Service Class Provider Behavior**

894 The SCP shall create and maintain UPS instances as instructed by N-CREATE requests and as specified by Table UUU.2.5-3.

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

898 The SCP shall accept N-CREATE request primitives only if the value of the Procedure Step State (0074,1000) attribute is "SCHEDULED". If the Procedure Step State attribute has another value, the SCP shall fail the N-CREATE.

900 The SCP may modify Attributes of a UPS instance, e.g., to correct invalid attribute values. A description of the modifications the SCP may perform shall be documented in the conformance statement of the SCP.

902 The SCP may also create and maintain UPS instances without receiving a UPS instance N-CREATE request, e.g., based on internal logic, operator inputs or HL7 messages. The contents of the instance
904 created by the SCP must still comply with the N-CREATE requirements in Table UUU.2.5-3.

906 Upon creating a new UPS Instance, the SCP shall update UPS Subscription Status of the Instance for each AE with a Global Subscription as described in UUU.2.3.

908 Upon creating a new UPS Instance, the SCP shall send UPS State Reports (if it supports the UPS Event SOP Class) as described in UUU.2.4.3 regardless of whether the creation was based on an N-CREATE or on internal logic.

910 Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7 and PS 3.15). PS 3.7 provides a "Refused: Not Authorized" error code. There are no specific
912 requirements to perform authorization.

UUU.2.5.4 Status Codes

914 The status values which are specific for this DIMSE operation are defined in Table UUU.2.5-4.

916 **Table UUU.2.5-4
STATUS VALUES**

Status	Meaning	Code
Success	The UPS was created as requested	0000
Warning	The UPS was created with modifications	B300
Failure	Refused: The provided value of UPS State was not	C309

	"SCHEDULED".	
--	--------------	--

918 **UUU.2.6 Set Unified Procedure Step Information (N-SET)**

920 This operation allows an SCU to set Attribute Values of a UPS Instance and provide information about a
922 specific real-world UPS that is under control of the SCU. This operation shall be invoked by the SCU
through the DIMSE N-SET Service.

922 **UUU.2.6.1 Unified Procedure Step IOD Subset Specification**

924 The Application Entity which claims conformance to the UPS Pull SOP Class as an SCU may choose to
926 modify a subset of the Attributes maintained by the SCP. The Application Entity which claims
conformance as an SCP to the UPS Pull SOP Class shall support attributes specified in Table UUU.2.5-3

926 **UUU.2.6.2 Service Class User Behavior**

928 The SCU shall specify in the N-SET request primitive the UID of the UPS Instance for which it wants to set
930 Attribute Values. Since all UPSs are created as instances of the UPS Push SOP Class, the Requested
SOP Class UID in the N-SET request shall be the UID of the UPS Push SOP Class. See UUU.3.1 for
further details.

932 To N-SET a UPS instance currently in the SCHEDULED state, the Transaction UID attribute shall not be
present in the request. For a UPS instance in the IN PROGRESS state, the SCU shall provide the current
Transaction UID (0008,1195) as an attribute.

934 The SCU shall be permitted to set Attribute values as specified in Table UUU.2.5-3. The SCU shall specify
the list of attributes for which it wants to set the Attribute Values. The SCU shall provide, with one or more
936 N-SET request primitives, the attribute values specified in Table UUU.2.5-3.

938 When modifying a sequence, the SCU shall include in the N-SET request all Items in the sequence, not
just the Items to be modified.

940 N-SET requests shall be atomic (indivisible) and idempotent (repeat executions have no additional effect).
Since it is possible for an N-GET to occur between two N-SET requests, any given N-SET shall leave the
942 UPS instance in an internally consistent state (i.e. when multiple attributes need updating as a group, do
this as multiple attributes in a single N-SET request, not as multiple N-SET requests)

944 The SCU shall not set the value of the Procedure Step State (0074,1000) attribute using N-SET.
Procedure Step State is managed using N-ACTION as described in UUU.2.1

946 The SCU shall create or set all Attributes to meet Final State requirements prior to using N-ACTION to set
the value of Procedure Step State (0074,1000) to "COMPLETED" or "CANCELED". See UUU.2.5.1.1 for
further details.

948 Once the Procedure Step State (0074,1000) has been set to "COMPLETED" or "CANCELED" the SCU
shall no longer modify the UPS SOP Instance.

950 Note: The SCU can only set Attribute Values which have already been created with an N-CREATE request.

952 **UUU.2.6.3 Service Class Provider Behavior**

954 The SOP Class UID of the specified UPS instance will always be the UPS Push SOP Class UID, which
might not match the UPS SOP Class negotiated with the SCU. See UUU.3.1 for further details.

956 The SCP shall support the attribute changes to the UPS instance specified by the SCU in the N-SET request primitive as specified in Table UUU.2.5-3.

958 The SCP shall refuse N-SET requests on an IN PROGRESS UPS and not modify the UPS if the N-SET request does not include the Transaction UID (0008,1195) attribute with the same value as currently recorded in the UPS instance.

960 The SCP shall refuse N-SET requests on a COMPLETED or CANCELED UPS.

962 The SCP shall merge the Specific Character Set (0008,0005) value provided by the SCU with the existing value in the UPS instance.

964 The SCP shall return, via the N-SET response primitive, the N-SET Response Status Code applicable to the associated request as specified in Section UUU.2.6.4.

966 The SCP may itself modify any Attributes of a UPS instance independently of an N-SET request, e.g., if the SCP is performing the procedure step itself, if it has been determined that the performing SCU has been disabled, or if it is necessary to correct attribute values after completion of the procedure in order to carry out reconciliation of the data. A description of the coercions the SCP may perform shall be documented in the conformance statement of the SCP.

970 Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7 and PS 3.15). PS 3.7 provides a "Refused: Not Authorized" error code. There are no specific requirements to perform authorization.

UUU.2.6.4 Status Codes

974 The status values which are specific for this DIMSE operation are defined in Table UUU.2.6-1. See PS 3.7 for additional response status codes.

976

**Table UUU.2.6-1
STATUS VALUES**

Status	Meaning	Code
Success	The requested modification of the attribute values is performed	0000
Warning	Requested optional Attributes are not supported.	0001
	Coerced invalid values to valid values	B305
Failure	Refused: The UPS is not in the "IN PROGRESS" state	C310
	Refused: The correct Transaction UID was not provided	C301
	Refused: The UPS may no longer be updated	C300
	Specified SOP Instance UID does not exist or is not a UPS Instance managed by this SCP	C307

978

UUU.2.7 Get Unified Procedure Step Information (N-GET)

980 This operation allows an SCU to get information from an SCP about a specific real-world Procedure Step which is represented as a Unified Procedure Step Instance. This operation shall be invoked by the SCU through the DIMSE N-GET Service.

UUU.2.7.1 Unified Procedure Step IOD Subset Specification

984 The Application Entity which claims conformance to the UPS Pull or UPS Watch SOP Classes as an SCU may choose to retrieve a subset of the Attribute values maintained by the SCP. The Application Entity

986 which claims conformance as an SCP to these SOP Classes shall support the attributes specified in Table
UUU.2.5-3.

988 **UUU.2.7.2 Service Class User Behavior**

The SCU uses the N-GET to request the SCP to provide attributes and values of a Unified Procedure Step
990 Instance. Since all UPSs are created as instances of the UPS Push SOP Class, the Affected SOP Class
UID (0000,0002) in the N-GET request shall be the UID of the UPS Push SOP Class. See UUU.3.1 for
992 further details.

The SCU shall specify in the N-GET Service Element the UID of the SOP Instance from which attributes
994 are to be retrieved.

The SCU shall specify the list of Unified Procedure Step Attributes for which values are to be returned.
996 The SCU shall not specify Attributes which are defined within a Sequence, but rather specify the sequence
itself to be retrieved in its entirety.

998 The SCU shall not request the value of the Transaction UID (0008,1195) attribute.

The SCU may request Attribute Values for optional Attributes which are not maintained by the SCP. In
1000 such a case, the SCU shall function properly regardless of whether the SCP returns values for those
Attributes or not. This Service Class Specification places no requirements on what the SCU shall do as a
1002 result of receiving this information.

Note: In order to accurately interpret the character set used for the Attribute Values returned, it is
1004 recommended that the Attribute Value for the Specific Character Set (0008,0005) be requested in the N-
GET request primitive.

1006 The SCU shall be permitted to request and shall be capable of receiving values for any attribute as
specified in Table UUU.2.5-3. Additionally, values may be requested for optional attributes.

1008 The SCU shall be capable of receiving all requested Attribute Values provided by the SCP in response to
the N-GET indication primitive.

Note: If the SCU or the user will need access to the final state attributes it is the responsibility of the SCU to
1010 Subscribe (See UUU.2.2) in order to receive State Change Events and then N-GET the necessary
1012 attributes promptly upon notification of a state change to COMPLETED or CANCELED. If the SCU sets
the Deletion Lock when subscribing, a COMPLETED or CANCELLED instance will continue to persist on
1014 the SCP, using resources. It is important that the SCU remove the lock (e.g. by unsubscribing) after
doing the N-GET on the COMPLETED or CANCELED instance.

1016

UUU.2.7.3 Service Class Provider Behavior

1018 The SOP Class UID of the specified UPS instance will always be the UPS Push SOP Class UID, which
might not match the UPS SOP Classes negotiated with the SCU. See UUU.3.1 for further details.

1020 The SCP shall return, via the N-GET response primitive, the selected Attribute values from the indicated
Unified Procedure Step Instance to the SCU.

Note: The requirement for the SCP to respond to N-GET requests for UPS Instances which have moved to the
1022 COMPLETED or CANCELED state is limited. See UUU.2.1.3 Service Class Provider Behavior.

1024 The SCP shall not return the Transaction UID (0008,1195) attribute. This is necessary to preserve this
attribute's role as an access lock.

1026 The SCP shall return, via the N-GET response primitive, the N-GET Response Status Code applicable to
the associated request. A Failure Code shall indicate that the SCP has not retrieved the SOP Instance.

1028 Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7
1030 and PS 3.15). PS 3.7 provides a “Refused: Not Authorized” error code. Further requiring or documenting
authentication and/or authorization features from the SCU or SCP is beyond the scope of this SOP Class.

UUU.2.7.4 Status Codes

1032 The status values which are specific for this DIMSE operation are defined in Table UUU.2.7-1. See PS 3.7
for additional response status codes.

1034 **Table UUU.2.7-1
STATUS VALUES**

Status	Meaning	Code
Warning	Requested optional Attributes are not supported	0001
Failure	Specified SOP Instance UID does not exist or is not a UPS Instance managed by this SCP	C307

1036

UUU.2.8 Search for Unified Procedure Step (C-FIND)

1038 This operation allows an SCU to locate and get information about Unified Procedure Step instances of
interest that are managed by an SCP. This operation shall be invoked by the SCU through the DIMSE C-
1040 FIND Service. The SCP processes such queries, matches UPS instances it manages against the keys
present in the Identifier and returns C-FIND responses.

1042 The SCU might be searching for UPS instance with the intention of starting work on one of them or
perhaps with the intention of subscribing to monitor the progress of an instance.

UUU.2.8.1 Operation

UUU.2.8.1.1 E/R Model

1046 In response to a given C-FIND request, the SCP might send several C-FIND responses, (i.e. one C-FIND
response per matching worklist item). Each worklist item describes a single task and its related
1048 information.

The Unified Procedure Step Query Information Model is represented by the Entity Relationship diagram
1050 shown in Figure UUU.2.8-1.



1052

Figure UUU.2.8-1 Unified Procedure Step E-R Diagram

There is only one Information Entity in the model, which is the Unified Procedure Step. The attributes of a
1054 Unified Procedure Step can be found in Table UUU.2.5-3.

UUU.2.8.1.2 C-FIND Service Parameters

UUU.2.8.1.2.1 SOP Class UID

1056 The Affected SOP Class UID of the C-FIND DIMSE request shall always be the UPS SOP Class
1058 negotiated for the Presentation Context under which the service is requested. This will always be either the
UPS Pull SOP Class or the UPS Watch SOP Class. See UUU.3.1 for further details.

1060 For both the UPS Pull SOP Class and the UPS Watch SOP Class, the C-FIND is performed against the Unified Procedure Step Information Model shown in UUU.2.8-1.

1062 **UUU.2.8.1.2.2 Priority**

1064 The Priority Attribute defines the requested priority of the C-FIND operation with respect to other DIMSE operations being performed by the same SCP.

1066 Processing of priority requests is not required of SCPs. Whether or not an SCP supports priority processing and the meaning of the different priority levels shall be stated in the Conformance Statement of the SCP.

1068 **UUU.2.8.1.3 Identifier**

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

1070 **UUU.2.8.1.3.1 Request Identifier Structure**

An Identifier in a C-FIND request shall contain:

- 1072 • Key Attributes values to be matched against the values of Attributes specified in the SOP Class identified by the Affected SOP Class UID.
- 1074 • Conditionally, the Attribute Specific Character Set (0008,0005). This Attribute shall be included if expanded or replacement character sets may be used in any of the Attributes in the Request Identifier. It shall not be included otherwise.
- 1076 • Conditionally, the Attribute Timezone Offset From UTC (0008,0201). This Attribute shall be included if Key Attributes of time are to be interpreted explicitly in the designated local time zone. It shall not be present otherwise, i.e., it shall not be sent with a zero-length value.

1080

1082 Note: This means that Specific Character Set (0008,0005) is included if the SCU supports expanded or replacement character sets in the context of this service. It will not be included if expanded or replacement character sets are not supported by the SCU.

1084

1086 The Key Attributes and values allowable for the query shall be defined in the SOP Class definition corresponding to the Affected SOP Class UID for the corresponding Unified Worklist And Procedure Step Information Model.

1088 **UUU.2.8.1.3.2 Response Identifier Structure**

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

1090 An Identifier in a C-FIND response shall contain:

- 1092 — Key Attributes with values corresponding to Key Attributes contained in the Identifier of the request (Key Attributes as defined in UUU.2.5-3.)
 - 1094 — Conditionally, the Attribute Specific Character Set (0008,0005). This Attribute shall be included if expanded or replacement character sets may be used in any of the Attributes in the Response Identifier. It shall not be included otherwise. The C-FIND SCP is not required to return responses in the Specific Character Set requested by the SCU if that character set is not supported by the SCP. The SCP may return responses with a different Specific Character Set.
 - 1096 — Conditionally, the Attribute Timezone Offset From UTC (0008,0201). This Attribute shall be included if any Attributes of time in the Response Identifier are to be interpreted explicitly in the designated local time zone. It shall not be present otherwise, i.e., it shall not be sent with a zero-length value.
- 1100

1102 Note: This means that Specific Character Set (0008,0005) is included if the SCP supports expanded or
1104 replacement character sets in the context of this service. It will not be included if expanded or
replacement character sets are not supported by the SCP.

1106 **UUU.2.8.2 Service Class User Behavior**

1108 All C-FIND SCUs shall be capable of generating query requests that meet the requirements of the
1108 "Worklist" Search Method (see UUU.2.8.3.1).

1110 Required Keys and Optional Keys, identified in Table UUU.2.5-3, associated with the Query may be
1110 contained in the Identifier.

An SCU conveys the following semantics using the C-FIND requests and responses:

- 1112 — The SCU requests that the SCP perform a match of all keys specified in the Identifier of the
request against the information it possesses of the Query specified in the request.
- 1114 — The SCU shall interpret Pending responses to convey the Attributes of a match of an item.
- 1116 — The SCU shall interpret a response with a status equal to Success, Failure, or Cancel to convey
the end of Pending responses.
- 1118 — The SCU shall interpret a Failure response to a C-FIND request as an indication that the SCP is
unable to process the request.
- 1120 — The SCU may cancel the C-FIND service by issuing a C-FIND-CANCEL request at any time during
the processing of the C-FIND. The SCU shall recognize a status of Cancel to indicate that the C-
FIND-CANCEL was successful.

1122

UUU.2.8.3 Service Class Provider Behavior

1124 All C-FIND SCPs shall be capable of processing queries that meet the requirements of the "Worklist"
1124 Search (see UUU.2.8.3.1). This does not imply that an SCP which supports the UPS Watch SOP Class
1126 must also be an SCP of the UPS Pull SOP Class.

The SCP shall support attribute matching as described in Section C.2.2.2.

1128 An SCP conveys the following semantics using the C-FIND requests and responses:

- 1130 — The SCP is requested to perform a match of all the keys specified in the Identifier of the request,
against the information it possesses. Attribute matching is performed using the key values
specified in the Identifier of the C-FIND request as defined in Table UUU.2.5-3.
- 1132 — The SCP generates a C-FIND response for each match using the "Worklist" Search method. All
such responses shall contain an Identifier whose Attributes contain values from a single match. All
1134 such responses shall contain a status of Pending.
- 1136 — When all matches have been sent, the SCP generates a C-FIND response which contains a status
of Success. A status of Success shall indicate that a response has been sent for each match
known to the SCP.
- 1138 Notes: 1. No Identifier is contained in a response with a status of Success. For a complete definition, see
PS 3.7.
- 1140 2. When there are no matches, then no responses with a status of Pending are sent, only a single
response with a status of Success.
- 1142 — The SCP shall generate a response with a status of Failure if it is unable to process the request. A
Failure response shall contain no Identifier.
- 1144 — If the SCP receives C-FIND-CANCEL indication before it has completed the processing of the
matches it shall interrupt the matching process and return a status of Cancel.

1146 Bi-directional Authentication of machines/users/applications is possible at association time (see PS 3.7
 1148 and PS 3.15). PS 3.7 provides a “Refused: Not Authorized” error code. Further requiring or documenting
 authentication and/or authorization features from the SCU or SCP is beyond the scope of this SOP Class.

UUU.2.8.3.1 Worklist Search Method

1150 The following steps are used to generate match responses.

- 1152 — Match the key match attributes contained in the Identifier of the C-FIND request against the values
 of the Key Attributes for each worklist entity.
- 1154 — If there are no matching keys, then there are no matches, return a response with a status equal to
 Success and with no Identifier.
- Otherwise,
 - 1156 ○ For each entity for which the Attributes match all of the specified matching key attributes,
 1158 construct an Identifier. This Identifier shall contain all of the values of the Attributes for this
 entity that correspond to the return keys specified in the C-FIND request.
 - Return a response for each remaining Identifier.

1160 Table UUU.2.5-3 defines the Attributes of the Unified Procedure Step Information Model, the requirements
 for key matching, and the requirements for return keys.

UUU.2.8.4 Status Codes

1162 Table UUU.2.8-2 defines the status code values that might be returned in a C-FIND response. Fields
 1164 related to status code values are defined in PS 3.7.

**Table UUU.2.8-2
 C-FIND RESPONSE STATUS VALUES**

1166

Service Status	Further Meaning	Status Codes	Related Fields
Failure	Refused: Out of Resources	A700	(0000,0902)
	Identifier Does Not Match SOP Class	A900	(0000,0901) (0000,0902)
	SOP Class not Supported	0122H	
	Unable to process	(any value C000 through CFFF as assigned by the implementation)	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied.	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	Identifier

	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.	FF01	Identifier
--	---	------	------------

1168 Note: Status Codes are returned in DIMSE response messages (See PS 3.7). The code values stated in column "Status Codes" are returned in Status Command Element (0000,0900).

1170 **UUU.3 UPS SOP CLASSES**

1172 There are four UPS SOP Classes associated with the Unified Procedure Step IOD. Each SOP Class supports different interactions with a UPS Instance (also referred to as a worklist item).

The **UPS Push SOP Class** allows SCU systems to:

- 1174 • create (push) a new worklist item (i.e. instance) onto a worklist
- submit a cancellation request for a worklist item

1176 The **UPS Pull SOP Class** allows SCU systems to:

- query a worklist for matching items
- 1178 • take responsibility for performing a worklist item
- add/modify progress/status/result details for the worklist item
- 1180 • finalize a controlled worklist item as Completed or Canceled.

The **UPS Watch SOP Class** allows SCU systems to:

- 1182 • query for worklist items of interest
- subscribe/unsubscribe for event notifications of changes to a given worklist item
- 1184 • subscribe/unsubscribe for event notifications of all worklist items
- get details for a given worklist item
- 1186 • submit a cancellation request for a given worklist item

The **UPS Event SOP Class** allows SCU systems to:

- 1188 • receive event notifications of changes to a worklist item

1190 The DICOM AEs that claim conformance to one or more of these SOP Classes shall support all services listed as "M" in the corresponding Table UUU.2-1, UUU.2-2, UUU.2-3 and UUU.2-4.

1192

UUU.3.1 Service Class and SOP Class UIDs

1194 All UPS Instances shall be created with the value of SOP Class UID set to "1.2.840.10008.5.1.4.34.6.1" (i.e. that of the UPS Push SOP Class).

1196 Note: UPS Instances are all based on the Unified Procedure Step IOD and are all created either internally by the SCP, or in response to an N-CREATE issued as part of the UPS Push SOP Class.

1198 Once created, UPS instances may be operated on by DIMSE services from any of the four UPS SOP Classes defined in the Unified Worklist and Procedure Step Service Class.

1200 During association negotiation, the Abstract Syntax UID shall be the implemented SOP Class as shown in the following list:

- 1202 • 1.2.840.10008.5.1.4.34.6.1 (UPS Push SOP Class)
- 1.2.840.10008.5.1.4.34.6.2 (UPS Watch SOP Class)
- 1204 • 1.2.840.10008.5.1.4.34.6.3 (UPS Pull SOP Class)
- 1.2.840.10008.5.1.4.34.6.4 (UPS Event SOP Class)

1206 **UUU.3.1.1 DIMSE Implications for UPS (Informative)**

A SOP Instance may be created with one SOP Class UID (UPS Push) and later DIMSE Services may refer to it over an association negotiated for a different SOP Class UID. Further details on this can be found in PS 3.7 Section 10.

1210 For DIMSE-N Services, the Affected SOP Class UID (0000,0002) or Requested SOP Class UID (0000,0003), when present, will be the UID of the UPS Push SOP Class regardless of the negotiated
1212 Abstract Syntax UID. The SCU and SCP will not reject DIMSE-N messages on the basis of the Affected/Requested SOP Class UID being that of the UPS Push SOP Class, rather than one of the other
1214 three SOP Class UIDs as listed in the Abstract Syntax UID during association negotiation. The SCU and SCP may reject the DIMSE-N messages if the instance is not a UPS Push SOP Class Instance.

1216 For DIMSE-C Services (C-FIND), the Affected SOP Class UID will always match the negotiated Abstract Syntax UID for the Presentation Context under which the request is made. This will be either UPS Watch
1218 or UPS Pull. Both of these SOP Classes represent the UPS Information Model described in UUU.2.8.1.

For example, in a typical "Pull Workflow" message exchange, the C-FIND query from a "performing SCU"
1220 would use the UPS Pull SOP Class UID for both the negotiated Abstract Syntax UID and the Affected SOP Class UID (0000,0002), however the SOP Class UID (0008,0016) of the C-FIND responses themselves
1222 will be set to the UPS Push SOP Class UID by the SCP. All the subsequent N-ACTION, N-SET, and N-GET messages, would then use the UPS Pull SOP Class UID for the negotiated Abstract Syntax UID, and
1224 the UPS Push SOP Class UID for the Affected SOP Class UID (0000,0002).

UUU.3.1.2 Global Instance Subscription UID

1226 The well-known UID for subscribing/unsubscribing to events for all UPS Instances managed by an SCP shall have the value "1.2.840.10008.5.1.4.34.5".

1228 **UUU.3.2 Association Negotiation**

Association establishment is the first phase of any instance of communication between peer DICOM AEs.
1230 The Association negotiation procedure specified in PS 3.7 shall be used to negotiate the supported SOP Classes.

1232 See the Association Negotiation definition for the Basic Worklist Management Service Class (Section K.5).

UUU.4 CONFORMANCE REQUIREMENTS

1234 Implementations providing conformance to any of the UPS SOP Classes (UPS Pull, UPS Push, UPS
1236 Watch and UPS Event) shall be conformant as described in the following sections and shall include within
their Conformance Statement information as described below.

An implementation may conform to any of the UPS SOP Classes as an SCU or as an SCP. The
1238 Conformance Statement shall be in the format defined in Annex A of PS 3.2.

UUU.4.1 SCU Conformance

1240 An implementation, which is conformant to any of the UPS SOP Classes as an SCU, shall meet
conformance requirements for the operations that it invokes.

UUU.4.1.1 Operations

The SCU Conformance Statement shall be formatted as defined in Annex A of PS 3.2.

1244 An implementation, that conforms to any of the UPS Push, UPS Pull or UPS Watch SOP Classes as an
SCU, shall specify under which conditions it will request the modification of the value of the Procedure
1246 Step State (0074,1000) attribute to "IN PROGRESS", "COMPLETED", and "CANCELED".

An implementation that conforms to the UPS Pull or UPS Watch SOP Classes as an SCU shall state in its
1248 Conformance Statement

- Whether it requests matching on Optional Matching Key Attributes for C-FIND.
- 1250 — Whether it requests Type 3 Return Key Attributes. If it requests Type 3 Return Key Attributes, then
it shall list these Optional Return Key Attributes.
- 1252 — Whether or not it supports extended negotiation of fuzzy semantic matching of person names for
C-FIND.
- 1254 — How it makes use of Specific Character Set (0008,0005) and Timezone Offset From UTC
(0008,0201) when encoding queries and interpreting responses for C-FIND.
- 1256 — What access mechanisms the SCP is capable of using for retrieving input data and/or making
output data available. (See PS 3.3 Referenced Instances and Access Macro Attributes table for
1258 details on the different Retrieval Sequences).

UUU.4.2 SCP Conformance

1260 An implementation which is conformant to any of the UPS SOP Classes as an SCP shall meet
conformance requirements for the operations which it performs.

UUU.4.2.1 Operations

The SCP Conformance Statement shall be formatted as defined in Annex A of PS 3.2.

1264 The SCP Conformance Statement shall provide information on the behavior of the SCP at the following
occurrences:

- 1266 — The creation of a new Instance of the UPS Push SOP Class with the status "SCHEDULED". The
1268 result of that process on the scheduling information and on the Attribute Values of the Unified
Procedure Step shall be specified.
- 1270 — The conditions for the update of the Attribute "Procedure Step State" (0074,1000), i.e. the change
to the state "IN PROGRESS" or to "CANCELED" or to "COMPLETED".
- 1272 — Which Attributes the SCP may update after the state has been set to "IN PROGRESS" or
"CANCELED" or "COMPLETED".

- 1274 — For how long the UPS Instance will persist on the SCP, and how long it will be available for N-GETs once its state has been set to “COMPLETED” or “CANCELED”.
- 1276 — Whether the SCP supports priority for C-FIND. If the SCP supports priority for C-FIND, then the meaning of the different priority levels shall be specified.
- 1278 — Whether the SCP supports case-insensitive matching for PN VR attributes for C-FIND. If the SCP supports case-insensitive matching of PN VR attributes, then the attributes for which this applies shall be specified.
- 1280 — Whether the SCP supports extended negotiation of fuzzy semantic matching of person names for C-FIND. If the SCP supports extended negotiation of fuzzy semantic matching of person names,
1282 then the mechanism for fuzzy semantic matching shall be specified.
- 1284 — How the SCP makes use of Specific Character Set (0008,0005) and Timezone Offset From UTC (0008,0201) when interpreting C-FIND queries, performing matching and encoding responses.
- 1286 — What rules the SCP may use to perform additional filtering during a C-FIND (e.g. limiting returns based on the requesting user and the confidentiality settings of the workitems, or limiting the return to a single item already selected on the SCP) and under what conditions those rules are invoked.
- 1288 — Whether the SCP might refuse Subscription requests and/or Deletion Locks and for what reasons.
- 1290 — What access mechanisms the SCP is capable of using for retrieving input data and/or making output data available. (See PS 3.3 Referenced Instances and Access Macro Attributes table for details on the different Retrieval Sequences).
- 1292

Part 6

1294 Add the following Data Elements to Part 6 Section 6

6 Registry of DICOM data elements

1296

Tag	Name	Keyword	VR	VM
(0074,1000)	Procedure Step State	ProcedureStepState	CS	1
(0074,1002)	Progress Information Sequence	ProgressInformationSequence	SQ	1
(0074,1004)	Procedure Step Progress	ProcedureStepProgress	DS	1
(0074,1006)	Procedure Step Progress Description	ProcedureStepProgressDescription	ST	1
(0074,1008)	Procedure Step Communications URI Sequence	ProcedureStepCommunicationsURISequenece	SQ	1
(0074,100a)	Contact URI	ContactURI	ST	1
(0074,100c)	Contact Display Name	ContactDisplayName	LO	1
(0074,100e)	Procedure Step Discontinuation Reason Code Sequence	ProcedureStepDiscontinuationReasonCodeSequence	SQ	1
(0074,1200)	Scheduled Procedure Step Priority	ScheduledProcedureStepPriority	CS	1
(0074,1202)	Worklist Label	WorklistLabel	LO	1
(0074,1204)	Procedure Step Label	ProcedureStepLabel	LO	1
(0074,1210)	Scheduled Processing Parameters Sequence	ScheduledProcessingParametersSequence	SQ	1
(0074,1212)	Performed Processing Parameters Sequence	PerformedProcessingParametersSequence	SQ	1
(0074,1216)	Unified Procedure Step Performed Procedure Sequence	UnifiedProcedureStepPerformedProcedureSequence	SQ	1
(0074,1224)	Replaced Procedure Step Sequence	ReplacedProcedureStepSequence	SQ	1
(0074,1230)	Deletion Lock	DeletionLock	CS	1
(0074,1234)	Receiving AE	ReceivingAE	AE	1
(0074,1236)	Requesting AE	RequestingAE	AE	1
(0074,1238)	Reason For Cancellation	ReasonForCancellation	LT	1
(0074,1242)	SCP Status	SCPStatus	CS	1
(0074,1244)	Subscription List Status	SubscriptionListStatus	CS	1
(0074,1246)	Unified Procedure Step List Status	UnifiedProcedureStepListStatus	CS	1
(0040,4041)	Input Readiness State	InputReadinessState	CS	1

Tag	Name	Keyword	VR	VM
(0040,4050)	<u>Performed Procedure Step Start DateTime</u>	<u>PerformedProcedureStepStartDateTime</u>	<u>DT</u>	<u>1</u>
(0040,4051)	<u>Performed Procedure Step End DateTime</u>	<u>PerformedProcedureStepEndDateTime</u>	<u>DT</u>	<u>1</u>
(0040,4052)	<u>Procedure Step Cancellation DateTime</u>	<u>ProcedureStepCancellationDateTime</u>	<u>DT</u>	<u>1</u>
(0040,E020)	<u>Type of Instances</u>	<u>TypeOfInstances</u>	<u>CS</u>	<u>1</u>
(0040,E021)	<u>DICOM Retrieval Sequence</u>	<u>DICOMRetrievalSequence</u>	<u>SQ</u>	<u>1</u>
(0040,E022)	<u>DICOM Media Retrieval Sequence</u>	<u>DICOMMediaRetrievalSequence</u>	<u>SQ</u>	<u>1</u>
(0040,E023)	<u>WADO Retrieval Sequence</u>	<u>WADORetrievalSequence</u>	<u>SQ</u>	<u>1</u>
(0040,E024)	<u>XDS Retrieval Sequence</u>	<u>XDSRetrievalSequence</u>	<u>SQ</u>	<u>1</u>
(0040,E030)	<u>Repository Unique ID</u>	<u>RepositoryUniqueID</u>	<u>UI</u>	<u>1</u>
(0040,E031)	<u>Home Community ID</u>	<u>HomeCommunityID</u>	<u>UI</u>	<u>1</u>
(0074,1220)	<u>Related Procedure Step Sequence</u>	<u>RelatedProcedureStepSequence</u>	<u>SQ</u>	<u>1</u> RET
(0074,1222)	<u>Procedure Step Relationship Type</u>	<u>ProcedureStepRelationshipType</u>	<u>LO</u>	<u>1</u> RET

1298

Add the following to Table A-1

UID Value	UID Name	UID Type	Part
...			
<u>1.2.840.10008.5.1.4.34.4</u>	<u>Unified Worklist and Procedure Step Service Class - Trial</u> <i>(Retired)</i>	<u>Service Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.4.1</u>	<u>Unified Procedure Step – Push SOP Class - Trial</u> <i>(Retired)</i>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.4.2</u>	<u>Unified Procedure Step – Watch SOP Class - Trial</u> <i>(Retired)</i>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.4.3</u>	<u>Unified Procedure Step – Pull SOP Class - Trial</u> <i>(Retired)</i>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.4.4</u>	<u>Unified Procedure Step – Event SOP Class - Trial</u> <i>(Retired)</i>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.5</u>	<u>Unified Worklist and Procedure Step SOP Instance</u>	<u>Well-known SOP Instance</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.6</u>	<u>Unified Worklist and</u>	<u>Service Class</u>	<u>PS 3.4</u>

	<u>Procedure Step Service Class</u>		
<u>1.2.840.10008.5.1.4.34.6.1</u>	<u>Unified Procedure Step – Push SOP Class</u>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.6.2</u>	<u>Unified Procedure Step – Watch SOP Class</u>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.6.3</u>	<u>Unified Procedure Step – Pull SOP Class</u>	<u>SOP Class</u>	<u>PS 3.4</u>
<u>1.2.840.10008.5.1.4.34.6.4</u>	<u>Unified Procedure Step – Event SOP Class</u>	<u>SOP Class</u>	<u>PS 3.4</u>

1300

Part 7

Add the following text to section 10.1

1302 10.1 SERVICES

1304 The following sections describe the DIMSE-N Services. The behavior of these services is also
 1306 described in PS 3.4. The Affected SOP Class UID in the DIMSE-N command need not match the
SOP Class UID in the Presentation Context negotiated for the association over which the DIMSE-N
command has been sent. PS 3.4 specifies which combinations are valid.

10.1.1 N-EVENT-REPORT

1308

Add the section to Annex C

1310 C.5.XX Refused: Not Authorized

Status Field	Tag	VR	VM	Description of Field
Status	(0000,0900)	US	1	Confirmation status of the operation. The value of this required field shall be set to 0124H.
Error Comment	(0000,0902)	LO	1	This optional field contains an application-specific text description of the error detected.

1312

Part 16

Add the following codes to CID 9300

1314 **CID 9300 Procedure Discontinuation Reasons**

Context ID 9300

1316 **Procedure Discontinuation Reasons**

Type: Extensible Version: 2009061620110128

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	110526	Resource pre-empted
DCM	110527	Resource inadequate
DCM	110528	Discontinued Procedure Step rescheduled
DCM	110529	Discontinued Procedure Step rescheduling recommended
<i>Include CID 9301 Modality PPS Discontinuation Reasons</i>		
<i>Include CID 9302 Media Import PPS Discontinuation Reasons</i>		

1318

1320 **Add the following to Annex D**

DICOM Code Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code Meaning	Definition	Notes
110526	Resource pre-empted	Procedure discontinued due to necessary equipment, staff or other resource becoming (temporarily) unavailable to the procedure.	
110527	Resource inadequate	Procedure discontinued due to necessary equipment, staff or other resource being inadequate to complete the procedure.	
110528	Discontinued Procedure Step rescheduled	A new Procedure Step has been scheduled to replace the Discontinued Procedure Step.	
110529	Discontinued Procedure Step rescheduling recommended	It is recommended that a new Procedure Step be scheduled to replace the Discontinued Procedure Step.	

1322

Add Annex Z1326 **Annex Z Unified Worklist and Procedure Step - UPS (INFORMATIVE)****Z.1 INTRODUCTION**

1328 This section provides examples of different implementations and message sequencing when using the Unified Worklist and Procedure Step SOP Classes (UPS Push, UPS Pull, UPS Watch and UPS Event).

1330 The examples are intended to provide a sense of how the UPS SOP Classes can be used to support a variety of workflow use cases. For the detailed specification of how the underlying DIMSE Services
1332 function, please refer to PS3.4 Annex UUU.

The Unified Worklist and Procedure Step Service Class combines the information that is conveyed
1334 separately by the Modality Worklist and Modality Performed Procedure Step into a single normalized object. This object is created to represent the planned step and then updated to reflect its progress from
1336 scheduled to complete and record details of the procedure performed and the results created. Additionally, the Unified Worklist supports subscription based notifications of progress and completion.

1338 The Unified Worklist and Modality Procedure Step Service Class does not include support for complex internal task structures. It describes a single task to be performed in terms of the task request and the task
1340 results. Additional complexity is managed by the business logic.

The UPS SOP Classes define services so UPSs can be created, their status managed, notifications sent
1342 and their attributes set, queried, and retrieved. DICOM intentionally leaves open the many combinations in which these services can be implemented and applied to enact a variety of approaches to workflow.

1344 Pull Workflow and Push Workflow

Similar to previous SOP Classes like Modality Worklist, UPS allows a performing system (using the UPS
1346 Pull SOP Class as a C-FIND SCU) to query a worklist manager (the SCP) for relevant tasks and choose which one to start working on. This is sometimes called “Pull Workflow” since the performer pulls down the
1348 list and selects an item.

UPS adds the ability for a scheduling system (using the UPS Push SOP Class as an N-CREATE SCU) to
1350 “push” a workitem onto the performing system (here an SCP). In “Push Workflow” the scheduler makes the choice of which system becomes responsible for the workitem.

1352 Performing systems (again as an SCP) could also schedule/create their own workitems, while allowing other systems (using the UPS Watch and UPS Event SOP Classes as N-EVENT-REPORT SCUs and N-
1354 GET SCUs) to receive notifications of the activities of the performer and examine the results.

Push and Pull can also be combined in various ways. A high level departmental scheduler could break
1356 down orders and push tasks onto the acquisition worklist manager and reporting worklist manager from which modalities and reporting workstations could pull their tasks. In another scenario, a modality that has

1358 pulled an acquisition workitem off a worklist, could push a follow-up task onto a workstation to perform 3D
processing or CAD on the results.

1360 **Reliable Watchers and Deletion Locks**

Some UPS features (specifically the Deletion Lock – See PS3.4 UUU.2.3.2) were introduced to support
1362 Reliable Watchers. By subscribing with a Deletion Lock, an SCU wishing to be a reliable watcher can
signal the SCP to persist instances until the watcher has been able to retrieve final state information and
1364 remove the lock.

This means that network latency, slight delays in processing threads, or even the watcher being offline for
1366 a short time, will not prevent the watcher from reliably collecting the final state details from UPS instances
it is interested in. This can be very important since the watcher may be responsible for monitoring
1368 completion of those instances, extracting details from them, and based on that and other internal logic,
creating subsequent UPS Instances and populating the input data fields with information from the
1370 completed UPS. Without some form of persistence guarantee, UPS instances could disappear
immediately upon entering a completed state.

1372 Having established the Deletion Lock mechanism, it is possible that, due to equipment or processing
errors, there could be cases where locks are not properly removed and some UPS instances might remain
1374 when they are no longer needed. Most SCP implementations will likely provide a way for such orphaned
UPS instances to be removed under administrator control.

1376 **Z.2 IMPLEMENTATION EXAMPLES**

The following sections describe ways UPS workflows could be used to address some typical scenarios.

1378 **Z.2.1 Typical SOP Class Implementations**

The decision of which SOP Classes to implement in which systems will revolve partly around where it
1380 makes the most sense for the business logic to reside, what information each system would have access
to, and what kind of workflow is most effective for the users.

1382 Table Z.1-1 shows a number of hypothetical systems and the combination of SOP Classes they might
implement. For example, a typical worklist manager would support all four SOP Classes as an SCP. A
1384 typical scheduling system might want to be a UPS Push SCU to submit work items to the worklist
manager, a UPS Watch SCU to subscribe for notifications and get details of the results, and a UPS Event
1386 SCU to receive the progress notifications. A simple “pull performer” might only be a UPS Pull SCU, similar
to modalities today.

1388 Other examples are listed for:

- “Minimal Scheduler”, a requesting system that is not interested in monitoring progress or results.
- 1390 • “Watcher”, a system interested in tracking the progress and/or results of Unified Procedure Steps.
- “General Contractor”, a system that accepts work items pushed to it, then uses internal business
1392 logic to subdivide/create work items which it pushes or makes available to systems that will
actually perform the work.
- 1394 • “Push Performer”, a system, for example a CAD system, that has work pushed to it, and provides
status and results information to interested observers.
- 1396 • “Self-Scheduled Performer”, which internally schedules it’s own work, but supports notifications
and N-GET so the details of the work can be made available to other departmental systems.

- 1398 • “Self-Scheduled Pull Performer”, which pushes a workitem onto a worklist manager and then pulls
 1400 it off to perform it. This allows it to work on “unscheduled” procedures without taking on the
 responsibility of being an SCP for notifications and events.

Table Z.1-1

SOP Classes for Typical Implementation Examples

1402

SOP Classes	SCU				SCP			
	UPS Push	UPS Watch	UPS Event	UPS Pull	UPS Push	UPS Watch	UPS Event	UPS Pull
Non-Performing SCUs								
Minimal Scheduler	X							
Typical Scheduler	X	X	X					
Watcher		X	X					
Worklist SCs								
Worklist Manager					X	X	X	X
General Contractor	X	X	X		X	X	X	X
Performing SCs								
Push Performer					X	X	X	
Self Scheduled Performer						X	X	
Performing SCUs								
Pull Performer				X				
Self Scheduled Pull Performer	X			X				

1404 A system that implements UPS Watch as an SCP will also need to implement UPS Event as an SCP to be
 1406 able to send Event Reports to the systems from whom it accepts subscriptions.

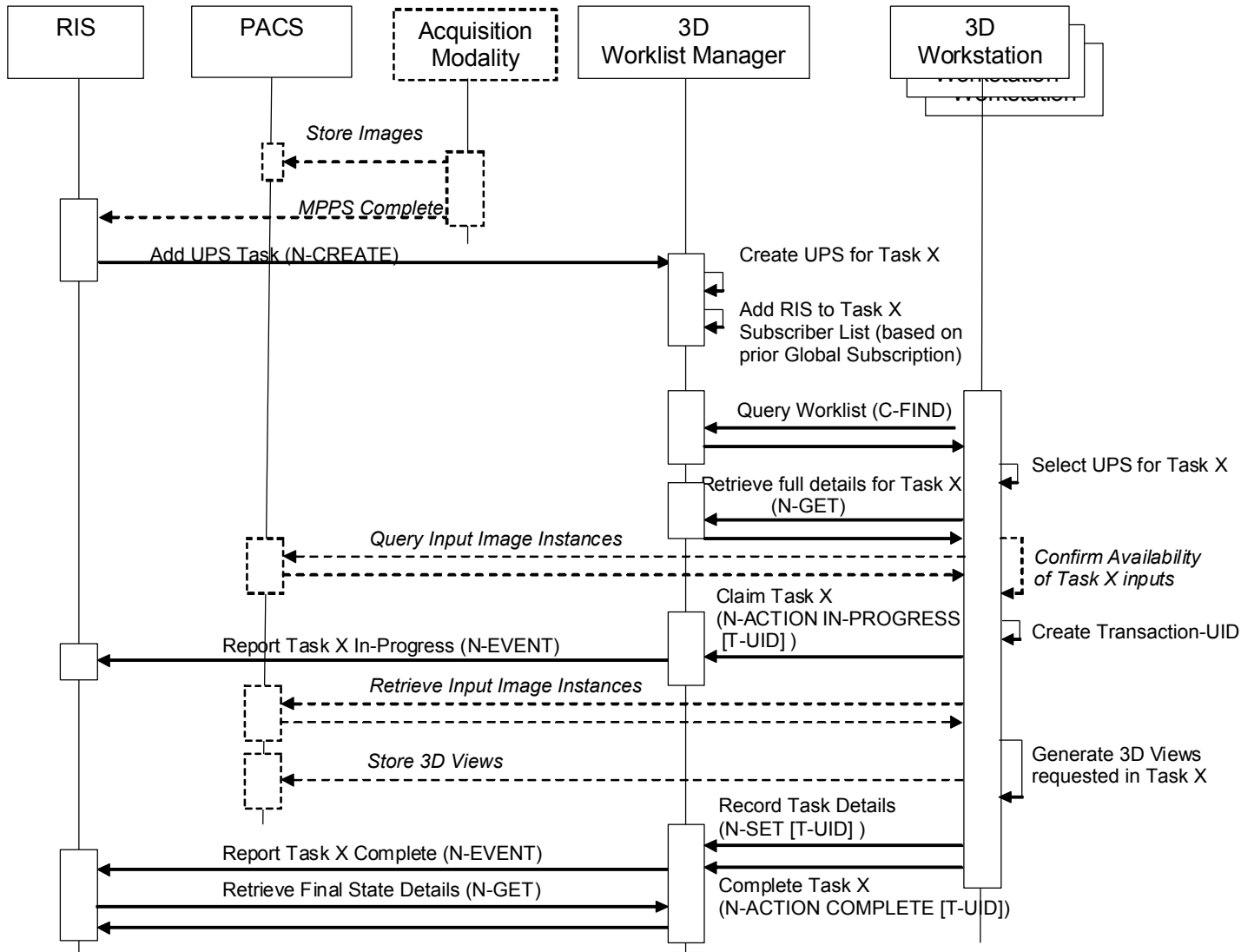
1406 Z.2.2 Typical Pull Workflow

1408 This example shows how a typical pull workflow could be used to manage the work of a 3D Lab. A group
 of 3D Workstations query a 3D Worklist Manager for work items which they perform and report their

1410 progress. In this example, the RIS would be a “Typical Scheduler”, the 3D Workstation is a “Pull Performer” as seen in Table Z.1-1 and the PACS and Modality do not implement any UPS SOP Classes.

1412 We will assume the RIS decides which studies require 3D views and puts them on the worklist once the acquiring modality has reported it’s MPPS complete. The RIS identifies the required 3D views and lists the necessary input objects in the UPS based on the image references recorded in the MPPS.

1414 Assume the RIS has subscribed globally for all UPS instances managed by the 3D Worklist Manager.



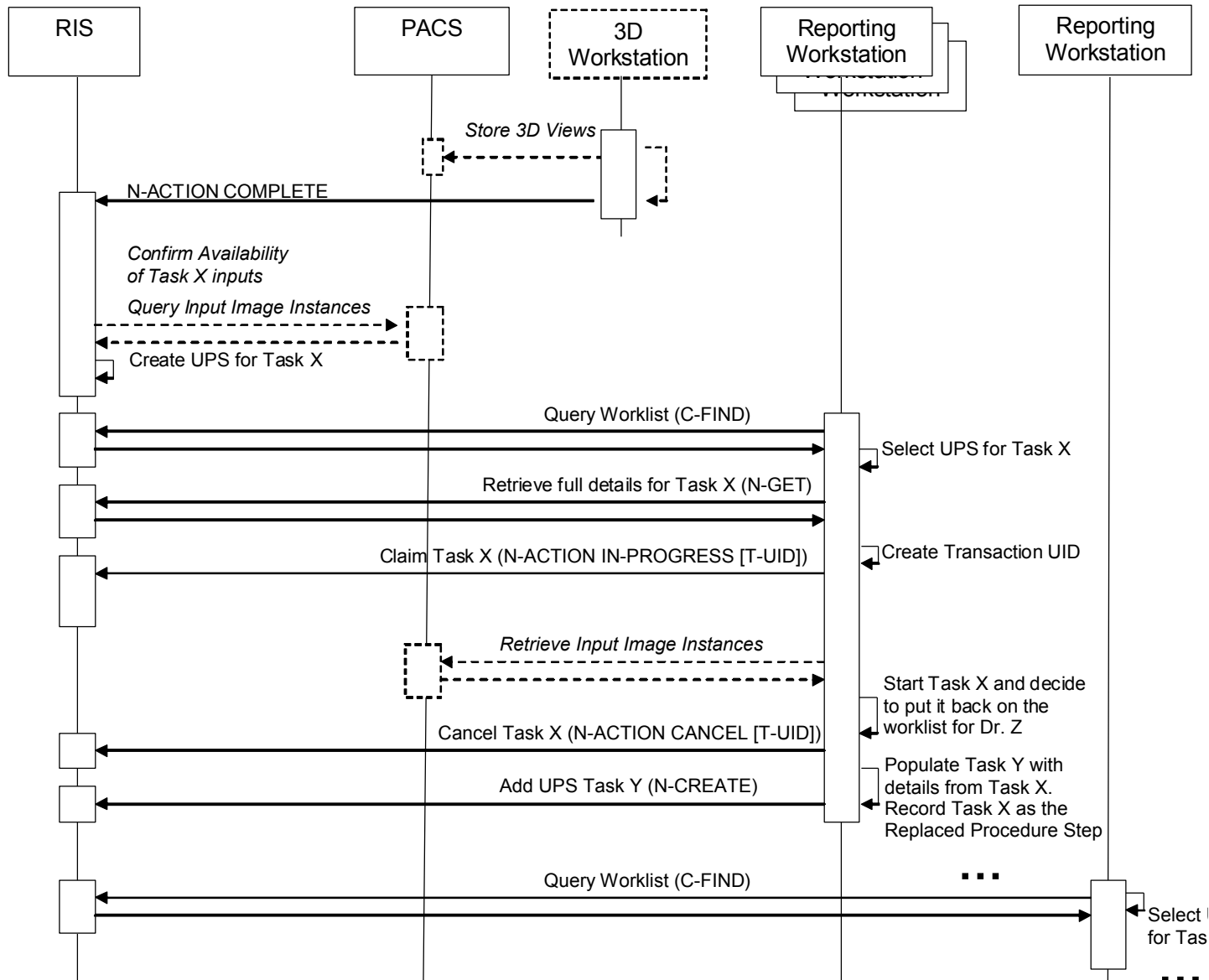
1416

Figure Z.2-1 Diagram of Typical Pull Workflow

Z.2.3 Reporting Workflow with “Hand-off”

1418 This example shows a reporting workflow with a “hand-off”. Reporting Workstations query a RIS for work items to interpret/report. In this example, the RIS is a “Worklist Manager”, the Reporting Workstation is both a “Pull Performer” and a “Minimal Scheduler” as shown in Table Z.1-1 and the PACS and Modality do not implement any UPS SOP Classes. A reporting workstation claims Task X but can’t complete it and “puts it back on the worklist” by canceling Task X and creating Task Y as a replacement, recording Task X as the Replaced Procedure Step.

1424 Assume the RIS is picking up where example Z.2.2 left off and was waiting for the 3D view generation task
 1426 to be complete before putting the study on the reading worklist. The RIS identifies the necessary input
 objects in the UPS based on the image references recorded in the acquisition MPPS and the 3D UPS.



1428 **Figure Z.3-1 Diagram of Reporting Workflow**

You could also imagine the 3D workstation is a Mammo CAD workstation. If the first radiologist completed the report, the RIS could easily schedule Task Y as the over-read by another radiologist.

For further discussion, refer to the Section Z.2.7 material on Hand-offs, Fail-overs and Putting Tasks Back on the Worklist.

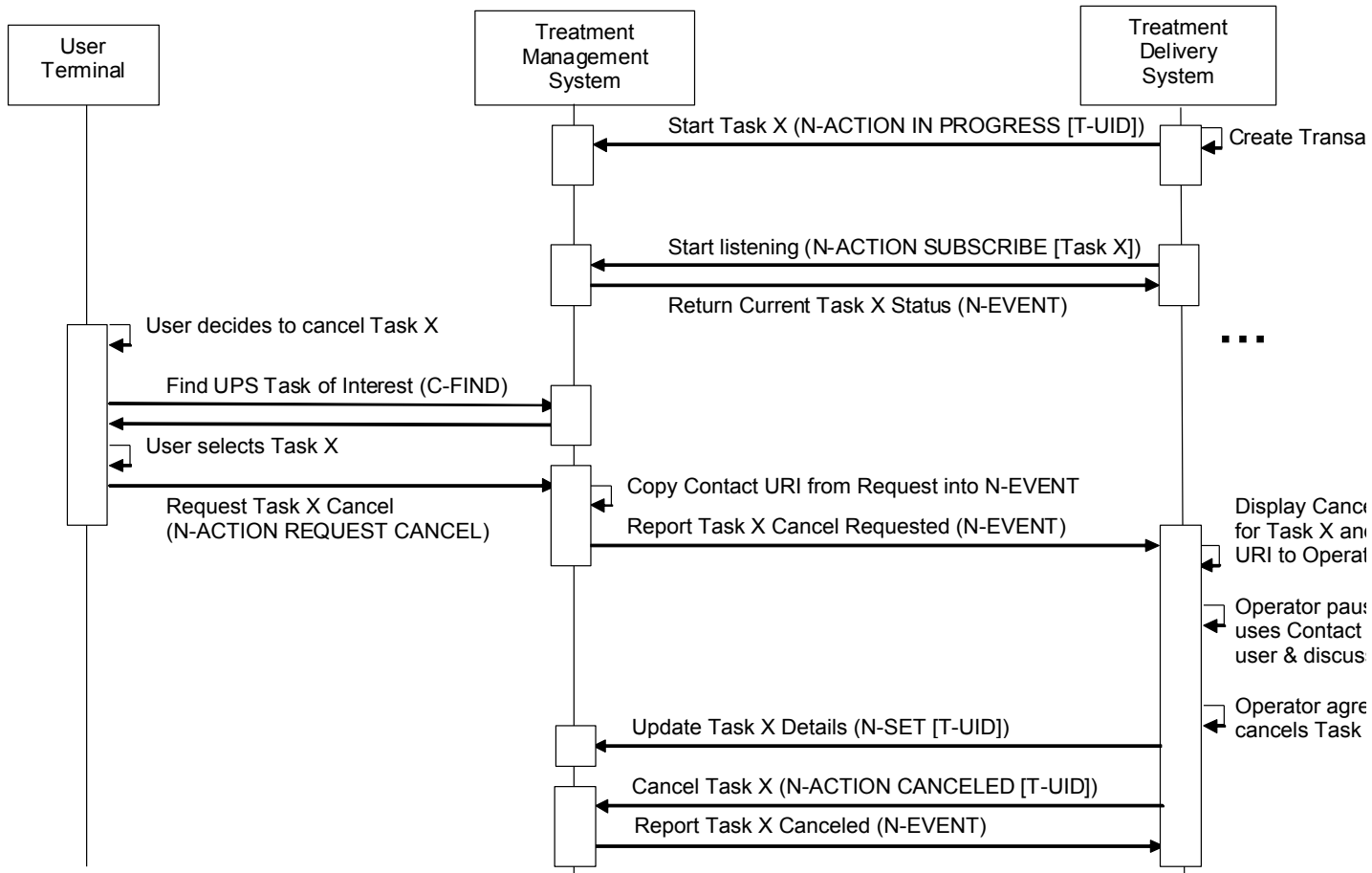
2.2.4 Third Party Cancel

1434 Cancel requests are always directed to the system managing the UPS instance since it is the SCP. When the UPS is being managed by one system (for example a Treatment Management System) and performed

1436 by a second system (for example a Treatment Delivery System), a third party would send the cancel request to the TMS and cancellation would take place as shown below.

1438 Performing SCUs are not *required* to react to cancel requests, or even to listen for them, and in some situations would be unable to abort the task represented by the UPS even if they were listening. In the diagram below we assume the performing SCU is listening, willing, and able to cancel the task.

1442 If the User had sent the cancel request while the UPS was still in the SCHEDULED state, the SCP (i.e. the TMS) could simply have canceled the UPS internally. Since the UPS state was IN PROGRESS, it was necessary to send the messages as shown. Note that since the TDS has no need for the UPS instance to persist, it subscribed without setting a Deletion Lock, and so it didn't need to bother unsubscribing later.



1446 **Figure Z.4-1 Diagram of Third Party Cancel**

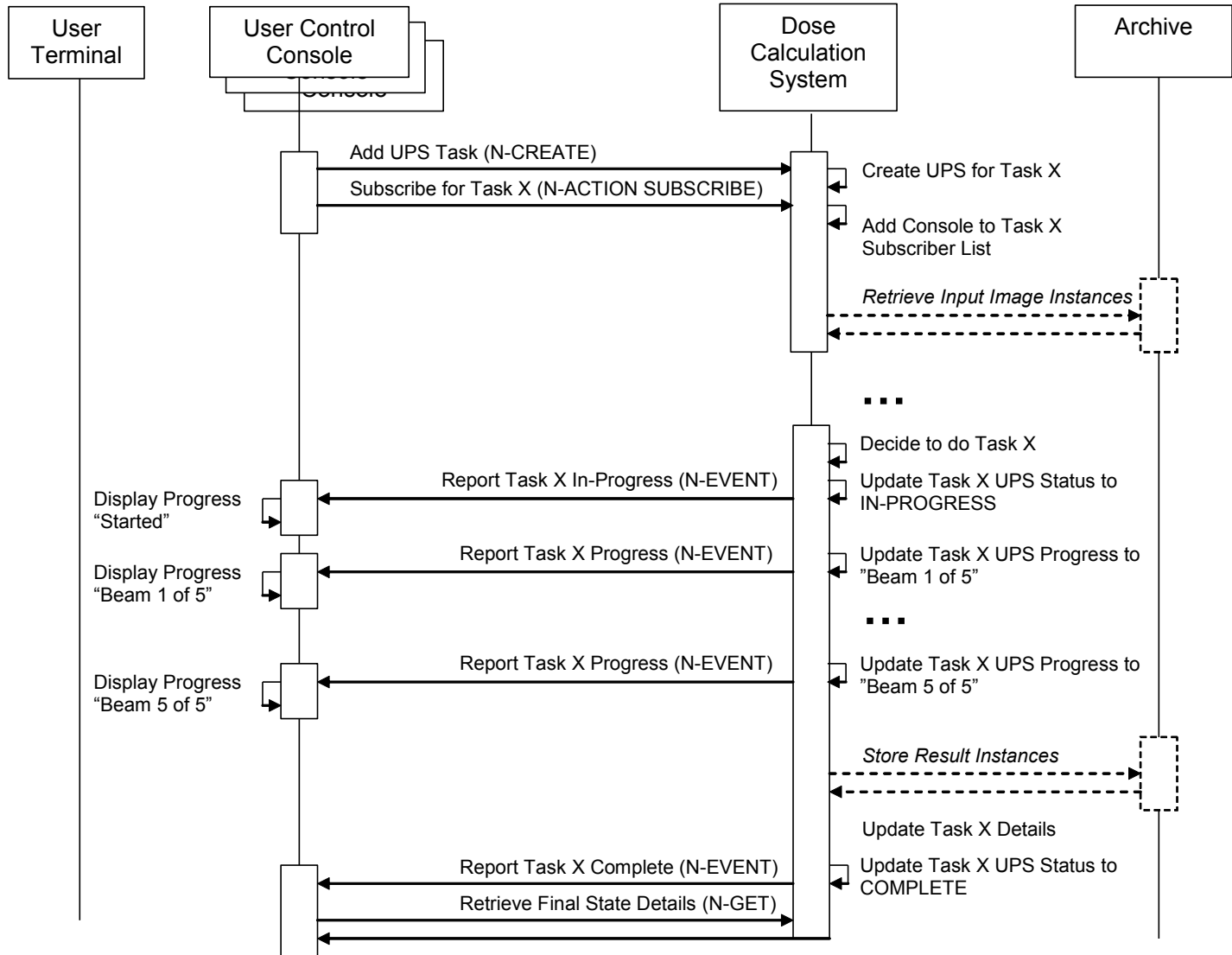
Z.2.5 Radiation Therapy Dose Calculation Push Workflow

1448 In this example, users schedule tasks to a shared dose calculation system and need to track progress. This example is intended as a demonstration of UPS and should not be taken as prescriptive of RT
1450 Therapy procedures.

1452 Pushing the tasks avoids problems with a pull workflow such as the server having to continually poll worklists on (a large number of) possible clients; needing to configure the server to know about all the clients; reporting results to a user who might be at several locations; and associating the results with

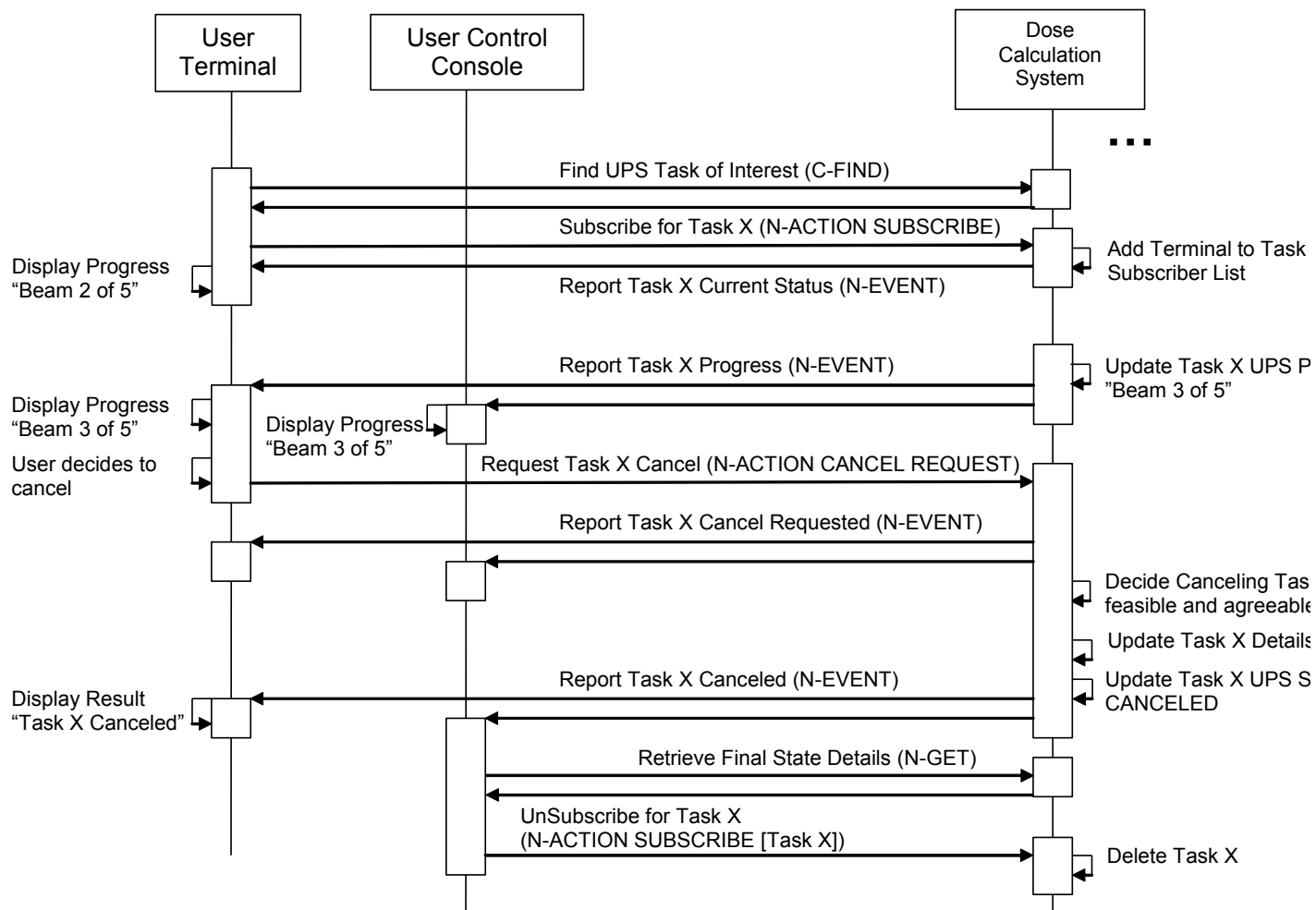
1454 clients automatically. Also, when performing machines each have unique capabilities, the scheduling must
 1456 target individual machines, and there can be advantages for integrating the scheduling and performing
 activities like this.

Although not shown in the diagram, the User could have gone to a User Terminal (“Watcher”) and
 1458 monitored the progress from there by doing a C-FIND and selecting/subscribing to Task X.



1460 **Figure Z.5-1 Diagram of Radiation Therapy Planning Push Workflow**

In a second example, the User monitors progress from another User Terminal (“Watcher”) and decides to
 1462 request cancellation after 3 beams.



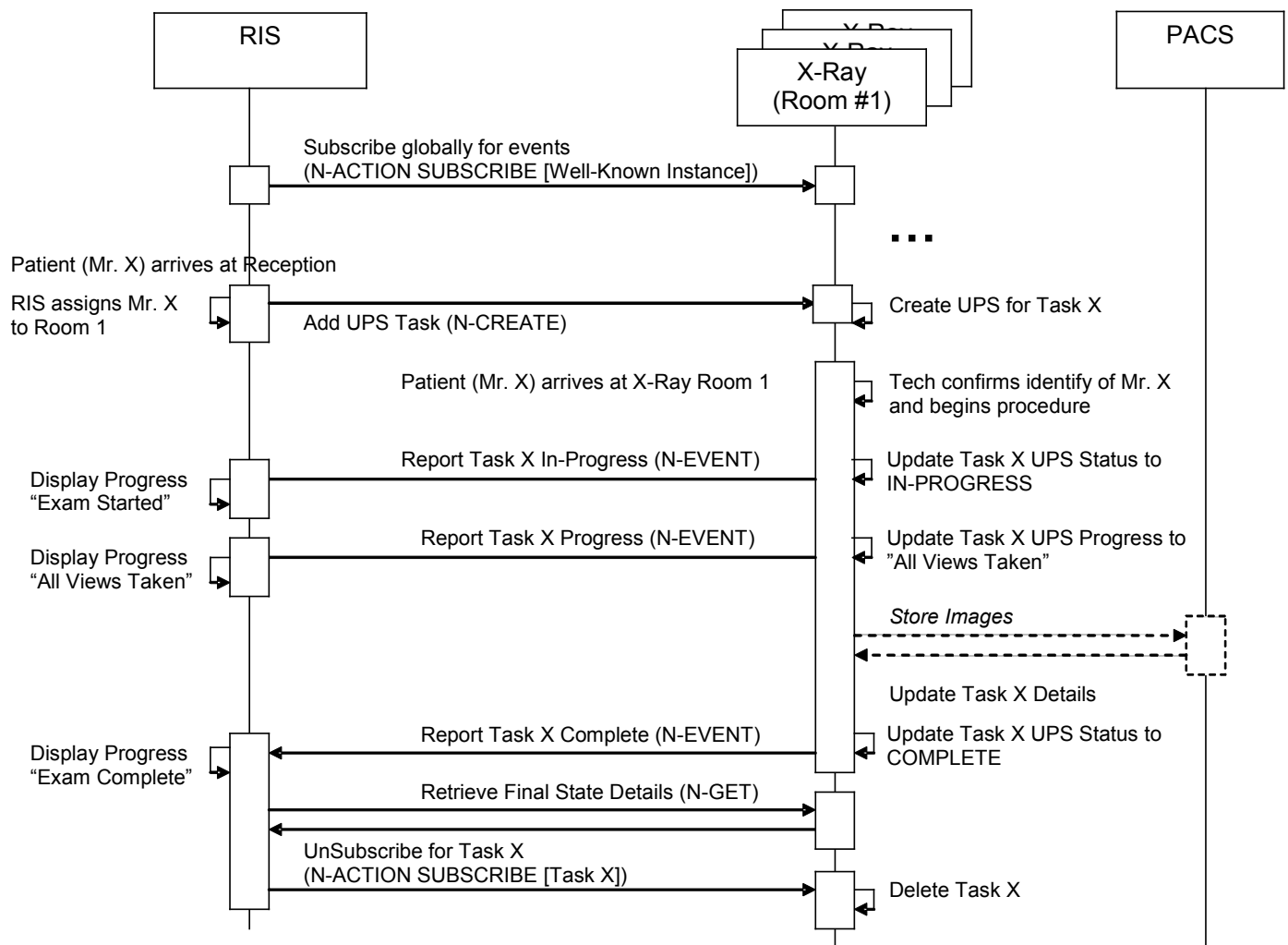
1464 **Figure Z.5-2 Diagram of Remote Monitoring and Cancel**

1466 **Z.2.6 X-Ray Clinic Push Workflow**

1466 In this example, arriving patients are admitted at the RIS and sent to a specific X-Ray room for their exam.

1468 The RIS is shown here subscribing globally for events from each Room. Alternatively the RIS could subscribe individually to each Task right after the N-CREATE is requested.

1470 It is left open whether the patient demographics have been previously registered and the patients scheduled on the RIS or whether they are registered on the RIS when they arrive.



1472

Figure Z.6-1 Diagram of X-Ray Clinic Push Workflow

Z.2.7 Other Examples

1474 A wide variety of workflow methods are possible using the UPS SOP Classes. In addition to those diagrammed in the previous sections, a few more are briefly described here. These include examples of
 1476 ways to handle unscheduled tasks, grouped tasks, append cases, "event forwarding", etc.

Self-Scheduling Push & Pull : Unscheduled and Append Cases

1478 In radiation therapy a previously unscheduled ("emergency") procedure may be performed on a Treatment
 1480 Delivery System. Normally a TDS performs scheduled procedures as a Performing SCU in a Typical Pull
 1482 Workflow like that shown in Z.2.2. A TDS that might need to perform unscheduled procedures could
 1484 additionally implement UPS Push (as an SCU) and push the "unscheduled" procedure to the departmental
 worklist server then immediately set it IN PROGRESS as a UPS Pull SCU. The initial Push to the
 departmental server allows the rest of the departmental workflow to "sync up" normally to the new task on
 the schedule.

A modality choosing to append some additional images after the original UPS was completed could use a
 1486 similar method. Since the original UPS can no longer be modified, the modality could push a new UPS
 1488 instance to the Worklist Manager and then immediately set it IN PROGRESS. Many of the attribute values
 in the new UPS would be the same as the original UPS.

1490 Note that for a Pull Performer that wants to handle unscheduled cases, this Push & Pull approach is pretty
1491 simple to implement. Becoming a UPS Push SCU just requires N-CREATE and N-ACTION (Request
1492 Cancel) which are quite similar to the N-SET and N-ACTION it already supports as a UPS Pull SCU.

1492 The alternative would be implementing both UPS Watch and UPS Event as an SCP which would be more
1493 work. Further, potential listeners would have to be aware of and monitor the performing system to track
1494 the unscheduled steps, instead of just monitoring the departmental Pull SCP.

Self-Scheduling Performer

1496 An example of an alternative method for handling unscheduled procedures is a CAD workstation that
1497 decides for itself to perform processing on a study. By implementing UPS Watch as an SCP and UPS
1498 Event as an SCP, the workstation can create UPS instances internally and departmental systems such as
1499 the RIS can subscribe globally to the workstation to monitor its activities.

1500 The workstation might create the UPS tasks in response to having data pushed to it, or potentially the
1501 workstation could itself also be a Watch and Event SCU and subscribe globally to relevant modality or
1502 PACS systems and watch for appropriate studies.

Push Daisy Chain

1504 Sometimes the performer of the current task is in the best position to decide what the next task should be.

1505 An alternative to centralized task management is daisy-chaining where each system pushes the next task
1506 to the next performer upon completion of the current task. Using a workflow similar to the X-Ray Clinic
1507 example in Z.6, a modality could push a task to a CAD workstation to process the images created by the
1508 modality. The task would specify the necessary images and perhaps parameters relevant to the
1509 acquisition technique. The RIS could subscribe globally with the CAD workstation to track events. Another
1510 example of push daisy chain would be for the task completed at each step in a reporting process to be
1511 followed by scheduling the next logical task.

1512 Hand-offs, Fail-overs and Putting Tasks Back on the Worklist

1513 Sometimes the performer of the current task, after setting it to IN PROGRESS, may determine it cannot
1514 complete the task and would like the task performed by another system. It is not permitted to move the
1515 task backwards to the SCHEDULED state.

1516 One approach is for the performer to cancel the old UPS and schedule a new UPS to be pulled off the
1517 worklist by another system or by itself at some point in the future. The new UPS would be populated with
1518 details from the original. The details of the new UPS, such as the Input Information Sequence
1519 (0040,4021), the Scheduled Workitem Code Sequence (0040,4018), and the Scheduled Processing
1520 Parameters Sequence (0074,1210), might be revised to reflect any work already completed in the old UPS.
1521 By including the "Discontinued Procedure Step rescheduled" code in the Procedure Step Discontinuation
1522 Reason Code Sequence (0074,100e) of the old UPS, the performer can allow watchers and other systems
1523 monitoring the task to know that there is a replacement for the old cancelled UPS. By referencing the UID
1524 of the old UPS in the Replaced Procedure Step Sequence (0074,1224) of the new UPS, the performer can
1525 allow watchers and other systems to find the new UPS that replaced the old. A proactive SCP might even
1526 subscribe watchers of the old UPS to the new UPS that replaces it.

1527 Alternatively, if the performer does not have the capability to create a new UPS, it could include the
1528 "Discontinued Procedure Step rescheduling recommended" code in the Procedure Step Discontinuation
1529 Reason Code Sequence (0074,100e). A very smart scheduling system could observe the cancellation
1530 reason and create the new replacement UPS as described above on behalf of the performer.

1532 Another approach is for the performer to “sub-contract” to another system by pushing a new UPS onto that system and marking the original UPS complete after the sub-contractor finishes.

1534 Yet another approach would be for the performer to deliver the Locking UID (by some unspecified mechanism) to another system allowing the new system to continue the work on the existing UPS. Coordination and reconciliation would be very important since the new system would need to review the current contents of the UPS, understand the current state, update the performing system information, etc.

Z.3 OTHER FEATURES

1538 Z.3.1 What was Scheduled vs. What was Performed

1540 The performing system for a UPS instance determines what details to put in the attributes of the Performed Procedure Information Module. It is possible that the procedure performed may differ in some details from the procedure scheduled. It is up to the performing system to decide how much the performed procedure can differ from the scheduled procedure before it is considered a different procedure, or how much must be performed before the procedure is considered complete.

1544 In the case of cancellation, it is possible that some details of the situation may be undeterminable. Beyond meeting the Final State requirements, accurately reflecting in the CANCELED UPS instance the actual state of the task (e.g. reflecting partial work completed and/or any cleanup performed during cancellation), is at the discretion of the performing system.

1548 In general it is expected that:

- 1550 • An SCU that completes a UPS differently than described in the scheduled details, but accomplishes the intended goal, would record the details as performed in the existing UPS and set it to COMPLETED. Interested systems may choose to N-GET the Performed Codes from the UPS and confirm whether they match the Scheduled Codes.
- 1554 • An SCU that completes part of the work described in a UPS, but does not accomplish the intended goal, would set the Performed Protocol Codes to reflect what work was fully or partially completed, set the Output Sequence to reflect the created objects and set the UPS state to CANCELED since the goal was not completed.
- 1558 • An SCU that completes a step with a different intent and scope in place of a scheduled UPS would cancel the original scheduled UPS, listing no work output products, and schedule a new UPS describing what was actually done, and reference the original UPS that it replaces in the Replaced Procedure Step Sequence to facilitate monitoring systems “closing the loop”.
- 1562 • An SCU that completes multiple steps, scheduled as separate UPS instances (e.g. a dictation & a transcription & a verification), as a block would individually report each of them as completed.
- 1564 • An SCU that completes additional unscheduled work in the course of completing a scheduled UPS would either report additional procedure codes in the completed UPS, or create one or more new UPS instances to record the unscheduled work.

1566 Z.3.2 Complex Procedure Steps

1568 There are cases where it may be useful to schedule a complex procedure that is essentially a grouping of multiple workitems. Placing multiple workitem codes in the Scheduled Workitem Code Sequence is not permitted (partly due to the additional complexities that would result related to sequencing, dependency, partial completion, etc.)

1572 One approach is to schedule separate UPS instances for each of the component workitems and to identify the related UPS instances based on their use of a common Study UID or Order Number.

1574 Another approach is for the site to define a single workitem code that means a pre-defined combination of
1575 what would otherwise be separate workitems, along with describing the necessary sequencing,
1576 dependencies, etc.

1576 **Z.3.3 Gift Subscriptions**

1577 The UPS Subscription allows the Receiving AE-Title to be different than the AE-Title of the SCU of the N-
1578 ACTION request. This allows an SCU to sign up someone else who would be interested for a subscription.
1579 For example, a reporting workflow manager could subscribe the RIS to UPSs the reporting workflow
1580 manager creates for radiology studies, and subscribe the CIS to UPSs it creates for cardiology studies. Or
1581 a RIS could subscribe the MPPS broker or the order tracking system to the high level UPS instances and
1582 save them from having independent business logic to determine which ones are significant.

1583 This can provide an alternative to systems using global subscriptions to stay on top of things. It also has
1584 the benefit of providing a way to avoid having to “forward” events. All interested SCUs get their events
1585 directly from the SCP. Instead of SCU A forwarding relevant events to SCU B, SCU A can simply
1586 subscribe SCU B to the relevant events.